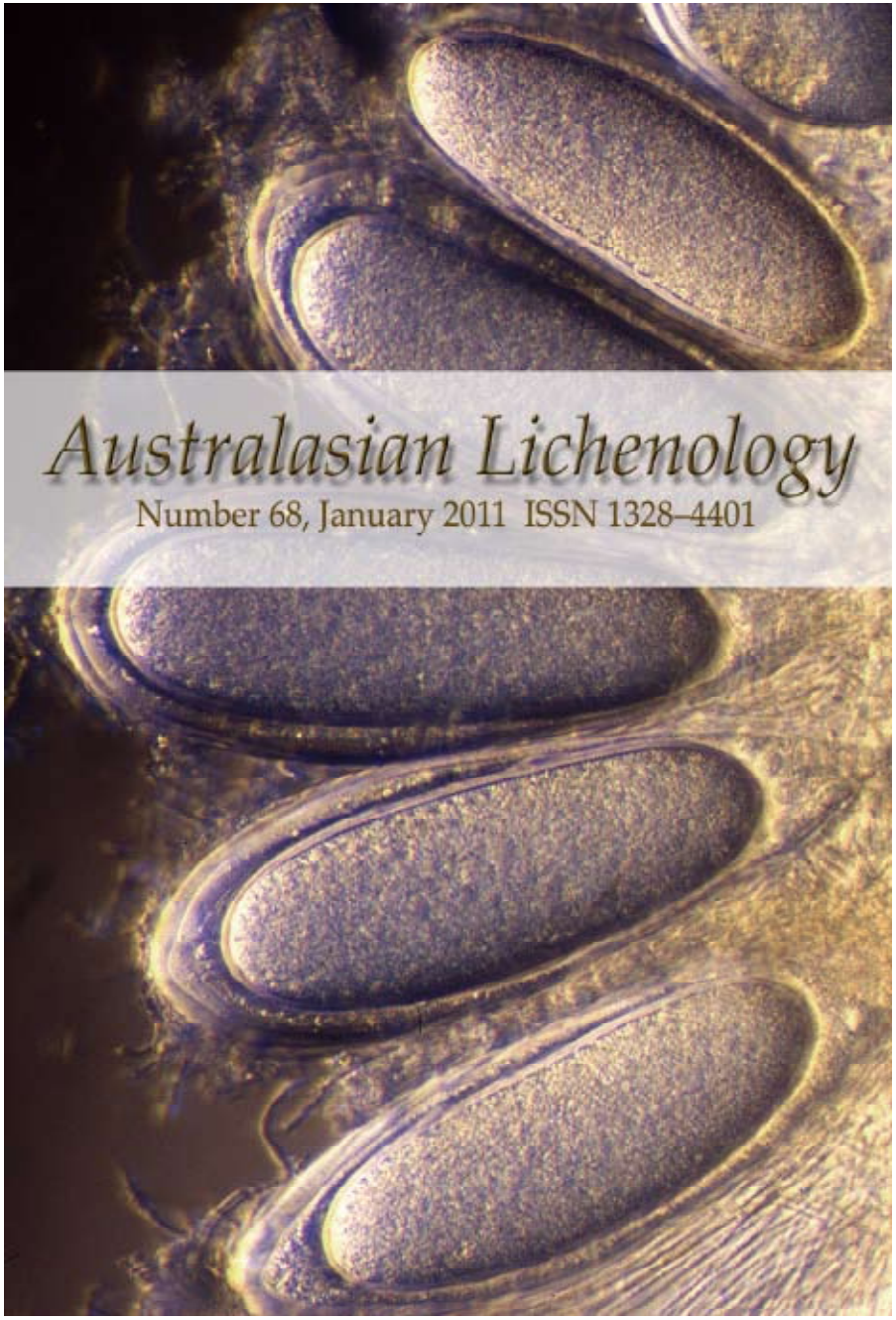

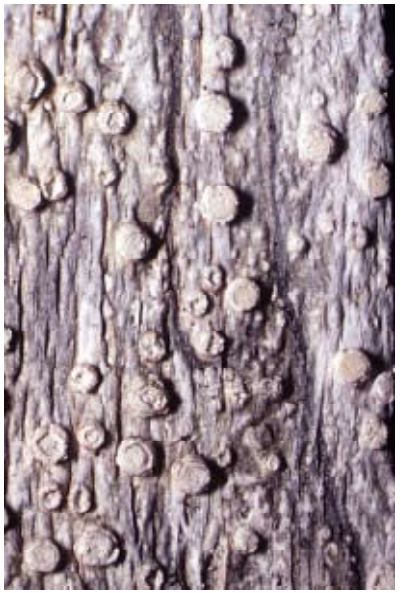

Australasian Lichenology
Number 68, January 2011 ISSN 1328–4401

Pertusaria scutellifera is a New Zealand endemic corticolous on several species of *Dracophyllum* and *Nothofagus*. Its asci are one-spored, and its spores can reach more than 180 µm in length. The photomicrograph on the cover looks like a differential interference image, but in fact was produced simply by sliding a piece of opaque paper partway across the condenser lens of the microscope to generate shadows. The technique has been whimsically called "ha'penny optics".

CONTENTS

Australasian Lichenology
Number 68, January 2011 ISSN 1328–4401

INFORMATION FOR SUBSCRIBERS

Australasian Lichenology is published twice a year, in January and July. Because of steadily rising printing and postage costs, copies are e-mailed to most subscribers as electronic .pdf files. Such files can be opened and read on either a PC or Macintosh computer using Adobe's Acrobat® Reader (version 5.0 or later). You can download a free copy of Acrobat Reader from Adobe's website (www. adobe. com). An electronic journal offers the advantage of not only requiring no shelf space but also of being searchable by computer. However, any subscriber who prefers hard-copies can print them out.

The journal is sent free to all electronic subscribers. Only a few selected library and herbaria subscribers will continue to get printed hard-copies, to meet the requirements of the nomenclatural Code that printed descriptions of new taxa be lodged in internationally recognized libraries and herbaria.

If you wish to subscribe electronically, simply e-mail your current e-mail address to the journal editor at <nancym@clear.net.nz> If you change your address, be sure to inform the editor by e-mail.

Volumes 58 and later can now be downloaded free from the website Recent Lichen Literature (RLL). The directory is http://www.nhm.uio.no/botanisk/lav/RLL/AL/ Those same volumes plus searchable scans of Volumes 41–57 can be downloaded from http://www.anbg.gov.au/abrs/lichenlist/Australasian_Lichenology.html

INFORMATION FOR AUTHORS

Research papers submitted to *Australasian Lichenology* must be original and on some aspect of Australasian lichens or allied fungi, and they are refereed. The journal also welcomes newsworthy items on lichenologists who are studying Australasian lichens or who are visiting the region. A manuscript can be posted as a single hard-copy to W.M. Malcolm at Box 320, Nelson, New Zealand 7040 (no computer disks, please), or e-mailed (nancym@clear.net.nz) as a text file saved in cross-platform "rich text format" (.rtf). See a recent issue for a guide to text formatting and reference citations.

Drawings should be inked originals, and photographs should be sharp and clear (prints will do but negatives or transparencies are preferred). Drawings and photographs can be air-mailed or else scanned at 600 dpi and then e-mailed as TIFF (.tif) or highest-quality JPEG (.jpg) files.

Australasian Lichenology provides electronic off-prints to authors as .pdf files. The journal does not ordinarily provide hard-copy off-prints, but off-prints of papers with colour plates can be purchased for NZ$2.00 per copy per A5 plate if they're ordered when the manuscript is accepted for publication.

Australasian Lichenology is the official publication of the Australasian Lichen Society, and formerly was named the *Australasian Lichenological Newsletter*. Its Editorial Board is W.M. Malcolm, J.A. Elix, G. Kantvilas, S.H.J.J. Louwhoff, and P.M. McCarthy.

New lichen records from Australia 73. *Agonimia opuntiella*

André Aptroot
ABL Herbarium, G. v.d. Veenstraat 107, NL-3762 XK Soest, The Netherlands.

Abstract: A corticolous specimen of *Agonimia opuntiella* (Buschardt & Poelt) Vězda from south-eastern Queensland is the first Australian record of this pyrenocarpous lichen.

Agonimia opuntiella (Buschardt & Poelt), *Lich. Rar. Exsicc.* **33**, 4 [330] (1997)
Basionym: *Physcia opuntiella* Buschardt & Poelt, *in* Poelt, *Flora* **169**, 24 (1980)

Thallus minutely squamulose, the squamules up to 2.0 × 0.5 mm, greenish grey to brownish, generally with a few deep incisions, with ellipsoid to subglobose blastidia; surface towards the tips with up to 0.1 mm long hyaline hairs; paraplectenchymatous throughout. Perithecia on the lobe bases, pyriform, black, rugose, 0.2–0.5 × 0.2–0.4 mm, the wall carbonized outside, cellular (perithecia not present in the Australian material). Interascal filaments absent. Asci clavate, 2-spored. Ascospores densely muriform, hyaline when young, yellowish brown when mature, 40–70 x 20–30 µm.

Originally described as a species of *Physcia* and subsequently transferred to *Phaeophyscia*, the discovery of perithecia finally saw this squamulose lichen accommodated in *Agonimia* (Verrucariaceae; Vězda 1977). It has been reported from alpine Europe, eastern Europe, the British Isles, France, Spain, Portugal, Macaronesia, Turkey, eastern and midwestern U.S.A., Mexico, Brazil and South-east and East Asia, and I know of unpublished collections from Peru, Ecuador and Japan. It grows on mosses and detritus over soil and rock and, in the tropics, on the dry, dusty and rather eutrophicated bark of mature trees.

Illustrations: Poelt (1980): 24–25; Vězda (1997): 5.
Descriptions: Poelt (1980): 24; Vězda (1997): 4; Breuss *in* Nash *et al.* (2002): 90; Aptroot *et al.* (2008): 28–29; Orange & Purvis *in* Smith *et al.* (2009): 138.

SPECIMEN EXAMINED
Queensland: • Brisbane, near the Brisbane River, alt. 50 m, 27º36'S, 153º03'E, on the bark of a cultivated tree, *A & M. Aptroot 21799*, ii.1988 (ABL).

References

Aptroot, A; Lücking, R; Sipman, HJM; Umaňa, L; Chaves, JL (2008): Pyrenocarpous lichens with bitunicate asci. A first assessment of the lichen biodiversity inventory in Costa Rica. *Bibliotheca Lichenologica* **98**, 1–162.
Nash, TH III; Ryan, BD; Gries, C; Bungart, F (eds) (2002): *Lichen Flora of the Greater Sonoran Desert Region, Volume I*. Lichens Unlimited, Tempe.
Poelt, J (1980): *Physcia opuntiella* species nova und die Lebensform der sprossenden Flechten. *Flora* **169**, 23–31.
Smith, CW; Aptroot, A; Coppins, BJ; Fletcher, A; Gilbert, OL; James, PW; Wolseley, PA (eds) (2009): *The Lichens of Great Britain and Ireland*. British Lichen Society, London.
Vězda, A (1997): *Lichenes Rariores Exsiccata* **33**, 1–11 (nos 321–330).

Marginal soralia and conidiomata in *Icmadophila splachnirima* (Icmadophilaceae) from southern New Zealand

Lars Ludwig
Vor dem Schlosse 11, 99947 Bad Langensalza, Germany
email: lars-ludwig@gmx.de

Abstract: Marginal soralia and occasional conidiomata are reported for the first time in populations of *Icmadophila splachnirima* (Icmadophilaceae) from southern New Zealand. Ecological implications are discussed, and an emended description is given.

Introduction

Icmadophila splachnirima (Hook.f. & Taylor) D.J.Galloway has a restricted distribution on peaty soil in wetlands of southern New Zealand, Chatham Islands, Campbell Island, Auckland Islands, Tasmania and Victoria (Galloway & Elix 1981; Galloway 1985, 2007; Johnston 2001). While mapping its distribution in the Dunedin area of southern New Zealand, I discovered specimens with soredia, previously unrecorded for the species. Preliminary observations on the occurrence of soredia, based on field and herbarium studies, are presented here, together with an emended description of *Icmadophila splachnirima* accommodating soralia and adding information on conidiomata that appear to be only rarely developed in the species.

Material and methods

Between December 2008 and February 2009, fresh material was sampled from two sites, a naturally drained peat bog on Swampy Summit (45°47.7'S, 170°29.0'E, c. 720 m) (Johnson & Gerbeaux 2004), and steep to overhanging sides of deeply eroded tramping paths in Silver Peaks Reserve between Green Hill and Silver Peak (45°44.5'S, 170°27.1'E, 650–750 m). Both sites are located a few kilometres north of Dunedin. All available herbarium specimens from OTA and CHR were thoroughly examined for sorediate margins. Scanning electron micrographs (SEM) were made with the assistance of Prof. Sieglinde Ott and her research group in Düsseldorf, Germany (Botanisches Institut, Heinrich-Heine-Universität, Universitätsstr. 1, D-40225 Düsseldorf, Germany).

Results

Marginal soralia were first noticed on a specimen collected near Silver Peak. Comparison of numerous colonies found on Swampy Summit ruled out the possibility of sorediate margins being merely a random abnormality. Hardly any colony seen was free of soralia, but the proportion of sorediate versus entire margins varied from 0–100%.

Field observations suggest an inverse correlation between the extent of marginal soralia and the development of apothecia—the more apothecia are produced, the fewer soralia are formed and *vice versa*. Strongly sorediate specimens are often densely covered with apothecium initials apparently arrested at an early developmental stage (Fig. 1). The majority of fertile specimens have predominantly entire margins (Fig. 2) or no soredia at all. In a very few cases, the same specimen has seemingly mature apothecia together with pronounced soralia (Fig. 3 and part Fig. 4).

Herbarium studies showed a wide distribution of sorediate colonies in southern New Zealand. A few specimens with relatively obvious soralia, comprising up to 30% of all margins, had been collected in 1959 (OTA 053083) and 1969 (CHR 373973) on Swampy Summit and Silver Peaks, respectively. Also, a specimen from Campbell Island sampled in 1960 (OTA 053076) shows extensive development of marginal soralia (30–50%). Rather inconspicuous sorediate areas (< 3%) are present on specimens collected on Swampy Summit in 1966 (OTA 046895) and Stewart Island in 1979 (CHR 373960), 1998 (CHR 528457) and 2001 (CHR 528458). Less noticeable (< 1%) but still distinct sorediate areas are detectable on specimens from the Awarua Plains near

Invercargill (1958, OTA 053080), Swampy Summit (1959, OTA 053084), Borland Bog (1996, OTA 046889), and Black Swamp (2003, OTA 058013). The four type specimens from Tasmania, held at the Natural History Museum in London (BM), were checked by Holger Thüs, who found no soralia (H. Thüs, pers. comm.).

SEM examination (Figs. 5a–5c) shows that at least some soredia develop into new lobules directly on their parent thalli. While esorediate specimens usually exhibit continuous thalli with relatively few large lobes that are oriented parallel to the substratum, many sorediate specimens display a flaking structure caused by many small, densely crowded, more or less overlapping, squamulose lobules that are often nearly perpendicular to the substratum.

Another noteworthy result was the observation of conidiomata (pycnidia), not mentioned in extant descriptions, although conidiophores were examined by Gierl & Kalb (1993).

To accommodate those findings, the following amendments to descriptions by Galloway & Elix (1981), Galloway (1985, 2000) and Johnston (2001) are proposed:

Icmadophila splachnirima (Hook.f. & Taylor) D.J.Galloway emend. L.R.Ludwig
(For additional synonymy see Galloway (2007: 650–651)) Figs 1–5

Soralia present or absent; when present marginal, narrowly labriform and eroding both upper and lower surfaces, usually on sterile specimens having apothecium initials only, soredia white, farinose. Conidiomata pycnidia, rare or absent; when present widely scattered to clustered, completely immersed and hardly noticeable, visible as whitish dots or dents on upper surface, not visible from below, ostiole without dark pigmented halo; in section ±circular to flattened-ovoid, c. 150–200 × 150–350 μm in diam.; hyphae of pycnidial wall densely woven. Conidiophores Type VI (Gierl & Kalb 1993) see Vobis (1980) and Vobis & Hawksworth (1981). Conidia cylindrical, 3–5 × 1.3–2 μm, released *via* a bayonet-like process of the intercalary conidiogenous cells.

SPECIMENS EXAMINED

Former herbarium ID-codes published earlier (e.g. in Galloway & Elix 1981) are given in square brackets. New Zealand, South Island, *Otago*: • Maungatua, H.H. Allan, 1936 (CHR 373970); • Silver Peaks near Pulpit Rock, J. Murray, 1959 (OTA 053083 [4236]); • Swampy Summit, J. Murray, 1959 (OTA 053084 [4183]), D.J. Galloway, 1966 (OTA 046895), D.J. Galloway, 1969 (CHR 373973); • Black Swamp, A. Pelletier, C. Haas, 2003 (OTA 058013); *Southland*: • Awarua Plains, W. Martin, 1958 (OTA 053080 [7300]); • Awarua Bay, D.J. Galloway, 1961 (CHR 373971), R.F. Johnson, 1961 (CHR 373972); *Stewart Island*: • Deceit Peaks, 1979, C.D. Meurk (CHR 373960); • Port Pegasus, C.D. Meurk, 1979 (CHR 373962), D.J. Galloway, 1967 (CHR 608290, CHR 608291, CHR 608293, CHR 608294, CHR 608295, CHR 608296), D.J. Galloway, 1969 (CHR 373974), D.J. Galloway, 1998 (CHR 528457), D.J. Galloway, 2001 (CHR 528458); *Auckland Islands*: • N.E. Harbour, G. Einar Du Rietz, *sine anno* (OTA 053082 [2572:7]); *Campbell Island*: • Mt Beeman, 1959 party, 1959 (OTA 053078 [5395]), G.P. Poppleton, 1959 (OTA [5463]); • *sine loco*, R.G. Ray, 1960 (OTA 053076 [5503], OTA 053079 [5504], OTA 053077 [5505], OTA 053081 [5471]).

Discussion

Neither soralia nor pycnidia are mentioned in the descriptions of *Icmadophila splachnirima* (Galloway & Elix 1981; Galloway 1985, 2000, 2007; Johnston 2001) published since the species was described from Tasmania in 1844 (Hooker & Taylor). As a result, the strongly sorediate specimens that I discovered in the Dunedin area initially seemed sufficiently distinct to justify their being described as a new species in a species pair, one of them fertile and esorediate and the other sterile and sorediate (Poelt 1970, Tehler 1982, Sparrius *et al*. 2005). However, after discovering a continuous

range of intermediates between those two extremes, I rejected that interpretation and now regard *I. splachnirima* as a single species. Further, I suggest that its occasional production of soredia is an adaptive response to unfavourable growing conditions. In good conditions, the species produces only apothecia. In contrast, the stress of poor conditions arrests the development of apothecia and triggers the production of soredia instead. Long-lived thalli could switch back and forth several times between those two extremes as a result of changes to moisture and irradiance in the species' disturbed habitat. As evidence for that hypothesis, strongly sorediate specimens often are densely covered with apothecium initials that appear to have been arrested early in their development (Fig. 1). Tehler (1982) discusses a case in the genus *Dirina* that is similar but on a larger scale, driven by changes in regional climate rather than local habitat.

Further evidence for an ecological explanation of soredia production in *I. splachnirima* is the restoration of apothecial growth by altered environmental conditions (Fig. 4) and the partly multi-layered thallus architecture resulting from new lobules growing out of soredia (Fig. 5). That growth pattern is beneficial for water economy (Jahns 1984), and could implicate photo-stress and/or desiccation as possible triggers for the inhibition of apothecial development and the formation of soralia. The occasional production of marginal soralia in addition to apothecia is also known in *Trapeliopsis colensoi* (C.Bab.) Gotth.Schneid., another Australasian lichen with a squamulose to small-foliose thallus and similar habitat preferences (Galloway 1985, 2007).

It appears most likely that biased collections are the reason why soralia were not noticed by previous collectors. Typically, collectors gather fertile specimens, which are predominantly esorediate. Occasional soralia are difficult to detect in the field, and identification of the species does not require closer examination of fertile material. On the other hand, strongly sorediate specimens without any apothecia are not readily identifiable as *I. splachnirima*, and could easily be confused with well-developed squamules of *Cladonia*.

To investigate further the production of soredia in *I. splachnirima*, a more comprehensive field study is planned, examining and manipulating the micro-environmental conditions of the two reproductive phenotypes. It will be supported by the British Lichen Society as a BLS Summer Vacation Scholarship Project. In addition, a molecular genetic study of the taxonomic status of sorediate colonies will be undertaken.

Acknowledgements

I am grateful to Landcare Research New Zealand Limited (Dunedin Office) and especially to Dr David Galloway for his supervision of my lichenological internship which led to the findings reported in this paper. Further, I thank David for improvements to the manuscript's English. For provision of accommodation and their kind hospitality during my internship, I warmly thank Wenzel Czepluch (Dunedin), Tara Schoenwetter (Christchurch) and Sue Gibb (Landcare Research, Lincoln). Many thanks also to Janet Ledingham (Dunedin) for transporting me and my equipment up to the study site at Swampy Summit. I thank Dr Holger Thüs (BM) for checking type specimens in London. I am also much indebted to Prof. Sieglinde Ott (Heinrich-Heine-University, Düsseldorf, Germany) and her research group (especially Dr Günter Schuster and Claudia Bauten), for the SEM examination and many valuable discussions. For introducing me to lichens a few years ago and arousing my interest in lichenology, I am particularly grateful to Dr Regine Stordeur (Martin-Luther-University, Halle, Germany) and Mark Schönbrodt (Halle).

References

Galloway, DJ (1985): *Flora of New Zealand Lichens*. P.D. Hasselberg, Government Printer, Wellington.

Galloway, DJ (2000): *Knightiella* belongs in *Icmadophila* (Helotiales: Icmadophilaceae). *Lichenologist* **32**, 294–297.

Galloway, DJ (2007): *Flora of New Zealand Lichens. Revised Second Edition Including Lichen-Forming and Lichenicolous Fungi*. Manaaki Whenua Press, Lincoln.

Galloway, DJ; Elix, JA (1981) ['1980']: *Knightiella* Müll.Arg., a monotypic lichen genus from Australasia. *New Zealand Journal of Botany* **18**, 481–486.

Gierl, C; Kalb, K (1993): Die Flechtengattung *Dibaeis*. Eine Übersicht über die rosafrüchtigen Arten von *Baeomyces* sens. lat. nebst Anmerkungen zu *Phyllobaeis* gen. nov. *Herzogia* **9**, 593–645.

Hooker, JD; Taylor, T (1844): Lichenes Antarctici, being characters and brief descriptions of the new Lichens discovered in the southern circumpolar regions, Van Diemen's Land and New Zealand during the Voyage of H.M. Discovery Ships *Erebus* and *Terror*. *London Journal of Botany* **3**, 634–658.

Jahns, HM (1984): Morphology, reproduction and water relations - a system of morphogenetic interactions in *Parmelia saxatilis*. *Beiheft zur Nova Hedwigia* **79**, 715–737.

Johnson, P; Gerbeaux, P (2004): *Wetland Types in New Zealand*. Department of Conservation, Wellington.

Johnston, J (2001): Icmadophilaceae. *Flora of Australia* **58A**, 17–23.

Poelt, J (1970): Das Konzept der Artenpaare bei den Flechten. *Vorträge aus dem Gesamtgebiet der Botanik, Neue Folge* **4**, 187–198.

Sparrius, LB; James, PW; Allen, MA (2005): The sorediate variety of *Sclerophytomyces circumscriptus*. *Lichenologist* **37**, 285–289.

Tehler, A (1982): The species pair concept in lichenology. *Taxon* **31**, 708–717.

Vobis, G (1980): Bau und Entwicklung der Flechten-Pycnidien und ihrer Conidien. *Bibliotheca Lichenologica* **14**, 1–141.

Vobis, G; Hawksworth, DL (1981): Conidial lichen-forming fungi. In Cole, GT; Kendrick, B (eds), *The Biology of Conidial Fungi* **1**, 245–273. Academic Press, New York.

Fig. 1. Sorediate specimen with apothecia initials.

Fig. 2. Fertile specimen with predominantly entire margins, exhibiting some inconspicuous yet distinct soralia. Width of the photographic field approx. 30 mm.

Fig. 3. Rare specimen with mature apothecia and pronounced soralia.

Fig. 4. Sorediate specimen with apothecium initials, which grew to maturity only when sheltered by litter from mountain flax, *Phormium cookianum*. The rotting leaf is still connected to the plant, indicating a permanent cover that probably facilitated apothecial development.

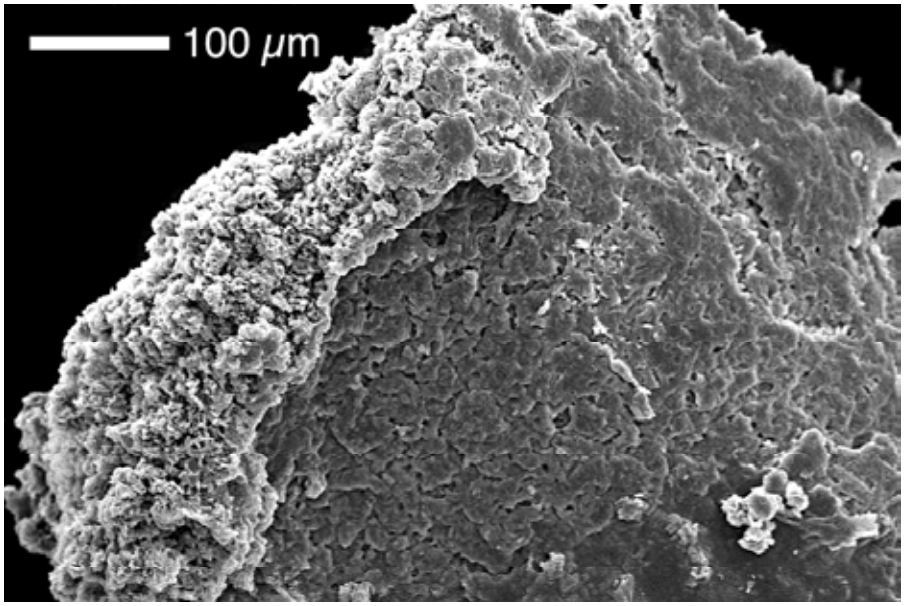

Fig. 5a. Soralia. SEM.

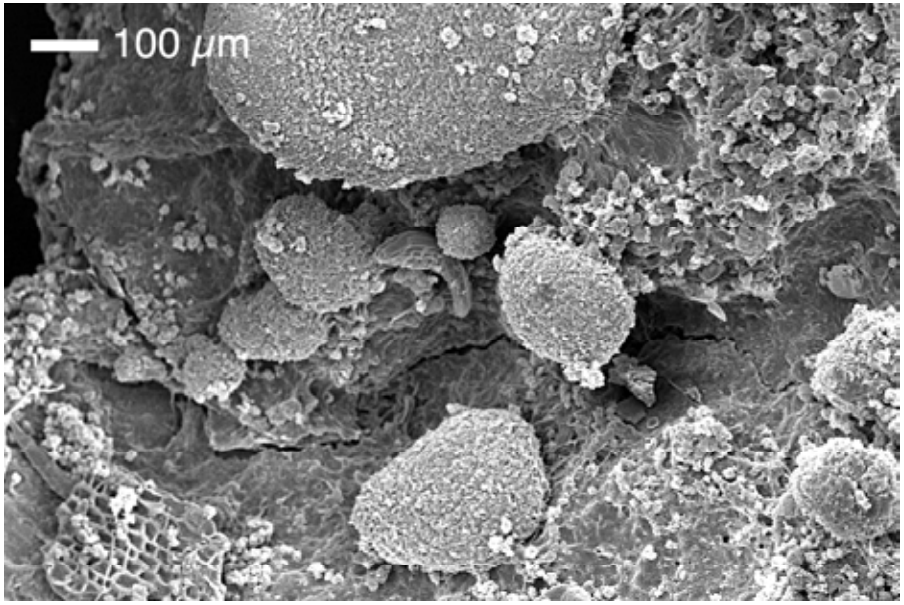

Fig. 5b. Minute new lobules emerging from soredia. SEM.

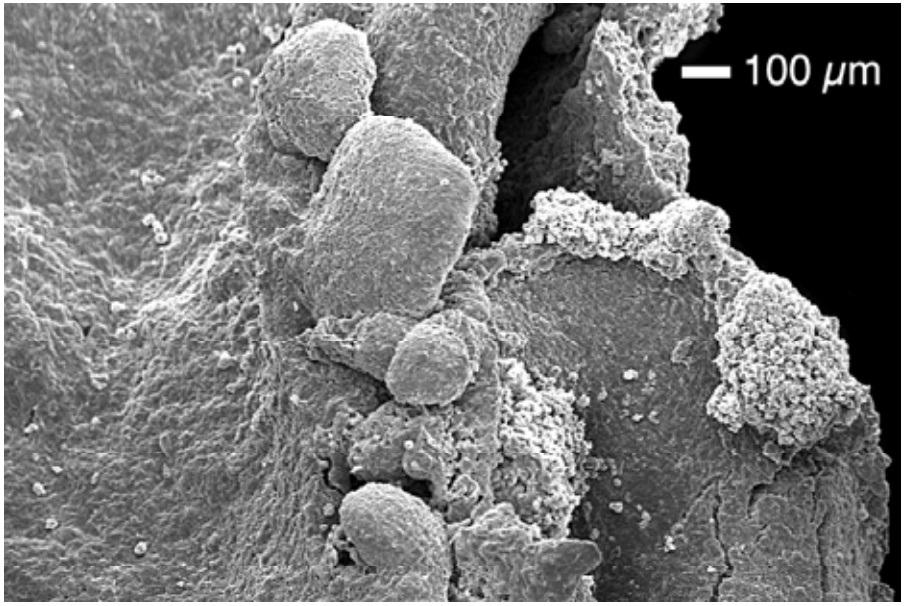

Fig. 5c. Older lobules apparently grown from soredia. SEM.

A new species of *Protopannaria* (Pannariaceae, Ascomycota) from the southern New Zealand shelf islands, and additional records of *Protopannaria* from South America

Dag O. Øvstedal
Bergen Museum, DNS, University of Bergen
Allégaten 41, N-5007 Bergen, Norway
e-mail: Dag.Ovstedal@bm.iub.no

Alan M. Fryday
Herbarium, Dept of Plant Biology, Michigan State University
East Lansing, MI 48824-1312, U.S.A.
email: fryday@msu.edu

Abstract:
The new species *Protopannaria campbellensis* is described from Campbell Island and the Auckland Islands. Additional records are also provided for *P. austro-orcadensis* and *P. azorellae*, which are reported for the first time from South America.

Introduction

The genus *Protopannaria* (Gyeln.) P.M.Jørg. & S.Ekman was originally described as a subgenus of *Pannaria* Delise ex Bory and accepted as such by Jørgensen (1994). It was elevated to genus level by Jørgensen (2000) for the single species *P. pezizoides* (Weber) P.M.Jørg. & S.Ekman. Currently, six species are known, including three from the southern subpolar region: *P. austro-orcadensis* (Øvstedal) P.M.Jørg. from the western Antarctic islands and Tierra del Fuego, *P. alcicornis* P.M.Jørg. & R.S.Poulsen from Îles Kerguelen, and *P. azorellae* P.M.Jørg. & R.S.Poulsen from Heard Island, Kerguelen, the Falkland Islands and Tierra del Fuego (Jørgensen 2001, 2004; Fryday & Øvstedal in prep.; Øvstedal & Gremmen 2006).

Protopannaria is characterized by a granular-areolate to small-squamulose thallus, often forming a dense cover over the substratum; an absent or indistinct prothallus; apothecia with a well-developed thalline margin; I+ blue hymenium; asci without internal amyloid structures; and simple ascospores, often with a warted exospore (Jørgensen 2007).

The Michigan State University Herbarium (MSC) contains much lichen material from the southern subpolar region, collected mainly by Henry Imshaug and coworkers between 1965 and 1973. In Australasia, Imshaug, with Richard Harris, visited Campbell Island in 1969–70 and the Auckland Islands in 1971, collecting almost 3,000 lichen specimens from the former and over 1,600 from the latter. Imshaug also visited Îles Kerguelen in 1971 with Harris and the Tasmanian lichenologist Geoff Bratt, and before and after each of those expeditions they also collected lichens from the South Island of New Zealand, totalling over 2,300 collections. Harris also made brief visits to the Snares and Antipodes Islands (Fryday & Prather 2001). Although some specimens were accessioned into MSC, the bulk of their collections received only a preliminary examination and remained in temporary storage in cardboard boxes. However, two recent awards from the US National Science Foundation (NSF) have seen much of this material accessioned into the herbarium and the label data added to a database and made available on-line, thus facilitating access to this extensive resource by other researchers.

A number of taxonomic innovations and additional records for New Zealand have previously been reported from these collections (Coppins & Fryday 2006, 2007; Fryday 2000a, b, 2001, 2003, 2004, 2007a, b, and 2008), and here we report a further new species from Campbell Island and the Auckland Islands.

Material and methods

The specimens are deposited in MSC. They were examined using a Zeiss Stemi 2000C stereo microscope and a Zeiss Axiolab compound microscope. Chemical constituents were sought with the aid of thin-layer chromatography (Elix & Ernst-Russell 1993).

Protopannaria campbellensis Øvstedal & Fryday sp. nov. Fig. 1
Mycobank No.: **MB 519070**

Protopannaria alcicornis similis sed squamulae marginalis cuneatus.
Typus: New Zealand, Campbell Island, wet grassland and upland peat bogs on the summit of Mt Dumas, alt. 503 m, *R.C. Harris 4980,* 2.i.1970 (holotypus–MSC).

Thallus brown, heteromerous; composed of flat tufts 4–5 cm across, consisting of imbricate squamules. In inner part, squamules 4–5 mm high, erect, ±terete, homoiomerous, 0.2–0.25 mm diam., simple or irregularly divided at apex; at margin of tufts squamules cuneiform, to 2 mm wide, with irregular projections. Photobiont *Nostoc*; individual cells 3–5 μm diam. In vertical section (flat parts), upper cortex 4–5 μm high, consisting of colourless hyphae lying parallel to the surface, subtended by a layer 40–50 μm high, consisting of densely agglomerated hyphae perpendicular to the surface, brownish in uppermost part but colourless further down; below that a colourless, loose medulla, 50–60 μm high, with short chains of cyanobacteria; and below that a massive layer, 130–140 μm high, consisting of a *textura intricata*; lower cortex absent, but thallus with strongly conglutinated hyphae and with short, loose hyphae ends. Apothecia and pycnidia not observed.
Chemistry: no lichen compounds detected.

Distribution: Known only from the summits of mountains on the southern New Zealand shelf islands (Campbell Island, Auckland Island), the type growing on acidic soil and other specimens growing on montane rocks.

ADDITIONAL SPECIMENS EXAMINED
New Zealand. *Campbell Island*: • rock outcrops on west end of Lyall ridge, alt. 366 m, *H.A. Imshaug 46214*, 26.xii.1969, (MSC); • *ibid*., rock outcrops on west end of Lyall ridge, alt. 366 m, *H.A. Imshaug 46159*, 26.xii.1969 (MSC); *Auckland Islands*: • summit of Mt Eden, alt. 497 m, *H.A. Imshaug 57514*, 7.i.1973 (MSC).

Remarks:
We know of no species like this on Prince Edward Islands, Heard Island, Îles Kerguelen, or on any of the Antarctic Islands. Neither is there any description matching it from New Zealand (Galloway 2007), and it is not known to Per Magnus Jørgensen (pers. comm., 2010). Because it is not fertile, the generic placement is tentative, but its general appearance, lack of lichen substances, and lack of rhizines strongly suggest a placement in *Protopannaria.* The new species differs from the two somewhat similar species, *viz. P. alcicornis* and *P. austro-orcadensis*, in the broad and flattened marginal lobes and the lack of a distinct lower cortex. Both of those two species have marginal lobes that are flat-lying, but they are subterete and little broadened. In addition, both species have a thin but distinct lower cortex of a pseudoparenchymatous tissue.

Additional Records of other Southern Hemisphere species

Protopannaria austro-orcadensis (Øvstedal) P.M.Jørg., *Cryptog. Mycol.* **22**, 68 (2001)

SPECIMENS EXAMINED
Argentina. *Tierra del Fuego Province*: • Isla Grande (Tierra del Fuego), along Rio Lashufashaj, along Ruta Nac. No. 3, just E of Tierra Mayor, 54°43'S, 68°1'W, alt. 300 m, on rocks on cliff, *H.A. Imshaug 55242 & K. Ohlsson*, 26.ix.1971 (MSC); • *ibid.*, barren alpine region on summit of mountain between Monte Cornu and Paso Garibaldi, Sierra

Lucas Bridges, 54°42'S, 67°45'W, alt. 900 m, *H.A. Imshaug 55418 & K. Ohlsson*, 27.xi.1971 (MSC).

Protopannaria azorellae P.M.Jørg. & R.S.Poulsen, in Jørgensen, *Cryptog. Mycol.* **22**, 70 (2001)

SPECIMENS EXAMINED
Falkland Islands. *West Falkland*: • Hill Cove, outcrops between Sharp Peak Ridge and Byron Sound, alt. 92 m, *H.A. Imshaug 41226 & R.C. Harris*, 26.i.1968 (MSC). *East Falkland*: • Stanley, cliffs on rock dome at summit of Mt Kent, alt. 458 m, *H.A. Imshaug 40486 & R.C. Harris*, 14.i.1968 (MSC).
Chile. *Magallanes and Antárctica Chilena Region*: • Brunswick Peninsula, *Nothofagus* grove at junction of airport and Punta Arenas-Cabeza del Mar roads, at Chabunco, *H.A. Imshaug 49507 & K. Ohlsson*, 6.x.1971 (MSC).

Remarks
The Falkland Islands material of *Protopannaria azorellae* is similar in most essential details to Kerguelen and Heard Island specimens, but has somewhat larger ascospores. The occurrence on moribund bryophytes in Brunswick Peninsula, Chile, indicates that this species has a wider ecological amplitude than previously understood. Both species are reported here for the first time from South America.

Acknowledgements
AMF thanks the US National Science Foundation for Awards No. DBI–9808735 and DBI–0237401 (Alan Prather, PI) to Michigan State University that facilitated access to Dr Imshaug's extensive collections.

References
Coppins, BJ; Fryday, AM (2006): New or previously misunderstood species of *Lithographa* and *Rimularia* (*Agyriaceae*) from the southern subpolar region and western Canada. *Lichenologist* **38**, 93–107.
Coppins, BJ; Fryday, AM (2007): Three new species of *Bacidia* s.lat. (Ramalinaceae) from Campbell Island (New Zealand). *Bibliotheca Lichenologica* **95**, 155–164.
Elix, JA; Ernst-Russell, KD (1993): *A Catalogue of Standardized Thin-Layer Chromatographic Data and Biosynthetic Relationships for Lichen* Substances, 2nd Edn, Australian National University, Canberra.
Fryday, AM (2000a): Additional lichen records from New Zealand 31. *Australasian Lichenology* **46**, 36–39.
Fryday, AM (2000b): Additional lichen records from New Zealand 32. *Australasian Lichenology* **47**, 30–31.
Fryday, AM (2001): Additional lichen records from New Zealand 33. *Australasian Lichenology* **48**, 38–39.
Fryday, AM (2003): Additional lichen records from New Zealand 39. *Australasian Lichenology* **52**, 25–26.
Fryday, AM (2004): New species and records of lichenized fungi from the Auckland Islands and Campbell Island, New Zealand. *Bibliotheca Lichenologica* **88**, 127–146.
Fryday, AM (2007a): Additional lichen records from New Zealand 47: *Coccotrema corallinum* Messuti, *Coccotrema pocillarium* (C.E.Cumm.) Brodo. *Australasian Lichenology* **61**, 3–5.
Fryday, AM (2007b): Additional lichen records from New Zealand 46: *Degelia symptychia* (Tuck.) P.M.Jørg. *Australasian Lichenology* **60**, 4–5.
Fryday, AM (2008): Three new species with cephalodia from the southern New Zealand shelf islands. *Lichenologist* **40**, 283–294.
Fryday, A; Øvstedal, DO (2011): The lichens of Falkland Islands. In prep.
Fryday, AM; Prather, LA (2001): The lichen collection of Henry Imshaug at Michigan State University Herbarium (MSC). *Bryologist* **104**, 464–467.

Galloway, DJ (2007): *Flora of New Zealand Lichens. Revised Second Edition Including Lichen-Forming and Lichenicolous Fungi*. Manaaki Whenua Press, Lincoln.
Jørgensen, PM (1994): Studies in the lichen family Pannariaceae VI: The taxonomy and phytogeography of *Pannaria* Del. *s. lat. Journal of the Hattori Botanical Laboratory* **76**, 197–206.
Jørgensen, PM (2000 [2001]): Survey of the lichen family Pannariaceae on the American continent north of Mexico. *Bryologist* **103**, 670–704.
Jørgensen, PM (2001): Studies in the lichen family Pannariaceae X. The lichen genus *Protopannaria* in the subantarctic islands. *Cryptogamie Mycologie* **22**, 67–72.
Jørgensen, PM (2004): Further contributions to the Pannariaceae (lichenized Ascomycetes) of the Southern Hemisphere. *Bibliotheca Lichenologica* **88**, 229–253.
Jørgensen, PM (2007): Pannariaceae. *Nordic Lichen Flora* **3**, 96–112.
Øvstedal, DO; Gremmen, NJM (2006): The lichens of Heard Island. *South African Journal of Botany* **72**, 353–366.

Fig. 1. *Protopannaria campbellensis*. Holotype. Scale bar = 2 mm

Three new species of *Heterodermia* (Physciaceae, Ascomycota) from Australia

John A. Elix
Research School of Chemistry, Building 33,
Australian National University, Canberra, A.C.T. 0200, Australia
email: John.Elix@anu.edu.au

Abstract: *Heterodermia archeri* Elix, *H. subneglecta* Elix and *H. verdonii* Elix are described as new to science, and the new combination *H. corcovadoensis* (Kurok.) Elix is made.

In his comprehensive work on the genus *Heterodermia*, Kurokawa (1962, 1973) accepted a relatively narrow species concept, but in a number of subsequent treatments a much broader species circumscription was adopted where chemical characters were largely discounted (Moberg & Purvis 1997; Moberg & Nash 1999, 2002; Moberg 2004a, 2004b). By contrast, very recent phylogenetic studies of the *H. obscurata-H. japonica* group in Costa Rica, utilizing molecular phylogenetic analyses of ITS sequences, confirmed that both medullary chemistry and pigmentation (and associated chemistry) of the lower surface are important diagnostic characters (Lücking *et al.* 2008). The latter characters are used to delimit species in the present work in which three new species are described for Australia.
Chemical constituents were identified by thin-layer chromatography (Elix & Ernst-Russell 1993), high-performance liquid chromatography (Elix *et al.* 2003) and comparison with authentic samples.

The new species

Heterodermia archeri Elix, sp. nov. Fig. 1
Sicut *Heterodermia spathulifera* sed laxe adnatus, lobis elobulatibus, et testaceinum continens et spathulinum deficiens differt.

Type: Australia. *Queensland*: Cook District, Flaggy Creek, Black Mountain Road, 9 km NNW of Kuranda, 16°47′S, 145°36′E, 420 m, on felled trees along the rainforest margin, *J.A. Elix 17595 & H. Streimann*, 7.vii.1984 (holotype – CANB).

Thallus foliose, orbicular to irregularly spreading, loosely adnate, up to 5 cm wide, but often forming colonies up to 10 cm wide. *Lobes* 0.5–1.2 mm wide but ±widening to c. 2–3 mm at the tips, flat to weakly convex, sublinear-elongate, dichotomously to subpalmately branched, radiating, the lobe-tips ±ascending, with marginal rhizines visible from above. *Upper surface* greenish white, whitish to cream-coloured, sorediate; soredia farinose to granular, in labriform soralia, sometimes becoming large, to 5 mm wide, and spathulate. *Medulla* white. *Lower surface* ecorticate, whitish at the margins, darkening to pale brown centrally, rhizinate; rhizines marginal, simple, white or creamish, 1–2(–3) mm long. *Apothecia* and pycnidia not seen.
Chemistry: Cortex and medulla K+ yellow; containing atranorin (major), zeorin (major), 6α-acetoxyhopane-16β,22-diol (minor), 6α,22-dihydroxyhopane-25-oic acid (minor), 6α-acetoxy-16β,22-dihydroxyhopane-25-oic acid (minor), 6α-acetoxy-22-hydroxy-hopane-25-oic acid (trace), leucotylin (trace), dissectic acid (minor), ±norbaeomycesic acid (minor), testacein (minor).
Etymology: The specific epithet honours my friend and colleague, the Australian lichenologist Dr Alan W. Archer.

Notes: This new species is distinguished by the loosely adnate thallus with narrow, sublinear-elongate lobes with pale marginal rhizines and spathulate soralia on some of the subascending lobe apices. Morphologically, *H. archeri* closely resembles *H. spathulifera* Moberg & Purvis, but the latter species has a firmly adnate thallus and contains spathulin (16β-acetoxyhopane-22-ol) as a major triterpene. In moist, shaded habitats, the soredia of *H. spathulifera* tend to develop into squamules that sometimes

cover the inner parts of the thallus, but the soredia of *H. archeri* do not do so. *Heterodermia archeri* also resembles the Asian species *H. allardii* (Kurok.) Trass and the Neotropical *H. galactophylla* (Tuck.) W.L.Culb., but *H. allardii* produces additional norstictic and connorstictic acids, while *H. galactophylla* lacks testacein. In addition, *H. galactophylla* has broader lobes (2–8 mm *versus* 2–3 mm at the tips) and fruticosely to thyrosoidly branched rhizines (simple in *H. archeri)*.

At present this new species is known from several localities in north-east Queensland and Papua New Guinea, where it occurs on bark and twigs in montane rainforests. Associated species include *Dirinaria applanata* (Fée) D.D.Awasthi, *Heterodermia hypocaesia* Yasuda, *H. hybocarponica* Elix, *H. queenslandica* Elix, *Menegazzia fissicarpa* P.James, *Pseudocyphellaria desfontainii* (Delise) Vain., *P. intricata* (Delise) Vain., *Parmotrema reticulatum* (Taylor) M.Choisy, *P. tinctorum* (Nyl.) Hale, *Pertusaria velata* (Turner) Nyl., *Sticta sayeri* Müll.Arg. and *Usnea pectinata* Taylor.

SPECIMENS EXAMINED
Australia. *Queensland*: • Kennedy North District, Kirrima State Forest, Cardwell Range, 24 km WNW of Cardwell, 18°12′S, 145°48′E, 750 m, on canopy twigs in rainforest along logging trail, *J.A. Elix 15718 & H. Streimann*, 20.vi.1984 (CANB).
Papua New Guinea. *Southern Highlands*: • Kengaput, 6 km SSE of Mendi, 6°13′S, 143°41′E, 1740 m, on small sapling in *Dacrydium* swamp, *J.A. Elix 12973 & H. Streimann*, 13.xii.1982 (CANB).

Heterodermia subneglecta Elix, sp. nov. Fig. 2
Sicut *Heterodermia neglecta* sed acidum norsticticum et acidum salzinicum deficiens differt.

Type: Australia. *New South Wales*: Mount Hyland Nature Reserve, 20 km N of Hernani, 30°10′44″S, 152°25′19″E, 1340 m, on fallen *Dorphora sassafras* in temperate rainforest, *J.A.Elix 36543*, 30.iv.2005 (holotype – CANB).

Thallus foliose, orbicular to irregularly spreading, loosely adnate, up to 5 cm wide, but often forming colonies up to 15 cm wide. *Lobes* 0.5–1.2 mm wide, but ±widening to c. 2–3 mm at the lobe junctions, flat to weakly convex or weakly concave, sublinear-elongate, dichotomously branched, radiating, the lobe-tips ascending, usually discrete, ±lobulate along the lobe margins; lobules ±rotund or sparingly branched, 0.1–0.25 mm wide, eciliate, those along the margin developing small soralia. *Upper surface* greenish white, whitish to cream-coloured, sorediate; soredia farinose to granular, in labriform to capitate soralia, on lateral or terminal lobes, sometimes spreading along lobe margins. *Medulla* white. *Lower surface* ecorticate, arachnoid, white, in part yellow- to orange-spotted, becoming dirty brown centrally as pigmented hyphae age, occasionally dark brown to almost black, rhizinate; rhizines marginal, black, simple or squarrosely branched, 1–3(–7) mm long. *Apothecia* not seen. *Pycnidia* rare, immersed, then becoming emergent, visible as black dots; conidia bacilliform, 4–5 × 1 μm.
Chemistry: Cortex and medulla K+ yellow, C–, KC–, P+ pale yellow; pigmented lower medulla K+ violet; containing atranorin (major), zeorin (major), 6α-acetoxyhopane-16β,22-diol (major), 6α,22-dihydroxyhopane-25-oic acid (trace), 6α-acetoxy-16β,22-dihydroxyhopane-25-oic acid (trace), dissectic acid (trace), hybocarpone (trace), norhybocarpone (trace), 7-chloroemodin (minor).
Etymology: The specific epithet derives from the similarity of this new species to *H. neglecta* Lendemer, R.C.Harris & E.Tripp (Lendemer *et al.* 2007).

Notes: *Heterodermia subneglecta* is characterized by the narrow lobes with sorediate apices, the absence of a lower cortex, the yellow- to orange-spotted lower surface (due to the K+ violet pigment 7-chloroemodin) and the presence of atranorin, zeorin and 6α-acetoxyhopane-16β,22-diol as major metabolites. It is morphologically very similar to *H. neglecta* and *H. japonica* (Sato) Swinscow & Krog, but the three species can be readily distinguished chemically. *Heterodermia neglecta* contains additional

depsidones (norstictic, salazinic and connorstictic acids), absent in the other two species, while *H. japonica* lacks a pigmented lower surface. This new species is an additional member of the *H. japonica* complex. In his synopsis of *Heterodermia* in eastern North America, Lendemer (2009) referred to *H. subneglecta* as "the norstictic acid-deficient strain of *H. neglecta*".

In Australia, this new species is known from three localities in New South Wales and Victoria, where it occurs on bark and twigs in temperate rainforest. Associated species include *Dirinaria applanata* (Fée) D.D.Awasthi, *Heterodermia microphylla* (Kurok.) Swinscow & Krog, *H. hybocarponica* Elix, *Hypotrachyna osseoalba* (Vain.) Y.S.Park & Hale, *Leioderma sorediatum* D.J.Galloway & P.M.Jørg., *Lepraria cupressicola* (Hue) J.R. Laundon, *Megalaria grossa* (Pers. ex Nyl.) Hafellner, *Parmelia erumpens* Kurok., *Parmelinopsis horrescens* (Taylor) Elix & Hale, *Pertusaria erythrella* Müll.Arg., *P. subplanaica* A.W.Archer & Elix, *Usnea molliuscula* Stirt. subsp. *molliuscula* and *Vainionora aemulans* (Vain.) Kalb.

SPECIMENS EXAMINED
New South Wales: • South East Forests National Park, Goodenia Rainforest Walk, 7 km ENE of Wyndham, 36°54′03″S, 149°43′00″E, 375 m, on *Bedfordia salicina* in warm-temperate rainforest, *J.A. Elix 44264*, 28.x.2010 (CANB).
Victoria: • Hensleigh Road, Queensborough River, 13 km SE of Bendoc, 37°14′S, 148°58′E, 860 m, on treelet stem in disturbed forest with *Atherosperma* and *Dicksonia* on river flats, *H. Streimann 43648A*, 12.ii.1990 (CANB).

Heterodermia verdonii Elix, sp. nov. Fig. 3
Sicut *Heterodermia angustiloba* sed acidum norsticticum et acidum salazinicum deficiens differt.

Type: Australia. *New South Wales*: below Waihou Trig. Station, 25 km NW of Coffs Harbour, 30°06′S, 153°02′E, 340 m, on sandstone outcrop in closed *Tristania-Ficus* forest with *Akania lucens* and *Orites excelsa* understorey on moderately to steeply sloping coastal hillside, *D. Verdon 3814*, 12.x.1978 (CANB – holotype; B – isotype).

Thallus foliose, orbicular to irregularly spreading, loosely adnate, up to 5 cm wide, but often forming colonies up to 10 cm wide. *Lobes* 0.5–1.2 mm wide, flat to weakly convex or weakly concave, sublinear-elongate, dichotomously branched, radiating, the lobe tips flat, usually discrete, eciliate; squamules, isidia and soredia absent. *Upper surface* greenish white, whitish to grey. *Medulla* white. *Lower surface* corticate, whitish to pale brown, sordid brown near the centre, rhizinate; rhizines mainly marginal, concolorous with the thallus or darkening near the apices, irregularly branched, 1–2 mm long. *Apothecia* laminal, substipitate, 0.5–2.5 mm wide; thalline exciple concolorous with the thallus, margin ±crenate; disc concave, brown to blackish brown, ±thinly grey-pruinose. *Asci* cylindrical to subclavate, 8-spored. *Ascospores Pachysporaria*-type, ellipsoid, sporoblastidia absent, 20–30 × 13–15 μm. *Pycnidia* common, immersed, then becoming emergent, visible as black dots; conidia bacilliform, 4–5 × 1 μm.
Chemistry: Cortex and medulla K+ yellow, C–, P–; containing atranorin (major), zeorin (major), 6α-acetoxyhopane-16β,22-diol (major), dissectic acid (major or minor), leucotylin (minor).
Etymology: The specific epithet honours the late Australian lichenologist Doug Verdon, who collected the type specimen.

Notes: *Heterodermia verdonii* is chacacterized by the narrow, sublinear-elongate lobes with a corticate lower surface, the lack of vegetative propagules and the presence of atranorin, zeorin, 6α-acetoxyhopane-16β,22-diol and dissectic acid as major metabolites. It is morphologically very similar to *H. angustiloba* (Müll.Arg.) D.D.Awasthi, but differs chemically in lacking the depsidones (norstictic, salazinic and connorstictic acids) present in the latter. Both species occur in Australia and eastern Asia.

At present, this new species is known from several localities in north-eastern New South Wales and eastern Queensland, where it occurs on rocks in coastal and montane forests. Associated species include *Canoparmelia texana* (Tuck.) Elix & Hale, *Coccocarpia palmicola* (Spreng.) Arv. & D.J.Galloway, *Leptogium austroamericanum* (Malme) C.W. Dodge, *L. cyanescens* (Rabenh.) Körb., *Lobaria pseudoretigera* Sipman, *Menegazzia fissicarpa* P.James, *Parmotrema crinitum* (Ach.) M.Choisy, *Pseudocyphellaria desfontainii* (Delise) Vain., *P. intricata* (Delise) Vain. and *Relicina limbata* (Laurer) Hale.

SPECIMENS EXAMINED
Queensland: • Moreton District, North Tamborine National Park, 27°56′S, 153°11′E, on rocks in stream bed, *J.A. Elix 1136*, 24.viii.1975 (CANB); • Cook District, Hugh Nelson Range, along Plath Road, 15 km S of Atherton, 17°25′S, 145°26′E, 1080 m, on rocks in *Eucalyptus grandis* woodland, *J.A. Elix 16345 & H. Streimann*, 25.vi.1984 (CANB); • Cook District, Great Dividing Range, Mt Baldy, 4 km SW of Atherton, 17°16′S, 145°23′E, 1060 m, on rocks near stream along margin of regrowth forest, *J.A. Elix 17142 & H. Streimann*, 2.vii.1984 (CANB).

New combination

Heterodermia corcovadoensis (Kurok.) Elix, comb. nov.
Basionym: *Anaptychia flabellata* var. *corcovadoensis* Kurok., *Beih. Nova Hedwigia* **6**, 60 (1962).
Heterodermia corcovadoensis is characterized by the absence of a lower cortex and soredia, the dark yellow to orange-brown (K+ violet) lower surface and ascospores with sporoblastidia. It is distinguished from *H. flabellata* (Fée) A.Massal. *sens. str.* by the presence of depsidones [i.e. norstictic, ±salazinic and connorstictic acids] (Kurokawa 1962, 1973), and was previously known from Brazil.
Chemistry: Atranorin (major), zeorin (major), 16β-acetoxyhopane-6α,22-diol (major), 6α-acetoxyhopane-16β,22-diol (minor), leucotylin (minor), norstictic acid (minor), connorstictic acid (trace), ±salazinic acid (minor or trace), 7-chloroemodin (minor).

SPECIMEN EXAMINED
Queensland: • Kennedy North District, Walter Hill Range, 26 km SE of Ravenshoe, 17°46′S, 145°41′E, 800 m, on canopy of rainforest tree, *J.A. Elix 17076 & H. Streimann*, 2.vii.1984 (CANB).

Acknowledgements
I thank Neal McCracken (ANU Photography) and Dr Patrick McCarthy (ABRS, Canberra) for preparing the photographs.

References
Elix, JA; Ernst-Russell, KD (1993): *A Catalogue of Standardized Thin-Layer Chromatographic Data and Biosynthetic Relationships for Lichen Substances*, 2nd Edn, Australian National University: Canberra.
Elix, JA; Giralt, M; Wardlaw, JH (2003): New chloro-depsides from the lichen *Dimelaena radiata*. *Bibliotheca Lichenologica* **86**, 1–7.
Kurokawa, S (1962): A monograph of the genus *Anaptychia*. *Beihefte zur Nova Hedwigia* **6**, 1–115.
Kurokawa, S (1973): Supplementary notes on the genus *Anaptychia*, *Journal of the Hattori Botanical Laboratory* **37**, 563–607.
Lendemer, JC (2009): A synopsis of the lichen genus *Heterodermia* (Physciaceae, lichenized Ascomycota) in eastern North America. *Opuscula Philolichenum* **6**, 1–36.
Lendemer, JC; Harris, RC; Tripp, E (2007): *Heterodermia neglecta*, a new lichen species from eastern North America. *Bryologist* **110**, 562–565.
Lücking, R; del Prado, R; Lumbsch, HT; Will-Wolf, S; Aptroot, A; Sipman, HJM; Umaña, L; Chaves, JL (2008): Phylogenetic patterns of morphological and chemical characters

and reproductive mode in the *Heterodermia obscurata* group in Costa Rica (Ascomycota, *Physciaceae*). *Systematics and Biodiversity* **6**, 31–41.
Moberg R (2004a): The lichen genus *Heterodermia* in Europe and the Macaronesian islands. *Bibliotheca Lichenologica* **88**, 453–463.
Moberg, R (2004b): Notes on foliose species of the lichen family *Physciaceae* in southern Africa. *Symbolae Botanicae Upsalienses* **34**(1), 257–288.
Moberg, R; Nash III, TH (2002): *Heterodermia. In*: Nash III, TH; Ryan, BD; Gries, C; Bungartz, F (eds) *Lichen Flora of the Greater Sonoran Desert Region* **1**, 207–219. Arizona State University, Tempe.
Moberg, R; Purvis, W (1997): Studies on the lichens of the Azores. Part 4. The genus *Heterodermia*. *Symbolae Botanicae Upsalienses* **32**(1), 187–194.

Fig. 1. *Heterodermia archeri* (*J.A. Elix 12973 & H. Streimann* in CANB).

Fig. 2. *Heterodermia subneglecta* (*J.A. Elix 44264* in CANB).

Fig. 3. *Heterodermia verdonii* (*J.A. Elix 1136* in CANB).

Lichen phytochemistry III: further additions and amendments

John A. Elix
Research School of Chemistry, Building 33,
Australian National University, Canberra, A.C.T. 0200, Australia

Abstract: New chemical data are reported for 20 lichen species, and *Acarospora ferdinandii* (Müll.Arg.) Hue is reinstated in the Australian lichen flora.

Chemical constituents were identified by thin-layer chromatography (Elix & Ernst-Russell 1993), high-performance liquid chromatography (Elix *et al.* 2003) and comparison with authentic samples.

1. **Acarospora ferdinandii** (Müll.Arg.) Hue, *Nouv. Arch. Mus. Hist. Nat.* sér. 5, **1**, 160 (1909)
Placodium ferdinandii Müll.Arg., *Flora* **64**, 508 (1881).

Previously this species was placed into synonymy with *Acarospora nodulosa* (Dufour) Hue var. *nodulosa* (McCarthy 2010), but that taxon lacks lichen substances. Another morphologically identical taxon, *A. nodulosa* var. *reagens* (Zahlbr.) Clauzade & Cl. Roux, contains norstictic acid (Knudsen 2007). Given its distinctive chemistry and geographical distribution, *A. ferdinandii* is reinstated here as an independent species.
Chemistry: 5-*O*-methylhiascic acid (major), gyrophoric acid (minor), lecanoric acid (minor).

SPECIMENS EXAMINED
Australia: *Western Australia*: • Southern Cross-Koolyanobbing road, 21.5 km S of Koolyanobing, 30º58′50″S, 119º28′32″E, 330 m, on soil in *Eucalyptus* woodland with saltbush and shrub understorey, *J.A. Elix 32451*, 27.iv.2004 (CANB). *South Australia*: • Euria Rockhole, 60 km NE of Fowlers Bay, on soil, *A. Richards 5 pr.p.*, i.1880 (holotype – G); • 20 km W of Swan Reach along the Sedan Road, 34º34′S, 139º23′E, 80 m, on soil in mallee scrub, *J.A. Elix 2781*, 16.xii.1976 (CANB); • Yorke Peninsula, 7 km W of Ardrossan along the Maitland Road, 34º25′S, 137º50′E, on soil in mallee scrub, *J.A. Elix 3713*, 30.viii.1977 (CANB). *New South Wales*: • 3.5 km S of Balranald along the Kyalite Road, 34º39′S, 143º34′E, 80 m, on soil in mallee scrub, *J.A. Elix 4110*, 16.xii.1977 (CANB). *Victoria*: • 30 km W of Ouyen along Highway 12, 120 m, on soil in mallee scrub, *J.A. Elix 3688*, 28.viii.1977 (CANB).

2. **Brigantiaea sorediata** Kashiw., M.Inoue & K.H.Moon, *Mem. Natn. Sci. Mus., Tokyo* **38**, 75 (2002)
Chemistry: thallus containing atranorin (major), zeorin (major); apothecia containing parietin.
Previous report: atranorin, zeorin (Kashiwadani *et al.* 2002).

SPECIMEN EXAMINED
Japan: *Honshu*: • Prov. Iwashiro (Pref. Fukushima), enroute from Miike to Hirosawatashiro, N slope of Mt Hiuchi, Hinoemata-mura, Minamiaizu-gun, on bark of *Thujopsis dolabrata*, c. 1650 m, *H. Kashiwadani 44106*, 7.x.2001 (CANB – isotype).

3. **Buellia alutacea** Zahlbr., *Denkschr. Akad. Wiss. Wien math.-naturwiss. Kl.* **104**, 374 (1941)
Chemistry: 2,5,7-trichloro-3-*O*-methylnorlichexanthone (major), isoarthothelin (minor), arthothelin (minor), atranorin (minor), chloroatranorin (trace).

SPECIMEN EXAMINED
New Zealand: *Northland*: • Hen Island, on rock, *L.B. Moore A85* (CHR - isotype).

4. **Buellia dunedina** Zahlbr., *Denkschr. Akad. Wiss. Wien math.-naturwiss. Kl.* **104**, 375 (1941)
Chemistry: arthothelin (major), thiophanic acid (trace), 4,5-dichloronorlichexanthone (trace).

SPECIMEN EXAMINED
New Zealand: *Otago*: • MaCraes Hill, near Dunedin, *J.S. Thomson T2466* (CHR).

5. **Buellia fuscoatratula** Zahlbr., *Denkschr. Akad. Wiss. Wien math.-naturwiss. Kl.* **104**, 374 (1941)
Chemistry: no lichen substances detected.

SPECIMEN EXAMINED
New Zealand: *Otago*: • Goat Island, near Dunedin, on coastal rock, *J.S. Thomson T1044* (CHR – isotype).

6. **Buellia macularis** Zahlbr., *Denkschr. Akad. Wiss. Wien math.-naturwiss. Kl.* **104**, 375 (1941)
Chemistry: norstictic acid (major), connorstictic acid (trace).

SPECIMEN EXAMINED
New Zealand: *Otago*: • Hyde, 400 m, on quartz, *J.S. Thomson T2328* (CHR – lectotype).

7. **Calicium glaucellum** Ach., *Methodus* 97 (1803)
Chemistry: brialmontin 1 (major), unknown (minor).

SPECIMEN EXAMINED
Australia: *Queensland*: • Bunya Mountains National Park, Westcott Plain, 45 km SW of Kingaroy, 26º52′S 151º47′E, c. 1000 m, on decorticated stump of *Tristania*, *L. Tibell 14818*, 13.xi.1983 (CANB).

8. **Calicium victorianum** var. **desidiosum** Tibell, *Symb. Bot. Upsal.* **27**(1), 59 (1987)
Chemistry: brialmontin 1 (major), ±brialmontic acid 1 (major), ±methyl brialmontate 2 (minor).

SPECIMENS EXAMINED
Australia: *Western Australia*: • Yallingup Caves, 65 km SW of Bunbury, 33º39′S, 115º02′E, on decorticated fencepost in low, open *Eucalyptus-Acacia* forest, *L. Tibell 13953*, 9.x.1983 (CANB). *New South Wales*: • 10 km SSW of Gloucester, 3 km E of Faulkland, 32º04′S, 151º54′E, c. 180 m, on wooden fencepost in open pasture, *L. Tibell 12332*, 15.iv.1981 (CANB).

9. **Calicium victorianum** (F.Wilson) Tibell var. **victorianum**, *Symb. Bot. Upsal.* **27**(1), 64 (1987)
Chemistry: brialmontin 1 (major), ±unknown (minor).

SPECIMENS EXAMINED
Australia: *Victoria*: • Spring Creek Gap, Bonang Highway, near Tingaringa Track, 14 km ENE of Bonang, 37º05′S, 148º46′E, 890 m, on dead tree in *Eucalyptus-Bedfordia*-dominated woodland, *J.A. Elix 19400 & H. Streimann*, 26.ix.1985 (CANB). *South Australia*: • 5 km W of Springton along the Williamstown road, on dead wood, *J.A. Elix 9177*, 26.x.1981 (CANB); Det. L. Tibell.

10. **Caloplaca cranfieldii** S.Kondr., Kärnefelt & Elix, *in* Kondratyuk *et al.*, *Biblioth. Lichenol.* **95**, 352 (2007)
Chemistry: parietin (major), erythroglaucin (submajor), xanthorin (minor).

SPECIMEN EXAMINED
Australia: *Western Australia*: • 2.7 km S of Lynton Station ruin, 28º12′44″S 114º20′09″E, on ironstone/sandstone, often in shade of *Acacia ligulata* in pasture, *S.Y. Kondratyuk 20423*, *I. Kärnefelt* & *R.J. Cranfield*, 6.i.2004 (CANB – isotype).

11. **Caloplaca montisfracti** S.Kondr. & Kärnefelt, *in* Kondratyuk *et al.*, *Biblioth. Lichenol.* **95**, 355 (2007)
Chemistry: parietin (major), erythroglaucin (minor), xanthorin (minor).

SPECIMEN EXAMINED
Australia: *Western Australia*: • N of Northampton, road to Port Gregory, sandstone-ironstone rocks, 28º12′40.9″S 114º20′9.2″E, *I. Kärnefelt 2004-1703*, *S.Y. Kondratyuk* & *R.J. Cranfield*, 6.i.2004 (CANB – isotype).

12. **Caloplaca streimannii** S.Kondr. & Kärnefelt, *in* Kondratyuk *et al.*, *Biblioth. Lichenol.* **95**, 355 (2007)
Chemistry: parietin (major), erythroglaucin (minor), xanthorin (minor).

SPECIMEN EXAMINED
Australia: *New South Wales:* • Blue Waterholes, Caves Creek, 42 km WNW of Adaminaby, 35º38′S, 148º41′E, 1250 m, limestone outcrops in grassland on semi-exposed rock face, *H. Streimann 45280A*, 15.xi.1990 (CANB – holotype).

13. **Caloplaca tomareeana** S.Kondr. & Kärnefelt, *in* Kondratyuk *et al.*, *Biblioth. Lichenol.* **95**, 355 (2007)
Chemistry: parietin (major), erythroglaucin (minor), xanthorin (minor), atranorin (minor).

SPECIMEN EXAMINED
Australia: *New South Wales*: • S of Anna Bay, Tomaree National Park, 32º47′16″S 152º4′48″E, rock (rhyolite) outcrops along the coast, *S.Y. Kondratyuk 20474*, *R.B. Filson* & *I. Kärnefelt*, 24.i.2004 (CANB – holotype).

14. **Caloplaca whinrayi** S.Kondr. & Kärnefelt, *in* Kondratyuk *et al.*, *Biblioth. Lichenol.* **95**, 381 (2007)
Chemistry: parietin (major), fallacinal (submajor), teloschistin (submajor), parietinic acid (minor).

SPECIMEN EXAMINED
Australia: *New South Wales*: • Port Macquarie township, Flynns Beach, 31º25′50″S 152º55′25″E, rock outcrops along the coast, *S.Y. Kondratyuk 20470* & *I. Kärnefelt*, 21.i.2004 (CANB – holotype).

15. **Chiodecton congestulum** Nyl., *Bull. Soc. Linn. Normandie*, sér. 2, **2**, 106 (1868)
Chemistry: roccellic acid (major), rugulosin (major), ±lepraric acid (major), ±skyrin (major), ±emodin (minor), ±atranorin (minor), ±unknown pigment (minor).
Previous reports: roccellic acid, secalonic acid X (major), secalonic acid A (minor) (Thor 1990).

SPECIMENS EXAMINED
Australia: *Queensland*: • Licuala State Forest, 20 km E of Tully, 17º54′27″S, 146º04′06″E, 760 m, on dead log in storm-damaged palm forest, *J.A. Elix 39147*, 28.vii.2006 (CANB); • Noosa Heads National Park, c. 1 km from the sea near road to lookout, 26º23′S, 153º07′E, 100 m, on bark in rainforest with emergent *Araucaria cunninghamii*, *G. Thor 4884*, 7.xi.1985 (CANB). *New South Wales*: • Karuah River, Karuah River Road, Chichester State Forest, 26 km SW of Gloucester, 32º07′S, 152º43′E, on tree in rainforest beside river, *J.A. Elix 25024*, 27.iv.1990 (CANB).

16. **Chiodecton sublaevigatum** Kremp., *Verh. K. K. Zool.-Bot. Ges. Wien*, B, **30**, 342 (1880)
Chemistry: roccellic acid (major), rugulosin (major), skyrin (major), gracilliformin (minor).
Previous reports: roccellic acid, secalonic acid X (major), secalonic acid A (minor), skyrin (trace) (Thor 1990).

SPECIMEN EXAMINED
Australia: *Queensland*: • Mistake Mtns, Goomburra State Forest, Mt Castle Look-out, 50 km NW of Warwick, 27º58′S, 152º31′E, 800 m, corticolous in subtropical rainforest, *R.W. Rogers & H.T. Lumbsch 5691a*, 28.ix.1987 (CANB), det. G. Thor.

17. **Haematomma ivoriense** Kalb & Staiger, *Biblioth. Lichenol.* **59**, 125 (1995)
Chemistry: emodin (major), placodiolic acid (submajor), atranorin (minor).
Previous report: atranorin, placodiolic acid, ivorione (Kalb & Staiger 1995).

SPECIMEN EXAMINED
Ivory Coast: • Cercle of Man, Mont Tonkoui. "Rocher aus Sacrifices", c. 1100 m, *R. Santesson 10649*, 14.viii.1954 (UPS – holotype).

18. **Lobaria discolor** (Bory) Hue, *Nouv. Arch. Mus,. Hist. Nat.*, sér. 4, **3**, 23 (1901)
Chemical Race 1: gyrophoric acid (major), lecanoric acid (minor or trace).
Previous report: gyrophoric acid (major), lecanoric acid (trace) (Elix 2001).

SPECIMENS EXAMINED
Australia: *Queensland*: • Kirrima State Forest, Cardwell Range, 24 km WNW of Cardwell, 18°12′S, 145°48′E, 750 m, on rocks in rainforest, *J.A. Elix 15733 & H. Streimann*, 20.vi.1984 (CANB); • Ravenshoe State Forest, along the Tully Falls Road, 18 km SE of Ravenshoe, 17°46′S, 145°33′E, 760 m, on *Schefflera* along rainforest margin, *J.A. Elix 16136 & H. Streimann*, 23.vi.1984 (CANB); • Millaa Millaa Falls, 4 km S of Millaa Millaa, 17°29′34″S, 145°36′41″E, 750 m, on fallen branches in remnant rainforest, *J.A. Elix 39308*, 29.vii.2006 (CANB); • Zillie Falls, 12 km NE of Millaa Millaa, 17°28′29″S, 145°39′22″E, 705 m, on fallen tree in remnant rainforest, *J.A. Elix 39507, 39510*, 29.vii.2006 (CANB).

Chemical Race 2: gyrophoric acid (major), lecanoric acid (minor), pseudocyphellarin A (minor).

SPECIMENS EXAMINED
Malaysia: *Sarawak*: • Bario, 03°45′S, 115°25′E, 1280 m, on bark in submontane forest, *L.B. Din, I.B. Ipor & B.A. Fasihuddin ISA4, ISA 29*, 14.ii.1995 (CANB).

19. **Tapellaria phyllophila** (Stirt.) R.Sant., *in* Thorold, *J. Ecol.* **40**, 129 (1952)
Chemistry: arthothelin (major), 6-*O*-methylarthothelin (minor), asemone (minor), thiophanic acid (trace), isoarthothelin (trace), 2,5-dichloronorlichexanthone (trace), 2,4-dichloronorlichexanthone (trace), 4,5-dichloronorlichexanthone (trace).

SPECIMENS EXAMINED
Australia: *New South Wales*: • Mt Hyland Nature Reserve, 20 km N of Hernani, 30°10′44″S, 152°25′19″E, 1340 m, on leaves of *Cordyline stricta* in temperate rainforest, *J.A. Elix 36665, 36668*, 30.iv.2005 (CANB). Det. P.M. McCarthy.

20. **Trapeliopsis colensoi** (C.Bab.) Gotth.Schneid., *Biblioth. Lichenol.* **13**, 146 (1979)
Chemistry: confriesiic acid (major), gyrophoric acid (minor or trace), skyrin (minor), friesiic acid C (minor), friesiic acid (trace).
Previous report: gyrophoric acid, unidentified pigments (Galloway 1985).

SPECIMENS EXAMINED
Australia: *Tasmania*: • Jane River Track near Lodden River, 42°15′S, 146°01′E, 520 m,

on peat at margins of *Leptospermum glaucescens* woodland, *G. Kantvilas 33/86*, 1.ii.1986 (CANB, HO); • summit of Mt Field East, 42°39'S, 146°39'E, 1270 m, on peaty soil among alpine dolerite boulders, *G. Kantvilas 1350/91*, 30.xii.2001 (CANB, HO); • summit of Mt Cuvier, 42°02'S, 146°02'E, 1350 m, on peaty soil in alpine heathland, *G. Kantvilas 68/05*, 24.ii.2005 (CANB, HO).

Acknowledgements
I thank Dr Christine Cargill and Ms Judith Curnow (CANB), Dr K. Kalb (Neumarkt), Dr G. Kantvilas (HO) and curators at CHR and G for their kind assistance with the loan of specimens.

References
Elix, JA (2001): *Lobaria*. *Flora of Australia* **58A**, 39–47.
Elix, JA; Ernst-Russell, KD (1993): *A Catalogue of Standardized Thin-Layer Chromatographic Data and Biosynthetic Relationships for Lichen Substances*, 2nd Edn, Australian National University, Canberra.
Elix, JA; Giralt, M; Wardlaw, JH (2003): New chloro-depsides from the lichen *Dimelaena radiata*. *Bibliotheca Lichenologica* **86**, 1–7.
Galloway, DJ (1985): *Flora of New Zealand Lichens*. P.D. Hasselberg, New Zealand Government Printer, Wellington.
Kalb, K; Staiger, B (1995): *Haematomma*-studien. I. Die Flechtengattung *Haematomma*. *Bibliotheca Lichenologica* **59**, 1–198.
Kashiwadani, H; Inoue, M; Moon, KH; Sasaki, K (2002): Lichens of Ozegahara Moor and adjacent areas, central Japan. *Mem. Natn. Sci. Mus., Tokyo* **38**, 71–93.
Knudsen, K (2007): *Acarospora*. In: Nash III, TH; Gries, C; Bungartz, F (eds) *Lichen Flora of the Greater Sonoran Desert Region* **3**, 1–38. Arizona State University, Tempe.
McCarthy, PM (2010): *Checklist of the Lichens of Australia and its Island Territories*. ABRS, Canberra: http://www.anbg.gov.au/abrs/lichenlist/introduction.html (Version 23 March, 2010).
Thor, G (1990): The lichen genus *Chiodecton* and five allied genera. *Opera Botanica* **103**, 1–92.

Pertusaria cryptostoma Müll.Arg., the earliest name for *Pertusaria limbata* Vain.

John A. Elix
Research School of Chemistry, Building 33,
Australian National University, Canberra, A.C.T. 0200, Australia

Alan W. Archer
National Herbarium of New South Wales
Mrs Macquaries Road, Sydney, N.S.W. 2000, Australia

Abstract: *Pertusaria cryptostoma* Müll.Arg. is reported as the earliest name for *P. limbata* Vain.
2-Chlorolichexanthone is an uncommon xanthone in the lichen genus *Pertusaria*. It is found with stictic acid in *P. cryptostoma* Müll.Arg., a species with eight-spored asci, and in the taxa listed in its synonymy below. The compound occurs, along with 2'-*O*-methylstenosporic acid, in *P. boweniana* A.W.Archer & Elix and with divaricatic acid in *P. orarensis* A.W.Archer & Elix (Archer 1997), and is the sole lichen compound in *P. torquatella* Müll.Arg.

Pertusaria cryptostoma Müll.Arg., *Flora* **71**, 206 (1888)
South Africa, Transvaal, Lydenberg, *Dr Wilms 24*, 1885; holotype: G.

Pertusaria limbata Vain., *Acta Soc. Fauna Fl. Fenn.* **7**, 110 (1890)
Brazil, Rio de Janeiro, E. Vainio, Lich. Bras. Exsicc. 208, 1885; holotype: TUR-V 6719.

Pertusaria spaniostoma Vain., *Ann. Univ. Fenn. Aboënsis*, Ser. A, **2**(3): 5 (1926); South Africa, Elsenberg, *P.A. van der Byl 242*; holotype: TUR-V 34431.

Pertusaria simplex Vain., *Bol. Soc. Brot.*, Ser. 2, **6**, 146 (1929)
Portuguese East Africa, [Mozambique], Palma, A. Pires de Lima 873, 1916; holotype: TUR-V 34430. [This reference was incorrectly cited as page 5 in Archer 1997: 93.]

Pertusaria robsonii C.W.Dodge, *Beih. Nova Hedwigia* **12**, 263 (1964)
Northern Rhodesia [Zambia], 7 miles E of Katate, *N.K.B. Robson s.n.*, 8.x.1958; holo: FH.

Thallus pale olive-green, areolate and cracked, surface smooth and dull, corticolous. Apothecia verruciform, flattened-hemispherical, concolorous with the thallus, conspicuous, scattered, sometimes confluent, becoming constricted at the base, 0.7–1.2 mm diam. Ostioles pale, translucent, 1 or 2 per verruca, occasionally fusing to form a sunken translucent disc. Ascospores 8 per ascus, irregularly biseriate, ellipsoid to subfusiform, smooth, (50–)65–75(–80) × 22–32 μm wide.
Chemistry: 2-chlorolichexanthone (major to minor), stictic acid (major to minor) and constictic acid (minor).

The species is characterized by asci with 8, usually biseriate, ascospores and the presence of 2-chlorolichexanthone and stictic acid accompanied by varying amounts of constictic acid. It is known from Brazil, South Africa, Zambia, Mozambique and Australia (Queensland, New South Wales and Lord Howe Island), and has also been reported from Angola (Vainio 1901).
The chemically similar *P. delicatula* Müll.Arg. described from Brazil (Müller 1884) is distinguished by its smaller verrucae and different concentrations of stictic acid (minor) and constictic acid (major).

References
Archer, AW (1997): The lichen genus *Pertusaria* in Australia. *Bibliotheca Lichenologica* **69**, 5–249.
Müller, J (1884): Lichenologische Beiträge XIX. Flora **67**, 396–402.
Vainio, EA (1901): *Lichens* in *Catalogue of African Plants collected by F. Welwitsch in 1853–1861*. Vol. 2, Part 2: 396–463.

New species of *Physcia* (Physciaceae, lichenized Ascomycota) from Australasia

John A. Elix
Research School of Chemistry, Building 33,
Australian National University, Canberra, A.C.T. 0200, Australia
email: John.Elix@anu.edu

Abstract: *Physcia austrocaesia* Elix, *P. caesiopsis* Elix, *P. neonubila* Elix, *P. rolandii* Elix and *P. verdonii* Elix are described as new to science.

Moberg's (2001) revision of Australian *Physcia* recognized 17 species, including seven cosmopolitan or pantropical-subtropical taxa and nine with a broad Southern Hemisphere distribution. Only one species, *P. jackii* Moberg, was confined to Australasia (Moberg 2001, Galloway & Moberg 2005), indicative of a very low degree of endemism for the region. The main characters employed in species circumscription have been (1) lobe width and shape, (2) the mode of reproduction (apothecia *versus* soredia or isidia), (3) the presence or absence of maculae and/or pruina on the upper surface and (4) the occurrence of medullary atranorin.

Apart from the distribution of atranorin, chemical characters have been largely discounted in recent treatments of *Physcia* (Moberg 1977, 1986, 1990, 1997, 2001, 2002a, 2002b; Galloway & Moberg 2005). In contrast, a very recent phylogenetic study utilizing molecular phylogenetic analyses of ITS sequences in the *Physcia aipolia* group in Australia has confirmed that both medullary triterpene chemistry and subtle morphological differences are indeed important species characters (Elix *et al.* 2009). Both triterpene chemistry and morphology are employed in the present work to delimit five new species.

Chemical constituents were identified by thin-layer chromatography (Elix & Ernst-Russell 1993), high-performance liquid chromatography (Elix *et al.* 2003) and comparison with authentic samples.

The new species

Physcia austrocaesia Elix, sp. nov. Fig. 1
Sicut *Physcia caesia* sed lobi latiore et acidum aipolicum chemosyndromum continenti differt.

Type: Australia. *Australian Capital Territory*: Molonglo Gorge Forest Park, 15 km SE of Canberra, 35°19′46″S, 149°14′59″E, 650 m, on moist sandstone ledge along the river bank in dry *Eucalyptus-Callitris* woodland with numerous rock outcrops, *J.A. Elix 39206*, 15.x.2008 (CANB – holotype; HO – isotype).

Thallus orbicular or spreading, adnate throughout or ±loosely adnate at the margins, 1–6 cm wide. *Lobes* 0.5–2.0(–2.5) mm wide, contiguous, imbricate or rarely separate, irregularly or pinnately branched, weakly to distinctly convex; margins entire; apices rounded to shallowly incised. *Upper surface* light to medium or bluish grey, sorediate, distinctly white-maculate with somewhat raised maculae, sometimes grey-white-pruinose at the apices; upper cortex pseudoparenchymatous. *Soralia* laminal and ±marginal, capitate, 0.5–1.0 mm wide, often coalescing and spreading over the surface, sometimes eroded and becoming crateriform and exposing the medulla or lower cortex; soredia coarsely granular, greenish when wet, whitish to grey or blue-grey when dry. *Lower surface* off-white to pale brown or brown centrally; rhizines simple or fasciculate at tips, often scattered at the apices to densely crowded and entangled centrally, whitish, grey to brown, 0.4–0.9 mm long; lower cortex prosoplectenchymatous. *Apothecia* very rare, laminal, 0.2–1.0 mm wide, sessile and constricted at the base; thalline exciple persistent, concolorous with the thallus, entire, smooth; disc flat, black to brown-black, matt, epruinose or with grey-white pruina. *Ascospores Pachysporaria*-type, broadly ellipsoid, 18–23 × 7.5–10 μm. Pycnidia sparse to common, immersed, visible as black dots; conidia bacilliform, 4–5 × 1 μm.

Chemistry: Cortex K+ yellow; medulla K+ yellow; containing atranorin (major), zeorin (major), 6α-acetoxyhopane-16β,22-diol (major), 6α-acetoxy-22-hydroxyhopane-25-oic acid [aipolic acid] (minor or trace), 6α,22-dihydroxyhopane-25-oic acid (minor), 6α-acetoxy-16β,22-dihydroxyhopane-25-oic acid (trace), 16β-acetoxyhopane-6α,22-diol (trace), leucotylin (minor or trace).
Etymology: The specific epithet refers to the superficial resemblance to the cosmopolitan *P. caesia* (Hoffm.) Fürnr.

Notes: This species could be confused with *P. caesia* (Galloway & Moberg 2005) and *P. poncinsii* Hue (Moberg 2001), because all three can have laminal soralia and a K+ yellow medulla. However, *P. poncinsii* has a maculate or weakly maculate upper surface, distinctly crateriform soralia, a white to pale grey lower surface, a preference for corticolous substrata and a different cohort of triterpenes (the *speciosa* chemosyndrome). *Physcia austrocaesia* differs from *P. caesia* in having broader, convex lobes, in its laminal capitate soralia and in chemistry. By contrast, *P. caesia* has flat to weakly convex, narrower lobes (0.5–1.0(–1.5) mm *versus* 0.5–2.0(–2.5) mm wide), and marginal to 'laminal' soralia. According to Moberg (2002), the 'laminal' soralia of *P. caesia* are in fact marginal soralia that have extended inwards. No triterpenes other than zeorin were detected in numerous European and North American collections of *P. caesia* examined, in contrast to the aipolic acid chemosyndrome observed in *P. austrocaesia*. The chemosyndrome has previously been recorded in *P. tropica* Elix (Elix *et al.* 2009).

This new species is common in southern Australia and New Zealand, where it occurs on rocks and rarely twigs in cool-temperate areas. Commonly associated taxa include *Buellia homophylia* (C.Knight) Zahlbr., *B. procellarum* A.Massal., *Lecanora pseudistera* Nyl., *Lecidea capensis* Zahlbr., *Parmotrema reticulatum* (Taylor) M.Choisy, *Ramboldia pertraeoides* (Nyl. ex C.Bab. & Mitt.) Kantvilas & Elix, *Relicina sydneyensis* (Gyeln.) Hale, *Rhizocarpon badioatrum* (Flörke ex Spreng.) Th.Fr. and numerous *Xanthoparmelia* species.

SPECIMENS EXAMINED
Australia. *Western Australia*: • Mt Clarence, Albany, 35°02′S, 117°54′E, 230 m, on shaded granite ledges in dry sclerophyll forest with large granite outcrops, *J.A. Elix 41384, H.T. Lumbsch & H. Streimann*, 15.ix.1994 (CANB).
Queensland: • Wyberba, junction of old highway and Eukey road, 23 km SSW of Stanthorpe, 28°52′S, 151°53′E, 770 m, on granite rocks in *Eucalyptus-Callitris*-dominated forest, *J.A. Elix 35840, 35841*, 6.ix.1993 (CANB).
New South Wales: • 10 km E of Cooma along Numeralla road, 910 m, on granite rocks in *Eucalyptus* woodland, *J.A. Elix 1516*, 19.i.1976 (CANB); • Southern Tablelands, 13 km S of Countegany along the Nimmitabel road, 36°20′S, 149°30′E, on granite rocks in pasture, *J.A. Elix 1976*, 29.iii.1976 (CANB); • W face of Mt Canobolas, 8 km SW of Orange, 33°21′S, 148°59′E, 1420 m, on dead twigs of *Leptospermum* in open woodland, *J.A. Elix 6257*, 8.viii.1979 (CANB); • Central-west slopes, 4 km E of Koorawatha, 34°02′S, 148°37′E, 365 m, on rocks in open woodland, *J.A. Elix 8872*, 10.ix.1980 (CANB); • South-west slopes, Great Yambla Ridge, 17 km SSE of Culcairn, 35°50′S, 147°04′E, 580 m, on sheltered rocks in grassland with numerous rock outcrops, *J.A. Elix 23104*, 16.xi.1989 (CANB); • South-west slopes, road to Mt Ulandra, 27 km ENE of Junee, 34°48′S, 147°54′E, 700 m, on sheltered granite rocks in grassland with scattered *Eucalyptus*, *J.A. Elix 23197*, 16.xi.1989 (CANB); • London Bridge, 18 km S of Queanbeyan, 35°30′S, 149°16′E, 670 m, on calcareous rocks along creek bank in pasture, *J.A. Elix 33111 & H.Mayrhofer*, 26.vii.1992 (CANB); • Blue Mountains National Park, Evans Lookout, trail to Grand Canyon, 4 km E of Blackheath, 33°38′47″S, 150°19′31″E, 860 m, on sandstone ledge in *Eucalyptus* woodland, *J.A. Elix 43940*, 4.v.2009 (CANB).
Australian Capital Territory: • Gudgenby River Gorge, 4.5 km S of Tharwa, 35°33′00″S, 149°04′23″E, 670 m, on sheltered granite rocks in *Callitris* woodland, *J.A. Elix 6096*, 26.i.1979 (CANB, UPS); • Summit of Mt Clear, Clear Range, 65 km S of Canberra,

35°53′S, 149°04′E, 1600 m, on *Hymenanthera* twigs at open summit, *J.A. Elix 8982*, 1. x.1980 (CANB).
Victoria: • Mt Korong, 13 km SE of Wedderburn, 36°28′S, 143°45′E, 220 m, on shaded bouder in disturbed *Eucalyptus* woodland with large granite outcrops, *H. Streimann 59106*, 6.xii.1996 (CANB).
Tasmania: • Harry Walker Tier, Cockatoo Gully Road, 6.5 km W of Dysart, 42°35′S, 147°09′E, 340 m, on sheltered sandstone rocks in *Eucalyptus* woodland, *J.A. Elix 40345 & G. Kantvilas*, 11.xii.1993 (CANB).
New Zealand. South Island. *Canterbury*: • 1 km S of Mt Palm, Lowry Peaks Range, 300 m, on exposed greywacke rocks in pasture, *J.A. Elix 6894*, 24.i.1980 (CANB, CHR); • Lees Valley Road, 7 km N of Oxford, 425 m, on exposed greywacke rocks in open scrubland, *J.A. Elix 8403*, 28.v.1980 (CANB).

Physcia caesiopsis Elix, sp. nov. Fig. 2
Sicut *Physcia caesia* sed lobi latiore, soraliis capitatus vel crateriformibus et 20α-acetoxyhopane-6α,22-diolum continenti differt.

Type: Australia. *New South Wales*: First Moonbi Lookout, 30 km N of Tamworth, 30°58′33″S, 151°05′58″E, 740 m, on granite rocks in remnant *Eucalyptus* woodland with *Brachychiton* and *Ficus*, *J.A. Elix 36231*, 27.iv.2005 (CANB – holotype).

Thallus orbicular or spreading, adnate throughout or ±loosely adnate at the margins, to 3 cm wide. *Lobes* 0.5–2.5 mm wide, contiguous to imbricate or separate, irregularly or pinnately branched, weakly to distinctly convex; margins entire; apices rounded to shallowly incised. *Upper surface* whitish grey to grey or brownish grey, sorediate, distinctly white-maculate with somewhat raised maculae, rarely grey-white-pruinose at the apices; upper cortex pseudoparenchymatous. *Soralia* laminal or rarely marginal, crateriform to capitate, 0.3–1.0 mm wide, often coalescing and spreading over the surface; soredia coarsely granular, greenish when wet, whitish or grey when dry. *Lower surface* off-white to pale brown or pale grey centrally; rhizines simple, scattered, whitish, grey to brown or grey, 0.2–0.9 mm long; lower cortex prosplectenchymatous. *Apothecia* not seen. *Pycnidia* sparse, immersed, then emergent, visible as black dots; conidia bacilliform, 4–5 × 1 μm.
Chemistry: Cortex and medulla K+ yellow; containing atranorin (major), 20α-acetoxyhopane-6α,22-diol [20α-acetoxyzeorin] (major), 6α-acetoxyhopane-20α,22-diol (minor), ±zeorin (trace), ±hopane-6α,20α,22-triol (trace).
Etymology: The specific epithet is derived from the Greek *-opsis* (a suffix indicating resemblance), because of the superficial resemblance of this species to the nearly cosmopolitan *P. caesia* (Hoffm.) Fürnr.

Notes: *Physcia caesiopsis* could be confused with *P. caesia* and *P. austrocaesia* (see above), but it is distinguished by its smaller thalli, broader lobes, crateriform to capitate soralia and distinctive chemistry (containing the 20α-acetoxyzeorin chemosyndrome). By contrast, *P. caesia* has larger thalli (4–10 cm *versus* 1–3 cm wide), narrower lobes (0.5–1.0(–1.5) mm *versus* 0.5–2.5 mm wide), and marginal to 'laminal' soralia. With regard to thallus chemistry, the 20α-acetoxyzeorin chemosyndrome is present in *P. caesiopsis*, but no triterpenes other than zeorin were detected in *P. caesia*. This chemosyndrome was previously observed in *P. austrostellaris* Elix (Elix *et al.* 2009), and the latter could well represent the fertile counterpart of *P. caesiopsis*.

At present this new species is only known from rocks in montane areas of northern New South Wales. Commonly associated lichens include *Buellia homophylia* (C.Knight) Zahlbr., *B. procellarum* A.Massal., *Parmelia signifera* Nyl., *Parmotrema reticulatum* (Taylor) M.Choisy, *Ramboldia pertraeoides* (Nyl. ex C.Bab. & Mitt.) Kantvilas & Elix, *R. sanguinolenta* (Kremp.) Kalb, Lumbsch & Elix, *Relicina sydneyensis* (Gyeln.) Hale, *Rhizocarpon badioatrum* (Flörke ex Spreng.) Th.Fr., *R. geographicum* (L.) DC. and numerous *Xanthoparmelia* species.

SPECIMEN EXAMINED
New South Wales: • Northern Tablelands, Bolivia Hill Nature Reserve, 12.8 km N of Deepwater, 29°20′18″S, 151°54′00″E, 990 m, on granite rocks in open *Eucalyptus* woodland with large granite outcrops, *J.A. Elix 39944*, 3.v.2005 (CANB).

Physcia neonubila Elix, sp. nov. Fig. 3
Sicut *Physcia nubila* sed lobi angustiore, apicibus nitidus, superfices maculatis et acidum 6α-acetoxy-22-hydroxyhopane-25-oicum et acidum 6α,22-dihydroxyhopan-25-oicum continenti differt.

Type: Australia. *Australian Capital Territory*: Molonglo Gorge Forest Park, 15 km SE of Canberra, 35°19′46″S, 149°14′59″E, 650 m, on *Melaleuca* shrubs along the river bank in dry *Eucalyptus*-*Callitris* woodland with numerous rock outcrops, *J.A. Elix 39207*, 25. x.2008 (CANB – holotype).

Thallus orbicular or irregularly spreading, adnate throughout, 1–6 cm wide. *Lobes* thin, 0.5–1.5 mm wide, densely imbricate to separate, irregularly branched, weakly concave to plane or rarely weakly convex; margins delicately scalloped, notched or incised; apices ±flat, becoming erose-sorediate towards the inner parts. *Upper surface* white, creamish to grey-white to dark grey, sorediate, matt or minutely roughened, usually distinctly white-maculate or rarely faintly maculate, glabrous at apices; upper cortex pseudoparenchymatous. *Soralia* marginal on the inner parts of lobes, erumpent-erose, occasionally coalescing and forming extensive sorediate patches centrally; soredia coarsely granular, white or grey-white. *Lower surface* creamish white to pale buff, with a narrow, darker marginal zone, smooth; rhizines scattered, rather sparse at the margins, more numerous centrally, concolorous with the lower surface, simple, with an apical squarrose tuft, 0.5–0.8 mm long; lower cortex prosplectenchymatous. *Apothecia* very rare, laminal, sessile, constricted at the base, rounded, 0.5–1(–1.5) mm diam.; thalline exciple persistent, thick, swollen, entire to ±scalloped, concolorous with the thallus, not becoming sorediate; disc concave to plane, matt, dark brown to black, epruinose or with grey-white pruina. *Ascospores Pachysporaria*-type, broadly ellipsoid, (16.5–)20–23 × 8–10.5 μm. *Pycnidia* occasional, immersed, visible as black dots; conidia bacilliform, 4–5 × 1 μm.
Chemistry: Cortex and medulla K+ yellow; containing atranorin (major), zeorin (major), 6α-acetoxyhopane-16β,22-diol (trace), 6α,22-dihydroxyhopane-25-oic acid (minor), leucotylin (minor or trace), 6α-acetoxy-22-hydroxyhopane-25-oic acid (trace), 6α-acetoxy-16β,22-dihydroxyhopane-25-oic acid (trace). This chemosyndrome of triterpenes is termed "the *speciosa* chemosydrome" because of its presence in the widespread *Heterodermia speciosa* (Wulfen) Trevis.
Etymology: The specific epithet refers to this species' superficial resemblance to *P. nubila* Moberg.

Notes: In his treatment of *P. nubila* in Australia, Moberg (2001) included two superficially similar taxa characterized by copious marginal soralia. However, *P. nubila* and *P. neonubila* differ in their thalline morphology, medullary chemistry and ecology. The upper surface of *P. nubila* is convex and typically emaculate, but areolate-scabrid to densely pruinose at the apices, whereas the upper surface of *P. neonubila* is concave to weakly convex, often distinctly white-maculate and usually glossy and smooth at the apices. Although both species have a K+ yellow medulla, *P. nubila* contains atranorin (major), zeorin (minor), 6α-acetoxyhopane-16β,22-diol (major), leucotylin (minor), ±16β-acetoxyhopane-6α,22-diol (trace), a very distinctive cohort of triterpenes (cf. above). The chemistry of *P. neonubila* is similar to that of *P. poncinsii*, but the latter has diagnostic crateriform, laminal soralia. The majority of specimens of *P. neonubila* were collected on bark in cool-temperate areas of southern Australia, whereas *P. nubila* occurs on rock and bark in drier, subarid habitats inland. The type collection of *P. nubila* from Peru was collected on small rocks in the mist zone of a

coastal desert (Moberg 1990). In our recent molecular study, we established that *P. nubila* and *P. neonubila* are paraphyletic (Elix *et al.* 2009).

The new species is widespread in southern Australia, where it occurs mainly on bark or more rarely on rocks and lignum. Commonly associated species include *Buellia dissa* (Stirt.) Zahlbr., *B. microsporella* Elix, *Flavoparmelia rutidota* (Hook.f. & Taylor) Hale, *Hyperphyscia adglutinata* (Flörke) H.Mayrhofer & Poelt, *Parmotrema reticulatum* (Taylor) M.Choisy, *P. subtinctorium* (Zahlbr.) Hale, *Physcia jackii* Moberg, *Ramalina celastri* (Spreng.) Krog & Swinscow subsp. *celastri* and *R. glaucescens* Kremp.

SPECIMENS EXAMINED

Western Australia: • Darling District, 16 km S of Lake Clifton, 32°55′S, 115°40′E, on *Banksia* in mixed scrub, *J.A. Elix 10788 & L.H. Elix*, 28.x.1982 (CANB); Ravensthorpe Range, South Coast Highway, 9 km E of Ravensthorpe, 33°35′S, 120°08′E, 160 m, on laterite rocks in dry sclerophyll forest with scattered *Callitris*, *J.A. Elix 41608,* 18.ix.1994 (CANB, UPS).

South Australia: • Summit of Mt Crawford, Mount Lofty Ranges, 34°41′S, 138°58′E, 562 m, on rocks in dry sclerophyll forest, *J.A. Elix 3835*, 2.ix.1977 (CANB); • 5 km W of Springton along the Williamstown road, 34°42′S, 138°58′E, 400 m, on *Banksia marginata* in dry sclerophyll forest, *J.A. Elix 9187*, 26.x.1981 (CANB); • Kangaroo Island, D'Estrees Bay, 35°56′S, 137°36′E, 2 m, on *Melaleuca* along foreshore, *J.A. Elix 19709 & L.H. Elix*, 28.x.1985 (CANB).

Queensland: • Carnarvon Highway, 39 km NNW of Roma, 26°10′S, 148°43′E, 310 m, on *Callitris* in *Eucalyptus-Callitris* woodland beside creek, *J.A. Elix 34011, 34015*, 19. viii.1993 (CANB).

New South Wales: • South Coast, 1 km N of Kioloa, 35°33′S, 150°22′E, 10 m, on remnant tree in pasture, *J.A. Elix 22932*, 2.xi.1989 (CANB); Coolah Tops National Park, Mullion Track to the Pinnacle, 33 km E of Coolah, 31°41′54″S, 150°01′04″E, 1058 m, on *Acacia* in open *Eucalyptus* woodland with *Acacia* understorey, *J.A. Elix 36185*, 26.iv.2005 (CANB); Goonoo State Forest, Mogriguy Forest Road, 5 km E of Mogriguy, 32°04′16″S, 148°42′53″E, 330 m, on *Callitris* in *Eucalyptus-Callitris* woodland with *Calytris and Westringia* understorey, *J.A. Elix 36760A*, 11.x.2005 (CANB).

Australian Capital Territory: • Type locality, on *Melaleuca*, *J.A. Elix 282*, 9.i.1974 (CANB), *J.A. Elix 11759*, 27.i.1984 (CANB); • Aranda Primary School, 5 km W of Canberra, 35°16′S, 149°05′E, 650 m, on trunk of *Fraxinus* in cultivated park, *J.A. Elix 38831*, 28. vi.2008 (CANB).

Victoria: • Levi Point, 5 km W of Warrnambool, 38°23′S, 142°28′E, 2 m, on *Melaleuca* in coastal scrub, *J.A. Elix 26064*, 16.xii.1990 (CANB); • Reef Hills State Park, 7 km SSW of Benalla, 36°36′53″S, 145°56′03″E, 155 m, on base of *Eucalyptus* in open *Eucalyptus* woodland, *J.A. Elix 37183*, 5.v.2006 (CANB); • Midland region, Long Forest Flora and Fauna Reserve, N of Western Hwy between Melton and Bacchus Marsh, 37°40′24″S, 144°30′40″E, 120 m, on lignotubers of *Eucalyptus behriana* in *Eucalyptus behriana*-dominated woodland, *V. Stajsic 2052*, 11.x.1998 (CANB, MEL); • Mouth Yeerung River, 29 km SE of Orbost, 37°59′S, 148°45′E, 10 m, on treelet branches in *Leptospermum*-dominated vegetation on large sand dune, *H. Streimann 39696*, 2.x.198 (B, CANB).

Physcia rolandii Elix, sp. nov. Fig. 4

Sicut *Physcia jackii* sed superfice emaculatis, scabrosus vel pruinosus et acidum 6α,22-dihydroxyhopane-25-oicum continente differt.

Type: Australia. *South Australia*: Boundary Road, 10 km N of Tailem Bend, 35°10′18″S, 139°27′57″E, 20 m, on *Leptospermum* in remnant mallee *Eucalyptus* woodland, *J.A. Elix 44005*, 3.vi.2010 (AD – holotype; CANB – isotype).

Thallus usually orbicular, rarely irregular, adnate, 1–6 cm wide. *Upper surface* medium to pale grey, usually glossy, indistinctly white-maculate, areolate-scabrid to frosted-pruinose at the apices. *Lobes* 0.5–1.2 mm wide, flat to weakly convex, often becoming

strongly rugulose and bullate-areolate in the centre of older lobes, sometimes with a distinct white margin; lobe tips more or less truncate and crenulate. Soredia and isidia absent. *Lower surface* off-white to pale brown; rhizines sparse to frequent, pale brown to black-brown, to 0.6 mm long. *Apothecia* laminal, at the centre of the thallus, abundant, 0.5–3.5 mm wide, sessile, constricted at the base; thalline exciple persistent, concolorous with the thallus, entire, smooth to crenulate; disc flat at first, then undulate-distorted, black to brown-black, densely grey-white-pruinose. *Ascospores Pachysporaria*-type to *Physcia*-type, ellipsoid, 17–30 × 7–12 μm. *Pycnidia* common, immersed then becoming emergent, visible as pale brown to black dots; conidia bacilliform, 4–5 × 1 μm.

Chemistry: Cortex and medulla K+ yellow; containing atranorin (major), zeorin (major), 6α,22-dihydroxyhopane-25-oic acid (minor), 6α-acetoxyhopane-16β,22-diol (minor or trace), 6α-acetoxy-22-hydroxyhopane-25-oic acid (trace), 6α-acetoxy-16β, 22-dihydroxyhopane-25-oic acid (trace), leucotylin (minor).

Etymology: This species is named in honour of the Swedish lichenologist Dr Roland Moberg for his contribution to our understanding of the genus *Physcia* in Australia and in many other parts of the world.

Notes: This new species could be confused with the very common southern Australian species *P. jackii* Moberg (Moberg 2001). The upper surface of *P. rolandii* is typically emaculate and areolate-scabrid to densely pruinose at the apices, whereas in *P. jackii* it is often distinctly white-maculate and smooth at the apices. Furthermore, *P. rolandii* differs in having larger apothecial discs (0.5–3.5 mm *versus* 0.5–1.5 mm wide) that sometimes become undulate-distorted with age (flat in *P. jackii*). Thalline chemistry also differs, with *P. jackii* containing atranorin (major), zeorin (major), 6α-acetoxyhopane-16β,22-diol (major), 16β-acetoxyhopane-6α,22-diol (major), 6α,16β-diacetoxyhopane-22-ol (minor), leucotylin (minor) (the leucotylin chemosyndrome of triterpenes) rather than the *speciosa* chemosyndrome present in *P. rolandii*. Like *P. jackii*, *P. rolandii* is a member of the *P. aipolia* group, with *P. jackii sens. lat.* being paraphyletic (Elix *et al.* 2009).

Physcia rolandii is known from inland Western Australia, South Australia, Queensland, New South Wales and Victoria. It grows on dead branches in dry *Callitris* and mallee *Eucalyptus* woodland. Commonly associated species include *Austroparmelina pruinata* (Müll.Arg.) A.Crespo, Divakar & Elix, *Buellia dissa* (Stirt.) Zahlbr., *B. microsporella* Elix, *Flavoparmelia rutidota* (Hook.f. & Taylor) Hale, *Hypogymnia billardieri* (Mont.) Filson, *Lecanora flavidomarginata* de Lesd., *Pertusaria thiospoda* C.Knight, *P. trimera* (Müll.Arg.) A.W. Archer, *Physcia nubila* Moberg and *Punctelia subalbicans* (Stirt.) D.J.Galloway & Elix.

SPECIMENS EXAMINED

Western Australia: • Porongurups National Park, slopes of Angwin Peak, Porongurups Range, 19 km ESE of Mt Barker, 34°40′S, 117°51′E, 360 m, on twigs of *Leucopogon* in low, heathy, dry sclerophyll forest, *J.A. Elix 41332, H.T. Lumbsch & H. Streimann*, 16. ix.1994 (CANB); • Halfway Rocks, 17.6 km SE of Bullfinch, 31°06′22″S, 119°13′44″E, 425 m, on twigs of shrub in open *Eucalyptus-Acacia* woodland, *J.A. Elix 32564*, 28. iv.2004 (CANB); • Avon district, 3.7 km W of Kondinin, on road to Kondinin Lake, 32°30′25″S, 118°13′35″E, on *Eucalyptus kondinensis* in *Eucalyptus* woodland with *Atriplex* sp., *W. O'Sullivan 1988C*, 5.iii.2003 (CANB, PERTH).

South Australia: • Just N of Ferries-McDonald Conservation Park, 10 km S of Monarto, 35°14′02″S, 139°07′54″E, 50 m, on *Melaleuca* in mallee *Eucalyptus* woodland, *J.A. Elix 39392, 39393*, 8.xii.2008 (CANB); • Eyre Highway near Conderia Tank, 37 km E of Penong, 31°56′S, 133°24′E, 90 m, on *Leptospermum* in low dry sclerophyll forest on flats, *J.A. Elix 41680*, 29.ix.1994 (CANB); • 2 km W of Peake, opposite Lindner Road, 35°21′30″S, 139°55′54″E, 20 m, on *Melaleuca* in remnant mallee *Eucalyptus* woodland, *J.A. Elix 43471*, 17.iv.2009 (CANB); • Type locality, on *Melaleuca* in remnant mallee *Eucalyptus* woodland, *J.A. Elix 43621*, 18.iv.2009 (CANB); • Boundary Road, 17 km N

of Tailem Bend, 35°06′40″S, 139°27′55″E, 50 m, on *Melaleuca* in remnant mallee *Eucalyptus* woodland, *J.A. Elix 43798, 43803*, 18.iv.2009 (CANB); • Flinders Ranges, Hawker to Blinman road, opposite turnoff to Wilpensa Pound, 31°31′S, 138°38′E, 500 m, on *Callitris* in open *Callitris* woodland, *C.H. Miller 393*, 30.ix.1985 (CANB).
Queensland: • Carnarvon Highway, 39 km NNW of Roma, 26°10′S, 148°43′E, 310 m, on *Callitris* in *Eucalyptus-Callitris* woodland beside creek, *J.A. Elix 34010*, 19.viii.1993 (CANB); • Bringalily State Forest, 41 km S of Millmerran on Millmerran-Inglewood road, 28°12′02″S, 151°10′35″E, 330 m, on twigs of *Hakea* in mixed *Eucalyptus, Callitris, Casuarina, Myoporum* woodland, *J.A. Elix 43650*, 8.v.2005 (CANB); • Near junction of Moore and Russell Roads, 8 km NE of Malanda, 17°19′S, 145°39′E, 750 m, on *Solanum* shrub in grazing land, *H. Streimann 46629A*, 15.xii.1990 (CANB).
New South Wales: • Lincoln State Forest, Brennans Road, 15 km ENE of Bellodoran, 21 km SE of Gilgandra, 31°51′33″S, 148°46′46″E, 345 m, on *Callitris* in *Eucalyptus-Callitris* woodland, *J.A. Elix 38449*, 12.x.2005 (CANB).
Victoria: • Piangil Road, 3 km NE of Walpeup, 35°07′13″S, 142°03′01″E, 75 m, on *Cassinia* and *Santalum* in remnant mallee *Eucalyptus* woodland, *J.A. Elix 43293, 43309, 43310*, 17.iv.2009 (CANB).

Physcia verdonii Elix, sp. nov. Fig. 5
Sicut *Physcia poncinsii* sed subtus fuscus vel brunneus et chemica continenti differt.

Type: Australia. *New South Wales*: Bunga, just W of Mimosa Rocks National Park, 18 km S of Bermagui, 36°33′S, 150°03′E, 50 m, on weathered granite rocks in pasture, *J.A. Elix 32648*, 17.x.2002 (CANB – holotype).

Thallus orbicular or spreading, adnate throughout, to 6 cm wide. *Lobes* 0.3–1.5 mm wide, imbricate to separate, irregularly or pinnately branched, weakly to distinctly convex to ±flat; margins entire to delicately notched or incised, not sorediate; lobe tips rounded to ±truncate, often slightly recurved. *Upper surface* light to dark grey, emaculate, often grey-white-pruinose at the apices, sorediate; upper cortex pseudoparenchymatous. *Soralia* laminal, crateriform with flaring margins to almost capitate, 0.1–1.0 mm wide, usually orbicular, beginning from cracks in the upper cortex, ±coalescing and spreading over the surface; soredia coarsely granular, greenish white to white. *Lower surface* pale to mid-brown near the margins to grey-brown or dark brown within; rhizines often scattered at the apices to densely crowded and tangled centrally, simple to squarrose-branched, whitish, tan to grey or brown, 0.4–0.9 mm long; lower cortex prosoplectenchymatous. *Apothecia* very rare, laminal, 0.2–1.0 mm wide, sessile and constricted at the base; thalline exciple persistent, concolorous with the thallus, entire, smooth or becoming sorediate; disc concave then flat, black to brown-black, with a fine grey-white pruina. *Ascospores Pachysporaria*-type, broadly ellipsoid, 17–22 × 7.5–10 μm. Pycnidia sparse to common, immersed, visible as black dots; conidia bacilliform, 4–5 × 1 μm.
Chemistry: Cortex K+ yellow; medulla K+ yellow; containing atranorin (major), zeorin (major), 16β-acetoxyhopane-6α,22-diol (major or minor), 6α-acetoxyhopane-16β,22-diol (minor), leucotylin (minor), 6α,16β-diacetoxyhopane-22-ol (minor), 6α,22-dihydroxyhopane-25-oic acid (trace).
Etymology: This species is named in honour of my late friend and colleague Doug Verdon.

Notes: According to Galloway & Moberg (2005), *P. poncinsii* Hue is a rather variable species with "corticolous specimens having thinner and flatter lobes than saxicolous specimens, which generally have thick, convex maculate lobes". The former represent *P. poncinsii sens. str.*, further distinguished by lobes that are usually narrower (0.3–1.0 mm *versus* 0.3–1.5 mm in *P. verdonii*), flat to weakly concave and with a lower surface that is white near the margins and darkens centrally to cream or pale greyish. This taxon is usually but not exclusively corticolous. The majority of saxicolous specimens represent *P. verdonii*, further distinguished by the thicker, convex lobes with a mid- to dark brown lower surface. *Physcia verdonii* is particularly common on coastal rocks. The two species also contain different triterpene chemosyndromes, *viz. P. poncinsii* with the *speciosa* chemosyndrome, whereas *P. verdonii* has the complete leucotylin chemosyndrome. *Physcia erumpens* Moberg also has crateriform soralia, but it has thinner, narrower lobes, a black lower surface and a pseudoparenchymatous lower cortex with thickened, brown cell-walls.

At present, *Physcia verdonii* is known from a number of coastal localities in south-eastern Australia and New Zealand, where it usually occurs on rocks and more rarely on bark or among mosses. Commonly associated species include several species of *Caloplaca*, *Diploicia canescens* subsp. *australasica* Elix & Lumbsch, *Dirinaria applanata* (Fée) D.D.Awasthi, *Heterodermia obscurata* (Nyl.) Trevis., *H. speciosa* (Wulfen) Trevis., *Pamotrema crinitum* (Ach.) M.Choisy, *P. reticulatum* (Taylor) M.Choisy, *P. tinctorum* (Nyl.) Hale, *Physcia littoralis* Elix, *Pyxine sorediata* (Ach.) Mont. and *Pertusaria subventosa* Malme.

SPECIMENS EXAMINED
Australia. *New South Wales*: • South Coast, Tathra, 36°43′S, 149°59′E, 15 m, on rocks of coastal cliffs, *J.A. Elix 255*, 14.v.1974 (CANB); • South Coast, Kiama, 34°39′S, 150°51′E, 4 m, on rocks along foreshore, *J.A. Elix 691*, 29.iii.1975 (CANB); • Type locality, on weathered granite rocks in pasture, *J.A. Elix 32647*, 17.x.2002 (CANB); • South Coast, Guerilla Bay, 11.5 km SE of Batemans Bay, 35°49′S, 150°14′E, 1 m, on rocks along foreshore, *J.A. Elix 2052*, 16.iv.1976 (CANB); Port Stevens, Fingal Bay, Fin-gal Head, 32°45′S, 152°11′E, 0–20 m, on siliceous rocks in rocky, heathy headland, *R.B. Filson & H.T. Lumbsch 8689a*, 25.vi.1991 (CANB); • South Coast, Jervis Bay, Murrays Beach, 35°08′S, 150°45′E, 8 m, among mosses over tree stump in rocky area above beach, *D. Verdon 3079*, 9.ix.1977 (CANB).
Victoria: • Gippsland, Cape Conran, 18 km E of Marlo, 37°48′S, 148°43′E, 1 m, on coastal granite rocks, *J.A. Elix 5287, 5305*, 21.ix.1978 (CANB).
Tasmania: • East Coast, Sleepy Bay, Freycinet National Park, 42°08′S, 148°19′E, 6 m, on granite rocks of coastal cliffs, *J.A. Elix 5507*, 13.i.1979 (CANB); • Boat Harbour, 10 km NW of Wynyard, 40°57′S, 145°38′E, 6 m, on tree trunk in coastal scrub, *J.A. Elix 23818*, 12.i.1990 (CANB).
New Zealand. South Island: *Nelson*: • Cable Bay, 17 km NE of Nelson, 41°09′S, 173°24′E, 60 m, on granite rock in pasture, *J.A. Elix 33434*, 1.ii.1993 (CANB).

Acknowledgements
I thank Neal McCracken (ANU Photography) for preparing the photographs.

References
Elix, JA; Corush, J; Lumbsch, HT (2009): Triterpene chemosyndromes and subtle morphological characters characterize lineages in the *Physcia aipolia* group in Australia (Ascomycota). *Systematics and Biodiversity* **7**, 479–487.
Elix, JA; Ernst-Russell, KD (1993): *A Catalogue of Standardized Thin-Layer Chromatographic Data and Biosynthetic Relationships for Lichen Substances*, 2nd Edn, Australian National University, Canberra.
Elix, JA; Giralt, M; Wardlaw, JH (2003): New chloro-depsides from the lichen *Dimelaena radiata*. *Bibliotheca Lichenologica* **86**, 1–7.
Galloway, DJ; Moberg, R (2005): The lichen genus *Physcia* (Schreb.) Michx. (Physciaceae: Ascomycota) in New Zealand. *Tuhinga* **16**, 69–102.
Moberg, R (1977): The lichen genus *Physcia* and allied genera in Fennoscandia. *Symbolae Botanicae Upsalienses* **22**(1), 1–108.
Moberg, R (1986): The genus *Physcia* in East Africa. *Nordic Journal of Botany* **6**, 843–864.
Moberg, R (1990): The lichen genus *Physcia* in Central and South America. *Nordic Journal of Botany* **10**, 319–342.

Moberg, R (1997): The lichen genus *Physcia* in the Sonora Desert and adjacent areas. *Symbolae Botanicae Upsalienses* **32**(1), 163–186.
Moberg, R (2001): The lichen genus *Physcia* in Australia. *Bibliotheca Lichenologica* **78**, 289–311.
Moberg, R (2002a): *Physcia.* In *Lichen Flora of the Greater Sonoran Desert Region, Vol. **1*** (T.H. Nash III, B.D. Ryan, C. Gries & F. Bungartz, eds), 358–373. Lichens Unlimited, Arizona State University, Tempe.
Moberg, R (2002b): *Physcia*. *Nordic Lichen Flora* **2**, 33–38.

Fig. 1. *Physcia austrocaesia* (holotype in CANB).

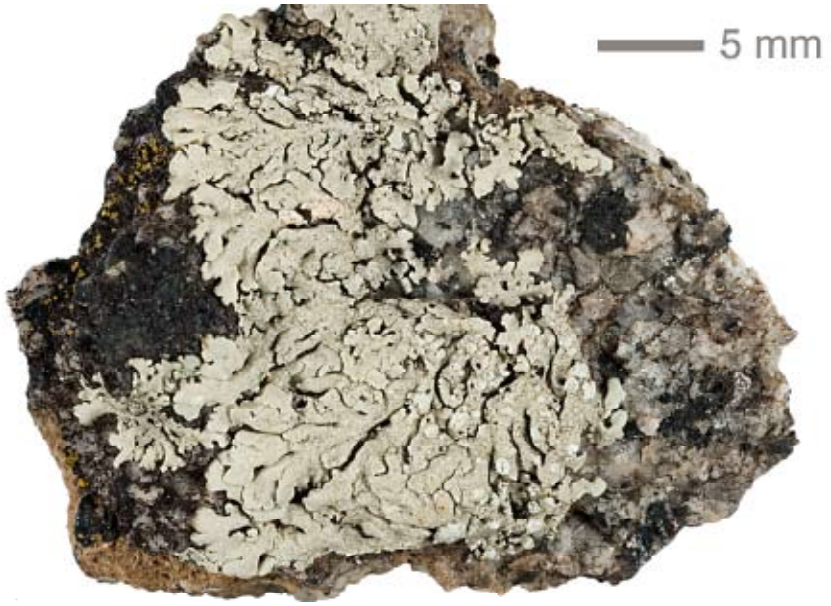

Fig. 2. *Physcia caesiopsis* (holotype in CANB).

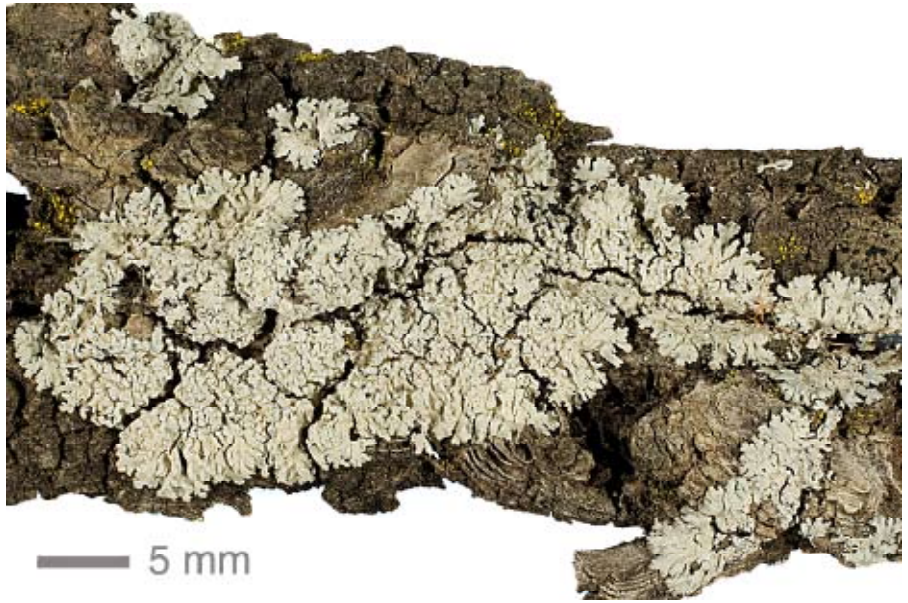

Fig. 3. *Physcia neonubila* (*J.A. Elix 11759* in CANB).

Fig. 4. *Physcia rolandii* Elix (isotype in CANB).

Fig. 5. *Physcia verdonii* (*J.A. Elix 32647* in CANB).

RECENT LITERATURE ON AUSTRALASIAN LICHENS

Aptroot, A (2011): Additional lichen records from Australia 73. *Agonimia opuntiella. Australasian Lichenology* **68**, 3.

Bugni, TS; Andjelic, CD; Pole, AR; Rai, P; Ireland, CM; Barrows, LR (2009): Biologically active components of a Papua New Guinea analgesic and anti-inflammatory lichen preparation. *Fitoterapia* **80**, 270–273.

Castello, M (2010): Notes on the lichen genus *Rhizoplaca* from continental Antarctica and on some other species from northern Victoria Land. *Lichenologist* **42**, 429–437.

Elix, JA (2011): Three new species of *Heterodermia* (Physciaceae, Ascomycota) from Australia. *Australasian Lichenology* **68**, 16–21.

Elix, JA (2011): Lichen phytochemistry III: further additions and amendments. *Australasian Lichenology* **68**, 22–26.

Elix, JA (2011): New species of *Physcia* (Physciaceae, lichenized Ascomycota) from Australasia. *Australasian Lichenology* **68**, 28–38.

Elix, JA; Archer, AW (2011): *Pertusaria cryptostoma* Müll.Arg., the earliest name for *Pertusaria limbata* Vain. *Australasian Lichenology* **68**, 27.

Ertz, D (2009): Revision of the corticolous *Opegrapha* species from the Paleotropics. *Bibliotheca Lichenologica* **102**, 1–176.

Galloway, DJ (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.

Giralt, M; Elix, JA (2010): New morphological and chemical data for *Buellia imshaugii. Lichenologist* **42**, 763–765.

Itten, B; Honegger, R (2010): Population genetics in the homothallic lichen-forming ascomycete *Xanthoria parietina. Lichenologist* **42**, 751–761.

Jørgensen, PM (2011): *Pannaria reflectens* (Nyl.) P.M.Jørg. comb. nov., the correct name for the lichen *Pannaria sorediata* C.Knight. *Lichenologist* **43**, 85–86.

Kantvilas, G; Fryday, AM (2010): Two additions to the lichen genus *Ramalina* Fr. (Ramalinaceae) with broad ascospores. *Lichenologist* **42**, 539–545.

Liska, J (2011): Lectotypifications of some of the lichen names described by A. Vězda. *Lichenologist* **43**, 83–84.

Ludwig, L (2011): Marginal soralia and conidiomata in *Icmadophila splachnirima* (Icmadophilaceae) from southern New Zealand. *Australasian Lichenology* **68**, 4–11.

Lumbsch, HT; Papong, K; Naikatini, A (2009): A new terricolous species of *Gyalidea* (Gomphillaceae), Ascomycota) from Fiji. *Nova Hedwigia* **88**, 111–116.

Øvstedal, DO; Lewis Smith, RI (2009): Further additions to the lichen flora of Antarctia and South Georgia. *Nova Hedwigia* **88**, 157–168.

Øvstedal, DO; Fryday, AM (2011): A new species of *Protopannaria* (Pannariaceae, Ascomycota) from the southern New Zealand shelf islands, and additional records of *Protopannaria* from South America. *Australasian Lichenology* **68**, 12–15.