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The Austral *Pannaria immixta* colonizes rock, bark, and occasionally bryophytes in both shaded and well-lit humid lowlands. Its two most distinctive traits are its squamulose thallus and its gyrose apothecial discs. 1 mm

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JACK ELIX AWARDED THE ACHARIUS MEDAL AT IAL5

The recent Fifth Conference of the International Association for Lichenology (IAL5) in Tartu, Estonia, was a highly successful event, and most Australasian lichenologists will have the opportunity to read of its various academic achievements in other media*. The social programme included the traditional IAL Dinner, where, after many days of symposia, poster sessions, excursions, meetings and other lichenological events, conference delegates mingle informally and dust away their weariness over food and drink. The IAL dinner in Tartu was particularly memorable for its elegant setting (in an historic library building), remarkable range of food and wine, and relaxing live background music.

One of the highpoints of the dinner is always the presentation of the Mason Hale and Acharius Awards, the latter conferred to individuals recognised as having offered outstanding service to lichenology. The list of Acharius Medallists over the years is now rather long, and includes such household names as Josef Poelt, Rolf Santesson, Gunnar Degelius, Peter James, Antonín Vezda, Aino Henssen and Teuvo Ahti. On this occasion, to this illustrious company was added the name of Jack Elix, the first Australasian recipient of the award.

Tom Nash from Arizona State University, a long-standing friend and colleague of Jack, presented the formal "laudatio". Tom briefly outlined Jack's life and education, his prolific publication record as a lichen taxonomist and chemist, the enormous breadth of his collaboration with so many lichenologists around the world, and the remarkable extent to which Jack's work has influenced lichenology. He also talked of Jack's willingness to help others with their tantalising chemical problems, and observed that a significant number of delegates present at the dinner had collaborated with Jack or been helped by him in their research.

In Jack's absence, the outgoing President of the IAL, Pier Luigi Nimis, one of lichenology's most colourful and enthusiastic proponents, presented Jack's medal to Gintaras Kantvilas, the sole Australasian lichenologist to attend the Conference.

Gintaras chose the moment to amplify some of Jack's other qualities. He related to the gathering Jack's reputation for hospitality, how lichenological visitors to Canberra were invariably treated *chez Elix*, sharing a cold cleansing ale and reviewing the day's scientific achievements in the comfort of Jack's sitting room at Aranda. Many younger lichenologists present knew Jack only by his scientific reputation but were reassured that were they to meet Jack personally, they would find he was not a "Herr Professor Doctor-type" but preferred to be addressed as "Jack" or "mate". Gintaras told the meeting that Jack would dearly love to be there to receive his award personally, and assured them that he would pass on to Jack all the gossip from IAL5 at the first opportunity. On Jack's behalf, he thanked the IAL for bestowing this honour, recalling how when Jack was presented with his *Festschrift* (edited by Pat McCarthy, Gintaras Kantvilas and Simone Louwhoff in 2001), his formal words of thanks were "geez, thanks fellas", and that if he were present in Tartu, he would surely respond in a similar manner. The enthusiastic applause from the delegates indicated that it was their unanimous opinion that Jack Elix was a most deserving Acharius Medallist. Well done, Jack!

Gintaras Kantvilas

* For example, the *Newsletter* of the IAL. If you are not a member, why not join and help support lichenology globally?

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The Lichen Hunters, by Oliver Gilbert. 208 pp. The Book Guild Ltd, 25 High Street, Lewes, East Sussex, BN7 2LU, United Kingdom. 2004. ISBN 1-85776-930-9. Distributed by Vine House Distribution Ltd, Waldenbury, North Chailey, East Sussex BN8 4DR, United Kingdom: sales@vinehouse.co.uk. Price £16.95 [c. $NZ46.00], plus post and packaging.

In 1856, the Scottish lichenologist William Lauder Lindsay introduced his book *A Popular History of British Lichens* in the following manner "... The purpose of the writer in laying before the public a familiar history of British Lichens, is to open up a hitherto neglected, or at least little read, page of the book of Nature; to introduce to those who desire an object to lead them to our coasts or hills, or who require a pursuit combining healthful recreation with scientific interest, a somewhat new, attractive, and fertile field of labour; to offer to observers in Natural History an opportunity of contributing towards the filling up of a gap, hitherto very conspicuous in British Botany, as well as towards the further development of the economical resources of our country. The Lichens may be said to be the only family of the *Cryptogamia* which has not met with its due meed of scientific or public attention, and whose natural history has consequently hitherto rested on a most insecure and unsatisfactory foundation. They have ever been the acknowledged *opprobria* of Cryptogamic Botany. The delicate waving frond of the fern is anxiously tended by jewelled fingers in the drawing rooms of the wealthy and noble; the rhodospermous seaweed finds a place beside the choicest productions of art in the gilt and broidered album; the tiny moss has been the theme of many a gifted poet; and even the despised mushroom has called forth classic works in its praise. But the Lichens, which stain every rock and clothe every tree, which form "Nature's livery o'er the globe where'er her wonders range" have been almost universally neglected, nay despised. This neglect is to us the more surprising when we consider the facility with which they may be collected, preserved and examined even by the humblest observer..." (Lindsay 1856).

It seems that in most regions there is a cyclical "rediscovery" of lichens, and that in most countries over the past two centuries since lichens were made the object of serious scientific study, there have been phases of neglect (often very protracted) and of subsequent joyful and enthusiastic rediscovery. Just as William Lauder Lindsay attempted to engage popular interest and enthusiasm for lichens in the mid-nineteenth century, so the foundation of the British Lichen Society in 1958 heralded a period of fruitful rediscovery after the long drought of the "lean years" as they have come to be called. This latter period of rediscovery and subsequent growth and consolidation of lichenological interest in a British context is the subject of Oliver Gilbert's latest book, *The Lichen Hunters*. Oliver Gilbert, a distinguished lichen ecologist for many years at the University of Sheffield (Department of Landscape Architecture) is also a gifted, and at times enthralling, writer on lichens and their place in nature, of their habitats, of the communities that they form, and of the people who study them. He joined the British Lichen Society not long after its foundation and since then has been a linchpin of many of the Society's activities, including Council Member, Referee, Bulletin Editor (1981–1989), Vice President (1974–1975), President (1976–1977), Honorary Member (1997) and foundation Ursula K. Duncan Awardee in 2004 (Pedley 2004). Oliver has contributed widely to the pages of the *Lichenologist* over many years on a variety of research agendas, several of which he has pioneered, and his regular and diverse accounts in the *BLS Bulletin* (see for example Gilbert *et al.* 1996, Gilbert & Henderson 2000, Gilbert 2000) reflect his wide tastes and sympathies allied to a fluent and graceful pen. His two earlier books (Gilbert 1989, 2000) confirmed his already formidable reputation as an author who has the ability and erudition to present a dazzling array of facts in a lively and readable, and often memorable form. *The Lichen Hunters* crowns his achievement and at the same time it breaks new ground.

The raison d'être of this book is given in the opening paragraph of the author's Preface "... This book has been written to put on record what it was like to be a member of that heady first generation of lichenologists, following on from the 'lean years' when the number of active participants in the subject could be counted on the fingers of one hand. The formation of the British Lichen Society (BLS) in 1958 stimulated a remarkable resurgence of interest as hundreds of young people, the majority of them amateurs, were attracted to the subject...". And, tellingly if somewhat ruefully as a postscript, "...The second generation (since the 'lean years') of mainly foreign, professional lichenologists is a very different breed from those who helped in the catching-up process; they are highly trained, computer-literate, and backed by well-equipped laboratories. These are the trend-setters, the 'whiz kids' of today. There is no way the clock can be turned back. As the subject advances, there will still be a role for the observer working from home with a pair of microscopes set up on a table surrounded by a small library, but I feel their heyday is drawing to a close. This is why I am putting on record what it was like to be involved in those exciting, impetuous days of catch-up lichenology when amateurs and professionals worked in harness...".

Gilbert's book charts the foundation and growth of the BLS from a small group of dedicated British amateurs who supported an even smaller group of professional, museum- or university-based lichenologists, to the far-flung and greatly expanded, international membership of the Society today. The sense of a lichenological fraternity, or a close, interdependent family is vividly presented through accounts of fieldwork and especially of the social aspects of BLS trips over the years. It is a fascinating entrée into this important but frequently overlooked world of British lichenology, which for many was part holiday, part serious research endeavour. The bulk of the book is an account of the various facets of Oliver Gilbert's field trips and research agendas as a practising lichen ecologist, with the chapters Island Years, The Mountains, Neglected Habitats, Weekends Away and Days Out, fleshing out in vivid and expansive prose, the excitement, trials, tribulations, victories and near misses in the vigorous life of a questing lichenologist. Very few lichenologists I suspect have the honesty or the ability to make a compelling story or an adventure out of field lichenology. Oliver Gilbert is the great exception, and we must be grateful that he is. His book is full of great lichenology and good writing – for example "...The 1970s and 1980s were serene and productive decades, a golden age. Lichenology, still new and exciting, was gradually expanding, and was held in high regard by other disciplines. We amateurs, though reliant on the professionals at the national institutions to help us name difficult specimens, were becoming more independent, and I hope that in return they found the flow of material we sent them of interest; we certainly provided a vibrant and appreciative audience for their own work...".

Most of the "characters" of British lichenology appear in the pages of the book, with charming and perceptive pen portraits of Peter James, Dougal Swinscow, Jack Laundon, Francis Rose, Frank Brightman, Brian Coppins, Tom Chester, Brian Fox and Alan Fryday, and many others from the venerable to the relatively recent, though I personally missed tributes to such stalwarts as Alice Burnett and Mary Hickmott. Oliver is particularly good at recreating the enthusiasm, effort, suspense and rewards of fieldwork, from the camaraderie of a comfortable churchyard group to the rigours of a carefully planned expedition to a remote mountain lochan. Much of the narrative one suspects is taken almost verbatim from his expedition diaries, and this shines a particularly vivid and perceptive light on the activities of a competent and dedicated lichen ecologist. This is "reality lichenology" writ large, and Oliver's aim to establish a new field, that of adventure lichenology,

was resoundingly successful, as much of the content of his book so vividly shows.

Oliver Gilbert concludes *The Lichen Hunters* with two pages on "the six stages of Lichenology", ending with the lovely sentence ..."You go to look for lichens and find in addition familiarity, beauty, companionship, laughter and the warmth of friends". There is an Index but no Bibliography, which would have been helpful. Instead, one must go to Gilbert's 2000 book on lichens to find chapter and verse on the books and papers that he has consulted, supplemented by Richardson (1975), Swinscow (1989) and Laundon (1995).

In summary, *The Lichen Hunters* is an extremely engaging, and at times an enthralling, read from a writer who has the ability to make his subject matter unfailingly interesting over a wide range of subjects, the whole enlivened by his affectionate remembrances of many of the personalities active in British lichenology over the last four decades. In terms of knowledge of the British lichen mycobiota, its brief is from Duncan (1970) to Purvis *et al.* (1992) and beyond, and fittingly, Oliver is the Chair of the Steering Committee charged with producing a revised edition of *The Lichen Flora of Great Britain and Ireland*. As a record of the range of achievements of the British Lichen Society from its foundation onwards, Gilbert's book says very little about the international aspects of the Society's work, publications, symposia, and conferences, or of the role and influence of the BLS in the development of lichenology worldwide. This is an area of interest and achievement that still needs to be written, and hopefully Oliver's book will provide the impetus for a wider history of the BLS to be written. Part autobiography, part history, part detective story, part traveller's tales, *The Lichen Hunters* breaks new ground in the wider literature of lichenology, and will be widely and warmly welcomed by lichenologists everywhere. Congratulations and thanks, Oliver, on sharing your "lichen life" with us in so richly diverse a fashion. It is all the more remarkable when one realises that most of the book was written while Oliver was suffering from the effects of periods of kidney dialysis and eventually a kidney transplant operation! *The Lichen Hunters* is a notable addition to the literature of contemporary lichenology and is very warmly recommended.

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Additional lichen records from Australia 55
Diploschistes conceptionis

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Abstract: *Diploschistes conceptionis* is reported as new to Australia, and a key to the terricolous species in Australia is provided.

The genus *Diploschistes* is relatively common in Australia, inhabiting both acidic and basic rocks from alpine areas to sea level, soil and as a parasite on *Cladonia* species. A recent revision of the genus in Australia (Lumbsch & Elix 2003) recorded a total of 15 species, of which five taxa occur on soil, independently or as a parasite on *Cladonia* in the juvenile phase. We have recently discovered an additional terricolous species, *Diploschistes conceptionis* Vain., which forms the subject of this report.

Diploschistes conceptionis Vain., *Hedwigia* **38**, 289 (1899).
This species was known previously from the Neotropics (Lumbsch 1993). It is characterized by the terricolous thallus, the apothecioid ascomata, and the presence of gyrophoric acid in the medulla. A detailed description follows.

Thallus crustose, uniform, adnate, rimose-areolate, dull, whitish-grey, pruinose. Areoles 0.52 mm wide, in section up to 2 mm high, irregularly angular; photobiont *Trebouxia* sp. Apothecia immersed or sessile, apothecioid, blackish, up to 2 mm wide; disc urceolate, open. Proper exciple blackish, up to 80 µm thick, pseudoparaplectenchymatous. Hymenium 80–100 µm high; hypothecium 20 µm high, hyaline. Paraphyses 2 µm thick, simple, lax. Asci cylindrical to subclavate, 70–90 × 15–28 µm, 6–8-spored. Ascospores brown, muriform, broadly ellipsoid to ellipsoid, 3–5 transverse septa, 1–2 longitudinal septa, 18–30 × 7–14 µm. Pycnidia immersed, ostiole blackening, cerebriform. Conidia bacilliform, 4–6 × 1–1.5 µm.
Chemistry: K–, C+ red, PD–, UV–; containing gyrophoric acid (major), lecanoric acid (minor or trace).

SPECIMENS EXAMINED
Western Australia. •Nookaminne Picnic Area, 4 km W of Quairading, 32°01'19"S, 117°22'19"E, 250 m, on soil in shrubland with *Casuarina, Acacia* and *Eucalyptus, JA Elix 31802*, 22.iv.2004 (CANB). •34 km E of Southern Cross, 1 km W of Yellowdine along the Great Eastern Highway, 31°17'51"S, 119°38'46"E, 370 m, on soil in *Eucalyptus–Melaleuca* woodland, *JA Elix 32090,* 24 April 2004 (CANB).

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Key to the terricolous Australian species of *Diploschistes*

1a. Apothecia perithecioid ..... **D. henssenieae** Lumbsch & Elix
1b. Apothecia apothecioid 2

2a. Thallus K+ yellow turning red (norstictic acid present); discs lecanoroid ..... **D. ocellatus** (Vill.) Norman
2b. Thallus K– or K+ yellow (lecanoric, gyrophoric, and/or diploschistesic acids present; discs urceolate 3

3a. Thallus thin, parasitic on *Cladonia* species when juvenile ..... **D. muscorum** subsp. **bartlettii** Lumbsch
3b. Thallus thick, not lichenicolous 4

4a. Thallus containing gyrophoric acid as major compound ..... **C. conceptionis** Vain.
4b. Thallus containing lecanoric and/or diploschistesic acid as major compounds ... 5

5a. Thallus verruculose or bullate; asci 4–8-spored; ascospores 20–38 × 9–17 µm ..... **D. diacapsis** (Ach.) Vain.
5b. Thallus plane; asci 8-spored; ascospores 16–28 × 6–16 µm ..... **D. thunbergianus** (Ach.) Lumbsch & Vězda

Australian species in the genus *Diorygma* (Graphidaceae)

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Abstract: The Australian species in the genus *Diorygma* are listed and a key to the Australian species is given. The new combinations *Diorygma nothofagum* and *Diorygma wilsonianum* are made.

A recent revision of the genus *Diorygma* (Kalb *et al.* 2004) has resulted in a number of species, previously reported from Australia as *Graphis* or *Graphina*, being transferred to the genus *Diorygma*. They are as follows:

D. circumfusum (Stirt) Kalb, Staiger & Elix, formerly *Graphis circumfusa* Stirt.
D. erythrellum (Mont.) Kalb, Staiger & Elix, previously reported as *Graphina incisa* A.W. Archer, and *Graphina atramontana* A.W. Archer (Archer 2001).
D. hieroglyphicum (Pers.) Kalb, Staiger & Elix, previously reported as *Graphina pallido-ochracea* (Krempelh.) Zahlbr. (Archer 2001).
D. junghuhnii (Mont. & Bosch) Kalb, Staiger & Elix, previously reported as *Graphina mendax* (Nyl.) Müll. Arg. (Archer 2001).
D. pruinosum (Eschw.) Kalb, Staiger & Elix, previously reported as *Cyclographina platyleuca* (Nyl.) Awasthi & M. Joshi (Archer 1999a) and later as *Graphina platyleuca* (Nyl.) Zahlbr. (Archer 2004).
D. rufopruinosum (A.W. Archer) Kalb, Staiger & Elix, previously reported as *Graphina rufopruinosa* A.W. Archer and *Graphina boweniana* A.W. Archer (Archer 2001).

In addition to the species listed above, the following new combinations are made:

Diorygma nothofagum (A.W. Archer) A.W. Archer, *comb. nov.*
Basionym: *Graphina nothofagi* A.W. Archer, *Mycotaxon* **77**, 168 (2001).
Diorygma nothofagum resembles *D. erythrellum,* but is distinguished from that species by the smaller ascospores.

Diorygma wilsonianum (Müll. Arg.) A.W. Archer, *comb. nov.*
Basionym: *Graphis wilsoniana* Müll. Arg., *Bull. Herb. Boissier* **1**, 57 (1893).
Diorygma wilsonianum resembles *D. circumfusum* both chemically and morphologically, but is distinguished from that species by the smaller ascospores and the more southerly distribution. It is so far known only from the type specimen (Archer 1999b).

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Key to the Australian species of *Diorygma*

1. Ascospores septate with lenticular locules; norstictic acid only 2
1a. Ascospores muriform; norstictic acid and/or other depsides 3

2. Ascospores 60–900 µm long ..... **D. circumfusum**
2a. Ascospores 45–55 µm long ..... **D. wilsonianum**

3. Ascospores <80 µm long 4
3a. Ascospores >80 µm long 5

4. Ascospores 30–65 µm long ..... **D. erythrellum**
4a. Ascospores 18–23 µm long ..... **D. nothofagum**

5. Stictic acid present ..... **D. hieroglyphicum**
5a. Norstictic or protocetraric acid present 6

6. Only norstictic acid present; ascospores 80–105 µm long ..... **D. junghuhnii**
6a. Protocetraric acid present with or without norstictic acid 7

7. Only protocetraric acid present; ascospores 95–150 µm long .. **D. pruinosum**
7a. Protocetraric and norstictic acids present; ascospores 120–150 µm long ..... **D. rufopruinosum**

A new species of *Flavoparmelia* (Parmeliaceae, lichenized Ascomycota) from Western Australia

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Abstract: The new species *Flavoparmelia marchantii* Elix, O. Blanco & A. Crespo is described from Western Australia. In addition, a further two new state records of *Flavoparmelia* are reported for Australia.

The lichen family Parmeliaceae is particularly well represented in Australia, and has been investigated intensively over the past 25 years (see Orchard 1994). However, the lichens of some poorly collected areas as well as some difficult species complexes remain to be studied. A detailed survey of the family in Australia is currently being undertaken, and a further new species is described here. Chemical constituents were identified by thin-layer chromatography (Culberson 1972, Culberson & Johnson 1982, Elix & Ernst-Russell 1993), high performance liquid chromatography (Feige *et al.* 1993, Elix *et al.* 2003), and comparison with authentic samples.

Flavoparmelia marchantii Elix, O. Blanco & A. Crespo, sp. nov. Fig. 1

Thallus ut in *Flavoparmelia pachydactyla* sed corticola, lobis latiore et subtus nitidus differt.

Type: **Australia**. *Western Australia*: •Fitzgerald River National Park area, c. 2 km beyond the western boundary at Calyerup Rocks, 33°54'43"S, 119°05'57"E, on bark of *Allocasuarina huegeliana*, around rock pools in a thicket of *A. huegeliana* and mixed *Melaleuca* spp., *B.G. Hammersley 2914*, 25.ix.2001; holo: PERTH.

Thallus corticolous, adnate, up to 6 cm wide. Lobes laterally imbricate to ±contiguous, irregularly branched, 2–10 mm wide; apically subrotund to rotund. Upper surface yellow-green, broadly undulating, rugose centrally, dull to slightly shiny, often with reticulate white maculae towards the lobe apices, dactylate; dactyls ±inflated, isidioid, globose to cylindrical, branched or not, 0.5–1.5 mm high, entire, apices syncorticate, rarely eroded (and appearing superficially sorediate), lacking soredia, pustules and isidia. Medulla white. Lower surface black, shiny, wrinkled, with a brown, erhizinate marginal zone; rhizines sparse, simple. Apothecia scattered, sessile to subpedicillate, 1–4 mm wide; disc concave, cinnamon-brown; thalline exciple densely dactylate. Ascospores ellipsoidal, 15–18 × 8–10 µm. Pycnidia common, punctiform, immersed. Conidia bacilliform, 6–8 × 1 µm.
Chemistry. Cortex K–; medulla K– or K+ dirty yellow-brown, C–, KC+ pink-red; P+ deep orange-red; containing usnic acid, protocetraric acid (major), virensic acid (trace), conprotocetraric acid (trace), convirensic acid (trace), subvirensic acid (trace), physodalic acid (trace).

The most characteristic features of this new species are the conspicuous isidioid dactyls on the upper surface and the presence of the protocetraric acid chemosyndrome in the medulla. The coarse, isidioid dactyls are easily shed (like typical cylindrical isidia) and clearly function as propagules, but are sometimes globose and inflated so that the syncorticate apices can then become eroded and appear superficially sorediate. The African species *Flavoparmelia pachydactyla* (Hale) Hale produces analogous dactyls on the upper surface and medullary protocetraric acid, but can be distinguished by the narrower lobes (1.0–1.5 mm *cf.* 2–10 mm wide), by the lower surface being velvety and jet-black to the margins (shiny and brown at the margins in *F. marchantii*), and by its preference for saxicolous substrata. *Flavoparmelia marchantii* could also be confused with *F. haysomii* (Dodge) Hale, another Australian species with a dactylate upper surface and medullary protocetraric acid. However, the laminal dactyls of *F. haysomii* are typically wart-like, subglobose or forming irregular ridges (never cylindrical), and are fragile, becoming ±erumpent apically and forming granular soredia, and unlike *F. marchantii*, *F. haysomii* prefers saxicolous substrata. Furthermore, the lower medulla of *F. haysomii* is commonly pigmented yellow-orange due to the presence of skyrin, but such pigmentation has not been observed in *F. marchantii*. The lower surface of *F. haysomii* is shiny as in *F. marchantii*, but is black in the thallus centre, and often pale brown at the margins. Molecular studies based on nu rDNA have confirmed that *F. haysomii* and *F. marchantii* are not closely related (Blanco & Crespo, unpublished data). This new species is named in honour of Dr Neville Marchant, Australian botanist and Director of the Western Australian Herbarium.

Flavoparmelia marchantii appears to be a scattered species in south-western Western Australia, where it grows on dead and burnt wood and on *Allocasuarina* and *Hakea* bark. Associated species include *Chrysothrix candelaris* (L.) J.R. Laundon, *Flavoparmelia rutidota* (Hook.f. & Taylor) Hale, *Physcia jackii* Moberg, *Ramalina inflata* subsp. *australis* G.N. Stevens, and *Teloschistes chrysophthalmus* (L.) Th.Fr.

SPECIMENS EXAMINED
Western Australia: •near Boyagin Rock, 32°28'S, 116°53'E, on dead wood in wandoo woodland, *D.J. Edinger s.n.*, 1.iv.1995 (PERTH); •Gairdner River, South Coast Highway, 5 km ENE of Jerramungup, 33°15'S, 118°58'E, 260 m, on *Hakea* in cleared rocky paddock with scattered trees, *JA. Elix 41545*, 18.ix.1994 (CANB); •Nyamup, 21 km E of Manjimup on the Muir Hwy, 34°19'21"S, 116°18'24"E, on burnt stump, *E. McCrum 02#29b*, 28.iv.2003 (MAF 10492).

New Records of *Flavoparmelia* for Australia

Flavoparmelia haywardiana Elix & J.Johnst., *Mycotaxon* **33**, 392 (1988).

This Australasian species is known from Tasmania and New Zealand, but has not been recorded previously from the Australian mainland (Elix & Johnston 1988, Kantvilas *et al.* 2002). It is characterized by the tightly adnate thallus, the coarse soredia that originate in roundish, capitate soralia on the surface of the younger, marginal lobes, and the medullary protocetraric acid. Older, central portions of the thallus typically become entirely granular sorediate, and the lower medulla is often pigmented yellow-orange due to the presence of skyrin. A detailed description is given in Elix & Johnston (1988).

SPECIMEN EXAMINED
South Australia: •0.5 km N of Springton along the Eden Valley Road, 34°42'S, 139°05'E, 360 m, on dead *Eucalyptus* log in pasture, *J.A. Elix 32659*, 28.ii.1992 (CANB).

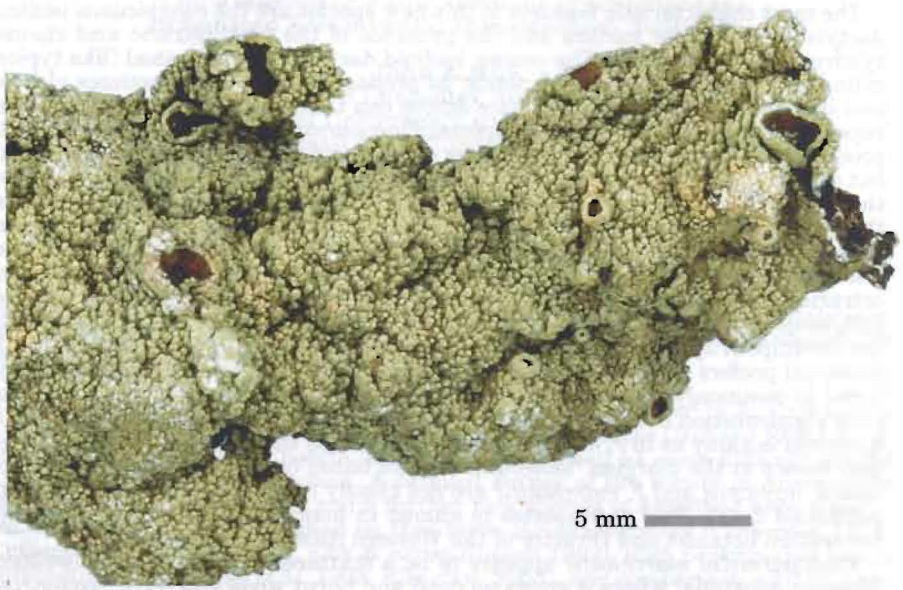
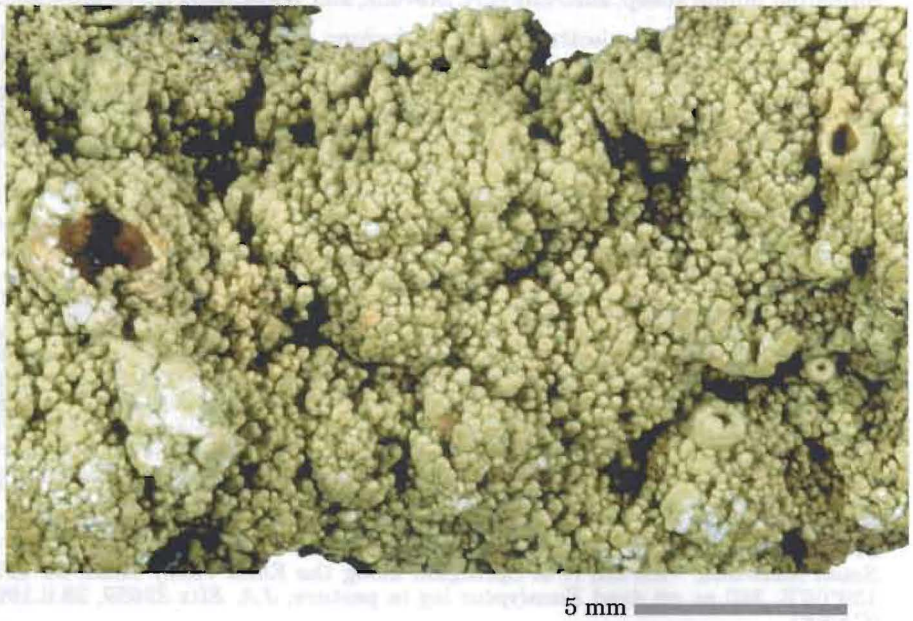


Figure 1. *Flavoparmelia marchantii* (holotype in PERTH).



Flavoparmelia kantvilasii Elix, *Mycotaxon* **47**, 105 (1993).

This endemic Australian species was previously known only from New South Wales (Elix 1994). It is characterized by the adnate, green to yellow-green thallus, with sorediate dactyls on the upper surface, a white medulla and the medullary protocetraric acid. The very coarse granular soredia develop from cracks in the upper surface as well as from erumpent pustules. The related species *F. haywardiana* has larger thalli (4–12 cm) and capitate soralia. A detailed description is given in Elix (1994).

SPECIMEN EXAMINED

Queensland: •Pine Mountain State Forest, near Flutter Creek, 24 km SSW of Calliope, 24'12'S, 151'05'E, 100 m, on branches of *Araucaria* in dry monsoon scrub on flats, *J.A. Elix 34820*, 27.viii.1993 (CANB).

Acknowledgements

We thank Stuart Hay and Neal McCracken of the Photographic Unit, ANU, for preparing the photograph, and the project CGL2004-1848/BOS for support.

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Umbilicaria murihikuana and *U. robusta* (Umbilicariaceae: Ascomycota), two new taxa from Aotearoa New Zealand

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Abstract: *Umbilicaria murihikuana* D.J.Galloway & L.G.Sancho, is newly described from southern New Zealand, and a new combination *Umbilicaria robusta* (Llano) D.J.Galloway & L.G.Sancho is proposed.

The lichen genus *Umbilicaria* is present in Aotearoa New Zealand on rocks in alpine and high-alpine biomes, being most commonly collected from the foothill ranges east of the Southern Alps in South Island, with *U. decussata* being collected from the summit rocks of Aoraki Mt Cook at an altitude of 3507 m, the highest exposed rocks in the country. A preliminary account of the genus in New Zealand (Galloway 1985) discussed 11 species, but it was recognized as being much in need of further study and collection. The preparation of a revised, 2nd edition of *Flora of New Zealand Lichens* (Galloway 2005) necessitated additional collecting, and a closer examination of specimens of *Umbilicaria* both in the field and in the herbarium. An earlier paper recorded two bipolar species of *Umbilicaria* as additions to New Zealand's lichen mycobiota, viz. *Umbilicaria grisea* and *U. kraschenninikovii* (Galloway 2001). Two additional new taxa are here recognized from New Zealand, one being described for the first time, and the other being a new combination. A detailed account of the 16 species of *Umbilicaria* presently recognized in New Zealand is in preparation and will be published elsewhere.

Umbilicaria murihikuana D.J.Galloway & L.G.Sancho, nov. sp. Figs. 1 and 2

Diagnosis: Thallus monophyllus, umbilicatus, orbiculatus vel irregularis, 1–2.5 cm diam., margine integris, hic illic fasciciculis rhizinarum ramosarum, nigrarum procurrentium. Pagina inferiora anthracina, exasperata vel areolato-scabrida, rhizinis marginalibus squarrose ramulosis, fasciculatis, apicaliter thalloconidiis coralloideis instructis. Apothecia immersa, discis nigris, impolitis, planis; margine proprio tenui, persistente, nitido, nigro, rhizinis nigris circumcirca. Ascosporae late ellipsoideae vel subglobosae, 13–15(–16.5) × 7–10(–12) µm. Medulla K+ flavorubens, C+ roseus, acidia gyrophorica et norstictica continens.

Type: **New Zealand**: *South Island*: Otago, Head of Rockburn, south end of Park Pass, on tops of boulders on ridge, associating with *Menegazzia inflata*, 1433 m, 16.v.1968, *D.J. Galloway 68352* (CHR 378718 – holotype).

Thallus monophyllous, orbicular to irregular, 1–2.5(–6) cm diam., margins entire, slightly wavy, to delicately notched or incised, conspicuously black-rimmed in places, and here and there with clusters of small, bushy, projecting, black rhizinomorphs. Upper surface pale olive-green to grey-green when wet, pale grey to grey-brown or charcoal-grey when dry, coriaceous, here and there with a sparse, white pruina, smooth, occasionally roughened or areolate-scabrid in patches, or with shallow wrinkled ridges centrally. Lower surface coal-black from margins to centre, minutely roughened to markedly areolate-scabrid (10× lens). Umbilicus compact, 2–6(–8) mm diam. Rhizinomorphs clustered at margins, exposing varying areas of lower surface, or in a dense, entangled mat from margins to centre, pale grey to black, mainly cylindrical, slender and delicate, 1–3 mm long, 0.1 mm diam., simple to mainly squarrosely branched, apical parts with minute, coralloid thalloconidia. Apothecia prominent, subimmersed and flush with surface of thallus, (0.5–)1–2(–3.5) mm diam., round to subirregular, solitary or in small groups or lines; disc black, matt, flat, rarely subconvex, epruinose; margins persistent, thin, black, slightly glossy, projecting slightly above surface of disc, entire to scalloped or crenulate, occasionally with small, black, projecting rhizinomorphs. Epithecium red-brown, 12–20 µm thick. Hymenium pale yellow-brown to pale reddish brown, 69–75(–90) µm tall. Paraphyses slender, 1–2 µm thick, apices swollen, red-brown, 5–7 µm diam. Hypothecium 200–300 µm thick, upper 125–150 µm yellow-brown, opaque, lower parts dense brown-black. Asci rather infrequent, clavate with a tapering narrow foot, 70–90 × 20–27 µm. Ascospores colourless, broadly ellipsoid to ovoid to subglobose, 13–15(–16.5) × 7–10(–12) µm. Pycnidia occasional to frequent at or near margins, black, punctiform, 0.1–0.2 mm diam. Conidia bacillar, 3.5–5 × 1 µm.

Chemistry: Medulla K+ yellow→red, C+ red, Pd–; containing norstictic and gyrophoric acids (for methods see Culberson 1972).

Diagnostic features: *Umbilicaria murihikuana* is characterized by: the saxicolous habit; the monophyllous thallus (1–2.5, rarely to 6 cm diam.); the smooth upper surface; black rhizinomorphs clustered at margins and in patches or covering lower surface; prominent, flat, black subimmersed apothecia (0.5–3.5 mm diam.), sometimes with projecting rhizinomorphs; broadly ellipsoid to ovoid or subglobose ascospores, 13–15(–16.5) × 7–10(–12) µm; and norstictic acid (K+ yellow→red) in the medulla.

Notes

Umbilicaria murihikuana is a presumed New Zealand endemic, known at present only from mountainous, high-rainfall areas of Otago and Southland [the Maori name Murihiku (literally "the tail of the fish", or "the tail end of the land" was the term used by Maori for the southern parts of South Island). It grows on exposed rocks and boulders in subalpine to alpine habitats close to the Main Divide of the Southern Alps between latitudes 44°25'S and 44°47'S, at an altitude of 1000–1515 m. Exposed boulders in alpine grasslands in these high-rainfall areas support a rich diversity of alpine lichens, many of them bipolar (Galloway 1999, 2003, 2004), but the detailed ecological requirements of this new species are still to be accurately determined.

SPECIMENS EXAMINED

Otago: •Matukituki Valley, v.1959, *D. Scott 4374* (OTA 057082); •Park Pass, on upper surface of boulder, 1205 m, 27.xii.1982, *P. Child 2064* (CHR 423179); •Lake Harris Saddle, on rocks in alpine *"Danthonia crassiuscula"* belt on the ridge S of Lake Harris Saddle, 12.ii.1927, *G.E. & G. Du Rietz 1753: 4* (UPS); •North Col, head of North Branch of the Routeburn, 1370 m, 8.v.1967, *D.J. Galloway s.n.* (CHR 378674); •Conical Hill, Humboldt Mountains, common on rocks, 1515 m, 15.iv.1978, *P. Child 1900* (CHR 423177). Southland: •Gertrude Valley, E of Homer Huts, c. 1070 m, 8.ii.1985, *H. Mayrhofer 5749, 7531 & H. Hertel* (GZU, CHR 440161).

Umbilicaria robusta (Llano) D.J.Galloway & Sancho comb. nov.
Basionym: *Agyrophora zahlbruckneri* var. *robusta* Llano, *Monogr. Lich. Fam. Umbilicariaceae*, 61 (1950).
Type: New Zealand: Stewart Island, Mt Anglem, c. 900 m, rocks near summit, 1.iii.1946, *W. Martin 44* (CHR 160018 – holotype).

Notes

Umbilicaria robusta is characterized by: the saxicolous habit; the orbicular to irregularly polyphyllous thallus (1–2 rarely to 4 cm diam.), with rhizinomorphs projecting from margins; a coriaceous, smooth, white-pruinose to areolate scabrid upper surface; a black, minutely roughened to areolate-scabrid lower surface, with thalloconidia and cylindrical to flattened rhizinomorphs 1–3(–5) mm long; distinctly pedicellate apothecia with a smooth, plane, black disc and with thick, glossy margins; and broadly ellipsoid ascospores, (16.5–)17.5–22.5(–23.5) × (7–)9–13.5 µm. The apothecia are distinctly pedicellate, the margins thicker and more obvious than those in *U. zahlbruckneri*; they are also distinctly raised and often glossy. Ascospores are ovoid and larger than those of *U. zahlbruckneri* (11.5–13.5(–16.5) × 7–10 µm). Rhizinomorphs are often but not always more robust, generally flattened and strap-like, and longer than those found in *U. zahlbruckneri*. And, the attaching umbilicus is thicker and wider than that of *U. zahlbruckneri*.

U. robusta occurs in southern New Zealand from the West Matukituki Valley to Stewart Island. It is a subalpine to alpine species, growing on exposed rocks between 950 and 1890 m in subalpine scrub and fellfield, and associating with the lichens *Pseudephebe pubescens, Rhizocarpon geographicum, Umbilicaria cylindrica* and *U. subaprina*.

SPECIMENS EXAMINED

Otago: •West Matukituki Valley, French Ridge, 1370–1700 m, on boulders in subalpine scrub, 23.x.1967, viii. 1968, *D.J. Galloway s.n.* (CHR 378709, 378656); •N slopes of Mt Cunningham, 1370 m, upper surface of exposed boulders, 15.v.1982, *P. Child 1984* (CHR 423120); •Rees Valley, Rough Creek, above 25 Mile Creek, on rocks in fellfield, 1850m, 13.ii.1996, *D.J. Galloway 5403, 5404* (CHR 533544, 533545); •West Hunter Valley, on valley floor boulders, 1218 m, 21.i.1971, *P. Child 1343, 1344* (CHR 423171, 423172); •Theatre Flats, Rockburn Valley, ii.1968, *D.J. Galloway s.n.* (CHR 378710 pr.min.p.). Stewart Island: •Mt Anglem, exposed rocks of western summit, ii.1966, *D.J. Galloway s.n.* (CHR 378708).

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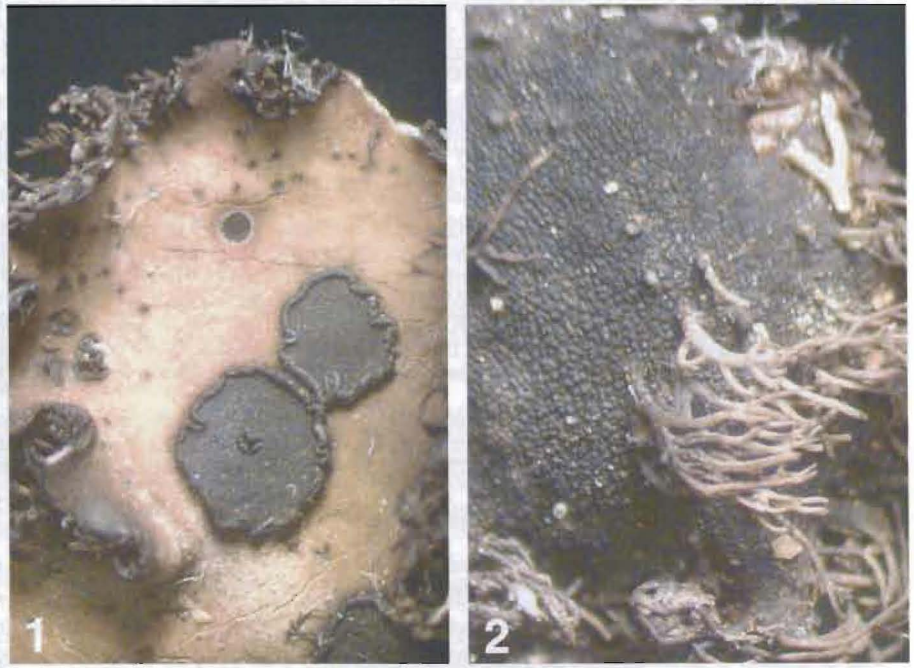

Figures 1 and 2. *Umbilicaria murihikuana* sp. nov., holotype (*D.J. Galloway 68352*, CHR 378718. 1. Upper surface, 1 mm ▬, 2. Lower surface, 1 mm ▬.

A new species of *Menegazzia* (Parmeliaceae, lichenized Ascomycota) and new records of Parmeliaceae from Papua New Guinea and the Philippines

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Abstract: The new species *Menegazzia malesiana* Elix, Bawingan & Schumm is described from Papua New Guinea and the Philippines. In addition, *Parmotrema lobulascens* (Steiner) Hale is reported as new to Papua New Guinea, and *Hypotrachyna kingii* (Hale) Hale as new to the Philippines.

The lichen genus *Menegazzia* is particularly widespread and diverse in temperate and montane habitats in the Southern Hemisphere, with centres of speciation in temperate South America (Santesson 1942, Adler & Calvelo 1996, Bjerke 2001, Bjerke & Elvebakk 2001), New Zealand (James 1985), and Australia (Kantvilas & James 1987, James & Galloway 1992, Kantvilas & Louwhoff 2004). Recently Papua New Guinea has also been shown to have a rich *Menegazzia* flora (James *et al.* 2001), and a further new species is described here, a species which also occurs in the Philippines.

Chemical constituents were identified by thin-layer chromatography (Culberson 1972, Culberson & Johnson 1982, Elix & Ernst-Russell 1993), high-performance liquid chromatography (Elix *et al.* 2003), and comparison with authentic samples.

Menegazzia malesiana Elix, Bawingan & Schumm, sp. nov. Fig. 1

Thallus ut in *Menegazzia nothofagi* sed lobis latiore, dactylatis, saepe lobulatis et pustulis efflorescentibus, infundibuliformis vel laceratis differt.

Type: **Papua New Guinea**. *Southern Highlands Province*: Lama Sawmill, 6 km SE of Ialibu, 6°20'S, 144°01'E, 1840 m, on branch of *Castanopsis* in montane forest, *J.A. Elix 12857 & H. Streimann*, 11.xii.1982; holo: CANB.

Etymology: The species epithet refers to the Malay Archipelago, which incorporates the islands of the Philippines and New Guinea.

Thallus corticolous, adnate to loosely adnate, up to 6 cm wide, often forming rosettes or sometimes irregularly spreading. Lobes hollow, sublinear-elongate, fragile, contiguous for the most part, more rarely partially discrete, ±overlapping in older parts of the thallus, subdichotomously to subirregularly branched, 1–2 mm wide; apices sometimes subpalmate; margins ±lobulate, lobules sublinear, 0.1–0.6 mm wide, up to 1 mm long, perforate or not. Upper surface grey or grey-green, often with blackish margins, flat to convex, dull to shiny, perforate, dactylate; dactyls inflated, isidioid, globose or cylindrical, not branched, 0.5–1.5 mm high, apices

soon eroding and becoming pustulate, pustules expanding and becoming efflorescent, funnel-shaped or lacerate, densely sorediate, soredia granular; soralia more rarely developing at lobe apices, labriform to gaping with ±lacerate margins. Perforations laminal, numerous or scattered, flush with surface or ultimately depressed, oval or rounded, gaping, with an inrolled edge, 0.3–1.0 mm wide. Medulla white or pale yellow in part, darkening with age, lower side of internal cavity black. Lower surface black, shiny, wrinkled, erhizinate. Apothecia and pycnidia not seen.

Chemistry: Cortex K+ yellow; medulla K+ yellow, C–, KC–; P+ yellow-orange; containing atranorin (minor), chloroatranorin (minor), stictic acid (major), constictic acid (minor), peristictic acid (minor/trace), norstictic acid (trace), ±vioxanthin (minor/trace), ±pigmentosin A (minor/trace), ±gyrophoric acid (minor).

The most characteristic features of this new species are the elevated, erumpent dactyls on the upper surface which are densely sorediate and expand to become funnel-shaped and ultimately lacerate, and the presence of the stictic acid chemosyndrome in the medulla. The Australasian species *M. nothofagi* (Zahlbr.) P. James & D.J. Galloway is similar in also producing sorediate pustules on the upper surface and containing the stictic acid chemosyndrome in the medulla. However, it can be distinguished by the narrower lobes (0.5–0.8 mm *cf.* 1–2 mm wide), and by the absence of marginal lobules. Furthermore, the erumpent dactyls of *M. malesiana* become efflorescent, funnel-shaped or lacerate, and much more extensively sorediate than do the simple eroded-sorediate pustules of *M. nothofagi*. *Menegazzia malesiana* could also be confused with *M. efflorescens* P. James, Aptroot, Sérus. & Diederich, another Papua New Guinean species with efflorescent soralia on the upper surface and medullary stictic acid. However, the thalli of *M. efflorescens* are much larger (up to 20 cm wide), the lobes much broader (3–5 mm wide *cf.* 1–2 mm wide) and inflated, and the soralia are borne on short, lateral lobes (or very rarely on laminal pustules), and are labriform to gaping with noticeably lacerate margins. According to James *et al.* (2001), *M. malesiana* is a member of their so-called "species aggregate 1".

In Papua New Guinea, *M. malesiana* appears to be a relatively common but scattered species in montane forests at elevations of 1600–2700 m, where it favours canopy branches of *Nothofagus* and *Castanopsis*. Associated species include *Anzia endoflavida* Yoshim. & Sipman, *Hypotrachyna exsecta* (Taylor) Hale, *H. neodigitata* Kurok. & K.H. Moon, *Lobaria isidiophora* Yoshim., *Parmotrema gloriosum* (Kurok.) Streim. and *Relicina gemmulosa* (Kurok.) Streim.

SPECIMENS EXAMINED

Papua New Guinea. *Eastern Highlands Province*: •Pusarasa Village, 2 km NNW of Okapa, 6°30'S, 145°36'E, 1720 m, on rotten branch in *Castanopsis–Lithocarpus* forest, *J.A. Elix 12566, 12581 & H. Streimann*, 9.xii.1982 (CANB); •near Famin, Kainantu–Okapa road 28 km SW of Kainantu, 6°30'S, 145°36'E, 2080 m, on *Sloanea* in montane forest, *J.A. Elix 12612, 12625, 12641 & H. Streimann*, 9.xii.1982 (CANB). *Southern Highlands Province*: •Andawe River, Lama sawmill logging area, 6 km SE of Ialibu, 6°20'S, 144°01'E, 1840 m, on branches in *Nothofagus–Podocarpus* forest, *J.A. Elix 12670, 12676, 12685, 12708, 12747, 12771 & H. Streimann*, 11.xii.1982 (CANB); •Lama Sawmill, 6 km SE of Ialibu, 6°20'S, 144°01'E, 1840 m, on branches of *Castanopsis* in montane forest, *J.A. Elix 12816, 12847 & H. Streimann*, 11.xii.1982 (CANB); •Pavende logging area, 15 km NNW of Ialibu, 6°08'S, 143°58'E, 2400 m, on branches in *Nothofagus* forest, *J.A. Elix 13066, 13024 & H. Streimann*, 14.xii.1982 (CANB); •Tari Gap, 27 km SE of Tari, 5°57'S, 143°10'E, 2660 m, on *Vaccinum* along rainforest margin, *J.A. Elix 13110 & H. Streimann*, 15.xii.1982 (CANB); •Piribu Sawmill, Tari–Komo road, 3 km SW of Tari, 5°52'S, 142°56'E, 1650 m, on bark of *Nothofagus* in montane forest, *J.A. Elix*

13317 & H. Streimann, 17.xii.1982 (CANB); •Tari Gap, 19 km SE of Tari, 5°57'S, 143°05'E, 2200 m, on *Nothofagus* along rainforest margin, *J.A. Elix 13110 & H. Streimann*, 15.xii.1982 (CANB); •Det Mission, 15 km SSW of Mendi, 6°16'S, 143°35'E, 1600 m, on dead log in montane forest, *J.A. Elix 13368 & H. Streimann*, 18.xii.1982 (CANB); •Onim Forestry Station, Iaro River, 14 km NNW of Ialibu, 6°09'S, 143°57E, 2280 m, on *Eucalyptus* along forest margin, *J.A. Elix 13430 & H. Streimann*, 19.xii.1982 (CANB).
Philippines. *Luzon, Mountain Province*: •Mt Data National Park, 16°52'N, 120°52'E, 2305 m, on mossy branch in rainforest, *P. Bawingan, M. Lardizaval & A. Rebogio CL0471*, 28.v.2002 (CANB). *Mindanao, Cotabato Province*: •Mt Apo, east bank of Lake Venado, 7°00'N, 125°16'E, 2210 m, on bark at margin of tropical montane forest, *U. Schwartz s.n.*, 20.iii.1999 (CANB, herb. Schumm 5435).

New Records of Parmeliaceae for Papua New Guinea and the Philippines

Hypotrachyna kingii (Hale) Hale, *Phytologia* **28**, 341 (1974).
A scattered southern Asian species known from India, Thailand, Indonesia and Taiwan (Hale 1968, Kurokawa & Lai 2001, Divakar & Upreti 2003). It is characterized by the fragile upper cortex, the pustulate upper surface where the pustules erode to expose the medulla but do not become sorediate, and the presence of medullary norstictic acid (major), salazinic acid (minor), and connorstictic acid (trace). A detailed description is given in Hale (1968) and Divakar & Upreti (2003).

SPECIMEN EXAMINED
Philippines. *Luzon, Benguet Province*: •Botanical Gardens, Baguio City, 16°24'N, 120°35'E, ca. 1200 m, on tree branch, *P. Bawingan CL0527*, Feb. 2001 (CANB).

Parmotrema lobulascens (Steiner) Hale, *Phytologia* **28**, 337 (1974).
This species was previously known from Africa, Asia (Krog & Swinscow 1981) and Australia (Elix 2001). It differs from the morphologically and chemically similar species *P. poolii* (Dodge) Krog & Swinscow in having a distinctly maculate upper surface of the lobes, secondary lobules on the lobe margins, accessory gyrophoric acid in the medulla, and filiform conidia (*P. poolii* is emaculate, elobulate, lacks gyrophoric acid, and has sublageniform conidia 7–8 × 1 µm). A detailed description is given in Elix (2001).

SPECIMENS EXAMINED
Papua New Guinea. *Morobe Province*: •Kebi, 5 km W of Bulolo, 7°13'S, 146°42'E, 850 m, on *Schefflera* trunk on edge of grasslands, *H. Streimann 19786*, 28.v.1982 (CANB); •Heads Hump, 5 km E of Bulolo, 7°11'S, 146°41'E, 800 m, on tree trunk in lower montane forest, *H. Streimann 22401A*, 16.vii.1982 (CANB); •Gumi Divide, head of Gumi Creek, 25 km W of Bulolo, 7°13'S, 146°25'E, 1700 m, on upper branched of large tree in Lauraceae-dominated forest, *H. Streimann 25111*, 13.x.1982 (CANB); •Mount Susu, 3 km SW of Bulolo, 7°13'S, 146°36'E, 1000 m, on fallen *Araucaria hunsteinii* branch in lower montane forest, *H. Streimann 25473*, 24.x.1982 (CANB); •Middle Creek, 6 km W of Bulolo, on *Agathis* trunk in lower montane forest, 7°13'S, 146°36'E, 980 m, *H. Streimann 34128*, 15.ii.1983 (CANB).

Acknowledgments
We thank Stuart Hay and Neal McCracken of the Photographic Unit, ANU, for preparing the photograph.

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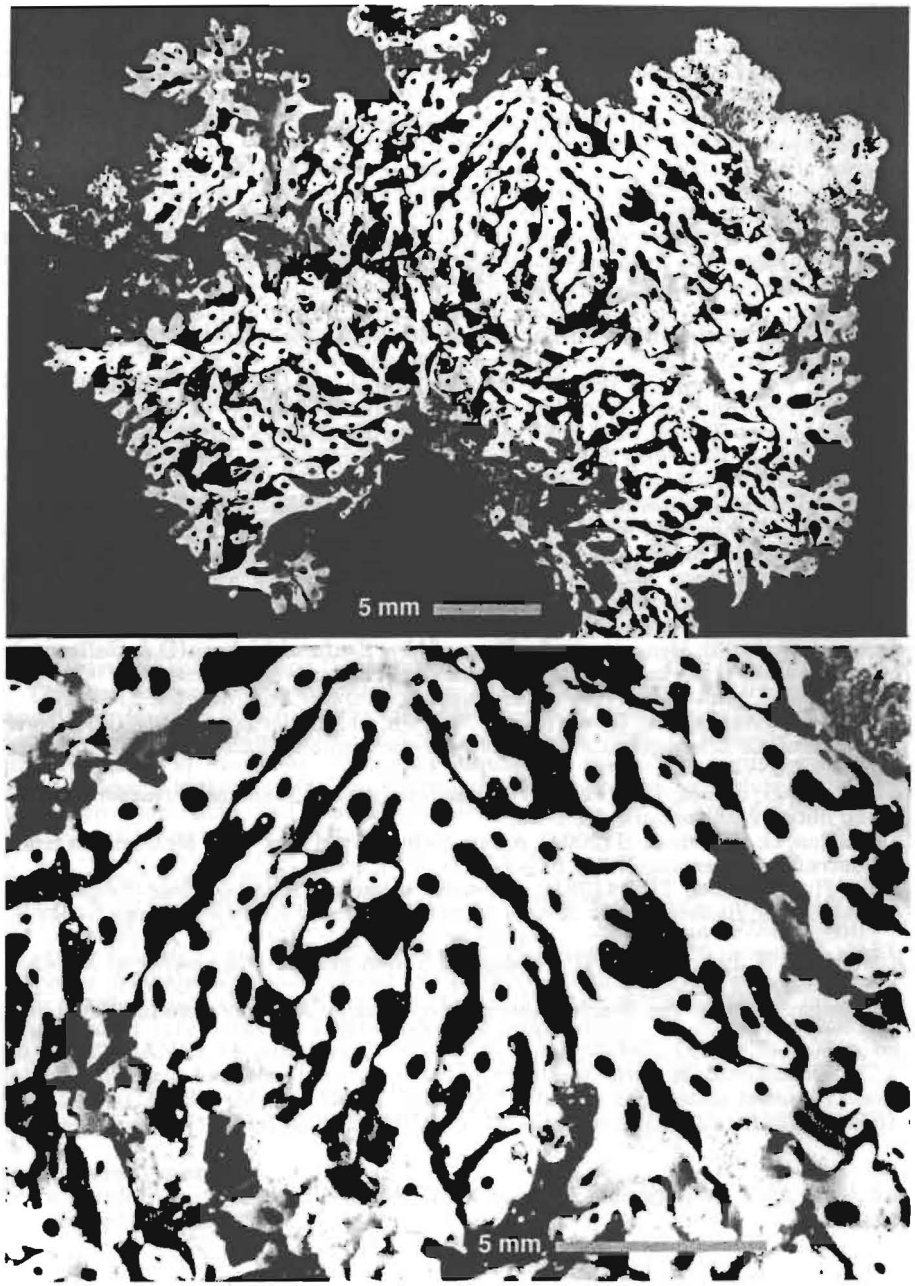

Figure 1. *Menegazzia malesiana* (holotype in CANB).

Transfer of *Dimerella rubrifusca* to *Coenogonium* (Gyalectaceae)

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In 2000, Lücking and Kalb argued cogently that the two genera *Dimerella* Trevis. and *Coenogonium* Ehrenb. can not be distinguished reliably with mycological characters, and therefore should be united in synonymy under *Coenogonium*, the older name. They began the transfer with seven foliicolous Brazilian species of *Dimerella* which they were working on at the time. Transfers of the 50–60 species of *Dimerella* have continued steadily since, with *Dimerella rubrifusca* added here.

Coenogonium Ehrenb. in Nees, *Horae Phys. Berol*: 20 (1820).
Typus: *Coenogonium linkii* Ehrenb. (Holotypus).
= *Dimerella* Trevis., *Rendiconti Reale Ist. Lombardo Sci.*: **13**: 66 (1880).
Typus: *Dimerella lutea* (Dicks.) Trevis. (Lectotypus).

Coenogonium rubrifuscum (Malcolm & Vězda) Malcolm comb. nov.
Basionym: *Dimerella rubrifusca* Malcolm & Vězda, *Australasian Lichenology* **41**, 34 (1997).

Reference

Lücking, R; Kalb, K (2000): Foliikole Flechten aus Brasilien (vornehmlich Amazonien), inklusive einer Checkliste und Bemerkungen zu *Coenogonium* und *Dimerella* (Gyalectaceae). *Botanische Jahrbücher Systematika* **122**, 1–61.

Lichen succession near Arthur's Pass, New Zealand

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Abstract: On gravels of braided rivers near Arthur's Pass, South Island, New Zealand, lichens are important in the early stages of revegetation following flood disturbance. Nitrogen-fixing lichens are common. *Placopsis* species are initial colonists of stones, and binders of the intervening gravels. *Stereocaulon* species are important at a later stage when mosses and vascular plants assume dominance.

Introduction

Flanking the Southern Alps of New Zealand, broad floodplains of braided rivers are associated with relatively young and tectonically active mountains, high rainfall, and frequent floods. In inland Canterbury, the readily shattered greywacke rock provides an ongoing source of sediment that regularly rejuvenates the valley floor surfaces, forever restarting a succession of vegetation from algae and lichens to mosses, grasses, shrubs, and often eventually to forest.

Plant colonization of Canterbury riverbeds has been described by Cockayne (1911), Calder (1961), and Wardle (1972), but those authors make at most only passing reference to the roles of lichens.

Arising from a reconnaissance of possible sites for study of the ecological role of nitrogen-fixing lichens, this preliminary account describes the part played by lichens in the recolonization process on the beds of the Waimakariri and Bealey rivers near Arthur's Pass National Park.

Riverbed environment

A typical valley floor in inland Canterbury has numerous braided river channels with islands of bared shingle, flanked by grassland on less frequently disturbed river terraces and stream fans, and by beech (*Nothofagus*) forest on adjacent hillsides. Riverbed surfaces are by no means uniform. Angular boulders predominate near valley heads and on the steep fans of side streams. Alluvium becomes more river-rounded, sorted, and of smaller particle size as it is transported down valley. Major floods fill a valley floor bank-to-bank, variously eroding former deposits, and differentially depositing new ones. Accumulations of boulders and large stones are deposited during and soon after the peak flows of floods. As a flood recedes, sheets of gravel and sand continue to be strewn, and the sand fraction will often accumulate as streaks or patches immediately downstream of obstructions such as protruding stones, logs, or tufted plants. As water level drops further, many of the channels turn to pools before draining completely, the finest silt then settling as a surface veneer along channel margins and their beds. Upon drying, the silt is often redistributed by wind across the riverbed. The marked decrease in rainfall east of the Main Divide produces a gradient from humid sites near valley heads to down-valley sites more influenced by drought and dust-carrying winds.

Major floods are not wholly destructive of former riverbed surfaces. Vegetated flats and channels can be inundated yet not eroded during a flood, and they might or might not receive a nourishing veneer of silt. If subjected to moving gravels and sand, then the upstream facets of lichen- and moss-covered stones can be selectively abraded. Stones and boulders can be strewn across an already vegetated surface, creating fresh young sites within a matrix of older ones, a situation which can confound estimation of the age of the overall surface.

Methods

General observations were made in June 1999 on riverbed lichens in the Cass, Hawdon, Otira, and Deception valleys, and a record made of vegetation composition on riverbed sites at the Waimakariri River (map reference NZMS 260, K34: 935990, altitude 650 m) and Bealey River (K33: 943029, 690 m). At those two sites, vegetation cover was estimated on three adjacent young river terraces of increasing elevation and distance from the river, representing a sequence of increasing age and vegetation development since major flood disturbance. Lichen specimens were collected for identification and for deposit in the Allan Herbarium (CHR) at Landcare Research, Lincoln.

Vegetation pattern

Table 1 summarizes data combined from the two riverbed sites sampled for cover of lichens and plants on three surfaces. Ages of those surfaces are not known, but probably they span a range from 5–10 years for surface A to 30–50 years for surface C. Data are presented for two substrate types: firstly the general surface of gravel, sand, and silt, and secondly for stones (>10 cm diam.), which protrude above the general surface and can account for 20–50% of it.

The cover contributions of lichens, vascular plant groups, and mosses are compared in Table 1. Note the general pattern of lichens being most important on the youngest surface, mosses and herbs having relatively constant total cover through the sequence, and the increase of grasses and woody plants towards the oldest surface. The early colonizing herbs are mainly mats of scabweed (three species of *Raoulia*) and the willow-herb *Epilobium melanocaulon*. Later common herbs are the naturalized species *Lupinus polyphyllus* and *Hieracium pilosella*. The main grasses of the two older surfaces are the naturalized species *Agrostis capillaris*, *Anthoxanthum odoratum*, and *Holcus lanatus*, though the native blue tussock *Poa colensoi* is also present. The woody plants are mainly subshrubs (e.g. *Parahebe*, *Leucopogon*, *Gaultheria* spp.), except for matagouri (*Discaria toumatou*), which forms a metre-tall shrubland on the oldest surface. The main mosses of the sequence are fine, low-growing species (not identified) on the youngest surface, *Racomitrium pruinosum* and *Racomitrium ptychophyllum* on surfaces B and C, and *Hypnum cupressiforme* on C.

Amongst the lichens on gravel, silt, and sand substrates, by far the most important initial colonists are *Placopsis trachyderma* and *Placopsis clavifera*. They become less abundant on the older surfaces, where they are joined by fruticose lichens (especially *Cladia aggregata* and *Cladonia* spp.), and are replaced by mosses and vascular plants. On the youngest gravel surface, nitrogen-fixing lichens comprise 98% of the lichen cover, but that proportion falls to 46% on surface B, then to 21% on surface C, the oldest.

Protruding stones have quite a different lichen community. Early colonists are mainly the brilliant red *Trentepohlia* alga and *Placopsis perrugosa*, and these persist at similar abundance on the oldest surface (C). Crustose small rosettes of *Porpidia crustulata* are frequent but of low cover from an early stage. *Placopsis dennanensis* appears to colonize slightly later than *Placopsis perrugosa* does, and *Placopsis hertelii* (Galloway 2004) becomes apparent on only surface B, where *Stereocaulon ramulosum* reaches its greatest abundance. Several other lichens, including *Stereocaulon corticatulum* and *Stereocaulon colensoi*, colonize only older stone surfaces. Nitrogen-fixing lichens account for 98% of the lichen cover on stones of the youngest surface (A), but remain important on surfaces B (88%) and C (87%).

Notes on riverbed *Placopsis* species

Four *Placopsis* species are shown growing together in Figure 1. The term "cow-pat lichen" (Wilson 1996) is an appropriate descriptor for those *Placopsis* species which create circular patches and bind the underlying shingle, the thalli closely covering the miniature contours of the ground surface. When lifted from the ground, they take with them a plate of substratum, and close examination of specimens from the Waimakariri riverbed reveals that the rhizines interweave among gravel and sand particles to a depth of at least 15 mm.

Placopsis trachyderma often forms circular patches 10–15 cm across on gravel and sand mixtures. It has apothecia with a brown or black disc. *Placopsis clavifera* appears to be a preferential colonist of fine sand and silt (including silty moss mats), forming greyish-green patches 2–6 cm across, recognizable by the presence of isidia plus apothecia with red discs.

Placopsis perrugosa is a common early colonist of riverbed stones. It is crustose, its thin thallus being closely attached to the rock surface, and it lacks the ability to grow upon gravels. *Placopsis perrugosa* is distinguished by its khaki colour (though it is more greenish when wet or partially shaded) and cephalodia that are rusty-orange, markedly so when dry. Young areolate rosettes display a feathery network of radiating arms which do not initially cover all of the rock surface. An apparently unusual feature of the main axes of those branching structures is a tomentum of dark scales, 0.5 mm tall, arising from the upper cortex and appearing to have a water-retention function. When the thalli are wet from rain, these tomentose areas are prominent by their darkness, and after rain they retain surface moisture for longer than the thinner parts of thallus. Older portions of thallus lack that feathery-branched appearance; they develop a warty (areolate) texture as the thallus becomes thicker and as it consolidates and covers all of the rock surface.

Placopsis dennanensis appears to be a later colonist than *Placopsis perrugosa* on riverbed stones. Distinguished by its relatively pale, cream-coloured thallus and pink apothecia, it seems to prefer humid sites, and was noted growing on stones that were well-covered with lichens, both alongside and extending over old thalli of *Placopsis perrugosa*. *Placopsis hertelii* is a moderately common species on stones, distinguished by the black hypothallus around its perimeter and by relatively dense and small black or brown apothecia.

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Table 1. Mean percent cover of lichens and plants on two substratum types of three riverbed surfaces (A,B,C) of increasing age on Waimakariri and Bealey riverbeds (* indicates nitrogen-fixing lichens).

	A	B	C
on gravel, sand, and silt			
*Placopsis trachyderma**	30	10	2
*Placopsis clavifera**	12	3	1
Cladia aggregata		13	11
Cladonia cf. *gracilis*		2	1
Cladonia chlorophaea			2
Cladonia mitis			1
*Peltigera dolichorhiza**			1
lichens (7 species)	42	28	19
mosses (5 species)	17	30	15
herbs (8 species)	19	19	17
grasses (6 species)	2	16	33
woody plants (11 species)		5	16
total	80	98	100
on stones			
Trentepohlia sp.	30	35	35
*Placopsis perrugosa**	30	20	35
*Placopsis dennanensis**	5	5	1
Porpidia crustulata	2	2	2
*Stereocaulon ramulosum**	1	12	2
*Placopsis hertelii**		2	
Rhizocarpon geographicum		1	1
*Stereocaulon corticulatum**		1	2
*Stereocaulon colensoi**			1
Neofuscelia sp.			1
Parmelia sulcata			1
Xanthoparmelia sp.			1
lichens (12 species)	38	43	47
total	68	78	82

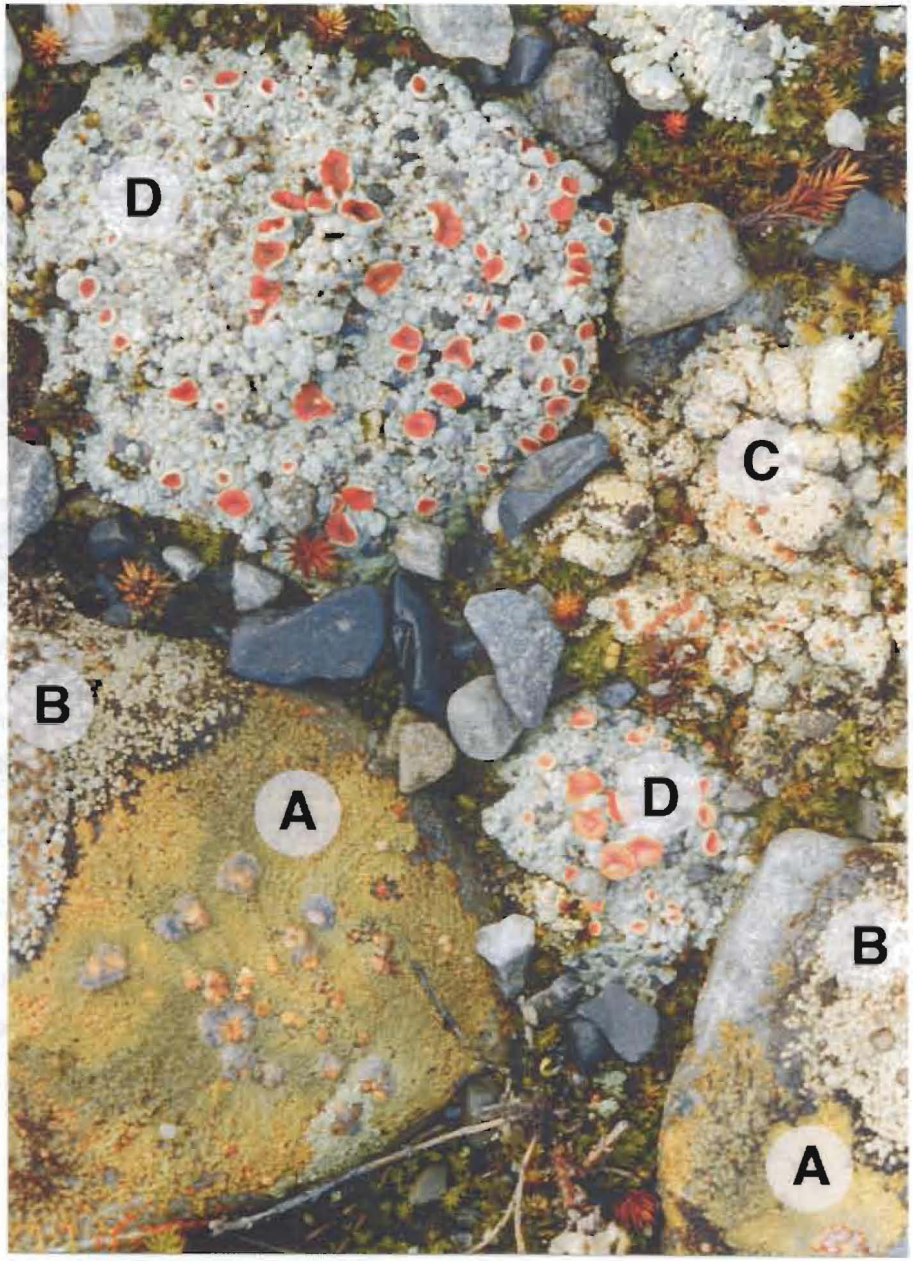

Fig. 1. *Placopsis* species common on Bealey River stones and gravel: **A**. *Placopsis perrugosa*, **B**. *P. hertelii*, **C**. *P. trachyderma*, **D**. *P. clavifera*. Scale = life size.

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