HANDBOOKS to the FLORA OF SOUTH AUSTRALIA

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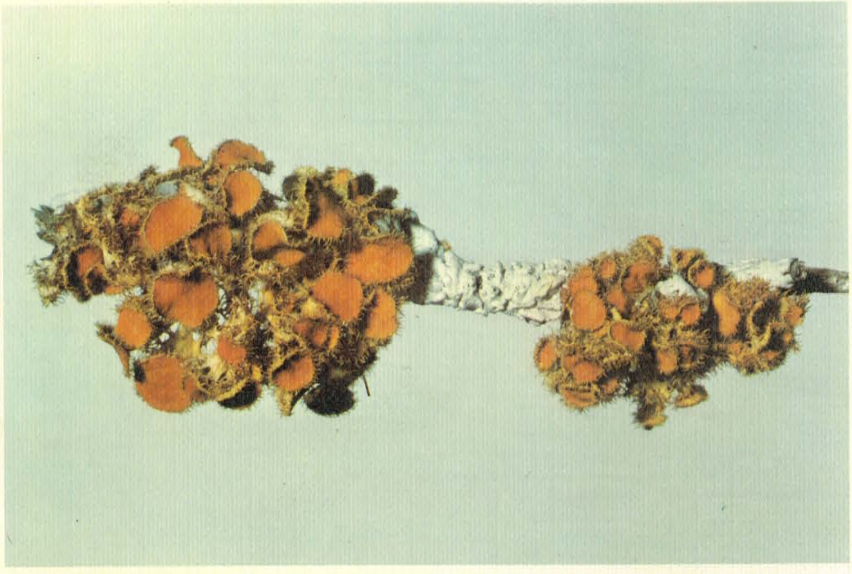
LICHENS OF SOUTH AUSTRALIA



by

REX B. FILSON

and

RODERICK W. ROGERS

Price $10.50

Handbook of the Flora and Fauna of South Australia, issued by the Handbooks Committee on behalf of the South Australian Government and published by favour of the Honourable the Premier (D. O. Tonkin, M.P.)

LICHENS OF SOUTH AUSTRALIA

by

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FOREWORD

What Matthew Flinders achieved for yachtsmen and mariners by charting the unknown coastal waters of this continent, so Mr. Filson and Dr. Rogers have succeeded in providing for botanists, zoologists, geologists and soil scientists a clear chart to guide them through the wide range of variation that is found in one of the most distinctive difficult and neglected groups of plants, the lichens.

This is the first regional lichen flora compiled in Australia this century. It is a pioneer landmark that justifies the years of effort spent in careful field collection, mounting and incorporation of specimens into the herbarium, purchase of expensive non-Australian taxonomic literature and the comparative morphological and biochemical studies. All of these are pre-requisites to the production of sound taxonomic work which forms the infra-structure to the production of regional floras.

The cumulative cost of all this lichenological research is estimated to be no less than two hundred and fifty to three hundred thousand dollars. However, the benefits of sound and careful herbarium taxonomy are also cumulative. The publication of the handbook will provide a useful excursion companion in South Australia and each of the adjoining States.

The book will benefit teachers, students and field workers who can now increase their awareness of the lichens around them and, like their careful collecting predecessors of note in South Australia, bring any new material that comes to hand back to the herbaria for further study and thereby help in the advancement of knowledge of all Australian lichens.

Armed with this new knowledge it is to be hoped that lichens will become better understood in their ecological role in the ecosystem.

The authors bring a worldwide experience and perspective to bear on the taxa described herein and both have worked in the British Museum, where the world's largest collections of lichens are curated.

The taxonomic value of the descriptions is enhanced considerably for future readers by including herbarium reference numbers to the actual voucher specimens examined in the course of this work.

(Dr.) D. M. Churchill
Director and Government
Botanist of Victoria

Code for Collectors

LICHENS ARE VULNERABLE

Lichens are extremely slow-growing organisms and are very dependent on their habitat. The recovery of a lichen colony after sampling may take many years.

Rare species could easily be lost by over-collecting and indeed this is already happening in other countries.

The use of lichens in dyeing must be discouraged as the colours produced can be obtained from other plant material. Already scenic areas in Australia are being denuded of their lichen flora by the thoughtlessness of home dyeing enthusiasts. These areas will never recover.

Small specimens are ample for most research purposes and collectors in Australia, as elsewhere, must never forget the need to preserve their heritage unimpaired.

Whether for serious research, for exchange, or general interest, indiscriminate or wasteful collecting is unethical, immoral, and altogether to be deplored.

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INTRODUCTION

The study of lichens has lagged far behind the other fields of botany. The reasons for this are diverse. They include—fear of a group that is notoriously difficult taxonomically, with species descriptions and keys unavailable, being published in overseas journals, often in foreign languages, and the purely pragmatic objection that the phanerogamic flora is still poorly known and its study must take precedence.

Within South Australia the phanerogams are relatively well known, thanks to the efforts of J. M. Black (1922-29) and Hj. Eichler (1965). The lichen flora is relatively small and the botanical library at the National Herbarium, Melbourne (MEL) has provided most of the literature relevant to this study.

Perhaps the most limiting factor in production of a lichen flora is the very lack of such a flora; for most naturalists will not collect a plant which they know they will not be able to name. If collections do not exist, taxonomists do not have a basis on which to produce a flora. In an effort to break this circle, the present work has been compiled. It is a first approximation presented in the hope that with this information available, collectors will be able to collect intelligently and so provide the material for a second, much improved edition.

Because information on the distribution of lichens in South Australia is so incomplete and the state of lichen taxonomy so fluid, individual collections have been cited under *Specimens examined*. Citing specimens in this manner identifies the precise localities on which the Handbook record is based, indicates broadly where the species is likely to occur, and provides opportunity for further checking to determine the sense in which the name has been applied, thereby facilitating revision.

All species known to occur in South Australia have been included as well as genera and species which, though not recorded, are likely to occur in the State.

Species descriptions have been based for the most part on material gathered by the authors, which is housed in the collections mentioned in the chapter on Collections in South Australia.

Early in the compilation of the manuscript it became apparent that information concerning the crustose lichens was sparse and their taxonomy confused (Weber 1962) and, except for the soil surface species, could be treated only at the generic level.

This work thus aims to provide the information needed to name the crustose lichens of South Australia to generic level and the fruticose and foliose lichens to specific level. The flora is synoptic: it summarises our present knowledge, but no new taxa are described herein; it is not the result of critical revisions, but rather points to groups in which such studies are needed; it points to areas in which further collections must be made.

The new combination *Peltula australiensis* (Müll.Arg.) R. B. Filson is made on page 142. Nine species, *Hypogymnia pulchrilobata* (Bitt.) Elix, *Parmelia* sp. *nov.* 1, *P.* sp. *nov.* 2, *P.* sp. *nov.* 3, *P.* sp. *nov.* 4, *P.* sp. *nov.* 5, *P.* sp. *nov.* 6, *P.* sp. *nov.* 7, are being described elsewhere. Three species, *Endocarpon* sp.,

Leptogium sp. *and Usnea* sp. are in groups which are not being revised at present, so that it will be some time before firm descriptions will be available for them.

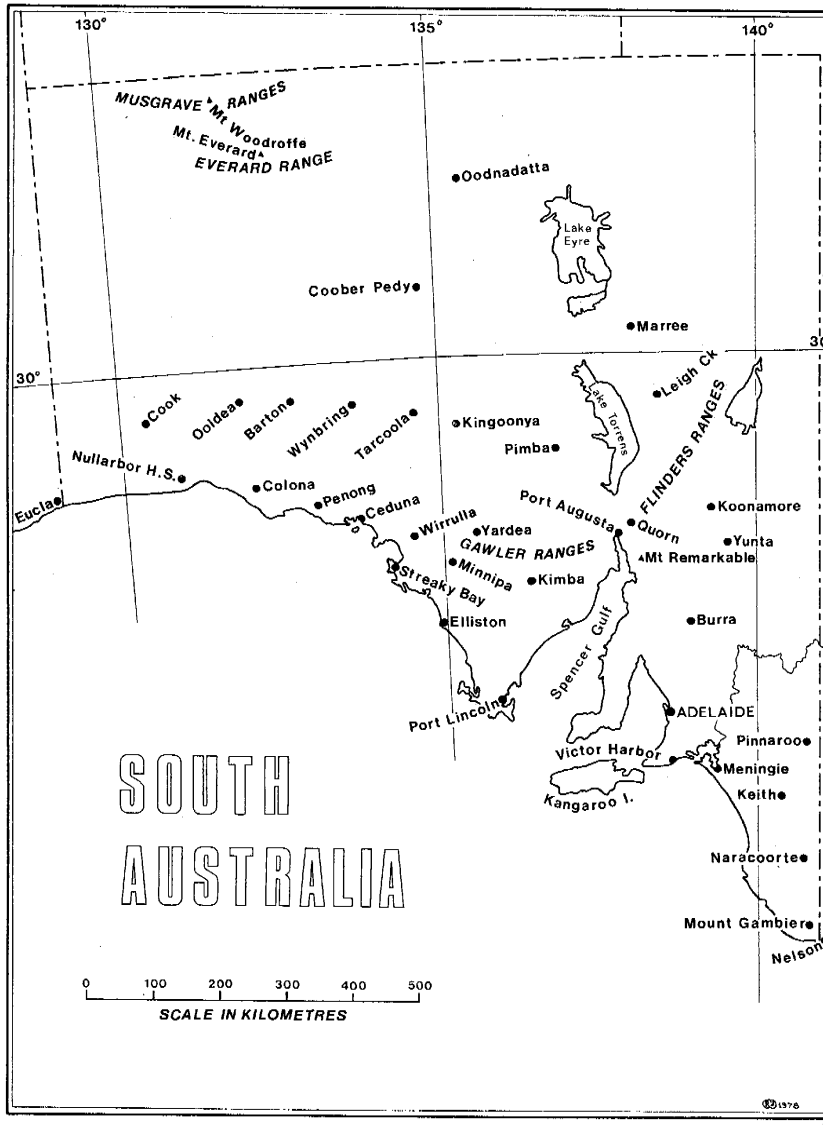


Fig. 1. Map of South Australia showing principal localities mentioned in the text.

ACKNOWLEDGEMENTS

The authors wish to thank the Director, Royal Botanic Gardens and National Herbarium, Melbourne, Victoria, for access to the unrivalled lichen collections and library facilities. We are indebted to the Department of Botany, Monash University, Victoria, and especially Mr. B. A. Fuhrer for the transparencies used in the coloured plates and also for the detailed photographs used in Figures 3 and 4. Mr. Cliff Lee of the Photographic Department, University of Queensland, Brisbane, photographed all of the specimens used to illustrate the remaining half-tone figures. All of the line drawings are by the authors. Acknowledgement is made to Professor R. L. Specht, the Handbooks Committee and the C.S.I.R.O. for permission to use Figures 5A, 6 and 7 based on his previously published work. To Glenys Bray we offer our sincere thanks for carefully typing the manuscript. One of us (R.B.F.) wishes to thank Arthur Court, Susan Filson and Warren Worboys for assistance with field work in South Australia. He is especially thankful to Sam and the people of Mimili for the assistance received whilst working in the Everard Ranges in 1975. Finally we wish to thank all of those interested people who have collected lichens in South Australia and thus contributed towards the production of this handbook.

STRUCTURE OF LICHENS

Lichens are classified as *cryptogams,* which are lower plants including the algae, fungi and bryophytes. Technically they are placed with the fungi though the layman often confuses them with the mosses. The fundamental part of lichen is called the *thallus,* which is in fact composed of two of the above cryptogamic groups; a fungus (the *mycobiont*) and an alga (the *phycobiont*). These two components grow together in an association loosely referred to as *symbiosis* or more correctly, controlled parasitism. Lichen symbiosis differs from all other kinds in that the thallus bears no resemblance to either the fungus or the alga growing in the free state, though the final shape is, in the majority of cases, determined by the fungal partner. This composite organism behaves as a single independent plant, the alga manufacturing sugars by photosynthesis and the fungus living off these foodstuffs and providing the alga with shelter, moisture and nutrients.

Lichens may be grouped into three main thallus types, *crustose* (Plate 9B and 9C), *fruticose* (Plate 2C and 16B) and *foliose* (Plate 10 and 14A).

Crustose lichens are tightly appressed to the substrate. They are composed of an *upper cortex,* an *algal layer* and a *medulla* (Fig. 2A). Sometimes they are completely immersed in the rock (*endolithic*) or bark (*endophloeadal*). Some crustose species develop from a basal *hypothallus* which is a thin film of non-lichenised *hyphae* and when present can be observed in the cracks between the *areolae* and at the margins of the thallus. Within this group is a sub-type, the *squamulose* (Plate 6A). This thallus is intermediate between the crustose and foliose and is composed of numerous small lobes or squamules which seldom grow to more than a few millimetres long.

Fruticose lichens are pendulous or erect and rising from the substrate. They may be entirely unattached or may arise from a disk or *holdfast* (Fig. 2C). The main branches may be cylindrical (*terete*) or more or less flattened and can be hollow or solid with or without a central cord-like strand (*axis*).

Foliose lichens vary considerably in thallus shape and size but basically they are typified by the development of more or less horizontally-spreading leaf-like *lobes.* The thalli are usually *dorsiventral* and usually consist of several well defined layers: the upper cortex, algal layer, medulla and lower cortex (Fig. 2B). Foliose lichens have two different growth forms: the typical form is lobed and leaf-like and attached to the substrate by *rhizines, tomentum,* or part of the lower cortex; and the *umbilicate* form which usually has a *peltate* thallus and is attached to the substrate by a single central holdfast (*umbilicus*).

All the three thallus types may be *gelatinous.* These lichens have no well defined layers in the thallus other than an upper and lower cortex. The medullary layer consists of loosely woven hyphae and scattered algal colonies. These genera are jelly-like and swollen when wet and rather shapeless when dry.

THALLINE STRUCTURES

Certain lichens have various modifications of the thallus which are important when studying the taxonomy of the group.

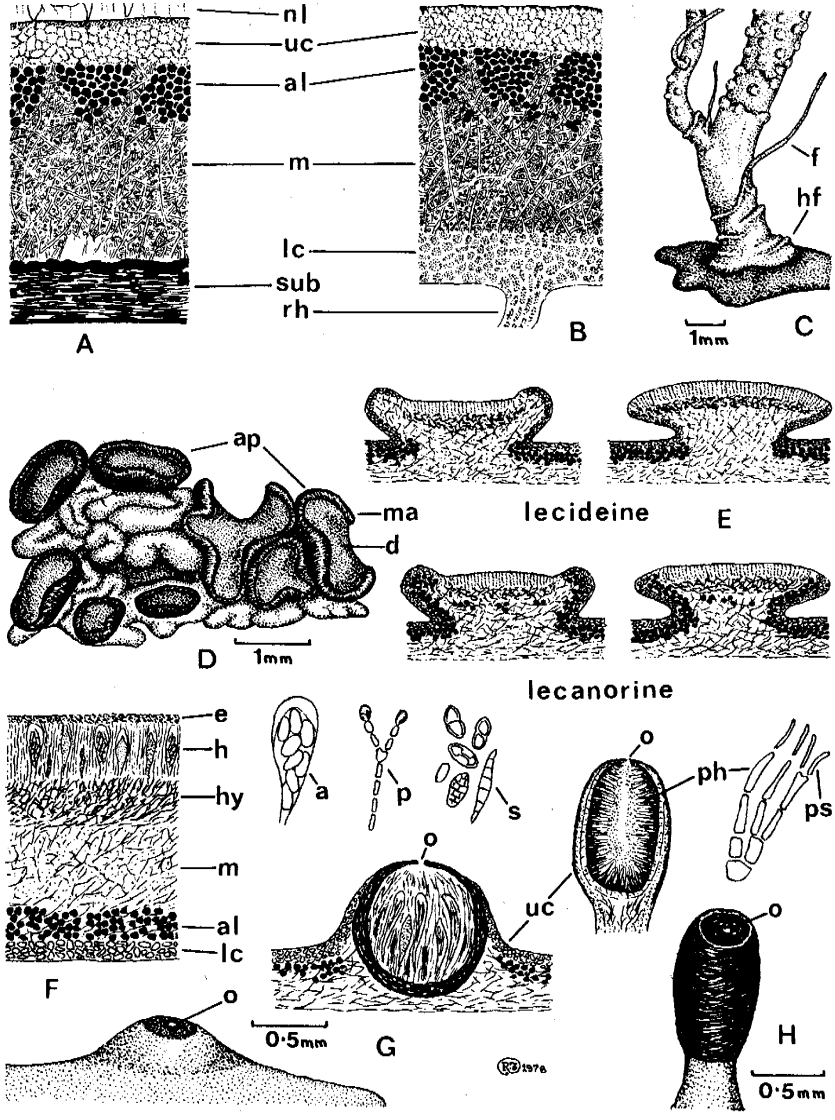


Fig. 2.—A, cross-section through crustose thallus; B, cross-section through foliose thallus; C, holdfast of fruticose thallus; D, apothecia on crustose thallus; E, cross-sections through lecideine and lecanorine apothecia; F, enlargement of cross-section through apothecia showing ascus, paraphyses and ascospores separated from hymenium; G, perithecium in thalline wart and cross-section; H, terminal pycnidium and cross-section showing pycnidiospore bearing hyphae. *a*, ascus; *al*, algal layer; *ap*, apothecia; *d*, disk; *e*, epithecium; *f*, fibril; *h*, hymenium; *hy*, hypothecium; *hf*, holdfast; *m*, medulla; *ma*, margin; *nl*, necrotic layer; *lc*, lower cortex; *o*, ostiole; *p*, paraphysis; *ph*, pycnidiospore-bearing hyphae; *ps*, pycnidiospore; *rh*, rhizine; *s*, ascospore; *sub*, substrate; *uc*, upper cortex.

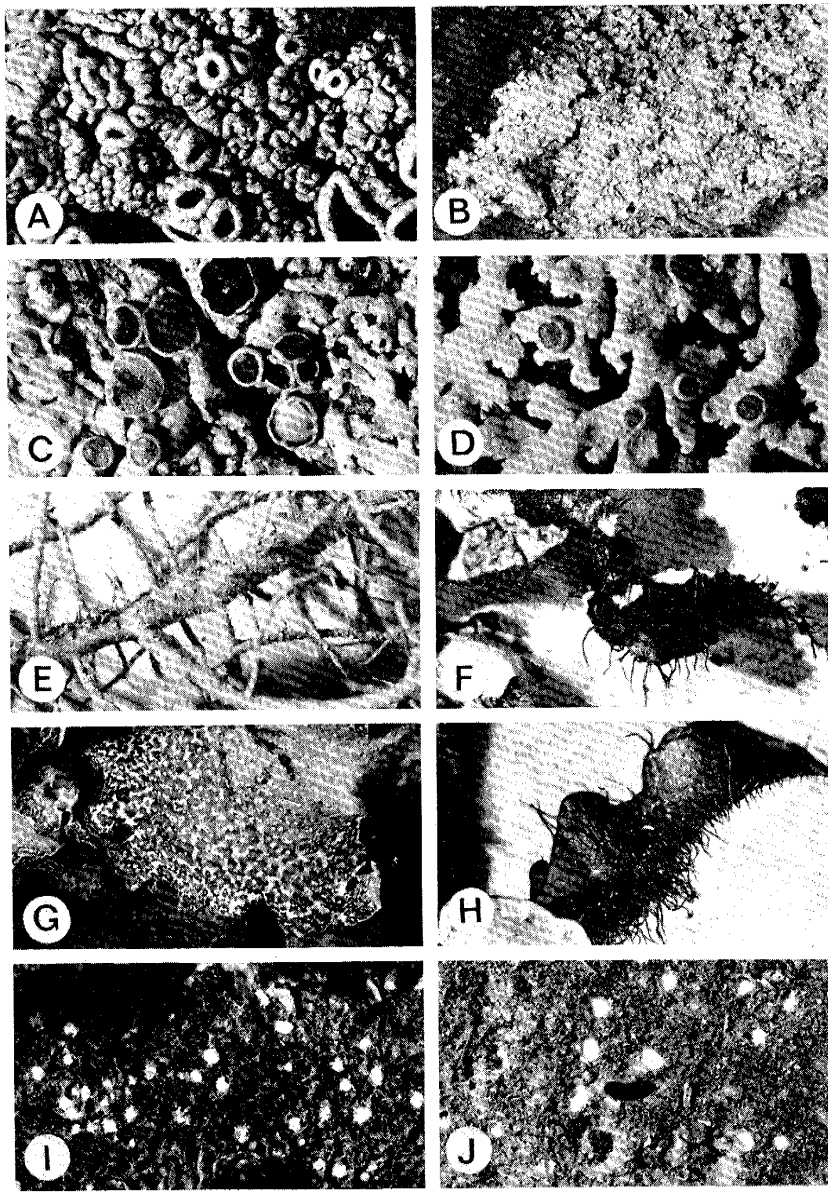


Fig. 3. A, rugulose; B, leprose; C, pruinose; D, maculose; E, spinulose; F, cilia; G, pseudocyphellae (upper surface); H, rhizines; I, pseudocyphellae (lower surface); J, cyphellae.

The upper surface of the thallus lobe may be smooth, wrinkled, *rugulose* (Fig. 3A), cracked, or reticulate. It may be *maculose* (Fig. 3D), where irregular patches in the algal layer gives the surface a white-spotted appearance. In some species this condition leads on to reticulate cracking, and in some leads on to the formation of *pseudocyphellae* (Fig. 3G) which are effigurate cracks through the upper cortex. Sometimes the lobes, especially at the ends, become *pruinose* (Fig. 3C). The lobes may be adorned with one of the accessory reproductive structures.

Soralia (Fig. 4D) are areas of the thallus where the upper cortex has broken down and is replaced by a powdery or granular mass of *soredia* (Fig. 4E). They originate in the *gonidial* layer from a crack or pore in the upper cortex. In crustose lichens the soralia may remain as small round patches or the entire thallus may completely dissolve into a sorediose mass. This condition is called *leprose*. In the fruticose and foliose thalli the soralia are often characteristic of species and have important taxonomic value. Therefore the development and position of the soralia is important. Some of the more commoner types of soralia are:—

Laminal soralia (Fig. 4G) occur in patches on the upper surfaces of the thallus lobes only. Sometimes on the older portions of the thallus the lobes are completely covered with soredia.

Marginal soralia (Fig. 4E) can be divided into three forms: the first where the soralia develop all along the margins of the lobes, the second where the soralia are confined to the underside of the lobe and then the lobe rolls upward exposing a lip-shaped *(labriform)* patch of soredia (Fig. 4F), and the third *capitate* (Fig. 4H) which is confined to the ends of the lobes which often stand erect and appear to be capped by a mass of soredia.

Pustular soredia (Fig. 4I) originate in small globose, inflated swellings on the thallus lobe. These swellings often open by an irregular tear in the cortex and then the margins of the swelling dissolve into soredia.

Each grain of soredia consists of a few algal cells enmeshed in a weft of fungal filaments; they are never corticate. The size of the grain may be important in diagnosis, fine flour-like grains are called *farinose* whilst those a little coarser are *granular*.

Isidia (Fig. 4A & B) differ from soralia in being corticate. They are coralloid outgrowths from the upper cortex and can occur over the whole surface of the lobe or be confined only to the margins. They may be sparse, scattered, or the whole central part of the thallus may become an isidiose mass. Isidia may be simple, cylindrical, globose, inflated, club-shaped or branched *(coralloid)* terete or flattened. Sometimes the apex splits and sometimes, though rarely, it becomes sorediose.

Lobules (Fig. 4C) resemble isidia except that they are dorsiventral. They usually occur on the margins of foliose and fruticose species; only in a few species do they occur on the surface of the lamina.

The margins of foliose lichens may be *ciliate* (Fig. 3F). These fine hair-like structures can be simple, branched or bulbate. If they occur on the upper surface

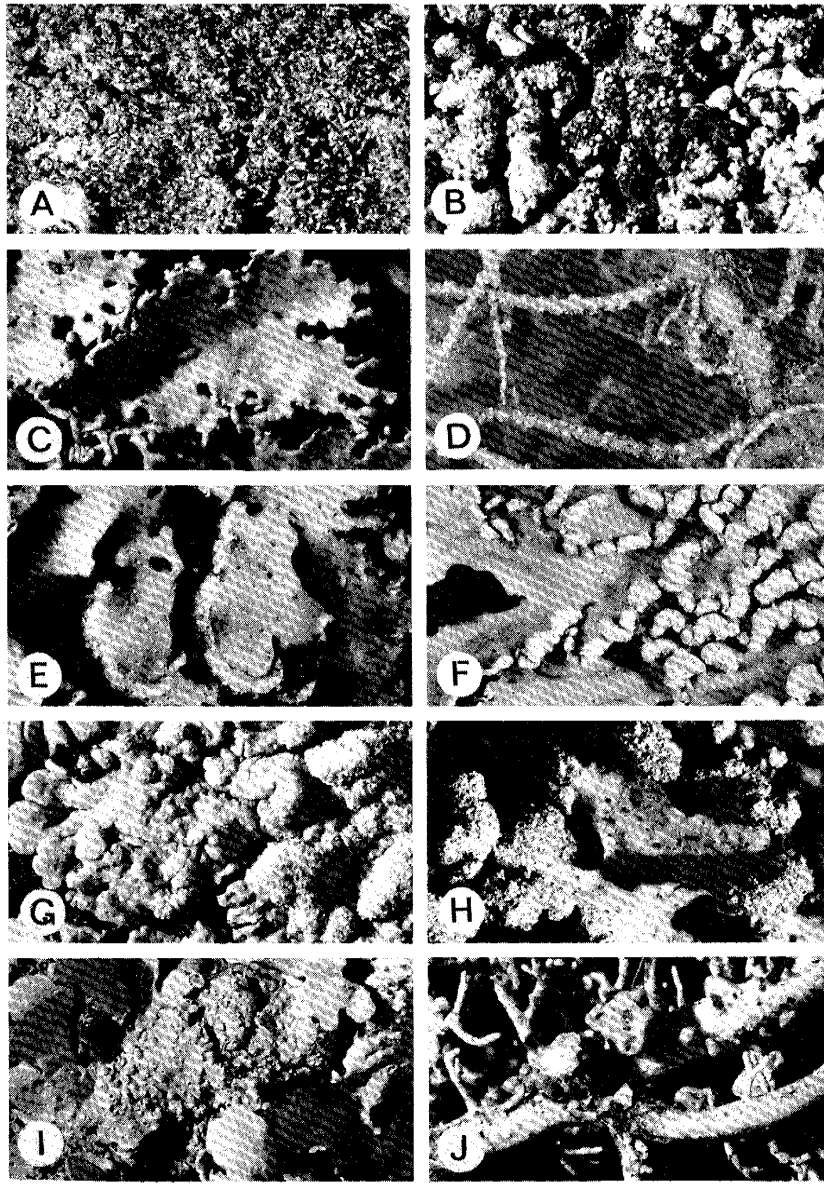


Fig. 4. A, cylindrical isidia; B, inflated isidia; C, lobules; D, soralia; E, marginal soredia; F, labriform soredia; G, laminal soredia; H, capitate soredia; I, pustulate soredia; J, cephalodia.

or on a fruticose thallus they are often referred to as *spinules* (Fig. 3E). *Papillae* are small wart-like outgrowths found on some fruticose thalli.

The lower surface of the thallus lobe may be ecorticate, corticate, bare or *rhizinate* (Fig. 3H). Rhizines are bundles of dark hair-like hyphae by which many of the foliose lichens are attached to the substrate; they may be simple, dichotomously or squarrosely branched or *fasciculate*. The lower surface of some species may be covered with fine hairs or pubescence which is referred to as *tomentum*. Small round or angular holes with a distinct marginal ring of cells through the lower cortex, exposing the medulla, are called *cyphellae* (Fig. 3J) whereas *pseudocyphellae* (Fig. 3I) are merely holes or elongated breaks in the cortex with intruding medullary filaments.

Small warted or cerebriform protuberences on some lichens are *cephalodia* (Fig. 4J). These structures occur when a lichen with an exclusive green algal phycobiont has trapped a blue-green alga. The importance of this structure lies in the fact that the blue-green alga is able to fix atmospheric nitrogen and has been shown to pass this to the mycobiont in the main part of the thallus (Jahns 1973:49).

REPRODUCTIVE STRUCTURES

Lichens mostly reproduce by asexual or vegetative means. This is more often achieved by *fragmentation* though many species produce highly specialised reproductive bodies; *soredia, isidia* and *lobules*. However, a great number of lichens do not have any obvious means of vegetative reproduction.

The fruiting bodies on a lichen thallus represent only the fungal component, and the spores which are produced are therefore only of the mycobiont. The most common fruiting body is the conspicuous saucer-shaped structure *(apothecium)* on the surface of the thallus. Apothecia may be immersed, *adnate* or *stipitate; laminal, marginal* or on the upper or the lower side of the lobe ends. The apothecium contains a number of tissues, the colour, thickness and type of which are diagnostic in identification of species (Fig. 2F). The *epithecium* is the upper part of the *hymenium* and is composed of the tips of the *paraphyses*. It is often coloured and forms the apothecial disk. The disk is variously coloured and sometimes covered by a powdery deposit called *pruina*. The *hymenium* is a layer of *asci* and sterile filaments *(paraphyses)* which originate in the dense layer of tissue called the *hypothecium*. The asci are small sacks containing the *ascospores*. The ascospores vary in shape, size structure and colour. Although the majority of asci contain 8 spores, some contain as few as one or as many as 300. The outer edge of the hypothecium forms a margin known as the *exciple*, or proper margin, around the edge of the apothecium. If this is the only margin present around the apothecium then it is said to be *lecideine* (Fig. 2E). If the exciple is surrounded by a secondary (outer) margin of thalline material containing algae, the apothecium is said to be *lecanorine* (Fig. 2E). The proper margin may in some instances be completely hidden by the *thalline margin*. Below the hypothecium is the *medulla* and enclosing the whole *ascocarp* is the lower cortex.

In some lichens the asci disintegrate at maturity leaving the spores and paraphyses free in a capitate mass. This is known as a *mazaedium*.

Some genera bear globular or pear-shaped receptacles, up to 1 mm in diameter, immersed in the thallus. These are called *perithecia* (Fig. 2G). The spores are contained in asci in a similar manner to the apothecia but instead of being discharged through the epithecium they are discharged through a narrow opening at the top. The same tissues are present in both types of fruiting body.

Pycnidia (Fig. 2H) are small globose or flask-shaped structures which occur in most lichen genera. They are mostly immersed in the thallus but in some genera they are sessile or stipitate. They can easily be confused with perithecia but the *pycnidiospores* bud off from simple or branched hyphae instead of being enclosed in an ascus. *Pycnidiospores* (Fig. 2H) have been variously called pycnospores, conidiospores, microconidia, or spermatia. Some authors suggest that they are asexual reproductive bodies capable of germination; others that they have a sexual function as they have been observed adhering to the trichogynes of ascogenous filaments (Letrouit-Galinou 1973: 62). If this latter observation is true these spores are spermatia and the pycnidia from which they emerge must be called spermogonia. Until this matter is clarified we prefer to use the terms pycnidia and pycnidiospores.

CHEMISTRY

No study of lichen taxonomy can be complete without some knowledge of the simple reagent tests discovered by Nylander (1863). Species which are easily confused without careful study are quickly separated by a simple test. Lichens produce unique chemical substances which are deposited in the form of crystals in the medullary hyphae. Each species usually has a constant chemical make-up so that when the same lichen is collected from a variety of different habitats the chemical tests will be constant. The three basic reagents are: Potassium hydroxide (abbreviated KOH or K), Calcium hypochlorite (abbreviated C), and paraphenylenediamine (abbreviated P). Calcium hypochlorite (common bleaching powder) should be mixed with water before each use as it deteriorates rapidly and will give no reaction when stale. Potassium hydroxide should be mixed as a 10 per cent solution in water and kept in a stoppered bottle. This solution is stable and will keep for several months. As this chemical is caustic it should be handled with extreme care. Paraphenylenediamine comes as dark rusty crystals and is used as a 5 per cent solution in 95 per cent alcohol which should be made up fresh before use. It can be purchased only from a chemical supply company and must also be handled with great care because the spilled solution or powder will ruin clothing and paper. It is most important not to let the chemical come in contact with the skin or to inhale the crystals as it possibly causes blindness and brain damage (J. Santesson 1966:216, Swinscow 1959:120). **Paraphenylenediamine is very dangerous.**

The chemical tests are usually carried out on the medullary tissue. Under a lens or dissecting microscope carefully remove a small section of the upper cortex exposing the white medulla. The reagent is then applied with a fine glass rod and any colour change noted. The tests K, C, and P are straightforward; the KC is observed when K is applied first then followed by a drop of C. Some skill is required in this latter test as sometimes the reaction is only fleeting and the unwary may miss it. With a little practice the chemical tests can be carried out on a very small area of the thallus.

For further determination of the lichen products crystal tests and thin layer chromatograms can be used but these techniques are beyond the scope of this present handbook.

COLLECTIONS IN SOUTH AUSTRALIA

Until recently few lichens had been collected in South Australia. In 1847 Dr. Ferdinand von Mueller emigrated from Germany to South Australia on the advice of Ludwig Preiss. He found employment with a chemist in Adelaide and in his spare time he commenced a study of the local flora. He sent his lichen collections to Dr. Georg E. Hampe in Germany who published their names and descriptions in *Linnaea* (1852). They included the first collections of two species new to science *Biatora byssaceae* Hampe and *Sticta muelleri* Hampe (now *Heterodea muelleri* (Hampe) Nyl.), the last species named in honour of Mueller. Mueller continued his collecting until 1853 when he moved from Adelaide to take up the position of Government Botanist in Melbourne in the Colony of Victoria.

Johann Gottlieb Otto Tepper* was born in 1841 at Neutomischel, Posen, Prussia and migrated with his parents to South Australia in 1847. The Tepper family soon settled on the land in the Lyndoch Valley and it was here that the young Otto grew up. Life on the farm was hard and he improved his education by studying Mathematics, Latin, English and German in his spare time. He started his working life as a shearer and later became partner in a flour mill. When the mill failed he was persuaded by a German pastor to take charge of the parish school. While there he passed the necessary examinations to qualify as a State school teacher, and there followed a teaching career which lasted for nearly 20 years. Tepper moved from school to school in South Australia and in each centre he pursued his interest in natural history and added greatly to his botanical collections.

In 1883 he was appointed Natural History Collector to the Adelaide Museum and later became Museum Entomologist. When J. G. O. Tepper died in 1923 his collections were donated to the Field Naturalists' Section of the Royal Society of South Australia. They later passed to the South Australian Museum and still later to the State Herbarium, Adelaide (AD) with odd duplicates in the National Herbarium, Melbourne (MEL) and the National Herbarium, Sydney (NSW).

Johann Friedrich Carl Wilhelmi was a professional seed collector, in about 1852, who sent specimens from Eyre Peninsula, Port Lincoln and Mount Gambier to Mueller in Melbourne (MEL).

Richard Helms was naturalist and botanical collector with Sir Thomas Elder's Expedition to Central and Western Australia in 1891-92. The expedition, under the command of David Lindsay, set out from Warrina Railway Siding in South Australia and headed northwestward to the Everard Ranges, then turned westward into Western Australia. Helms's specimens were also sent to Mueller in Melbourne (MEL).

Mueller forwarded portions of these collections to Professor Jean Müller (Müll. Arg.) at the University of Geneva, Switzerland, who published on his determinations (Müll. Arg. 1892, 1893). Twelve collections by Helms were

*see Krahenbuehl 1969.

reported as new to science including *Endocarpon helmsianum* Müll. Arg. named in honour of its collector. These collections are housed in the herbaria in Geneva (G), Melbourne (MEL) and Adelaide (AD).

Professor T. G. B. Osborn arrived in Adelaide as first Professor of Botany in 1912, and encouraged botanical exploration, making some lichen collections himself and despatching large numbers to Scandanavia for determination. It was probably from this parcel that Magnusson (1940) described *Pseudocyphellaria australiensis* Magn. This species was described from material collected at Encounter Bay by Professor J. B. Cleland, Professor of Medical Pathology in the University of Adelaide. Professor (later Sir John) Cleland was Chairman of the Handbooks Committee from 1921 to 1969.

Dr. Colin Barnard, of the C.S.I.R.O. Division of Plant Industry, collected lichens from the Koonamore Vegetation Reserve, north of Yunta, in 1927. These collections were sent to the Kew Herbarium in England (K) and specimens reputed to be duplicates were retained in the Adelaide University Herbarium (ADU). All of the lichen collections from the Kew Herbarium were later transferred to the British Museum (Natural History), London (BM). The collections in Adelaide were examined again in 1966 and the names were found to be so confused that it is difficult to accept thay they are in fact duplicates of those at Kew. Miss C. M. Eardley, Lecturer in Botany at the University of Adelaide for many years made collections in the Koonamore Reserve in 1946. Dr. J. H. Willis, Assistant Government Botanist at the National Herbarium of Victoria until 1972, was the botanist with the Russell Grimwade Expedition of 1947. He collected lichens on the western coastal strip of the State (Willis 1953). Mr. D. Kemsley made collections in the Nullarbor region in 1952 and Mr. T. R. N. Lothian in the arid north west of the State in 1954.

Mr. B. Copley collected near Bute in 1960 and Dr. E. Shaw near Iron Knob in the same year. Miss D. Hunt made extensive collections between Naracoorte and Penola in 1962. Mrs. V. Cruikshank collected widely in the Mount Lofty and Flinders Ranges in the years 1964-68. In 1965 Mr. G. Hazel collected a number of specimens from near Kapunda, and Mr. A. C. Beauglehole collected widely across the state from Meningie to the Nullarbor Plain. Mr. D. N. Krahenbuehl collected samples from the Gawler Ranges in 1968. Mr. R. D. Seppelt collected a few specimens from the Millicent area, and more from the Mount Lofty Ranges in 1970. A number of other persons have collected a very small number of specimens and are not mentioned here. Virtually all of the collections mentioned are housed in the herbaria in Adelaide (AD) or Melbourne (MEL).

In the 1960's Mr. L. D. Williams (L.D.W.) collected some 70 numbers mostly of foliose and fruticose species from locations ranging widely over the state, and his private collections have proved very valuable in extending the ranges of some species, and as the only collections known for others.

Mr. N. N. Donner is actively engaged in the collection and curation of the lichens in the State Herbarium of South Australia. He has travelled throughout South Australia in his efforts to obtain comprehensive collections of the State's lichen flora.

Of the present authors, Dr. R. W. Rogers collected extensively in the years 1965-1970. These specimens are housed mostly in his personal herbarium (R.W.R.) with some duplicates held in Adelaide (AD) and Melbourne (MEL). Rogers's collections are dominated by specimens from arid areas and the Mount Lofty Ranges. He has studied the crustose species of the arid zone (Rogers 1971, 1972a, 1972b, 1974).

Mr. R. B. Filson collected extensively throughout the State in the years 1967-77. His collections range from the South-East, Eyre Peninsula, Nullarbor Plain, along the East-West Railway Line, Flinders Ranges, Stuart Highway, Everard and Musgrave Ranges. The main set from these collections is housed in Melbourne (MEL) with some duplicates in other institutions.

LICHEN ECOLOGY

The taxonomic study of lichens is assisted by ecological investigations which can help to amplify visible distinctions between species and to suggest underlying physiological differences. Ecological information can be very helpful in suggesting new areas where a species might be found and in deciding whether different collections of similar material represent one or more than one taxon.

Ecological studies are an avenue of research open to amateurs. Investigations on the distribution of a single species, and the factors controlling the distribution (autecology) are easily carried out. Studies on the groupings of species colonising certain surfaces and the factors controlling the groupings (synecology) are more involved, but very rewarding.

In order to live, a lichen has a few simple requirements, the fulfilment of which present some problems. The thallus must be exposed to sufficient light, moisture and minerals to allow the algal cells buried within it to photosynthesise and produce food. If the thallus is growing in strong sunlight, it is likely to dry out rapidly as the lichen thallus has no special adaptations for water conservation. It is apparently only by change of shape, or increase in cortex thickness, that lichens adapt to varying water availability. Thus fruticose lichens, with a large exposed surface area, are quite rare in desert regions, whereas crustose lichens, and lichens which have their thalli immersed within the rock or soil, are more common. Lichens, however, have special physiological properties which allow them to overcome this problem. Whereas flowering plants die if they dry out, lichens can survive complete desiccation. Specimens of the South Australian desert lichen, *Chondropsis semiviridis*, kept air dry for nine months recovered fairly normal photosynthetic activity within 30 minutes of being rewetted.

Another hazard facing organisms growing in full sunlight is heat. Temperatures as high as 65°C have been recorded on rocks and soil in the mid-summer sun. Although flowering plants can tap reserves of water beneath the surface of the soil, the lichen thallus cannot. It has been found that if the lichen thallus is air-dried it is not damaged by high substrate temperatures, but if it is wet before it is exposed to high substrate temperatures then it is quite sensitive. This may be the reason why lichens are rare in the areas of arid northern Australia which have a hot, humid summer. The South Australian deserts are rich in lichens, presumably because of the usually very dry summers and cool, sometimes moist winters.

Resistance to cold is not a hazard that must be faced by most South Australian lichens. However some lichens are very cold-resistant and records show that they have recovered after exposure to temperatures below −150°C.

Lichens can quite rapidly absorb water from fogs and even from moist air. This is demonstrated in the so-called 'fog oases' in the desert regions along the western coasts of North and South America, and of North and South Africa. The lichen *Ramalina maciformis* from the Negev Region in Israel, one of the driest deserts, survives on the moisture received as dew in the early morning. This moisture soon evaporates in the first few hours after the sun rises. There

are places in Chile which have a rich lichen flora on the soil and rocks where no rain has fallen in a hundred years. Also in Chile are areas where the desert cacti are festooned with lichens that are normally associated with rainforests rather than with deserts. This phenomenon is not recorded in Australia, but could possibly occur along the coast of the Great Australian Bight or south of Onslow in Western Australia.

Lichens have evidently evolved very powerful mechanisms for the rapid absorption of mineral nutrients from the environment. This has revealed itself in some unfortunate ways, perhaps the most notable involving the reindeer lichens *(Cladina)* of Lapland. These lichens concentrated the biologically dangerous radio-isotope Strontium 90 (released from aerial atom bomb tests) within the thallus. After the reindeer ate the lichen, they retained the Strontium 90 in their tissue which was in turn absorbed by the Laplanders when they ate the reindeer meat. The ability to absorb and concentrate elements relating to air pollution is discussed in a later section.

LICHENS AND SUBSTRATES

While many lichens grow on a wide range of substrates, some species are very selective in the surfaces they colonise. Some species are apparently restricted to the bark of a single species of tree, some to limestone rocks or granite, whereas others grow on a wide range of trees as well as on rocks. A granite habitat has a particular rich lichen flora. The study of the lichen flora on various types of rocks is in itself an interesting project. In semi-arid and arid areas (which includes the Mallee) there is a well-developed lichen flora on the soil surface. This habitat does not occur in wetter areas as small plants and perennials apparently shade the lichens out.

Lichens are found on the trunks, twigs and leaves of trees. A number of species in South Australia are usually found on thin twigs (especially *Ramalina* species) rather than on thick branches and tree trunks. No leaf-inhabiting lichens have been reported from South Australia, although they are quite common in the rainforests and wet areas of other States.

Dead trees, fallen branches and fence posts are the substrates preferred by a number of lichens, and some species are confined to charred wood. *Thysanothecium hyalinum* is one species commonly found in South Australia on charred logs and stumps.

In addition to the natural surfaces discussed above, lichens seem able to colonise almost any stable surface. Around old garbage dumps in the bush they may be observed growing on old boots, tiles, crockery and glass.

ENVIRONMENTAL MODIFICATION

The lichen thallus can be subjected to a range of extreme conditions and is considerably influenced by changes in the microclimate. These microclimes may be separated from each other by only a few centimetres, for example the upper and lower surfaces of a rock ledge, or the part of a tree trunk down which water runs and the part from which the water is diverted. Because of difference in

exposure to the sun the north and south faces of a tree trunk provide very different habitats for lichens. The upper surfaces of species of *Teloschistes* growing in strong sunlight are mostly deep orange in colour, whereas those in the shade tend to be a pale yellow. The colour of crustose lichens may also vary, not only with insolation, but with the chemical nature of the surface on which they grow. Young individuals of many species tend to look different from bleached and worn older populations. Near the extremes of species tolerance individuals tend to be rather stunted and distorted.

An interesting environmental modification is demonstrated by the crustose species, *Aspicilia calcarea*, which grows on limestone pebbles and soils in the arid regions. Under some conditions it ceases to form the normal flat areolate thallus, the areoles then elongate vertically, producing rope-like structures which become more or less recumbent and spreading; in fact a fruticose modification of a crustose thallus. The collector and taxonomist must be aware of the plasticity of lichens and exercise caution in the interpretation of the likely influence of environmental variation on lichen thalli.

LICHENS AND CITIES

Overseas studies have shown that lichens are sensitive to conditions found in some cities. The sensitivity is normally attributed to air pollution, especially pollution by sulphur dioxide. It appears that sulphur dioxide changes the acidity of rainfall to such an extent that highly toxic sulphite ions are produced which oxidise the chlorophyll in the lichen. The ability of lichens to concentrate nutrients from very dilute sources is also a hazard in the city. Lichens are indiscriminate in what they absorb and have been shown to accumulate large, and often fatal, amounts of toxic substances such as fluorides emitted by aluminium smelters, brick-works, fertiliser factories and cement works.

Generally, lichens growing on tree trunks have the least buffered substrate and as they suffer from acidification most easily, they are the lichens most sensitive to air pollution. Those growing on tiles, rocks, soil, cement, and asbestos cement sheeting are progressively better buffered against acidification of water supplies, and are therefore less sensitive to pollution. As a general rule fruticose lichens are more sensitive than others and the crustose species are the most resistant. However, not all lichens are disadvantaged by urbanisation and some species seem to thrive on the slightly richer air found there. These lichens are sometimes known as 'nitriphiles' (nitrogen lovers) and include the genera *Candelaria* and *Xanthoria*.

A study of the distribution of lichen species in relation to city development, air movements and sources of pollution, is an ecological project within the range of those who can determine the lichens they choose to study.

THE ROLE OF LICHENS IN THE ECOSYSTEM

Lichens do not occupy a prominent place in most ecosystems but in some special circumstances may be important. Perhaps the best known role of lichens is colonisation of bare rock surfaces. Lichens are amongst the very few

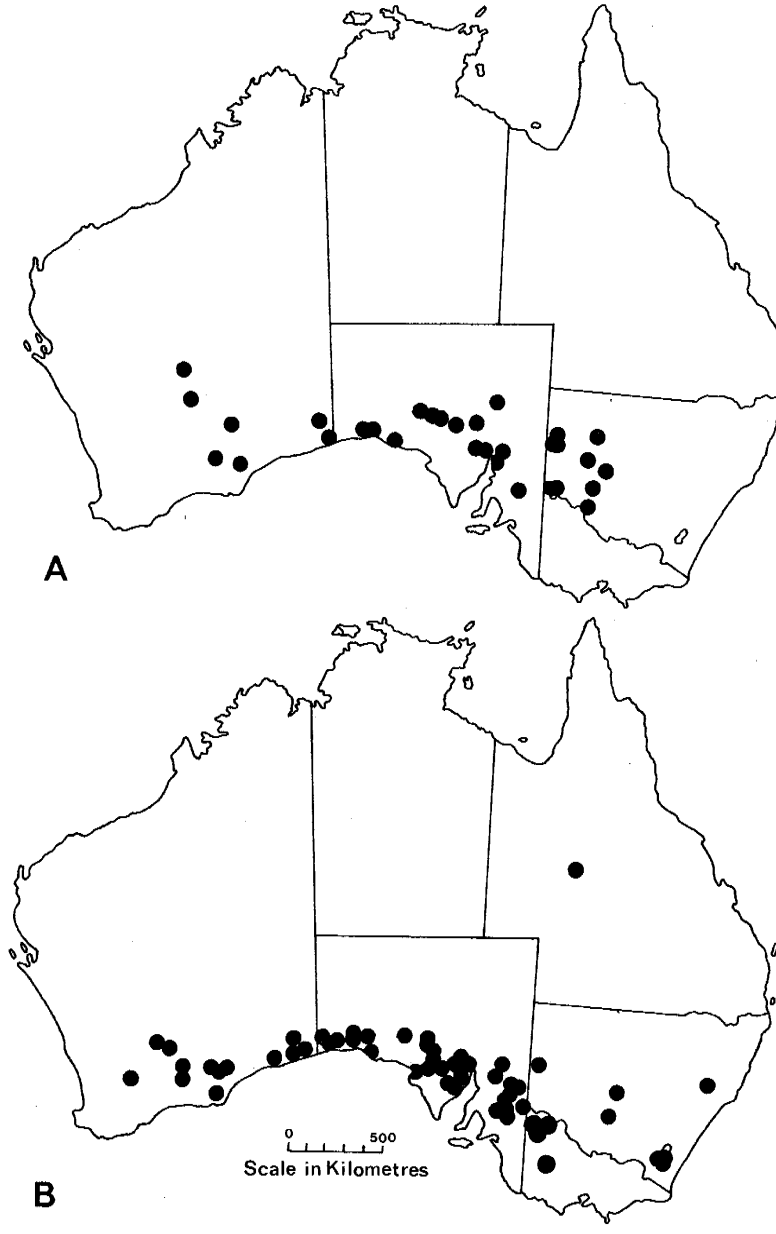


Fig. 5. A, the known distribution in Australia of *Maireana sedifolia*, after Hall et al. 1964, B, the known distribution of *Chondropsis semiviridis*, after Rogers 1971.

organisms that can survive on bare rock. Once established they tend to facilitate soil formation on the rock in two ways: they weather the rock by penetrating its structure physically with rhizines and hyphae, and they chemically erode the rocks with the various acids they produce. In addition to this direct action, the lichen thallus traps wind-blown dust and plant material thus building up a substrate for mosses and small herbs.

In arid areas lichens colonise stable soil surfaces. Once covered with lichens the soil is protected from wind, and to a large extent water erosion, even if the scrub cover dies during drought periods. The carpet of lichens on arid soils

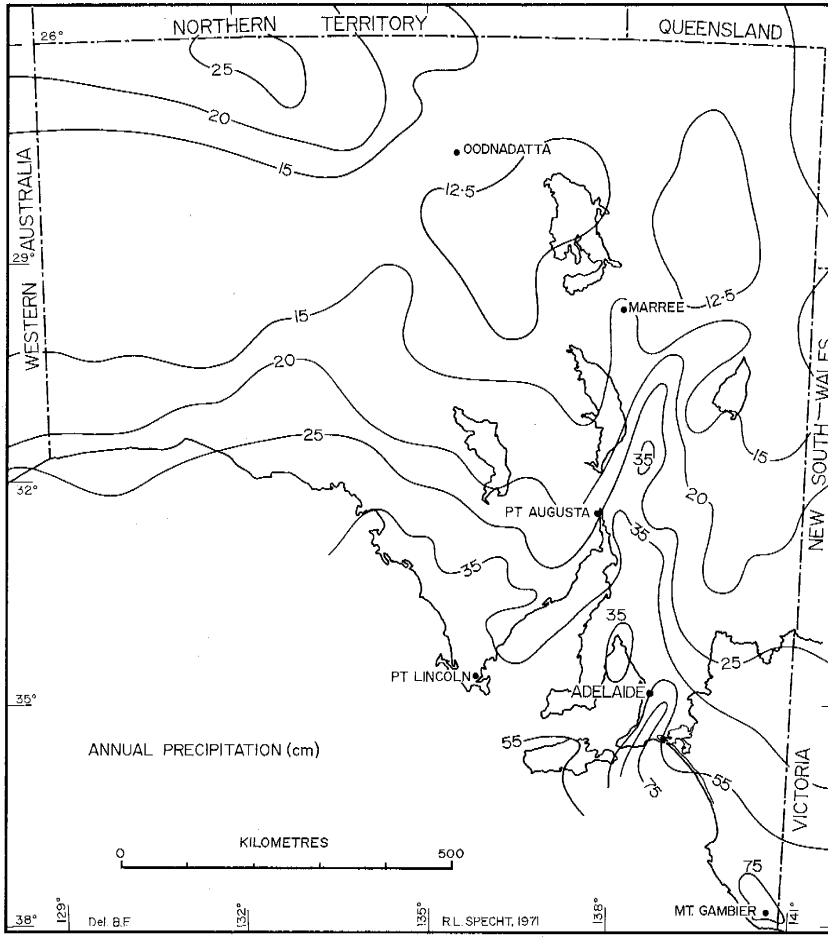


Fig. 6. Rainfall map of South Australia, showing annual isohyets, after Specht 1972.

contains at least one species capable of fixing nitrogen *(Collema coccophorum)* and provides a habitat for numerous other nitrogen-fixing blue-green algae, thus enriching the nitrogen reserves in the soil. This lichen crust is very sensitive to trampling by sheep and once destroyed is slow to recover.

DISTRIBUTION PATTERNS OF LICHENS

As it is expected lichens show distribution patterns which are often basically similar to those of flowering plants. The distribution of *Chondropsis semiviridis* (Fig. 5B) in South Australia for example is very similar to that of the shrub

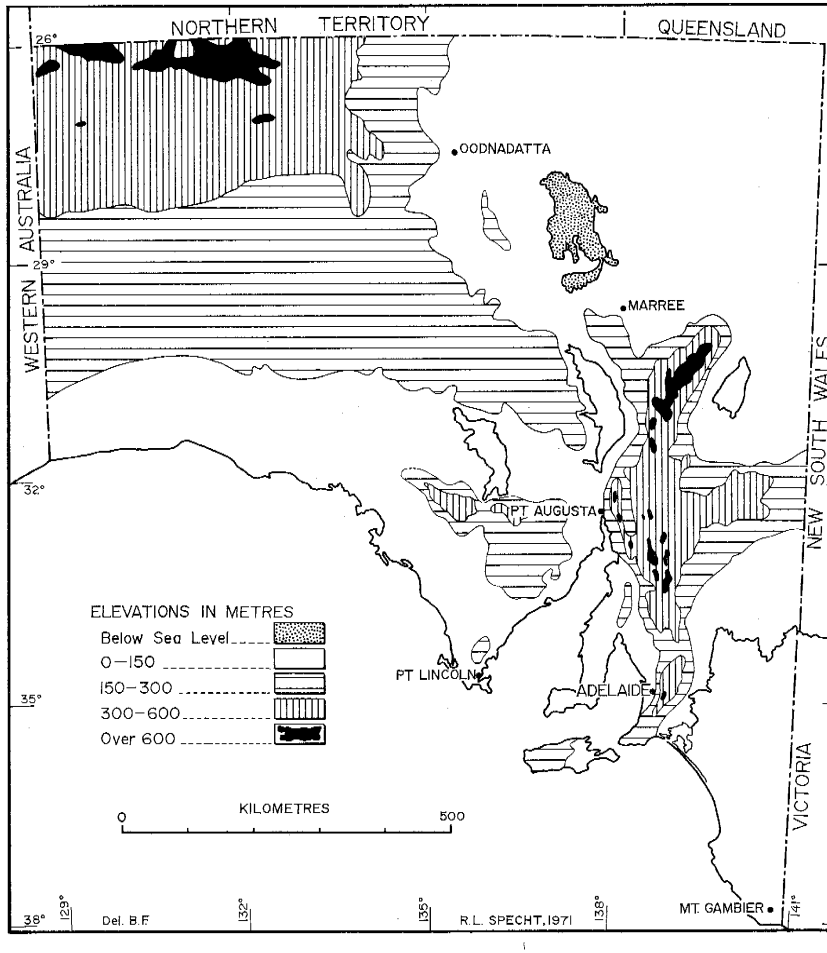


Fig. 7. Relief map of South Australia, after Specht 1972.

Maireana sedifolia (F. Muell.) P. G. Wilson (Fig. 5A), both of which require alkaline soils (which are almost universal in South Australian semi-arid lands) and a rainfall between 150 and 350 mm. *Cladia aggregata* is also a soil surface species, but appears to grow on slightly acid to alkaline soils, or over a layer of decaying plant litter, in areas with a rainfall of more than 250 mm (Fig. 8A) *Cladia schizopora* (Fig. 8B), which appears to be restricted to rotting logs in areas with a rainfall of more than 550 mm is much more limited in its distribution than the two above species.

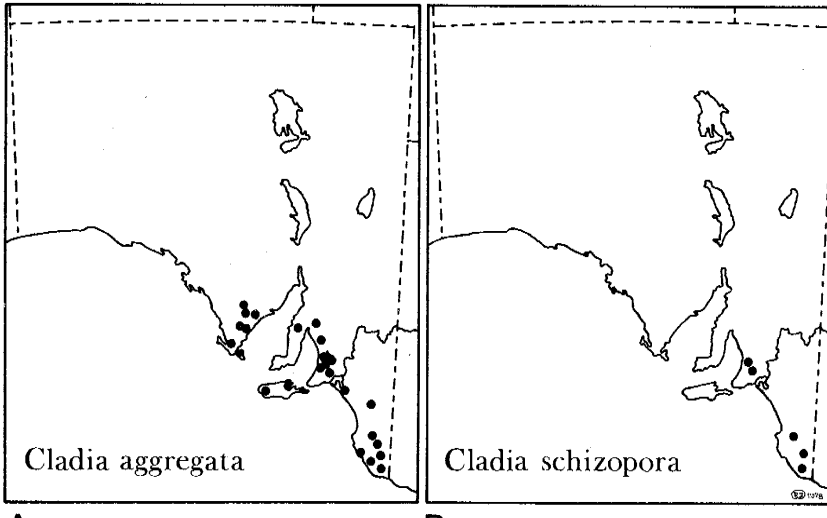


Fig. 8. A, known distribution of *Cladia aggregata* (Sw.) Nyl. in South Australia; B, known distribution of *Cladia schizopora* (Nyl.) Nyl. in South Australia.

Some species are confined to only a few localities, for example the beautiful *Cladia ferdinandii* known in South Australia only from the south of Eyre Peninsula, Kangaroo Island, the Aldinga National Park and near Meningie. Every occurrence is on sandy soil near the coast. Perhaps a thorough search will reveal this species growing on the tip of Yorke Peninsula, and on the sands near Robe or the Coorong. Establishing distribution patterns for lichens and interpreting the ecological factors controlling the distribution is a project that could be easily undertaken by any naturalist.

At present there are few lichen species which have been collected only from South Australia. However, as the lichen flora of the other States is examined in more detail, some of these lichens may be found to occur there. Surprisingly it appears that there is no lichen genus endemic to Australia. We know insufficient about the reproductive and dispersal mechanism of lichens to explain this, but endemism is apparently quite rare.

FURTHER READING

Recently a number of good books have become available on the general biology and ecology of lichens. The most suitable introductory volume is by Dr. Mason E. Hale Jr. of the Smithsonian Institution, Washington, D.C., U.S.A., entitled "The Biology of Lichens". For the more serious student two volumes published by Academic Press "The Lichens", edited by V. Ahmadjian and M. E. Hale, and "Lichen Ecology", edited by M. R. D. Seaward, are very well worthwhile.

HOW TO COLLECT LICHENS

Lichens are very easy to collect and the main tools which are needed are: a heavy hammer and a cold chisel (for forcing off slivers of rock bearing crustose species) and a sheath knife for detaching foliose and fruticose forms.

Always try to collect complete specimens, including the margins of the lichen and the fruiting structures when present. Never try to scrape crustose lichens off the substrate as the resultant crumbs and fragments are useless. With a little practice good complete specimens can be chiseled out from the rock. The rock fragment should be as thin as possible and no larger than 15-20 cm diameter. Foliose lichens should be carefully detached from the rock or wood with the knife blade. If the knife blade is cut into the rock immediately below the holdfast the rock will be found to be softer here and a small fragment of the rock will come away with the lichen complete.

In the field the specimens should be air-dried if possible and rock samples wrapped in tissue and placed in paper bags for transit to the laboratory. Never pack lichens in plastic bags as they quickly discolour and mould.

Once in the laboratory the collections should be first thoroughly air-dried before packing away when they may be sorted and curated at leisure.

Permission must be obtained before collecting in State Forests, Reserves and National Parks.

CURATION OF LICHENS

Specimens which are firmly attached to rock, bark or wood can be glued down with PVC adhesive to standard index card 75 x 125 mm. Lichen crusts on soil should be stabilised first. This is done by diluting the adhesive with water and adding one or two drops of detergent. The soil sample is then placed lichen side down on a piece of blotting paper. The dilute adhesive is fed onto the soil by means of a small dropper, taking care that it does not soak right through and spoil the sample. When the soil is fully charged with adhesive it is allowed to dry before fixing to card in the normal manner.

Fruticose or foliose specimens can be wetted and lightly pressed between blotting paper but special care must be taken that they do not mould on re-drying. Brittle species can also be fixed to card, either with adhesive or paper strips, to prevent fragmentation. The cards are then placed in 16 × 10 cm packets and stored upright in drawers or shoe boxes.

The documentation of specimens is of prime importance. Good samples are useless unless the precise locality of collection, the name of the collector, collector's number and date of collection are provided. Notes on the habitat, substrate and associated species are useful additions to the label. This label should be affixed to the front of the packet or printed onto the paper from which the packet is folded (Fig. 9).

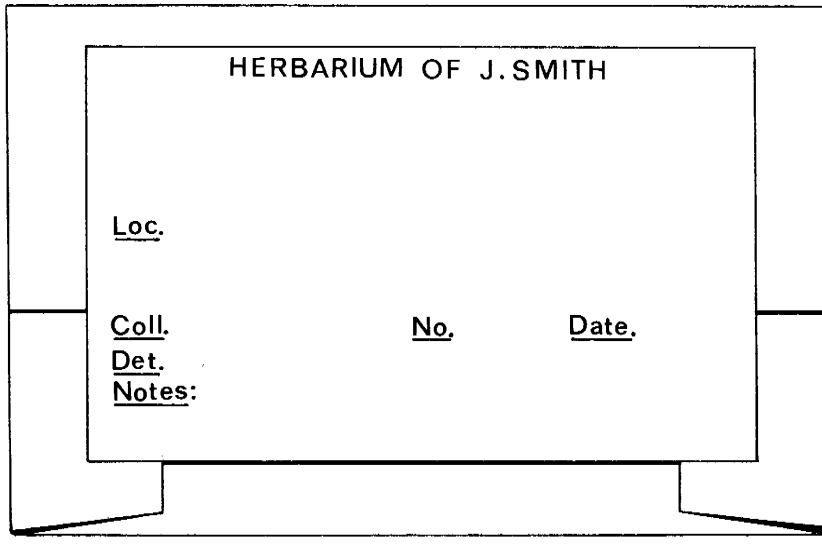


Fig. 9. Folded packet with label.

EXAMINATION OF MATERIAL FOR INDENTIFICATION

To study a lichen properly a small number of essential items are required: a good quality hand lens or dissecting microscope, for examining the morphological characters; a scalpel or one-edged razor blade; a pair of fine forceps; a needle in a handle; the use of a microscope with a magnification at least up to 400x and an eyepiece micrometer; glass slides and coverslips.

The most useful method of examining the fruiting structures of a lichen is to make a squash preparation. First soften the sample with a little water to which a drop or two of detergent has been added. Prick out a small piece from the apothecium, perithecium or pycnidium with a scalpel, corner of a razorblade or the point of a needle. This should be done under a low power dissecting microscope or with a hand lens. Transfer the small fragment to a drop of mounting solution (see below) on a clean glass slide, place a coverslip over it and press down firmly with the corner of a soft rubber or the plastic end of a ball point pen. Just enough pressure should be applied to spread the tissue and not mutilate it or break the coverslip. Examine the preparation two or three times during squashing, first when the tissue breaks so as to note colour and thickness of the epithecium, hymenium, hypothecium, position and kind of exciple. Then apply more pressure and note the size and shape of filaments, paraphyses, and asci. Finally press hard enough to burst the asci and release the spores so that they can be measured free.

For temporary preparations the most suitable mounting solution is water, to which has been added a drop or two of detergent. For more permanent preparations the specimens can be mounted in lactophenol and the cover slips ringed with clear nail varnish. Slides prepared in this manner will last several years.

CLASSIFICATION

Prior to 1866 it was not recognised that lichens were dual organisms, an alga and a fungus. Even as late as 1896 a prominent lichenologist wrote "lichens are a special class different from and contrasting with fungi".

It is now widely accepted that lichen fungi ought to be classified along with other fungi. However, no satisfactory taxonomic system has been developed which integrates lichen fungi with the others. It is therefore necessary to classify lichens into Orders and Families of their own. These Orders can be arranged within Classes and Subclasses recognised amongst the non-lichenised fungi.

ARRANGEMENT OF THE SOUTH AUSTRALIAN LICHENS:

This arrangement is based on Hale (1967) and Poelt (1973).

CLASS ASCOMYCETIDAE

Order ARTHONIALES
ARTHONIACEAE Reichenb.
Arthonia Ach., *Arthothelium* Mass.

OPEGRAPHACEAE Stiz. ex Tuck.
Chiodecton Ach., *Enterographa* Fée, *Opegrapha* Ach.

Order DOTHIDEALES
PLEOSPORACEAE Wint.
Arthopyrenia Mass., *Polyblastiopsis* Zahlbr.

Order VERRUCARIALES
VERRUCARIACEAE Eschw.
Dermatocarpon Eschw., *Endocarpon* Hedw., *Verrucaria* Schrad.

Order PYRENULALES
PYRENULACEAE Zahlbr.
Anthracothecium Hampe ex Mass.

TRYPETHELIACEAE Eschw.
Trypethelium Spreng.

Order CALICIALES
CALICIACEAE Fée
Calicium Pers., *Chaenotheca* Th. Fr., *Cyphelium* Ach.

Order OSTROPALES
THELOTREMATACEAE Zahlbr.
Diploschistes Norm.

Order GRAPHIDALES
GRAPHIDACEAE Dumort
Graphina Müll. Arg., *Graphis* Adans., *Phaeographina* Müll. Arg., *Phaeographis* Müll. Arg.

MELASPILEACEAE W. Wats.
Melaspilea Nyl.

GYALECTACEAE Zahlbr.
Dimerella Trevis.

Order LECANORALES

LICHENACEAE Nyl.
Lichina C. Ag., *Synalissa* Fr., *Porocyphus* Koerb., *Thyrea* Mass.

HEPPIACEAE Zahlbr.
Heppia Naeg., *Peltula* Nyl.

PLACYNTHIACEAE Dahl
Psoroma (Ach.) Michx.

PELTIGERACEAE Dumort
Peltigera Willd.

NEPHROMACEAE Moreau
Nephroma Ach. ex Luyken

LOBARIACEAE Chev.
Pseudocyphellaria Vain.

COLLEMATACEAE Fée
Collema Wigg., *Leptogium* (Ach.) Gray, *Physma* Mass.

COCCOCARPIACEAE Henssen
Coccocarpia Pers.

PANNARIACEAE Tuck.
Erioderma Fée, *Pannaria* Del., *Parmeliella* Müll. Arg.

LECIDEACEAE Chev.
Bacidia de Not., *Bombyliospora* de Not., *Catillaria* Mass. em Th. Fr.
Lecidea Ach. em Th. Fr., *Rhizocarpon* Ram. ex DC., *Toninia* Mass.

LECANORACEAE Fée
Haematomma Mass., *Lecanora* Ach. ex Luyken

ASPICILIACEAE Poelt
Aspicilia Mass.

PARMELIACEAE Eschw.
Chondropsis Nyl., *Hypogymnia* Nyl., *Menegazzia* Mass., *Parmelia* Ach.

USNEACEAE Eschw.
Usnea P. Browne ex Adans.

RAMALINACEAE C.A. Ag.
Ramalina Ach. ex Luyken

ANZIACEAE Sato
Anzia Stiz.

STEREOCAULACEAE Chev.
Pilophorus Th. Fr.

CLADONIACEAE Reichenb.
Cladonia Hill ex Web. in Wigg., *Gymnoderma* Nyl., *Thysanothecium* Mont. et Berk., *Ramalea* Nyl.

CLATHRINACEAE Duv.
Cladia Nyl.

HETERODEACEAE Filson
Heterodea Nyl.

BAEOMYCETACEAE Fée
Baeomyces Pers., *Icmadophila* Trevis.

SIPHULACEAE Reichenb.
Siphula Fr.

ACAROSPORACEAE Zahlbr.
Acarospora Mass., *Biatorella* de Not., *Maronea* Mass., *Sarcogyne* Flot.

PERTUSARIACEAE Koerb.
Ochrolechia Mass., *Pertusaria* DC.

CANDELARIACEAE Hakulinen
Candelaria Mass., *Candellariella* Müll. Arg.

TELOSCHISTACEAE Zahlbr.
Blastenia Mass., *Caloplaca* Th. Fr., *Fulgensia* Mass. et de Not. *Teloschistes* Norm., *Xanthoria* (Fr.) Th. Fr.

PHYSCIACEAE Zahlbr.
Anaptychia Koerb., *Buellia* de Not., *Diploicia* Mass., *Physcia* (Schreb.) Michx., *Physciopsis* Choisy, *Rinodina* (Ach.) Gray.

TRAPELIACEAE H. Hertel
Trapelia Choisy

NOTES ON THE KEYS AND DESCRIPTIONS

In the following pages keys are provided to the families and genera of lichens which are known to occur, or are likely to occur, in South Australia. To determine the genus to which a specimen belongs, two different approaches are possible. The specimen may be keyed directly to genus using the *Artificial Key to Genera.* This is probably the easiest and quickest way to get a result. This is certainly the best key to use when the material is sterile.

The *Artificial Key to Families* and the *Artificial Key to Genera within Families* require fertile material and often require difficult decisions to be made early in

the key. Before attempting to use these keys the student should be familiar with simple squash preparations and the chemical reagent tests.

Following the keys is a systematic treatment of the genera. This treatment includes a description of each genus and an account of what is known of the species which occur in South Australia. Where possible a key to these species is provided together with a short description and a selected list of specimens to give some indication of the distribution.

Anyone using this handbook can expect to discover species or genera hitherto unrecorded in South Australia. Inability to name a specimen from this study is therefore not failure, but a possible new find and may represent an advance in our knowledge of South Australian lichens.

ARTIFICIAL KEY TO FAMILIES

1. Phycobiont blue-green (Cyanophyta, genera includes *Calothrix, Nostoc, Scytonema* and *Gloeocapsa)* 2
1. Phycobiont green (Chlorophyta, genera includes *Chlorella, Chlorosarcina, Coccobotrys, Coccomyxa, Myrmecia, Haematococcus, Pseudochlorella,* and most commonly *Trebouxia)* 10
2. Thallus gelatinous when wet 3
2. Thallus not gelatinous when wet 5
3. Thallus a thin film on the substrate ..... VERRUCARIACEAE
3. Thallus foliose or fruticose 4
4. Thallus foliose, apothecium with open disk, phycobiont *Nostoc* ..... COLLEMATACEAE
4. Thallus fruticose, apothecium flask-like or open, phycobiont *Calothrix* or *Gloeocapsa* ..... LICHINACEAE
5. Thallus foliose 6
5. Thallus more or less squamulose 8
6. Apothecia laminal ..... COCCOCARPIACEAE
6. Apothecia on upper or lower tips of the lobes 7
7. Apothecia produced on the upper surface of the thallus lobe ..... PELTIGERACEAE
7. Apothecia produced on the lower surface of the thallus lobe ..... NEPHROMACEAE
8. Medulla well developed, asci usually with eight ascospores 9
8. Medulla absent or poorly developed, asci sometimes with eight but usually with greater than 16 ascospores ..... HEPPIACEAE
9. Upper cortex of longitudinal hyphae ..... COCCOCARPIACEAE
9. Upper cortex of erect hyphae ..... PANNARIACEAE
10. Fruiting bodies immersed (perithecia) 48
10. Fruiting bodies discoid or elongate not immersed 11
11. Fruiting bodies elongate (lirellae) sometimes stellately arranged or in lines 45
11. Fruiting bodies discoid (apothecia) 12
12. Apothecia with a proper exciple only 13
12. Apothecia with a thalline exciple usually displacing the proper exciple 23

13. Ascospores brown ..... PHYSCIACEAE
13. Ascospores hyaline 14
14. Thallus crustose or squamulose supporting podetia or pseudopodetia . 15
14. Thallus not crustose or squamulose supporting podetia or pseudopodetia 17
15. Apothecia pink, rarely turning brown, primary thallus crustose ..... BAEOMYCETACEAE
15. Apothecia black, brown or red, primary thallus squamulose or rarely sorediose 16
16. Apothecia jet black (in SA) podetia deep green . STEREOCAULACEAE
16. Apothecia dark brown, pale brown, red..... CLADONIACEAE
17. Thallus of pseudopodetia, pseudopodetia hollow, fenestrate CLATHRINACEAE
17. Thallus not of pseudopodetia 18
18. Thallus crustose 19
18. Thallus foliose or fruticose 22
19. Thallus yellow orange or greenish-orange 21
19. Thallus not as above 20
20. Paraphyses thick, inflated at apices ..... LECIDEACEAE
20. Paraphyses thin, not inflated at apices ..... TRAPELIACEAE
21. Thallus yellow, orange or greenish-orange, K+ purple ..... TELOSCHISTACEAE
21. Thallus yellow or greenish-yellow, K− ..... CANDELARIACEAE
22. Apothecia yellow or orange, disk K+ purple .... TELOSCHISTACEAE
22. Apothecia pale brown, K− ..... HETERODEACEAE
23. Thallus crustose or squamulose 24
23. Thallus foliose or fruticose 32
24. Ascospores minute, many per ascus ..... ACAROSPORACEAE
24. Ascospores larger, two to eight per ascus 25
25. Apothecia with well developed thalline and proper exciples 26
25. Apothecia with the thalline exciple dominant, the proper exciple virtually displaced 27
26. Thallus crustose, thick, terricolous ..... THELOTREMACEAE
26. Thallus crustose, thin, endophloeodal ..... GYALECTACEAE
27. Apothecia sunken, disk almost closed by a thick thalline margin ..... PERTUSARIACEAE
27. Apothecia immersed, adnate, sessile, disk open, thalline margin thin ... 28
28. Ascospores brown ..... PHYSCIACEAE
28. Ascospores hyaline 29
29. Apothecia yellow, orange, the disk K+ purple ..... TELOSCHISTACEAE
29. Apothecia pale to dark brown to black, the disk K− 30
30. Thallus squamulose ..... PLACYNTHIACEAE
30. Thallus crustose 31
31. Apothecia sessile, rarely immersed, ascospores less than 30 μm long ..... LECANORACEAE
31. Apothecia immersed, ascospores large..... ASPICILIACEAE
32. Thallus foliose 33

32. Thallus fruticose 38
33. Apothecia yellow or orange, the disk K+ purple ... TELOSCHISTACEAE
33. Apothecia yellow, green, grey, brown, disk K– 34
34. Ascospores non-septate 35
34. Ascospores septate 37
35. Lower surface corticate ..... PARMELIACEAE
35. Lower surface ecorticate 36
36. Lower surface with a thick layer of tomentum ..... ANZIACEAE
36. Lower surface of interwoven hyphae ..... PLACYNTHIACEAE
37. Thallus usually small, less than 5 cm diam., grey-green, lower surface sparsely rhizinate, without pores through the lower cortex ..... PHYSCIACEAE
37. Thallus usually large, yellow-green to brown, lower surface densely rhizinate sometimes with pores through the lower cortex ..... LOBARIACEAE
38. Apothecium with a proper exciple only 39
38. Apothecium with a thalloid exciple 42
39. Thallus crustose or squamulose supporting podetia or pseudopodetia ... 40
39. Thallus not crustose or squamulose supporting podetia or pseudopodetia ..... CLATHRINACEAE
40. Apothecia pink, rarely turning brown, primary thallus crustose ..... BAEOMYCETACEAE
40. Apothecia black, brown or red, primary thallus squamulose or rarely sorediose 41
41. Apothecia jet black (in SA) podetia deep green ..... STEREOCAULACEAE
41. Apothecia dark brown, pale brown, red ..... CLADONIACEAE
42. Thallus of rather flattened yellow branches K+ purple ..... TELOSCHISTACEAE
42. Thallus of flattened or terete grey to grey-green branches K+ yellow or yellow-red, not purple 43
43. Thallus flat, thick, upright, low, terricolous, grey, K+ yellow ..... SIPHULACEAE
43. Thallus not as above 44
44. Thallus upright or pendulous, flat or terete with distinct central axis ..... USNEACEAE
44. Thallus upright or pendulous, flat or inflated without a central axis ..... RAMALINACEAE
45. Ascocarp immersed to sessile, surrounded by thalline tissue, ascospores colourless 3-15 septate ..... OPEGRAPHACEAE
45. Ascocarps sparingly or not bordered by thalline tissue 46
46. Ascocarps round to irregularly branched, receptacle rudimentary, ascospores colourless or tinged with brown, 1-8 septate ..... ARTHONIACEAE
46. Ascocarps elongate, irregularly branched, receptacle thick, interwoven 47
47. Ascospores 1 septate, pale brown ..... MELASPILEACEAE

47. Ascospores several septate to muriform ..... GRAPHIDACEAE
48. Perithecia many in stroma, ascospores colourless . TRYPETHELIACEAE
48. Perithecia solitary or grouped in warts 49
49. Ascospores transversely septate ..... PLEOSPORACEAE
49. Ascospores simple or muriform 50
50. Ascospores simple ..... VERRUCARIACEAE
50. Ascospores muriform 51
51. Thallus crustose ..... PYRENULACEAE
51. Thallus squamulose ..... VERRUCARIACEAE

ARTIFICIAL KEY TO GENERA WITHIN FAMILIES
(arranged alphabetically)

The number of species at present known from South Australia is shown in parenthesis.

ACAROSPORACEAE

1. Apothecium with a thalloid exciple 2
1. Apothecium with only a proper exciple 3
2. Apothecium immersed, ascospores non-septate ..... *Acarospora* (6)
2. Apothecium sessile, ascospores non- or once-septate ..... *Maronea* (1)
3. Exciple hyaline or coloured ..... *Biatorella* (0)
3. Exciple dark, carbonaceous ..... *Sarcogyne* (0)

ANZIACEAE

1. Thallus yellow to yellow-green, lower surface ecorticate with thick layer of tomentum ..... *Anzia* (1)

ARTHONIACEAE

1. Thallus crustose or immersed, disk irregularly round or oblong, ascospores clavate 3-8 septate ..... *Arthothelium* (0)
1. Thallus crustose or immersed, disk irregularly round, ascospores obovate to fusiform ..... *Arthonia* (0)

ASPICILIACEAE

1. Thallus crustose to effigurate, apothecia immersed, ascospores large, up to eight per ascus ..... *Aspicilia* (1)

BAEOMYCETACEAE

1. Primary thallus crustose or sorediose, apothecia borne on pale pink podetia ..... *Baeomyces* (0)
1. Primary thallus crustose or granulose, apothecia sessile .. *Icmadophila* (0)

CALICIACEAE

1. Ascocarps stalked 2
1. Ascocarps sessile ascospores brown, 1-septate ..... *Cyphelium* (0)
2. Ascospores brown, 1-septate ..... *Calicium* (1)
2. Ascospores brown, simple ..... *Chaenotheca* (0)

CANDELARIACEAE

1. Thallus lobes flattened, sub-foliose, minutely incised, ascospores hyaline, eight per ascus ..... *Candelaria* (1)
1. Thallus completely granular or sometimes minutely sub-squamulose ascospores hyaline, 16 per ascus ..... *Candelariella* (3)

CLADONIACEAE

1. Podetia short, simple, seldom forked 2
1. Podetia longer, often branched, simple or cup-shaped..... *Cladonia* (11)
2. Primary thallus foliose, podetia marginal..... *Gymnoderma* (0)
2. Primary thallus crustose or granular podetia laminal 3
3. Apothecia lateral, podetia foveolate or striate ..... *Thysanothecium* (1)
3. Apothecia terminal, podetia granular and deformed ..... *Ramalea* (0)

CLATHRINACEAE

1. Thallus of pseudopodetia with longitudinal cracking or fenestration *Cladia* (4)

COCCOCARPIACEAE

1. Upper cortex composed of longitudinal hyphae ..... *Coccocarpia* (1)

COLLEMATACEAE

1. Thallus corticate ..... *Leptogium* (2)
1. Thallus ecorticate 2
2. Ascospores non-septate ..... *Physma* (0)
2. Ascospores septate ..... *Collema* (6)

GRAPHIDACEAE

1. Ascospores hyaline 2
1. Ascospores brown 3
2. Ascospores transversely septate only ..... *Graphis* (0)
2. Ascospores muriform ..... *Graphina* (0)
3. Ascospores transversely septate only ..... *Phaeographis* (0)
3. Ascospores muriform ..... *Phaeographina* (0)

GYALECTACEAE

1. Thallus thin, granulose, or endophloedal, apothecia yellow-orange *Dimerella* (0)

HEPPIACEAE

1. Ascospores eight per ascus ..... *Heppia* (1)
1. Ascospores many per ascus ..... *Peltula* (4)

HETERODEACEAE

1. Thallus foliose, upper side pale green to greyish-green; lower surface black, black with pale depressions, or pale ..... *Heterodea* (2)

LECANORACEAE

1. Ascospores septate ..... *Haematomma* (1)
1. Ascospores non-septate ..... *Lecanora* (4)

LECIDEACEAE

1. Ascospores non-septate ..... *Lecidea* (4)
1. Ascospores variously septate 2
2. Ascospores transversely septate only 3
2. Ascospores transversely and longitudinally septate 5
3. Ascospores two- many septate ..... *Bacidia* (0)
3. Ascospores once septate 4
4. Ascospores acicular ..... *Toninia* (1)
4. Ascospores more or less ovoid ..... *Catillaria* (?)
5. Ascospores hyaline, apothecia orange-brown ..... *Bombyliospora* (1)
5. Ascospores brown, apothecia black ..... *Rhizocarpon* (1)

LICHINACEAE

1. Growing in marine environments below high tide level, phycobiont *Calothrix* ..... *Lichina* (1)
1. Not growing in marine environments 2
2. Thallus a mat of thin branched filaments, phycobiont *Stigonema* ..... *Ephebe* (1)
2. Thallus upright not a mat of branched filaments 3
3. Thallus terete, phycobiont *Gloeocapsa* or *Calothrix* 4
3. Thallus broad and flat, phycobiont *Xanthocapsa* ..... *Thyrea* (1)
4. Terricolous in arid areas, phycobiont *Gloeocapsa* ..... *Synalissa* (1)
4. Saxicolous in damp areas on rock outcrops, phycobiont *Calothrix* ..... *Porocyphus* (1)

LOBARIACEAE

1. Thallus large, marginal lobes broad, underside densely covered with short rhizines, yellow pseudocyphellae present ..... *Pseudocyphellaria* (2)

MELASPILEACEAE

1. Thallus crustose, apothecia rounded or elongate, ascospores brown 1-septate ..... *Melaspilea* (0)

NEPHROMACEAE

1. Thallus yellow-green, green or brown, phycobiont blue-green, apothecia on the under side of the lobe ends ..... *Nephroma* (0)

OPEGRAPHACEAE

1. Thallus crustose, apothecia immersed in stroma 2
1. Thallus crustose, apothecia not immersed in stroma ..... *Opegrapha* (0)
2. Hypothecium dark ..... *Chiodecton* (0)
2. Hypothecium pale ..... *Enterographa* (0)

PANNARIACEAE

1. Thallus squamulose to subfoliose, upper surface smooth 2
1. Thallus subfoliose to foliose, upper surface covered in soft hairy tomentum ..... *Erioderma* (0)
2. Apothecia lecanorine ..... *Pannaria* (1)
2. Apothecia lecideine ..... *Parmeliella* (0)

PARMELIACEAE

1. Lower cortex devoid of rhizines 2
1. Lower cortex with rhizines ..... *Parmelia* (60)
2. Thallus solid with thick, tough, small-celled upper cortex rolling into a ball when dry ..... *Chondropsis* (1)
2. Thallus solid or hollow with a thin, larger celled upper cortex, not rolling into a ball when dry 3
3. Upper cortex perforate ..... *Menegazzia* (1)
3. Upper cortex imperforate ..... *Hypogymnia* (4)

PELTIGERACEAE

1. Thallus deep blue green, phycobiont blue-green, apothecia on upper side of the lobe ends ..... *Peltigera* (1)

PERTUSARIACEAE

1. Thallus crustose, apothecia in warts, disk almost completely covered by margin, only small pore visible ..... *Pertusaria* (?)
1. Thallus crustose, apothecia sessile or immersed, disk open, margin at first large and heavily inrolled ..... *Ochrolechia* (4)

PHYSCIACEAE

1. Thallus crustose 2
1. Thallus foliose 4
2. Thallus sorediose, non fertile ..... *Buellia (Diploicia)* (1)
2. Thallus non-sorediose, fertile 3
3. Apothecia with a proper exciple only ..... *Buellia* (6)
3. Apothecia with a thalline exciple ..... *Rinodina* (2)
4. Upper cortex of hyphae parallel to the surface ..... *Anaptychia* (5)
4. Upper cortex of hyphae vertical to the surface 5
5. Pycnidiospores 10-25 μm long, upper surface K−, closely appressed to the substrate, usually grey-brown ..... *Physciopsis* (2)
5. Pycnidiospores 2-3 μm long, upper surface K+, attached to the substrate by longer rhizines, grey-blue or pale grey ..... *Physcia* (9)

PLACYNTHIACEAE

1. Thallus squamulose to subfoliose, apothecia large up to 3 mm diam., ascospores hyaline, simple ..... *Psoroma* (1)

PLEOSPORACEAE

1. Ascospores transversely septate ..... *Arthopyrenia* (0)
1. Ascospores muriform ..... *Polyblastiopsis* (0)

PYRENULACEAE

1. Thallus crustose, ascospores muriform, brown ..... *Anthracothecium* (0)

RAMALINACEAE

1. Thallus fruticose, erect or pendulous, flattened or inflated, without a central axis ..... *Ramalina* (4)

SIPHULACEAE

1. Thallus terricolous, fruticose, flattened or subterete, thick, attached to the substrate by penetrating rhizines ..... *Siphula* (1)

STEREOCAULACEAE

1. Thallus granular-crustose, pseudopodetia deep green, non-branched, apothecia terminal, black ..... *Pilophorus* (1)

TELOSCHISTACEAE

1. Thallus fruticose or subfoliose, upper cortex of hyphae parallel to the surface ..... *Teloschistes* (4)
1. Thallus foliose, upper cortex pseudoparenchymatous, hyphae vertical to the surface ..... *Xanthoria* (2)

THELOTREMATACEAE

1. Thallus terricolous or saxicolous, crustose, apothecia sunken into low warts, ascospores brown, muriform ..... *Diploschistes* (3)

TRAPELIACEAE

1. Thallus crustose fruiting bodies immersed, ascospores simple, hyaline .... *Trapelia* (1)

TRYPETHELIACEAE

1. Thallus crustose, fruiting bodies immersed in stromatic warts, ascospores hyaline, transversely septate ..... *Trypethelium* (0)

USNEACEAE

1. Thallus fruticose, erect or pendulous, terete, simply or compoundly branched with a strong central axis ..... *Usnea* (5)

VERRUCARIACEAE

1. Thallus crustose, saxicolous in marine environments ..... *Verrucaria* (1)
1. Thallus squamulose, terricolous or saxicolous in arid non-marine environments 2
   2. Perithecia immersed, ascospores non-septate, hyaline *Dermatocarpon* (2)
   2. Perithecia immersed, ascospores muriform, brown .... *Endocarpon* (4)

ARTIFICIAL KEY TO GENERA

1. Thallus fruticose or foliose 2
1. Thallus squamulose, crustose or leprose 3
2. Thallus fruticose ..... Section I
2. Thallus foliose ..... Secton II
3. Thallus squamulose or crustose ..... Section III
3. Thallus leprose ..... Section IV

Section I. Fruticose thalli

1. Thallus gelatinous when wet, phycobiont blue-green 2
1. Thallus not gelatinous when wet, phycobiont green 5
2. In marine splash zone on rocks ..... *Lichina*
2. Not in marine splash zone, on rocks and soil 3
3. Thallus a mat of elongate prostrate to ascending filaments ..... *Ephebe*
3. Thallus more or less ascending not filamentous 4
4. Thallus a cushion of thin, ascending terete branches ..... *Porocyphus*
4. Thallus forming a crust-like plaque of ascending branches as thick as they are tall ..... *Synalissa*
5. Primary thallus crustose bearing minute stipes a few millimetres tall, the stipes not photosynthetic, apothecia more or less globular on the stipes . 6
5. Thallus truly fruticose, or primary thallus crustose or squamulose but bearing podetia or pseudopodetia which are photosynthetic 7
6. Ascospores non-septate ..... *Chaenotheca*
6. Ascospores once-septate ..... *Calicium*
7. Thallus less than 1 cm tall, leprose- sorediose, in sheltered parts under rocky overhangs ..... *Leprocaulon*
7. Thallus not as above 8
8. Thallus elongate, thin, cylindrical to more or less terete 9
8. Thallus thick, more or less irregular 13
9. Thallus hollow upright on earth or amongst litter with few or many perforations through the walls ..... *Cladia*
9. Thallus solid, compactly filled with medulla 10
10. Thallus with a resistant central axis ..... *Usnea*
10. Thallus without a resistant central axis 11
11. Thallus perforated through the outer walls growing upright on earth or amongst litter ..... *Cladia*
11. Thallus not perforated, pendulous from trees or rocks or recumbent on calcareous soil 12
12. Thallus recumbent on soil ..... *Aspicilia*
12. Thallus erect or pendulous on trees ..... *Ramalina*
13. Primary thallus granulate-crustose, apothecia on erect pseudopodetia .. 14
13. Primary thallus not granular crustose 17
14. Apothecia pink or pale to dark brown 15
14. Apothecia black 16
15. Apothecia terminal pink to pale brown ..... *Baeomyces*
15. Apothecia laminal, cream to slate ..... *Thysanothecium*
16. Apothecia aggregated, disk flat ..... *Cladia*

16. Apothecia not aggregated, disk hemispheric ..... *Gymnoderma*
17. Thallus hollow 18
17. Thallus solid 21
18. Thallus forming cups ..... *Cladonia*
18. Thallus not forming cups 19
19. Thallus much inflated and somewhat lacerate, perforations in the walls very irregular ..... *Ramalina*
19. Thallus not inflated or lacerate 20
20. Thallus with a regular pattern of perforations through the walls into the central cavity ..... *Cladia*
20. Thallus imperforate, slightly irregularly perforate, or perforations appearing only in the axils of the branches ..... *Cladonia*
21. Thallus yellow-green to flame-orange, K+ purple ..... *Teloschistes*
21. Thallus other than above, K− 22
22. Thallus with basal squamules, on charred tree stumps or hard soil 23
22. Thallus without basal squamules 24
23. Brownish-green to yellow-brown, apothecia terminal ..... *Ramalea*
23. Straw-yellow to yellowish-green, apothecia lateral ..... *Thysanothecium*
24. On twigs, bark and occasionally on rock ..... *Ramalina*
24. On soil 25
25. With extensive underground branching system, thallus mineral-grey, medulla white ..... *Siphula*
25. Without extensive underground branching system, thallus greenish-brown, medulla yellow ..... *Ramalea*

Section II. Foliose thalli

1. Phycobiont blue-green 2
1. Phycobiont green 15
2. Thallus gelatinous when wet 3
2. Thallus not gelatinous when wet 9
3. Thallus corticate 4
3. Thallus ecorticate 6
4. Cortex distinctly cellular ..... *Leptogium*
4. Cortex of interwoven hyphae 5
5. Ascospores non-septate, thick walled ..... *Physma*
5. Ascospores septate, thin walled ..... *Collema*
6. Phycobiont *Nostoc* 7
6. Phycobiont *Calothrix* or *Xanthocapsa* 8
7. Ascospores non-septate, thick walled ..... *Physma*
7. Ascospores septate, thin walled ..... *Collema*
8. Phycobiont *Calothrix* ..... *Porocyphus*
8. Phycobiont *Xanthocapsa* ..... *Thyrea*
9. Lower cortex pseudocyphellate ..... *Pseudocyphellaria*
9. Lower cortex not pseudocyphellate 10
10. Lower cortex veined ..... *Peltigera*
10. Lower cortex not veined 11
11. Upper surface covered in soft hairy tomentum ..... *Erioderma*

11. Upper surface smooth 12
12. Apothecia lecideine 13
12. Apothecia lecanorine 14
13. Upper cortex of longitudinal hyphae ..... *Coccocarpia*
13. Upper cortex not of longitudinal hyphae ..... *Parmeliella*
14. Ascospores ovoid-elongate, with a thin wall, upper and lower cortices well developed ..... *Pannaria*
14. Ascospores round to ovoid with a thick wall, cortices poorly developed to missing ..... *Physma*
15. Lower surface pseudocyphellate or appearing pseudocyphellate 16
15. Lower surface not pseudocyphellate 17
16. Lower surface a mat of black rhizoids or rhizoids restricted to marginal tufts with a spongy lower surface ..... *Heterodea*
16. Lower surface uniformly rhizinate, rhizines scattered, lower cortex distinctly cellular ..... *Pseudocyphellaria*
17. Thallus gold or bright yellow, at least in part 18
17. Thallus neither gold nor bright yellow 20
18. Thallus K− ..... *Candelaria*
18. Thallus K+ 19
19. Thallus foliose, closely appressed, not beset with fine cilia or spinules ..... *Xanthoria*
19. Thallus more or less fruticose, ascending, often beset with fine cilia or spinules ..... *Teloschistes*
20. Thallus with vein-like markings on the lower surface 21
20. Thallus without vein-like markings on the lower surface 22
21. Apothecia on the upper side of marginal lobes, lower surface ecorticate ..... *Peltigera*
21. Apothecia on the lower side of marginal lobes, lower surface corticate ..... *Nephroma*
22. Lower surface with a dense tomentum 23
22. Lower surface naked or rhizinate 24
23. Thallus brown or grey ..... *Psoroma*
23. Thallus green or yellow-green ..... *Anzia*
24. Lower surface naked 25
24. Lower surface rhizinate 29
25. Thallus hollow 26
25. Thallus solid 27
26. Lobes perforated through the upper surface ..... *Menegazzia*
26. Lobes not perforated ..... *Hypogymnia*
27. Thallus neatly dichotomous, curling into a ball when dry ..... *Chondropsis*
27. Thallus irregularly lobed, not curling into a ball when dry 28
28. Thallus lobes less than 2 mm broad, thallus flat, upper surface brown ..... *Physciopsis*
28. Thallus lobes more than 2 mm broad, thallus inflated, upper surface bluish-grey ..... *Hypogymnia*
29. Rhizines restricted to the margins of the lobes 30
29. Rhizines uniformly distributed or absent from the margins 31

30. Margins of the thallus recurving when dry, cilia absent ..... *Heterodea*
30. Margins of the thallus not recurving when dry, ciliate ..... *Anaptychia*
31. Cortex poorly developed ..... *Normandina*
31. Cortex well developed, with apothecia if fertile 32
32. Thallus yellow-green, or with bulbate marginal cilia, or with dichotomous rhizines, or with a broad zone devoid of rhizines at the tips of the lobes ..... *Parmelia*
32. Thallus with none of the above characteristics 33
33. Ascospores unicellular, hyaline, lobes of many species more than 3 mm broad ..... *Parmelia*
33. Ascospores two-celled, brown, lobes less than 3 mm broad 34
34. Lower surface ecorticate ..... *Anaptychia*
34. Lower surface corticate 35
35. Thallus with marginal soralia, K+, P+ ..... *Anaptychia*
35. Thallus with other character combinations ..... *Physcia*

Section III. Crustose or squamulose thalli

1. Fruiting body stipitate, on podetia or pseudopodetia 2
1. Fruiting body immersed, adnate or sessile 13
2. Apothecia on tiny stipes not more than 1 mm tall 3
2. Apothecia on large podetial growths more than 3 mm tall 8
3. Ascospores brown, free in a mazaedium 4
3. Ascospores hyaline, enclosed in an ascus 5
4. Ascospores simple ..... *Chaenotheca*
4. Ascospores septate ..... *Calicium*
5. Ascospores many per ascus 6
5. Ascospores eight per ascus 7
6. Exciple pale, soft ..... *Biatorella*
6. Exciple black, brittle ..... *Sarcogyne*
7. Thallus crustose, apothecia lecanorine, ascospores septate ... *Icmadophila*
7. Thallus squamulose, apothecia lecideine, ascospores non-septate ..... *Gymnoderma*
8. Apothecia lateral, broad and flat ..... *Thysanothecium*
8. Apothecia terminal, usually convex 9
9. Podetia perforate 10
9. Podetia imperforate 11
10. Podetia perforate only in the axils, apothecia not forming terminal cymes ..... *Cladonia*
10. Podetia extensively perforate, often becoming clathrate, apothecia sometimes forming terminal cymes ..... *Cladia*
11. Brownish-green to yellow-brown ..... *Ramalea*
11. Straw-yellow to yellowish -green 12
12. Primary thallus a fine powdery crust, podetia mostly devoid of algae ..... *Baeomyces*
12. Primary thallus granulose to squamulose, podetia with algal layer ..... *Cladonia*
13. Ascospores more than eight per ascus 14

13. Ascospores one to eight per ascus 19
14. Phycobiont blue-green ..... *Peltula*
14. Phycobiont green 15
15. Apothecia immersed ..... *Acarospora*
15. Apothecia adnate or sessile 16
16. Apothecia lecanorine 17
16. Apothecia lecideine 18
17. Thallus yellow ..... *Candelariella*
17. Thallus grey to green ..... *Maronea*
18. Exciple pale, soft ..... *Biatorella*
18. Exciple dark, brittle ..... *Sarcogyne*
19. Ascospores simple, unilocular 20
19. Ascospores septate or polaribilocular 36
20. Thallus squamulose 21
20. Thallus crustose 27
21. Phycobiont blue-green 22
21. Phycobiont green 23
22. Apothecia lecideine ..... *Parmeliella*
22. Apothecia lecanorine ..... *Pannaria*
23. Fruiting body an apothecium 24
23. Fruiting body a perithecium 26
24. Apothecia immersed ..... *Trapelia*
24. Apothecia sessile to adnate 25
25. Apothecia lecideine ..... *Lecidea*
25. Apothecia lecanorine ..... *Psoroma*
26. Upper surface corticate, on rocks and soil ..... *Dermatocarpon*
26. Upper surface ecorticate, on bark ..... *Normandina*
27. Phycobiont blue-green 28
27. Phycobiont green 30
28. Thallus of discrete short, thick, erect, cylindrical lobes 29
28. Thallus granular ..... *Pyrenopsidium*
29. Substrate siliceous ..... *Porocyphus*
29. Substrate calcareous ..... *Synalissa*
30. Fruiting body a perithecium ..... *Verrucaria*
30. Fruiting body an apothecium 31
31. Apothecia immersed in the thallus or in warts 32
31. Apothecia adnate to sessile 34
32. Apothecia immersed in thalline warts ..... *Pertusaria*
32. Apothecia not in warts 33
33. Paraphyses unbranched ..... *Aspicilia*
33. Paraphyses branched and anastomosing ..... *Trapelia*
34. Disk of apothecium K+ purple ..... *Fulgensia*
34. Disk of apothecium K− or K+ but not K+ purple 35
35. Apothecia lecideine ..... *Lecidea*
35. Apothecia lecanorine ..... *Lecanora*
36. Fruiting body a perithecium or perithecium-like 37
36. Fruiting body not perithecial 42

37. Ascospores two-celled ..... *Microthelia*
37. Ascospores many-celled 38
38. Ascospores transversely septate only 39
38. Ascospores transversely and longitudinally septate 40
39. Fruiting bodies immersed in stromatic warts ..... *Trypethelium*
39. Fruiting bodies not immersed in stromatic warts ..... *Arthopyrenia*
40. Ascospores hyaline ..... *Polyblastiopsis*
40. Ascospores brown 41
41. Thallus squamulose ..... *Endocarpon*
41. Thallus crustose ..... *Anthracothecium*
42. Fruiting body with a round hymenial layer 43
42. Fruiting body with an elongate, irregular or star-shaped hymenial layer 58
43. Ascospores hyaline 44
43. Ascospores brown 54
44. Apothecia lecanorine 45
44. Apothecia lecideine 47
45. Ascospores with four or more cells ..... *Haematomma*
45. Ascospores two-celled or polaribilocular 46
46. Ascospores polaribilocular ..... *Caloplaca*
46. Ascospore walls not thickened ..... *Icmadophila*
47. Ascospores polaribilocular or two-celled 48
47. Ascospores more than two-celled 52
48. Ascospores polaribilocular ..... *Blastenia*
48. Ascospore walls not thickened 49
49. Thallus squamulose ..... *Toninia*
49. Thallus crustose 50
50. Apothecial disk yellow to orange ..... *Dimerella*
50. Apothecial disk pale to dark not orange 51
51. Apothecia less than 1 mm broad ..... *Catillaria*
51. Apothecia more than 1 mm broad ..... *Icmadophila*
52. Ascospores transversely septate only ..... *Bacidia*
52. Ascospores transversely and longitudinally septate 53
53. Apothecia black, ascospores grey to brown to black ..... *Rhizocarpon*
53. Apothecia yellow or pale, ascospores hyaline ..... *Bombyliospora*
54. Ascospores transversely septate only 55
54. Ascospores transversely and longitudinally septate 57
55. Apothecia lecideine ..... *Buellia*
55. Apothecia lecanorine 56
56. Ascospores free in a mazaedium ..... *Cyphelium*
56. Ascospores retained in the ascus ..... *Rinodina*
57. Apothecia immersed in the thallus or lecanorine ..... *Diploschistes*
57. Apothecia adnate to sessile, lecideine ..... *Rhizocarpon*
58. Ascospores transversely septate only 59
58. Ascospores transversely and longitudinally septate 65
59. Ascospores brown 60
59. Ascospores hyaline 61

60. Ascospores two-celled ..... *Melaspilea*
60. Ascospores more than two-celled ..... *Phaeographis*
61. Fruiting bodies clustered, immersed in stroma 62
61. Fruiting bodies single, not immersed in stroma 63
62. Hypothecium dark ..... *Chiodecton*
62. Hypothecium pale ..... *Enterographa*
63. Paraphyses unbranched, exciple well developed ..... *Graphis*
63. Paraphyses branched and anastomosing, exciple usually poorly developed 64
64. Ascospores usually two- to four-celled, cells of unequal size ... *Arthonia*
64. Ascospores usually four or more celled, cells uniform ..... *Opegrapha*
65. Ascospores brown ..... *Phaeographis*
65. Ascospores hyaline 66
66. Paraphyses branched and anastomosing ..... *Arthothelium*
66. Paraphyses unbranched ..... *Graphina*

Section IV. Leprose thalli

1. Thallus fruticose, pseudopodetia cartilaginous, leprose-sorediose, powdery ..... *Leprocaulon*
1. Thallus crustose, pseudopodetia absent, leprose, powdery ..... *Lepraria*

1. ACAROSPORA Mass. 1852a:27

Literature: Magnusson 1929, Weber 1968.

Thallus squamulose, scattered or forming a continuous crust, margins often lobed, commonly cellular throughout. *Apothecia* minute, immersed to subimmersed, 1-3 in each squamule, ascospores more than 100 in an ascus, minute, simple, hyaline.

ARTIFICIAL KEY TO SPECIES

1. Thallus yellow, greenish-yellow, yellow and pruinose ..... (Section Xanthothallia) 2
1. Thallus brown, reddish-brown to black, grey pruinose ..... (Section Phaeothallia) 3
2. Thallus of scattered areoles or if continuous then margins not lobate ... *A. schleicheri*
2. Thallus contiguous, margins sublobate ..... *A. novae-hollandiae*
3. Growing on rock 4
3. Growing on earth 7
4. Thallus K+ red on non-calcareous rock ..... *A. smaragdula*
4. Thallus K− 5
5. Growing on non-calcareous rock 6
5. Growing on calcareous rock, thallus C− ..... *A. cervina*
6. Thallus C+ red, growing on non-ferruginous rock ..... *A. fuscata*
6. Thallus C−, growing on ferruginous rock ..... *A. sinopica*
7. Thallus K+ red, on non-calcareous earth ..... *A. reagens*
7. Thallus K− on calcareous earth ..... *A. ferdinandii*

Acarospora cervina (Ach.) Mass. 1852a:28

Lecanora cervina Ach. 1814:188.

Thallus crustose to squamulose, indeterminate, pale brown, greyish-brown to greyish-white, often each areole has a white pruinose margin. *Apothecia* solitary or rarely two per areole; disk up to 1 (−2) mm diam., concave becoming level with the thallus at maturity, dark brown to black, sometimes pruinose; margin indistinct.

Reactions: Thallus K−, C−.

Specimen examined: On cement rendering on wall, Wynbring Rocks, 1·2 km north of Wynbring on East-West Railway Line, *R.B. Filson 11947,* 28.x.1970 (MEL 515439).

This species occurs also in Western Australia.

Acarospora ferdinandii (Müll. Arg.) Hue 1909:160.

Placodium ferdinandii Müll. Arg. 1881:508.

Thallus crustose or squamulose, of scattered areolae forming colonies varying from a few areolae to patches 5-6 cm diam.; areolae pale cream to dark brown in shaded habitats becoming heavily greyish-white pruinose in exposed. *Apothecia* solitary, rarely two per areole, up to 1·5 mm diam., at first punctiform becoming sessile at maturity; disk concave, dull, dark brown becoming jet black, epruinose; margin prominent, concolourous with the disk.

Reactions: Thallus K−, C−.

Figure: Habit, fig. 10A.

Specimens examined: Eyre Highway, 40 km east of Kimba, *R. B. Filson 11734,* 22.x.1970 (MEL 1017958); Mona, 6·4 km southwest of Bute, *R. B. Filson 12009,* 31.x.1970 (MEL 515435).

This species occurs also in Western Australia, Victoria and New South Wales.

Acarospora fuscata (Schrad.) Arn. 1872:279.

Lichen fuscatus Schrad. 1794:83.

Thallus crustose to squamulose, indeterminate, areolate, pale brownish-yellow to dark brown to reddish-brown, sometimes as scattered areoles sometimes continuous; upper surface smooth, somewhat shining. *Apothecia* one to several per areole; disk at first deeply punctiform then concave, reddish-brown to black.

Reactions: Thallus K−, C+ red, KC+ red.

This species has not yet been recorded in South Australia, but it grows in the rocky sandstone areas in the Big Desert, Victoria, near to the South Australian border.

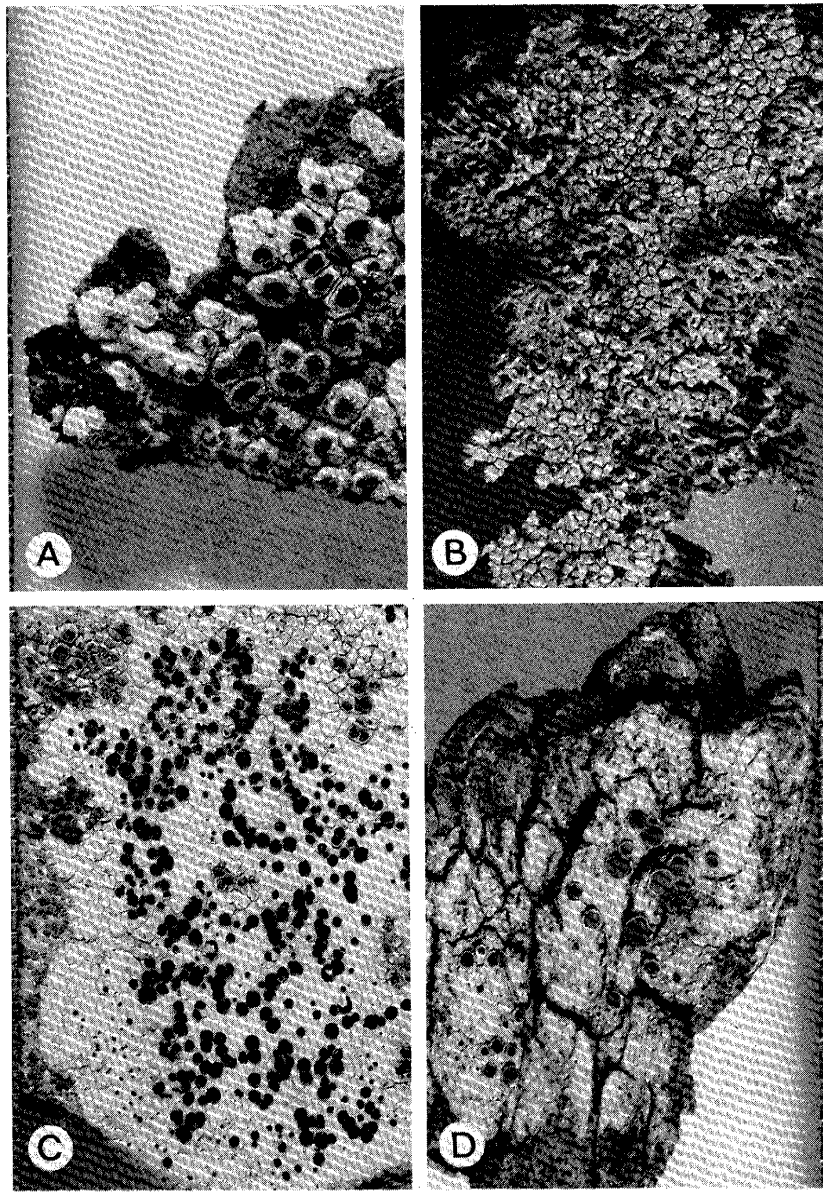


Fig. 10. A, *Acarospora ferdinandii*; B, *Aspicilia calcarea*; C, *Buellia subalbula*; D, *Caloplaca cerina*. Scale in millimetres.

Acarospora novae-hollandiae H. Magn. 1929:89.

Thallus crustose, contiguous, up to 8 cm diam., thin, greenish-yellow in the shade to bright primuline yellow in sunlight, epruinose; margins sublobate. *Apothecia* solitary, punctiform, 0·2-0·3 mm diam.; disk deeply immersed, dark brown to black; margin concolourous with the thallus heavily inrolled.

Reactions: Thallus K−, C−, UV+.

Specimens examined: vicinity of Arckaringa Creek, *R. Helms 66,* 25.v.1891 (MEL 9180); Everard Ranges, 3000 feet (1000 m), *R. Helms 85,* 3.vi.1891 (MEL 9183); Rocky hillside, Olive Grove Station, 14·5 km south of Quorn, *R. B. Filson 11991,* 30.x.1970 (MEL 515442).

The species occurs also in Western Australia, Northern Territory, Victoria and New South Wales.

Acarospora reagens Zahlbr. 1902:162.

Thallus crustose or squamulose of scattered areolae forming small colonies up to 3 cm diam.; areolae pale brownish-cream in shaded habitats becoming heavily greyish-white pruinose in exposed. *Apothecia* one to several per areole up to 1·5 mm diam. immersed in areolae; disk concave to flat, sometimes convex at maturity, dull, black, epruinose; margin indiscernible.

Reactions: K+ red, C−.

A. reagens occurs in Western Australia and Victoria; it has not yet been recorded in South Australia but it is likely to occur on soil in arid regions. It is very similar to *A. ferdinandii* differing in the emarginate apothecium which is never raised above the surface of the areolae and in the K+ reaction of the thallus.

Acarospora schleicheri (Ach.) Mass. 1852a:27.

Urceolaria schleicheri Ach. 1810:322.

Thallus crustose to squamulose, areolae scattered or sometimes contiguous but then the margins never become sublobate, thick, greenish-yellow to primuline yellow sometimes to pale orange. *Apothecia* solitary up to 0·5 (−1·0) mm diam. concave; disk pale reddish-brown to dark brown, concave; margin prominent or absent.

Reactions: K−, C−.

Selected specimens examined: c. 70 km south of Vokes Corner. Vokes Corner is c. 230 km north of Cook on the East-West Railway Line, *N. N. Donner 3974a,* 21.vii.1972 (MEL 1018590, AD); near the Everard Ranges, *R. Helms 25,* 31.v.1891 (MEL 9184); Officer Creek, 30 miles south of Everard Ranges, *D. N. Krahenbuehl 2413,* 5.ix.1968 (MEL 37635); Wynbring Rocks, 1·2 km north of Wynbring on the East-West Railway Line, *R. B. Filson 11942,* 28.x.1970 (MEL 515436); Wilgena Hill, 6·5 km north of Kingoonya-Tarcoola Road, 67·5 km west of Kingoonya, *R. B. Filson 11924,* 26.x.1970 (MEL 515434); vicinity of

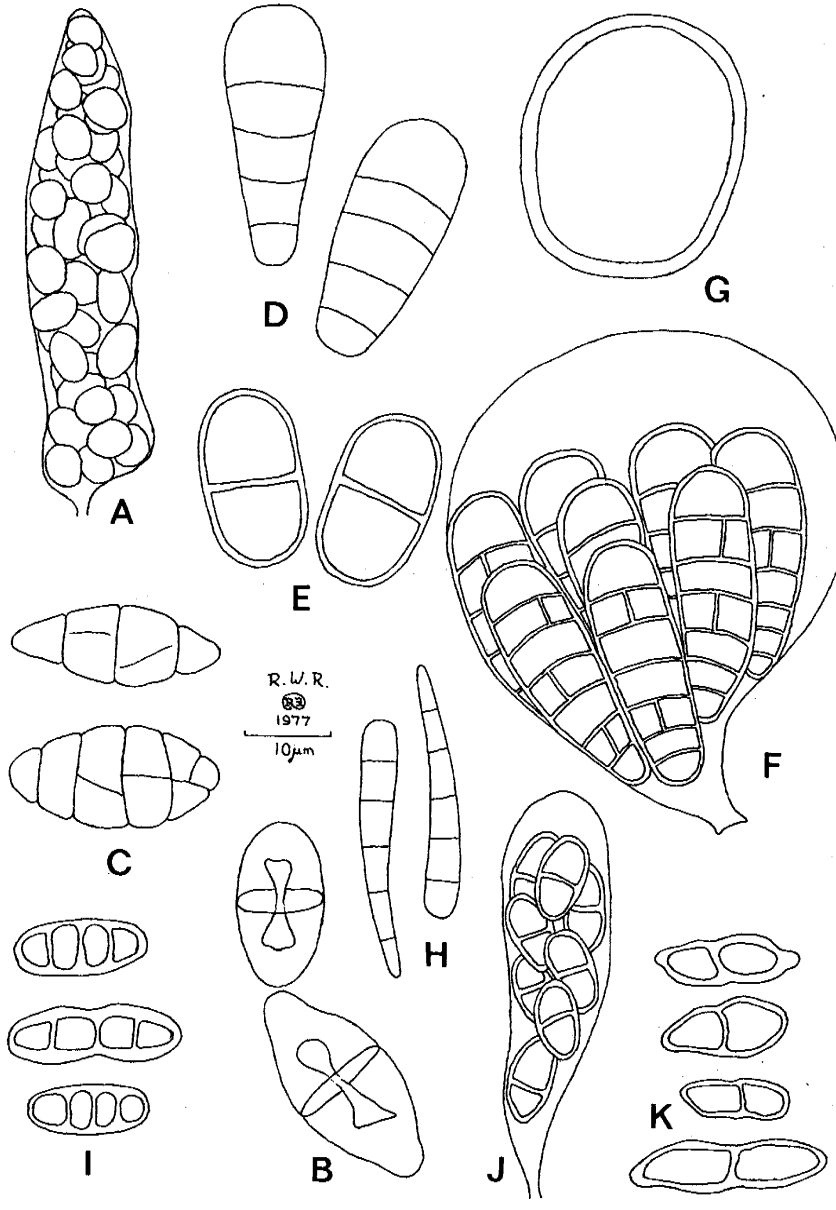


Fig. 11. A, *Acarospora smaragdula*, ascus containing spores; B, *Anaptychia tremulans*, ascospores; C, *Anthracothecium ochraceoflavum*, ascospores; D, *Arthonia* sp., ascospores; E, *Arthopyrenia alba*, ascospores; F, *Arthothelium* sp., ascus containing spores; G, *Aspicilia calcarea*, ascospore; H, *Bacidia fuscorubella*, ascospores; I, *Bombyliospora domingensis* var. *aurantiaca*, ascospores; J, *Buellia subalbula*, ascus containing spores; K, *Buellia parasema*, ascospores.

Arckaringa Creek, *R. Helms 65*, 25.v.1891 (MEL 9184); summit of low ridge above Warren Gorge, *J. Curtis 5*, 23.iv.1967 (MEL 26343).

Acarospora schleicheri is a very common yellow lichen found in almost every inland habitat where it sometimes covers areas many metres in diameter. It may be confused with *A. novae-hollandiae* which is also a yellow species growing in similar habitats; however *A. schleicheri* usually forms a thicker areole which does not have lobate, radiate margins and the areoles are more often scattered. On the other hand the thallus of *A. novae-hollandiae* is more often continuous, with radiate margins and the margins of isolated areole become sublobulate. These two species are difficult to separate when the sample consists of only a few areoles.

Acarospora sinopica (Wahlenb.) Körb. 1859:57.

Endocarpon sinopicum Wahlenb. apud Ach. 1803:30.

Thallus crustose, areolate, forming small patches on substrate, reddish-brown to dark brown to almost black. *Apothecia* abundant, one to several per areole; disk dark brown to black, deeply punctiform, 0·5 mm diam.

Reactions: K−, C−.

Specimen examined: Simpson Desert, K. G. Simpson, ? 1973 (MEL 1020179).

This species occurs also in Western Australia.

Acarospora smaragdula (Wahlenb.) Mass. 1852a:29.

Endocarpon smaragdulum Wahlenb. apud Ach. 1803:29.

Thallus crustose to squamulose, indeterminate, pale brownish-cream to mid-brown, usually scattered on substrate. *Apothecia* several per areole; disk dull, dark brown to black, up to 0·3 mm diam.; margin not prominent.

Reactions: K+ red, C−.

Figure: Ascus containing spores, fig. 11A.

Acarospora smaragdula has been recorded from dry areas in Western Australia; it has not yet been recorded in South Australia but is likely to occur on non-calcareous rock. It differs from the other rock-inhabiting species in the K+ reaction of the thallus.

2. ANAPTYCHIA Körb. 1848:197.

Literature: Kurokawa 1962.

Thallus foliose, prostrate to somewhat ascending at the margins, lobes flat or caniculate, often ciliate, attached to the substrate by rhizines which may be restricted to the margins, differentiated into an upper cortex of parallel hyphae, an algal and medullary layer and a poorly formed lower cortex. *Apothecia* small to large, sessile or pedicillate; disk slightly convex, brown, black or pruinose; margin concolourous with the thallus; ascospores eight in ascus, brown, oblong to ellipsoid, uniseptate.

ARTIFICIAL KEY TO SPECIES

1. Lower surface corticate 2
1. Lower surface ecorticate 3
   2. Medulla K+ yellow turning red ..... *A. pseudospeciosa*
   2. Medulla K+ persistent yellow ..... *A. tremulans*
3. Medulla K+ yellow turning red ..... *A. dendritica*
3. Medulla K+ persistent yellow 4
   4. Lower surface deep or brownish-yellow ..... *A. obscurata*
   4. Lower surface white ..... *A. japonica*

Anaptychia dendritica (Pers.) Vain. 1890a:134.

Borrera dendritica Pers. 1826:207.

Thallus greyish- or greenish-white, forming rosettes which sometimes coalesce, up to 15 cm in diam., attached to the substrate by marginal rhizines, lobes 0·7-2·0 mm broad, smooth, often slightly pruinose near the apices, without soredia or isidia; lower surface ecorticate and arachnoid, purple-black near the centre, but often yellow or ochraceous near the ends of the lobes. *Apothecia* rare, 1·0-4·0 mm diam.

Reactions: Thallus K+ yellow, medulla K+ yellow turning red, C−, P+ yellow.

This species occurs in Victoria, New South Wales and Queensland. It is at present not recorded for South Australia, but is likely to occur in the Mount Lofty Ranges or the South-East.

Anaptychia japonica (Sato) Kurokawa 1962:58.

Anaptychia dendritica var. *japonica* Sato 1936:427.

Thallus greyish-white forming colonies up to 5 cm diam., attached to the substrate by marginal rhizines; lobes 1·0-1·5 mm broad, smooth, sometimes lightly pruinose, the apices ascending with terminal soralia; lower surface white, corticate only at the margins, the rest arachnoid; rhizines marginal, white to black. *Apothecia* rare, 1·0-1·5 mm diam.; ascospores 11-15 x 22-30 μm, with thick walls and complex locules.

Reactions: Thallus K+ yellow, medulla K± yellow, C−, KC−, P± yellow.

Specimen examined: Hindmarsh Falls, *R. W. Rogers 2010,* 7.v.1976 (R.W.R.).

This species occurs over mosses on sheltered ledges at Hindmarsh Falls and is unlikely to be common in South Australia. It is found also in Victoria and on the Bass Strait islands.

Anaptychia obscurata Tuck. in Nyl. 1863b:440.

Thallus greyish- or greenish-white, up to 15 cm diam., attached to the substrate by marginal rhizines; lobes 0·7-2·0 mm broad, smooth, without pruina,

forming capitate soralia at the tips of lateral lobes, non-isidiose; lower surface ecorticate and arachnoid, deep yellow to brownish-yellow. *Apothecia* rare 1·0-5·0 mm diam.

Reactions: Thallus K+ yellow, medulla K+ yellow, C−, KC−, P± pale yellow.

This species occurs in Victoria and New South Wales. It is not at present recorded in South Australia, but it is likely to occur in the Mount Lofty Ranges or the South-East.

Anaptychia pseudospeciosa Kurokawa 1959:176.

Thallus greyish-white forming rosettes which sometimes coalesce, up to 5 cm diam., attached to the substrate by laminal rhizines, non-isidiose; lobes 0·7-1·5 mm broad; soralia capitate at the tips of short lateral lobes; lower surface white, corticate, with sparse pale rhizines. *Apothecia* rare, 1·0-3·0 mm diam.

Reactions: Thallus K+ yellow, medulla K+ yellow turning red, C−, KC−, P+ yellow.

This species is common on coastal rocks in Victoria. It is not known in South Australia, but may occur on rocks in wetter areas.

Anaptychia tremulans (Müll. Arg.) Kurokawa 1973:597.

Physcia hypoleuca var. *tremulans* Müll. Arg. 1880:277.

Anaptychia pseudospeciosa var. *tremulans* (Müll. Arg.) Kurokawa 1962:26.

Thallus greyish-white forming rosettes which sometimes coalesce, up to 5 cm diam., attached to the substrate by laminal rhizines, non isidiose; lobes 0·7-1·5 mm broad with capitate soralia at tips of short lateral lobes; lower surface white, ecorticate, with sparse pale rhizines. *Apothecia* rare, 1·0-3·0 mm diam.; ascospores brown, thick walled, simple, 12-14 x 26-32 μm.

Reactions: Thallus K+ yellow, medulla K+ yellow, C−, KC−, P+ yellow.

Figure: Ascospores, fig. 11B.

Specimen examined: Victor Harbor, *R. W. Rogers 1887,* 28.viii.1970 (R.W.R.).

A common coastal species of Victoria, Tasmania, New South Wales and Queensland.

Kurokawa (1962) considered the species one of the commonest lichens in tropical and temperate regions. It is very variable in thallus morphology, and is found on a range of substrates, including both rock and bark. It is likely to be found throughout the wetter parts of the State, probably in association with *Physcia* species, with which it may be confused. *A. tremulans* differs from *A. pseudospeciosa* in the absence of salacinic acid resulting in the K+ yellow medullary reaction.

3. ANTHRACOTHECIUM Hampe apud Mass. 1860:330

Thallus crustose, epi- or endophloic, ecorticate. *Pseudothecia* perithecium-like, more or less immersed in small thalline warts, either singly or in groups; asci clavate with one to eight spores; ascospores brown, muriform; paraphyses unbranched, free.

Figure: Ascospores, fig. 11C.

No specimens referable to this genus have been located in South Australia, but it is likely to grow on bark in the South-East of the State.

4. ANZIA Stiz. 1861:44

Thallus foliose, lobate, upper surface corticate, cellular, of vertical hyphae, algal layer distinct, medulla woolly, composed of more or less parallel longitudinal interwoven hyphae; lower surface composed of a spongy network of anastomosing hyphae. *Apothecia* laminal, concave to crateriform, lecanorine; margin concolourous with the thallus; asci many spored; ascospores hyaline, simple, ellipsoidal or slightly curved.

ARTIFICIAL KEY TO SPECIES

1. Thallus isidiose, usually sterile ..... *A. wilsonii*
1. Thallus non-isidiose, usually fertile ..... *A. angustata*

Anzia angustata (Pers.) Müll. Arg. 1889:507.

Parmelia angustata Pers. 1826:195

Thallus yellow-green, up to 5 cm across, lobes 1·0-2·0 mm broad, non-isidiose; lower surface dark and spongy. *Apothecia* common up to 1 cm diam.

Figure: Habit, fig. 12B.

This species is common in Victoria and New South Wales; it is at present not recorded in South Australia, but is likely to occur in the Mount Lofty Ranges or in the South-East.

Anzia wilsonii Räs. 1944:2.

Thallus yellow-green, up to 5 cm across, lobes 1·0-2·0 mm broad, densely papillose-isidiose; lower surface with dark spongy patches. *Apothecia* rare 2·0-3·0 mm diam.

Figure: Habit, fig. 12A.

Specimen examined: Comaum, *K. Alcock 24,* 2.ix.1973 (MEL 1018635).

The species occurs in Victoria, Tasmania, New South Wales and Queensland.

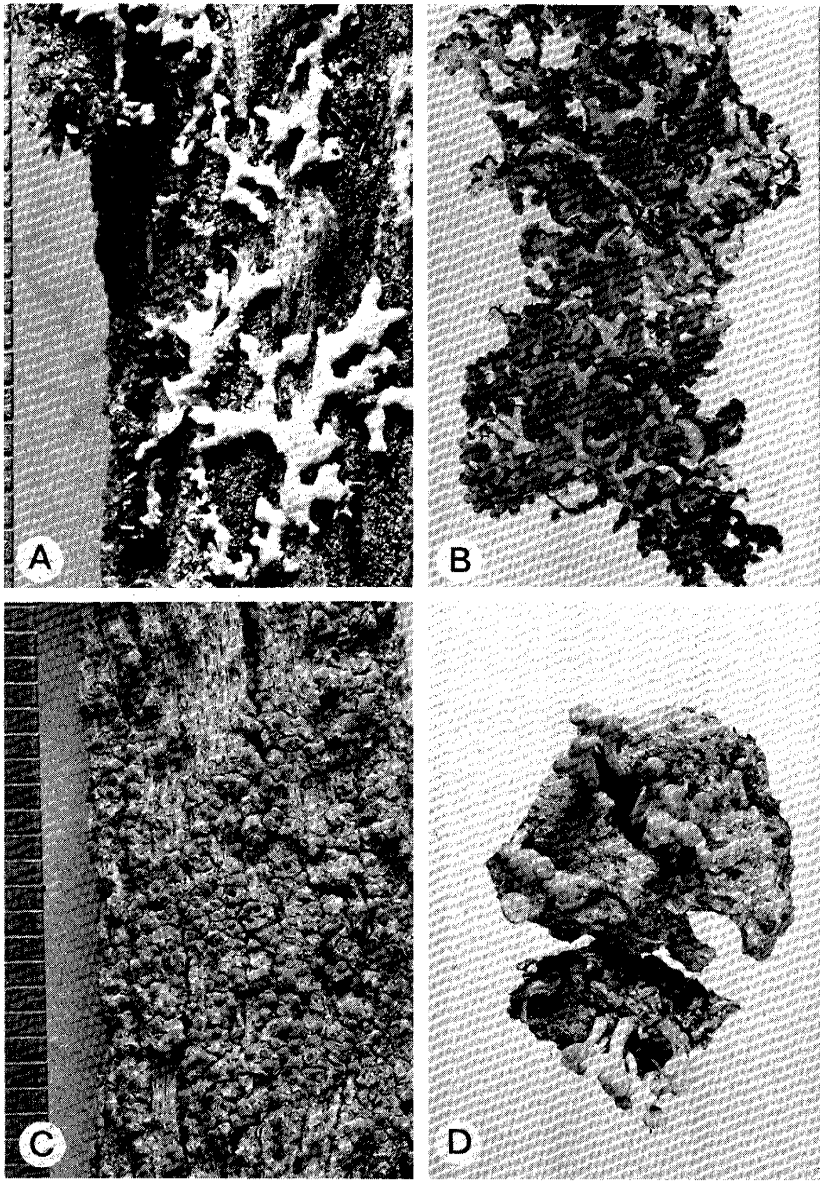


Fig. 12. A, *Anzia wilsonii;* B, *Anzia angustata;* C, *Bombyliospora domingensis* var. *aurantiaca;* D, *Baeomyces fungoides.* Scale in millimetres.

5. ARTHONIA Ach. 1806:3

Thallus crustose, often endophloic, ecorticate. *Pseudothecia* often rather lirella-like, elongate to round or star-shaped, immersed in the thallus, devoid of an exciple; asci almost globose to pyriform or obovoid, often with a heavily thickened apex, eight-spored; ascospores two- to many-celled, the locules often of unequal size, usually hyaline; paraphyses very thin, reticulately branched and interwoven.

Figure: Ascopores, fig 11D.

At present no collections are known of this genus in South Australia but it is likely to occur as inconspicuous white stains on the bark of trees.

6. ARTHOPYRENIA Mass. 1852a:165

Thallus crustose, thin, often endophloic. *Pseudothecia,* perithecium-like more or less immersed in the thallus; asci eight-spored; ascopores hyaline, transversely two- to six-septate, often with protuberences on the ends; paraphyses reticulately branched and anastomosing.

Figure: Ascospores, fig. 11E.

At present there are no known collections from South Australia but it is likely to occur on wood, bark or rock.

7. ARTHOTHELIUM Mass. 1852a:54

Thallus crustose, often endophloic, ecorticate. *Pseudothecia* rather lirella-like, elongate to round or star-shaped, immersed in the thallus, devoid of an exciple; asci almost globose to pyriform or obovoid, often with a heavily thickened apex, eight-spored; ascospores muriform, usually hyaline; paraphyses very thin, reticulately branched and interwoven.

Figure: Ascus containing spores, fig. 11F.

At present there are no collections known from South Australia but species of this genus are likely to be found forming inconspicuous white stains on the bark of trees.

8. ASPICILIA (Stiz.) Mass. 1852a:169

Thallus crustose or subfruticose, more or less areolate, corticate or ecorticate. *Apothecia* immersed in the thallus; asci normally eight-spored; ascospores hyaline, simple, ellipsoidal.

Aspicilia calcarea (L.) Mudd. 1861:161

Lichen calcareus L. 1753:1140

Lecanora calcarea (L.) Sommerf. 1826:102

Thallus rough, chinky to areolate or fruticose, grey to greyish-white. *Apothecia* small 0·5-1·0 mm diam., immersed; disk flat, brown to black often heavily pruinose; margin thin, concolourous with the thallus, smooth becoming crenulate sometimes disappearing; ascospores two to eight in ascus, broadly ellipsoid, 18-30 x 14-27 μm, hyaline.

Figure: Habit, fig. 10B; ascospore, fig 11G.

Specimen examined: Koonamore Vegetation Reserve, *R. W. Rogers 1416*, 28.v.1968 (MEL 1011689).

Aspicilia calcarea is widespread on soil and rocks in arid areas of Victoria and New South Wales. The fruticose form is usually found growing off pebbles onto the soil. This form has pseudocyphellae on the upper surface, is always sterile and has been referred to a separate genus, *Agrestia* Thomson.

9. BACIDIA de Not. 1846:189.

Thallus crustose, granulose, inconspicuous, sometimes disappearing, not differentiated into distinct layers. *Apothecia* usually adnate, but sometimes sessile or immersed, lecideine; disk becoming convex, flesh-coloured to brown or black; margin concolourous with the disk; asci long- or cylindrico-clavate, eight-spored; ascospores hyaline acicular, several septate.

Figure: Ascospores, fig. 11H.

No collections from South Australia have been determined as *Bacidia*, but *B. luteola* (Schrad.) Mudd. was collected on bark at Portland in western Victoria, so it is likely to occur in the South-East.

10. BAEOMYCES Pers. 1794:19

Literature: Thomson 1967.

Thallus crustose, granulose, squamulose or marginally foliose, attached to the substrate by medullary hyphae or rhizines; cortex with one or more paraplechtenchymatous layers, or lacking. *Apothecia* round, finally swollen on more or less a distinct podetia often containing algae, sometimes the base of the podetia partly or entirely overgrown by an algal layer with a cortex similar to that of the thallus; hypothecium and exciple not distinct from the interior of the stipe; asci cylindrical; ascospores eight in ascus, fusiform or ellipsoidal, hyaline, up to four-celled; paraphyses simple or sparingly branched.

ARTIFICIAL KEY TO SPECIES

1. Podetium tall, chalk-pink, bearing a single apothecium ..... *B. fungoides*
1. Podetium low or lacking, flesh-coloured, bearing one to numerous apothecia ..... *B. heteromorphus*

Baeomyces fungoides (Sw.) Ach. 1803:320

Lichen fungoides Sw. 1788:146.

Thallus a thin green granular crust, sometimes almost lacking. *Apothecia* solitary terminal on pink chalk-like podetia up to 1·5 cm tall, emarginate, inflated sometimes almost spherical.

Figure: Habit, fig. 12D.

Baeomyces heteromorphus Nyl. 1860:351.

Thallus a thin green to granular crust. *Apothecia* solitary or numerous on short pinkish-brown to flesh-coloured podetia up to 1 cm tall, with a distinct margin; disk plane to hemispheric but not inflated.

Baeomyces is common in Victoria, Tasmania and New South Wales; it has not yet been recorded for South Australia but is likely to occur on roadside cuttings and other bare soil in the damper parts of the State.

11. BIATORELLA Th. Fr. 1861b:299.

Thallus crustose, sometimes lobed at the margins, ecorticate or with a rudimentary upper cortex. *Apothecia* with a pale soft proper exciple, sessile to shortly stipitate; asci broadly clavate, many spored; ascospores hyaline, simple; paraphyses simple.

Material referable to this genus has been collected on soil in Mallee areas. Other species are likely to be found on wood.

12. BLASTENIA Mass. 1852a:101.

Thallus crustose, smooth or powdery to granulose or areolate, devoid of differentiation into layers. *Apothecia* immersed to adnate; disk pale orange to reddish-orange or black, concave to convex; margin concolourous with the disk, sometimes disappearing; asci clavate; ascospores usually eight in the ascus, hyaline, ellipsoid to oblong-ellipsoid, two-celled.

At present this genus is not recorded in South Australia but it is likely to occur on trees or rocks.

13. BOMBYLIOSPORA de Not. apud Mass. 1852a:114.

Thallus crustose, smooth or powdery to granulose or areolate, not differentiating into layers. *Apothecia* immersed or sessile, pale orange to reddish-black; margin concolourous with the disk, sometimes disappearing; asci linear, usually eight-spored; ascospores four- to many-celled.

Bombyliospora domingensis var. **aurantiaca** Zahlbr. in Magnusson and Zahlbr. 1945:32.

Thallus granular crustose of greyish-green squamules. *Apothecia* numerous, bright orange to brick-red.

Figure: Habit, fig. 12C; ascospores fig. 11I.

Specimens examined: Canunda National Park, 9 miles (14 km) west of Millicent, *R. B. Filson 14657,* 17.v.1973 (MEL 1018594); 10 km north of Artimore Ruins, Flinders Ranges, *R. B. Filson 15582,* 11.xi.1975 (MEL 1018595).

It is recorded also from Victoria and the Bass Strait islands.

The name *Caloplaca aurantiaca* (Lightf.) Th. Fr. has been erroneously applied to collections of this taxon in Australia.

14. BUELLIA de Not. 1846:195.

Literature: Magnusson 1955, Sheard 1964.

Thallus crustose to warty or granulose, commonly areolate. *Apothecia* hard, immersed or sessile; disk black, flat to convex; margin concolourous with the disk, disappearing; asci clavate; ascospores eight in the ascus, brown, usually two-celled, ellipsoidal, or oblong-ellipsoidal, often constricted at the septum.

Figure: Buellia subalbula, habit, fig. 10C; ascus containing spores, fig. 11J. *Buellia parasema,* ascospores, fig. 11K.

This genus contains a great number of species; the Australian material being poorly known. Two species are known to occur on the arid soils, *B. epigaea* (Hoffm.) Tuck., which is subfoliose and has a chalky-white upper surface and *B. subcoronata* (Müll. Arg.) Malme, which is squamulose with a cream upper surface.

Two species are common on limestone pebbles, *B. subalbula* (Nyl.) Müll. Arg. which has a thin white powdery thallus with uni-septate spores and *B. alboatra* (Hoffm.) Branth. et Rostr. which has a thicker, white areolate thallus with muriform spores. *B. spuria* (Schaer.) Anzi is common on acidic rocks and *B. parasema* (Schaer.) de Not., together with *Buellia (Diploicia) canescens* (Dicks.) Mass., are common on trees and posts.

15. CALICIUM Pers. 1794:20.

Literature: Tibel 1975.

Thallus endophloic to coarsely granular, bearing stipitate fruiting bodies up to 2 mm tall. *Apothecia* cup-like to lens-shaped, with a flat to convex open disk; asci cylindrical to clavate; ascospores eight in ascus, two-celled, brown to black. With age the asci disintegrate leaving the spores free in the paraphyses.

Figure: Ascospores, fig. 13A.

Calicium glaucellum Ach. 1803:97.

Thallus thin to endophloic. *Apothecia* black, cup-shaped, faintly white-pruinose on lower side; stipe up to 2 mm tall, black; ascospores brown.

Specimen examined: Ewens Ponds, 10 km east of Port MacDonnell, *R. B. Filson 15814*, 8.iii.1977 (MEL 1018555).

Calicium species are difficult to locate in the field. They are lignicolous or corticolous and blend in with the features of the substrate. Several species are known to occur in south-eastern South Australia, however the one described above appears to be the most common. Species of *Calicium* are common also in Victoria and New South Wales.

16. CALOPLACA Th. Fr. 1871:167.

Literature: Wade 1965. Alon and Galun 1970.

Thallus crustose or squamulose, closely appressed to the substrate; upper surface corticate, yellow to orange-red, or white, grey or black. *Apothecia* usually yellow to orange, sessile or immersed; margin usually prominent, concolourous with the thallus; asci eight-spored; ascospores hyaline, polaribilocular.

Figure: Caloplaca fulgens, habit, plate 2A (MEL 1021213). *Caloplaca cerina*, habit, fig. 10D; ascospores, fig. 13B. *Caloplaca ferruginea*, ascospores, fig. 13C. *Caloplaca holocarpa*, ascospores, fig. 13D. *Caloplaca murorum*, ascospores, fig. 13E.

Reactions: Thallus K− or K+ purple, apothecial disk always K+ purple.

This is a large genus and the Australian material is very poorly known. A number of species are recorded from South Australia on soil, rock and bark. On arid soils, *C. cinnabarina* (Ach.) Zahlbr. is widespread but not common. It possibly also occurs on rocks. *C. murorum* (Hoffm.) Th. Fr. is a common species on rock and is easily distinguished by the presence of distinct marginal lobes. *C. holocarpa* has a grey, evanescent thallus and *C. fulgens* a deep orange thallus with immersed apothecia. *C. cerina* (Ehrh. ex Hedw.) Th. Fr. and *C. ferruginea* (Huds.) Th. Fr. both occur on bark, but the former has a distinguishing white or grey thalline margin to the apothecia.

17. CANDELARIA Mass. 1852a:567.

Literature: Almborn 1966.

Thallus foliose, more or less irregularly lobed, usually bright yellow but sometimes greenish-yellow; upper and lower cortex well developed with a thin algal and medullary layer, attached to the substrate by rhizines. *Apothecia* small up to 1 mm diam., sessile; disk flat to convex; margin prominent, concolourous with the thallus; ascospores sixteen to thirty-two in the ascus, hyaline, ellipsoid to ovate, simple or two-celled.

Candelaria concolor (Dicks.) Stein *in* Cohn 1879:84.

Lichen concolor Dicks. 1793:18.

Thallus citrine-yellow forming patches up to 1 cm across, sometimes coalescing into larger, areas, ascending from the substrate; lobes up to 0·4 mm broad, often lacerate, margins usually with granular soredia, which may spread to the upper and lower surfaces; lower surface white or pale brown. *Apothecia* rare, less than 1 mm diam., concave to slightly convex.

Reactions: Thallus K−.

Figure: Ascospores, fig. 13F.

Specimens examined: Roopena Station 60 km north west of Whyalla, *R. W. Rogers 1748*, 10.viii.1969 (R. W. R.); Lincoln Gap Station, 25 km south west of Port Augusta, *R. W. Rogers 75*, 13.i.1966 (R.W.R.); Burra, *R. W. Rogers 1879*, 20.viii.1970 (R.W.R.).

Rare on the bark of trees and shrubs, so far only collected from the arid and sub-arid parts of the State. It is common in Victoria, New South Wales and Queensland.

This species is easily distinguished from *Teloschistes* or *Xanthoria* by the K− reaction of the upper cortex.

18. CANDELARIELLA Müll. Arg. 1894:11.

Literature: Hakulinen 1954.

Thallus crustose, areolate, warty, marginal lobes sometimes radiate. *Apothecia* sessile; disk yellow to golden; margin concolourous with the thallus; ascospores eight in ascus, hyaline, simple or two-celled.

ARTIFICIAL KEY TO SPECIES

1. Thallus growing on bark, ascospores eight in ascus ..... *C. antenaria*
1. Thallus growing on rock 2
   2. Ascospores eight in ascus ..... *C. spraguei*
   2. Ascospores > eight in ascus ..... *C. vitellina*

Candelariella antenaria Räs. 1939:137.

Thallus evanescent. *Apothecia* 0·2-0·7 mm diam., plane to convex; margin entire to crenate; disk deep yellow, opaque; ascospores eight in ascus, simple, 14-20 x 5-6 μm; paraphyses septate with annulate, club-shaped apices.

Reactions: Thallus K−, medulla K−, apothecia K−.

Specimen examined: Koonamore Vegetation Reserve, *R. W. Rogers 1594*, 19.xii.1968 (R.W.R.).

It is often found growing on dead wood amongst *Bombyliospora domingensis* var. *aurantiaca* and is also common in Victoria.

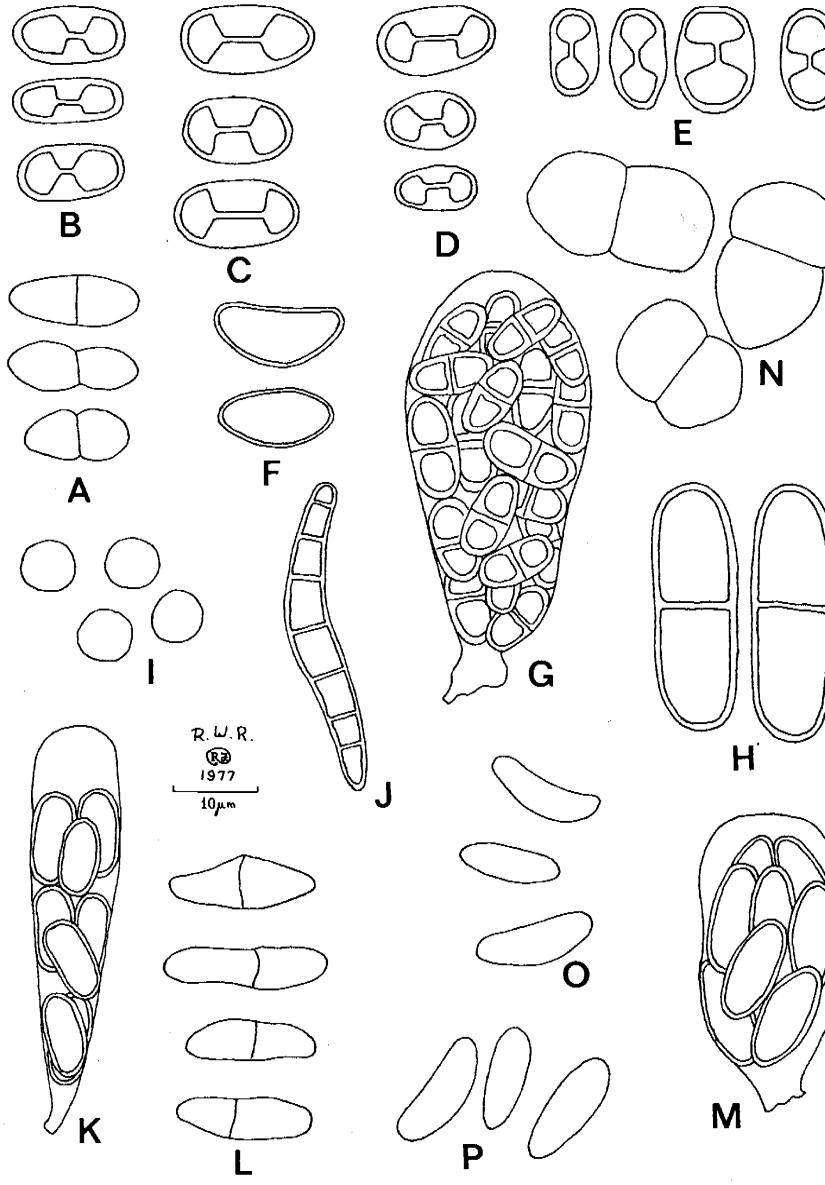


Fig. 13. A, *Calicium albietinum*, ascospores; B, *Caloplaca cerina*, ascospores; C, *Caloplaca ferruginea*, ascospores; D, *Caloplaca holocarpa*, ascospores; E, *Caloplaca murorum*, ascospores; F, *Candelaria concolor*, ascospores; G, *Candelariella vitellina*, ascus containing spores; H, *Catillaria* sp., ascospores; I, *Chaenotheca* sp., ascospores; J, *Chiodecton* sp., ascospores; K, *Chondropsis semiviridis*, ascus containing spores; L, *Collema coccophorum*, ascospores; M, *Coccocarpia pellita*, ascus containing spores; N, *Cyphelium* sp., ascospores; O, *Cladonia verticillata*, ascospores; P, *Cladia aggregata*, ascospores.

Candelariella spraguei (Tuck.) Zahlbr. 1928:802.

Placodium spraguei Tuck. 1882: I, 54.

Thallus saxicolous, of scattered or continuous small lobulate, imbricated areolae, bright yellow to greenish-yellow. *Apothecia* up to 0·75 mm diam., clustered, contorted; disk greenish-yellow, convex; margin concolourous with the thallus, prominent, crenulate; ascospores simple, hyaline 10-15 x 6-7 μm.

Reactions: Thallus K−, medulla K−, apothecia K−.

Specimen examined: Rocky outcrop, 100 metres from the Ernabella road, 6 km west of "Kenmore Park" H.S., Musgrave Ranges, *R. B. Filson 15689*, 26.xi.1975 (MEL 1018603).

Candelariella vitellina (Ehrh.) Müll. Arg. 1894:47.

Lichen vitellinus Ehrh. 1785: 155.

Thallus saxicolous of scattered areolae, golden-yellow to yellow-orange. *Apothecia* up to 0·5 mm diam., clustered; disk yellow-orange, plane to convex; margin persistent, at first entire becoming crenulate, concolourous with the thallus; ascospores up to 32 per ascus, ellipsoid, simple, often appearing two-celled, sometimes slightly curved, 9-10 x 5-6 μm.

Reactions: Thallus K−, medulla K−, apothecia K−.

Figure: Ascus containing spores, Fig. 13G.

Specimen examined: side track, 100 metres north from Port Germein Gorge road, 16 km east of Port Germein, *R. B. Filson 15551a*, 16.xi.1975 (MEL 1018577).

It also occurs in Victoria, New South Wales, Queensland and Western Australia.

19. CATILLARIA (Ach.) Th. Fr. 1874:563.

Lecidea Catillaria* Ach. 1803:33.

Thallus crustose, granulose, warty or areolate, not differentiated into layers. *Apothecia* immersed to adnate or sessile, lecideine; disk yellowish-brown to brown or black; margin concolourous with the disk; ascospores eight in ascus, hyaline, oblong to fusiform two-celled or more rarely simple.

Figure: Ascospores, fig. 13H.

The genus *Catillaria* is poorly understood, and the Australian material in need of taxonomic study. A species of *Catillaria* is common on the bark of trees in the Mount Lofty Ranges, where it forms a very thin white crust with small black apothecia, especially on very smooth surfaces.

20. CHAENOTHECA (Th. Fr.) Th. Fr. 1861b:350.

Calicium β *Chaenotheca* Th. Fr. 1856: 128.

Literature: Tibel 1975.

Thallus crustose, powdery to warty, fruiting bodies stalked; stalks up to 2 mm tall. *Apothecia* more or less globular, always with open disks and proper dark margins; asci cylindrical, disintegrating with age to leave the spores free in the paraphyses; ascospores eight in ascus, globose, simple, dark coloured.

Figure: Ascospores, fig. 13I.

At present this genus is not known from South Australia, but specimens are likely to be found on decaying wood and bark in the wetter parts of the State.

21. CHIODECTON Ach. 1814:108

Thallus adnate to the substrate, ecorticate with pseudothecia immersed in stromatic bodies on the upper surface. *Pseudothecia* simple to elongate or stellate, with a well developed proper exciple; hypothecium dark and carbonaceous; the hypothecia of several disks joining at the base; asci clavate; ascospores eight in ascus, transversely many-septate, hyaline; paraphyses reticulately branched and interwoven.

Figure: Ascospores, fig. 13J.

At present no collections are known to have been made from South Australia but specimens are likely to be found on bark or rock.

22. CHONDROPSIS Nyl. *in* Crombie 1879:397.

Literature: Filson 1967, Rogers 1971.

Chondropsis semiviridis F. Muell. ex Nyl. *in* Cromb. 1879:397.

Parmeliopsis semiviridis F. Muell. ex Nyl. 1869:57.

Parmelia semiviridis (F. Muell. ex. Nyl.) P. Bibby 1955:60.

Thallus foliose, repeatedly dichotomously branched, branches divergent, hardly overlapping; upper cortex prosoplectenchymatous, thick, opaque when dry, transparent when wet, with a distinct algal layer; medulla loosely woven, lower cortex of interwoven hyphae; lower surface devoid of rhizines. Thallus rolls into a ball when dry. *Apothecia* rare, sessile, concave becoming flat; disk light brown to reddish-brown; margin concolourous with the thallus; asci clavate; ascospores eight in ascus, hyaline simple 10 × 5 μm.

Reactions: K−, C−, KC−, P+ yellow becoming orange.

Figure: Habit, fig. 14A; ascus containing spores, fig. 13K.

Selected specimens examined: 26½ miles (42 km) west-south-west of "Koonalda" H.S., Nullarbor Plain, *A.C. Beauglehole 14907*, 26.ix.1965 (MEL 22843); 11 miles (18 km) north-west of "Nullarbor" H.S., *R. B. Filson 9430*, 11.i.1967 (MEL 25373); Eyre Highway 40 km east of Kimba, *R. B. Filson 11731*, 22.x. 1970; Yardea Station, Northern Eyre Peninsula, *R. W. Rogers 1190*, 22.v.1967 (AD 97733155); Iron Knob, *R. W. Rogers 556*, 1.x. 1966 (AD

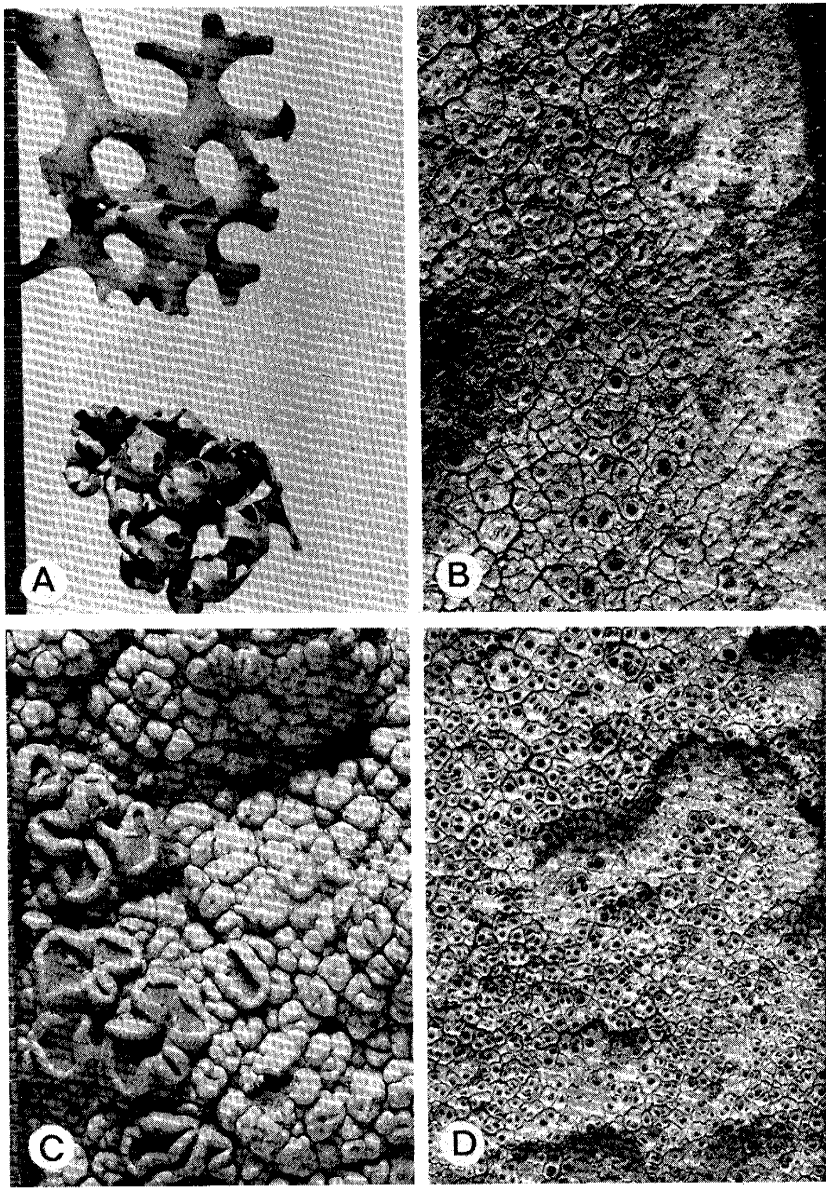


Fig. 14. A, *Chondropsis semiviridis;* B, *Diploschistes gypsaceus;* C, *Diploschistes ocellatus;* D, *Diploschises scruposus.* Scale in millimetres.

97733157); Koonamore Vegetation Reserve, *B. Barrien,* ?1944 (AD); "Quondong" Station, east of Burra, *R.W. Rogers 1135,* 18.v.1967 (AD 97733156); Morgan, *Cleland,* ?1966 (AD).

23. CLADIA Nyl. 1870:167.

Literature: Filson 1970.

Thallus fruticose, composed of pseudopodetia, simple or intricately branched, not arising from primary thallus; pseudopodetia sometimes hollow, sometimes filled with loose or compact medullary tissue, walls clathrate to sparingly perforate. *Apothecia* minute, brown to dark brown to black; ascospores hyaline, simple; pycnidia sessile on tips of pseudopodetia; pycnidiospores bacilliform.

ARTIFICIAL KEY TO SPECIES

1. Thallus hollow 2
1. Thallus not hollow, with tightly packed medulla 4
   2. Fenestrations many, the pseudopodetia becoming hollow clathrate structures ..... *C. ferdinandii*
   2. Fenestrations few, pseudopodetia not clathrate 3
3. Thallus tall robust, sterile pseudopodetia>3 mm tall not sorediose. ..... *C. aggregata*
3. Thallus short, sterile pseudopodetia<3 mm tall, sorediose, sometimes reduced to a powdery mass ..... *C. schizopora*
   4. Thallus white to grey, cortex smooth, internal medulla white ..... *C. corallaizon*
   4. Thallus yellow to yellow-brown, cortex crystalline, internal medulla white above, brown below ..... *C. sullivanii*

Cladia aggregata (Sw.) Nyl. 1870:69

Lichen aggregatus Sw. 1788:147.

Cladonia aggregata (Sw.) Ach. 1795:68.

Thallus fruticose, composed of pseudopodetia, up to 8 cm tall in lush situations and as low as 1 cm in poor; hollow, fragile when dry, walls perforate; perforations round to elliptic, varying in number, in pulvinate clumps or scattered amongst leaf debris, varying in colour from green through shades of cream, brown to almost black; sterile pseudopodetia horny, rigid when dry, extremely variable in size from 0·5-0·8 mm diam., dichotomously or irregularly branched, flexuose, prostrate or ascending; fertile pseudopodetia much thicker and taller and usually more perforate and more branched towards the apex. *Apothecia* terminal on the branches of upright fertile pseudopodetia, lecideine, 0·15-0·3 mm diam; disk slightly concave to flat, dull brownish-black; margin slightly raised; hymenium up to 50 μm tall; asci 48 × 11 μm; ascospores eight in ascus, simple, hyaline 12-15 × 4-5 μm ellipsoidal.

Reactions: Cortex all reactions negative, medulla K−, C−, KC−, P±

Figure: Habit, plate 5A (MEL 1022006) & 5B (MEL 1021219); ascospores, fig. 13P.

Selected specimens examined: Marble Range, Eyre Peninsula, *R. B. Filson 11868,* 24.x.1970 (MEL 1015446); Memory Cove, Cape Catastrophe, *R. B. Filson 11849,* 24.x.1970 (MEL 1015444); Dark Island, 9 miles (14 km) north-east of Keith, *R. L. Specht & P. Rayson,* v.1950 (MEL 25267); Torrens Gorge, *N. N. Donner 1312,* 13.iii.1965 (MEL 9115); Mt. Crawford, 8 km west of Springton, *J. A. Elix 2166,* 18.v.1976 (MEL 1017181); Between the Coorong and the sea, south of Meningie, *A. C. Beauglehole 15099,* 2.x.1965 (MEL 22866); Humbug Scrub, 25 miles (40 km) north-east of Adelaide, *J. D. Curtis,* 9.iv.1967 (MEL 25296); Aldinga Scrub, *R. B. Filson 15723* 5.xii.1975 (MEL 1015493); 14 km south-east Mount Burr Township, *I. B. Wilson 542,* 8.vii.1966 (MEL 27391); Western River, Kangaroo Island, *M. A. Allender,* 5.ix.1974 (MEL 1013771); Eucalypt Forest, 6 km east of Penola, *R. B. Filson 15401,* 12.xi.1975 (MEL 1015411).

This species occurs also in Western Australia, Tasmania, Victoria, New South Wales and Queensland.

Cladia corallaizon R. Filson 1970:324.

Thallus fruticose, composed of pseudopodetia up to 5 cm tall, in pulvinate clumps up to 12 cm diam. or occasionally in scattered clusters 3-4 cm diam., white to grey sometimes stramineous when old; sterile pseudopodetia rigid, horny when dry 2-3 mm diam, dichotomously branched, walls perforate, perforations narrow elliptic, regularly spaced, medulla compact below the algal layer and loosely filling the hollow interior of the pseudopodetia; fertile pseudopodetia similar. Apothecia terminal on the upper branches of the fertile pseudopodetia, lecideine, 0·2-0·7 mm diam.; disk slightly concave to flat becoming strongly convex on maturity, dull reddish-brown to black; margin slightly raised at first, disappearing; hymenium 50-80 µm tall; asci 48 x 12 µm; ascospores eight in ascus, hyaline, ellipsoidal, simple, 15 x 3 µm.

Reactions: K−, C−, KC−, P−.

Figure: Habit, plate 5C (MEL 1021216) & fig. 15 B.

Specimens examined: Monster Mount, 10 km south of Keith, *R. D. Seppelt 2784,* 28.vii.1973 (MEL 1012082).

This species occurs also in Western Australia, Victoria, New South Wales and Queensland.

Cladia ferdinandii (Müll. Arg.) R. Filson 1970:325.

Cladonia ferdinandii Müll. Arg. 1882:293.

Thallus fruticose, composed of pseudopodetia up to 10 cm tall, in pulvinate clumps or patches several metres wide, creamy white to yellowish-white; sterile pseudopodetia rigid, horny when dry, up to 12 mm diam., irregularly branched,

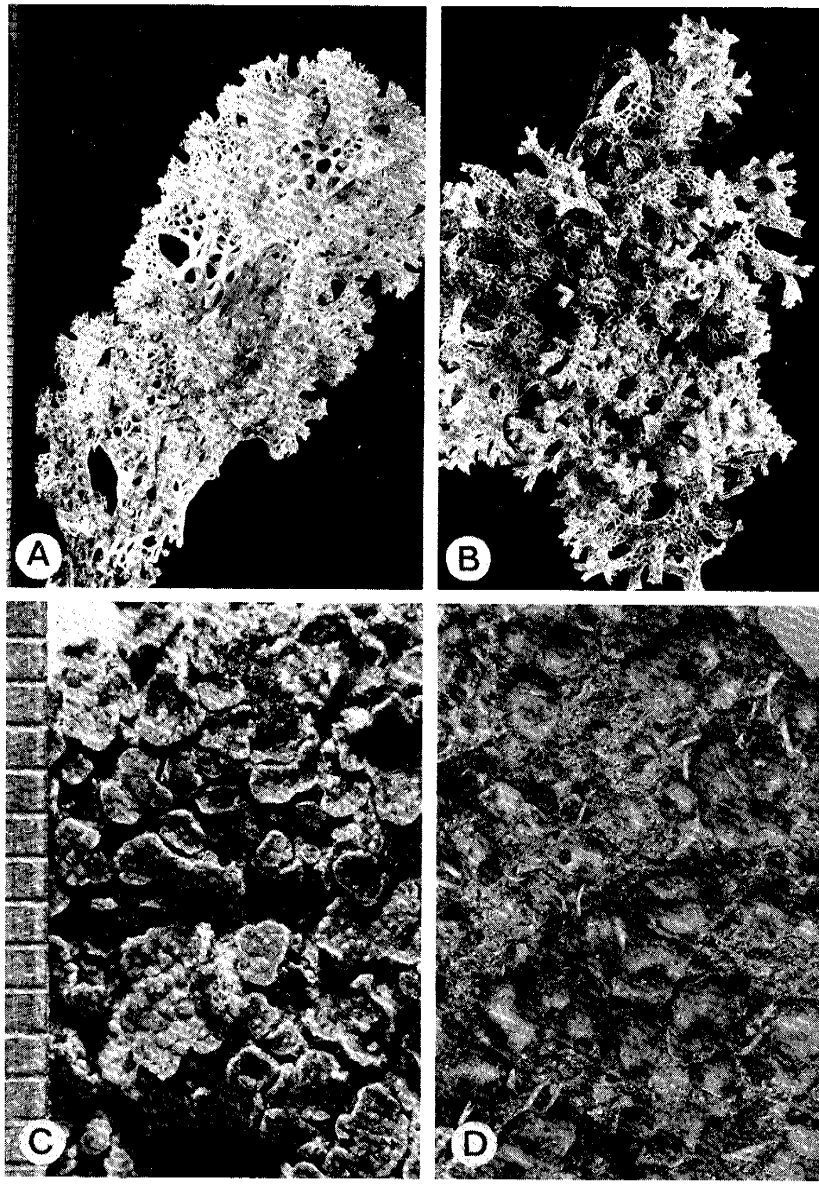


Fig. 15. A, *Cladia ferdinandii;* B, *Cladia corallaizon;* C, *Lecidea crystallifera;* D, *Lecidea globifera.* Scale in millimetres.

walls regularly perforate, perforations large, up to 4 mm diam., irregularly round, medulla loosely woven, the inside of the hollow pseudopodetia completely devoid of medullary tissue; fertile pseudopodetia not seen.

Reactions: K+ pale yellow, C−, KC−, P−.

Figure: Habit, fig. 15A.

Specimens examined: Koppio, 35 km north of Port Lincoln, *J. Tapley,* 17.iv.1965 (MEL 1007501); Aldinga Scrub, Aldinga Beach, *R. B. Filson 15724,* 5.xii.1975 (MEL 1015494); Meningie, *L. D. Williams 723,* 22.iv.1960 (MEL 1007496); Kangaroo Island, *Tate* (MEL 6707).

Endemic in southern regions of Western Australia and South Australia.

Cladia schizopora (Nyl.) Nyl. 1870:69.

Cladonia schizopora Nyl. 1860:217.

Thallus fruticose, composed of pseudopodetia up to 1·5 cm tall, forming continuous patches on bark and fallen trees; sterile pseudopodetia up to 2 mm high, sorediose on the tips or sometimes reduced to a powdery mass; fertile pseudopodetia horny, perforate, perforations irregular, sorediose on the inner walls, branched towards the apex, hollow pseudopodetia completely devoid of medullary tissue. *Apothecia* terminal on the branches of the fertile pseudopodetia, lecideine, 0·3-0·5 mm diam.; disk slightly concave to flat, dull, brownish-black to black; margin slightly raised at first, disappearing at maturity; hymenium up to 40 μm tall; asci 30-40 x 8-11 μm; ascospores eight in ascus, simple, hyaline, ellipsoidal 8-10 x 3 μm. *Pycnidia* terminal on the lobes of the sterile pseudopodetia, ellipsoidal, 120 μm long x 60 μm diam.

Reactions: K−, C−, KC−, P−.

Figure: Habit, plate 5D (MEL 1022008).

Selected specimens examined: 3 km north of Carey Gully, *J. A. Elix 2287,* 22.v.1974 (MEL 1017115); Roadside between Prospect Hill and Kuitpo, *R. W. Rogers 1864,* 19.v.1970 (MEL 1011692); Comaum Forest c. 30 km south-east of Naracoorte, *R. D. Seppelt 2599,* 3.v.1973 (MEL 1015510); 6 km east of Penola, *R. B. Filson 15397,* 12.xi.1975 (MEL 1015502).

This species occurs also in Western Australia, Tasmania, Victoria and New South Wales.

Cladia sullivanii (Müll. Arg.) Martin 1965:9

Cladonia sullivanii Müll. Arg. 1882:294.

Thallus fruticose, composed of pseudopodetia up to 4 cm tall, usually in clumps, stramineous, cinnamon-brown to blackish-brown; sterile pseudopodetia rigid and horny when dry, coarsely farinose, up to 5 mm diam. in expanded specimens, unevenly branched, walls perforate, perforations irregularly rotund to elliptic; medulla compactly woven below the algal layer and loosely filling the whole of the hollow interior of the pseudopodetia; hyphae hyaline below the

algal layer becoming brown to brownish-black in the centre; fertile pseudopodetia similar but much taller. *Apothecia* terminal on the upper branches of the fertile pseudopodetia 0·2-0·7 mm diam.; disk flat becoming strongly convex at maturity, dull, reddish-brown to brownish-black; margin just discernible when young, disappearing; hymenium 60-70 μm tall; ascospores eight in ascus, simple hyaline slightly pointed at one end, 15-17 x 5 μm. *Pycnidia* terminal on the smaller branches of the sterile pseudopodetia c. 320 x 120 μm.

Reactions: K−, C−, KC− or + yellow, P−.

This species has not yet been collected in South Australia but as it occurs in Victoria close to the South Australian border it is likely to be found in the south-east of the State. It occurs also in Tasmania and New South Wales.

Cladia aggregata is widespread on soil and rotting logs in the wetter parts of the State and is probably the most commonly seen fruticose lichen in South Australia. The other species in this genus have more localised distribution. *Cladia ferdinandii* is endemic in South Australia and Western Australia. The record of *Cladia retipora* (Labill.) Nyl. in Weber and Wetmore (1972:26) refers to the collection from Kangaroo Island by Tate which was first determined as that species. However, *C. ferdinandii* is a much taller and more robust species.

24. CLADONIA Hill. 1773:91

Literature: Martin 1958, Thompson 1968.

Primary thallus of squamules, granular or foliose, the upper surface corticate; podetia arising from the primary thallus, cylindrical, trumpet-shaped irregular or branched, with or without cups, with or without squamules, podetia may be tiered one proliferating from the other; *podetia* variously corticate or ecorticate, sorediose or esorediose. *Apothecia* on margins of cups or branches of podetia; disk flat to convex, scarlet or brown; margin usually disappearing; asci clavate; ascospores eight in ascus, hyaline, ellipsoidal, simple.

ARTIFICIAL KEY TO SPECIES

1. Apothecia scarlet 2
1. Apothecia brown 3
   2. Thallus P+ orange, K+ yellow, soredia very fine, basal squamules present ..... *C. macilenta*
   2. Thallus P−, K−, squamules up the podetia ..... *C. didyma*
3. Thallus pale, yellow or yellowish-grey (usnic acid present) .. *C. capitellata*
3. Thallus not yellow or yellowish-grey, (usnic acid absent) 4
   4. Medullary hyphae longitudinally arranged, podetia longitudinally split ..... *C. capitata*
   4. Medullary hyphae not longitudinally arranged podetia not conspicuously longitudinally split 5
5. Podetia cupless, axils usually perforate 6
5. Podetia with cups, axils imperforate 11
   6. Thallus K+ yellow 7

6. Thallus K− 8
7. Covered with squamules or granules, P+ yellow turning orange ..... *C. squamosula*
7. Without squamules or granules P+ weakly yellow ..... *C. aueri*
8. Without small squamules or granules in upper part of the podetium ..... *C. furcata*
8. With small squamules or granules in the upper part of the podetium ... 9
9. Podetia 5-8 cm tall, quite cupless, axils clearly open ..... *C. scabriuscula*
9. Podetia up to 5 cm tall, sometimes with narrow cups axils not open 10
10. Podetia short, less than 2·5 cm tall, growing up from persistent basal squamules ..... *C. balfourii*
10. Podetia taller, not growing up from persistent squamules ..... *C. pityrea*
11. Cups proliferating in tiers from the centre 12
11. Cups not proliferating 13
12. Podetia flaring smoothly into non-lacerating cups, with narrow, incised basal squamules ..... *C. verticillata*
12. Podetia flaring abruptly into deeply lacerate cups without conspicuous basal squamules ..... *C. calycantha*
13. Podetia dilated into broad cups 5 mm ..... *C. chlorophaea*
13. Podetia narrowing into minute cups, or without cups 14
14. With granular soredia, podetia less than 2·5 cm high ..... *C. balfourii*
14. With farinose soredia, podetia taller, never with cups ..... *C. farinacea*

Cladonia aueri Räs. 1932:53.

Podetia whitish-grey or brown up to 2 mm diam. and 6 cm tall, little branched, the axils gaping open, cupless, usually without squamules. *Apothecia* brown.

Reactions: Thallus K+ weakly yellow, P+ weakly yellow.

Specimen examined: Mount Burr, *Wilson 549,* 7.ix.1966 (AD).

Apparently rare, fringing a *Melaleuca* swamp.

Cladonia balfourii Cromb. 1876:433

Primary thallus persistent, minutely crenulate. *Podetia* arising from the primary thallus, ashy-white, up to 2·5 cm tall and 2-3 mm diam., often with very narrow cups in the tapering tips, ecorticate except for a narrow squamulose part towards the base, granular sorediose throughout. *Apothecia* single on the tip of the podetia or in a small ring around the rim of the narrow cup, brown.

Reactions: K−, C−, KC−, P+ red.

Selected specimens examined: Mount Lofty, *R. W. Rogers 551,* 24.ix.1966 (R.W.R.); Hindmarsh Valley, *R. W. Rogers 1046,* 25.iv.1967 (R.W.R.); Ashbourne, *D. Whibley 1397,* 2.vi.1964 (AD 97519493); Naracoorte, *D. Hunt,* 6.vii.1962 (AD 97733136).

This species grows on sand or humus in moist places in Victoria, Tasmania and New South Wales.

Cladonia calycantha Del. ex Nyl. 1859:209

Primary thallus usually persistent but sometimes disappearing. *Podetia* corticate, without soredia or squamules, up to 8 cm tall, with distinct cups, whitish- to greenish-grey, cups flaring abruptly, proliferating from the centre of the cup up to seven times, margins lacerate. *Apothecia* brown, stipitate on the margins of the cups.

Reactions: K−, C−, KC−, P+ red.

Specimens examined: 2 km west of Bascombe Well, Eyre Peninsula, *N. N. Donner 2348,* 7.x.1967 (MEL 27385); Sandy Creek, *R. W. Rogers 1486,* 29.x.1968 (R.W.R.); Mount Bonython, *R. D. Seppelt,* 23.vii.1969 (R.W.R.); Encounter Bay, *R. W. Rogers 1041,* 25.iv.1967 (R.W.R.); Mount Burr, *I. B. Wilson 866,* 7.ix.1968 (AD 97412385).

Occurs also in Western Australia, Victoria, Tasmania and New South Wales.

Cladonia capitata (Michx.) Spreng. 1827:271.

Helopodium capitatum Michx. 1803:329.

Primary thallus persistent, undivided. *Podetia* rising from the primary thallus up to 1·5 cm tall and 1-2 mm thick, without cups, grey to brownish-grey, corticate, squamulose near the base, ribbed, twisted, longitudinally split, distorted, simple or sparingly branched. *Apothecia* brown, large, bulging over the top of the podetium.

Reactions: K+ yellow becoming brown, C−, KC−, P+ red.

Selected specimens examined: hundred of Blesing, Eyre Peninsula, *N. N. Donner 2272,* 5.x.1967 (AD 97733138); Maitland, *R. W. Rogers 951,* 9.ii.1967 (R.W.R.); Cherry Gardens, *R. W. Rogers 1653,* 19.v.1969 (R.W.R.).

The species occurs also in Victoria.

Cladonia capitellata (Hook.f. & Tayl.) Bab. 1855:296.

Cenomyce capillata (sic) Hook.f. & Tayl. 1844:652.

Primary thallus disappearing. *Podetia* up to 8 cm high and 0·5-2·0 mm diam., yellow-grey to stramineous, with or without narrow, irregular cups, axils open, without soredia, squamulose at the base. *Apothecia* stipitate, brown.

Reactions: K−, C−, KC−, P−.

Figure: Habit, plate 3A.

Specimen examined: c. 14 km south-east of Mount Burr Township, *I. B. Wilson 549,* 7.ix.1966 (MEL 27390).

C. capitellata is found also in Victoria and New South Wales.

A similar but un-named species has been recorded by E. Dahl in South Australia. It differs from the typical *C. capitellata* in having regular cups, no squamules and is P+ red.

Cladonia chlorophaea (Flörke in Sommerf.) Spreng. 1827:273.

Cenomyce chlorophaea Flörke in Sommerf. 1826:130.

Primary thallus persistent or disappearing. Podetia greenish-grey, thickset, flaring gradually into broad deep cups, up to 1·5 cm tall, coarsely granular sorediose. *Apothecia* sessile or stipitate on the cup margins, brown.

Reactions: K− or rarely K+ yellow, C−, KC−, P+ red, or rarely P−.

Specimens examined: Alligator Gorge, *L. D. Williams 1808,* 6.ix.1963 (L.D.W.); Cape Jervis, *R. W. Rogers 1472,* 1.ix.1968 (R.W.R.).

Cladonia chlorophaea is found also in Victoria, Tasmania and New South Wales. It has many chemical variants the P− is known as *C. grayi* Merr. A specimen collected by J. A. Elix (2185) 9 km east of Springton has a K+ yellow reaction (containing atranorine) and could be referred to *C. conistea* (Del.) Asah.

Cladonia didyma (Fée) Vain. 1887:137.

Scyphorus didymus Fée 1824:98.

Primary thallus persistent or disappearing. *Podetia* whitish- to greenish-grey, cupless, terete, up to 2·5 cm tall and 1-2 mm diam., corticate for the most part, with coarse soredia or granular squamules. *Apothecia* scarlet, bulging over the top of the podetium, up to 2 mm diam.

Reactions: K−, C−, KC+ orange, P−.

Figure: Habit, plate 2B (MEL 1022013).

This species has not yet been recorded in South Australia, but it is common all along the eastern coast of Australia so is likely to occur in the South-East.

Cladonia farinacea (Vain.) Evans 1950:95.

Cladonia furcata var. *scabriuscula* f. *farinacea* Vain. 1887:339.

Primary thallus persistent or disappearing. *Podetia* greenish-grey, up to 8 cm tall, dichotomously branched, axils open, corticate and squamulose at the base becoming sorediose and esquamulose in the upper parts. *Apothecia* brown, on the tips of the branches.

Reactions: K−, C−, KC−, P+ red.

Specimen examined: Ewens Ponds, South-East, *R. B. Filson 15816,* 8.iii. 1977 (MEL 1018570).

The species occurs also in Victoria and New South Wales.

Cladonia furcata (Huds.) Schrad. 1794:107.

Lichen furcatus Huds. 1762:458.

Primary thallus usually disappearing. *Podetia* arising from the margins of the primary thallus, up to 12 cm tall, pale green to olive-green to brownish-grey,

sometimes almost forming cups, axils open, corticate, sometimes squamulose, esorediose. *Apothecia* rare, brown, at the tips of the branches.

Reactions: K−, C−, KC−, P+ red.

Figure: Habit, plate 3B (MEL 1021856).

Specimen examined: Mount Burr, *I. B. Wilson 516,* 7.ix.1960 (AD, MEL 27392).

This is probably the largest *Cladonia* species recorded in the State, but found only at one location, fringing a *Melaleuca* swamp. It occurs also in Victoria, Tasmania and New South Wales.

Cladonia macilenta Hoffm. 1796:126

Primary thallus persistent. *Podetia* rising from the upper surface of the primary thallus, up to 1·5 cm tall, pale grey to grey, with narrow and indistinct apical cups or tapering apically, corticate, squamulose at the base or part way up the podetia; soredia diffused, farinose. *Apothecia* terminal or in a ring or part ring on cup margin, bright scarlet.

Reactions: K+ deep yellow, C−, KC−, P+ orange.

Specimen examined: Naracoorte, *D. Hunt,* June-July 1962 (AD 97733141).

Cladonia macilenta is a common red-fruited species occurring in southern States.

Cladonia pityrea (Flörke) Fr. 1826:21.

Capitularia pityrea Flörke 1808:135.

Primary thallus usually persisting. *Podetia* arising from the upper side of the primary thallus, simple, or rarely with long narrow cups, up to 4 cm tall, corticate, abundantly sorediose with coarse granular soredia, sometimes squamulose at the base. *Apothecia* terminal on the podetia, reddish-brown to dark brown.

Reactions: K− or K+ yellow, C−, KC−, P+ red.

Figure: Habit, plate 3C (MEL 1021857).

Although no specimens were examined, this species is known to occur in the wetter areas of the South-East. It is an extremely common and polymorphic species found in Victoria, Tasmania and New South Wales.

Cladonia scabriuscula (Del. in Duby) Nyl. 1875:447.

Cenomyce scabriuscula Del. in Duby 1830:623.

Primary thallus disappearing. *Podetia* light grey or greenish-grey up to 8 cm tall, cupless, dichotomously branched, axils open, sometimes granular sorediose, sometimes squamulose at the base. *Apothecia* small, terminal, brown.

Reactions: K−, C−, KC−, P+ red.

This species has not been recorded in South Australia, but it is widespread in New South Wales and Victoria and is likely to be found in dry sclerophyll forest.

Cladonia squamosula Müll. Arg. 1883:19.

Primary thallus persistent or disappearing. *Podetia* dark grey or dark greenish-grey, up to 2·0 cm tall and 1·0-1·5 mm thick, cupless, tapering to the apices, corticate in the lower part, covered in coarse granules or squamules, sometimes the ultimate tips bare and decorticate. *Apothecia* small, terminal, brown.

Reactions: K+ deep yellow, C−, KC−, P+ yellow becoming orange.

Figure: Habit, plate 4A (MEL 1021282).

Selected specimens examined: Angaston, *R. W. Rogers 1823,* 31.xii.1967 (R.W.R.); Balhannah, *R. W. Rogers 351,* ?1965 (R.W.R.); Kuitpo, *R. W. Rogers 1439,* 28.vii.1968 (R.W.R.).

This species is common on rotting stumps in the wetter areas and sometimes completely covers old stumps. It is found in all southern States.

Cladonia verticillata (Hoffm.) Schaer. 1823:31.

Cladonia pyxidata C. verticillata* Hoffm., 1796:122.

Primary thallus persistent or disappearing. *Podetia* greenish-grey, up to 8 cm tall with smoothly dilated cups proliferating from the centre, margins of the cups smooth rarely lacerate, corticate, esorediose, sometimes with well developed basal squamules. *Apothecia* brown, stipitate, on the margins of the cups.

Reactions: K−, C−, KC−, P+ red.

Figure: Habit, plate 4C (MEL 1021199); ascospores, fig. 13O.

Specimen examined: Mylor, *V. M. Cruikshank,* 26.vi.1966 (R.W.R.).

This species occurs in all southern States.

25. COCCOCARPIA Pers. 1826:206.

Literature: Malme 1926.

Thallus foliose, attached to the substrate by rhizines or tomentum, upper and lower cortex of longitudinal hyphae. *Apothecia* lecideine, sessile or adnate, disk convex; ascospores eight in ascus, simple, hyaline. Phycobiont *Scytonema.*

Coccocarpia pellita var. **cocoes** (Fée) Zahlbr. 1925:286.

Circinaria cocoes Fée 1824: 127.

Coccocarpia pellita var. *semiincisa* Müll. Arg. 1882:321.

Thallus silver-grey or lead-grey forming rosettes, attached to the substrate by a dense black tomentum; upper surface longitudinally finely striate; lobes

sublinear, 2·0-4·0 mm broad, isidiose near the centre of the thallus. *Apothecia* dark brown or black.

Figure: Ascus containing spores, fig. 13M.

Recorded for South Australia by Weber and Wetmore (1972:33). This variety, or others in this very plastic genus, may be found on bark or rock in wetter areas. It occurs in Victoria, New South Wales and Queensland.

26. COLLEMA Web. *in* Wigg. 1780:89.

Literature: Degelius 1954, 1974.

Thallus variable, subcoralline or lobate, adnate or ascending, thick or thin, esorediose, with or without isidia. *Apothecia* common, lecanorine, adnate or sessile; disk concave to flat or slightly convex; margin thin to thick, entire or irregular; ascospores eight in ascus, hyaline, cylindrical to fusiform, transversely septate or muriform.

ARTIFICIAL KEY TO SPECIES

1. Thallus isidiose 2
1. Thallus non-isidiose 4
2. Ascospores transversely septate, thallus lobes lobulate 3
2. Ascospores muriform, lobes not lobulate ..... *C. subconveniens*
3. Thallus rosulate, on earth (in arid and sub-arid areas) ascospores 1-3 septate ..... *C. coccophorum*
3. Thallus lobes not rosulate, amongst mosses, ascospores 5-8 septate ..... *C. rugosum*
4. Thallus rosulate 5
4. Thallus not rosulate, lobes lobulate, amongst mosses ascospores 5 septate ..... *C. durietzii*
5. Thallus lobes lobulate, on earth (in arid and sub-arid areas) ascospores 1-3 septate ..... *C. coccophorum*
5. Thallus lobes not lobulate, corticolous, ascospores 6-13 septate 6
6. Apothecia glaucous-white ..... *C. glaucophthalmum*
6. Apothecia reddish-brown ..... *C. glaucophthalmum* var. *implicatum*

Collema coccophorum Tuck. 1862:385.

Thallus dark-olive-green to black, forming small sub-fruticose to subfoliose rosettes up to 2·5 cm across, often partly buried in the substrate; lobes radiate, 0·5-3·0 mm broad, with or without isidia, often with swollen margins which may be lobulate; lobules sometimes terete. *Apothecia* common 1·0-2·0 mm diam.; ascospores hyaline, 1-3 septate.

Figure: Ascospores, fig. 13L.

Specimens examined: Port Wakefield, *R. W. Rogers 909*, 9.xi.1967 (AD 97733144); Kingoonya, *R. W. Rogers 204*, 23.ii.1966 (AD 97733140); Cowell,

R. W. Rogers 642, 1.x.1966 (AD 97733142); Yunta, *R. W. Rogers 1142*, 18.v.1967 (AD 97733143); Renmark, *R. W. Rogers 280*, 8.iii.1966 (AD 97733139).

This species is very widespread, especially on calcareous, arid zone soils in Victoria, Western Australia and New South Wales.

Collema durietzii Degelius 1974:98.

Thallus foliose to subfoliose, of scattered lobes or irregular in shape, deep olive green to brownish-green; lobes short and broad, imbricate, incised and undulate, lobulate. *Apothecia* not seen.

Specimen examined: By waterhole in Frome River, 6 km north of Evans Outstation, 40 km east-south-east of Copley, Flinders Ranges, *R. B. Filson 15617*, 19.xi.1975 (MEL 1018582).

Collema glaucophthalmum Nyl. 1858:377 var. **glaucophthalmum.**

Thallus dark olive-green to black forming rosettes up to 10 cm diam., closely adnate to the substrate; lobes 0·5-1·0 cm broad, pustular and ridged, without isidia. *Apothecia* common 0·5-1·0 mm diam.; disk densely white pruinose; ascospores hyaline, acicular, 30-95 x 3-6·5 μm transversely 6-13 septate.

Figure: Habit, plate 4B (MEL 1021281).

Specimens examined: Memory Cove, Cape Catastrophe, Eyre Peninsula, *R. B. Filson 11845*, 24.x.1970 (MEL 1018616); Point Drummond, west coast of Eyre Peninsula, *R. B. Filson 11874*, 25.x.1974 (MEL 1018614); Mambray Creek, *L. D. Williams 1981*, 12.ix.1964 (L.D.W.); Angaston, *R. W. Rogers 1349*, 31.xii.1967 (R.W.R.); Robe, *L. D. Williams 1552*, 8.x.1962 (L.D.W.).

Collema glaucophthalmum var. **implicatum** (Nyl.) Degelius 1974:167.

Collema implicatum Nyl. 1863a:428.

This variety differs from the species in having shining red-brown disk to the apothecium; in all other ways it resembles the species.

Specimens examined: Point Drummond, west coast of Eyre Peninsula, *R.B. Filson 11874a*, 25.x.1970 (MEL 1018615); along the track into Memory Cove, 24 km south-south-west of Port Lincoln, *R.B. Filson 11850*, 24.x.1970 (MEL 1018617).

Both var. *glaucophthalmum* and var. *implicatum* grow on the bark of trees in the wetter parts of the State. They are also widespread in Western Australia, Victoria, Tasmania, New South Wales and Queensland.

Collema rugosum Kremp. 1870:128.

Thallus foliose, broadly lobate, adnate to ascending, deep olive-green to brown, matt or slightly shining, lobulate, isidiose; isidia numerous towards the

centre covering tops of ridges. *Apothecia* rare in South Australia, sessile; ascospores eight in ascus 40-75 x 4-6·5 μm, fusiform, hyaline, 5-8 septate.

Specimen examined: Canunda National Park, 9 miles (14 km) west of Millicent, *R. B. Filson 14658 (in part)*, 17.v.1973 (MEL 1018600).

This species is common in Victoria and New South Wales.

Collema subconveniens Nyl. 1888:8.

Thallus light-green to blue-green, forming rosettes up to 8 cm diam., adnate or ascending at the margins, sparsely isidiose; lobes smooth, 4-8 mm broad. *Apothecia* numerous, 0·7-2·0 mm diam.; disk pale or dark red, epruinose; ascospores muriform, up to 7 transverse septa and 1-3 longitudinal septa, sometimes markedly constricted at the septa, 26-36 x 10-13 μm.

Although we have not seen specimens collected in South Australia it is reported from Mount Gambier on bark by Degelius (1974:139). It occurs also in Western Australia, Victoria, Tasmania, New South Wales and Queensland.

27. CYPHELIUM Ach. 1815:261.

Thallus crustose, powdery to more or less areolate. *Apothecia* sessile or almost immersed in thalline warts; disk at first almost closed, opening at maturity; margin either lecideine or double with an additional thalline rim; ascospores brown, uniseptate, constricted at the septum; paraphyses little branched.

Figure: Ascospores, fig. 13N.

This genus has not been recorded in South Australia, but collections are likely to be made from dry wood or bark.

28. DERMATOCARPON Eschw. 1824:21.

Thallus squamulose to crustose, upper surface corticate. *Perithecia* immersed, without hymenial algae; ascospores eight in ascus, simple, hyaline; paraphyses soon gelatinise and disappear.

ARTIFICIAL KEY TO SPECIES

1. Thallus growing on rock ..... *D. compactum*
1. Thallus growing on soil ..... *D. lachneum*

Dermatocarpon compactum (Mass.) Lettau 1912:97.

Placidium compactum Mass. 1856a:32.

Thallus of small dark brown to black squamules 0·2-0·3 mm diam., packed together to form a crust. *Perithecia* immersed; ascospores eight in ascus, simple.

Specimen examined: Koonamore Vegetation Reserve, *R. W. Rogers 1772*, 22.ix.1969 (R.W.R.).

This is probably a common species but as it is inconspicuous it is rarely collected. It grows on calcareous pebbles.

Dermatocarpon lachneum (Ach.) A.L. Smith 1911:270.

Lichen lachneus Ach. 1798:140.

Dermatocarpon hepaticum (Ach.) Th. Fr. 1861b:356.

Thallus of tan to dark brown squamules 1·0-3·0 mm diam., at first ovate, entire, plane to slightly convex, becoming crenate and distorted with age; attached to substrate by fine hyphal rhizoids. *Perithecia* immersed; ascospores eight in ascus, simple, 10-16 x 6-8 μm ellipsoidal.

Figure: Habit, plate 6A (MEL 1022009); ascus containing spores, fig. 16A

Specimens examined: 1·6 km west of Barton on the East-West Railway Line, *R. B. Filson 11931*, 27.x.1970 (MEL 1018622); 11 miles (17 km) north-west of "Nullarbor" H.S., *R. B. Filson 9475*, 11.i.1967 (MEL 25450); Ceduna, *R.B. Filson 9399*, 26.xii.1966 (MEL 25439); 31 km west of Oodnadatta, *R. B. Filson 15633*, 21.xi.1975 (MEL 1018592); Frome River 6 km north of "Evans O.S.", Flinders Ranges, *R. B. Filson 15616*, 19.xi.1975 (MEL 1018583); Port Wakefield, *R. W. Rogers 907*, 9.xi.1967 (AD); Murray Bridge, *R. W. Rogers 378*, 11.v.1966 (AD).

This species is very common on calcareous soils throughout the Mallee and Saltbush regions. It is a major component of many areas of soil surface lichen crust in Western Australia, Victoria, New South Wales, Queensland and Northern Territory.

29. DIMERELLA Trev. 1880:65.

Thallus crustose, effuse, ecorticate, margins clearly hyphal. *Apothecia* sessile; disk pale to intensely yellow to orange; margin lecideine, pale; ascospores eight in ascus, two-celled, hyaline; paraphyses simple, unbranched.

Dimerella lutea (Dicks.) Trev. 1880:65.

Lichen luteus Dicks. 1785:11.

Thallus crustose, thin, ecorticate, pale green to greenish-white. *Apothecia* sessile, lecideine, up to 1·5 mm diam.; disk concave to flat becoming convex at maturity, pale yellow-orange; margin prominent, becoming flexuose, concolourous with the disk; ascospores eight in ascus, uniseptate, hyaline, 10-14 x 3-4 μm.

Figure: Ascospores, fig. 16B.

Although this species has not been recorded in South Australia, it is widespread in Victoria, and is likely to be found in the wetter parts of the State on the bark of trees or amongst mosses on dead wood.

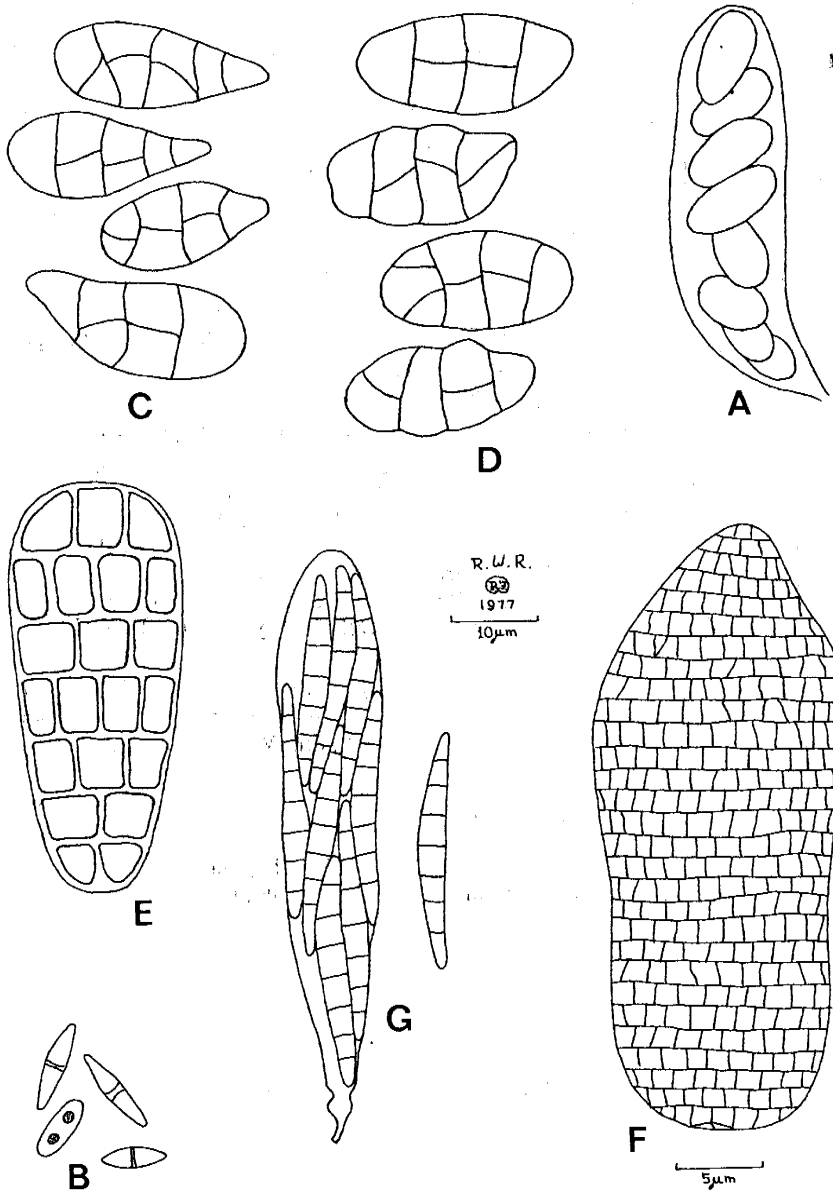


Fig. 16 A, *Dermatocarpon lachneum,* ascus containing spores; B, *Dimerella lutea,* ascospores; C, *Diploschistes scruposus,* ascospores; D, *Diploschistes ocellatus,* ascospores; E, *Endocarpon victorianum,* ascospore; F, *Endocarpon* sp., ascospore (note separate scale); G, *Enterographa* sp., ascus containing spores and one free ascospore.

30. DIPLOSCHISTES Norm. 1853:7

Literature: Magnusson 1955:281-287.

Thallus crustose, areolate, warty with a cortex of entangled hyphae. *Apothecia* immersed in the thallus or adnate; disk almost closed, open at maturity, black; margin bipartite, the inner proper exciple concolourous with the disk and the outer thalline concolourous with the thallus; ascospores brown, 2-8 per ascus, muriform.

ARTIFICIAL KEY TO SPECIES

1. Thallus thick, chalky-white, apothecia adnate, 2-4 mm diam . . *D. ocellatus*
1. Thallus thin, greyish-white to brownish-white, apothecia immersed, up to 1 mm diam 2
   2. On soil, thallus K+ . . . . . *D. scruposus*
   2. On rock, thallus K− . . . . . *D. gypsaceus*

Diploschistes gypsaceus (Ach.) Zahlbr. 1892:35.

Urceolaria gypsacea Ach. 1810:338.

Thallus crustose, areolate, white to greyish-white patches on rocks. *Apothecia* less than 1 mm diam., immersed, proper margin black or white-pruinose, almost enclosing the disk.

Reactions: Medulla K−, C−, KC−, P−, I−.

Figure: Habit, fig. 14B.

Specimens examined: Torrens Gorge, *R. W. Rogers 1740*, ?1968 (R.W.R.); Yunta Hills, *R. W. Rogers 1280*, 18.viii.1967 (R.W.R.).

This species is fairly common on rocks but is not often collected. It is known also in Victoria.

Diploschistes ocellatus (Vill.) Norm. 1853:232.

Lichen ocellatus Vill. 1789:988.

Thallus forming a thick extensive, white or greyish-white crust, areoles smooth, 0·5-1·5 mm diam. *Apothecia* up to 4 mm diam.; disk almost black sometimes pruinose; thalline margin prominent.

Reactions: Medulla K+ yellow becoming red, C−, KC−, P−, I−.

Figure: Habit, fig. 14C; ascospores, fig. 16D.

Selected specimens examined: Hesso, 50 km north-west of Port Augusta, *R. W. Rogers 46*, 24.ix.1965 (R.W.R.); "Tregolana" Station 18 km north of Whyalla, *R. D. Seppelt*, 7.vi.1969 (R.W.R.); "Koonamore" Station, 60 km north of Yunta, *R. W. Rogers 1641*, 19.iv.1969 (R.W.R.); "Quondong" Station 120 km north-north-east of Morgan, *R. W. Rogers 1340*, 19.xi.1967 (R.W.R.).

Diploschistes ocellatus, known also from Victoria and New South Wales, is widespread but not common on arid and sub-arid soil. Material referred to *D. subocellatus* (Nyl. ex Cromb.) Zahlbr. by Weber and Wetmore (1972:37) has been treated here as *D. ocellatus*.

Diploschistes scruposus (Schreb.) Norm. 1853:232.

Lichen scruposus Schreb. 1771:133.

Thallus crustose, areolate, forming extensive white to grey to brownish-grey patches, up to 20 cm diam.; areoles smooth to rugulose, less than 1 mm diam. *Apothecia* deeply immersed, proper margin black, sometimes almost enclosing the disk, radiately striate.

Reactions: Thallus K+ yellow or yellow turning red, C+ rose or purple-grey, I+ blue.

Figure: Habit, plate 14D; ascospores, fig. 16C.

Selected specimens examined: Tarcoola, *R. W. Rogers 213*, 23.iii.1966 (AD); *R. W. Rogers 1155*, 22.v.1967 (AD 97733147); Port Wakefield, *R. W. Rogers 904*, 9.ii.1967 (AD 97733146); Tarlee, *R. W. Rogers 1509*, 29.x.1968 (AD 97733147); Loxton, *R. W. Rogers 422*, 11.v.1966 (AD 97733145); Finniss, *R. W. Rogers 1545*, 6.xi.1968 (AD 97733149).

This species is one of the most common arid soil lichens. It has been recorded from all States with the exception of Tasmania.

31. ENDOCARPON Hedw. 1789:56.

Thallus squamulose, sometimes appearing almost crustose; medulla, algal layer and upper cortex differentiated. *Perithecia* immersed, or the apex just protruding; algae present in the hymenial layer; ascospores 2-4 in ascus, muriform, brown; paraphyses soon gelatinise.

ARTIFICIAL KEY TO SPECIES

1. Ascospores one per ascus 2
1. Ascospores two per ascus ..... *E. pusillum*
   2. Ascospores 75-107 × 24-35 μm ..... *E. victorianum*
   2. Ascospores 140 × 60 μm ..... *E. sp.*

Endocarpon pusillum Hedw. 1789:56.

E. helmsianum Müll. Arg. 1892:197.

Thallus of thick brown to greenish-brown squamules 2-5 mm diam.; margins entire or crenate; undersurface with extensive rhizoidal and stolon development. *Perithecia* immersed, thallus raised into a rim around the ostiole; ascospores two per ascus, muriform, brown.

Specimens examined: 14 miles (22 km) east-south-east of "Kenmore Park", *A. C. Beauglehole 25680,* 2.vii.1968 (MEL 1018671); Tarcoola, *R. W. Rogers 211,* 23.ii.1966 (AD 97733151); Cowell, *R. W. Rogers 641,* 1.x.1966 (AD 97733150); Hope Valley, *R. W. Rogers 1553,* 12.xi.1968 (AD 97733137); Koonamore Vegetation Reserve, *R. W. Rogers 1330,* 20.xi.1967 (R.W.R.); Mount Rescue Conservation Park near Gosse Hill, 30 km east-south-east of Tintinara, *R. W. Rogers 1447,* 6.vii.1968 (R.W.R.).

Endocarpon pusillum appears to involve two distinct taxa. One a large pale to clay-brown squamulose thallus, with a smooth to rugulose, dull, upper surface and crenulate margins. This is identical with the type of *Endocarpon helmsianum* Müll. Arg. The other is smaller with pale to reddish-brown or greenish-brown thallus, upper surface is always smooth and sometimes shining, margins smooth, mostly deflexed. This agrees with the accepted interpretation of *E. pusillum.* Perithecial structures of both entities appear to be the same.

It is known from all Australian States.

Endocarpon victorianum Müll. Arg. 1893b:62.

Thallus of creamy-brown to pale brown squamules up to 10 mm diam., with entire to crenulate margins; upper surface flat to deeply concave, smooth, sometimes incised or flexuose. *Perithecia* immersed, ostiole indistinct; ascospores solitary in ascus, at first grey becoming brown to black at maturity, 75-105 × 24-35 μm

Figure: Ascospores, fig. 16E.

Specimens examined: Mona, 6·5 km south-west Bute, *R. B. Filson 12012,* 31.x.1970 (MEL 1018620); 3 km north of Kokatha on the Poochera-Kingoonya road, *R. B. Filson 11920,* 26.x.1970 (MEL 1018624).

Endocarpon victorianum was first described from Victoria.

This species is easily confused with *E. pusillum.* Macroscopically it appears to be intermediate between forms *pusillum* and *helmsianum* but differs from both in the large ascospores which are solitary in the ascus. There could be justification for including this entity with *E. pusillum* but we have never observed intermediates containing large and small, single and double-spored asci.

Endocarpon sp.

Thallus strongly convex to pulvinate, appearing polyphyllous, clay-brown to charcoal-brown up to 10 mm diam.; upper surface strongly rugulose and cracked. *Perithecia* immersed, ostiole indistinct; ascospores solitary in ascus, hyaline, to grey becoming brown to black, 140 x 60 μm.

Figure: Ascospore, fig. 16F.

Specimen examined: South side of Carappee Hill 8 km north-east of Darke Peak, Eyre Peninsula, *R. B. Filson 11773,* 22.x.1970 (MEL 1018630).

Unfortunately this species is known only from a single collection. The pulvinate, apparently polyphyllous thallus and the very large ascospores make it distinctive.

32. ENTEROGRAPHA Fée 1824:xxxii & 57.

Thallus crustose, ecorticate. *Pseudothecia* immersed in stromatic bodies on the upper surface, simple to elongate or stellate, with well developed rudimentary exciple; hypothecium pale; asci clavate; ascospores 8, transversely many septate, hyaline; paraphyses reticulately branched and interwoven.

Figure: Ascus containing spores and one free spore, fig. 16G.

This genus has not been collected in South Australia, but it is likely to occur on bark and rocks.

33. EPHEBE Fr. 1825:256.

Literature: Henssen 1963.

Thallus of thin-walled, many-celled hyaline hyphae extending longitudinally and laterally within the gelatinous sheath of the phycobiont, sometimes protruding through the sheath, sometimes the hyphae intertwine and form plechtenchyma towards the base of the filaments. *Apothecia* minute, immersed, often in groups; asci short-clavate to cylindrico-clavate; ascospores eight, hyaline, simple or obscurely once septate.

Ephebe lanata (L.) Vain. 1888:20.

Lichen lanatus L. 1753:1155.

Thallus deep olive-green to black, forming inconspicuous turf-like tufts over the substrate, of very thin, cylindrical, branched filaments, taking its general form from the phycobiont *Stigonema*.

Specimen examined: Marble Range near Elliston, *R. B. Filson 11859,* 24.x.1970 (MEL 1018571).

This species is probably common over rocks, growing in water run-off channels. It is known also in Victoria and Tasmania.

34. ERIODERMA Fée 1824:145.

Literature: Keuck 1977.

Thallus foliose, loosely attached to the substrate; upper surface corticate, covered with a dense layer of soft hairy tomentum; lower surface ecorticate, rhizinate. *Apothecia* peltate, lecideine; asci eight-spored; ascospores hyaline, simple, paraphyses unbranched. Phycobiont *Scytonema*.

At present this genus is unknown in South Australia but it is likely to occur on bark and rotting wood in the very wet areas of the South-East.

35. FULGENSIA Mass. et de Not. *in* Mass. 1853b:10.

Literature: Poelt 1965a.

Thallus crustose, thick, marginal lobes with both upper and lower cortex; upper surface becoming granular sorediose. *Apothecia* deep orange-red to reddish-brown, sessile; asci eight-spored; ascospores simple or rarely two-celled, hyaline.

Fulgensia subbracteata (Nyl.) Poelt 1961:137.

Lecanora subbracteata Nyl. 1883:534.

Caloplaca subbracteata (Nyl.) Lett. 1958:28.

Thallus small, 1-2 cm diam., white to pale lemon-yellow to yellow-orange, continuous or areolate with small but distinct marginal lobes, becoming granular sorediose. *Apothecia* uncommon, up to 1·5 mm diam.; disk flat, reddish-brown; margin crenulate, concolourous with the thallus; ascospores hyaline, simple, 13-15 x 5-6 μm.

Reactions: Apothecial disk K+ purple or violet.

Figure: Ascospores, fig. 17A.

Selected specimens examined: 26½ miles (42 km) west-south-west of Koonalda, Nullarbor Plain, *A. C. Beauglehole 14908*, 24.ix.1965 (MEL 22841); "Colona" H.S., Yalata Aboriginal Reserve, *J. H. Willis*, 27.viii.1947 (MEL 9221); by Lincoln Highway, 17 miles (29 km) south of Cowell, *R. B. Filson 11792*, 23.x.1970 (MEL 1018686); south-west Fishery Bay, 21 miles (34 km) south of Port Lincoln at Whalers Way fence, *R. B. Filson 11803*, 23.x.1970 (MEL 1018682); Mona, 6 km south-west of Bute, *R.B. Filson 12013*, 31.x.1970 (MEL 1018685).

This species is widespread on soil in arid and semi-arid areas of Western Australia, Victoria and New South Wales.

36. GRAPHINA Müll. Arg. 1880:22.

Literature: Wirth and Hale 1963.

Thallus crustose, epi- or endophloic, ecorticate or with a rudimentary cortex. *Apothecia* immersed, adnate or sessile, generally elongate, simple or sparsely branched often contorted; disk narrow and slit-like; margin sometimes carbonaceous; asci clavate 1-3 spored; ascospores hyaline, muriform; paraphyses unbranched.

Figure: Ascospores, fig. 17B.

At present this genus is not known in South Australia, but it is likely to occur on bark or fence posts.

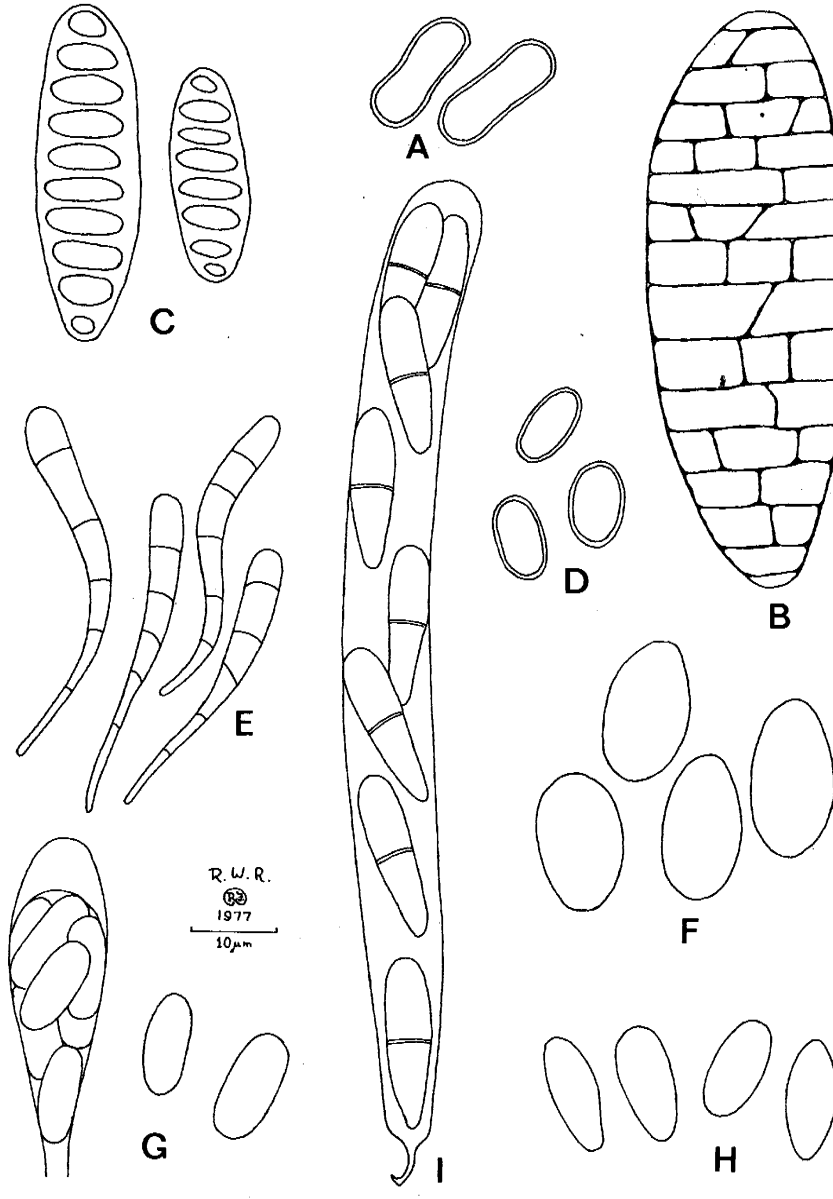


Fig. 17. A, *Fulgensia subbracteata,* ascospores; B, *Graphina* sp., ascospore; C, *Graphis desquamescens,* ascospores; D, *Gymnoderma melacarpum,* ascospores; E, *Haematomma puniceum,* ascospores; F, *Heppia lutosa,* ascospores; G, *Heterodea muelleri,* ascus containing spores and two free ascospores; H, *Hypogymnia pulchrilobata,* ascospores; I, *Icmadophila ericetorum,* ascus containing spores.

37. GRAPHIS Adans. 1763:11

Literature: Nakanishi 1966, Wirth & Hale 1963.

Thallus crustose, epi– or endophloic, ecorticate or with a rudimentary cortex. *Apothecia* immersed, adnate or sessile, generally elongate, simple or sparsely branched, often contorted; disk narrow and slit-like; margin sometimes carbonaceous; asci clavate to oblong, 1-8 spored; ascospores hyaline, transversely one- to many- septate; paraphyses unbranched.

Figure: Ascospores, fig. 17C.

At present there are no records of this genus for South Australia, but it is probably quite common on bark of trees.

38. GYMNODERMA Nyl. 1860:26.

Literature: Yoshimura and Sharp 1968, Hawksworth and Yoshimura 1973.

Gymnoderma melacarpum (F. Wils.) Yoshimura 1973:287.

Neophyllus melacarpa F. Wils. 1891:372.

Thallus squamulose, minute, yellow-green, finely divided, laciniae ascending, 0·1-0·2 mm wide. *Apothecia* marginal, black, globose or subglobose, capitate on short podetia up to 1 mm tall; ascospores eight in ascus, simple, ellipsoid, 10-13 x 4-7 μm.

Figure: Ascospores, fig. 17D.

This species is at present unknown in South Australia but it is likely to occur on rotting logs in the wetter parts of the State.

39. HAEMATOMMA Mass. 1852a:32.

Literature: Culberson 1964.

Thallus crustose, continuous, rugulose or smooth, cracked or continuous, sometimes powdery. *Apothecia* adnate or sessile; disk red to brownish-red; margin concolourous with the thallus; ascospores eight in ascus, 3- many septate, hyaline, acicular.

Haematomma puniceum (Sm. *apud* Ach.) Mass. 1860:253.

Lichen puniceus Sm. *apud* Ach. 1803:167.

Thallus crustose, rugulose, cracked, greyish- to brownish-white. *Apothecia* sessile; disk red to orange-red, up to 1·75 mm diam.; margin prominent, crenulate, concolourous with the thallus; ascospores hyaline, acicular 3-6 septate, 40 x 5 μm.

Figures: Habit, fig. 18A; ascospores, fig. 17E.

Specimen examined: Adelaide, *A. L. Smith,* Aug. 1914 (BM).

Haematomma puniceum occurs widely in Victoria, Tasmania, New South Wales and Queensland.

40. HEPPIA Naeg. *in* Hepp 1853:49.

Literature: Wetmore 1970.

Thallus squamulose, attached to the substrate by hyphae. *Apothecia* immersed; ascospores eight in ascus, hyaline, simple.

Heppia lutosa (Ach.) Nyl. 1863c:45.

Collema lutosum Ach. 1814:309.

Thallus squamulose, grey to olive, irregularly round to elongate, sometimes forming a rosette-like group, concave or flat, margins becoming granular sorediose. *Apothecia* usually one per squamule, immersed, 0·5-1·5 mm diam.; disk concave to flat, yellowish-brown.

Reactions: Thallus K−, hymenium I+ wine-red.

Figure: Ascospores, fig. 17F.

Selected specimens examined: "Mount Eba" Station, *R. W. Rogers 515*, 8.ix.1966 (AD 97733152); "Quondong" Station, 120 km north-north-east of Morgan, *R. W. Rogers 1131*, 23.ii.1967 (AD 97733154); Alford, 20 km north-east of Wallaroo, *R. W. Rogers 934*, 9.ii.1967 (AD 97733153).

This lichen is common but obscure on soils in arid areas of the state.

41. HETERODEA Nyl. 1867:47.

Literature: Filson 1978.

Thallus foliose, becoming erect or spreading irregularly on the substrate; upper surface smooth without soredia or isidia; lower surface ecorticate, felt-like, sometimes veined, sparse to moderately rhizinate. *Apothecia* on the margins of the lobes; ascospores single, hyaline, ellipsoidal. *Pycnidia* marginal subspherical, sessile.

ARTIFICIAL KEY TO SPECIES

1. Lower surface black with paler depressions or pores, or pale with a network of black veins ..... *H. muelleri*
1. Lower surface white or pale grey sometimes indistinctly pitted, but never with a network of black veins ..... *H. beaugleholei*

Heterodea beaugleholei R. Filson 1978:18.

Cladonia alcicornis var. *firma* sensu Müll. Arg. non Nyl.

Thallus foliose forming loosely irregular patches up to 5 cm diam.; lobes ascending at the margins; upper surface smooth, dull to slightly shining, grey-green to yellow-brown; lower surface dirty-white to pale grey, ecorticate, beset

with scattered fasciculate rhizines and occasionally indistinctly pitted; rhizines mainly marginal, black. *Apothecia* terminal on marginal lobes, up to 3 mm diam,. reddish-brown; ascospores eight in ascus, simple, hyaline. *Pycnidia* marginal, stipitate, spherical.

Reactions: K−, C−, KC−, P−.

Specimens examined: Arcoellinna well, Everard Ranges, *R. Helms 18,* 28.v.1891 (ADU); Kimba to Cowell road, 18 km north-west of Cowell, *R. B. Filson 11778,* 22.x.1970 (MEL 1017087); 5 km east of Murray Bridge on Karoonda road, *R. W. Rogers 381,* 11.v.1966 (R.W.R.); Weary Paddock, "Quondong" Station, *R. W. Rogers 1333,* 20.xi.1967 (R.W.R.).

A common soil-growing lichen in Western Australia, Victoria, New South Wales, Queensland and Northern Territory.

Heterodea muelleri (Hampe) Nyl. 1867:47.

Sticta muelleri Hampe 1852:711.

Thallus foliose becoming erect or spreading up to 10 cm across and up to 4 cm tall, lobes ascending and recurved at margins; upper surface smooth, dull to slightly shining, yellow-green to yellow-brown; lower surface ecorticate, densely beset with brown to black rhizines, sometimes pale with a network of dark veins, sometimes black with paler depressions or spots, sometimes wholly black. *Apothecia* on the margins of the lobes up to 1 mm diam., pale reddish-brown to dark reddish-brown; margin not prominent; ascospores eight in ascus, ellipsoidal, simple, hyaline. *Pycnidia* marginal, stipitate, spherical.

Reactions: K−, C−, KC−, P−.

Figures: Habit, plate 7A (MEL 1022010); ascus containing spores and two free spores, fig. 17G.

Selected specimens examined: Everard Ranges, *R. Helms 20,* l.vi.1891 (MEL 7275, ADU); south side of Carappee Hill, Eyre Peninsula, *R. B. Filson 11772,* 22.x.1970 (MEL 1017088); in Mount Lofty Ranges, *F. Mueller,* 1847 (MEL 7279); Para Wirra Recreation Park, *R. W. Rogers 94,* 17.i.1966 (R.W.R.); Rabbit Island soak, Mount Rescue Conservation Park, *R. W. Rogers 1449,* 19.viii.1968 (R.W.R.); near Barossa Reservoir, *R. W. Rogers 1475,* 30.x.1968 (ADU); 2 miles (3 km) north-east of Native Valley, *R. W. Rogers 1518,* 5.xi.1968 (ADU); Koonamore Vegetation Reserve, *R. W. Rogers 1642,* 2.v.1969 (R.W.R.); Ferguson Park, Burnside, *R. W. Rogers 1842,* 6.i.1970 (R.W.R.); Monster Mount, 10 km south of Keith, *R. D. Seppelt 2804,* 28.vii.1973 (MEL 1015509).

Heterodea muelleri occurs in all Australian States.

42. HYPOGYMNIA Nyl. 1881:537.

Literature: Bitter 1901a, Filson 1970, Elix 1979.

Thallus foliose, solid or hollow, dorsiventral, corticate, imperforate, naked below. *Apothecia* round, lecanorine, pedicillate to stipitate; disk brown,

concave to strongly convex; margin prominent, concolourous with the thallus; ascospores eight in ascus, hyaline, simple.

ARTIFICIAL KEY TO SPECIES

1. Thallus solid 2
1. Thallus hollow 3
2. Lobes narrow free, without extensive lateral contact ..... *H. mundata*
2. Lobes broad, contiguous, flattened and expanded towards apices ..... *H. billardieri*
3. Thallus sorediose, usually sterile, medulla usually P− or P+ ..... *H. subphysodes*
3. Thallus esorediose, frequently fertile, medulla P− ..... *H. pulchrilobata*

Hypogymnia billardieri (Mont.) Filson 1970:325.

Cetraria billardieri Mont. 1856:322.

Thallus grey to greenish-grey, forming loosely attached rosettes over the substrate, lobes broad, imbricate, without soredia or isidia; lower surface black, dull, naked, showing at the margins of the lobes from above. *Apothecia* common, up to 10 (−12) mm diam., concave at first becoming lumped and irregular with age; margin thin smooth at first becoming crenulate; ascospores hyaline, ellipsoid, 5-8 x 4·5-6·5 μm.

Reactions: Thallus K+ yellow; medulla K+ yellow becoming dingy brown, KC+ red, P−.

Specimens examined: Springton, *J. A. Elix 181,* 31.xii.1973 (MEL 1012604); western slopes of Mount Crawford, *J. A. Elix 3840,* 2.ix.1977 (J.A.E.).

This species occurs also in Victoria, Tasmania, New South Wales and Queensland.

Hypogymnia mundata (Nyl.) Rassad. 1956:11.

Parmelia mundata Nyl. 1860:401.

Thallus whitish-grey to greenish-grey, large, irregular, lobes enlongate, loosely branched, free, without extensive lateral contacts, without soredia or isidia. *Apothecia* not seen.

Reactions: Thallus K+ yellow, medulla K−, KC+ red, P−.

Specimen examined: 6·5 km west of Springton along the High Eden road, *J. A. Elix 2240,* 20.v.1976 (J.A.E.).

As yet only one specimen has been collected in South Australia. It occurs also in New South Wales and Tasmania.

Hypogymnia pulchrilobata (Bitt.) Elix in press 1979.

Parmelia pulchrilobata Bitt. 1901a:244.

Thallus whitish-grey forming a rosette up to 10 cm diam., adnate to the substrate; lobes elongate, imbricate, 1·0-2·0 mm broad, without soredia or

isidia; lower surface black, dull, naked. *Apothecia* numerous, distinctly pedicillate, up to 20 mm diam.; margin entire, sometimes involute at first, becoming crenulate; ascospores hyaline, ellipsoid, 7·5-8·5 x 5-6 μm.

Reactions: Thallus K+ yellow; medulla K−, KC+ red, P−.

Figure: Habit, plate 7B (MEL 1021190); ascospores, fig. 17H.

Specimen examined: Millbrook, *R. W. Rogers 1777*, 24.ix.1969 (AD 97650005).

Hypogymnia pulchrilobata is found also in Victoria, New South Wales and Western Australia.

Hypogymnia subphysodes (Kremp.) Filson 1970:325.

Parmelia subphysodes Kremp. 1880:338.

Thallus greyish-white, forming a loose mat over the substrate, attached mostly at the base of the lobes which are up to several centimetres long and very sparsely branched, densely sorediose on the older lobes; lower surface black, dull, naked, clearly visible from above. *Apothecia* not seen.

Reactions: Thallus K+ yellow; medulla K+ yellow turning brown, KC+ red, P+ pale yellow-orange to red.

Figure: Habit, plate 6B (MEL 1021853).

Specimens examined: Mount Lofty, *E. Dahl*, 4.v.1970 (CANB 228124); Kuitpo Forest, *R.W. Rogers 1423*, 21.viii.1968 (MEL 1018688); western side of the border road, 13 km north of Nelson-Caveton road, *R.B. Filson 14627*, 16.v.1973 (MEL 1018689).

Hypogymnia subphysodes is found growing over old stumps and on the persistent bark at the base of trees in the dry sclerophyll forests. It has been recorded in Western Australia, Victoria, New South Wales and Queensland.

43. ICMADOPHILA Trev. 1851-52:267.

Thallus crustose, granular, ecorticate. *Apothecia* lecideine, sessile or shortly stipitate, disk pale pink or brownish-pink, margin concolourous with the disk, ascospores eight in ascus, hyaline, uniseptate, rarely three-septate.

Figure: Ascus containing spores, fig. 17I.

Icmadophila has not yet been recorded in South Australia but species in this genus have been collected on roadside cuttings and earth banks in western Victoria.

44. LECANORA Ach. 1810:77.

Literature: Imshaug and Brodo 1966, Magnusson 1931.

Thallus crustose to subfoliose, usually poorly differentiated into layers, upper and lower cortex distinct or indistinct. *Apothecia* lecanorine, sessile; disk flat to

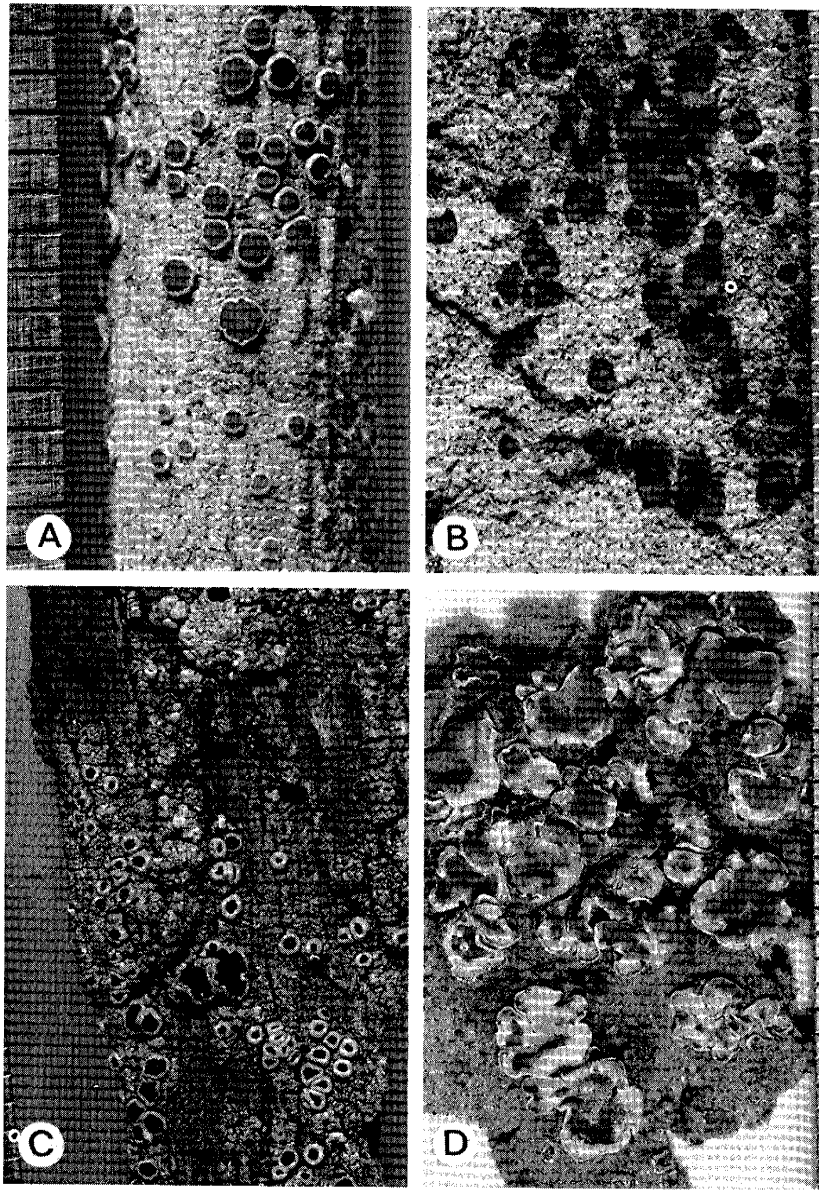


Fig. 18. A, *Haematomma puniceum*; B, *Peltula euploca*; C, *Lecanora atra*; D, *Lecidea decipiens*. Scale in millimetres.

convex; margin concolourous with the thallus; ascospores eight in ascus, hyaline simple.

Figures: Lecanora atra, habit, plate 7C (MEL 1021202) and fig. 18C; ascospores, fig. 19A.

Lecanora is a large genus, and the Australian material is not well known. A number of species have been collected in South Australia. *L. atra* (Huds.) Ach., has a white to greyish-white rugulose thallus, flat to convex black disk with a crenulate margin, concolourous with the thallus. This species is common in the drier areas on soil, rock and wood especially on old fence posts. *L. subcarnea* (Sw.) Ach., has large pale apothecia and is found on rocks in wetter areas. *L. sphaerospora* Müll. Arg. with its bluish-white pruinose, black apothecia and white thallus, the upper surface of which is cracked into solid angles giving it a crystalline appearance, is common on limestone pebbles in the arid areas. *L. varia* (Hoffm.) Ach., has a thin greenish-white thallus with flat, pale brown apothecia with lighter coloured prominent margins and is found on the smooth-barked trees in the dry sclerophyll forests.

45. LECIDEA Ach. 1803:32 em Zahlbr. 1905:130.

Literature: Hertel 1967, 1968, 1969b.

Thallus crustose or squamulose, mostly ecorticate with sessile apothecia. *Apothecia* lecideine; disk usually black or dark brown; margin concolourous with the disk; ascospores eight in ascus, simple, hyaline.

This is one of the largest of the crustose lichen genera, containing about 1 500 described species. The Australian material, as with other crustose genera, is poorly known except for the few squamulose species. A number of species of *Lecidea* occur on rocks, and soil, for which reliable names are not available.

ARTIFICIAL KEY TO THE SQUAMULOSE SPECIES

1. Squamules pink to brownish-pink with or without a white pruinose margin ..... *L. decipiens*
1. Squamules grey, brown or cream but not pink 2
2. Upper surface cracked into solid angles, thus having a crystalline appearance ..... *L. crystallifera*
2. Upper surface smooth 3
3. Squamules dark brown, round ..... *L. globifera*
3. Squamules cream, crenate ..... *L. psammophila*

Lecidea crystallifera Tayl. 1847:148.

Thallus squamulose, thick, grey or brown, up to 3 mm diam., sometimes much larger; upper surface cracked into pyramid-like polygons making it appear like a mass of crystals. *Apothecia* common, flat to strongly convex, marginal or laminal.

Figure: Habit, fig. 15C.

Selected specimens examined: Koonalda Cave, Nullarbor Plain, *R. B. Filson 9415,* 28.xii.1966 (MEL 25428); Gawler Ranges, *D. N. Krahenbuehl 2416,* 15.ix.1968 (MEL 37628); Memory Cove, Cape Catastrophe, *R. B. Filson 11823,* 24.x.1970 (MEL 1018623); 17 km north-east of Kimba, *A.C. Beauglehole 15113,* 27.ix.1965 (MEL 27922); Kingoonya, *R. W. Rogers 488,* 7.ix.1966 (AD 97733160); Port Wakefield, *R. W. Rogers 906,* 9.ii.1967 (AD 97733162); Two Wells, *R. W. Rogers 1568,* 11.xi.1968 (AD 97733163); Swan Reach, *R. W. Rogers 451,* 11.v.1966 (AD 97733159); Pinnaroo, *R. W. Rogers 323,* 9.iii.1966 (AD 97733158).

This species is common on arid and sub-arid soils where it is found covering small spaces between pebbles or forming rosettes on open areas. It has been recorded in Victoria and Western Australia.

Lecidea decipiens (Hoffm.) Ach. 1803:80.

Psora decipiens Hoffm. 1794:68.

Thallus squamulose, thin, pink to brownish-pink, up to 3 (−6) mm diam., commonly with a white pruinose margin, becoming crenate or lobed; upper surface smooth, cracking on older squamules, sometimes heavily white pruinose. *Apothecia* common, black, convex to hemispheric, usually marginal.

Figures: Habit, fig. 18D; ascospores, fig. 19B.

Selected specimens examined: Vicinity of Koonalda Cave, Nullarbor Plain, *R. B. Filson 9412,* 28.xii.1966 (MEL 25427); Gawler Ranges, *D. N. Krahenbuehl 2418,* 15.ix.1968 (MEL 37629); Koonamore Vegetation Reserve, *C. M. Eardley* 24.vi.1946 (MEL 7236); 9 miles (14 km) east of Springton, *J. A. Elix 471,* 15.x.1974 (MEL 1013130); Two Wells, *R. W. Rogers 1567,* 11.xi.1968 (AD); Kadina, *R. W. Rogers 938,* 9.ii.1967 (AD); Milang, *R. W. Rogers 1539,* 5.xi.1968 (AD).

This very common and widely distributed lichen apparently comprises several physiologically and chemically different races. It is recorded from all continents except South America, and from hot tropical deserts to within the Arctic Circle.

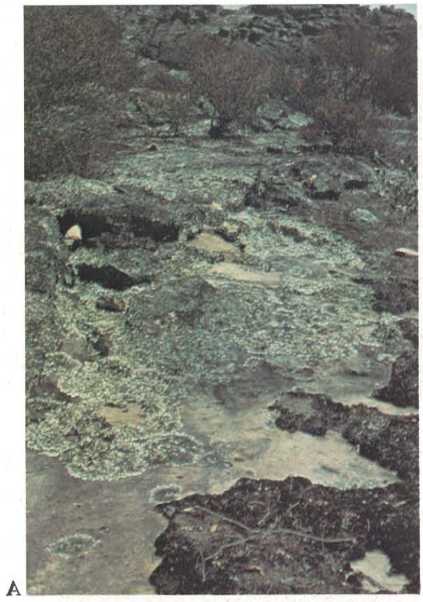
Lecidea globifera Ach. 1810:213.

Thallus squamulose, thin, brown, up to 2 mm diam., becoming irregularly lobed; upper surface, smooth or slightly rough. *Apothecia* black, flat to covex, laminal.

Figure: Habit, fig. 15D.

Specimen examined: Cape Jervis, *R. W. Rogers 1469,* 1.ix.1968 (AD 97649767).

This species is apparently rare, growing on exposed soil.


A


B


C

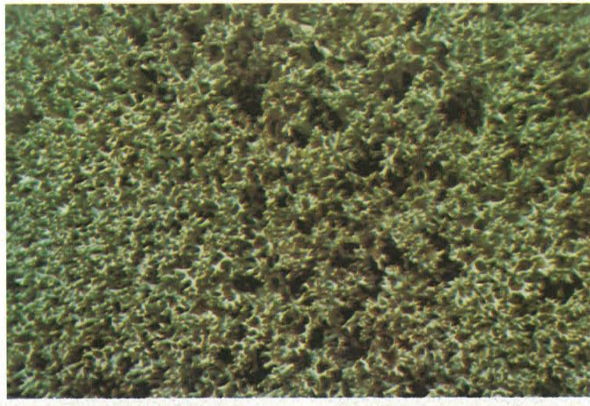
Plate 1. Lichen habitats: A, rock flats; B, branches; C, earth flats.

A

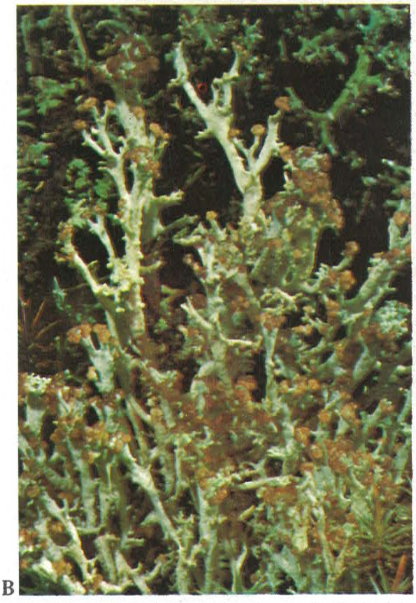
B

C

Plate 2. A, *Caloplaca fulgens;* B, *Cladonia didyma;* C, *Cladonia fimbriata.*



A



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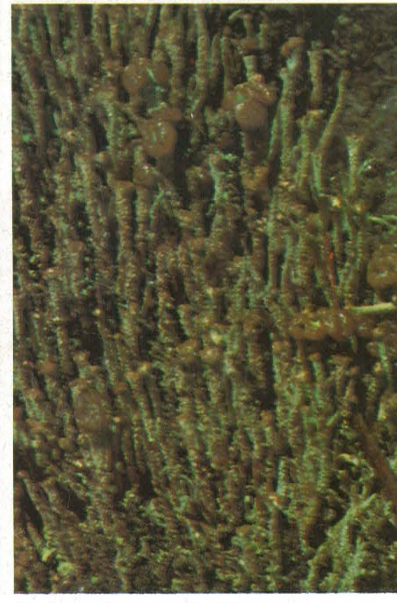


C

Plate 3. A, *Cladonia capitellata;* B, *Cladonia furcata;* C, *Cladonia pityrea.*

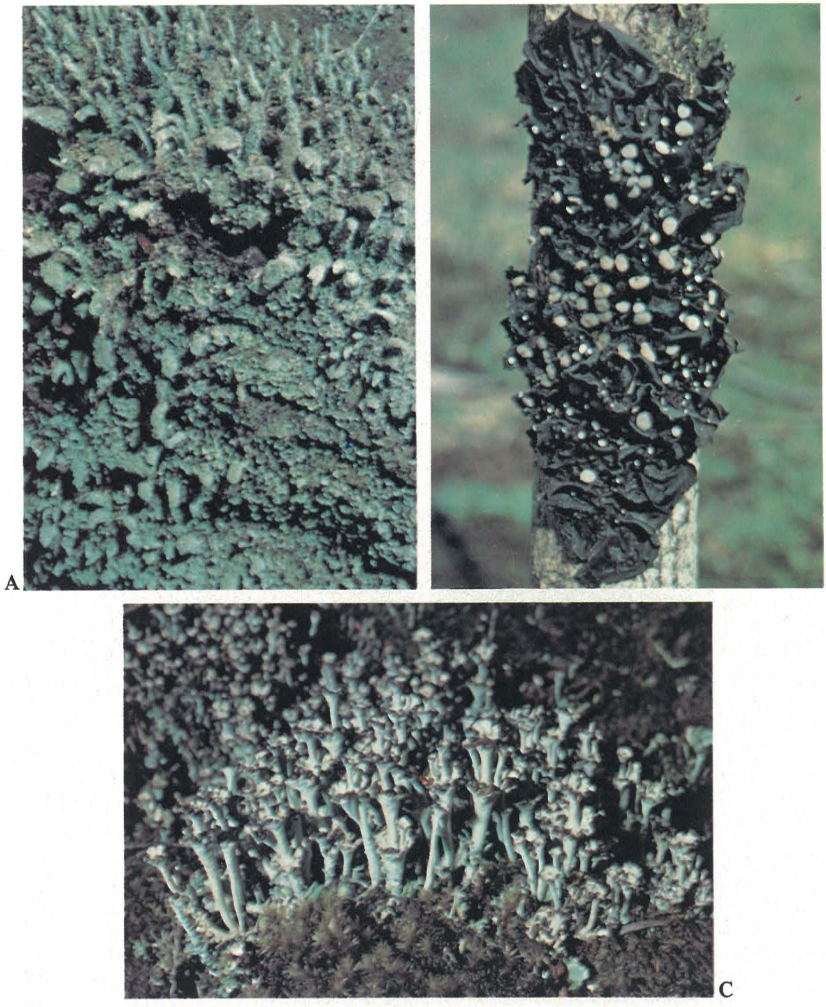


Plate 4. A, *Cladonia squamosula;* B, *Collema glaucophthalma;* C, *Cladonia verticillata*

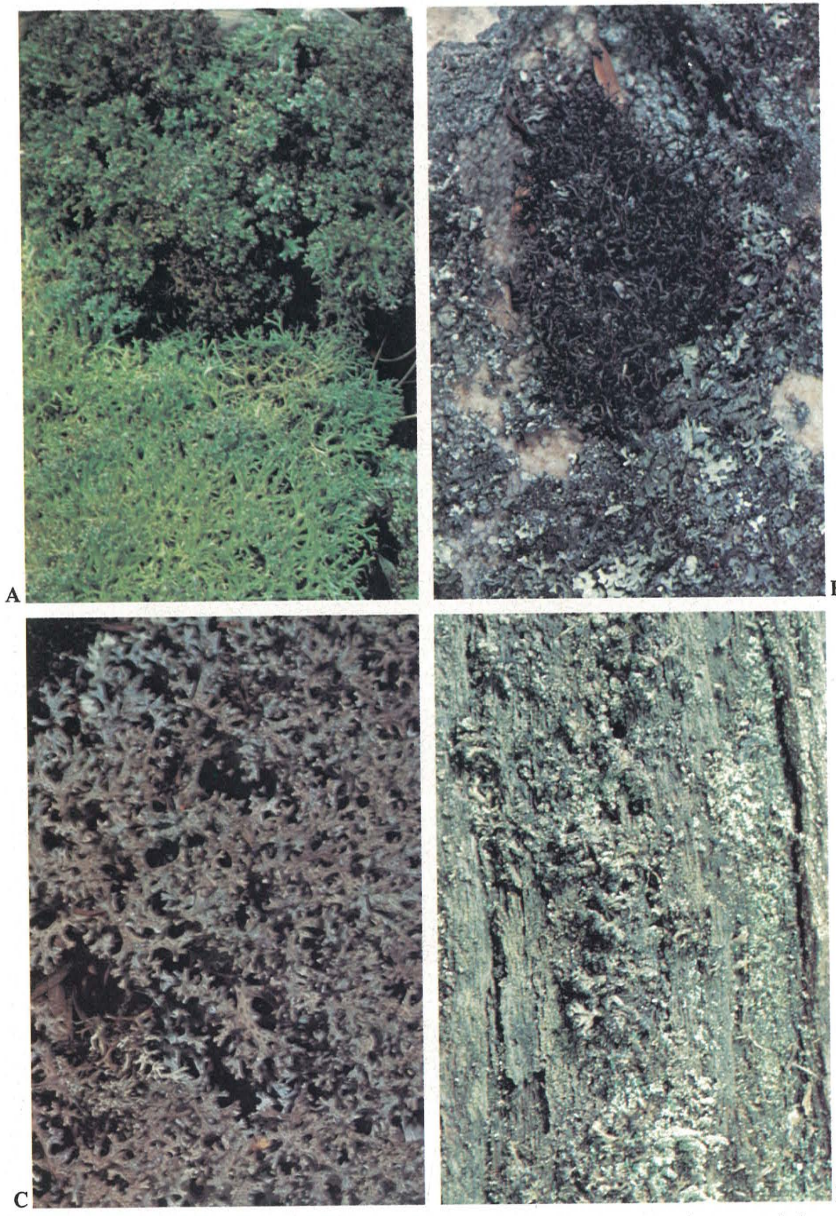


Plate 5. A, *Cladia aggregata*, green forest form; B, *Cladia aggregata*, brown rock form; C, *Cladia corallaizon;* D, *Cladia schizopora.*

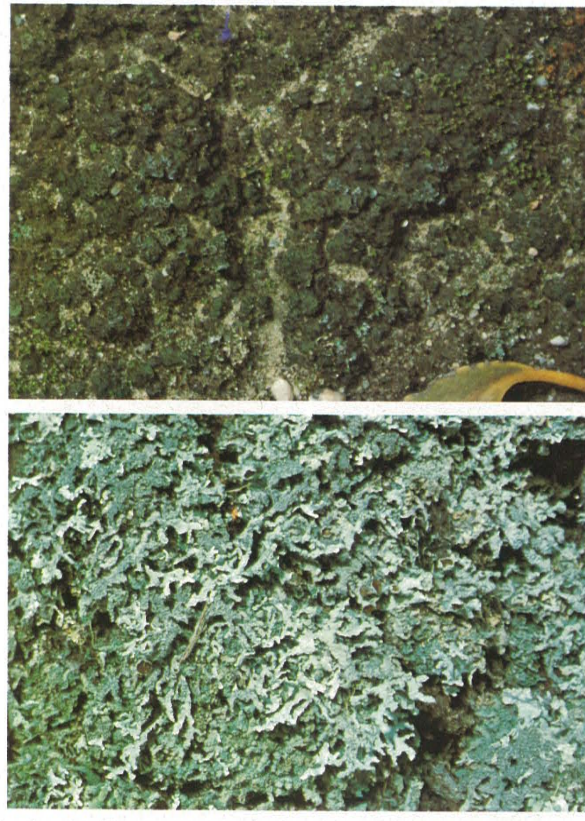


Plate 6. A, *Dermatocarpon lachneum;* B, *Hypogymnia subphysodes.*

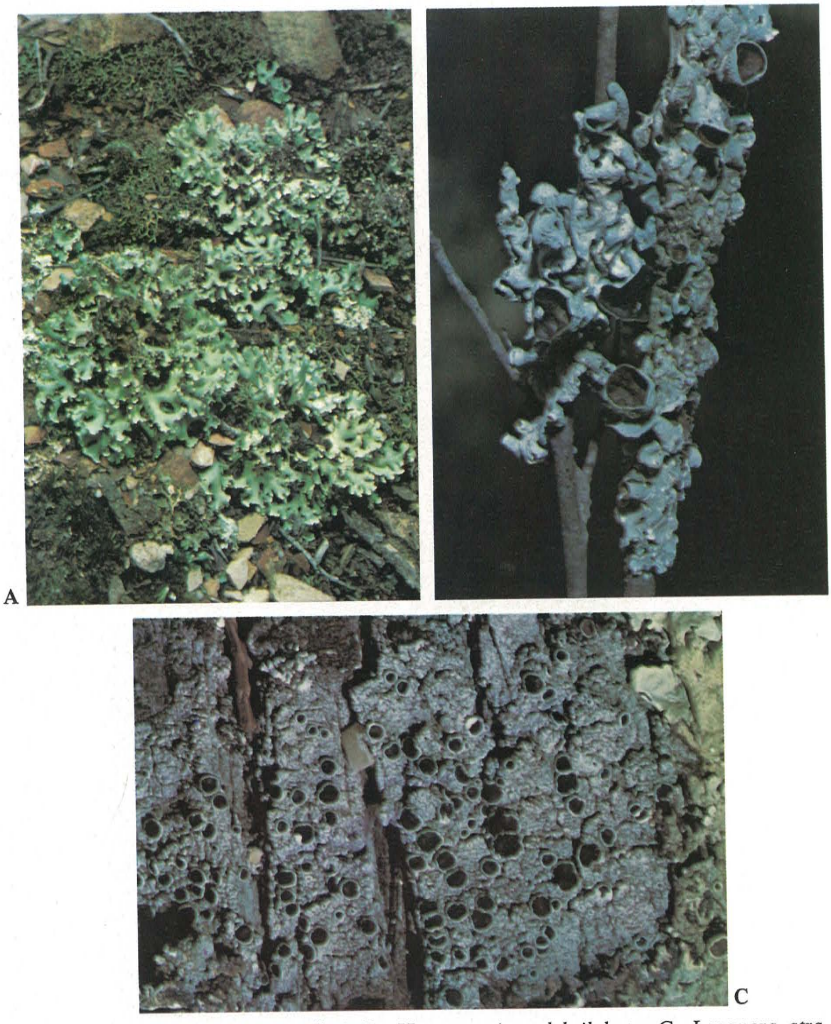


Plate 7. A, *Heterodea muelleri;* B, *Hypogymnia pulchrilobata;* C, *Lecanora atra.*

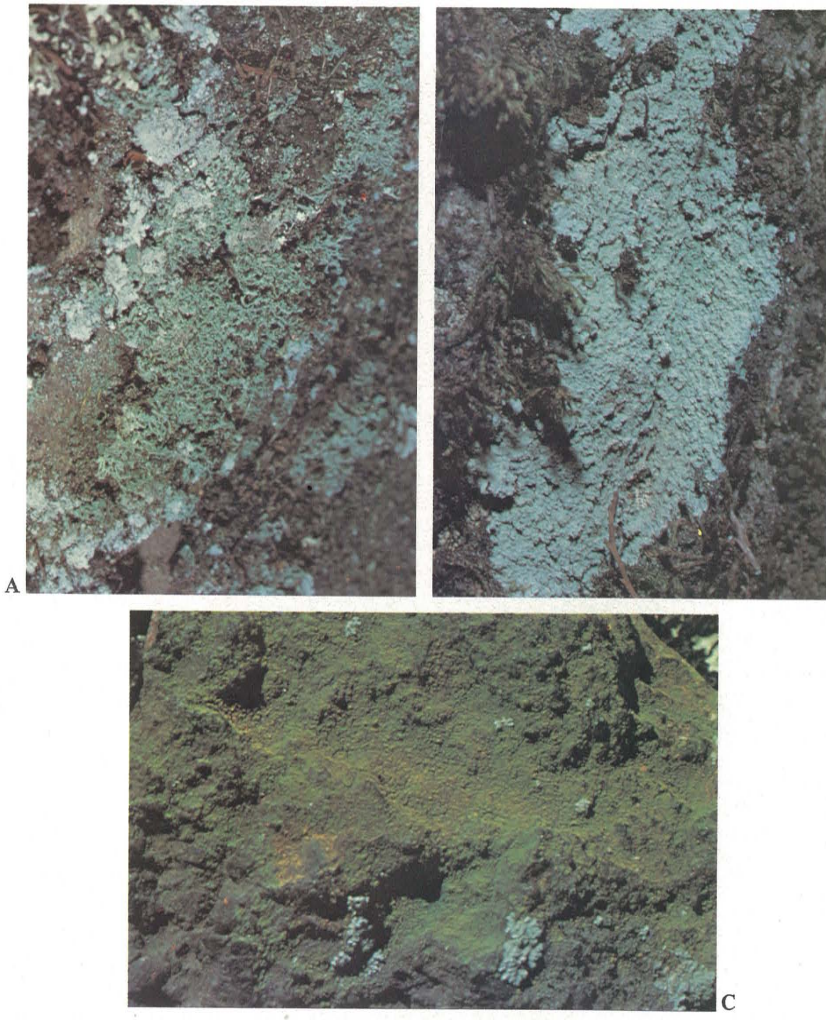


Plate 8. A, *Leprocaulon microscopicum;* B, *Lepraria membranaceae;* C, *Lepraria candelaris.*

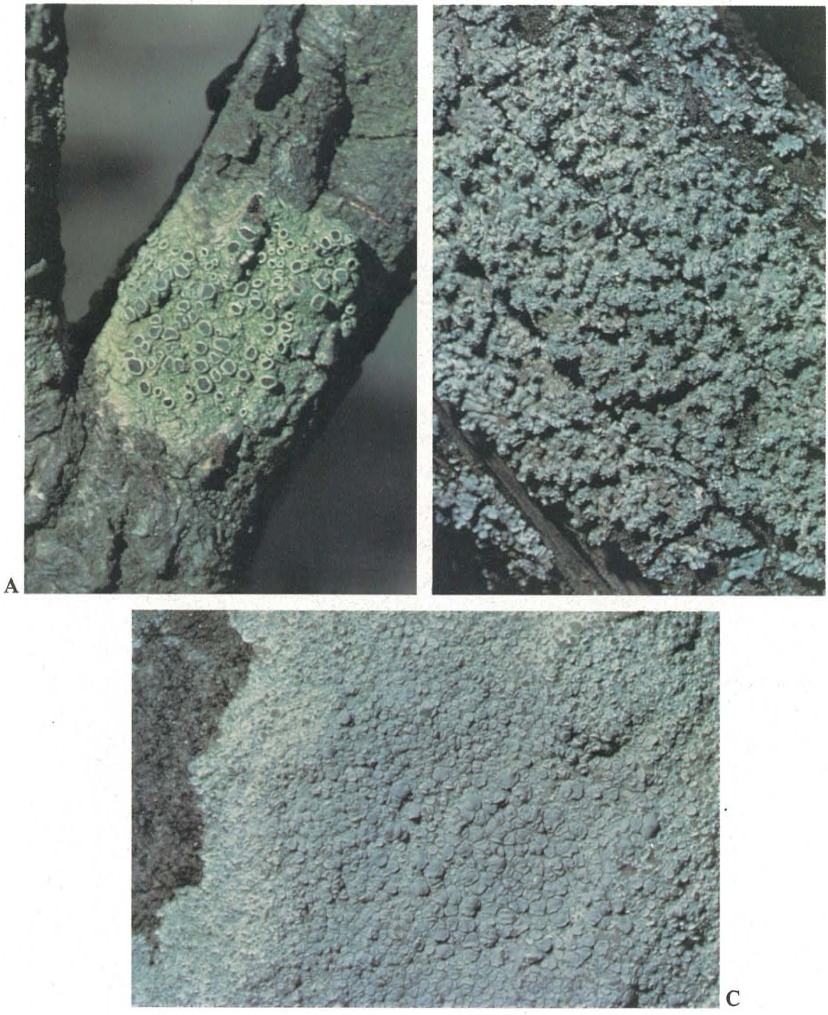


Plate 9. A, *Maronea constans;* B, *Menegazzia globulifera;* C, *Ochrolechia* sp.

A

B

Plate 10. A, *Parmelia caperata;* B, *Parmelia cheelii.*

A

B

C

Plate 11. A, *Parmelia cinerascens;* B, *Parmelia congesta;* C, *Parmelia furcata.*

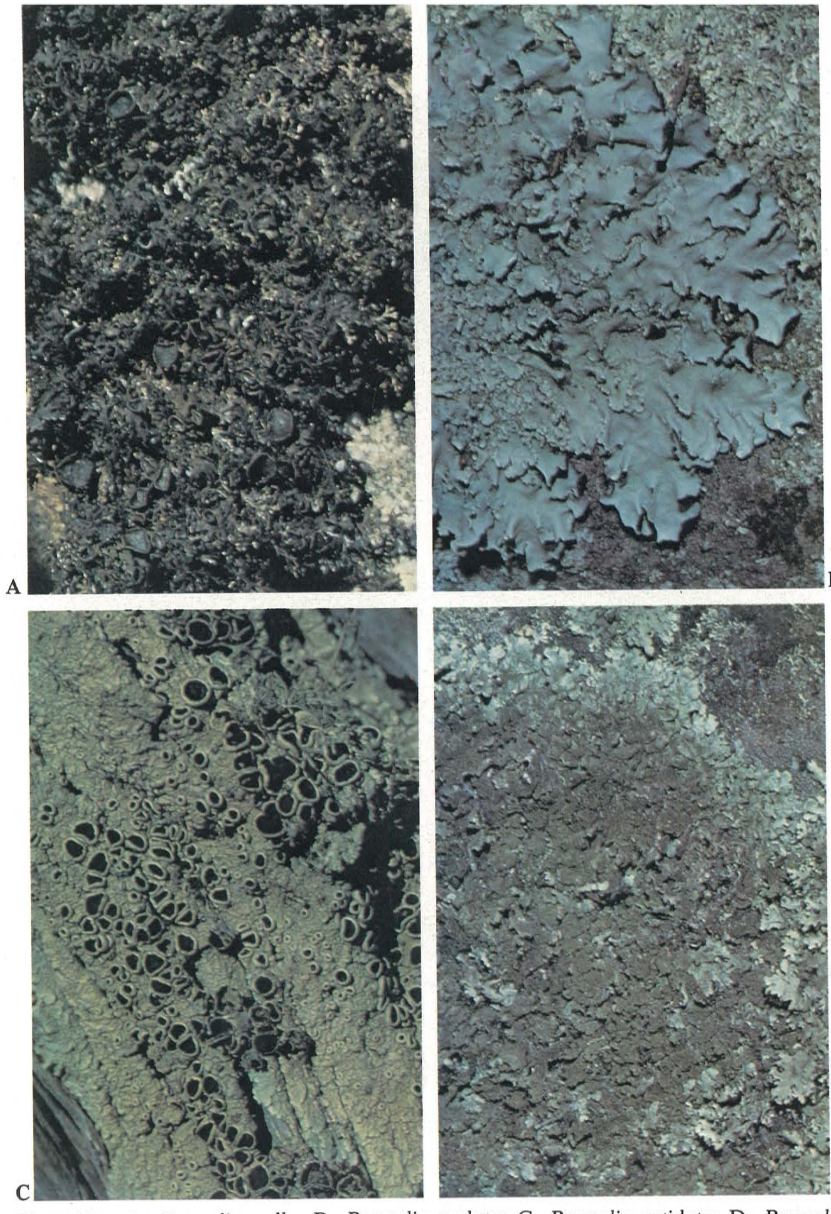


Plate 12. A, *Parmelia pulla;* B, *Parmelia perlata;* C, *Parmelia rutidota;* D, *Parmelia scabrosa.*

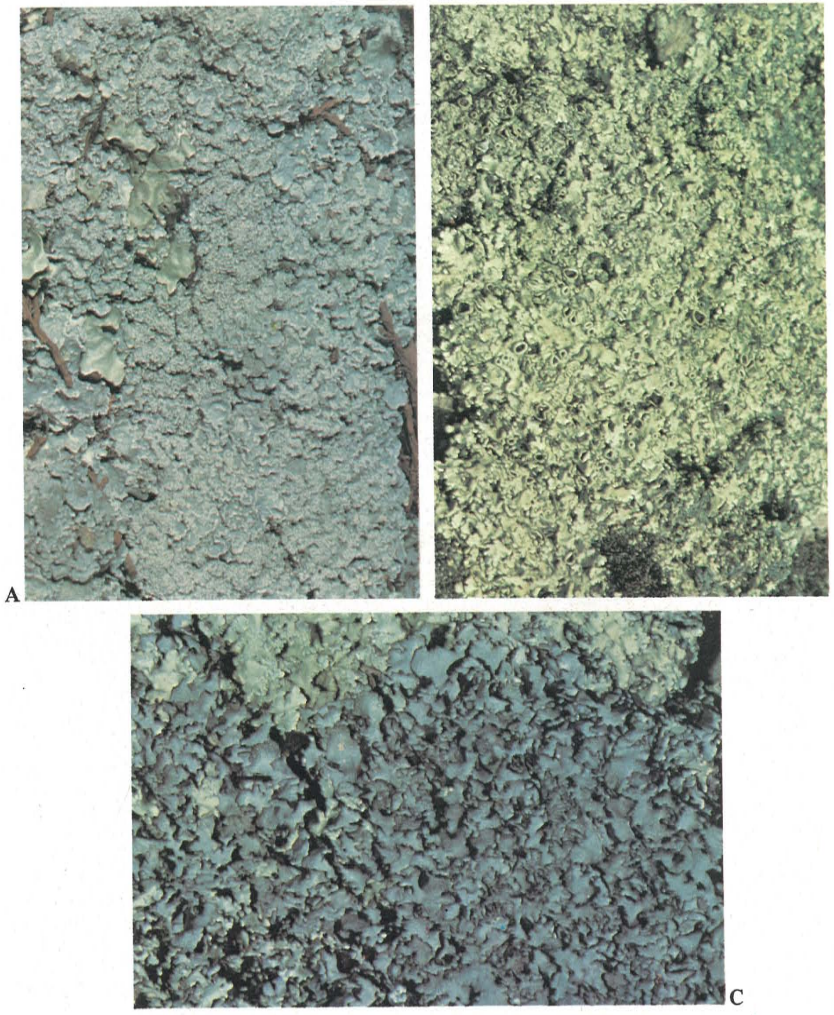


Plate 13. A, *Parmelia subrudecta;* B, *Parmelia tasmanica;* C, *Parmelia tenuirima.*

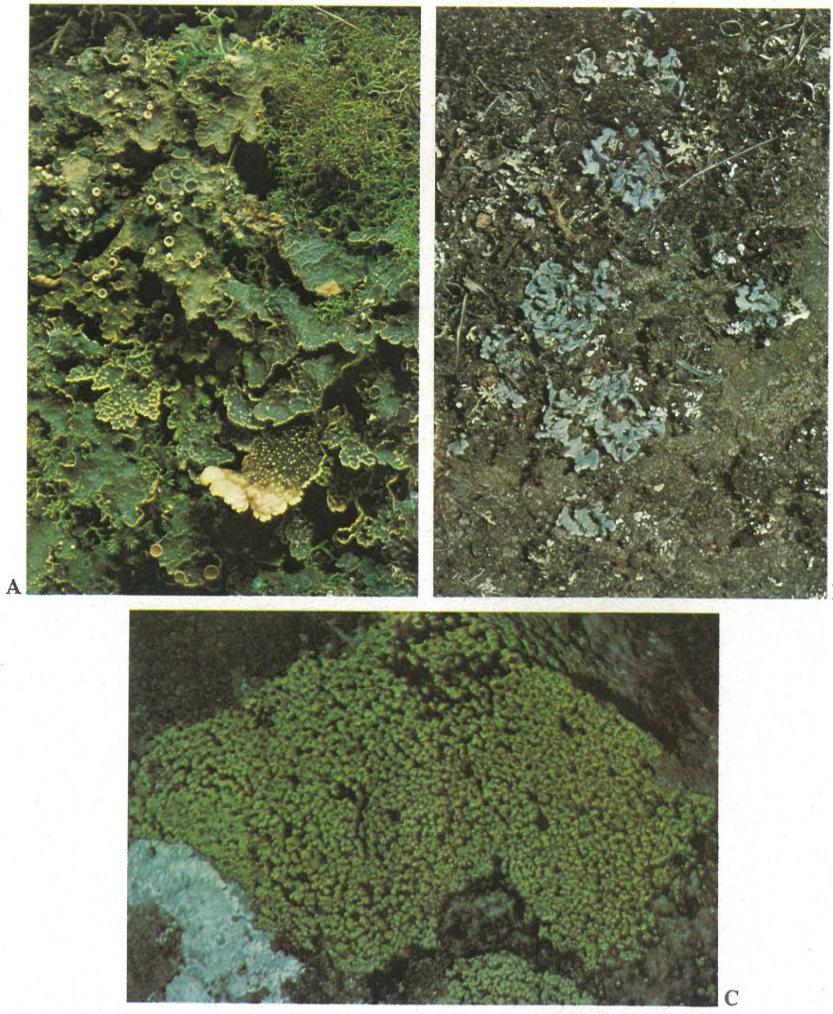
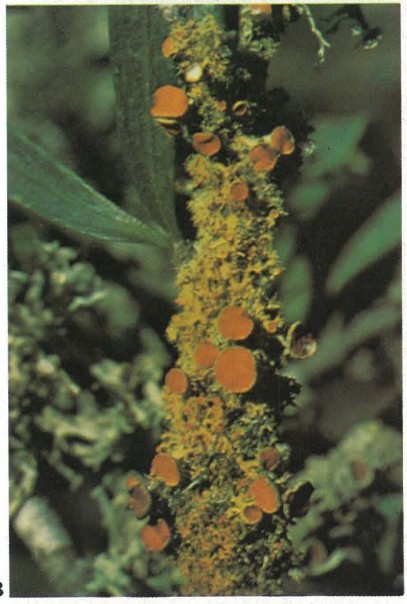


Plate 14. A, *Pseudocyphellaria australiensis;* B, *Siphula coriacea;* C, *Rhizocarpon tinei.*

A



B

C

Plate 15. A, *Teloschistes chrysophthalmus;* B, *Teloschistes sieberianus;* C, *Teloschistes velifer.*

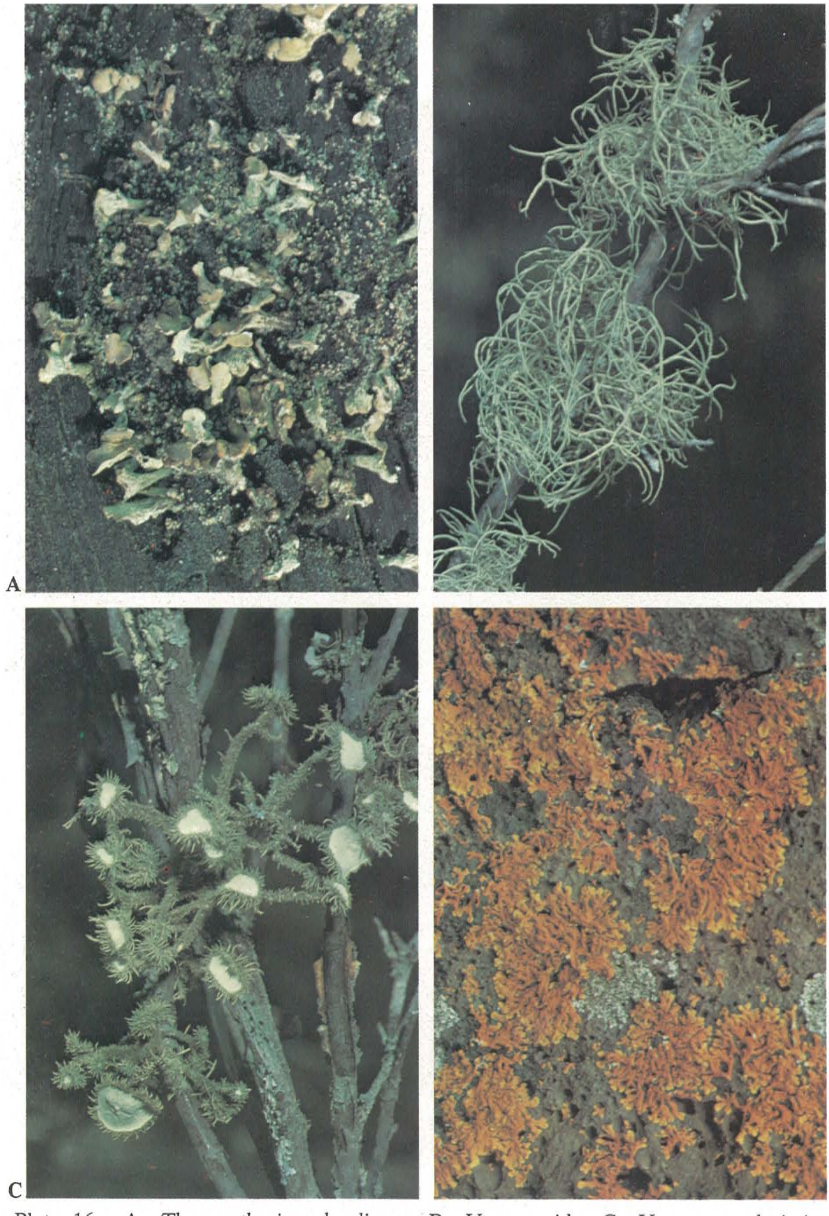


Plate 16. A, *Thysanothecium hyalinum;* B, *Usnea arida;* C, *Usnea ramulosissima;* D, *Xanthoria ectanea.*

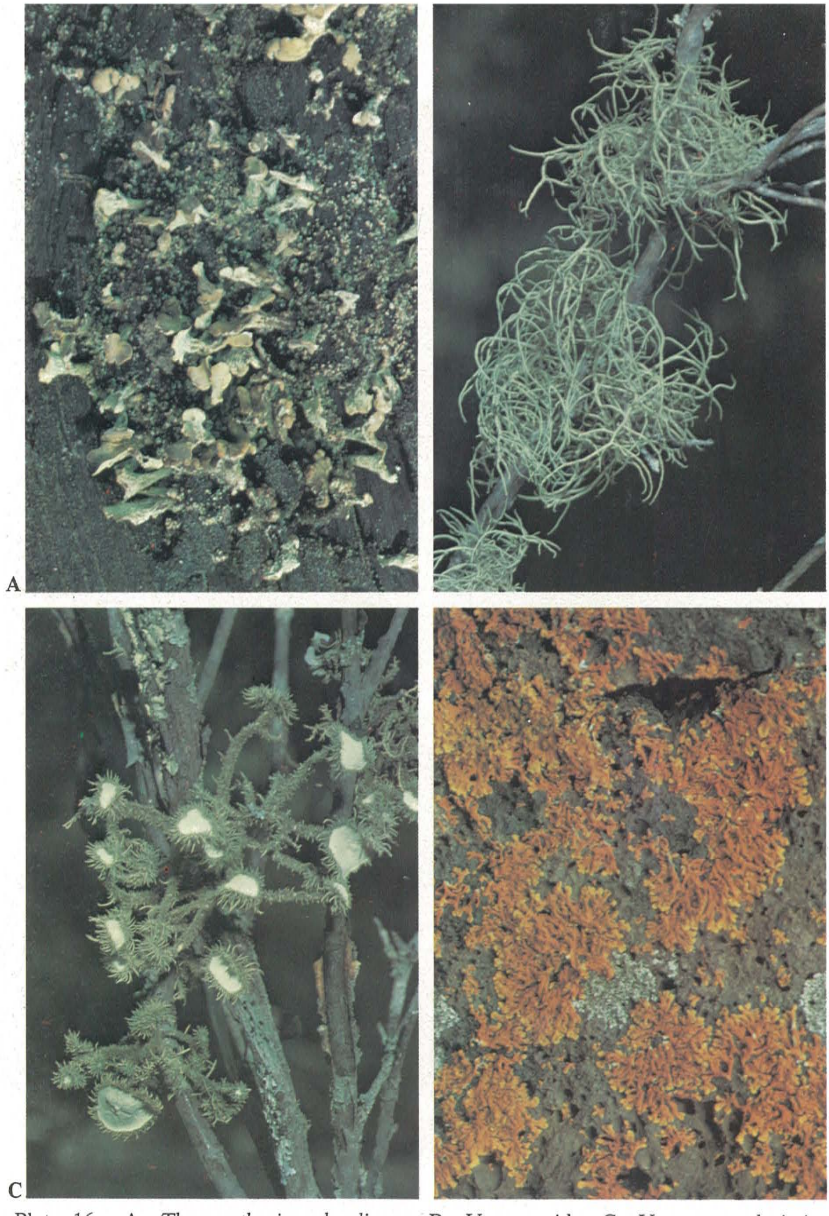


Plate 16. A, *Thysanothecium hyalinum;* B, *Usnea arida;* C, *Usnea ramulosissima;* D, *Xanthoria ectanea.*

Lecidea psammophila (Müll. Arg.) Zahlbr. 1925:889.

Psora psammophila Müll. Arg. 1892:194.

Thallus squamulose, cream or pale brown, thick, crenulate; upper surface more or less smooth, concave. *Apothecia* black.

Specimens examined: Camp 10, 14 miles (22 km) west of Turner Hill, *R. Helms 24,* 28.v.1891 (MEL 7147); "Quondong" Station, 120 km north-east of Morgan, *R. W. Rogers 1089,* 17.v.1967 (AD 97733166); Greenock, *R. W. Rogers 1491,* 29.x.1968 (AD 97733164); Murray Bridge, *R. W. Rogers 368,* 11.v.1966 (AD 97733167); Kanmantoo, *R. W. Rogers 1527,* 4.xi.1968 (AD 97733165).

This species is also found in the arid and sub-arid environments of Victoria and New South Wales.

46. LEPRARIA Ach. 1803:3.

Thallus crustose, leprose-sorediose, powdery, sometimes as scattered granules sometimes aggregated into clusters sometimes continuous; granules ecorticate. Fruiting bodies unknown.

ARTIFICIAL KEY TO SPECIES

1. Thallus primuline-yellow to gold, usually corticolous..... *L. candelaris*
1. Thallus white to greyish-white, usually muscicolous or terricolous..... ..... *L. membranaceae*

Lepraria candelaris (L.) Fr. 1824:16.

Byssus candelaris L. 1753:1169.

Thallus crustose, of primuline-yellow to golden granules scattered on the substrate, sometimes forming a continuous mass and covering large areas.

Figure: Habit, plate 8C (MEL 1021195).

Although there appear to be no representatives of this species in the collections, it is known to occur in the wetter areas of the South-East.

Lepraria membranaceae (Dicks.) Lett. 1958:127.

Lichen membranacea Dicks. 1790:21.

Thallus crustose of white to greyish-white granules, usually held together by wefts of fungal hyphae, sometimes scattered on the substrate, sometimes in clusters and sometimes continuous.

Specimens examined: Southern face of Mount Illbillie, Everard Ranges, *R. B. Filson 15673,* 25.xi.1975 (MEL 1018605); Naracoorte, *M. Beek 194,* 12.v.1974 (MEL 1018658).

Figure: Habit, plate 8B (MEL 1021205).

This species grows on bare earth and amongst mosses under shaded overhangs, often in dry places. It has been recorded in Victoria and the Northern Territory.

L. membranaceae may be confused with *Leprocaulon* sp. but it is always granular-sorediose and never produces fruticose pseudopodetia.

47. LEPROCAULON Nyl. ex Lamy 1868:352.

Literature: Lamb and Ward 1974.

Thallus fruticose, cartilaginous, simple or branched, terete or subterete, leprose-sorediose. Fruiting bodies unknown.

ARTIFICIAL KEY TO SPECIES

1. Thallus faintly yellowish-grey, slender filiform, more or less covered with mealy powdery granules ..... *L. microscopicum*
1. Thallus white to whitish-grey more or less dorsiventral without fine powdery granules ..... *L. arbuscula*

Leprocaulon arbuscula (Nyl.) Nyl. 1889:8.

Stereocaulon arbuscula Nyl. 1860:253.

Thallus in small scattered groups or tufts, branched, distinctly dorsiventral, soft and fragile, up to 2 cm tall, ultimate branches very fine; pseudopodetia leprose-sorediose above becoming bare below, grey to greyish-white to pale greyish-green.

Reactions: K+ brown, P± red.

Specimen examined: Port Germein Gorge, Southern Flinders Ranges, *R. B. Filson 15505,* 15.xi.1975 (MEL 1018587).

L. arbuscula grows on bark, mosses over rock or on bare rock and occurs in shaded moist habitats. Recorded also in Victoria.

Leprocaulon microscopicum (Vill.) Gams ex Hawksworth in Hawksworth and Skinner 1974:128.

Lichen microscopicus Vill. 1789:949.

Thallus crowded into tufts, more or less erect up to 3 cm tall, slender filiform, subsimple to sparingly branched; pseudopodetia completely covered with mealy-powdery sorediose granules, pale yellowish-green to pale yellowish-white.

Reactions: K−, P−.

Figure: Habit, plate 8A (MEL 1021207).

Specimen examined: On rocky hillside, "Olive Grove" Station, 14·5 km south of Quorn, *R. B. Filson 11989,* 30.x.1970 (MEL 1018602).

L. microscopicum is usually found on soil in crevices of rocks, under overhangs, in shady but often dry habitats. It is recorded also from Victoria.

48. LEPTOGIUM (Ach.) S. F. Gray 1821:400.

Literature: Sierk 1964.

Thallus foliose, irregular in shape, with an upper and lower cortex, each usually of a single layer of cells; medulla poorly developed, the algal cells scattered amongst the loosely woven hyphae; attached to the substrate by rhizines. *Apothecia* adnate, sessile or shortly stipitate, laminal; disk reddish-brown to black; margin concolourous with the thallus, sometimes disappearing; ascospores usually eight in ascus hyaline, fusiform to ellipsoid, muriform.

ARTIFICIAL KEY TO SPECIES

1. Upper surface smooth, margins of lobes lacerate, lobulate, lower surface bare ..... *L. lichenoides*
1. Upper surface smooth, margins of lobes entire, lower surface covered with light tomentum ..... *L. sp.*

Leptogium lichenoides (L.) Zahlbr. 1924:136.

Tremella lichenoides L. 1753:1157.

Thallus forming patches up to 5 cm diam., pulvinate, composed of erect to semi-erect foliose lobes, lead-grey to brown; lobes orbicular to elongate, margins entire or finely divided sometimes fimbriate; upper surface smooth to distinctly wrinkled; lower surface smooth, bare. *Apothecia* sessile on the upper surface, up to 1·5 mm diam.; disk concave to slightly convex, brown to reddish-brown; margin entire paler than the disk, thalloid margin thin, sometimes lobulate, concolourous with the thallus; ascospores ellipsoid to fusiform, 27-30 x 10-13 μm, hyaline, muriform.

Figure: Ascospore, fig. 19D

Specimens examined: Aldgate, *L. D. Williams 1934e*, 2.viii.1964 (L.D.W.); Coonalpyn, *L. D. Williams 2348*, 22.viii.1965 (L.D.W.).

Leptogium lichenoides grows also in Victoria, Tasmania and New South Wales.

Leptogium sp.

Thallus continuous or of scattered lobes amongst mosses, at the base of trees or terricolous, grey, greenish-grey to brown; lobes up to 8 mm wide, margins smooth sometimes lobulate; upper surface smooth, dull or shining towards the margins; lower surface with dense tomentum in the centre of lobes, bare towards the margins. *Apothecia* up to 0·75 mm diam., laminal, sessile; disk concave, reddish-brown; margin entire paler than the disk, thalloid margin very thin sometimes with scattered rhizines towards the base; ascospores 27-31 x 11-12 μm, hyaline, muriform.

Figure: Ascospores, fig. 19C.

Specimens examined: Meningie, *L. D. Williams 871,* 28.vii.1960 (L.D.W.); Canunda National Park, 14 km west of Millicent, *R. B. Filson 14658,* 17.v.1973 (MEL 1018600).

This species has affinities with *L. menziesii* Mont. but differs in having smaller apothecia and less dense tomentum on the under surface. It is also similar to *L. inflexum* Nyl. differing from that species in the smaller apothecia, smaller spores and in the rhizines on the lower parts of the thalloid margin.

49. LICHINA C.Ag. 1821:104.

Literature: Henssen 1963.

Thallus minutely fruticose, more or less erect, of densely clustered branches; cortex indistinctly plechtenchymatous or of tangled hyphae; algal layer irregular. *Apothecia* minute, immersed in tip of the branches; disk more or less closed; asci cylindrical; ascospores eight in ascus, hyaline, oblong, simple.

Lichina pygmaea (Lightf.) C.Ag. var. **intermedia** Bab. 1855:311.

Thallus dark olive-green to black, forming small, tufty cushions of erect terete lobes 0·1-0·2 mm diam., up to 10 mm tall, lobes much branched. *Apothecia* mostly terminal, immersed in swollen flask-like structures 0·3-0·5 mm diam.

Figure: Ascospore, fig. 19E.

Specimens examined: Port Victoria, Yorke Peninsula, *R. D. Seppelt 637,* 21.i.1973 (MEL 515807); rocky outcrop on coast 3 miles (5 km) north of Arno Bay turnoff on the Lincoln Highway, Eyre Peninsula, *R. B. Filson 11799,* 23.x.1970 (MEL 1018655); Cape Northumberland, 2 km west of Port MacDonnell, *R. B. Filson 15819,* 9.iii.1977 (MEL 1018656).

Growing on rocks in the littoral zone, mostly in a westerly aspect. It occurs also in Western Australia, Victoria, Tasmania and New South Wales.

50. MARONEA Mass. 1856a:291.

Literature: Magnusson 1934.

Thallus crustose, ecorticate. *Apothecia* adnate to sessile; margin concolourous with the thallus; asci clavate; ascospores numerous in ascus, hyaline, simple or uniseptate.

Maronea constans (Nyl.) Hepp 1860:771.

Lecanora constans Nyl. 1855b:199.

Thallus crustose, grey-green to brown, continuous, granulose, up to 2 cm diam. *Apothecia* sessile, up to 1·5 mm diam.; disk warm brown to dull black; margin crenulate, concolourous with the thallus, ascospores numerous, hyaline, simple, 4-7 x 3-4 μm.

Figures: Habit, plate 9A (MEL 1021855); ascus containing spores and one free ascospore, fig. 19F.

Specimens examined: Mount Whyalla, *R. W. Rogers 1809,* 5.xi.1969 (R.W.R.); Seppeltsfield, *R. D. Seppelt,* ? 1969 (R.W.R.); Hamley Bridge, *R. W. Rogers 1323,* 18.xi.1967 (R.W.R.); Two Wells, *R. W. Rogers 1579,* 11.xi.1968 (R.W.R.).

Maronea constans is widespread on the bark of trees and is recorded from Victoria and New South Wales.

51. MELASPILEA Nyl. 1856:416

Literature: Wirth and Hale 1963.

Thallus crustose, thin, endo- or epiphloic, ecorticate. *Apothecia* immersed, adnate or sessile, round to irregular or elongate, simple or branched, with a proper exciple; asci oblong to clavate; ascospores eight in ascus, becoming brown, usually uni-septate but occasionally more, locules usually unequal, constricted at the septum; paraphyses unbranched, sometimes absent.

Figure: Ascospores, fig. 19G.

At present this genus has not been recorded in South Australia, but it is likely to occur on bark.

52. MENEGAZZIA Mass. 1854:3.

Literature: Santesson 1943.

Thallus foliose, inflated, hollow, lobate, radiate, dorsiventral, corticate; upper surface smooth, perforate; lower surface naked, attached to the substrate by the lower cortex. *Apothecia* round, somewhat pedicillate. lecanorine; ascospores two to eight in ascus, hyaline, ellipsoidal, simple.

Menegazzia globulifera Sant. 1943:30.

Thallus blue-grey to greenish-grey, forming small rosettes up to 4 cm diam., closely adnate to the substrate; lobes up to 2 mm broad, perforated at the ends; soralia globose becoming crateriform and then opening into the thalline cavity; lower surface black, dull naked. *Apothecia* not seen.

Reactions: Medulla K+ yellow, C−, P+ ochre-red.

Figures: Habit, plate 9B (MEL 1021201); ascospores, fig. 19H.

Specimens examined: Port Lincoln, *R. B. Filson 11852,* 24.x.1970 (MEL 1018654); Cape Jervis, *R. W. Rogers 1859,* 8.vi.1969 (R.W.R.); Myponga, *R. W. Rogers 1707,* 16.vi.1969 (R.W.R.); Millbrook, *R. W. Rogers 1774,* 20.xi.1969 (R.W.R.); Millicent, *L. D. Williams 3382C,* 2.viii.1969 (L.D.W.); Penola, *D. Hunt,* 25.xi.1962 (AD 97733169).

As an uncommon species on the bark of trees in the wetter areas of the state; recorded also in Victoria.

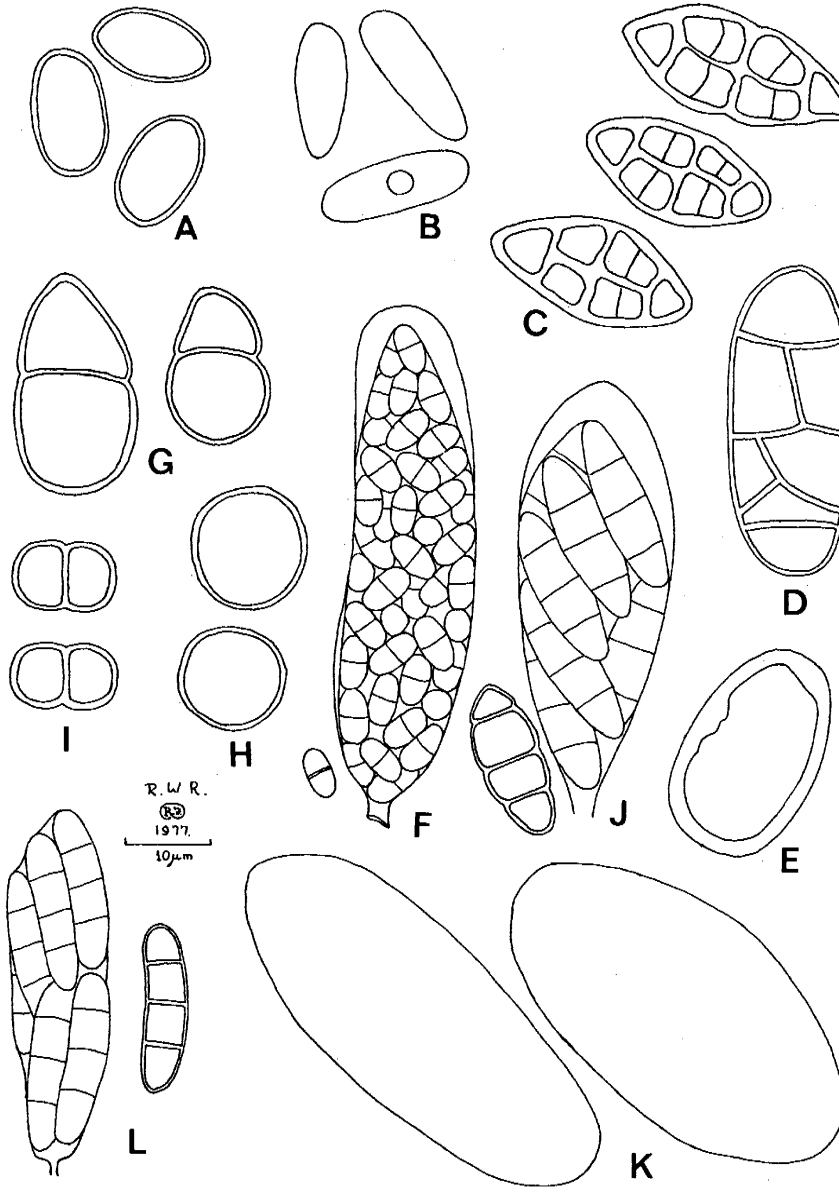


Fig. 19. A, *Lecanora atra*, ascospores; B, *Lecidea decipiens*, ascospores; C, *Leptogium* sp., ascospores; D, *Leptogium lichenoides*, ascospore; E, *Lichina pygmaea* var. *intermedia*, ascospore; F, *Maronea constans*, ascus containing spores and one free ascospore; G, *Melaspilea* sp., ascospores; H, *Menegazzia* sp., ascospores; I, *Microthelia aterrima*, ascospores; J, *Nephroma cellulosum*, ascus containing spores and one free ascospore; K, *Ochrolechia pseudotartarea*, ascospores; L, *Opegrapha* sp., ascus containing spores and one free ascospore.

53. MICROTHELIA Körb. 1855:372.

Literature: Wetmore 1967:287.

Thallus crustose, ecorticate or with a thin cortex, smooth granular or areolate, sometimes evanescent. *Pseudoperithecia* flask-shaped; ascospores eight in ascus, brown, ellipsoid to fusiform, two-celled. Phycobiont *Trentepohlia*.

Microthelia aterrima (Anzi) Zahlbr. 1922:255.

Rinodina aterrima Anzi 1864:11.

Thallus thin, smooth or granular, continuous or in scattered patches on the substrate, dark brownish-black to black. *Pseudoperithecia* immersed to subimmersed in the thallus; ostiole disk-like 0·15 mm diam.; ascospores brown, slightly constricted at the septum, 12 x 8 µm.

Figure: Ascospore, fig. 19I.

Specimen examined: Wilgena Hill, 6·5 km north of Kingoonya-Tarcoola road, 67·5 km west of Kingoonya, *R. B. Filson 11922,* 26.x.1970 (MEL 1018618).

This is a very common black granular lichen on inland rocks, in all States.

54. NEPHROMA Ach. 1810:101.

Thallus foliose, irregularly lobed, differentiated into a thick cellular upper cortex, algal and medullary layers and a thin cellular lower cortex. *Apothecia* marginal or submarginal on the lower surface of the lobes, flat, reddish-brown; margin thin, concolourous with the thallus, often disappearing; ascospores eight in ascus, brown, ellipsoid to oblong-ellipsoid or fusiform, 1-6 celled.

ARTIFICIAL KEY TO SPECIES

1. Thallus upper surface smooth, green ..... *N. australe*
1. Thallus upper surface scrobiculate, grey-brown ..... *N. cellulosum*

Nephroma australe Rich. 1832:31.

Thallus green to yellow-green, as scattered lobes or forming extensive patches, ascending from the substrate; lobes up to 10 mm broad, sometimes with small marginal lobules; upper surface smooth or somewhat wrinkled, especially over the apothecia. *Apothecia* common, up to 10 mm diam., dark red-brown, on the underside of the ascending lobes.

This species is not recorded in South Australia, but it is likely to occur over bark or rocks in the Mount Lofty Ranges or the south-east corner of the State. It is recorded for Victoria, Tasmania and New South Wales.

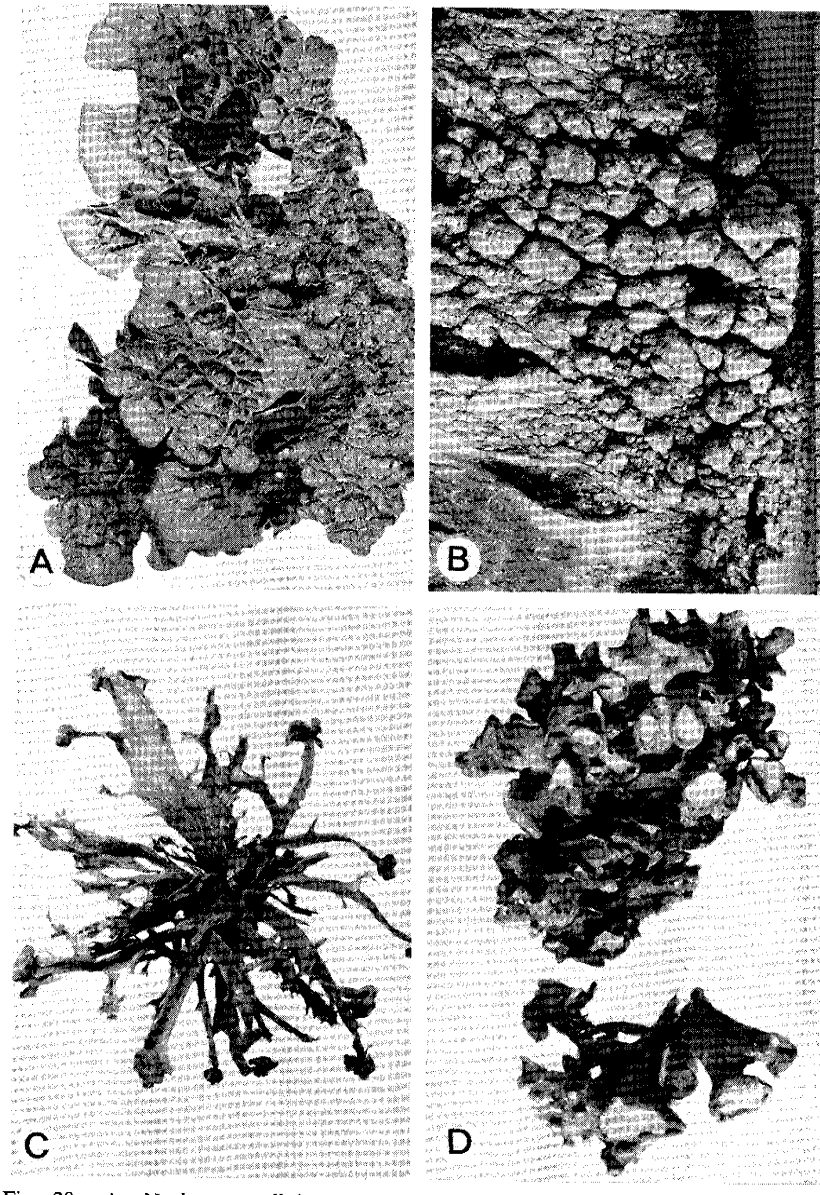


Fig. 20. A, *Nephroma cellulosum;* B, *Pertusaria* sp.; C, *Ramalina fastigiata;* D, *Ramalina pusilla.* Scale in millimetres.

Nephroma cellulosum (Sm. ex Ach.) Ach. 1810:523.

Lichen cellulosus Sm. ex Ach. 1803:289.

Thallus brown to greyish-brown, as scattered lobes or forming patches up to 10 cm across, more or less ascending; lobes up to 2 cm broad; upper surface scrobiculate, strongly reticulate ridged. *Apothecia* common, up to 10 mm diam., red-brown, on the underside of the marginal lobes.

Figure: Habit, fig. 20A, ascus containing spores and one free spore, fig. 19J.

Nephroma cellulosum occurs in Victoria and New South Wales.

It is not recorded in South Australia but it is likely to occur over bark and rocks in the wetter parts of the State.

55. NORMANDINA Wainio 1890b:188.

Literature: Henssen 1976.

Normandina pulchella (Borr. apud Hook. et Sow.) Nyl. 1861a:382.

Verrucaria pulchella Borr. apud Hook. et Sow. 1831:t.2606 f. 1.

Normandina jungermaniae Nyl. 1855b:191.

Thallus squamulose to sub-foliose 1·0-2·0 (-3·0) mm diam., pale grey or greenish-grey, margins raised and inrolled; upper surface corticate or ecorticate, sometimes glaucous, pruinose or sorediose; lower surface pale, ecorticate, tomentose. Fruiting structures unknown.

Normandina is a monotypic genus with uncertain family affinities (Poelt 1973:630, Henssen 1976:133). Perithecia often found associated with the thallus of *N. pulchella* have been shown by Henssen (1976:128) to be those of the lichenicolous fungus *Sphaerulina chlorococca* (Leight.) R. Sant. *N. jungermanniae* was recorded by Tate in 1882b as collected by O.Tepper at Clarendon, South Australia. It is likely to occur amongst mosses on the bark of trees in the wetter areas. *Normandina pulchella* has been found in Victoria, New South Wales and Queensland.

56. OCHROLECHIA Mass. 1852a:30

Literature: Verseghy 1962.

Thallus crustose, white, yellow to ochre or lead-grey, continuous to areolate, rugose, granulose to coralloid, with or without a cortex, but with a distinct algal layer. *Apothecia* sessile to pedicillate, rotund or distorted; disk concave to plane, pink to greyish-white, sometimes pruinose; margin usually prominent, concolourous with the thallus, lecanorine, thin to thick, sorediose, isidiose, pustulose or naked; paraphyses much branched; ascospores six to eight (rarely two) in ascus, simple, hyaline, ovoid-elliptic, large.

Figure: Habit, plate 9C (MEL 1021197).

ARTIFICIAL KEY TO SPECIES

1. Growing on wood or bark 2
1. Growing on rock ..... *O. parella*
2. Thallus discernible, thick to thin, smooth to verrucose 3
2. Thallus obscure, evanescent, K−, KC−, apothecial disk K−, KC+ red ..... *O. subathallina*
3. Thallus K−, KC−, apothecial disk K−, KC− ..... *O. pseudotartarea*
3. Thallus K−, KC+ red, apothecial disk K−, KC+ red− .. *O. subpallescens*

Ochrolechia parella (L.) Mass. 1852a:32.

Lichen parellus L. 1767:132.

Thallus grey to greyish-white to pinkish-white, thick to thin, continuous or cracked into areolae, smooth to rugulose. *Apothecia* sessile; disk at first concave becoming convex, pale to pinkish-white with or without pruina; margin prominent and thick at first becoming thin and almost disappearing at maturity concolourous with the thallus; ascospores six to eight in ascus, 18-22 × 44-48 μm.

Reactions: Thallus K−, C−, KC−, P−, apothecial disk K−, C+ rose, KC+, red, P−.

This species has not yet been recorded in South Australia but it is common on granite outcrops in Victoria close to the border.

Ochrolechia pseudotartarea (Vain) Verseghy 1962:21.

Ochrolechia pallescens var. *pseudotartarea* Vain. 1903:21.

Thallus white, smooth. *Apothecia* sessile up to 2 mm diam.; disk concave, white granulose; margin thick concolourous with the thallus; ascospores six to eight in ascus 63-70 x 30-35 μm.

Reactions: Thallus K−, C−, KC−, P−, apothecial disk K−, C−, KC−, P−.

Figure: Ascospores, fig. 19K.

Specimens examined: Meningie, *L.D. Williams 3685*, 17.iv.1971 (L.D.W.); Iron Knob, *R.W. Rogers 558*, 1.x.1966 (R.W.R.).

Ochrolechia pseudotartarea is probably widespread on the bark of trees. It is recorded also in Victoria.

Ochrolechia subathallina Magn. 1939:252.

Thallus crustose, white, thin to evanescent. *Apothecia* sessile, up to 2 mm diam.; disk white to pale pink, pruinose; margin prominent, thick, white; ascospores eight in ascus, hyaline, 18-20 x 51-55 μm.

Reactions: Thallus K−, C−, KC−, P−, apothecial disk K+ pale yellow or K−, C+ red, KC+ red or KC−.

Specimens examined: Comaum Forest Headquarters, *K. Alcock*, 26.viii.1973 (MEL 1012144); Ewen Ponds, east of Port MacDonnell, *R. B. Filson 15815*, 8.ii.1977 (MEL 1018575).

This species is common on the bark of trees in the damper areas, sterile thalli occur as white stains on the surface.

Ochrolechia subpallescens Verseghy 1962:118.

Thallus crustose, white, thick, granulose, uneven. *Apothecia* sessile up to 3 mm diam.; disk plane, pink, epruinose; margin prominent, thick, concolourous with the thallus; ascospores eight in ascus, 44-50 x 20-25 μm.

Reactions: Thallus K−, C+ rose, KC+ red, P−, apothecial disk K−, C+ rose, KC+ red, P−.

Specimens examined: Para Wirra, *R. W. Rogers 88*, 17.i.1966 (R.W.R.); Comaum Forest Headquarters, *K. Alcock*, 26.viii. 1973 (MEL 1012143).

Figure: Habit, fig. 22A.

This species is possibly also common on the bark of trees. It is found in Western Victoria.

57. OPEGRAPHA Humb. 1793:57.

Thallus crustose, ecorticate. *Pseudothecia* immersed to adnate or sessile, pseudothecia round, to more commonly elongated with a slit-like disk, enclosed by a carbonaceous proper exciple; ascospores eight in ascus, hyaline, one to eight celled with transverse septa only; paraphyses reticulately branched and interwoven.

Figure: Ascus containing spores and one free ascospore, fig. 19L.

This genus has not yet been recorded in South Australia, but it is likely to be found on bark or wood.

58. PANNARIA Del. in Bory 1828:20.

Literature: Tavares 1966, Weber 1965.

Thallus squamulose, occasionally sub-foliose, closely attached to the substrate by rhizines, on a distinct hypothallus, differentiated into a distinctly cellular upper cortex, algal and medullary layers and a cellular lower cortex. *Apothecia* adnate to sessile; disk concave to convex, reddish-brown to black; margin concolourous with the thallus; ascospores eight in ascus, hyaline, simple. Phycobiont *Nostoc*.

Pannaria rubiginosa (Thunb. ex Ach.) Del. 1828:20.

Lichen rubiginosus Thunb. ex Ach. 1798:99.

Thallus foliose or squamulose, radiating at the margins; marginal lobes imbricate, crenulate, deeply concave; older lobes becoming lobulate-isidiose;

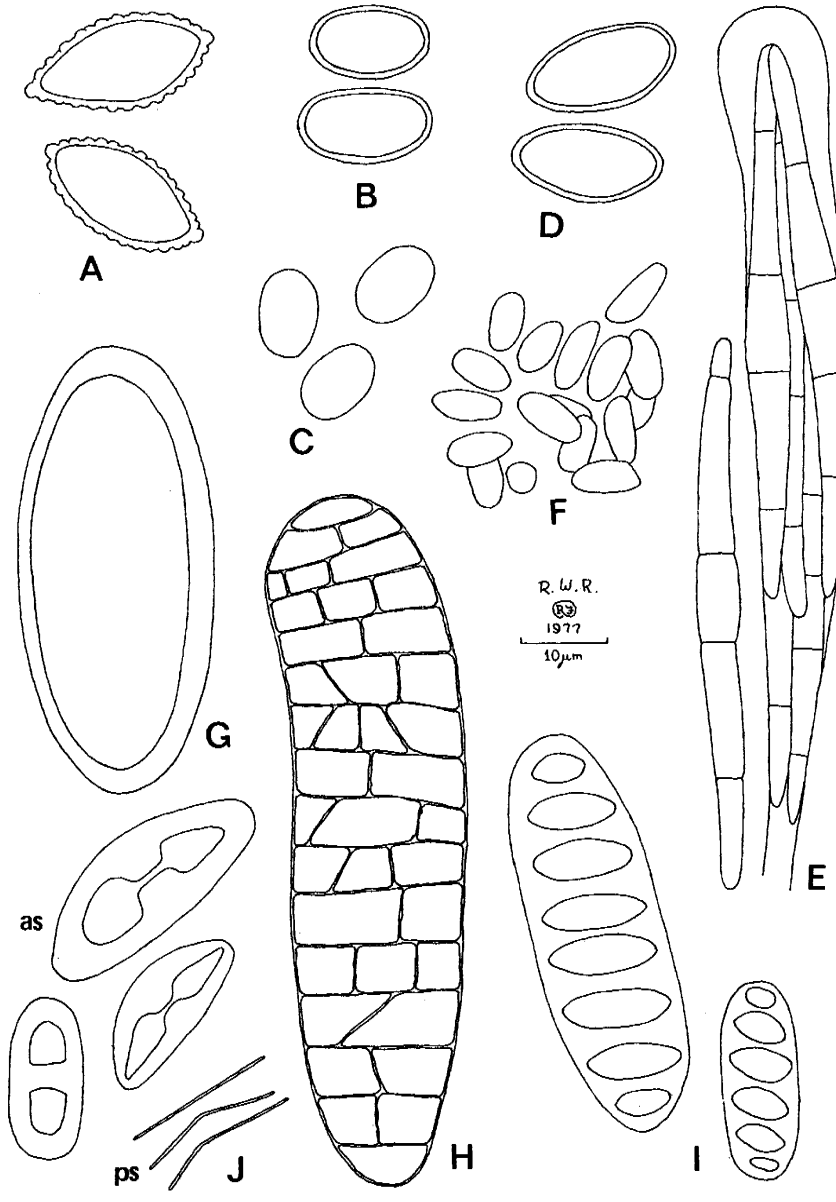


Fig. 21. A, *Pannaria rubiginosa*, ascospores; B, *Parmelia pseudotenuirima*, ascospores; C, *Parmelia subdistorta*, ascospores; D, *Parmeliella* sp., ascospores; E, *Peltigera spuria*, ascus containing spores and one free ascospore; F, *Peltula obscurens*, ascospores; G, *Pertusaria* sp., ascospore; H, *Phaeographina*, ascospore; I, *Phaeographis* sp., ascospores; J, *Physciopsis elaeina*, ps. pycnidiospores, as. ascospores.

upper surface reticulate rugulose, brown, buff or bluish-grey, margins a little lighter coloured; under surface pale, densely covered with felted brown rhizines which turn bluish-black and form a hypothallus which sometimes protrudes from under the lobe ends. *Apothecia* up to 2·0 mm diam., lecanorine; disk red-brown; margin prominent, coarsely crenulate, lobulate, concolourous with the thallus; ascospores 16-18 x 9-11 μm, hyaline, acutely ellipsoid, verrucose.

Reactions: Thallus K+ pale yellow, KC+ intense yellow, medulla K−, KC−, C−, P−.

Figure: Ascospores, fig. 21A.

Specimen examined: Canunda National Park, north of Lake Bonney, 14 km west of Millicent, *R. B. Filson 14655,* 17.v.1973 (MEL 1018649).

P. rubiginosa grows also in Victoria, Tasmania, New South Wales and Queensland.

Another species of *Pannaria* with affinities close to *P. leucosticta* Tuck. occurs on soil; both of these species are apparently restricted to the wetter areas.

59. PARMELIA Ach. 1803:153.

Literature: Hale & Kurokawa 1964, Hale 1965, 1976a, b, Esslinger 1977, Kurokawa & Filson 1975.

Thallus foliose, appressed, adnate, subascending or loose on the substrate; lobes narrow-elongate to broad-rotund, margins entire naked or ciliose; lower surface black, brown or pale, rhizinate; rhizines simple or branched, matted or sparse. *Apothecia* adnate to shortly pedicellate; ascospores eight in ascus, simple, hyaline, globose to ellipsoid.

ARTIFICIAL KEY TO SPECIES

1. Thallus yellow-green, green, green-grey or grey 2
1. Thallus yellowish-brown, brown or brownish-black 64
2. Thallus without soredia or isidia 3
2. Thallus with soredia or isidia 42
3. Lower surface pale to dark brown 4
3. Lower surface black 28
4. Lower surface pale to ivory or light brown 5
4. Lower surface brown to dark brown 21
5. Thallus mineral grey 6
5. Thallus yellowish-green 7
6. Corticolous, thallus lobes flat, apothecia abundant ..... *P. subalbicans*
6. Saxicolous, thallus lobes convex-pulvinate, apothecia rare *P. spodochroa*
7. Terricolous 8
7. Saxicolous 17
8. Thallus unattached, loose on the substrate 9
8. Thallus attached to the substrate, but the marginal and secondary lobes may be free 13

9. Thallus rolling into a ball when dry, lower surface pale, completely devoid of rhizines ..... *Chondropsis semiviridis*
9. Thallus not rolling into a ball when dry, lower surface sparsely rhizinate 10
10. Medulla K+ 11
10. Medulla K− 12
11. Medulla K+ yellow becoming red ..... *P. convoluta*
11. Medulla K+ constant yellow or gold ..... *P.* sp. *nov.* 7
12. Medulla P+ orange ..... *P. reptans*
12. Medulla P− ..... *P. australiensis*
13. Medulla K− 14
13. Medulla K+ 15
14. Medulla P+ orange ..... *P. reptans*
14. Medulla P− ..... *P. subdistorta*
15. Thallus repeatedly dichotomous branched 16
15. Thallus not repeatedly dichotomous ..... *P.* sp. *nov.* 6
16. With stictic and norstictic acids ..... *P. amphixantha*
16. With salacinic acid ..... *P.* sp. *nov.* 1
17. Medulla K+ 18
17. Medulla K− 19
18. Thallus marginal lobes tightly appressed to the substrate, apothecia smaller than 2·5 mm diam ..... *P. rimalis*
18. Thallus marginal lobes loose on the substrate, apothecia larger than 3 mm and up to 7 mm diam ..... *P. metaclystoides*
19. Medulla KC+ 20
19. Medulla KC− ..... *P. ustulata*
20. Thallus lobes revolute or convolute ..... *P. incrustata*
20. Thallus lobes almost plane, never revolute or convolute ..... *P. flavescentireagens*
21. Thallus yellowish-green 22
21. Thallus mineral grey ..... *P. subcaperata*
22. Medulla K− 23
22. Medulla K+ 25
23. Medulla KC− 24
23. Medulla KC+ rose ..... *P. furcata*
24. Medulla P− ..... *P.* sp. *nov.* 4
24. Medulla P+ red ..... *P. pertinax*
25. Medulla K+ yellow becoming red, P+ gold or red 26
25. Medulla K+ pale brown, P+ red ..... *P. pertinax*
26. Thallus forming a thick mat, marginal lobes loose on the substrate ... 27
26. Thallus not such a thick mat, fewer secondary lobes, marginal lobes adnate to substrate ..... *P. incerta*
27. Lobes long, narrow 2 mm wide ..... *P. polyphylloides*
27. Lobes rotund 3 mm wide ..... *P. hypoclystoides*
28. Thallus mineral grey 29
28. Thallus yellowish-green 31
29. Medulla K+ yellow becoming red 30
29. Medulla K− ..... *P. quercina*

30. Yellow pigment in the lower medulla ..... *P. corrugativa*
30. Yellow pigment lacking in the lower medulla ..... *P. tenuirima*
31. Corticolous or lignicolous 32
31. Terricolous or saxicolous 34
32. Yellow pigment in the lower medulla ..... *P. jeleneckii*
32. Yellow pigment lacking in the lower medulla (two chemical species) . 33
33. Medulla K− ..... *P. rutidota*
33. Medulla K+ salmon pink ..... *P. ferax*
34. Terricolous 35
34. Saxicolous 37
35. Thallus loose on substrate, secondary lobes dorsiventral, up to 1·5 mm wide 36
35. Thallus closely adnate, secondary lobes subterete, 0·5 mm diam . *P. pumila*
36. Rhizines dichotomous, thick right to the margins of lobes, sparingly ciliate ..... *P.* sp. *nov.* 2
36. Rhizines simple, sparse, lobes eciliate ..... *P. callifolia*
37. Medulla K− 38
37. Medulla K+ 39
38. Medulla KC+ rose ..... *P. hypoprotocetrarica*
38. Medulla KC− ..... *P. praeterissima*
39. Yellow pigment in the lower medulla ..... *P. dichromatica*
39. Yellow pigment lacking (three species which only differ macroscopically in lobe shape and degree of imbrication) 40
40. Containing norstictic acid, lobes small and sometimes imbricate ..... *P. congesta*
40. Containing salacinic acid, lobes densely imbricate 41
41. Lobes wider than long ..... *P. tasmanica*
41. Lobes longer than wide ..... *P. cheelii*
42. Thallus sorediose 43
42. Thallus isidiose 49
43. Lower surface black 44
43. Lower surface pale to brown ..... *P. subrudecta*
44. Thallus yellowish-green 45
44. Thallus mineral grey 47
45. Soredia arising from pustules mainly on the older lobes ..... *P. caperata*
45. Soredia not arising from pustules, occurring right to the marginal lobes . 46
46. Thallus large, lobes broad, K+ ..... *P. soredians*
46. Thallus small, lobes narrow, K− ..... *P. soredians* forma
47. Upper surface reticulate, K+ yellow becoming red 48
47. Upper surface not reticulate K+ persistent yellow ..... *P. perlata*
48. Lower surface of lobe with a bare or very sparsely rhizinate brown marginal zone ..... *P. reticulata*
48. Lower surface of the lobe without bare zone, rhizines thick right to margin of lobe ..... *P.* sp. *nov.* 5
49. Lower surface pale to dark brown 50
49. Lower surface black 59
50. Lower surface pale ivory to light brown 51

50. Lower surface brown to dark brown 55
51. Medulla K+ yellow becoming red 52
51. Medulla K− 53
52. Isidia inflated, globose ..... *P. plittii*
52. Isidia cylindrical, not inflated ..... *P. mexicana*
53. Saxicolous 54
53. Terricolous ..... *P. constipata*
54. Thallus mineral grey with faint pale yellow tinge in parts .. *P. schistaceae*
54. Thallus green ..... *P. scabrosa*
55. Medulla K+ yellow becoming red 56
55. Medulla K− 57
56. Corticolous ..... *P. pseudotenuirima*
56. Saxicolous ..... *P. scotophylla*
57. Isidia small nipple-shaped ..... *P. sp.*
57. Isidia not as above 58
58. Isidia strongly inflated at top ..... *P. globulifera*
58. Isidia not inflated ..... *P. scabrosa*
59. Thallus yellowish-green 60
59. Thallus mineral grey 63
60. Thallus lobes 1 mm wide 61
60. Thallus lobes <1 mm, closely adnate to the substrate ..... *P. adhaerens*
61. Thallus loose on substrate, isidia not inflated towards the tips 62
61. Thallus adnate to the substrate, isidia inflated towards the tips ..... *P. refringens*
62. Isidia light and sparse ..... *P. tinctina*
62. Isidia dense, sometimes the centre of the thallus completely covered to make a continuous isidiose mat ..... *P.* sp. *nov.* 3
63. Thallus large, lobes broad, saxicolous ..... *P. cinerascens*
63. Thallus small, lobes narrow, corticolous ..... *P. dissecta*
64. Thallus sorediose or isidiose 67
64. Thallus not sorediose or isidiose 65
65. Lower surface dark brown to black 66
65. Lower surface pale tan to pale brown ..... *P. luteonotata*
66. Medulla KC+ red ..... *P. imitatrix*
66. Medulla KC+ rose ..... *P. pulla*
67. Thallus isidiose 68
67. Thallus sorediose ..... *P. fuscosorediata*
68. Medulla KC− 70
68. Medulla KC+ 69
69. Medulla KC+ rose ..... *P. incantata*
69. Medulla KC+ red turning orange ..... *P. loxodella*
70. Lower surface dark brown to black ..... *P. verrucella*
70. Lower surface pale tan ..... *P. subverrucella*

Parmelia adhaerens Nyl. *in* Cromb. 1876:19.

Thallus foliose, forming small rosettes on smooth rocky substrates; lobes small, flat to slightly convex, less than 1 mm wide and not imbricate; marginal

obes radiate, centre of the thallus becoming crustose-areolate, isidia light and very sparse sometimes only on the marginal lobes. *Apothecia* small up to 0·75 mm diam.; margin thin, persistent; disk concave to irregular, dark brown.

Reactions: Medulla K+ yellow becoming red, C−, P+ faint yellow becoming pale orange, KC−.

Specimens examined: Memory Cove, Cape Catastrophe, *R. B. Filson 11835,* 24.x.1970 (MEL 1011752); Humbug Scrub, 40 km north-east of Adelaide, *J. Curtis,* 9.iv.1967 (MEL 34813p/p).

Parmelia adhaerens occurs also in Victoria, Tasmania, New South Wales and Queensland.

Parmelia amphixantha Müll. Arg. 1888:139.

Thallus foliose forming rosettes on earth, up to 5 cm diam.; lobes dichotomously branched 0·5-1·5 mm wide.; upper surface plane to convex, marginal lobes maculate, otherwise smooth or minutely wrinkled and cracked on the older lobes, isidia and soredia absent; lower surface pale yellow-green to dark brown sparsely rhizinate. *Apothecia* very rare sessile.

Reactions: Medulla K+ yellow becoming red, C−, P+ yellow becoming red under the cortex, KC−.

Specimens examined: Hill top, 12 miles (19 km) west of Murray Bridge, *R. W. Rogers 364,* 11.v.1966 (R.W.R.); Kimba to Cowell road, 18 km north-west of Cowell, *R. B. Filson 11782,* 22.x.1970 (MEL 1011819); Camp 7, west of Moolapinna Hill, *R. Helms 61,* 30.x.1891 (MEL 6218); Yudnapinna, c. 70 km north-west of Port Augusta, *R. W. Rogers 19,* 11.ii.1965 (MEL 10386).

The species occurs also in Western Australia, Victoria and New South Wales.

Parmelia amphixantha is morphologically similar to three other species *P.* sp. *nov.* 1, *P. reptans* and *P.* sp. *nov.* 7. These four species are included in the "amphixantha group".

Parmelia australiensis Cromb. 1879:395.

Thallus unattached, loose on substrate; lobes elongate, convolute, contorted; upper surface pale yellow-green, smooth rugulose and cracked on the older parts, isidia and soredia absent, marginal lobules sometimes present; lower surface pale yellow-green to pale brown, sparsely rhizinate. *Apothecia* not seen.

Reactions: Medulla K−, C−, KC+ rose, P−.

Specimens examined: "Nullarbor" H. S., *J. H. Willis,* 29.viii.1947 (MEL 6207); "White Wells" (abandoned), *D. Kemsley,* 7.i.1952 (MEL 6208), Eyre Highway 11 miles (17 km) east of Koonalda, *J. H. Willis,* 8.x.1961 (MEL 6237); Knowles Cave, Nullarbor Plain *R. B. Filson 9453,* 5.i.1967 (MEL 25312).

This species is very similar to *P. convoluta* and in most cases can only be separated from it by the chemical tests.

Parmelia sp. *nov.* 1

Thallus forming rosettes on earth up to 4 cm diam.; lobes dichotomously branched 0·5-1·6 mm wide; upper surface smooth, moderately convex, marginal lobes emaculate, pale yellow-green sometimes darker greenish-yellow towards the centre, soredia and isidia absent; lower surface canaliculate, pale brown with narrow marginal band concolourous with the upper surface, sparsely rhizinate. *Apothecia* not seen.

Reactions: Medulla K+ yellow becoming red, C−, KC−, P+ yellow becoming orange.

Specimens examined: 16 miles (25 km) north of "Lords Well" O.S., *R. W. Rogers 1105,* 27.x.1967 (R.W.R.); Eyre Highway, 40 km east of Kimba, *R. B. Filson 11733a,* 20.x.1970 (MEL 1011830); Loveday, *E. Gaube,* 28.x.1943 (MEL 11292).

Parmelia callifolia Kurokawa in Kurokawa and Filson 1975:42.

Parmelia versicolor Müll. Arg. 1881:506.

Thallus loosely adnate to soil substrate, up to 15 cm diam., often growing over litter; lobes at the margins up to 3 mm wide, free, imbricate; secondary lobes growing out from lobules on the margins of older lobes, flat, up to 1·5 mm wide, irregularly branched, sometimes convolute; upper surface pale yellow-green, smooth at marginal lobes, older portions becoming rugulose and cracked; lower surface brown at marginal lobes becoming progressively darker until black at the centre. *Apothecia* not seen.

Reactions: Medulla K+ yellow slowly brown to blackish-red, C−, KC−, P+ yellow becoming orange to red.

Specimens examined: 25·5 km north of Port Augusta, *R. W. Rogers 133,* 21.ii.1966 (R.W.R.); Koonamore Vegetation Reserve, *R. W. Rogers 1644,* 19.iv.1969 (R.W.R.); Wilgena Hill, 6·5 km north of the Kingoonya-Tarcoola road, 67·5 km west of Kingoonya, *R. B. Filson 11925,* 26.x.1970 (MEL 1011838); 3·2 km north of Kokatha on the Poochera-Kingoonya road, *R. B. Filson 11918a,* 26.x.1970 (MEL 1011846); Iron Knob-Yardea road, 40 km west of Iron Knob, *R. W. Rogers 1172,* 22.v.1967 (R.W.R.); 11 miles (17 km) east of "Koonalda" H.S., Nullarbor Plain, *J. H. Willis,* 18.x.1961 (MEL 10178); hillside near "Lake Everard" Station, western end of the Gawler Ranges, *D. N. Krahenbuehl 2422,* 15.ix.1968 (MEL 37634).

Found also in Western Australia, Victoria and New South Wales.

Parmelia callifolia forms part of the "callifolia group". It is a dry soil inhabiting species and likes sheltered positions under bushes and is often found growing amongst litter. It may be confused with *P. pumila* but this species is more adnate on the substrate. It may also be confused with *P. subdistorta* but it is easily separated from this species in the broader marginal lobes and the narrower secondary lobes growing out from lobules, the black lower surface and the positive reaction of KOH on the medulla.

Parmelia caperata (L.) Ach. 1803:216.

Lichen caperatus L. 1753:1147.

Thallus foliose, saxicolous rarely corticolous, loosely attached to the substrate, pale straw coloured to light yellow-green, up to 15 cm diam.; lobes irregular up to 3 mm wide, strongly imbricate; upper surface dull to slightly shining, smooth at the margins becoming pustulate towards the centre, pustules bursting to form granular soredia; lower surface jet black with a pale brown zone at the margins. *Apothecia* not seen.

Reactions: Thallus K−, medulla K−, C−, KC−, P+ orange-red.

Figure: Habit, plate 10A (MEL 1021206).

Specimens examined: Sellick Hill, 72 km south of Adelaide, *R. B. Filson 15491*, 14.xi.1975 (MEL 1014890).

The species occurs also in Victoria, Tasmania, New South Wales and Queensland.

Of the eight species which form the "caperata group" *P. caperata* is possibly the easiest to distinguish in the field. The pustulate soredia coupled with the lack of pigment in the lower medulla clearly separate it from others in this group. The species included in this group are *P. caperata, P. soredians, P. rutidota, P. ferax, P. jeleneckii (P. euplecta* is similar to *P. caperata* but differs in having a yellow pigment in the lower medulla which is K+ purple, *P. helmsii* is similar to *P. rutidota* but contains barbatic acid rather than protocetraric acid. Neither of these two species are dealt with in this handbook).

Parmelia cheelii Gyel. 1938:271.

Thallus saxicolous, loosely attached to the substrate; lobes numerous, densely imbricate, narrow 1·0-2·0 (-3·0) mm wide, elongate; upper surface yellow-green with black border, isidia and soredia lacking; lower surface jet black. *Apothecia* up to 7 mm diam., deeply concave; disk reddish-brown; margin persistent; ascospores 10-11 × 6-7 μm.

Reactions: Medulla K+ yellow becoming red, C−, KC−, P+ red.

Figure: Habit, plate 10B (MEL 1022012).

Specimens examined: South side of Carappee Hill, Eyre Peninsula, *R. B. Filson 11766*, 22.x.1970 (MEL 1011812); beside the Eyre Highway, 35·5 km east of Kimba, *R. B. Filson 11757*, 22.x.1970 (MEL 1011720); on rocky hillside, "Olive Grove" Station, 14·5 km south of Quorn, *R. B. Filson 12001*, 30.x.1970 (MEL 1011741); Humbug Scrub, 40 km north-east of Adelaide, *J. Curtis*, 9.iv.1967 (MEL 34828).

The species occurs in Victoria and New South Wales.

P. cheelii resembles *P. tasmanica*, differing from it in the shorter and narrower marginal lobes.

Parmelia cinerascens Lynge 1914:104.

Thallus foliose, saxicolous, moderately adnate, forming irregular patches up to 8 cm diam.; lobes up to 5 mm wide, irregularly branched, sometimes incised, with rounded apices, hardly imbricated; upper surface mineral grey, slightly pale brown at the lobe ends, bordered with black, without soredia, isidia dense in the centre of the thallus, scattered on the marginal lobes, cylindrical, branched, slightly swollen at the apices; lower surface jet black. *Apothecia* up to 4 mm diam., deeply concave; disk cinnamon-brown; margin thin inrolled, isidiose; ascospores 13-16 × 8-10 μm.

Reactions: Thallus K+ yellow, medulla K+ yellow becoming red, C−, KC−, P+ orange.

Figure: Habit, plate 11A (MEL 1021210).

No collections have been determined as this species but it is known to occur in the Southern Flinders Ranges. It grows also in Victoria.

Parmelia congesta Kurokawa and Filson 1975:36.

Thallus saxicolous, adnate to the substrate, up to 10 cm diam.; lobes flat, sometimes imbricate, 0·7-2·0 mm wide; upper surface pale yellow-green with a black border, older lobes greying, isidia and soredia lacking; lower surface black. *Apothecia* up to 8 mm diam., concave, flattening at maturity; disk dark to almost black; margin persistent, crenulate; ascospores 9-10 × 6-7 μm.

Reactions: Medulla K+ yellow becoming red, C−, KC−, P+ yellow.

Figure: Habit, plate 11B (MEL 1021215).

Specimens examined: South side of Carappee Hill, Eyre Peninsula, *R. B. Filson 11765*, 22.x.1970 (MEL 1011821); Marble Range, Eyre Peninsula, *R. B. Filson 11870*, 24.x.1970 (MEL 1011837); Gum Flat, 40 km northwest of Elliston, Eyre Peninsula, *R. B. Filson 11893*, 25.x.1970 (MEL 1011841); Podinna Rock, 24 km north of Minnipa, *R. B. Filson 11901c*, 25.x.1970 (MEL 1011861).

Parmelia constipata Kurokawa and Filson 1975:37.

Thallus terricolous, adnate to the substrate, up to 7 cm diam.; lobes sublinear elongate, sometimes imbricate, up to 2 mm wide; upper surface yellow-green, slightly rugulose, densely isidiose; isidia cylindrical, branched, coralloid, up to 2 mm high; soredia absent; lower surface pale brown, darkening towards the lobe ends. *Apothecia* not seen.

Reactions: Thallus K−, medulla K−, C−, KC± rose, P−.

Specimens examined: Koonamore Vegetation Reserve, *R. D. Seppelt*, v.1971 (MEL 1013410); along the High Eden road, 6·5 km west of Springton. *J. A. Elix 869*, 8.v.1975 (J.A.E.).

Parmelia convoluta Kremp. 1880:337.

Thallus unattached, loose on substrate; lobes elongate, convolute; upper surface pale yellow-green, smooth, rugulose and cracked in the older parts,

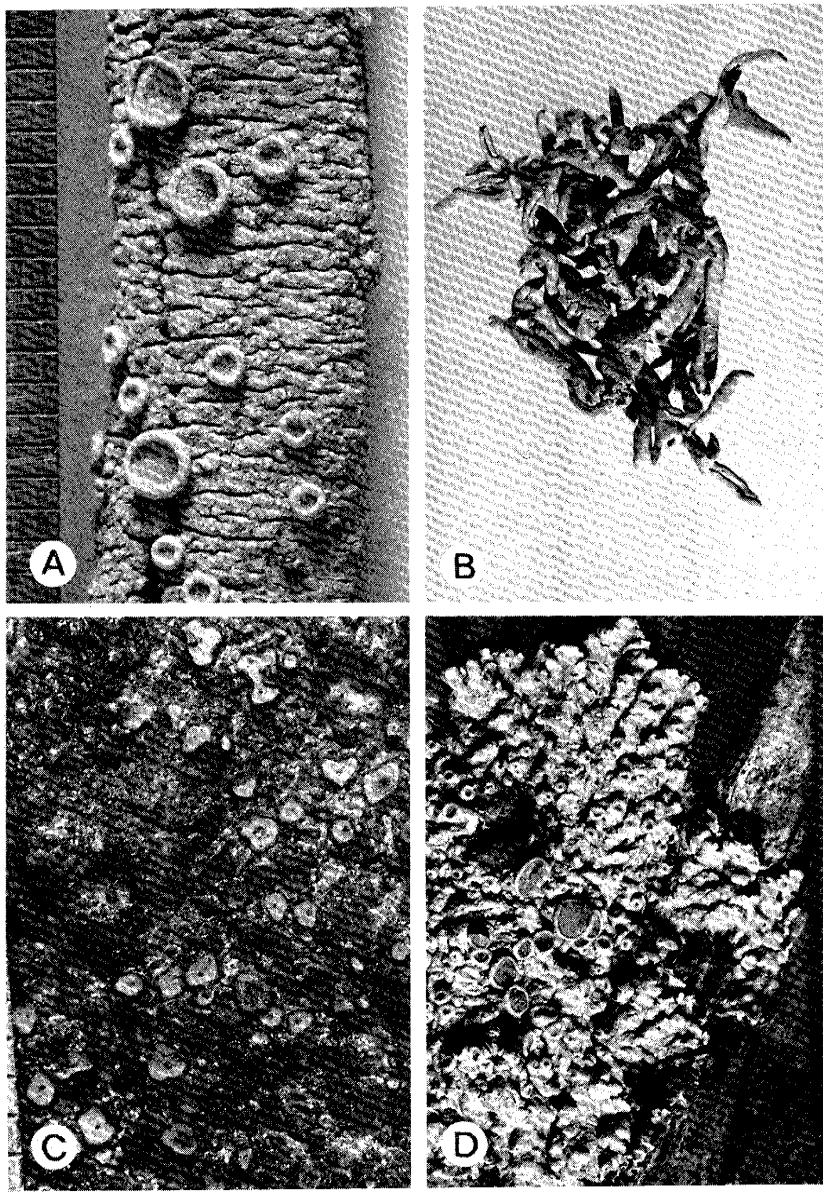


Fig. 22. A, *Ochrolechia subpallescens;* B, *Parmelia convoluta;* C, *Peltula australiensis;* D, *Physcia aipolia.* Scale in millimetres.

isidia and soredia absent, marginal and laminal lobules sometimes present on the older lobes; lower surface pale to dark brown. *Apothecia* not seen.

Reactions: Thallus K−, medulla K+ yellow becoming red, C−, KC−, P± orange.

Figure: Habit, fig. 22B.

Specimens examined: The Catacombs Caves, Nullarbor Plain, *R. B. Filson 9440*, 4.i.1967 (MEL 25333); Hesso, c. 50 km northwest of Port Augusta, *R. W. Rogers 17*, 10.ii.1965 (MEL 1011799); Eyre Highway, 40 km east of Kimba, *R. B. Filson 11730*, 22.x.1970 (MEL 1011823); Koonamore Vegetation Reserve, *C. M. Eardley*, vi.1946 (MEL 6206).

Grows also in Victoria and the Northern Territory.

Parmelia convoluta often grows in close association with *P. australiensis* and can be separated from it only by the chemical tests.

Parmelia corrugativa Kurokawa and Filson 1975:38.

Thallus corticolous, adnate to the substrate, margins of the lobes free; lobes irregularly elongate, mildly imbricate, up to 4 mm wide, without cilia; upper surface mineral grey, rugulose, without isidia or soredia; lower surface black. *Apothecia* abundant adnate, up to 4 mm diam.; disk at first deeply concave, cinnamon brown; margin persistent, crenulate; ascospores 10-12 x 7-8 μm.

Reactions: Thallus K+ yellow, medulla K−, C+ red, KC−, P−, lower medulla K+ purple.

Specimens examined: Shady Grove, Unitarian Church site, Mt. Barker Junction, 5 km south-east of Balhannah, *R. W. Rogers 553*, 3.vi.1966 (MEL 1013418); Para Wirra Recreation Park, *R. W. Rogers 95*, 17.i.1966 (MEL 1013419).

P. corrugativa is a distinctive grey-*Parmelia* species growing on dead twigs and branches. It could be confused with *P. quercina* but is easily separated from this species by the deep yellow pigment in the lower medulla.

Parmelia dichromatica Hale 1971:348.

Thallus saxicolous, tightly adnate to the substrate, up to 15 cm diam.; lobes flat, scarcely imbricate, 3·0-3·5 (-4·0) mm wide; upper surface dull yellow-green, older lobes becoming cracked, rugulose and sub-areolate, isidia and soredia lacking; lower surface black. *Apothecia* up to 6 mm diam.; margin persistent, inrolled; ascospores 12 x 8 μm.

Reactions: Thallus K−, medulla K+ bright yellow becoming red to blackish red, C−, KC−, P+ pale yellow-orange, orange pigment in the lower medulla K+ purple.

Specimens examined: Wynbring Rocks, c. 1 km north of Wynbring on the East-West Railway Line, *R. B. Filson 11941*, 28.x.1970 (MEL 1011726); south side of Carappee Hill, Eyre Peninsula, *R. B. Filson 11767*, 22.x.1970 (MEL

1011813); on hill to south of old dam on western side of the Corunna Range, 6·5 km north of Iron Knob, *R. B. Filson 11723*, 21.x.1970 (MEL 1011840).

Parmelia dissecta Nyl. 1882:451.

Thallus foliose; corticolous, tightly adnate, up to 4 cm diam.; lobes up to 1·5 (−2·0) mm broad, subdichotomous, short, rounded, hardly imbricate; upper surface pale grey, sometimes with a pale brown tinge at the lobe ends, distinctly black bordered, weakly pseudocyphellate, without soredia, isidia papillate becoming cylindrical, simple, with dark grey apices; lower surface jet black, with a pale brown bare zone at the tips of the lobes. *Apothecia* not seen.

Reactions: Thallus K+ yellow, medulla K−, C+ red, KC+ rose, P−.

Specimen examined: Western side of the border road, 13 km north of the Nelson-Caveton road, *R. B. Filson 14632*, 16.v.1973 (MEL 1018690).

The species grows also in Victoria and New South Wales.

Parmelia ferax Müll. Arg. 1886:257.

Thallus lignicolous on dead wood and old fence posts, pale yellow-green, up to 10 cm diam.; lobes irregular up to 3·0 mm wide, margin crenulate, imbricate, lobulate, without soredia; upper surface more or less rugulose at the margins, densely rugulose towards the centre; lower surface black, rugulose. *Apothecia* up to 6 mm diam.; disk cinnamon brown to dark brown; margin persistent, strongly inrolled; ascospores 13-15 x 7-8 μm.

Reactions: Thallus K−, KC+ pale yellow, medulla K± pale brown, C−, KC−, P+ deep orange.

Specimens examined: Stuart Highway c. 40 km north-west of Port Augusta, *J. H. Willis*, 2.viii.1966 (MEL 34883); Warren Gorge, Flinders Ranges, *R. B. Filson 11987*, 30.x.1970 (MEL 1011715); "Canegrass" Station, 53 km north of Morgan, *R. W. Rogers 1074*, 17.v.1967 (R.W.R.); Koonamore Vegetation Reserve, *R. W. Rogers 1304*, 27.xi.1967 (R.W.R.).

Occurs in Victoria and New South Wales.

P. ferax is a chemical species. It is very close to and easily confused with *P. rutidota*. *P. ferax* contains physodalic acid whilst *P. rutidota* contains protocetraric acid. Whilst these substances are easily separated by microcrystal tests in the field it is a little more difficult. The lobes of *P. ferax* are on the whole slightly smaller and the central portions of the thallus far more rugulose. It is debatable whether it is a distinct species.

Parmelia flavescentireagens Gyel. 1934:154.

Thallus saxicolous, loosely attached to the substrate, pale yellow-green to pale yellow-blue-green, up to 15 cm diam.; marginal lobes broad subrotund up to 2·5 mm wide; secondary lobes narrower than marginal lobes sometimes building up the thallus into a thick mat; upper surface flat to slightly convex,

without isidia or soredia; lower surface varying in colour from pale ivory to light brown. *Apothecia* uncommon up to 10 mm diam.; disk deeply concave, pale brown; margin thin, crenulate, deeply incised; ascospores 13-14 x 7 μm.

Reactions: Thallus K−, medulla K−, C+ faint rose, KC+ rose, P−.

Specimens examined: Humbug Scrub, 40 km north-east of Adelaide, *J. Curtis 2*, 9.iv.1967 (MEL 34841); 6·5 km east of Eden Valley, *J. A. Elix 828*, 5.v.1975 (J.A.E.); 16 km east of Springton on rocky hillside along the Marne River Gorge, *J. A. Elix 841*, 6.v.1975 (J.A.E.).

The species occurs also in Victoria, Tasmania and New South Wales.

Parmelia furcata Müll. Arg. 1886:256.

Thallus foliose, saxicolous, loosely attached to the substrate; lobes narrow elongate, 0·5-1·5 mm wide, up to 8 mm long, irregularly dichotomous, branched, upper surface smooth, yellow-green, without soredia or isidia; lower surface pale brown to dark brown, sparsely rhizinate. *Apothecia* up to 5 mm diam.; disk brown to dark brown; margin thin, heavily inrolled, crenulate, incised.

Reactions: Thallus K−, medulla K−, C−, KC+ faint rose, P−.

Figure: Habit, Plate 11C (MEL 1021218).

No specimens have been determined as this species but it may occur in the Springton district. It grows in Victoria, Tasmania and New South Wales.

Parmelia fuscosorediata Essl. 1977:68.

Thallus foliose, corticolous, appressed to the substrate, olive-brown to reddish-brown to almost black; lobes up to 4 mm wide, short, rounded, weakly imbricate; upper surface smooth to weakly wrinkled, dull, sometimes pruinose, pruina dark grey, soredia laminal originating from small warts or isidia-like nodules; lower surface pale brown to black. *Apothecia* sessile, up to 1·5 mm diam.; disk smooth, concave, dull or slightly shining; margin thin, crenulate, becoming sorediate; ascospores ellipsoid, 9-13 x 5·5-9 μm.

Reactions: Thallus K−, HNO_3−; medulla K+ very pale pink-violet or pale yellow, fading, C+rose, KC+ rose-red, P−.

Specimen examined: Gum Flat, 40·25 km north-west of Elliston, *R. B. Filson 11893*, 25.x.1970 (MEL 1011841).

The species grows also in Victoria.

Parmelia sp. *nov.* 2

Thallus terricolous, tightly adnate to substrate, yellow-green, up to 10 cm diam.; lobes irregular, elongate, imbricate with prominent black margins, up to 3·0 (−5·0) mm wide; secondary lobes 0·4-1·0 mm wide overlaying the centre of the thallus; upper surface without isidia or soredia; lower surface black.

Apothecia sessile, up to 4 mm diam., deeply concave; disk cinnamon brown; margin thin at first, strongly inrolled, slightly crenulate and lacerate; ascospores 9-10 x 6-7 μm.

Reactions: Thallus K−, medulla K+ yellow becoming crimson, C−, KC−, P+ bright orange.

Specimens examined: 6·5 km south of Spalding , *R.W. Rogers 687*, 28.x.1966 (R.W.R.); c. 3 km northeast of Native Valley, *R.W. Rogers 1517*, 4.xi.1968 (R.W.R.).

Occurs also in Victoria and New South Wales.

This species is found in open, arid areas where it grows on the ground.

Parmelia globulifera Kurokawa and Filson 1975:38.

Thallus saxicolous, closely adnate, areolate, straw-yellow, up to 13 cm diam.; lobes subirregular, shortly elongate with rounded apices, 1·5-3·0 mm wide; upper surface strongly convex, isidiose but without soredia; isidia inflated, sometimes breaking open at the apices; lower surface pale to brown. *Apothecia* not seen.

Reactions: Thallus K−, medulla K−, C−, KC−, P−.

Specimen examined: Wynbring Rocks, c. 1 km north of Wynbring on the East-West Railway Line, *R. B. Filson 11940*, 28.x.1970 (MEL 1011707). As yet the species is known only from South Australia.

This is a very unusual *Parmelia* as the areolate lobes give the lichen a crustose appearance. It is morphologically similar to *P. refringens* another isidiose species in the "incrustata group" but can be separated from this species by the colour of the surface and the chemical reactions on the medulla.

Parmelia sp. *nov.* 3

Thallus saxicolous, loosely attached to the substrate, pale yellow-green to pale yellow-blue-green, covering patches up to 20 cm diam.; lobes irregular, subrotund, 1·0-2·5 mm wide, strongly imbricated, secondary lobes similar to the marginal lobes, sometimes building up thallus into a thick mat; upper surface smooth to slightly rugulose, without soredia but heavily isidiose on the older parts; isidia cylindric, coralloid; lower surface black. *Apothecia* up to 8 mm diam.; disk cinnamon brown to dark brown, deeply concave; margin thin, isidiose, inrolled at first, crenulate, incised; ascospores 10-11 x 6 μm.

Reactions: Thallus K−, medulla K+ yellow slowly brick-red to blackish-red, C−, KC−, P+ deep orange.

Specimen examined: Memory Cove, Cape Catastrophe, Eyre Peninsula, *R. B. Filson 11828*, 24.x.1970 (MEL 1011750).

The species grows in all Australian States.

It is a mat-forming *Parmelia* which can be separated from other species in this group by the black lower surface and the presence of small congested isidia.

Sometimes the central portion of the thallus can be hidden by a mass of isidia which gives the appearance of a dense isidiose mat.

Parmelia hypoclystoides (Müll. Arg.) Gyel. 1935a:25.

Parmelia conspersa var. *hypoclystoides* Müll. Arg. 1883:20.

Thallus foliose, saxicolous, loose to moderately adnate; lobes short and broad, rounded at the apices, up to 5 mm wide, irregular, strongly imbricate and mat-forming; upper surface smooth, sometimes shining at the marginal lobes, becoming dull and wrinkled at the centre, without soredia or isidia; lower surface pale tan to brown, sparsely rhizinate. *Apothecia* up to 10 mm diam.; disk pale to dark brown, wrinkled; margin thin, inrolled, crenulate, deeply lacerate in older structures; ascospores 8-9 x 7 μm.

Reactions: Thallus K−, medulla K+ yellow becoming red, C−, KC−, P+ dirty orange.

Specimens examined: Fowlers Bay, *Richards* (MEL 6194); Mount Gambier, *F. Mueller,* (MEL 6200).

The species is found also in Victoria.

Parmelia hypoprotocetrarica Kurokawa and Elix 1971:113.

Thallus saxicolous, loose to moderately adnate on the substrate, pale yellow-green, up to 8 cm diam.; lobes irregular, imbricate, margins sub-ascending, 1·0-2·0 (-3·0) mm wide; upper surface flat, heavily maculate without soredia or isidia; lower surface black. *Apothecia* up to 7 mm diam.; disk pale to dark brown, deeply concave; margin thin crenulate to deeply incised; ascospores 6-8 x 4-5 μm.

Reactions: Thallus K−, medulla K−, C−, KC−, P−.

Specimens examined: Elder Expedition, *R. Helms 1,* 1891 (MEL 9118); Springton, c. 55 km northeast of Adelaide, *J. A. Elix 203,* 27.xii.1973 (J.A.E.); Torrens Gorge, c. 3 km east of Gorge Kiosk, *N. N. Donner 1308,* 13.iii.1965 (MEL 9118).

This species is known also in Victoria and New South Wales.

Parmelia imitatrix Tayl. 1847:161.

Thallus saxicolous, appressed to substrate, olive-brown to reddish-brown; lobes elongate, up to 3 mm wide, hardly imbricate; upper surface dull, smooth to weakly wrinkled becoming rugose towards the centre, without soredia or isidia; lower surface dark brown to black. *Apothecia* up to 6 mm diam., sessile to shortly stipitate; disk concave, becoming flat; margin thin, entire, becoming crenulate, sometimes infolded; ascospores ellipsoid to almost subglobose, 7-11·5 x 4·5-6·5 μm.

Reactions: Thallus K−, HNO_3 + dark blue-green; medulla K−, C− or C+ pale yellow, KC+ rose-red, P−.

Specimens examined: Kimba to Cowell road, 18 km north-west of Cowell, *R. B. Filson* 11774, 22.x.1970 (MEL 1011811); Podinna Rock, 24 km north of Minnipa, *R. B. Filson 11902,* 25.x.1970 (MEL 1012291).

Parmelia imitatrix occurs also in Western Australia, Victoria and Tasmania.

Parmelia incantata Essl. 1977:115

Thallus foliose, terricolous, saxicolous or rarely lignicolous, tightly appressed to substrate, yellow-brown to reddish-brown to dark brown; lobes up to 1·5 mm wide, broad and rounded or elongate and sublinear, hardly imbricate; upper surface smooth, becoming rugose towards the centre, dull, shining at the lobe ends, sometimes lightly pruinose, without soredia, isidiose, isidia cylindrical or claviform; lower surface dark brown or black. *Apothecia* not seen.

Reactions: Thallus K−, HNO_3−; medulla K−, C−, KC+ rose-red, P−.

Specimens examined: Sandhill 1·6 km west of Barton on the East-West Railway, *R. B. Filson 11936,* 27.x.1970 (MEL 1012288); 3·2 km north of Kokatha on Poochera-Kingoonya road, *R. B. Filson 11914,* 26.x.1970 (MEL 1012284); Wilgena Hill, 6·4 km north Kingoonya-Tarcoola road 67·5 km west of Kingoonya, *R. B. Filson 11929,* 26.x.1970 (MEL 1012285); Waterfall Gully, Mount Lofty Ranges, *A. C. Beauglehole 15064,* 30.ix.1965 (MEL 1011702).

Parmelia incantata is known also from Western Australia.

Parmelia incerta Kurokawa and Filson 1975: 39.

Thallus saxicolous, closely adnate to the substrate, pale yellowish-green, up to 5 cm diam.; upper surface flat to slightly convex; marginal lobes smooth, black bordered; older lobes rimose rugulose, without soredia or isidia; lower surface dark brown. *Apothecia* adnate, up to 8 mm diam.; disk dark brown, deeply concave; margin thin, crenulate to deeply incised; ascospores 12-13 x 7·5-8·0 μm.

Reactions: Thallus K−, medulla K+ yellow becoming red, C−, KC−, P+ intense yellow.

Specimen examined: Warren Gorge, Southern Flinders Range, *J. Curtis 7,* 23.iv.1967 (MEL 34825).

Parmelia incerta is at present known only from South Australia.

Parmelia incrustata Kurokawa and Filson 1975:39.

Thallus saxicolous, pale straw-coloured, up to 5 cm diam.; lobes irregular imbricate, 0·7-1·2 mm wide, convex sometimes the central lobes becoming revolute; lower surface pale reddish-brown blackening at the margins. *Apothecia* up to 1·2 mm in diam.; disk dark brown, concave; margin thin, slightly crenulate; ascospores 12 x 6 μm.

Reactions: Thallus K−, medulla K−, C−, KC+ rose, P−.

Specimens examined: 23 km east-south-east of "Kenmore Park."*A. C. Beauglehole 25673*, 2.vii.1968 (MEL 1011699); 90 km south of Coober Pedy, *A. C. Beauglehole 25377*, 24.vi.1965 (MEL 1011701); summit of the Wallabyng Range, 21 km north of Kingoonya, *R. B. Filson 11958*, 28.x.1970 (MEL 1011709); near old gold mine, Waukaringa Hill, *R. W. Rogers 1287*, 9.x.1967 (R.W.R.).

Parmelia incrustata occurs also in New South Wales.

This is the name species for the "incrustata group" which comprises *P. globulifera, P. incrustata, P. pertinax, P. refringens* and *P. rimalis*. It can be separated from the other isidiose members of this group by the pale reddish-brown lower surface, narrow marginal lobes and the negative reaction of the medulla with Pd.

Parmelia jeleneckii Kremp. 1870:114.

Thallus corticolous, adnate to the substrate, green or yellow-green, up to 20 cm diam.; lobes irregular, subrotund, up to 10 mm wide, margins crenulate, flexuose, imbricate; upper surface more or less rugulose without isidia or soredia; lower surface jet black. *Apothecia* up to 7 mm diam.; disk cinnamon to dark brown, concave; margin strongly inrolled at first becoming less so at maturity; ascospores 15-18 x 9-12 μm.

Reactions: thallus K−, medulla K−, C−, KC−, P+ orange-red, lower medulla K+ purple.

No collections of this species have been made from South Australia; however it occurs in Victoria close to the State border and in Tasmania and New South Wales.

P. jeleneckii is part of the "caperata group" and is distinguished from other non-sorediose members of this group by the yellow lower medulla which has a positive reaction with KOH.

Parmelia loxodella Esslinger 1977:120.

Thallus foliose, saxicolous, tightly appressed to the substrate, olive-brown to dark reddish-brown, up to 12 cm diam.; lobes 1-2 mm wide, short, rounded, imbricate; upper surface smooth and strongly shining on the lobe ends becoming dull and cracked on the olders parts of the thallus, without soredia; isidia cylindrical, simple or branched, continuous and dense in the centre of the thallus thinning but occurring right to marginal lobes; lower surface dull, black, ends of the lobes dark brown. *Apothecia* not seen.

Reactions: Medulla K−, C−, KC+ red turning dingy orange-red, P−.

Specimens examined: Gawler Ranges, 160 km west of Port Augusta, *D. N. Krahenbuehl 2419*, 15.ix.1968 (MEL 37631). Also recorded in Esslinger (1977:120) near Burra, *Bratt & Cashin 70/964* (TLE, not seen).

The species occurs also in Victoria.

Parmelia luteonotata J. Stein. 1902:472.

Thallus foliose, saxicolous, tightly appressed to the substrate, reddish-brown to dark brown; lobes up to 3 mm wide, hardly imbricate; upper surface dull in the centre, slightly shining on the marginal lobes, flat, becoming strongly rugose in the centre, without soredia or isidia; lower surface pale tan to pale brown. *Apothecia* common up to 5 mm diam., sessile or shortly stipitate; disk concave or flat, dull, dark reddish-brown to blackish-brown; margin thin, entire; ascospores ellipsoid, 8-9·5 x 4·5-6 μm.

Reactions: Thallus K−, HNO_3+ dark blue-green; medulla K−, C− or C+ rose, KC− or KC+ rose, P−.

Specimens examined: Eyre Highway, 40 km east of Kimba, *R. B. Filson 11743,* 22.x.1970 (MEL 1011809); Eyre Peninsula, foot of north-east side of Darke Peak, *R. B. Filson 11762,* 22.x.1970 (MEL 1011732); Summit of Wallabyng Range, 21 km north of Kingoonya, *R. B. Filson 11960a,* 28.x.1970 (MEL 1012293).

Occurs also in Victoria and New South Wales.

Parmelia metaclystoides Kurokawa and Filson 1975:40.

Thallus saxicolous, tightly adnate to the substrate, up to 7 cm diam.; lobes flat, imbricate, 0·7-1·5 mm wide; upper surface dull, yellow-green, greying to almost black on the older portions of the thallus, isidia and soredia absent; lower surface pale, becoming pale brown at the ends of the lobes. *Apothecia* adnate, up to 7 mm diam.; disk deep brown; margin inrolled at first becoming flat and undulate; ascospores 9-10 x 6 μm.

Reactions: Thallus K−, medulla K+ pale yellow becoming orange then red, C−, KC−, P+ pale yellow then orange.

Specimen examined: Kimba to Cowell road, 18 km north-west of Cowell, *R. B. Filson 11783,* 22.x.1970 (MEL 1011810).

The species is known only from the type collection.

P. metaclystoides resembles *P. hypoclystoides* in both having pale undersides. It can be separated from *P. hypoclystoides* by the smaller lobes, paler underside. In the field *P. hypoclystoides* appears to have a more greyish-green appearance towards the ends of the marginal lobes.

Parmelia mexicana Gyel. 1931:281.

Thallus saxicolous, moderately to tightly appressed to the substrate, yellow-green to yellow-blue-green, forming patches up to 10 cm diam.; lobes irregular elongate, imbricate, up to 2·0 mm wide; upper surface smooth, shining, flat to slightly convex, without soredia, isidia cylindrical, slightly inflated, coralloid, short, densely covering the central portion of the thallus; lower surface pale to light brown. *Apothecia* adnate, immersed in isidia, up to 4 mm diam.; disk dark brown, at first deeply concave becoming less on ageing.

Reactions: Thallus K−, medulla K+ yellow becoming red, C−, KC−, P+ immediate orange.

Specimen examined: On rocky hillside, "Olive Grove" Station, 15 km south of Quorn, *R. B. Filson 11994*, 30.x.1970 (MEL 1011714).

The species occurs also in Victoria, Tasmania and New South Wales.

P. mexicana differs from the closely related *P. plittii* in the broader subrotund lobes and the denser isidia; which is shorter and more or less inflated at the tips.

Parmelia sp. *nov.* 4.

Thallus moderately loose on the substrate; marginal lobes up to 3 mm wide, short, rounded, strongly imbricate, secondary lobes narrower, up to 1 mm wide, imbricate and entangled, sometimes overgrowing the marginal lobes; upper surface smooth, dull, pale yellow-green, without soredia or isidia; under surface brown to dark brown, sparsely rhizinate. *Apothecia* up to 5 mm diam., margin heavily inrolled, hardly crenulate or incised; disk deeply concave, dark brown; ascospores 10-11 x 6-7 μm.

Reactions: Thallus K−, medulla K−, C−, KC−, P−.

Specimen examined: Podinna Rock, 24 km north of Minnipa, *R. B. Filson 11903*, 25.x.1970 (MEL 1011864).

This species is known only from South Australia.

Parmelia sp. *nov.* 5

Thallus corticolous, loosely attached to the substrate, pale greyish-white, up to 10 cm diam., lobes up to 6 mm wide, densely ciliose with simple or branched cilia, flexuose, hardly imbricate; upper surface maculate in a reticulate pattern, sometimes tips of lobes grey pruinose, older lobes becoming thick and wrinkled, without isidia, submarginally sorediose, becoming capitate; lower surface black, heavily rhizinate right to the margins of the lobes and mingling with the marginal cilia. *Apothecia* not seen.

Reactions: Thallus K+ yellow, medulla K+ yellow becoming red, C−, KC−, P+ orange.

Specimen examined: Gum Flat, 40 km north-west of Elliston, Eyre Peninsula, *R. B. Filson 11895*, 25.x.1970 (MEL 1011865).

Occurs also in Victoria, Tasmania and New South Wales.

The species is very similar to *P. reticulata* but easily separated from that species in the rhizines occurring right to the ends of the lobes.

Parmelia perlata (Huds.) Ach. 1803:216.

Lichen perlatus Huds. 1762:448.

Thallus corticolous, loose to moderately adnate on substrate, mineral grey, up to 15 cm diam.; lobes rotund, up to 8 mm wide, ciliate; upper surface smooth

without isidia, submarginally sorediose; soredia cause the lobe margin to become revolute; lower surface black becoming light to dark brown at the lobe tips. *Apothecia* very rare, up to 7 mm diam.; disk pale brown to cinnamon; margin thick, inrolled, sorediose; ascospores 25-27 x 16-18 μm.

Reactions: Thallus K+ yellow, medulla K+ yellow, C−, KC−, P+ pale orange becoming red.

Figure: Habit, plate 12B (MEL 1021204).

Specimens examined: Callendale North, 30 km south of Lucindale *M. Beek 11,* 10.vi.1970 (MEL 1012084); Hindmarsh Falls, *R. W. Rogers 1050.1,* 30.iv.1967 (R.W.R.); Tent Hill, near Deep Creek, Fleurieu Peninsula, *R. W. Rogers 1454,* 1.ix.1968 (R.W.R.); north-west slope of Mount Bonython, *R. D. Seppelt 1742,* 23.vii.1969 (R.W.R.).

The species grows also in Western Australia, Victoria, New South Wales and Queensland where it is widespread.

Parmelia perlata may be confused with two similar species, *P. reticulata* and *P. tenuirima,* but it is separated from both of these species by the smooth upper surface and the persistent yellow reaction of the medulla with KOH.

Parmelia pertinax Kurokawa and Filson 1975:41.

Thallus saxicolous, closely attached to the substrate, up to 1·0 cm diam., yellow to yellow-green; lobes up to 2·5 mm wide, not imbricate, becoming areolate towards the centre; upper surface flat, smooth at the margins, becoming rugulose and cracked towards the centre, without isidia or soredia; lower surface brown to dark brown. *Apothecia* 2·0 mm (rarely to 4·0 mm) diam.; margin thick inrolled, slightly lacerate; ascospores 8-10 x 5-7 μm.

Reactions: Thallus K−, medulla K−, C−, KC−, P+ red.

Specimens examined: On hill to the south of old dam on western side of the Corunna Range, 6 km north of Iron Knob, *R. B. Filson 11728,* 21.x.1970 (MEL 1011843); summit of Wallabyng Range, 21 km north of Kingoonya, *R. B. Filson 11959,* 28.x.1970 (MEL 1011708); Warren Gorge, 18 km north of Quorn, *R. B. Filson 11970,* 30.x.1970 (MEL 1011739).

The species is known only from South Australia.

In the field it is hard to separate *P. pertinax* from its closely related *P. rimalis.* The macroscopic differences are not well defined; *P. pertinax* is slightly more greenish-yellow in colour, lobes not imbricate. However a chemical test with KOH easily separates them as *P. pertinax* reveals a negative reaction.

Parmelia plittii Gyel. 1931:287.

Thallus saxicolous, moderately to tightly appressed to the substrate, yellow-green to yellow-blue-green, forming patches up to 10 cm diam.; lobes elongate, not or hardly imbricate, 1·0-1·5 mm wide; upper surface smooth shining, flat to slightly convex, without soredia, isidia simple, short, sparse, sometimes slightly inflated; lower surface pale to light brown. *Apothecia* not seen.

Reactions: Thallus K−, medulla K+ yellow becoming red, C−, KC−, P+ orange.

Specimens examined: Eyre Highway, 40 km east of Kimba, *R. B. Filson 11744,* 22.x.1970 (MEL 1011808); 3 km north of Kokatha on the Poochera-Kingoonya road, *R. B. Filson 11910,* 26.x.1970 (MEL 1011802); 4 miles (6 km) west of Oodla Wirra, *R. W. Rogers 1654,* 21.v.1969 (R.W.R.).

Occurs in Western Australia, Victoria and Tasmania.

This species is very hard to distinguish from *P. mexicana* in the field. The more elongate, hardly imbricate lobes are a good guide but the most reliable feature is the simple, sparse and scattered isidia.

Parmelia polyphylloides Gyel. 1934:371.

Thallus saxicolous, loosely attached to substrate, covering patches up to 20 cm diam.; lobes irregular, elongate, up to 2 mm wide, strongly imbricate, secondary lobes similar to the marginal lobes, building up the thallus into a thick mat; upper surface smooth to slightly rugulose, pale yellow-green becoming brownish-yellow to dark grey on the older lobes, distinctly black-bordered; lower surface brown to dark brown, blackening towards the margins. *Apothecia* up to 6 mm wide; margin thin, crenulate to flexuose, at first inrolled almost disappearing at maturity; disk dark brown, dull, concave, smooth becoming rugulose; ascospores 9-11 x 5-7 μm, thin walled.

Reactions: Thallus K−, medulla K+ yellow becoming red, C−, KC−, P+ pale yellow becoming orange.

Specimen examined: Hill south of old dam, western side of Corunna Range, 6 km north of Iron Knob, *R. B. Filson 11726,* 21.x.1970 (MEL 1011849).

Parmelia polyphylloides may be confused with *P. flavescentireagens* differing from it in the narrower lobes, darker underside, and in the chemical reactions.

Parmelia praeterissima Kurokawa and Filson 1975:41.

Thallus saxicolous, tightly adnate to the substrate up to 8 cm diam.; lobes sublinear elongate, 1·2-3·0 mm wide; upper surface yellow-green, greying on the older lobes, wrinkled and rugulose, isidia and soredia absent; lower surface dull, brown but becoming black near the apices of the lobes. *Apothecia* numerous, adnate, up to 10 mm diam.; disk deep brown; margin inrolled at first, later unrolling but the apothecia always remaining cup-shaped; ascospores 7 × 10 μm.

Reactions: Thallus K−, medulla K−, C−, KC−, P−.

Specimens examined: On rock outcrop by saltlake, 50 km east of Tarcoola, *R. B. Filson 11949,* 28.x.1970 (MEL 1011717); 6 km east of Oodla Wirra, *R. W. Rogers 1656,* 18.v.1969 (R.W.R.).

As yet known only from South Australia.

Parmelia praeterissima is very similar to *P. tasmanica;* however it differs in being a little more tightly adnate to the substrate; the upper surface is dull rather than shining, wrinkled rather than smooth; the lower surface brown rather than black. It differs also in the negative chemical reactions on the medulla.

Parmelia pseudotenuirima Gyel. 1931:289.

Thallus corticolous, up to 9 cm. diam., closely adnate to substrate; lobes rotund, 2-4 mm wide, without cilia, hardly imbricate; upper surface pale mineral grey, dull, heavily scrobiculate and pseudocyphellate with isidia forming on the tops of ridges; isidia cylindric, coralloid, branched, densely covering the centre of the thallus; lower surface jet black, densely rhizinate right to the margins of the lobes. *Apothecia* up to 8 mm diam., margin thin inrolled at first becoming deeply lacerate and distorted, pseudocyphellate, sometimes developing isidia on the older apothecia; disk dull, dark brown to almost black; ascospores 14-16 × 9-10 μm.

Reactions: Thallus K−, medulla K+ yellow becoming red, C−, KC−, P+ yellow becoming red.

Figure: Ascospores, fig. 21B.

Specimen examined: The Gap, 48 km north of Naracoorte, *M. Beek 33,* 15.vii.1973 (MEL 1013807).

This species grows also in Victoria and New South Wales.

Parmelia pulla Ach. 1814:206.

Thallus foliose, loosely to moderately attached to substrate, olive-brown to yellowish-brown, reddish-brown to dark brown; lobes up to 5 mm wide, short, rounded to elongate and linear, imbricate to entangled; upper surface smooth to weakly wrinkled, dull to slightly shining without soredia or isidia; lower surface dark brown to black. *Apothecia* up to 8 mm diam., sessile to shortly stipitate; disk deeply concave to flat, reddish-brown; margin thin, crenulate to lacerate; ascospores ellipsoid, 8-10 × 4·5-7 μm.

Reactions: Thallus K−, HNO_3+ pale to dark blue-green; medulla K−, C− or C+ rose to red, KC− or KC+ rose-red, P−.

Figure: Habit, plate 12A (MEL 1021187).

Specimens examined: 26½ miles (41 km) west-south-west Koonalda, *A. C. Beauglehole 14910,* 24.ix.1965 (MEL 1012254); Marble Range, Eyre Peninsula, *R. B. Filson 11866,* 24.x.1970 (MEL 1011805); Memory Cove, Cape Catastrophe, *R. B. Filson 11824,* 24.x.1970 (MEL 1012287); Kingscote, Kangaroo Island, *R. D. Seppelt,* 10.xii.1972 (MEL 1012251); Warren Gorge, Flinders Ranges, *R. B. Filson 11972,* 30.x.1970 (MEL 1012294).

Occurs also in Western Australia, Victoria, Tasmania, New South Wales and Queensland.

P. pulla is probably our most common brown *Parmelia*. A similar species, *P. glabrans* Nyl., is a chemical variant of *P. pulla*, having a strong blue-white fluorescence of the medulla in ultraviolet light (Alectoronic acid).

Parmelia pumila Kurokawa and Filson 1975:42.

Thallus terricolous, closely adnate to the substrate, up to 6 cm diam.; lobes up to 1·5 mm wide, imbricate; secondary lobes subterete, coralloid, isidia-like growing up from lobules in the centre of the thallus; upper surface pale yellow-green, smooth, often pruinose on the marginal lobes, older parts becoming rugulose and cracked, without soredia or isidia; lower surface brown at the marginal lobes, progressively darker until black in the centre. *Apothecia* up to 2·5 mm diam.

Reactions: Thallus K−, medulla K+ yellow slowly brown then blackish-red, C−, KC−, P+ yellow becoming orange then red.

Specimens examined: Knowles Cave, Nullarbor Plain, *R. B. Filson 9454*, 5.i.1967 (MEL 25398); vicinity of Koonalda Cave, Nullarbor Plain, *R. B. Filson 9410*, 28.xii.1966 (MEL 25385); "Nullarbor" H.S., *J. H. Willis*, 29.viii.1947 (MEL 6246); Eyre Highway 16 km west of Ivy Shed Tanks, *G. C. Bratt 67/183*, 4.x.1967 (R.W.R.).

Known only from South Australia.

P. pumila is closely allied to *P. callifolia* and is separated from it by the closer adnation to the substrate, narrower marginal lobes, and the sub-terete, isidia-like secondary lobes.

Parmelia quercina (Willd.) Vain. 1899:279.

Lichen quercina Willd. 1787:353.

Thallus corticolous, firmly attached to the substrate, pale greenish-grey to whitish-grey, up to 6 mm diam.; lobes up to 2·5 mm wide, hardly imbricate, ciliate; upper surface convex sometimes pruinose on the marginal lobes, slightly rugulose, without soredia or isidia; lower surface jet black. *Apothecia* up to 6 mm diam.; disk pale brown, sometimes pruinose, flat to slightly concave; margin thin entire; ascospores 12 x 9 μm.

Reactions: Thallus K+ yellow, KC+ orange, medulla K−, C+ blood red, KC−, P−.

Specimens examined: Greenhill, *R. W. Rogers 886*, 15.i.1967 (R.W.R.); near Mount Bold Reservoir, *V. M. Cruikshank*, x.1967 (R.W.R.); The Gap, 31 km north of Naracoorte, *M. Beek 37*, 15.vii.1973 (MEL 1013823).

Occurs in all States except the Northern Territory.

Parmelia refringens Kurokawa and Filson 1975:43.

Thallus saxicolous, moderately appressed to the substrate, covering patches by regeneration to 15 cm diam., pale yellow-green to straw-yellow; lobes

imbricate, up to 3 mm wide; upper surface smooth at the marginal lobes, central lobes becoming rugulose and cracked, not sorediose but isidiose; isidia verruculose, inflated at the apices, sometimes almost spherical, apices breaking open but not forming soredia; lower surface black. *Apothecia* up to 6 mm diam.; disk dark brown, deeply concave; margin thick inrolled, lacerate, sometimes heavily isidiose; ascospores 9-10 x 5-6 μm.

Reactions: Thallus K−, medulla K+ yellow becoming red, C−, KC−, P+ yellow becoming orange.

Specimens examined: Wynbring rocks, c. 1 km north of Wynbring on the East-West Railway Line, *R. B. Filson 11940a,* 28.x.1970 (MEL 1013381).

Known only from South Australia.

P. refringens is part of the "incrustata group" and can be separated from the closely related species *P. globulifera* by the black under surface.

Parmelia reptans Kurokawa apud C. Baker et al. 1973:137.

Thallus forming irregular rosettes on earth, up to 4 cm diam.; lobes irregular to irregular-dichotomous, 0·5-1·5 (−2·0) mm wide; upper surface pale yellow-green, plane to slightly convex, soredia and isidia absent; lower surface pale brown sometimes with a paler zone towards the tips of the lobes. *Apothecia* not seen.

Reactions: Thallus K−, medulla K−, C−, KC−, P+ orange or yellow becoming red-orange.

Figure: Habit, fig. 23A.

Specimens examined: On hill to the south of old dam on western side of Corunna Range, 6·5 km north of Iron Knob, *R. B. Filson 11727,* 21.x.1970 (MEL 1011850); Koonamore Vegetation Reserve, *C. Barnard,* 12.xii.1927 (R.W.R.); 4 miles (6 km) east of Oodla Wirra, *R. W. Rogers 1938,* 2.xi.1971 (R.W.R.).

Occurs also in Western Australia and Victoria.

As with other species in the "amphixantha group" this species is difficult to distinguish in the field as it tends to grade into the other three species. To be sure of determination they must be separated chemically.

Parmelia reticulata Tayl. apud Mack. 1836:148.

Thallus corticolous, loosely attached to the substrate, mineral grey, up to 20 cm diam.; lobes up to 6 mm wide, secondary lobes building up the thallus into a thick mat, ciliate; upper surface heavily maculate in a reticulate pattern so that with ageing the surface of the lobe becomes reticulately cracked, without isidia, submarginally sorediose, becoming capitate; lower surface black, heavily rhizinate with a dark brown bare zone at tips of lobes. *Apothecia* rare up to 8 mm diam.; disk pale to warm brown, concave; margin thick, heavily sorediose, deeply incised; ascospores 13-16 × 9-11 μm.

Reactions: Thallus K+ yellow, medulla K+ yellow becoming red to brown to black, C−, KC−, P+ yellow becoming orange-red.

Specimens examined: Monster Mount, 13 km south of Keith, *R. D. Seppelt 2781*, 28.vii.1973 (MEL 1018048); Nixon-Skinner Conservation Park, Myponga, *R. W. Rogers 1709*, 16.vi.1969 (R.W.R.).

Occurs in all States except the Northern Territory.

Parmelia reticulata may be confused with *P.* sp. *nov.* 5 but can easily be separated from this species by the bare or moderately rhizinate zone under the lobe ends. It differs from *P. perlata* in having a reticulate upper surface.

Parmelia rimalis Kurokawa apud Kurokawa and Filson 1975:43.

Thallus saxicolous, closely appressed to the substrate, up to 15 cm diam., straw-yellow; lobes elongate, up to 2·5 mm wide, moderately imbricate becoming areolate towards the centre of the thallus; upper surface smooth at the margins becoming rugulose and cracked towards the centre, without soredia or isidia; lower surface brown. *Apothecia* up to 5 mm diam.; disk dark brown, concave; margin thick, inrolled, slightly lacerate; ascospores 12-13 × 6-7 μm.

Reactions: Thallus K−, medulla K+ yellow becoming red, C−, KC−, P+ intense yellow.

Specimens examined: On rocky outcrop by salt lake, 50 km east of Tarcoola, *R. B. Filson 11949*, 28.x.1970 (MEL 1011713); summit of the Wallabyng Range, 21 km north of Kingoonya, *R. B. Filson 11958a*, 28.x.1970 (MEL 1011710); Yudnapinna Station, 28 km west of Hesso, *R. W. Rogers 24*, 22.vi.1965 (R.W.R.); spur to the south-west of Mount Arden, Southern Flinders Ranges, *John Curtis 2*, 23.iv.1967 (MEL 34826); Koonamore Vegetation Reserve, *R. W. Rogers 1309* 21.xi.1967 (R.W.R.); near old gold mine Waukaringa, *R. W. Rogers 1288*, 9.x.1967 (R.W.R.).

Known also from New South Wales.

Parmelia rutidota Hook.f. and Tayl. 1844:645.

Thallus foliose, corticolous or lignicolous, adnate to the substrate, green or yellow-green, up to 20 cm diam.; lobes irregular 2·0-8·0 mm wide, margins crenulate, imbricate, lobulate; upper surface dull, sometimes slightly shining, more or less rugulose at the margins becoming rugulose towards the centre, isidia and soredia absent; lower surface jet black, sparsely rhizinate; medulla white to cream, sometimes with yellowish patches in the lower part. *Apothecia* up to 7 mm diam.; disk cinnamon brown, concave; margin strongly inrolled at first becoming less so at maturity; ascospores 55 x 27μm.

Reactions: Thallus K−, medulla K−, C−, KC−, P+ deep orange, yellow patches in the lower medulla K−.

Figures: Habit, plate 12C (MEL 1021191) and fig. 23B.

Specimens examined: On sandhill, 1·6 km west of Barton on the East-West Railway Line, *R. B. Filson 11938*, 27.x.1970 (MEL 1011719); Gum Flat,

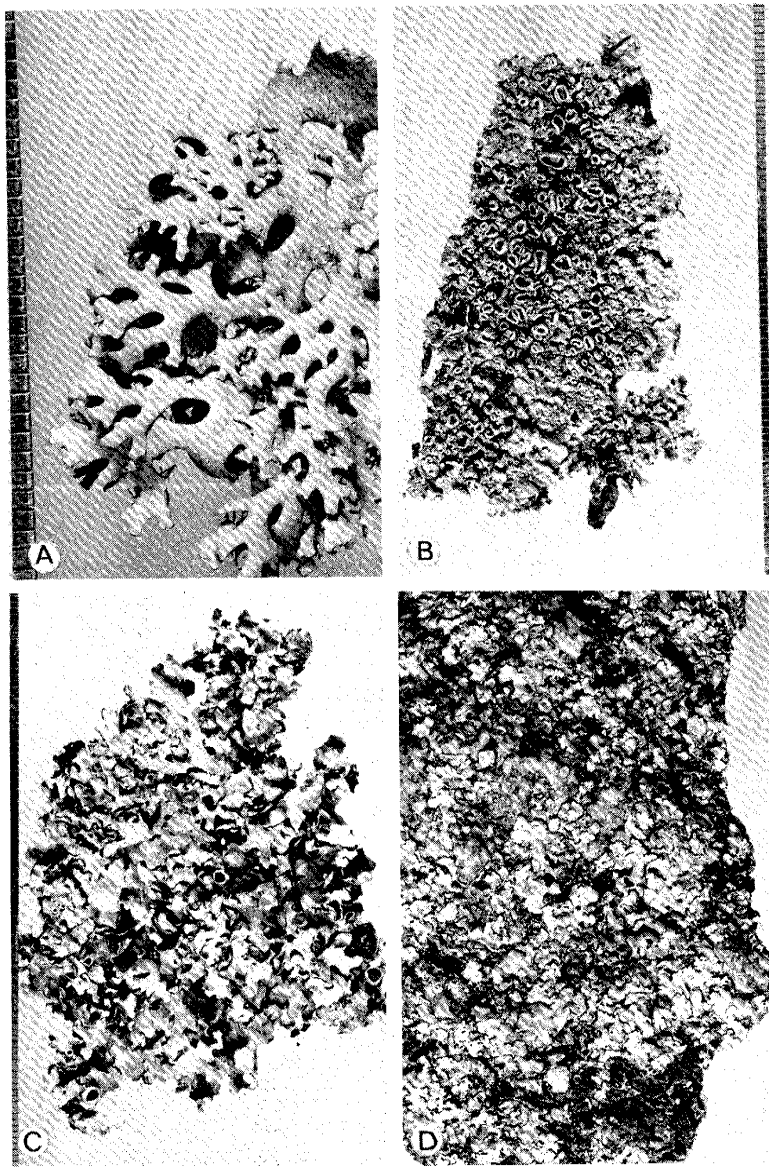


Fig. 23. A, *Parmelia reptans;* B, *Parmelia rutidota;* C, *Parmelia tasmanica;* D, *Parmelia tinctina.* Scale in millimetres.

40·25 km north-west of Elliston, Eyre Peninsula, *R. B. Filson 11896,* 25.x.1970 (MEL 1011832); along the track to Memory Cove, Cape Catastrophe, 24 km south-south-west of Port Lincoln, *R. B. Filson 11857,* 24.x.1970 (MEL 1011754); Nixon Skinner Conservation Park, near Myponga, *R.W. Rogers 1708,* 17.vi.1969 (R.W.R.); Hindmarsh Reservoir, Hindmarsh Tiers, Fleurieu Peninsula, *R.W. Rogers 1047,* 25.iv.1967 (R.W.R.); Ferguson Park, Burnside, *R.W. Rogers 1829,* 3.i.1970 (R.W.R.); Naracoorte, *M. Beek 5,* 30.v.1973 (MEL 1012083).

Occurs in all States.

Parmelia rutidota is at its best on dead wood in dry habitats. It may be confused with other species in the "caperata group" particularly with *P. ferax* from which it differs in chemistry. It is easily separated from *P. jeleneckii* in the chemical reactions on the pigment in the lower medulla and in the less divided and flexuose margins to the lobes.

Parmelia scabrosa Tayl. 1847:162.

Thallus moderately loose on the substrate; lobes imbricate up to 5 mm wide; upper surface yellow-blue-green, blackening towards the centre, smooth, shining at marginal lobes becoming dull and cracked on the older portions, soredia lacking, isidiose; isidia cylindric coralloid, up to 1·5 mm tall; lower surface brown to dark brown, blackening at the tips of the lobes. *Apothecia* up to 6·5 mm diam.; disk at first strongly concave becoming flat, dark brown, shining; margin at first inrolled, isidiose; ascospores 8-12 x 5-6 μm.

Reactions: Thallus K−, medulla K−, C−, KC+ pale rose, P−.

Figure: Habit, plate 12D (MEL 1021193).

Specimens examined: Near summit of Mount Bonython, *R.W. Rogers 877,* 15.i.1967 (R.W.R.).

Known also in Western Australia and Victoria.

Parmelia schistaceae Kurokawa and Filson 1975:44.

Thallus foliose, saxicolous, tightly adnate to the substrate, mineral-grey to pale yellowish-grey, up to 4 cm diam.; lobes sublinear elongate, irregularly branched; upper surface dull to slightly shining in parts, convex, smooth, cracked, without isidia, pustulate; pustules not readily forming soredia; lower surface pale brown. *Apothecia* not seen.

Reactions: Thallus K+ yellow, medulla K−, C−, KC−, P−.

Specimen examined: Wilgena Hill, 6·5 km north of Kingoonya, *R.B. Filson 11921,* 26.x.1970 (MEL 1011839).

Known only from South Australia.

Parmelia scotophylla Kurokawa apud Kurokawa and Filson 1975:45.

Thallus foliose, saxicolous, adnate to the substrate, mineral-grey, outside margins of the lobes darkening to a brownish-grey, up to 10 cm diam.; lobes up

to 3 mm wide, slightly imbricate; upper surface flat to slightly convex, shining, smooth becoming cracked towards the centre, sparsely isidiose, without soredia; lower surface pale to light brown. *Apothecia* uncommon, substipitate, up to 6 mm diam.; disk pale brown, deeply concave; margin thin, inrolled, isidiose.

Reactions: Thallus K+ yellow, medulla K+ yellow becoming red, C−, KC−, P+ yellow becoming orange.

Specimens examined; Warren Gorge, 17 km north of Quorn, *R. B. Filson 11971,* 30.x.1970 (MEL 1011743); vicinity of Arkaringa Creek, *R. Helms 69,* 25.v.1891 (MEL 6153).

Grows also in New South Wales.

This species may be confused with *P. schistaceae* as it sometimes has a pale yellowish cast to the thallus, it is separated from *P. schistaceae* in the presence of isidia, the larger, flat, more spread out lobes and in the reaction of KOH on the medulla.

Parmelia soredians Nyl. 1872:259.

Thallus corticolous, tightly adnate to to the substrate, up to 8 cm diam.; lobes rotund up to 3 mm wide, imbricate; upper surface yellow-green, smooth, dull to slightly shining, starting at the margins with sorediose bumps becoming heavily ridged with pulvinate soredia towards the centre; soredia granular, without isidia; lower surface black with dark brown zone at tips of lobes. *Apothecia* not seen.

Reactions: Thallus K−, medulla K+ yellow becoming red, C−, KC−, P+ yellow becoming orange.

Specimens examined: 6 km west of Springton along the High Eden road, *J.A. Elix 2238,* 20.v.1976 (J.A.E.); 1 km east of Hallett Cove, *J. A. Elix 2137,* 13.v.1976 (J.A.E.).

Occurs in Victoria and New South Wales.

Parmelia soredians is a very distinctive yellow-green sorediose lichen found growing on old fence posts. A form with narrower more strongly dissected marginal lobes, less dense soredia and a negative reaction with KOH is also found growing in similar habitats.

Parmelia spodochroa Kurokawa and Filson 1975:46.

Thallus saxicolous, tightly adnate to the substrate, pale grey to ash-coloured, up to 4 cm diam.; lobes irregular, up to 1·5 (−2·0) mm wide, sometimes imbricate; upper surface smooth, dull convex, becoming cracked towards the centre, without soredia or isidia; lower surface pale, becoming dark brown to blackish-brown at the margins. *Apothecia* not seen.

Reactions: Thallus K+ yellow, medulla K+ yellow becoming red, C−, KC−, P+ orange.

Specimen examined: Warren Gorge, 17 km north of Quorn, *R. B. Filson 11976,* 30.x.1970 (MEL 1011718).

At present known only from the type collection.

Parmelia spodochroa is allied to *P. schistaceae* and *P. scotophylla* and differs from them in the lack of pustules, soredia or isidia.

Parmelia subalbicans Stirt. 1877-78:254.

Thallus corticolous or lignicolous, adnate to moderately adnate to the substrate, varying in colour from greyish-white to mineral-grey to almost blackish-grey, up to 8 cm diam.; lobes elongate, up to 2·5 (−3·0) mm wide, crenulate, margins blackish-grey and sometimes pruinose, not ciliate; upper surface dull to slightly shining, smooth, flat, becoming pseudocyphellate, without soredia or isidia; lower surface pale to light brown. *Apothecia* common, stipitate, crowded into the central parts of the thallus, up to 6 mm diam.; disk pale brown to very dark brown, concave to almost flat; margin thin, crenulate, persistent; ascospores ellipsoidal, 15-16 × 8-10 μm.

Reactions: Thallus K+ yellow, medulla K−, C+ red, P−.

Specimens examined: On sandhill 1·5 km west of Barton on the East-West Railway Line, *R. B. Filson 11939,* 27.x.1970 (MEL 1011729); 35 km east of Refuge Rockholes, 40 km west of Whyalla, *N. N. Donner 2199 (in part),* 28.viii.1967 (MEL 1018046); Stuart Highway, c. 43 km north of Hesso, *R. W. Rogers 11,* 2.iv.1965 (MEL 1011853, AD); Koonamore Vegetation Reserve, *R. W. Rogers 1316,* 1.xii.1967 (R.W.R.); Ferguson Park, Burnside, *R. W. Rogers 1830,* 5.i.1970 (R.W.R.).

Occurs in Western Australia, Victoria, Tasmania and New South Wales.

Parmelia subalbicans is a very common lichen on old fence posts and post and rail fences where it is often found in association with *P. rutidota.*

Parmelia subcaperata Kremp. 1873:10.

Thallus corticolous, lignicolous or occasionally saxicolous, loosely attached to the substrate, pale grey to buff, up to 15 cm diam.; lobes up to 15 mm wide, margins black, heavily ciliate; cilia up to 3 mm long, often branched; upper surface smooth, shining, strongly maculate becoming cracked on the older parts of the thallus, without soredia or isidia; lower surface brown to dark brown. *Apothecia* up to 20 mm diam., stipitate; disk light brown with a perforation in the centre; margin thin deeply incised; ascospores 15 × 9-10 μm.

Reactions: Thallus K+ yellow, medulla K+ yellow becoming red to blackish-red, C−, KC−, P+ yellow becoming orange.

Specimens examined: Kapunda, 70 km north-north-east of Adelaide, *G. Hazel,* ix.1965 (MEL 1011798, AD); top of The Bluff, Victor Harbor, *R. W. Rogers 1888,* ix.1970 (R.W.R.).

Occurs in Victoria and Tasmania.

Parmelia subcaperata might be confused with two chemically identical species, *P. tenuirima* and *P. reticulata.* It differs from *P. tenuirima* in having long marginal cilia and from *P. reticulata* in not having reticulate maculae on the upper surface and in the lack of soredia.

Parmelia subdistorta Kurokawa 1969:212.

Thallus, terricolous or saxicolous on pebbles on the ground, mostly adnate to the substrate, pale yellow-green, up to 10 cm diam.; lobes at the margins sublinear-elongate, up to 1·0 mm wide, imbricate; secondary lobes overgrowing the centre of the thallus, narrower than the marginal lobes, revolute, dichotomous, 0·3-0·5 (−0·7) mm wide; upper surface minutely rugulose, flat strongly convex, without soredia or isidia; lower surface pale, darkening to greyish-brown at the lobe ends. *Apothecia* rare up to 3 mm diam.; disk pale to dark brown; margin thick revolute; ascospores 10 × 7 μm.

Reactions: Thallus K−, medulla K−, C−, KC+ rose, P−.

Figure: Ascospores, fig. 21C.

Specimens examined: Kimba to Cowell road, 18 km north-west of Cowell, *R. B. Filson 11780*, 22.x.1970 (MEL 1011818); "Cariewerloo" Station, 50 km west-north-west of Port Augusta on the road to Hesso, *R. W. Rogers 1934*, 25.iii.1965 (R.W.R.); alongside a secondary road, c. 3 km north-west of Quorn, *R. B. Filson 11964*, 29.x.1970 (MEL 1011744); "Baratta" H. S., 65 km east of Hawker, *N. N. Donner 5037*, 10.vii.1974 (AD); Oodla Wirra, *R. D. Seppelt*, 1.v.1971 (R.W.R.).

Occurs also in Western Australia and Victoria.

This species may be confused with some forms of *P. australiensis* which is chemically similar. However it differs in having narrower revolute lobes and is usually rosette forming rather than being loose and scattered on the substrate.

Parmelia subrudecta Nyl. 1888:26.

Thallus corticolous, loosely attached to the substrate, mineral-grey to pale tan, up to 15 cm diam.; lobes up to 6 mm wide, without cilia; upper surface, dull, flat, without isidia, heavily pseudocyphellate; pseudocyphellae on the older lobes sometimes developing into soredia; soredia mainly marginal; lower surface smooth to rugulose, pale to pale brown. *Apothecia* rare up to 4 mm diam.; disk pale brown to tan, deeply concave; margin at first inrolled, pseudocyphellate becoming sorediose; ascospores 16-18 × 9-15 μm.

Reactions: Thallus K+ yellow, medulla K−, C+ blood-red, KC+ red, P−.

Figure: Habit, plate 13A (MEL 1021209).

Specimens examined: Warren Gorge, 18 km north of Quorn, *R. B. Filson 11969*, 30.x.1970 (MEL 1011738); Comaum, 17 km north-east of Penola, *K. Alcock*, 21.vii.1972 (MEL 1011852).

Occurs in all States except the Northern Territory.

Parmelia subverrucella Essl. 1977:133.

Thallus foliose, saxicolous, tightly adnate, up to 3 cm diam.; lobes up to 1·5 (-3) mm broad, short, rounded, contiguous, subimbricate; upper surface olive-brown to dark brown, smooth to weakly wrinkled, without soredia, isidia

subglobose, at times becoming lobulate, sometimes almost black; lower surface pale tan, moderately rhizinate. *Apothecia* not seen.

Reactions: Thallus K−, medulla K−, C−, KC−, P−.

Specimen examined: Summit of Wallabyng Range, 21 km north of Kingoonya, *R. B. Filson 11960,* 28.x.1970 (MEL 1012292).

At present known only from South Australia.

Parmelia tasmanica Hook. and Tayl. 1844:644.

Thallus foliose, saxicolous, loosely attached to the substrate; lobes numerous, densely imbricate, 2·5-5·0 mm wide with masses of secondary lobes building up the thallus into a thick mat; upper surface yellow-green to yellow-blue-green, shining, soredia and isidia absent; lower surface jet black with narrow cinnamon brown zone at the lobe ends. *Apothecia* up to 15 mm diam., deeply cup-shaped; disk reddish-brown, shining; margins inrolled; ascospores 10 × 6 μm.

Reactions: Thallus K−, medulla K+ yellow becoming red to brownish-red, C−, KC−, P+ yellow becoming brick red.

Figures: Habit, plate 13B (MEL 1021208) and fig. 23C.

Specimens examined: Podinna rock, 24 km north of Minnipa, *R. B. Filson 11901b,* 25.x.1970 (MEL 1011863); south side of Carappee Hill, Eyre Peninsula, *R. B. Filson 11764,* 22.x.1970 (MEL 1011814); Hawker to Marree road, 21 km south of Copley, *A C. Beauglehole 28186,* 2.viii.1968 (MEL 1011700); rocky hillside, "Olive Grove" Station, 14 km south of Quorn, *R. B. Filson 12000,* 30.x.1970 (MEL 1011733); 5 km up River Torrens past Cudlee Creek, *R. W. Rogers 1260,* 20.vii.1967 (R.W.R.); Hindmarsh Falls, *R. B. Filson 15480,* 13.xi.1975 (MEL 1015122).

Occurs in Victoria, Tasmania and New South Wales.

Parmelia tasmanica is very common on rock in open situations.

Parmelia tenuirima Hook. and Tayl. 1844:645.

Thallus saxicolous rarely corticolous, loosely attached to the substrate, pale whitish-grey to mineral-grey, sometimes becoming pale brown in the centre of the thallus, up to 30 cm diam.; lobes up to 10 mm wide, strongly imbricate, secondary lobes building up the thallus into a thick mat, without cilia; upper surface dull, flat, heavily pseudocyphellate, but the pseudocyphellae never forming soredia, without isidia; lower surface jet black with a brown zone at the ends of the lobes. *Apothecia* up to 25 mm diam., sessile; disk rugulose, warm brown to dark brown, concave at first, becoming flat and undulating then distorted; margin thin, hardly revolute, crenulate, deeply incised and lacerate, sometimes right to the centre; ascospores 14-16 × 8-9 μm.

Reactions: Thallus K+ yellow, medulla K+ yellow becoming red to blackish-red, C−, KC−, P+ yellow becoming orange.

Figure: Habit, plate 13C (MEL 1021192).

Specimens examined: Near the summit of Mount Lofty, *R. W. Rogers 1838,* x.1969 (R.W.R.).

Occurs in Victoria, Tasmania, New South Wales and Queensland.

Parmelia tenuirima may be confused with two chemically similar species; it can be separated from *P. subcaperata* in the lack of marginal cilia and from *P. reticulata* by the lack of soredia.

Parmelia sp. *nov.* 6

Thallus terricolous, or lignicolous on small debris twigs, loosely attached to the substrate, pale yellow-green, in loose disjointed patches up to 5 cm diam., lobes elongate, revolute to convolute, up to 1·0 mm wide growing over and under one another, secondary lobes narrower, 0·3-0·5 mm wide over growing the other lobes; upper surface dull, smooth to slightly rugulose, convex, without soredia or isidia; lower surface pale to light brown. *Apothecia* up to 2 mm diam., adnate to the thallus; disk brown, smooth, concave; margin thick, crenulate; ascospores 8-10 x 6 μm.

Reactions: Thallus K−, medulla K+ yellow becoming red, C−, KC−, P+ yellow becoming orange.

Specimens examined: Near Owen, *J. B. Cleland,* 28.x.1966 (R.W.R.); Weary Paddock, "Quondong" Station, *R. W. Rogers 1291,* 1.xi.1967 (R.W.R.).

Known also from Victoria.

This species is part of the "callifolia group" differing from *P. callifolia* in the pale underside and from *P. subdistorta* in chemistry and the non-rosette forming habit.

Parmelia tinctina Maheu and Gillet 1925:860.

Thallus saxicolous, adnate to the substrate, yellow-green to yellow-blue-green, becoming blackish-green in the centre, up to 10 cm diam., lobes strongly imbricate, up to 3 mm wide, secondary lobes narrower overlaying the centre of the thallus, without soredia; isidia short, subglobose but occasionally cylindrical; upper surface smooth, shining, flat to slightly convex; lower surface jet black. *Apothecia* not seen.

Reactions: Thallus K−, medulla K+ yellow becoming red to blackish-red, C−, KC−, P+ yellow becoming orange.

Figure: Habit, fig. 23D.

Specimens examined: Memory Cove, Cape Catastrophe, Eyre Peninsula, *R. B. Filson 11831,* 24.x.1970 (MEL 1011800); by waterhole in Frome River, 6 km north of "Evans O.S.", 40 km east-south-east of Copley, *R. B. Filson 15610,* 19.xi.1975 (MEL 1014744); rocks just above high tide mark on The Bluff, Victor Harbor, *R. W. Rogers 1940,* 27.viii.1971 (R.W.R.).

Occurs also in Victoria.

Parmelia tinctina is morphologically similar to *P. mexicana* and *P. plittii* but differs from both of those species in having a black under surface.

Parmelia ustulata Kurokawa and Filson 1975:46.

Thallus saxicolous, moderately adnate to the substrate, yellow-green at the margins to blackish-green in the centre of the thallus, without soredia or isidia; lobes elongate, up to 4 mm wide, imbricate, flexuose; upper surface mainly dull but the marginal lobes are sometimes shining, smooth at the margins becoming cracked on the older lobes; lower surface pale brown, margins pale greyish-brown. *Apothecia* adnate, up to 10 mm diam.; disk dark brown to blackish-brown, concave; margin thick, crenulate, incised; ascospores 10 x 5-6 μm.

Reactions: Thallus K−, medulla K−, C−, KC−, P−.

Specimens examined: Memory Cove, Cape Catastrophe, Eyre Peninsula, *R. B. Filson 11834*, 24.x.1970 (MEL 1011807); on rocky hillside, "Olive Grove" Station, 14·5 km south of Quorn, *R. B. Filson 11997*, 30.x.1970 (MEL 1011734).

Known only from South Australia.

Parmelia ustulata may be confused with *P. flavescentireagens* as both are morphologically similar however it is more tightly appressed to the substrate and the marginal lobes are wider. *P. flavescentireagens* also has a positive reaction with C and KC on the medulla.

Parmelia verrucella Esslinger 1977:132.

Thallus saxicolous or terricolous, moderately to loosely adnate, up to 6 cm diam., yellowish-brown to dark-brown; lobes up to 2·5 mm wide, flat, imbricate or entangled; upper surface wrinkled in part, dull or slightly shining at the lobe ends, sometimes lightly pruinose, without soredia, isidia sometimes dense, cylindrical, simple or branched; lower surface black. *Apothecia* up to 2·0 mm diam.; disk concave to flattening; margin entire or sparsely isidiose; ascospores 8-9 x 5-6 μm.

Reactions: Medulla K−, C−, KC− or KC+ faint rose, P−.

Specimens examined: Along road to "Artimore" (ruins) 2 km. from Narrina Creek, 20 km north-east of Blinman, *R. B. Filson 15571*, 17.xi.1975 (MEL 1014505).

Occurs also in Victoria.

Parmelia verrucella is very similar to *P. subverrucella* differing in the colour of the underside. It may be confused with *P. incantata* but the KC reaction of that species is usually more stronger.

Parmelia sp. *nov.* 7

Thallus terricolous, loose to lightly attached to the substrate; lobes elongate, irregularly branched 1·0-2·5 mm wide; upper surface plane to slightly convex, maculate, isidia and soredia absent; lower surface concolourous with the upper surface, plane to canaliculate, rhizines infrequent. *Apothecia* not seen.

Reactions: Thallus K−, medulla K+ faint gold, C−, KC−, P+ faint yellow becoming orange then red.

Specimens examined: Eyre Highway, 11 miles (18 km) east of Koonalda, Nullarbor Plain, *J. H. Willis*, 18.x.1961 (MEL 17651); vicinity of Koonalda Cave, Nullarbor Plain, *R. B. Filson 9420b*, 28.xii.1966 (MEL 1013686).

Occurs in Western Australia, Victoria and Tasmania.

60. PARMELIELLA Müll. Arg. 1862:376.

Thallus squamulose to subfoliose, attached to the substrate by a dark prothallus or rhizoids; upper surface corticate, mineral-grey; lower surface ecorticate. *Apothecia* laminal; disk reddish-brown to brown; margin prominent; ascospores eight in ascus, simple, hyaline; phycobiont *Nostoc*.

Figure: Ascospores, fig. 21D.

No records of this genus are known from South Australia but it is likely to be found amongst mosses on bark or earth in the wetter areas.

61. PELTIGERA Willd. 1787:347.

Literature: Kurokawa et. al. 1966, Thomson 1950.

Thallus foliose, large, more or less lobed, loosely attached to the substrate, differentiated into a well-developed cellular upper cortex, a distinct algal layer and a medullary layer, upper surface smooth, sometimes tomentose; lower surface ecorticate, more or less veined; rhizines fasciculate. *Apothecia* on the upper surface at the margins of the lobes; disk reddish-brown sometimes revolute; margin concolourous with the thallus; ascospores eight in ascus, hyaline to brown, fusiform to acicular, 3 to 8-celled.

Peltigera spuria (Ach.) DC. ex Lam. et DC. 1805:406.

Lichen spurius Ach. 1798:159.

Thallus brownish-grey, of scattered lobes each 0·5-1·5 cm wide, adnate to the substrate by long white rhizines; upper surface finely tomentose, occasionally with orbicular laminal soralia, non-isidiose; under surface very pale tan with slightly darker veins. *Apothecia* digitate.

Figure: Ascus containing spores and one free ascospore, fig. 21E.

Specimens examined: Mount Compass, *R. W. Rogers 1882*, 29.vii.1970 (R.W.R.); Meningie, *L. D. Williams 1938*, 6.viii.1964 (L.D.W.); Fairview Reserve, c. 35 km west Naracoorte, *T. Roach 18*, 10.v.1970 (AD).

Occurs also in Victoria.

Peltigera spuria is often found on compacted soil in wetter areas.

62. PELTULA Nyl. 1853:316.

Literature: Wetmore 1970.

Thallus areolate, squamulose, peltate or sub-fruticose, attached by a small group of rhizines or umbilicus. *Apothecia* immersed in thallus; disk usually open; ascospores many in ascus, hyaline, simple.

Figure: Ascospores, fig. 21F.

ARTIFICIAL KEY TO SPECIES

1. Thallus saxicolous 2
1. Thallus terricolous ..... *P. australiensis*
2. Thallus sorediose 3
2. Thallus non sorediose ..... *P. omphaliza*
3. Thallus squamulose, margins of squamules down-rolled, soredia blue-grey to brown ..... *P. euploca*
3. Thallus areolate, margins of thallus placodiform, margins of areoles slightly raised, soredia brown to black ..... *P. placodizans*

Peltula australiensis (Müll. Arg.) R. B. Filson

Heppia australiensis Müll. Arg. 1892:193.

Thallus squamulose, terricolous, up to 2·5 mm diam., deeply concave or flat; margins smooth, entire or lobed, usually thickened and upturned; upper surface rugulose, olive, sometimes appearing yellow-pruinose; lower surface covered with pale brown rhizinae which penetrate the substrate. *Apothecia* usually one per squamule (sometimes up to three), up to 1·5 mm diam., immersed; disk flat to convex, pale red to brown; margin sometimes prominent sometimes absent; ascospores numerous in asci, globose up to 5 μm diam.

Figure: Habit, fig. 22C.

Specimens examined: Arcoellinna well, Everard Ranges, *R. Helms 35,* 28.v.1891 (MEL 5780); by side of Everard road, 26 km west of Stuart Highway, *R. B. Filson 15641a,* 23.xi.1975 (MEL 1018606); Wilgena Hill, 6·5 km north of Kingoonya-Tarcoola road, 67 km west of Kingoonya, *R. B. Filson 11929a,* 26.x.1970 (MEL 1018619); Koonamore Vegetation Reserve, *R. W. Rogers 1725,* 4.viii.1969 (MEL 1011695).

Occurs in Victoria.

Peltula euploca (Ach.) Wetmore, 1970:184.

Lichen euplocus Ach. 1798:141.

Heppia euploca (Ach.) Vain. 1921:14.

Thallus saxicolous, squamulose, peltate, irregularly round, up to 10 mm diam.; margins smooth, entire, lobed or slightly lacerate, usually thickened and downturned, sorediose; upper surface olive to brown to almost black, smooth,

rugulose, cracked in older specimens, sometimes with soredia along older cracks sometimes with soralia; soredia farinose, blue-grey to greenish-brown. *Apothecia* not seen.

Figure: Habit, fig. 18B.

Specimens examined: Murrawijinnie Cave No. 2, 6 miles (10 km) north of Eyre Highway, *D. S. Kemsley,* 7.i.1952 (MEL 1011697); rocky outcrop 100 m north of Ernabella road, 6 km west of "Kenmore Park", Musgrave Ranges, *R. B. Filson 15698,* 26.xi.1975 (MEL 1018604); Illbillie area, Everard Ranges, *A. C. Beauglehole 13579,* 24.vi.1965 (MEL 1018634); 3 km north of Kokatha on Poochera-Kingoonya road, *R. B. Filson 11911,* 26.x.1970 (MEL 1018621); Waukaringa mines near Koonamore road, *R. W. Rogers 1822,* 18.xii.1969 (MEL 1011686).

Occurs in Victoria, New South Wales and Northern Territory.

Peltula omphaliza (Nyl. in Eckf.) Wetmore, 1970:194.

Heppia omphaliza Nyl. in Eckf. 1889:106.

Thallus saxicolous, squamulose, peltate, irregularly round, up to 2 mm diam., flat to slightly convex; margins smooth, entire or slightly lobed; upper surface olive to pale brown with dark brown border, smooth, dull or occasionally slightly shining. *Apothecia* several per squamule, immersed, disk punctiform; ascospores ellipsoid, 3-6 μm diam.

Specimen examined: Big Rock, 8 km east of Teeta Bore, Everard Ranges, *R. B. Filson 15659,* 24.xi.1975 (MEL 1018612).

Peltula placodizans (Zahlbr.) Wetmore, 1970:196.

Heppia placodizans Zahlbr. 1908:299.

Thallus saxicolous, areolate, varying from small rosette up to 1 cm diam. to covering patches along cracks several centimetres long, margins lobate, placodiform; marginal lobes 0·2-0·5 mm wide, up to 1·5 mm long, flat to convex; central areoles irregularly round, up to 0·6 mm diam., flat, convex to hemispheric, margin smooth, incised, flexuose; upper surface olive, sometimes appearing pruinose, soredia dark brown to black in capitate soralia. *Apothecia* one per areole, immersed; disk up to 0·3 mm diam., flat, pale red; ascospores globose to subglobose 4-5 × 4-6 μm.

Specimen examined: Wynbring Rocks, 1·2 km north of Wynbring on East-West Railway Line, *R. B. Filson 11946,* 28.x.1970 (MEL 1018626).

Occurs in Victoria and in the Northern Territory.

63. PERTUSARIA DC. ex Lam. et DC. 1805:319.

Literature: Oshio 1968.

Thallus crustose, with or without an upper cortex; medulla of interwoven hyphae. *Apothecia* immersed in wart-like structures on the upper surface,

opening through pores; ascospores one to eight in ascus, hyaline, ellipsoid, simple, usually large.

Figures: Habit, fig. 20B; ascospore, fig. 21G.

Pertusaria is a large genus and the South Australian material not reliably determined. The most useful characters in separating species are—the number of ascospores in the ascus; the number of layers in the wall of the ascospore; the presence or absence and degree of ornamentation in the ascospore walls; and colour reactions of the thallus with the chemical reagents. Gross thallus morphology is apparently very plastic.

64. PHAEOGRAPHINA Müll. Arg. 1882:398.

Literature: Wirth and Hale 1963.

Thallus crustose, epi- or endophloic, ecorticate or with a rudimentary cortex. *Apothecia* immersed to adnate or sessile, generally elongate, simple or sparingly branched, often contorted; disk narrow and slit-like; margin sometimes carbonaceous; ascospores one to three in ascus, brown, muriform; paraphyses unbranched.

Figure: Ascospore, fig. 21H.

At present this genus has not been recorded in South Australia but it is likely to occur on bark.

65. PHAEOGRAPHIS Müll. Arg. 1882:336.

Literature: Wirth and Hale 1963.

Thallus crustose, ecorticate or with a rudimentary cortex, epi- or endophloic. *Apothecia* immersed, adnate or sessile, generally elongate, simple or branched, often contorted; disk narrow and slit-like; margin sometimes carbonaceous; asci clavate to oblong; ascospores one to eight in ascus, brown, one- to many-celled, with transverse septa; paraphyses unbranched.

Figure: Ascospore, fig. 21I.

There are no records of this genus for South Australia, but collections are likely to be made on wood or bark.

66. PHYSCIA (Schreb. in L.) Th.Fr. em Vain 1890a:138.

Lichen Secn *Physcia* Schreb. in L. 1791:768.

Literature: Thomson 1963.

Thallus foliose, mainly attached to the substrate by rhizines; lobes flat to convex, corticate, sometimes ciliate or fibrillose; upper cortex densely paraplectenchymatous; medulla plectenchymatous; lower cortex densely plectenchymatous or paraplectenchymatous. *Apothecia* lecanorine, laminal,

sessile or shortly stalked; margin concolourous with the thallus; disk brown or black, sometimes white or red pruinose; ascospores eight in ascus, brown two-celled. *Pycnidiospores* 2-3 μm long, straight.

ARTIFICIAL KEY TO SPECIES

1. Lobes with long ascending marginal cilia 2
1. Lobes without marginal cilia 3
2. Ends of the lobes inflated, open underneath, open parts thus exposed sorediose ..... *P. adscendens*
2. Ends of the lobes not inflated, soredia in terminal soralia ..... *P. tenella*
3. Thallus without soredia 4
3. Thallus sorediose 6
4. Thallus maculose on the upper surface ..... *P. aipolia*
4. Thallus emaculose, upper surface uniformly coloured 5
5. Medulla K+ yellow ..... *P. alba*
5. Medulla K− ..... *P. stellaris*
6. Soredia laminal, capitate 7
6. Soredia marginal 8
7. Thallus maculose, lobes cartilaginous ..... *P. caesia*
7. Thallus emaculose, lobes soft ..... *P. tribacoides*
8. Medulla K+ yellow or yellow becoming red 9
8. Medulla K− ..... *P. tribacia*
9. Medulla P+ yellow ..... *Anaptychia sp.*
9. Medulla P− ..... *P. albicans*

Physcia adscendens (Fr.) Oliv. em Bitt. 1901b:431.

Parmelia stellaris var. *adscendens* Fr. 1846:105.

Thallus pale to dark grey, forming isolated rosettes, sometimes coalescing; lobes long and narrow, up to 1 mm wide, inflated to globose at the ends with long marginal cilia; loosely attached to the substrate by rhizines; lower surface white, sorediose under open inflated ends. *Apothecia* not seen.

Reactions: Thallus K+ yellow, medulla K−, P−

Specimens examined: Seppeltsfield, *R. D. Seppelt*, 25.v.1969 (R.W.R.); Mount Lofty, *R. W. Rogers 1836*, 28.viii.1970 (R.W.R.); "between Coorong and sea", south of Meningie, *A. C. Beauglehole 15089*, 2.x.1965 (MEL 23023).

Recorded for Victoria, Tasmania, New South Wales and Queensland.

Physcia adscendens is rarely fertile; it occurs on bark and rarely on rock in the wetter parts of the state.

Physcia aipolia (Ehrh. in Humb.) Hampe in Fürnr. 1838:249.

Lichen aipolius Ehrh. in Humb. 1793:19.

Thallus blue-grey to whitish-grey, maculate, forming rosettes, adnate to the substrate; lobes up to 1·5 mm wide, soredia and isidia absent; lower surface pale

brown. *Apothecia* sessile up to 1·7 mm diam.; disk black, often heavily pruinose; margin prominent, concolourous with the thallus; ascospores 27-31 x 12-14 μm, two-celled, brown.

Reactions: Thallus K+ yellow, medulla K+ yellow, P−.

Figure: Habit, fig. 22D; ascospores, pycnidiospores, fig. 25A.

Specimens examined: "Colona" Station, Yalata Aboriginal Reserve, *J. H. Willis*, 27.viii.1947 (MEL 26324); Spur to south-west of Mount Arden, Southern Flinders Ranges, *John Curtis 1a*, 23.iv.1967 (MEL 26293); Seppeltsfield, *R. D. Seppelt*, 1.vi.1969 (R.W.R.); Comaum Forest Headquarters, *K. Alcock*, 26.viii.1973 (MEL 1012141).

Grows in Victoria, Tasmania, New South Wales and Queensland.

This is a widespread but apparently uncommon species found growing on bark.

Physcia alba (Fée) Müll. Arg. 1887:136.

Parmelia alba Fée 1824:125.

Thallus pale bluish-grey, forming distinct rosettes up to 12 cm diam., closely adnate to the substrate; lobes up to 3 mm wide, soredia and isidia absent; lower surface pale. *Apothecia* sessile; disk black, usually pruinose; margin prominent.

Reactions: Thallus K+ yellow, P+ yellow, medulla K+ yellow, P+ yellow.

Figure: Habit, fig. 24B.

Specimens examined: Iron Knob, *R. W. Rogers 555*, 1.x.1966 (R.W.R.); Hamley Bridge, *R. W. Rogers 1325*, 18.xi.1967 (R.W.R.); Kuitpo Forest, *R. W. Rogers 1444*, 29.vii.1968 (R.W.R.); Salt Creek, *G. C. Bratt 67/130a*, 30.ix.1967 (R.W.R.); Naracoorte, *D. Hunt*, 1962 (AD).

Occurs in Victoria.

This species is widespread and common on bark.

Physcia albicans (Pers.) Thoms. 1963:88.

Parmelia albicans Pers. 1811:17.

Thallus bluish-grey to olive, forming distinct rosettes several centimetres across, closely attached to the substrate; lobes up to 4 mm wide, contiguous, margins more or less ascending; soralia labriform; lower surface pale becoming dark towards the centre. *Apothecia* rare.

Reactions: Thallus K+ yellow becoming red, P−, medulla K+ yellow becoming red, P−.

Figure: Habit, fig. 24A.

Specimen examined: Middleback Station, *R. W. Rogers 1807*, 5.xi.1969 (R.W.R.); Koonamore Vegetation Reserve, *R. W. Rogers 1784*, 20.xi.1967

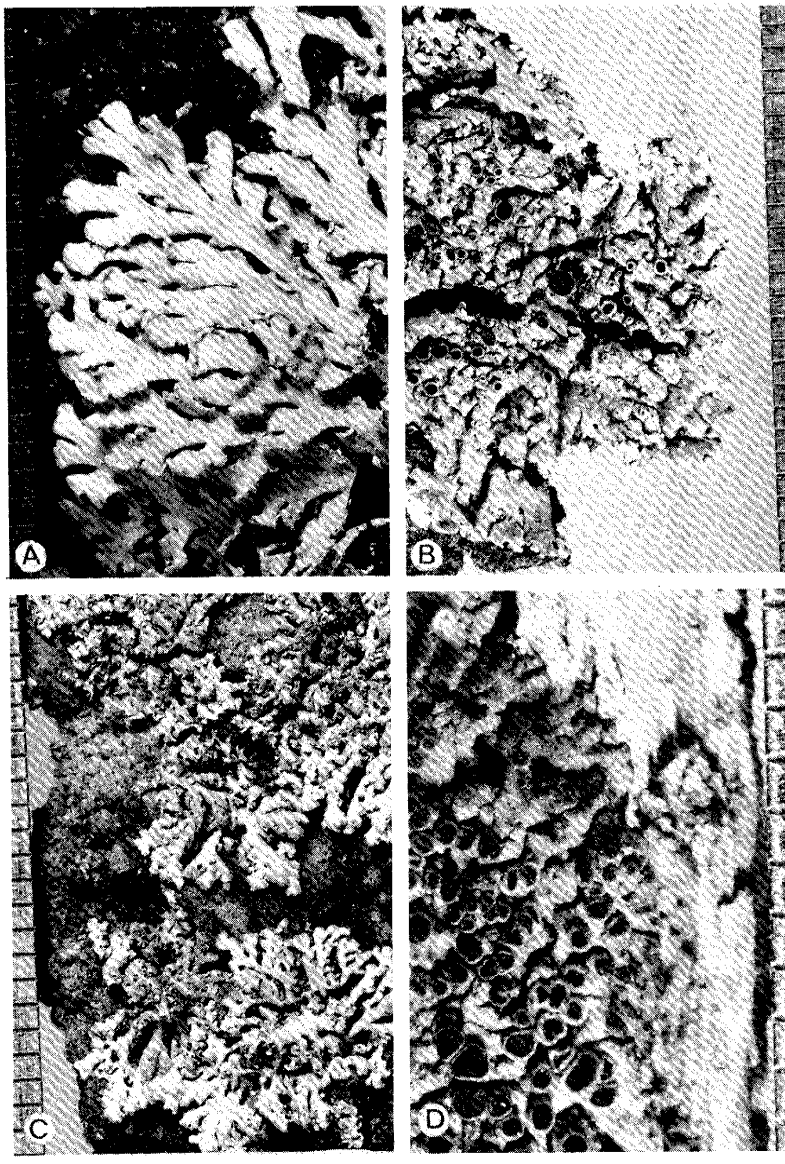


Fig. 24. A, *Physcia albicans*; B, *Physcia alba*; C, *Physcia tribacea*; D, *Physciopsis syncolla*. Scale in millimetres.

(R.W.R.); City of Adelaide, *R. W. Rogers 1422*, 29.vi.1968 (R.W.R.); Victor Harbor, *R. W. Rogers 1883*, 28.vii.1970 (R.W.R.).

Also in Victoria, New South Wales and Queensland.

A widespread and common species occurring on bark and occasionally on rock.

Physcia caesia (Hoffm.) Hampe in Fürnr. 1839:250.

Lichen caesius Hoffm. 1784:65.

Thallus blue-grey or grey, forming small rosettes up to 2 cm diam., sometimes coalescing; lobes appressed, 0·5-1·0 mm wide, maculate on the ends, without isidia; soralia laminal, capitate; soredia coarsely granular; lower surface pale to brown. *Apothecia* rare.

Reactions: Thallus K+ yellow, P+ slowly yellow, medulla K+ yellow, P+ yellow.

Specimens examined: Chilpitty Rock, near Minnipa, *Purdie*, 29.ix.1969 (R.W.R.); Mount Whyalla, *R. W. Rogers 1805*, 5.xi. 1969 (R.W.R.); Keith, *R. L. Specht*, 18.ii.1972 (R.W.R.); Victor Harbor, *R. W. Rogers 1885*, 28.viii.1970 (R.W.R.)

Grows in Victoria and Tasmania.

A rarely collected species growing on granitic rocks. It is likely that the South Australian populations of this species constitute a chemical race as Thomson (1963:75) obtained a negative reaction of Pd on the medulla.

Physcia stellaris (L.) Nyl. 1856:307.

Lichen stellaris L. 1753:1144.

Thallus bluish-grey or greyish-white, forming patches up to 4 cm across, sometimes coalescing, not closely appressed to the substrate; lobes up to 1·5 mm wide, soredia and isidia absent; lower surface pale. *Apothecia* up to 1·5 mm diam.; disk reddish-brown becoming black at maturity, sometimes heavily pruinose; margin prominent, persistent, concolourous with the thallus; ascospores 21-22 × 9-13 μm, at first grey becoming brown.

Reactions: Thallus K+ yellow, P−, medulla K−, P+ yellow-brown.

Figure: Ascus containing spores and two free ascospores, fig. 25B.

Specimens examined: Everard Ranges, *R. Helms 59*, 31.v.1891 (MEL 6332); Lock, *N. N. Donner 2363*, (AD); Koonamore Vegetation Reserve, *R. W. Rogers 1322*, 20.xi.1967 (R.W.R.)

Physcia stellaris is restricted to bark and not often collected. South Australian representatives have been from dry habitats, unlike the distribution in North America and Europe. It is morphologically similar to *P. alba*, and may have been overlooked in the wetter parts of the state.

Physcia tenella (Scop.) DC. em Bitt. 1901b:431.

Lichen tenellus Scop. 1772:394.

Thallus bluish-grey forming small rosettes; lobes up to 1 mm wide with long marginal cilia, soralia labriform, terminal on the ends of the lobes; lower surface white. *Apothecia* rare.

Reactions: Thallus K+ yellow, P+ yellow, medulla K−, P−.

Specimen examined: Belair National Park, *R.D. Seppelt,* 5.vii.1970 (R.W.R.).

Occurs also in Victoria.

A rare species which Thomson (1963:39) suggests may only be a sporadic variant of *P. adscendens.* It differs only in the form of the soralia, which are labriform and terminal. The lobe ends are reflexed, rather than inflated and globose.

Physcia tribacia (Ach.) Nyl. 1874:307.

Lecanora tribacia Ach. 1810:415.

Thallus pale grey to lead-grey, forming rosettes up to 2 cm across, loosely attached to the substrate; lobes up to 1 mm wide, tips broadening, fan-shaped; margins becoming sorediose; lower surface pale. *Apothecia* not known.

Reactions: Thallus K+ yellow, P−, medulla K−, P−.

Figure: Habit, fig. 24C.

Specimen examined: Mount Whyalla, *R.W. Rogers 1806,* 5.xi.1969 (R.W.R.).

The only South Australian collection examined by the authors was collected on rock. According to Thomson, the medulla of *P. tribacia* is K−, however he believes that this material is best referred to this species.

Physcia tribacoides Nyl. 1869a:322.

Thallus light grey, forming scattered groups of lobes or small rosettes, closely appressed to the substrate; lobes broadening to the tips, up to 2·5 mm wide, with laminal, capitate soralia; lower surface pale. *Apothecia* not seen.

Reactions: Thallus K+ yellow, P−, medulla K+ yellow, P−.

Specimen examined: City of Adelaide , *R. D. Seppelt,* 25.vi.1970 (R.W.R.).

Apparently a rare species in South Australia; only one collection has been cited and this from the bark of an elm tree in the centre of the city.

67. PHYSCIOPSIS Choisy 1950:20.

Literature: Poelt 1965b.

Thallus foliose, closely appressed to the substrate; lobes flattened, corticate, layered; upper cortex densely paraplectenchymatous; medulla plectenchymatous; lower surface densely plectenchymatous or paraplectenchymatous.

Apothecia laminal, sessile or shortly stalked; disk brown or black; margin prominent, concolourous with the thallus; ascospores eight in ascus, brown, two-celled. *Pycnidiospores* 10-15 μm long.

ARTIFICIAL KEY TO SPECIES

1. Thallus esorediose, lobes 1 mm wide ..... *P. syncolla*
1. Thallus sorediose, lobes 0·2-0·5 mm wide ..... *P. elaeina*

Physciopsis elaeina (Sm. in Sm. and Sow.) Poelt 1965b:30.

Lichen elaeinus Sm. in Sm. and Sow. 1810:2158.

Physcia elaeina (Sm.) A.L.Sm. 1918:244.

Thallus dull grey-green to grey-brown, of isolated lobes or forming extensive patches many centimetres across, closely attached to the substrate; lobes 0·2-0·5 mm wide with laminal soralia, non-isidiose; under surface pale around the margins, darkening towards the centre. *Apothecia* small, 0·5-0·8 mm diam., disk dark brown to black, concave; margin thick prominent, strongly inrolled; ascospores 16-22 x 6-12 μm grey at first becoming brown, thick walled, two-celled.

Reactions: Thallus K−, medulla K−, P−.

Figure: Ascospores, pycnidiospores, fig. 21J.

Specimens examined: Burnside, *R.W. Rogers 1826,* 3.i.1970 (R.W.R.); Victor Harbor, *R.W. Rogers 1858,* 15.i.1970 (R.W.R.).

Probably occurs in all States.

This is an obscure species merging with the bark of trees, and therefore it is not often collected.

Physciopsis syncolla (Tuck.) Poelt 1965b:30.

Physcia syncolla Tuck. *in* Nyl. 1858:428.

Thallus brown, often forming extensive patches, closely attached to the substrate; lobes closely contiguous, up to 1 mm wide, without soredia or isidia; under surface dark. *Apothecia* up to 1·5 mm diam.; disk concave at first becoming strongly convex, matt, dark brown to black, sometimes pruinose; ascospores grey at first becoming brown at maturity, thick walled, two-celled, 12-21 x 6-7 μm.

Reactions: Thallus K−, medulla K−, P−.

Figure: Habit, fig. 24D.

Specimens examined; 6 km west of "Kenmore Park" H.S., Musgrave Ranges, *R. B. Filson 15686,* 26.xi.1975 (MEL 1018663); Everard Ranges, *R. Helms,* 28.v.1891 (AD); Oodla Wirra, *R.W. Rogers 1744,* 18.vi.1969 (R.W.R.); Koonamore Vegetation Reserve, *R.W. Rogers 1639,* 19.iv.1969 (R.W.R.).

This species has not often been collected. All South Australian gatherings have been from bark in the dry areas.

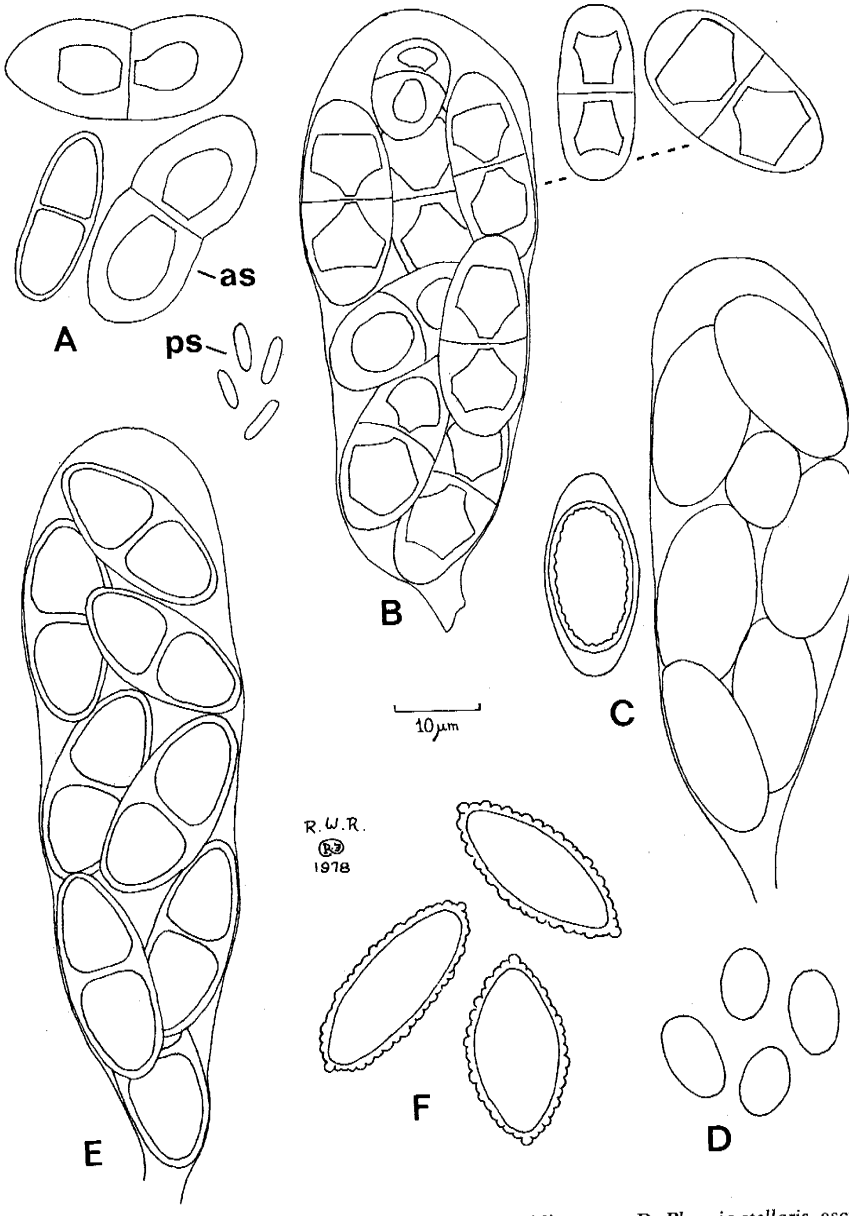


Fig. 25. A, *Physcia aipolia*, as. ascospores, ps. pycnidiospores; B, *Physcia stellaris*, ascus containing spores and two free ascospores; C, *Physma byrsinum*, ascus containing spores and one free ascospore; D, *Porocyphus lichinelloides*, ascospores; E, *Pseudocyphellaria australiensis*, ascus containing spores; F, *Psoroma sphinctrinum*, ascospores.

68. PHYSMA Mass. 1854:6.

Thallus foliose, over a spongy hypothallus, ecorticate, algae scattered in the medulla, hyphae lax. *Apothecia* sessile; disk reddish-brown to black, lecanorine; margin prominent; ascospores eight in ascus, simple, hyaline, ellipsoid.

Physma byrsinum (Ach.) Müll. Arg. 1885:531.

Parmelia byrsina Ach. 1803:222.

Thallus olive, forming patches up to 8 cm across, adnate to the substrate; lobes discrete, radiating, up to 4 mm wide; lower surface spongy, black. *Apothecia* common up to 5 mm diam., disk deeply concave, reddish-brown.

Figure: Ascus containing spores and one free ascospore, fig. 25C.

Occurs in Queensland, New South Wales and Victoria.

Not known from South Australia but likely to occur on the bark of trees (especially *Callitris* sp.) throughout the State.

69. POLYBLASTIOPSIS Zahlbr. 1903:67.

Thallus crustose, ecorticate, endo- or epi-phloic. *Pseudothecia* perithecium-like, sessile to more or less immersed in the thallus; ascospores eight in ascus, hyaline, muriform; paraphyses reticulately branched and anastomosing.

No records of this genus are known from South Australia, but collections are likely to be made on bark.

70. POROCYPHUS Körb. 1855:425.

Literature: Henssen 1963.

Thallus crustose, granulose or minutely fruticose, devoid of differentiation. *Apothecia* terminal, minute, immersed or sessile; disk concave, closed or open; margin indistinct, concolourous with the disk, surrounded by a thicker, irregular thalloid margin; ascospores 8-16 in ascus, simple, hyaline.

Porocyphus lichinelloides A. Henssen 1963:68.

Thallus fruticose, pulvinate, dark olive-green to black, of narrow terete upright branched filaments, less than 0·1 mm diam., up to 3 mm tall. *Apothecia* terminal, up to 0·2 mm diam.; disk concave red-brown; ascospores eight in ascus, hyaline, ellipsoidal, 8-10 × 5·5-6 μm.

Figure: Ascospores, fig. 25D.

No specimens from South Australia have been positively referred to this genus, however it has been recorded on granite outcrops in the dry areas of both Victoria and Western Australia.

71. PSEUDOCYPHELLARIA Wainio 1890a:182.

Literature: Magnusson 1940.

Thallus foliose, loosely attached to the substrate, smooth to rugulose, differentiated into a thick, well developed plechtenchymatous upper cortex, distinct algal layer, loosely woven medullary layer and a well developed lower cortex broken by pseudocyphellae. *Apothecia* lecanorine, adnate to substipitate, marginal or laminal; disk concave to convex; ascospores eight in ascus, hyaline to brown, oblong, ovoid to fusiform, two- to four- celled.

ARTIFICIAL KEY TO SPECIES

1. Lobes with small, flattened isidia or lobules, often broken off giving the appearance of soredia ..... *P. australiensis*
1. Lobes with marginal and laminal soredia ..... *P. crocata*

Pseudocyphellaria australiensis Magn. 1940:9.

Thallus pale to dark brown, up to 12 cm diam., or forming an extensive mat, loosely attached to the substrate; lobes 1·0-4·0 cm wide; upper surface densely ridged, without soredia; margins densely isidiose and lobulate; isidia often broken at the apex and appearing sorediose; lower surface pale to dark brown, densely tomentose with yellow pseudocyphellae; medulla deep yellow. *Apothecia* up to 2·0 mm diam., ascospores eight in ascus, 23-29 × 9-12 μm, two-celled, brown.

Figures: Habit, plate 14A (MEL 1022007) and fig. 26A; ascus containing ascospores, fig. 25E.

Specimens examined: Angaston, *R. W. Rogers 1346*, 31.xii.1967 (R.W.R.); Sellicks Hill, 50 km south of Adelaide, *R. B. Filson 15497*, 14.xi.1975 (MEL 1018656); Belair, *H. B. S. Womersley*, 27.vi.1943 (ADU); Kuitpo, *V. Cruikshank*, 20.v.1967 (R.W.R.); Hindmarsh Falls, *R. W. Rogers 1054*, 30.iv.1967 (R.W.R.).

Known also from Victoria, New South Wales and Tasmania.

This species is common over rocks in the wetter parts of the State where it favours exposed sunny positions.

Pseudocyphellaria crocata (L.) Wainio 1898:36.

Lichen crocatus L. 1791:310.

Thallus brown, loosely attached to the substrate, forming rosettes 5·0-7·0 cm diam.; lobes 0·5-1·5 cm wide, densely reticulately ridged; ridges often with warts which burst into yellow soredia; lower surface dark, densely tomentose with yellow pseudocyphellae; medulla grey or pale yellow. *Apothecia* rare 1·5-2·5 mm diam.

Specimen examined: Angaston, *R. W. Rogers 1350*, 31.vii.1967 (R.W.R.).

Reported from Victoria.

This species has been found only once on the bark of a eucalypt, but it is likely to occur on rock and bark throughout the wetter parts of the State.

72. PSOROMA Nyl. 1855b:175.

Thallus squamulose to foliose with a well differentiated cellular cortex, indistinct algal and medullary layers, thin lower cortex of interwoven hyphae with few rhizoids. *Apothecia* lecanorine, adnate to sessile; disk concave to flat, red or brownish-red; ascospores eight in ascus, hyaline, ellipsoid to spherical, simple.

Figure: Psoroma sphinctrinum, habit, fig. 26B; ascospores, fig. 25F.

P. crawfordii Müll. Arg. is the only species that has been recorded for South Australia. Although the precise locality is not known it is likely to be in the Mount Lofty Ranges or the South-East of the State. Another species, *P. sphinctrinum* (Mont.) Nyl., although not recorded is also likely to be found in these areas.

73. PYRENOPSIDIUM Forss. 1885:39, and 59.

Thallus crustose, granular to warty, continuous or areolate attached to the substrate by hyphae. *Apothecia* lecanorine, the margin almost closing the narrow disk; asci oblong to almost globose; ascospores eight in ascus, hyaline, simple; paraphyses distinct and unbranched. Phycobiont *Chroococcus.*

There is no definite record of this genus being collected in South Australia.

Pyrenopsidium decorticans Müll. Arg. 1892:191 is possibly a species of *Peltula.*

74. RAMALEA Nyl. 1866c:289.

Thallus of yellowish-brown granules or squamules, often densely packed, forming extensive patches; squamules 1·0-2·0 mm wide; podetia up to 10 mm tall, arising from basal squamules. *Apothecia* terminal; ascospores eight in ascus, hyaline, simple.

Ramalea cochleata Müll. Arg. 1896:89.

Primary thallus greyish-brown to olive-green, granular or squamulose; squamules 1·0-2·0 mm diam.; podetia up to 15 mm tall but usually shorter, granular, often twisted and distorted, expanding towards the top. *Apothecia* terminal, clustered; ascospores eight in ascus, hyaline, simple, sometimes appearing two-celled, 9 x 4 μm.

This species may be confused with *Thysanothecium* but is easily distinguished by the subfoliose primary thallus and the clustered apothecia terminal on the podetium. It is not yet known in South Australia though it has been found on the acid soils in heathlands in Victoria and Western Australia.

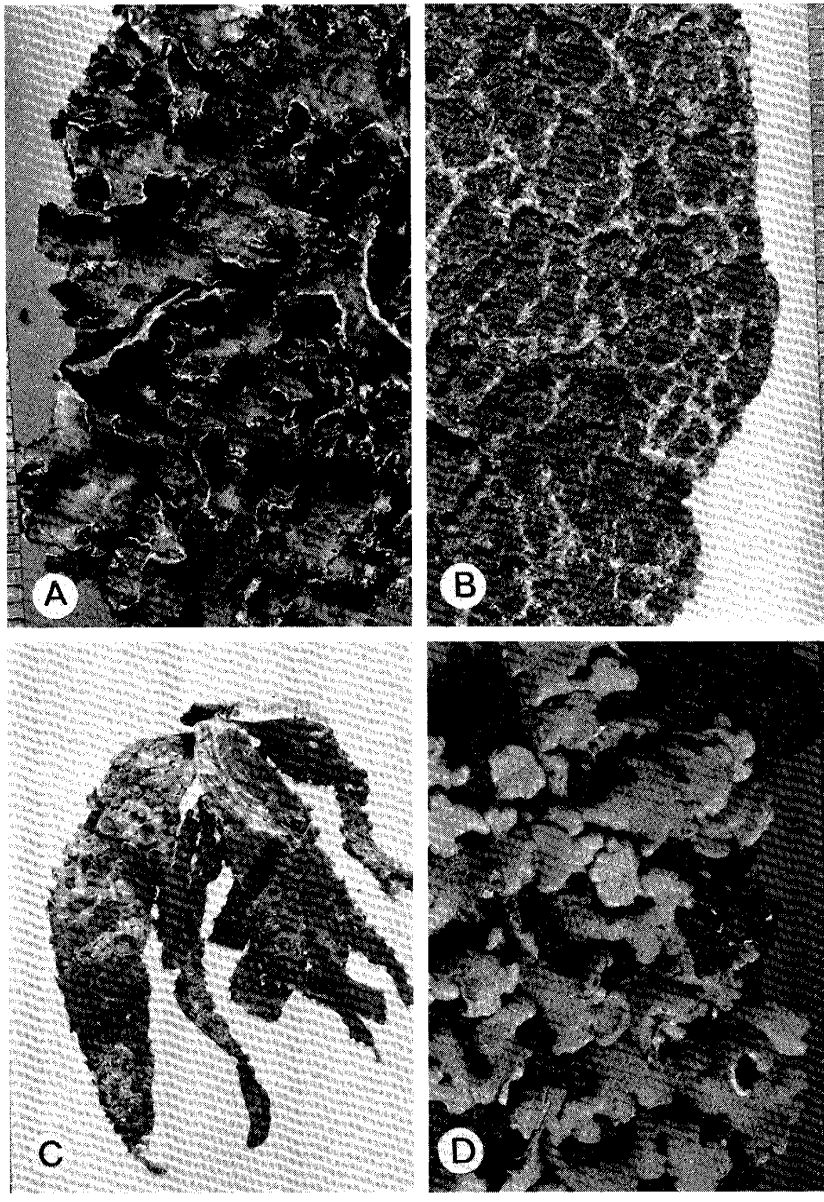


Fig. 26. A, *Pseudocyphellaria australiensis;* B, *Psoroma sphinctrinum;* C, *Ramalina ecklonii;* D, *Siphula coriacea.* Scale in millimetres.

75. RAMALINA Ach. 1810:122.

Thallus fruticose, erect or pendulous; lobes flattened and strap-like or hollow and inflated, differentiated into a cortical layer of closely interwoven longitudinal hyphae, an algal layer and a medulla of loosely interwoven hyphae. *Apothecia* laminal, lateral or terminal, sessile or pedicellate; disk concave to convex, buff or greenish-yellow; margin concolourous with the thallus usually prominent; ascospores eight in ascus, hyaline, oblong-ellipsoid, two-celled.

This genus is poorly understood, and the Australian entities are in need of investigation.

ARTIFICIAL KEY TO SPECIES

1. Thallus inflated and fistulate or hollow, usually less than 2 cm tall 2
1. Thallus flat and leaf-like, neither fistulate nor hollow, usually several centimetres long 3
   2. Thallus fistulous, horny in texture, of stout construction ..... *R. pusilla*
   2. Thallus hollow, with small or larger openings into the hollow lobes, of a light, tissue-paper like construction ..... *R. geniculata*
3. With numerous laminal apothecia, few lobes per thallus, little branched .. .. *R. ecklonii*
3. With few terminal apothecia, many lobes forming a shrubby thallus, lobes much branched ..... *R. fastigiata*

Ramalina ecklonii (Spreng.) Meyen et Flotow 1843:213.

Parmelia ecklonii Spreng. 1827:328.

Thallus greenish-yellow, forming a tuft of erect or pendulous lobes, up to 8 cm long, attached to the substrate by a small holdfast; lobes longitudinally striate, up to 1 cm wide, isidia and soredia absent. *Apothecia* common, laminal, 2·0-3·0 mm diam.; disk yellow-green; margin prominent sometimes disappearing; ascospores hyaline, slightly curved or straight, two-celled, 13-15 × 6·0-6·5 μm.

Reactions: Medulla K−, C−, KC−, P−.

Figure: Habit, fig. 26C; ascospores, fig. 27A.

Specimens examined: Cape Jervis, *R. W. Rogers 1458,* 1.ix.1968 (R.W.R.); Hope Valley, *R. W. Rogers 1572,* 11.xi.1968 (R.W.R.); Seppeltsfield, *R. D. Seppelt,* 1.vi.1969 (R.W.R.) Oodla Wirra, *R. W. Rogers 1623,* 27.ii.1969 (R.W.R.).

Reported from all States except the Northern Territory.

Ramalina ecklonii is a very variable and widespread species found on twigs and bark.

Ramalina fastigiata (Pers.) Ach. 1810:603.

Lichen fastigiatus Pers. 1794:156.

Thallus thin somewhat translucent, greenish-yellow, forming an erect shrubby clump up to 4 cm high, attached to the substrate by a small basal holdfast; lobes

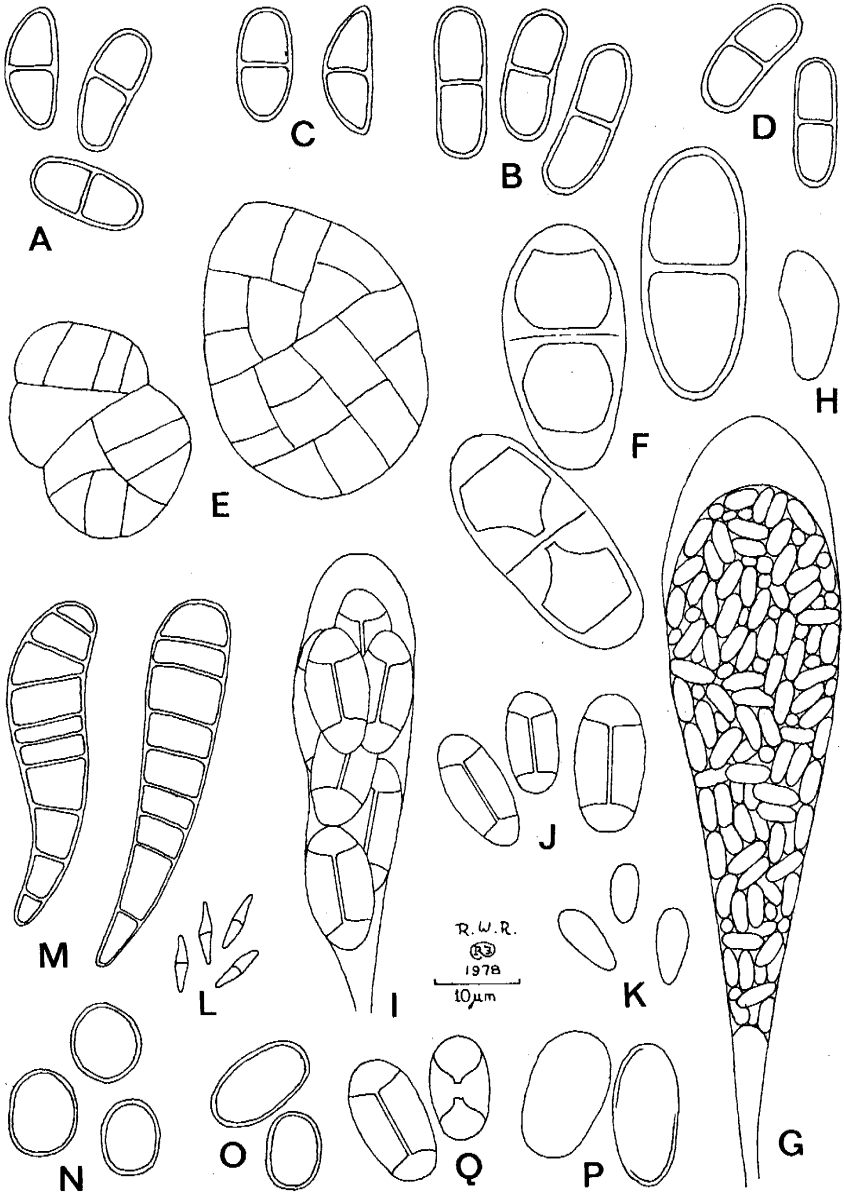


Fig. 27. A, *Ramalina ecklonii*, ascospores; B, *Ramalina fastigiata*, ascospores; C, *Ramalina geniculata*, ascospores; D, *Ramalina pusilla*, ascospores; E, *Rhizocarpon tinei*, ascospores; F, *Rinodina australiensis*, ascospores; G, *Sarcogyne pruinosa*, ascus containing spores; H, *Synalissa symphorea*, ascospore; I, *Teloschistes chrysophthalmus*, ascus containing spores; J, *Teloschistes velifer*, ascospores; K, *Thysanothecium hyalinum*, ascospores; L, *Toninia caeruleonigricans*, ascospores; M, *Trypethelium eluteriae*, ascospores; N, *Usnea ramulosissima*, ascospores; O, *Usnea scabrida*, ascospores; P, *Verrucaria microsporoides*, ascospores; Q, *Xanthoria ectanea*, ascospores.

up to 1 cm wide, longitudinally striate, isidia and soredia absent. *Apothecia* terminal or sub-terminal, up to 3 mm diam.; disk concave becoming flat; margin prominent; ascospores hyaline, slightly curved or straight, two-celled, long ellipsoid, 15-19 × 6·0-6·5 μm.

Reactions: Medulla K−, C−, KC−, P−.

Figure: Habit, fig. 20C; ascospores, fig. 27B.

Specimens examined: Point Drummond, *R. B. Filson 11878*, 25.x.1970 (MEL 1018640); Cape Jervis, *R. W. Rogers 1456*, 1.ix.1968 (R.W.R.); Millbrook, *R. W. Rogers 1780*, 20.ix.1969 (R.W.R.); Kuitpo, *R. W. Rogers 1442*, 29.vii.1968 (R.W.R.); Murray Bridge, *R. W. Rogers 392*, 11.v.1966 (R.W.R.); Penola, *K. Alcock*,25.vii.1972 (R.W.R.).

Reported also from Tasmania.

This species is common on bark in the wetter areas. It is likely that a number of different taxa key out to this species. *Ramalina sinensis* is a similar species but it tends to have broader lobes. Chemical variation is also likely to occur.

Ramalina geniculata Hook.f. & Tayl. 1844:655.

Thallus of a light, papery texture, greenish-yellow, forming a small erect shrubby clump, up to 2 cm tall, attached to the substrate by a small basal holdfast; lobes inflated to the tips, with distinct openings to the central cavity, isidia and soredia absent. *Apothecia* subterminal, up to 4·0 mm diam.; disk concave, becoming plain, smooth at first becoming rugulose; margin prominent disappearing at maturity; ascospores hyaline, long ellipsoidal, two-celled, straight, 13-15 × 6·0-6·5 μm.

Reactions: Medulla K−, C−, KC−, P−.

Figure: Ascospores, fig. 27C.

Specimens examined: Gum Flat, 25 miles (40 km) north-west of Elliston, *R. B. Filson 11887*, 25.x.1970 (MEL 1018639); Memory Cove, Cape Catastrophe, *R. B. Filson 11841*, 24.x.1970 (MEL 1018638); Kuitpo, *R. W. Rogers 1443*, 29.vii.1968 (R.W.R.); Kersbrook, *V. M. Cruikshank*, 10.iv.1966 (R.W.R.).

Occurs in Queensland, New South Wales, Victoria and Tasmania.

Ramalina pusilla le Prev. in Duby 1830:614.

Thallus greenish-yellow, forming a small erect, shrubby clump up to 2 cm tall, attached to the substrate by a small basal holdfast; lobes inflated, sometimes appearing globose, longitudinally fistulate, soredia and isidia absent. *Apothecia* terminal, 1-2 mm diam.; disk concave; margin prominent smooth; ascospores hyaline, straight or curved, two-celled, 14-15 × 5·0-6·5 μm.

Reactions: Medulla K−, C−, KC−, P−.

Figure: Habit, fig. 20D; ascospores, fig. 27D.

Specimens examined: Iron Knob, *R. W. Rogers 556*, 1.x.1966 (R.W.R.); Minlaton, *R. W. Rogers 1898*, 2.i.1971 (R.W.R.); Cudlee Creek, *R. W. Rogers 1419*, 10.vi.1968 (R.W.R.); Oodla Wirra, *R. W. Rogers 1622*, 27.ii.1969 (R.W.R.); Bagdad near Millicent, *R. D. Seppelt*, 1971 (R.W.R.).

Ramalina pusilla grows on dead wood and fine twigs. It is a very common and widespread species in Victoria and South Australia.

76. RHIZOCARPON Lam. apud Lam. & DC. 1805:365.

Literature: Runemark 1956.

Thallus crustose to squamulose, areolate, not well differentiated. *Apothecia* lecideine, immersed to sessile; disk flat to convex, black; margin concolourous with the disk, disappearing; ascospores eight in ascus, hyaline or brown, transversely septate or muriform.

Rhizocarpon tinei (Tornab.) Runemark 1956:118.

Lecidea tinei Tornab. 1848:17.

Thallus crustose forming bright yellow patches; hypothallus distinct, bordering the thallus and showing between the areolae. *Apothecia* small, numerous, immersed to adnate; ascospores eight in ascus, at first grey becoming dark brown, muriform, 20-40 × 10-22 μm.

Figure: Habit, plate 14C (MEL 1021196); ascospores, fig 27E.

Specimen examined: Angaston, *R. W. Rogers 1359*, 31.xii.1967 (R.W.R.).

This lichen forms large brilliant yellow patches over exposed rocks throughout the Mount Lofty Ranges and in Victoria. There are a number of grey and greyish-brown crustose lichens found on rocks which also belong in this genus, but the taxonomy is very confused and the species occurring in South Australia lack reliable determination.

77. RINODINA (Ach.) S. F. Gray 1821:448.

Literature: Sheard 1967.

Thallus crustose, granulose to areolate or squamulose, with a poorly developed cortex and more or less differentiated algal and medullary layers. *Apothecia* lecanorine, immersed, adnate to sessile; disk flat to convex, brown to black, sometimes pruinose; margin usually raised, concolourous with the thallus; ascospores eight (rarely 16-24) in ascus, brown, two-celled.

Figure: Rinodina australiensis, ascospores, fig. 27F.

There are no collections of *Rinodina* known from South Australia however Victorian records indicate that *R. pachyspora* Müll. Arg. is likely to be found on rocks, and *R. australiensis* Müll. Arg. on bark. Both of these species are small, forming patches 1-2 cm across, with small black apothecia.

78. SARCOGYNE Flot. 1851:753 and 759.

Thallus crustose, weakly developed or disappearing, ecorticate, or with a rudimentary cortex. *Apothecia* circular, adnate to sessile or shortly stipitate; margin concolourous with the disk; ascospores many in ascus, hyaline simple; paraphyses simple.

Figure: Ascus containing ascospores, fig. 27G.

Specimens referable to this genus have been collected from arid soils in north-western Victoria and in Western Australia. It is also likely to occur in South Australia in similar situations.

79. SIPHULA Fr. 1825:238.

Thallus fruticose, sparingly branched; cortex of closely packed, longitudinally extending hyphae; medulla loosely packed. *Apothecia* unknown.

Siphula coriacea Tayl. ex Nyl. 1860:263.

Thallus fruticose, forming rosettes up to 5·0 cm diam.; lobes mineral grey to pale bluish-grey at the tips, fan-shaped, up to 10 mm tall and 2·0-3·0 mm wide above the soil surface, cylindrical and bearing an extensive rhizoid system below the surface.

Figure: Habit, plate 14B (MEL 1021214) and fig. 26D.

Specimens examined: South side of Carappee Hill, Eyre Peninsula, *R. B. Filson 11771,* 22.x.1970 (MEL 1018625); Jamestown, *R. W. Rogers 689,* 3.x.1966 (R.W.R.); Hamley Bridge, *R. W. Rogers 667,* 23.x.1966 (R.W.R.); Mount Pleasant, *V. M. Cruikshank,* 30.vii.1967 (R.W.R.); Tintinara, *R.W. Rogers 1880,* 12.viii.1970 (R.W.R.)

Also in New South Wales, Victoria, Tasmania and Western Australia. A very widespread species on bare soils.

80. SYNALISSA Fr. 1825:297

Thallus fruticose, erect, much branched; branches cylindrical, clavate, coralloid, devoid of differentiation into layers, attached to the substrate by rhizoids. *Apothecia* terminal; disk open or closed, margin thick, concolourous with the thallus; ascospores 8-32 in ascus, hyaline, ellipsoid to spherical, simple.

Synalissa symphorea (Ach.) Nyl. 1856:264.

Lichen symphoreus Ach. 1798:135.

Thallus dark olive-green to black, clumped together into patches up 3 cm diam., the individual thalli up to 2·0 (-3·0) mm high and less than 1·0 mm diam., attached to the substrate by basal rhizoids; thallus branched, lobes tightly packed, somewhat nodulose. Apothecia up to 0·2 mm diam., terminal, but

sometimes appearing immersed in the lobes; disk reddish brown; margin inrolled, concolourous with the thallus; ascospores eight in ascus, hyaline, irregular ellipsoid, 15 × 17 μm.

Figure: Ascospores, fig. 27H.

Specimens examined: Whalers Way Fence, Fishery Bay, Eyre Peninsula, *R. B. Filson 11808,* 23.x.1970 (MEL 1018641); 25 km north of Mount Dutton Railway Siding, Marree-Oodnadatta road, *R. B. Filson 15627,* 21.xi.1975 (MEL 1018610); Tarcoola, *R. W. Rogers 215,* 23.ii.1966 (AD); Koonamore Vegetation Reserve, *R. W. Rogers 1318,* 20.xi.1967 (R.W.R.); Yunta, *R. W. Rogers 117,* date ? (AD); Swan Reach, *R. W. Rogers 150* (AD).

Recorded also from Western Australia, Victoria and New South Wales.

An inconspicuous species on desert soils; forming small black plaques, or in small tufts growing amongst other lichens, or randomly distributed as isolated individuals.

81. TELOSCHISTES Norm. 1853:228

Literature: Filson 1969.

Thallus fruticose to subfoliose, prostrate or ascending; lobes terete or flattened; cortex of longitudinally arranged conglutinate hyphae; medulla loosely interwoven. *Apothecia* lateral, terminal or scattered, sessile to subsessile; disk concave to flat, yellow or orange; margin concolourous with the thallus, entire or crenulate, often ciliate; ascospores eight in ascus, hyaline, oblong-ellipsoid, polaribilocular.

ARTIFICIAL KEY TO SPECIES

1. Lobes narrow, fruticose beset with fine rhizines or cilia 2
1. Lobes broadly flattened, subfoliose, without fine rhizines or cilia 5
   2. Mature lobes slightly hooded, with soredia on the lower surface under open ends ..... *T. velifer*
   2. Mature lobes not hooded 3
3. Thallus lobes with isidia-like nodules or soredia on the margins *T. spinosus*
3. Thallus lobes without isidia-like nodules or soredia on the margins 4
   4. Apothecia mostly pedicillate, the margin strongly ciliate ..... *T. chrysophthalmus*
   4. Apothecia more or less sessile, the margin eciliate but the underside of the apothecium often with scattered cilia ..... *T. sieberianus*
5. Lobes ascending, slightly hooded, soredia on lower surface under open ends ..... *T. velifer*
5. Lobes appressed, neither hooded nor sorediose ..... *Xanthoria sp.*

Teloschistes chrysophthalmus (L.) Th. Fr. 1861*a*:51.

Lichen chrysophthalmus L. 1771:311.

Thallus orange to greyish-orange, forming a fruticose to subfoliose clump up to 2 cm diam., lobes 0·5-2·5 mm wide with long marginal fibrils, without soredia

or isidia. *Apothecia* terminal, pedicillate, up to 6 mm diam.; disk light chrome-yellow to orange; margin prominent, with numerous spinulous fibrils; ascospores eight in ascus, 15-16 × 7-8 μm polaribilocular.

Figure: Habit plate 15A; portion of thallus, fig. 28F; section through thallus lobe, fig. 28H; section through apothecium, fig. 28J; ascus containing spores, fig. 27I.

Specimens examined: Stuart Highway 24 miles north of Port Augusta, *J. H. Willis* 3.vii.1966 (MEL 17313); Gawler Ranges, *Tietkins,* c.1880 (MEL 7595); Waterfall Gully, *A. C. Beauglehole 15072,* 30.ix.1965 (MEL 23027); Meningie, *L. D. Williams 2747,* 16.ii.1966 (L.D.W.); Bool Lagoon, c. 20 km south of Naracoorte, *D. Hunt,* iii.1962 (AD).

Reported from all States except the Northern Territory.

Teloschistes chrysophthalmus is common on bark and twigs in the wetter parts of the State.

Teloschistes sieberianus (Laur.) Hillman 1930:315.

Parmelia sieberiana Laur. 1827:38.

Thallus golden orange, up to 6 cm diam.; lobes flat, radiating, appressed to ascending 0·3-1·0 mm wide; margins fibrilate up to 3·0 mm long, isidia and soredia absent. *Apothecia* sessile, up to 5 mm diam., with fibrils on the lower surface but not on the margin; ascospores 12-16 × 7-9 μm.

Figure: Habit, plate 15B (MEL 1021852).

Specimens examined: Wilpena Pound, *R. G. Gray,* 31.viii.1952 (MEL 7452); Cape Jervis, *R. W. Rogers 1455,* 1.ix.1968 (R.W.R.); East Payneham, c. 6 km north-east of Adelaide, *J. G. O. Tepper,* 28.i.1893 (AD); Kersbrook, *V. M. Cruikshank,* 10.iv.1966 (R.W.R.); Kuitpo, *V. M. Cruikshank,* 8.vii.1967 (R.W.R.).

In all States except the Northern Territory.

This species is common on twigs and bark in the wetter parts of the state.

Teloschistes spinosus (Hook. f. & Tayl.) J. Murray 1960:205.

Parmelia spinosa Hook. f. & Tayl. 1844:644.

Thallus golden orange, up to 3 cm diam., sometimes forming small cushions; lobes flat, radiately appressed to ascending, 0·3-0·8 mm wide, with fine fibrils on the upper surface; margins granular sorediose, or with isidia-like nodules, fibrilose. *Apothecia* up to 4 mm diam., sessile, nodular or sorediose below; ascospores 12-16 × 8-9 μm.

Figure: Thallus lobe, fig. 28G.

Specimens examined: Whyalla, *R. W. Rogers 1749,* 10.viii.1969 (R.W.R.); Mount Brown, c. 17 km north-west of Wilmington, *J. D. Curtis,* 27.v.1967

(MEL 32123); Two Wells, *R. W. Rogers 1580,* 12.xi.1968 (R.W.R.); Coonalpyn, *L. D. Williams 3114,* 20.viii.1967 (L.D.W.).

Found in Victoria, Tasmania and New South Wales.

Teloschistes spinosus is both corticolous and saxicolous and is widespread but not common, it is found in the wet and dry areas.

Teloschistes velifer F. Wils. 1889:69.

Thallus yellow-orange to golden-orange, of scattered lobes or forming patches 2-4 cm diam.; lobes subfruticose, up to 5 mm wide and 10 mm long, slightly hooded at the apex, open underneath, the open part thus exposed, ecorticate, sorediose, attached to the substrate by rhizoids. *Apothecia* up to 3 mm diam., without fibrils; ascospores 12-16 × 6-8 μm.

Figure: Habit, plate 15C (MEL 1021851); ascospores, fig. 27J.

Specimens examined: Tent Hill, near Deep Creek, Fleurieu Peninsula *R. W. Rogers 1460,* 3.ix.1968 (R.W.R.); Kuitpo Forest, *R. W. Rogers 1435,* 10.viii.1968 (R.W.R.).

Also in New South Wales, Victoria and Tasmania.

This species is not often collected. It grows on thin twigs sometimes in association with *Ramalina sp.*

82. THYREA Mass. 1856b:210

Thallus fruticose or subfoliose, lobed or branched, adnate or ascending, attached to the substrate by a holdfast. *Apothecia* immersed or adnate, lecanorine; disk open or closed, sometimes deeply concave. Ascospores 8-10 in ascus, simple, hyaline; paraphyses simple.

As yet not recorded in South Australia, but specimens referable to this genus have been collected in western New South Wales and the Northern Territory. It could occur in damp places on granite outcrops in the drier parts of the State.

83. THYSANOTHECIUM Mont. & Berk. 1846:257.

Primary thallus granular or squamulose; upper surface corticate; lower surface without rhizines; pseudopodetia erect, unbranched or little branched, solid, expanded towards the apices. *Apothecia* terminal on lateral surface of the pseudopodetia, round or lobed; disk pale to dark brown; ascospores eight in ascus, hyaline, ellipsoid, simple or two-celled.

Thysanothecium hyalinum (Tayl.) Nyl. 1857:94.

Baeomyces hyalinus Tayl. 1847:187.

Thallus finely granular, sometimes almost indiscernible, yellow-green to brownish-green; pseudopodetia up to 1·5 (-2·0) cm tall. *Apothecia* terminal,

solitary, up to 7 mm diam.; disk pale yellow-green, sometimes lightly pruinose; margin prominent, crenulate, concolourous with the thallus; ascospores hyaline, long ellipsoid, 7-10 × 3-5 μm.

Figure: Habit, plate 16A (MEL 1022011); ascospores, fig. 27K.

Specimens examined: hundred of Blesing, *N. N. Donner 2335*, 6.x.1967 (AD 97528235); Millbrook, *R. W. Rogers 1779*, 20.ix.1969 (R.W.R.); Mount Lofty, *R. W. Rogers 1874*, 3.viii.1970 (R.W.R.); Cape Jervis, *R. W. Rogers 1471*, 1.ix. 1968 (R.W.R.).

In all States except the Northern Territory.

Thysanothecium hyalinum is a common lichen on burnt wood in eucalypt forest. If found growing on the ground or earth banks careful examination will reveal that it is attached to small pieces of charcoal.

84. TONINIA Mass. 1852a:107.

Thallus crustose or squamulose with an indistinctly cellular upper cortex, algal and medullary layers. *Apothecia* lecideine, adnate or sessile; disk flat to convex, usually black; margin concolourous with the disk, sometimes disappearing; ascospores eight in ascus, hyaline, ellipsoid to fusiform, two-to many-celled.

Toninia caeruleonigricans (Lightf.) Th. Fr. 1874:336.

Lichen caeruleonigricans Lightf. 1777:805.

Thallus of irregular, inflated dark grey to brown squamules, up to 1 mm diam., usually reticulately cracked, densely white to bluish-white pruinose. *Apothecia* up to 2 mm diam.; disk flat, black, sometimes pruinose; margin black or pruinose; ascospores fusiform, two-celled.

Figure: Ascospores, fig. 27L.

Specimens examined: Top of the cliffs, Great Australian Bight, 12 miles (19 km) south of "Koonalda" H. S., *R. B. Filson 9432*, 29.xii.1966 (MEL 25393); Kingoonya, *R. W. Rogers 492*, 7.ix.1966 (AD); Port Augusta, *R. W. Rogers 1149*, 22.v.1967 (AD); Kadina, *R. W. Rogers 941*, 9.ii.1967 (AD); Morgan, *R. W. Rogers 1058*, 17.v.1967 (AD); Pinnaroo, *R. W. Rogers 324*, 9.iii.1966 (AD).

Occurs in Western Australia, Victoria and New South Wales.

A very common lichen found on calcareous rocks, pebbles or sandy soils.

85. TRAPELIA Choisy 1949:112.

Literature: Hertel 1969a.

Thallus crustose to squamulose, upper surface corticate. *Apothecia* lecideine, adnate to immersed; ascospores eight in ascus, hyaline, simple; paraphyses reticulately branched and anastomosing.

Trapelia coarctata (Turn. ex Sm. & Sow.) Choisy in Wern. 1932:160.

Lichen coarctatus Turn. ex Sm. & Sow. 1799:534.

Thallus of small white to greyish-white, bullate squamules, up to 2 mm diam., crowded or scattered. *Apothecia* 0·2-0·4 mm diam., immersed to erumpent or sessile; disk pale to black; ascospores simple, eight per ascus.

Specimens examined: "Roopena" Station, Eyre Peninsula, *R. W. Rogers 1758,* 10.viii.1969 (R.W.R.); Tarlee, *R. W. Rogers 1511,* 29.x.1968 (AD 97733168); Barossa Reservoir, *R. W. Rogers 1479,* 30.x.1968 (AD 97733170); Kanmantoo, *R. W. Rogers 1528,* 5.xi.1968 (AD 97733171).

Reported from Western Australia, New South Wales and Victoria.

Trapelia coarctata is common on dry, compacted soils.

86. TRYPETHELIUM Spreng. 1805:309.

Thallus crustose, epi- or endophloic, ecorticate or with a thin cartilaginous cortex. *Pseudothecia* perithecium-like immersed in stromatic bodies on the upper surface, one to many in each stroma; ascospores eight in ascus, hyaline, transversely septate, 3-17 celled.

Figure: Trypethelium eluteriae ascospores fig. 27M.

No collections of this genus are known for South Australia but specimens are likely to be found on bark.

87. USNEA (Hill.) Wigg. 1780:90.

Literature: Motyka 1936-38.

Thallus fruticose, filamentous, erect, pendulous or prostrate, branched; branches thinning towards the apex, terete, angled, smooth, foveolate, verrucose, tuberculate or spinulose; attached to the substrate by a holdfast; cortex coriaceous or spongy of densely woven vertical hyphae; medulla variable in thickness, with a chondroid axis of longitudinal hyphae, usually very solid, sometimes hollow. *Apothecia* lecanorine, lateral, subterminal or terminal; ascospores simple, hyaline, ellipsoidal.

All of the South Australian material examined has been of the short, subpendulous or erect species, the filaments being less than 5 cm long. No long, pendulous species, nor any species with coloured medulla or hollow axis have been found.

ARTIFICIAL KEY TO SPECIES

1. With neither isidia nor soredia, usually fertile, main branches densely covered with short branchlets or spinules 2
1. Sorediose or isidiose, usually sterile, sometimes the isidia growing into spinules 3

2. Medulla K+ yellow becoming reddish-orange ..... *U. ramulosissima*
2. Medulla K− ..... *U. scabrida*
3. Branches densely covered with isidia growing into spinules 5
3. Branches without isidiate spinules, rarely constricted or articulate, main branches with fibrils 4
4. Medulla K+ red ..... *U. arida*
4. Medulla K− ..... *U. angulosa*
5. Branches constricted and articulate at the base ..... *U. sp.*
5. Branches not constricted and articulate at the base ..... *U. inermis*

Usnea angulosa (Müll. Arg.) Mot. 1937:512

Usnea dasypogoides var. *angulosa* Müll. Arg. 1886:254.

Thallus of yellowish-green terete to angular-terete branches, 1·0-5·0 cm long, more or less pendant, frequently branched, without distinct articulations at the joints; main branches 0·1-0·5 mm thick, beset with soredia and fibrils in discrete patches; medulla of loosely woven hyphae. *Apothecia* not seen.

Reactions: Medulla K−, C−, KC−, P−.

Specimens examined: Mount Bonython, *R. W. Rogers 880,* 15.i.1967 (R.W.R.); Mount Pleasant, *V. M. Cruikshank,* 30.vii.1967 (R.W.R.); Hindmarsh Valley, *R. W. Rogers 1048,* 25.x.1967 (R.W.R.); Angaston, *R. W. Rogers 1355,* 31.xii.1967 (R.W.R.); Bagdad Station near Millicent, *R. D. Seppelt,* ? 1971 (R.W.R.).

This is a common species on trees and rocks in the wetter areas. It differs from *U. arida* in reaction of KOH on the medulla and in the angular ridges on the branches.

Usnea arida Mot. 1937:492.

Thallus of yellowish-green terete branches 1·0-5·0 cm long, more or less pendant, frequently branched, without distinct articulations at the joints; main branches 0·1-0·5 mm thick, fibrillose, sorediose; medulla of loosely woven hyphae. *Apothecia* not seen.

Reactions: Medulla K+ orange-brown, C−, KC−, P−.

Figure: Habit plate 16B (MEL 1021189).

Specimens examined: Kuitpo, *R. W. Rogers 1430,* 21.vii.1968 (R.W.R.); Hindmarsh Valley, *R. W. Rogers 1051,* 30.iv.1967 (R.W.R.).

Known from Queensland, New South Wales, Victoria and Tasmania.

Usnea arida is common on trees in the wetter areas.

Usnea inermis Mot. 1937:109.

Thallus of yellowish-green terete branches 1·0-5·0 cm long, erect or subpendant, frequently branched, without distinct articulations at the joints;

main branches densely beset with isidia which often grow out into spinules; medulla loosely woven. *Apothecia* not seen.

Reactions: Medulla K−, C−, KC−, P−.

Known from Victoria and New South Wales.

No specimens of this species have been seen from South Australia, however it is recorded for this State in Weber and Wetmore (1972:118).

Usnea ramulosissima Stevens and Rogers 1978:45.

Thallus yellowish-green of terete branches 1·0-5·0 cm long, erect, branched, without distinct articulations at the joints; main branches 1·0-2·0 mm thick, very densely beset with fibrils, isidia and soredia absent; medulla of loosely woven hyphae. *Apothecia* lateral, up to 10 mm diam.; disk greenish-yellow; margin flexuose, fibrilose; ascospores hyaline, broad-ellipsoid to subspherical, 7-10 × 8-9 μm.

Reactions: Medulla K+ yellow becoming orange, C−, KC−, P+.

Figure: Habit, plate 16C (MEL 1021188); ascospores, fig. 27N.

Specimens examined: Verdun, *R. D. Seppelt,* 17.v.1969 (R.W.R.); Mylor, *R. D. Seppelt,* 25.vii.1971 (AD); Murray Bridge, *V. M. Cruikshank,* 1965 (AD); Karoonda, *R. W. Rogers 390a,* 11.v.1966 (R.W.R.).

Known from Queensland, New South Wales, Victoria and Tasmania.

This species differs from *U. scabrida* in being more branched and having coarse papillae amongst the fibrils. The apothecia are lateral and the marginal cilia often initiate new branches.

Usnea scabrida Tayl. 1844:1095.

Thallus yellowish-green of terete branches 1·0-5·0 cm long erect, commonly branched, without distinct articulations at the joints; main branches 1·0-2·0 mm thick, very densely beset with fibrils, isidia and soredia absent; medulla of loosely woven hyphae. *Apothecia* terminal, up to 10 mm diam.; disk greenish-yellow sometimes pruinose, margin prominent, flexuose, densely fibrilose; ascospores hyaline, broad-ellipsoid to subspherical, 9-13 × 7-8 μm.

Reactions: Medulla K−, C−, KC−, P−.

Figure: Ascospores, fig. 27O.

Specimens examined: Wudinna, *A. Bailey,* ix.1967 (R.W.R.); Whyalla, *R. W. Rogers 1746,* 8.viii.1969 (R.W.R.); Kersbrook, *V. M. Cruikshank,* 10.iv.1966 (R.W.R.); Karoonda, *R. W. Rogers 390b,* 11.v.1966 (AD).

Reported also from Victoria and Tasmania.

Usnea scabrida is a common species on bark on old wooden fence posts in the subarid areas. It differs from *U. ramulosissma* in being less spinulose and having terminal apothecia.

Usnea sp.

Thallus of yellow-green terete branches up to 5·0 cm long, erect, branched; branches 1·0-2·0 mm diam., with distinct arthropod-like articulations at the joints, densely beset with spinules and isidia which grow out into spinules; medulla of loosely woven hyphae. *Apothecia* not seen.

Reactions: Medulla K+ yellow becoming orange-brown, C−, KC−, P−.

Specimens examined: Myponga, *R. W. Rogers 1715*, 16.vi.1968 (R.W.R.); Penola, *K. Alcock*, vi.1971 (R.W.R.).

Known also from Victoria.

88. VERRUCARIA Wigg. 1780:85.

Thallus crustose to endophloic or endolithic, smooth or areolate, ecorticate. *Perithecia* sessile, immersed in the thallus or in thalline warts; ascospores eight in ascus, simple, hyaline; paraphyses soon dissolve into mucilage.

Figure: Verrucaria microsporoides, ascospores, fig. 27P.

Verrucaria is a very large and difficult genus. Two species reported for South Australia are *V. maura* Wahlenb. ex Ach. growing on sandstone rocks in the maritime splash zone and *V. calciseda* DC. in Lam. et DC. growing on calcareous pebbles in arid areas. The common species found growing on the coastal dune limestones below high water mark is referable to *V. microsporoides* Nyl. apud Crouan.

89. XANTHORIA Th. Fr. 1861b:166.

Literature: Filson 1969.

Thallus foliose, radiate, dorsiventral, with a distinct pseudoparenchymatous upper and lower cortex formed from vertical hyphae; medulla of loosely woven hyphae. *Apothecia* lecanorine, sessile or shortly stipitate; disk concave becoming convex at maturity; margin prominent, concolourous with the thallus; ascospores eight in ascus, hyaline, polaribilocular.

Reactions: Thallus and apothecia K+ claret.

ARTIFICIAL KEY TO SPECIES

1. Lobes thin, rugulose, ultimate lobes concave with a slightly raised flexuose margin ..... *X. parietina*
1. Lobes thick, smooth, ultimate lobes slightly convex and appressed to the substrate ..... *X. ectanea*

Xanthoria ectanea (Ach.) Räs. ex R. Filson 1969:83.

Parmelia parietina var. *ectanea* Ach. 1810:464.

Thallus forming a yellow to deep golden-orange rosette, up to 8·0 cm diam., adnate to the substrate; lobes smooth, up to 2·5 mm wide, margins slightly

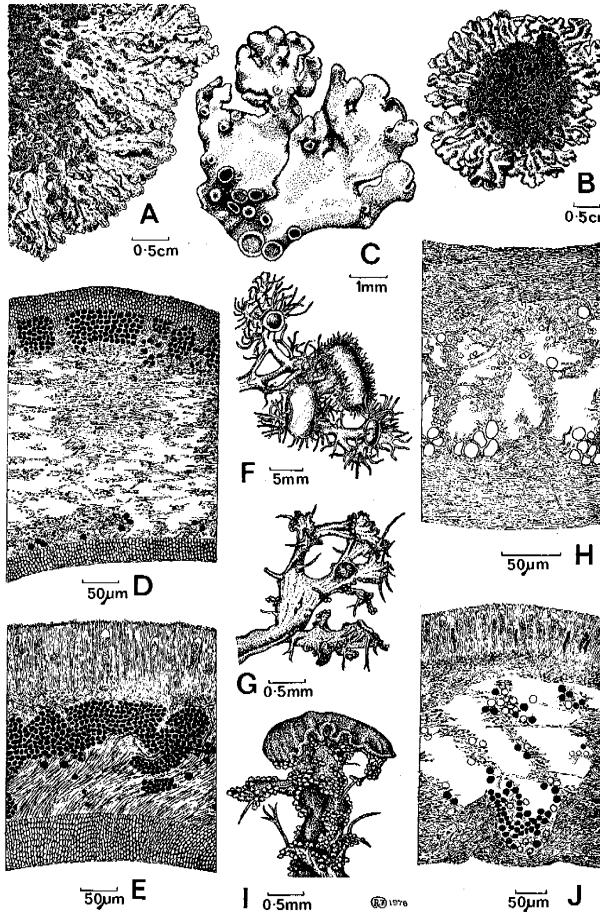


Fig. 28. A, *Xanthoria parietina*, portion of thallus; B, *Xanthoria ectanea*, typical thallus; C, *Xanthoria ectanea*, portion of thallus lobe showing apothecia in various stages of development, D, *Xanthoria ectanea*, section through thallus lobe showing structure of upper and lower cortex; E, *Xanthoria ectanea*, section through apothecium; F, *Teloschistes chrysophthalmus*, portion of thallus showing apothecia in various stages of development; G, *Teloschistes spinosus*, thallus lobe showing pycnidia and granular soredia; H, *Teloschistes chrysophthalmus*, section through thallus lobe showing structure of upper and lower cortex; I, apothecium, spinules and granules; J, *Teloschistes chrysophthalmus*, section through portion of apothecium. After Filson 1969.

raised then deflexed, isidia and soredia absent. *Apothecia* clustered into the centre of the thallus up to 2·5 mm diam.; ascospores hyaline, polaribilocular, canal sometimes absent, 14-16 × 6-8 μm.

Figure: Habit, plate 16D; typical thallus, fig. 28B; section through thallus Lobe, fig. 28D; section through apothecium, fig. 28E; ascospores, fig. 27Q.

Specimens examined: "Koonalda" Station, Nullarbor Plain, *D. S. Kemsley,* 9.i.1952 (MEL 7462); "Colona" Station, Yalata Aboriginal Reserve, *J. H. Willis,* 27.viii.1947 (MEL 7435); 24 miles (38 km) north-west of Port Augusta, *J. H. Willis,* 3.viii.1966 (MEL 17314); Middle River, Kangaroo Island, *S. J. Edmonds,* v.1952 (MEL 7490); Kings Beach Cliffs near Victor Harbor, *R. W. Rogers 1889,* 31.i.1966 (MEL 16196).

Reported for all States except Queensland and the Northern Territory.

Xanthoria parietina (L.) Beltr. 1858:102.

Lichen parietinus L. 1753:1143.

Thallus forming a yellow to deep golden-orange rosette up to 10 cm diam., adnate to the substrate; lobes rugulose, up to 5 mm wide, margins slightly reflexed and flexuose, isidia and soredia absent. *Apothecia* on the older parts of the thallus, up to 3 mm diam.; ascospores hyaline, polari-bilocular, canal mostly present, 12-15 × 7-10 μm.

Figure: Portion of thallus, fig. 28A.

Specimens examined: Koonalda Cave, Nullarbor Plain, *R. B. Filson 9419,* 28.xii.1966 (MEL 25277); Fowlers Bay, *R. B. Filson 9492,* 12.i.1967 (MEL 25276); River Torrens Gorge, *N. N. Donner 1307,* 13.iii.1965 (MEL 9117); Princes Highway, 7 miles (11 km) east of Murray Bridge, *R. T. M. Pescott,* 26.vi.1966 (MEL 17335).

In all States except Queensland and the Northern Territory.

Xanthoria parietina occurs only in the settled areas and is especially common on introduced trees. It may be an introduction.

GLOSSARY

Acicular: long and needle-shaped.
Adnate: closely attached, the thallus close to the substrate, or the apothecium flat on the thallus.
Aggregated: apothecia arranged one upon the other like a pile of dishes.
Algal layer: the band of gonidia (phycobiont) in the lichen thallus.
Anastomosing: with numerous cross-connections.
Apex (pl. *Apices):* tip.
Apical: situated at the tip.
Apothecium (pl. *Apothecia):* the disk-shaped fruiting body (ascocarp) of an ascomycete, (see Fig. 2D).
Appressed: closely adhering to the substrate.
Arachnoid: cobweb-like in structure.
Areole: a small part of a lichen thallus separated from the rest of the thallus by minute cracks.
Areolate: consisting of a mosaic of areoles.
Articulate: thallus constricted and jointed thus appearing like a crustacean's leg.
Ascending: rising from the substrate.
Ascocarp: the sporocarp of an ascomycete lichen producing asci and ascospores, i.e. apothecium, perithecium, pseudothecium.
Ascospore: a spore produced by an ascus.
Ascostroma: a stroma bearing asci.
Ascus (pl. *Asci):* sac containing spores.
Axil: the angle between branches or lobes.
Axis (pl. *Axes):* the main stem of a branched lichen, or in *Usnea*, the central cartilaginous core.

Bullate: expanded like a bubble.

C±: calcium hypochlorite ($Ca(ClO)_2$) used as a reagent colour test (see Chemical Tests in the Introduction).
Canaliculate: grooved or channelled.
Capitate: shaped like a head—usually with reference to more or less globular soralia.
Cartilaginous: of firm dense tissue like mammalian cartilage.
Cerebriform: having an irregular brain-like appearance.
Cephalodia: a tubercle containing blue-green algal cells, which is sometimes found in or on a thallus containing a green phycobiont.
Chondroid axis: the elastic, cartilaginous central core in the genus *Usnea*.
Cilium (pl. *Cilia):* a hair-like growth on the margins or upper surface of lobes; or on the margins or lower surface of apothecia.
Clathrate: net-like.
Clavate: club-shaped.
Coralloid: coral-like.
Coriaceous: leathery.
Cortex: the outermost layer of the thallus, consisting of compacted hyphae which may appear either fibrous or cellular.

Corticolous: growing on bark.
Crenate: with a wavy or notched margin.
Crustose: thallus type, forming a closely adnate, strongly adherent crust over the substrate; without a lower cortex or rhizines.
Cyphella (pl. *Cyphellae):* a pore in the lower surface, lined with pseudo-cortex.

Digitate: finger-like.
Dilated: become larger, opening out.
Disk: the upper surface of the apothecium, (see Fig. 2D)
Dorsiventral: with distinct differences between the upper and lower surfaces.

Ecorticate: without a cortex.
Effigurate: having a defined outline.
Emarginate: without a margin (e.g. the apothecial margin).
Endolithic: immersed in rock or stone.
Endophloedal: immersed in wood or bark.
Entire: smooth and unbroken, without notches.
Epithecium: the surface of the apothecial disk, the top-most layer of the hymenium (see Fig. 2F).
Erect: rising vertically from the substrate.
Evanescent: soon disappearing.
Exciple: the layer surrounding the hymenium which sometimes develops into a distinct margin. A proper exciple has no algal component and is derived from apothecial tissue, a thalloid exciple has an algal component and is derived from the vegetative thallus.

Farinose: fine, floury, powdery, usually with reference to soredia.
Fasciculate: in bundles or clusters.
Fenestrate: with small perforations.
Fertile: with apothecia or perithecia.
Fibril: short, thin lateral branches, especially in *Usnea.*
Fibrillose: having fibrils.
Filamentous: hair or thread-like.
Fistulate: hollow and pipe-like with gaping mouths.
Foliose: thallus type, usually with upper and lower cortices, dorsiventral, flat and somewhat leaf-like.
Foveolate: pitted, with grooves and depressions.
Fruticose: thallus type, usually erect and uprising or pendulous, commonly radially symmetrical but sometimes dorsiventral.
Fusiform: spindle shaped.

Gelatinous: jelly-like.
Gonidial: algal layer (see phycobiont).
Granulose: with granules or coarse grains. Usually with reference to soredia or some crustose thalli.

Heteromerous: a thallus form in which more or less distinct tissues are present.
Holdfast: a disk-like base by which some lichens are attached to the substrate.

Homiomerous: a thallus form in which the algal and fungal components are uniformly dispersed.
Hymenium: that part of the ascocarp composed of asci and paraphyses, (see Fig. 2F).
Hypha (pl. *hyphae):* a filament of fungal cells.
Hypothallus: a growth of undifferentiated hyphae upon which a differentiated thallus develops. Sometimes present as a distinct layer below or around a thallus.
Hypothecium: the tissue in the ascocarp from which the paraphyses and asci initiate, (see Fig. 2F).

Imbricate: overlapping like roofing tiles.
Immersed: sunken into the thallus.
Inflated: expanded, often hollow.
Isidium (pl. *isidia):* an outgrowth from the thallus with a cortex.

K±: 10% potassium hydroxide (caustic potash) solution used as a colour test, (see Chemical Tests in the Introduction).

Labriform: lip-like.
Lacerate: irregularly cut or torn.
Laminal: on the surface.
Lecanorine: referring to an apothecium like that of *Lecanora,* with a thalline margin around the disk, (see Fig. 2E).
Lecideine: referring to an apothecium like that of *Lecidea* with a proper exciple around the disk, (see Fig. 2E).
Leprose: entirely sorediose.
Lignicolous: growing on wood.
Linear: narrow and uniform in width.
Lirelliform: having a shape rather like the characters of Chinese writing.
Lobe: a segment of a branched thallus.
Lobule: a small lobe on the margin or upper surface of a larger lobe.

Maculose: spotted; submacroscopic white spots showing on the upper surface caused by breaks in the algal layer.
Marginal: on the edge or margin rather than on the upper or lower surface.
Marginate: with a distinct margin (with reference to apothecia).
Mazaedium (pl. *mazaedia):* a fruiting body in which ascus walls break down to form an amorphous spore mass.
Medulla: an internal layer of loosely woven hyphae, between the algal layer and lower cortex, (see Fig. 2F).
Muriform: resembling bricks in a wall—with reference to spores with both longitudinal and cross septa, (see Fig. 16C, D, E & F).
Mycelial: made up of mycelium or intertwined strands of hyphae.
Mycobiont: the fungal component of a lichen.

Nodule: a small lump or knot.

Orbicular: more or less round.
Ostiole: a pore-like opening at the apex of a perithecium through which the spores escape.

Papilla (pl. *papillae):* a small wart-like outgrowth from the thallus.
Paraphysis (pl. *paraphyses):* a specialised hyphal form, either simple or branched, in the hymenium.
Paraplectenchymatous: a fungal tissue with a cellular structure.
P±: an alcoholic solution of paraphenylenediamine used for colour testing, (see Chemical Tests in the Introduction).
Pedicellate: on a pedicel or short stalk.
Peltate: like a shield on a central stalk.
Pendulous: hanging.
Perforate: with holes through the thallus or into a central cavity.
Perithecium (pl. *perithecia):* a flask-shaped fruiting body immersed in the thallus with a single, terminal opening, (see Fig. 2G).
Phycobiont: the algal component of a lichen.
Placodiform: a crustose thallus having effigurate lobes tightly appressed to the substrate.
Plectenchyma: parenchyma-like tissue of tightly packed hyphae.
Podetium (pl. *podetia):* an erect portion of a thallus derived from tissue of apothecial origin, rising from a primary thallus.
Polar: referring to two-celled spores in which the cells are at opposite ends of the spore, separated by a very thick wall.
Polaribilocular: referring to spores which are non-septate, but in which the wall thickens almost dividing the cell into two polar compartments.
Proper margin: an exciple formed from tissue of apothecial origin—without algae in the rim.
Prosoplechtenchymatous: fungal tissue of fibrous or indistinctly cellular appearance.
Pruina: a white or bluish coating or bloom on the surface.
Pruinose: with pruina.
Pseudocyphella (pl. *pseudocyphellae):* areas of the thallus where the upper or lower cortex is perforated or split and medullary hyphae come to the surface.
Pseudoparenchymatous: having the appearance of parenchyma—i.e., isodiametric cells.
Pseudopodetium (pl. *pseudopodetia):* a podetium-like structure that has its origin in vegetative rather than reproductive tissue.
Pseudothecium (pl. *pseudothecia):* term used for the fruiting structures in pyrenocarpous lichens with bitunicate asci.
Pubescent: clothed with soft hair or down.
Punctiform: dot-like.
Pustular: having slight elevations like blisters.
Pycnidium (pl. *pycnidia):* a flask-shaped structure producing pycnidiospores.
Pycnidiospores: the spore type produced in a pycnidium.

Radiate: with lobes arranged in a radial manner.
Recumbent: lying upon the substrate.

Reflexed: turned up at the margin.
Reticulate: with a network of ridges, lines or cracks on the surface.
Rhizine (pl. *rhizines):* hyphal structures on the lower surface anchoring the thallus.
Rhizoid: a short branch of the thallus resembling a root.
Rosulate: with a crustose effigurate rosette.
Rugulose: with a wrinkled surface.

Saxicolous: growing on rock.
Scrobiculate: marked by shallow depressions.
Septate: divided by a septum or wall.
Sessile: without a stem or stipe, sitting on the surface.
Soralium (pl. *soralia):* a patch of soredia.
Soredium (pl. *soredia):* microscopic powdery structures containing a group of algal cells and hyphae, but lacking a cortex.
Spinule: a small spine.
Squamule: a small scale-like thallus segment, usually lacking a lower cortex.
Squamulose: a growth form composed of squamules.
Stipe: a stalk that supports a fruiting body.
Stipitate: elevated on a stipe.
Stoloniferous: having an underground stem system.
Striate: with parallel stripes.
Stroma (pl. *stromata):* a compact mass of fungal tissue in which fruits are formed.
Substrate: the material on which an organism is living.

Terete: circular in cross-section.
Terminal: ending the structure, or on the end.
Terricolous: growing on soil.
Thalline margin: an exciple in which part of the vegetative thallus has grown up around the apothecium so that algae occur in the margin.
Thallus (pl. *thalli):* the lichen body, both alga and fungus.
Tomentum: a dense woolly covering of hyphae.
Tubercle: A small wart-like outgrowth through the cortex.
Type (specimen): the type of a family, genus, species or subspecies; the single element of a taxon to which the name is attached; the original specimen from which the description was drawn up.

Umbilicus: a point attachment at the centre of a thallus.

INDEX TO AUTHORS AND THEIR ABBREVIATION

Ach.: Acharius, E.
Adans.: Adanson, M.
Anzi, M.
Arn.: Arnold, F. C. G.

Bab.: Babington, C.
Baker, C.
Beltr.: Beltramini de Casati, F.
Berk.: Berkeley, M. J.
Bibby, P. N. S.
Bitt.: Bitter, F. A. G.
Borr.: Borrer, W.

C.A.Ag.: Agardh, C. A.
Choisy, M.
Cohn, F. J.
Cromb.: Crombie, J. M

DC.: De Candolle, A. P.
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Del.: Delise, D. F.
de Not.: Notaris, de G.
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Eckf.: Eckfeldt, J. W.
Ehrh.: Ehrhart, F.
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Eschw.: Eschweiler, F. G.
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Flot.: Flotow,
J. C. G. U. G. G. A. E. F. von
Forss.: Forssell, K. B. J.
F. Muell.: Mueller, F.
Fr.: Fries, E. M.
Furnr.: Furnrohr, A. E.
F. Wils.: Wilson, F. R. M.

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Hook.f.: Hooker, J. D.
Huds.: Hudson, W.
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Humb.: Humboldt, F. H. A. von

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Kremp.: Krempelhuber, A. von
Kurokawa, S.

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Lamy.: Lamy de la Chapelle, P. M. E.
le Prev.: Le Prevost, A.
Lett.: Lettau, G.
Lightf.: Lightfoot, J.
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Th. Fr.: Fries, T. M.
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Trev.: Trevisan de St.-Leon
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Vill.: Villars, D.

Wahlenb.: Wahlenberg, G.
Wainio.: Vainio E. A.
Web.: Weber, G. H.
Wern.: Werner, R. G.
Wetmore, C. M.
Wigg.: Wiggers, F. H.
Willd.: Willdenow, C. L.
Wilson, F. R. M.

Yoshimura, I.

Zahlbr.: Zahlbruckner, A.

REFERENCES

ACHARIUS, E. (1795). Anmärkningar och förbättringar vid afhandlingen om Lafvarnes indelning. *K. svenska Vetensk Akad. Handl.* 16:66–

ACHARIUS, E. (1798). *Lichenographiae Sueciae Prodromus* (D. G. Björn: Linkoping).

ACHARIUS, E. (1803). *Methodus Quo Omnes Detectos Lichenes* (F.D.D. Ulrich: Stockholm).

ACHARIUS, E. (1806). *Arthonia*, novum genus Lichenum. *Neues J. Bot.* 1(3), 1-23.

ACHARIUS, E. (1810). *Lichenographia Universalis* (Dankwerts: Gottingen).

ACHARIUS, E. (1814). *Synopsis Methodica Lichenum* (Svanborg et Soc.: Lund).

ACHARIUS, E. (1815). Afhandling om de Cryptogamiske vexter som komma under namn af Calicioidea. *K. svensk VetenskAkad,Handl.* 1815, 246-271.

ADANSON, M. (1763). *Familles des plantes.* 2 vols. (Vincent: Paris).

AGARDH, C. A. (1820-22). *Species algarum rite cognitae, cum synonymis, differentiis specificis et descriptionibus succinctis.* Vol. 1 (Mauritius: Gryphiswald).

AHMADJIAN, V. & M. E. HALE (1973). *The Lichens* (Academic Press: London).

ALMBORN, O. (1966). Revision of some lichen genera in Southern Africa. I. *Bot. Not.* 119, 70-112.

ALON, G. & M. GALUN (1970). The genus *Caloplaca* in Israel. *Isr. J. Bot.* 20, 273-292.

ANZI, M. (1864). Symbolae lichenum rariorum vel novorum Italiae superioris. *Comment. Soc. Crittogam. Ital.* 2 (1), 3-28.

ARNOLD, F. (1872). Lichenologische Ausflüge in Tirol. VII Umhausen. *Verh. zool. bot. Ges. Wien.* 22, 279.

BABINGTON, C. (1855). Lichenes. *In* J. D. Hooker, *(ed.) The Botany of the Antarctic Voyage of H.M. Discovery Ships Erebus and Terror in the years 1839-1843* 2(2), 266-311.

BABINGTON, C. & W. MITTEN (1860). Lichens. *In* J. D. Hooker, *(ed.) The Botany of the Antarctic Voyage of H.M. Discovery Ships Erebus and Terror in the years 1839-1843* 3(2), 343-354.

BAKER, C., J. A. ELIX, D. P. H. MURPHY, S. KUROKAWA, & M. V. SARGENT (1973). *Parmelia reptans,* a new lichen species producing the depsidone Succinprotocetraric acid. *Aust. J. Bot.* 21, 137-140.

BELTRAMINI DE CASATI, F. (1858). *Licheni Bassanesi enumerati e descritti* (Roberti: Bassano).

BERRY, E. C. (1941). A monograph of the genus *Parmelia* in North America north of Mexico. *Ann. Mo. Bot. Gdn.* 28, 31-146.

BIBBY, P. (1955). A remarkable lichen from arid Australia. *Muelleria* 1, 60.

BITTER, G. (1901a). Zur Morphologie und systematik von *Parmelia* untergattung *Hypogymnia*. *Hedwigia* 40, 171-274.

BITTER, G. (1901b). Ueber die variabilität einiger Laubflechten und über den einfluss äusserer Bedingungen auf ihr Wachsthum. *Jb. Wiss, Bot.* 36, 421-492 + 7 tables.

BLACK, J. M. (1922-29). The Flora of South Australia. Handbooks of the Flora and Fauna of South Australia. (Government Printer: Adelaide).

BOISTEL, A. B. M (1896). *Nouvelle Flore des Lichens* (Librairie Generale de l'Enseignemont: Paris).

BORY DE ST. VINCENT, J. B. M. (1822-31). *Dictionnaire classique d'histoire naturelle* (Edit.) 17 Vols (Paris).

CANDOLLE, A.P.DE (1828). *Botanicon gallicum, seu synopsis plantarum in Flora gallica descriptarum.* Editio secunda (Desray: Paris).

CHOISY, M. (1949). Catalogue des lichens de la region Lyonnaise. *Bull. mens. Soc. linn. Lyon.* 18, 104-120, 137-152.

CHOISY, M. (1950). Catalogue des lichens de la region Lyonnaise. *Bull. mens. Soc. linn. Lyon.* 19, 9-24.

CLELAND, J. B. (1934). Toadstools and Mushrooms and other larger fungi of South Australia. Handbooks of the Flora and Fauna of South Australia. (Government Printer: Adelaide).

COHN, F. (1879). *Kryptogamen-Flora von Schlesien.* 2 vols (Breslau).

CROMBIE, J. M. (1876). Lichenes Capense: an enumeration of the lichens collected at the Cape of Good Hope by the Rev. A. E. Eaton during the Venus-Transit Expedition in 1874. *J. Linn. Soc. Bot.* 15, 165-180.

CROMBIE, J. M. (1877). Lichenes Insulae Rodriguesii. *J. Linn. Soc. Bot.* 15, 431-445.

CROMBIE, J. M. (1879). Enumeration of Australian Lichens in herb. Robert Brown (Brit. Mus.) with descriptions of new species. *J. Linn. Soc. Bot.* 17, 390-401.

CROUAN, P. L. & H. CROUAN (1867). *Florule du Finistere, contenant des descriptions de 360 especes nouvelles de Sporagames, des nombreuses observations* (Paris et Brest).

CULBERSON, C. F., W. L. CULBERSON & T. L. ESSLINGER (1977). Chemosyndromic variation in the *Parmelia pulla* group. *Bryologist* 80, 125-135.

CULBERSON, W. L. (1964). A summary of the lichen genus *Haematomma* in North America. *Bryologist* 66, 224-236.

DEGELIUS, G. (1954). The genus *Collema* in Europe. *Symb. bot. upsal.* 13(2), 1-499.

DEGELIUS, G. (1974). The lichen genus *Collema* with special reference to the extra-european species. *Symb. bot. upsal* 20(2), 1-215.

DELISE, D. F. (1828). *Histoire de Lichens, Genre* Sticta. (Chalopin: Caen).

DICKSON, J. (1785-1801). *Fasciculi plantarum Cryptogamicarum Britanniae* (London).

DUBY, J. E. (1830). *Botanicon Gallicum seu Synopsis Plantarum in Flora Gallica descriptarum. Ex herbariis et schedis Candolleanis propriisque digestum.* (V. Desnay: Paris).

DUNCAN, U. K. (1970). *Introduction to British lichens* (T. Buncle & Co. Ltd.: Arbroath).

ECKFELDT, J. W. (1889). New North American Lichens. *Bull. Torrey Bot. Club* 16, 104 ff. (Original not seen).

EHRHART, F. (1785). *Plantae officinales exsicattae* (Original not seen).

EICHLER, Hj. (1965). Supplement to J. M. Black's Flora of South Australia. Handbooks of the Flora and Fauna of South Australia. (Government Printer: Adelaide).

ELIX, J. A. (1979). A taxonomic revision of the genus *Hypogymnia* in Australasia. *Brunonia,* 3, (in press).

ESCHWEILER, F. G. (1824). *Systema Lichenum, genera exhibens rite distincta, pluribus novis adaucta* (Schrag: Nuremburg).

ESSLINGER, T. L. (1977). A Chemosystematic Revision of the Brown *Parmeliae. Journ. Hattori Bot. Lab.* 42, 1-211.

EVANS, A. W. (1950). Notes on the Cladoniae of Connecticut (IV) *Rhodora* 52, 77-123.

FÉE, A. L. A. (1824). *Essai sur les Cryptogames des écorces exotiques officinales* (Firmin-Didot: Paris).

FILSON, R. B. (1967). Supplementary descriptions for two Victorian desert lichens. *Muelleria* 1, 197-202.

FILSON, R. B. (1969). A review of the genera *Teloschistes* and *Xanthoria* in the lichen family Teloschistaceae in Australia. *Muelleria* 2, 65-115.

FILSON, R. B. (1970). Studies in Australian lichens—1. *Victorian Nat.* 87, 324-327.

FILSON, R. B. (1976). Australian Lichenology: a brief history. *Muelleria* 3(3), 183-190.

FILSON, R. B. (1978). A Revision of the genus *Heterodea* Nyl. *Lichenologist* 10: 13-25.

FLÖRKE, H. G. (1808). Beschreibung der *Capitularia pyxidata. Mag. d. Ges. naturf. Freunde* (Berlin) 2, 132. (Original not seen).

FLOTOW, J. (1851). Briefe über *Psora privigna* (Ach.) Fw. 1848. *(Sarcogyne corrugata* Fw. ad int. 1845, *Lichen simplex* Dav., *Patellaria simplex* Wallr., *Lecidea* Hook.) *Bot. Ztg* 9, 753-759, 769-776.

FORSSELL, K. B. J. (1885). Beiträge zur Kenntnis der Anatomie u. Systematik der Gloeolichenen. *Nova Acta R. Soc. Scient. upsal.* ser. 3, 13, 1-118.

FORSSELL, K. B. J. (1887). Beiträge zur Kenntniss der Anatomie und Systematik der Gloeolichenen. *Nov. acta R. Soc. Scient. upsal.* 13(6), 1-118.

FRIES, E. M. (1824-27). *Schedulae criticae de Lichenibus Suecanis.* Fasc. I-IV, VIII, IX et XIII. (Lund.).

FRIES, E. M. (1825). *Systema orbis vegetabilis. Primas lineas novae constructionis periclitatur* Elias Fries. Pars 1. *Plantae homonemeae* (Typographia Academica: Lund.).

FRIES, E. M. (1826). *Novae schedulae criticae de Lichenibus Suecanis.* (Lund).

FRIES, E. M. (1846). *Summa vegetabilium Scandinaviae* (Bonnier: Stockholm).

FRIES, T. M. (1856). Observationes lichenologicae: Decas Prima. *Oefvers af K.Vet. Ak. Förh.* 13, 123. (Original not seen).

FRIES, T. M. (1861a). *Genera Heterolichenum europaea recognita* (Edquist: Uppsala).

FRIES, T. M. (1861b). Lichenes arctoi Europaeae Grönlandiaeque hactenus cogniti. *Nova Acta R. Soc. Scient. upsal.* ser. 3, 3, 103-398.

FRIES, T. M. (1871). *Lichenographia Scandinavica sive dispositio lichenum in Dania, Suecia, Norvegia, Fennia, Lapponia Rossica hactenus collectorum.* Pars Prima (E. Berling: Uppsala).

FRIES, T. M. (1874). *Lichenographia Scandinavica sive dispositio lichenum in Dania, Suecia, Norvegia, Fennia, Lapponia Rossica hactenus collectorum.* Pars Secunda (E. Berling: Uppsala).

FÜRNROHR, A. E. (1838). *Nätushistorische Topographie von Regensburg.* 3 Vols (Regensburg).

GRAY, S. F. (1821). *A natural arrangement of British plants according to their relations to each other, . . . etc.* 2 Vols (Baldwin, Cradock and Joy: London).

GYELNIK, V. (1931). Additamenta ad cognitionem *Parmeliarum. Reprium nov. Spec. Regni veg.* 29, 149-291.

GYELNIK, V. (1934). Additamenta ad cognitionem *Parmeliarum. Reprium nov. Spec. Regni veg.* 35, 366-377.

GYELNIK, V. (1935a). Revisio typorum ab auctoribus variis descriptorum I. *Annls hist.-nat. Mus. natn. hung.* 29, 1-54.

GYELNIK, V. (1935b). De familia Heppiacearum II. *Reprium nov. Spec. Regni veg.* 38, 307-313.

GYELNIK, V. (1938). Additamenta ad cognitionem Parmeliarum VIII. *Annls mycol.* 36, 267-294.

HAKULINEN, R. (1954). Die Flechtengattung *Canderlariella* Müller-Argoviensis mit besonderer Berucksichtigung Auftretens und ihrer Verbreitung in Fennoskandien. *Suomal. elain-ja kasvit. Seur. van Julk.* 27 (3) 1-127.

HALE, M. E. (1961). The Lichen Handbook (Smithsonian Institution: Washington D.C.).

HALE, M. E. (1965). A Monograph of *Parmelia* subgenus *Amphigymnia. Contr. U.S. Natn. Herb.* 36, 193-358.

HALE, M. E. (1969). *The Lichens* (Wm. C. Brown Co.: Dubuque, Iowa).

HALE, M. E. (1967). *The biology of Lichens* (Contemporary Biology. Edward Arnold Ltd.: London).

HALE, M. E. (1971). Studies on *Parmelia* subgenus *Xanthoparmelia* (Lichenes) in South Africa. *Bot. Not.* 124, 343-354.

HALE, M. E. (1976a). A monograph of the lichen genus *Pseudoparmelia* Lynge (Parmeliaceae). *Smithsonian Contr. Bot.* 31, i-iii, 1-62.

HALE, M. E. (1976b). A monograph of the lichen gnus *Parmelia* Hale (Parmaeliaceae). *Smithsonian Contr. Bot.* 33, i-iii, 1-60.

HALE, M. E. & S. KUROKAWA (1964). Studies on *Parmelia* subgenus *Parmelia*. *Contr. U.S. Natn. Herb.* 36, 121-191.

HALL, E.A.A., R. L. SPECHT, & C. M. EARDLEY (1964). Regeneration of the vegetation on Koonamore Vegetation Reserve, 1926-1962. *Aust. J. Bot.* 12, 205-264.

HAMPE, G. E. (1852). Plantae Mullerianae, Beitrag zur Flora Sudaustraliens. Lichenes. *Linnaea* 25, 709-712.

HAWKESWORTH, D. L. & J. F. SKINNER (1974). The Lichen Flora and Vegetation of Black Head, Ilsham, Torquay. *Trans. and Proc. Torquay Nat. Hist. Soc.* 16, 121-136.

HAWKESWORTH, D. L. & I. YOSHIMURA (1973). Nomina Conservanda Proposita, *Gymnoderma* Nyl. *Taxon* 22 (4), 503.

HEDWIG, J. (1787-1797). *Descriptio et adumbratio microscopico-analytica Muscorum frondosorum nec non aliorum vegetantium e classe cryptogamica Linnaei novorum dubiisque vexatorum.* Stirpium cryptogamicarum (J. G. Müller: Lipsiae).

HENSSEN, A. (1963). Eine Revision der Flechtenfamilien Lichinaceae und Ephebaceae. *Symb. Bot. upsal.* 18(1), 1-123.

HENSSEN, A. (1976). Studies in the developmental morphology of lichenized Ascomycetes. *In* D. H. Brown, D. L. Hawkesworth & R. H. Bailey (eds) *Lichenology: Progress and Problems* (Academic Press: London).

HEPP, P. (1853-67). *Die Flechten Europas in getrockneten mikroskopisch untersuchten Exemplaren mit Beschreibung* v. Abbildung ihrer Sporen. 16 Fasc. (Zürich).

HERTEL, H. (1967). Revision einiger Caliciphiler formenkreise de Flechtengattung *Lecidea*. *Beih. Nova Hedwigia* 24, 1-155.

HERTEL, H. (1968). Beiträge zur Kenntnis der Flechtenfamilie *Lecidea* I. *Herzogia* 1, 25-39.

HERTEL, H. (1969a). Die Flechtengattung *Trapelia* Choisy. *Herzogia* 1, 111-130.

HERTEL, H. (1969b). Beiträge zur Kenntnis Flechtenfamilie *Lecidea* II. *Herzogia* 1, 321-329.

HILL, J. (1751). *A general Natural History*, Vol. II: A history of plants (Osborne: London).

HILL, J. (1773). *A general Natural History*, Vol. II: A history of Plants. Edit. 2. (Osborne: London).

HILLMAN, J. (1930). Studien über die Flechtengattung *Teloschistes* Norm. *Hedwigia* 69, 303-343.

HOFFMANN, G. F. (1784). *Enumeratio Lichenum iconibus et descriptionibus illustrata* (Walther: Erlangen).

HOFFMAN, G. F. (1790-1801). *Plantae lichenosae. Descriptio et Adumbratio plantarum e classe cryptogamica Linnaei, quae Lichenes dicuntur.* 3 Vols (Crasium: Lipsiae).

HOFFMAN, G. F. (1796). *Deutschlands Flora oder botanisches Taschenbuch.* II. Teil *Kryptogamie* (Erlangen).

HOOKER, J. D. & T. TAYLOR (1844). Lichenes Antarctici; being characters and brief descriptions of the new Lichens discovered in the Southern circumpolar regions, Van Diemens Land and New Zealand, during the Voyage of H.M. Discovery Ships *Erebus* and *Terror. London J. Bot.* 3, 634-658.

HOOKER, W. J. & J. SOWERBY (1831). *English Botany: Supplement, The descriptions synonyms and places of growth* (London).

HUDSON, W. (1762). *Flora Anglica, exhibens plantas per regnum Angliae sponte cresentes, . . . etc.* (London).

HUE, A. M. (1886-87). Addenda nova ad Lichenographiam europaeam. Exposuit in Flora Ratisbonensi. W. Nylander, in ordine systematico disposuit Parts I, II. *Rev. Bot. Bull. Mens.* 5, 1-125; 6, 5.

HUE, A. M. (1909). Lichenes morphologice et anatomice disposuit. *Nouv. Arch. du Museum* ser. 5, 1, 110-166.

HUMBOLDT, F. A. (1793). *Florae Fribergensis specimen plantas cryptogamicas praesertim subterranes exhibens* (Rottmann: Berlin).

IMSHAUG, H. A. & I. M. BRODO (1966). Biosystematic studies on *Lecanora pallida* and some related lichens in the Americas. *Nova Hedwigia* 12, 1-59.

JAHNS, H. M. (1974) [1973]. Anatomy, Morphology and Development. *In* V. Ahmadjian and M. E. Hale, (eds.) *The Lichens:* 3-58 (Academic Press Inc.: New York).

KEUCK, G. (1977). Ontogenetisch—systematische Studie über *Erioderma* in Vergleich mit anderen cyanophilen Flechtengattungen. *Bibliotheca Lichenologica* 6, 1-175.

KÖRBER, G. W. (1848). *Grundriss der Kryptogamen-Kunde. Zur Orientirung beim Studium der Kryptogamischen Pflanzen, sowie zum Gebrauch bei seinen Vorlesungen.* (E. Trewendt:Breslau).

KÖRBER, G. W. (1855). *Systema Lichenum Germaniae* (Trewendt & Granier: Breslau).

KÖRBER, G. W. (1859-1865). *Parerga Lichenologica. Ergänzungen zum Systema Lichenum Germaniae.* (E. Trewendt: Breslau).

KRAHENBUEHL, D. N. (1969). The Life and works of J. G. O. Tepper, FLS, and his association with the Field Naturalists' Section of the Royal Society of South Australia. *S. Aust. Nat.* 44, 23-42.

KREMPELHUBER, A. (1870). Lichenes. In *Reise der Österreichischen Fregate* Novara *um die Erde in dem Jahren 1857, 1858, 1859.* 1, 106-129.

KREMPELHUBER, A. (1873-74). Lichenes Brasilienses. Partic. XIV von E. Warming Symbolae ad floram Brasiliae cognoscendam. *Vidensk. Meddr. dansk. naturh. Foren.* 5, 1-35.

KREMPELHUBER, A. (1880). Ein neuer Beitrag zur Flechtenflora Australiens. *Verh. zool.-bot. Ges. Wien* 30, 329-342.

KUROKAWA, S. (1959). Anaptychiae (lichens) and their allies of Japan (2). *J. Jap. Bot.* 34, 174-184 + 2 pl.

KUROKAWA, S. (1962). A monograph of the genus *Anaptychia. Beih. Nova Hedwigia,* 6, 1-115.

KUROKAWA, S. (1969). On the occurrence of Norlobaridone in *Parmeliae. J. Hattori bot. Lab.* 32, 205-218.

KUROKAWA, S. (1973). Supplementary notes on the genus *Anaptychia. J. Hattori bot. Lab.* 37, 563-607.

KUROKAWA, S. & J. A. ELIX (1971). Two new Australian *Parmeliae. J. Jap. Bot.* 46, 113-116.

KUROKAWA, S. & R. B. FILSON (1975.) New Species of *Parmelia* from South Australia. *Bull. natn. Sci. Mus., Tokyo.* 1, 35-48.

KUROKAWA, S., Y. JINZENJI, S. SHIBATA, & H. C. CHIANG (1966). Chemistry of Japanese *Peltigera* with some Taxonomic notes. *Bull. natn. Sci. Mus., Tokyo* 9(2), 101-114.

LAMARCK, J. B. P. A. de M.de & A. P. de CANDOLLE (1805 & 1815). *Flore Francaise, ou descriptions succinctes de toutes les plantes qui croissent naturellement en France, ... etc.* 5 Vols (Desray: Paris).

LAMB, I. MACKENZIE & ANNMARIE WARD (1974). A preliminary conspectus of the species attributed to the imperfect lichen genus *Leprocaulon* Nyl. *J. Hattori. bot. Lab.* No. 38, 499-553.

LAMY DE LA CHAPELLE, E. (1878). Catalogue raisonné des lichens du Mont-Dore et de la Haute-Vienne. *Bull. Soc. Bot. France* 25, 321-536.

LAURER, F. (1827). Siebersche Lichenen. *Linnaea* 2, 38-46.

LETROUIT-GALINOU, M. A. (1974) [1973]. Sexual Reproduction. *In* V. Ahmadjian and M. E. Hale, (eds.) *The Lichens* 59-90 (Academic Press: London).

LETTAU, G. (1912). Beiträge zur Lichenographie Von Thuringen. *Hedwigia* 52, 81-264.

LETTAU, G. (1958). Flechten aus Mitteleuropa XIII. *Reprium nov. Spec. Regni veg.* 61, 1-73.

LIGHTFOOT, J. (1777). *Flora scotica.* 2 Vols (White: London).

LINNAEUS, C. (1753). *Species Plantarum* (Laurentii Salvii: Stockholm).

LINNAEUS, C. (1767). *Mantissa Plantarum* (Stockholm).

LINNAEUS, C. (1771). *Mantissa Plantarum altera* (Stockholm).

LINNAEUS, C. (1774). *Systema Vegetabilium* (Gottingen).

LINNAEUS, C. (1791). *Genera Plantarum* Ed. 8 (Magdeburg).

LYNGE, B. (1914). Die Flechten der ersten Regnellschen Expedition. Die gattungen *Pseudoparmelia* Gen. nov. und *Parmelia* Ach. *Ark. Bot.* 13(13), 1-171.

MACKAY, J. T. (1836). *Flora hibernica, comprising the flowering Plants, ferns characeae, Musci, Hepaticae, Lichenes and Algae of Ireland, arranged according to the natural system, with a Synopsis of the genera according to the Linneean system* (William Curry, Inn and Co.: Dublin).

MAGNUSSON, A. H. (1929). A monograph of the genus *Acarospora*. *K. svenska Vetensk-Akad. Handl. ser.* 3, 7(4), 1-400.

MAGNUSSON, A. H. (1931). Beiträge zur Systematik der Flechtengruppe *Lecanora subfusca*. *Acta Horti gothoburg* 7, 65-87.

MAGNUSSON, A. H. (1934). Die Flechtengattung *Maronea* Mass. *Acta Horti gothoburg* 9, 41-66.

MAGNUSSON, A. H. (1939). Western American Lichens, mainly from Oregon. *Acta Horti gothoburg* 13, 237-253.

MAGNUSSON, A. H. (1940). Studies in species of *Pseudocyphellaria*. The *Crocata* group. *Acta Horti gothoburg* 14, 1-35.

MAGNUSSON, A. H. (1953). Key to saxicolous *Buellia* species, mainly from South America. *Ark. Bot.* 3(9), 205-221.

MAGNUSSON, A. H. (1955). A Catalogue of Hawaiian Lichens. *Ark. Bot.* 3(10), 223-402.

MAGNUSSON, A. H. & A. ZAHLBRUCKNER (1945). Hawaiian Lichens. *Ark. Bot.* 32a(2), 1-89.

MAHEU, J. & A. GILLET (1925). Deuxième contribution à l'étude des lichens du Maroc. *Bull. Soc. bot. Fr.* 72, 858-871.

MALME, G. O. (1926). Die Pannariazeen des Regnelschen Herbars. *Ark. Bot.* 20a(3), 1-23.

MARTIN, W. (1958). The Cladoniae of New Zealand. *Trans. R. Soc. N.Z.* 85, 603-632.

MARTIN, W. (1965). The Lichen Genus Cladia. *Trans. R. Soc. N.Z.* 3, 7-12.

MASSALONGO, A. B. (1852a). *Ricerche sull' autonomia dei Licheni crostosi e Materiali pella loro naturale ordinazione* (Frizerio: Verona).

MASSALONGO, A. B. (1852b). Monografia dei Licheni Blasteniospori. *Atti Ist. veneto Sci. ser.* 3, 4(2) append. 3.

MASSALONGO, A. B. (1852c). Synopsis lichenum Blasteniosporum. *Flora, Jena* 35, 561-576.

MASSALONGO, A. B. (1853a). *Memorie lichenografiche, con un appendice alle Ricerche sull' Autonomia dei Licheni crostosi* (Münster: Verona).

MASSALONGO, A. B. (1853b). *Alcuni generi di Licheni nuovamente limitati e descritti* (Antonelli: Verona).

MASSALONGO, A. B. (1854). *Neagenea Lichenum* (Ramanzini: Verona).

MASSALONGO, A. B. (1856a). *Miscellanea lichenologica.* (Civelli: Verona-Milano).

MASSALONGO, A. B. (1856b). *De nonnullis Collemaceis ex tribu Omphalariearum brevis commentatio. Flora, Jena* 39, 209-215.

MASSALONGO, A. B. (1856c). Genera lichenum aliquot nova. *Flora, Jena* 39, 281-286, 289-292.

MASSALONGO, A. B. (1860). Esame comparativo di alcune generi de licheni. *Atti Ist. veneto Sci. ser.* 3, 5, 247-276, 313-337.

MEYEN, F. J. F. & J. FLOTOW (1843). Observationes in itinere circum terram institutae (1830-1832): Lichenes. *Nov. Acta Acad. Caesar. Leop. Carol.* 19 Suppl., 209-232.

MICHAUX, A. (1803). *Flora Boreali-Americana* (Levrault: Paris) (Original not seen).

MONTAGNE, J. F. C. & M. J. BERKELEY (1846). On *Thysanothecium,* a new genus of Lichens. *London. J. Bot.* 5, 257-258.

MONTAGNE, J. F. C. (1856). *Sylloge generum specierumque cryptogamarum quas in variis operibus descriptas iconibusque illustratas, nunc ad diagnosim reductas, multasque novas interjectas, ordine systematico disposuit* (Balliere: Paris).

MOTYKA, J. (1936-38). *Lichenum generis* Usnea *studium monographicum. I. Pars systematica* (Motyka, Leopoli, Lwów).

MUDD, W. (1861). *A Manual of British Lichens* (H. Penney: Darlington).

MÜLLER ARGOVIENSIS, J. (1862). Principes de Classification des Lichens et Énumeration des Lichens de Genève. *Mem. Soc. Phys. Hist. nat. Genève* 16(2), 343-433.

MÜLLER ARGOVIENSIS, J. (1880). Lichenologische Beiträge. *Flora, Jena* 63, 17-24, 40-45, 259-268, 275-290.

MÜLLER ARGOVIENSIS, J. (1881). Lichenologische Beiträge. *Flora, Jena* 64, 505-511, 513-527.

MÜLLER ARGOVIENSIS, J. (1882). Lichenologische Beiträge. *Flora, Jena* 65, 291-306, 316-322, 326-337, 381-386, 397-402.

MÜLLER ARGOVIENSIS, J. (1883). Lichenologische Beiträge. *Flora, Jena* 66, 17-25.

MÜLLER ARGOVIENSIS, J. (1885). Lichenologische Beiträge. *Flora, Jena* 68, 528-533.

MÜLLER ARGOVIENSIS, J. (1886). Lichenologische Beiträge. *Flora, Jena* 69, 252-258.

MÜLLER ARGOVIENSIS, J. (1887). Revisio Lichenum Féeanorum. *Revue. mycol.* 9, 82-89, 133-140.

MÜLLER ARGOVIENSIS, J. (1888). Lichenologische Beiträge. *Flora, Jena* 71, 129-142.

MÜLLER ARGOVIENSIS, J. (1889). Lichenologische Beiträge. *Flora, Jena* 72, 505-508.

MÜLLER ARGOVIENSIS, J. (1892). Lichenes Australiae occidentalis a cl. Helms recenter lecti et a celeb. Bar. Ferd. v. Mueller communicati. *Hedwigia* 5, 191-198.

MÜLLER ARGOVIENSIS, J. (1893a). Scientific results of the Elder exploring expedition. Lichenes. *Trans. R. Soc. S. Aust.* 16, 142-149.

MÜLLER, ARGOVIENSIS, J. (1893b). Lichenes wilsoniani. *Bull. Herb. Boissier* 1, 33-65.

MÜLLER ARGOVIENSIS, J. (1894). Conspectus systematicus lichenum Novae Zealandiae quem elaboravit. *Bull. Herb. Boissier* 2, append. 1, 1-114.

MÜLLER ARGOVIENSIS, J. (1896). Analecta Australiensia. *Bull. Herb. Boissier* 4, 87-96.

MURRAY, J. (1960). Studies of New Zealand Lichens II, the Teloschistaceae. *Trans. R. Soc. N.Z.* 88, 197-210.

NAKANISHI, M. (1966). Taxonomical studies of the family Graphidaceae of Japan. *J. Sci. Hiroshima Univ. ser.* B, *div.* 2, 11, 51-126.

NEES von ESENBECK, C. G. (1820). *Horae Physicae Berolinenses collectae ex symbolis virorum doctorum* (Bonn).

NORMAN, J. M. (1853). Conatus praemissus redactionis novae generum nonnullorum Lichenum in organis fructificationis vel sporis fundatae. *Nytt Mag. Naturv.* 7, 213-252.

NOTARIS, de G. (1846). Frammenti lichenografici di un lavoro inedito. *Giorn. Bot. Ital.* 2(1), 174-224, 299-330.

NYLANDER, W. (1853). Lichenes Algerienses novi. *Annls Sci. nat. Bot. sér.* 3, 20, 314-320.

NYLANDER, W. (1855a). Essai d'une nouvelle classification des Lichens. *Mém. Soc. Sci. Nat. Cherbourg.* 2, 5-16.

NYLANDER, W. (1855b). Essai d'une nouvelle classification des Lichens. Second Memoire. *Mém. Soc. Sci. Nat. Cherbourg* 3, 161-202.

NYLANDER, W. (1856). Prodromus Lichenographiae Galliae et Algeriae. *Act. Soc. Linn. Bordeaux* 21, 249-467.

NYLANDER, W. (1857). Enumération générale des lichens, avec l'indication sommaire de leur distribution géographique. *Mém. Soc. Sci. Nat. Cherbourg* 5, 85-146, 332-339.

NYLANDER, W. (1858). Lichenes collecti in Mexico a Fr. Müller. *Flora, Jena* 41, 377-386.

NYLANDER, W. (1858-1860). *Synopsis methodica Lichenum.* Vol. 1 (Martinet: Paris).

NYLANDER, W. (1859). Lichenes in regionibus exoticis quibusdam vigentes, exponit synopticis enumerationibus. *Annls Sci. Nat. Bot. sér.* 4, 11, 205-264.

NYLANDER, W. (1861a). Additamentum ad Lichenographiam Andium Boliviensium. *Annls Sci. Nat. Bot. sér.* 4, 15, 365-382.

NYLANDER, W. (1861b). Lichenes Scandinaviae. *Not. Sällsk. Fauna Fl. Fenn. Förh.* 5, 1-312.

NYLANDER, W. (1863a). Circa Lichenes Armoricae et Alpium Delphinatus Observationes. *Acta Soc. Sci. Fenn.* 7, 391-413.

NYLANDER, W. (1863b). Lichenographiae Nova-Granatensis prodromus. *Acta Soc. Sci. Fenn.* 7, 415-504.

NYLANDER, W. (1863c). *Synopsis methodica Lichenum* Vol. 2. (Martinet, Paris).

NYLANDER, W. (1866a). Quaedam addenda ad nova criteria chemica in studio Lichenum. *Flora, Jena* 49, 233-234.

NYLANDER, W. (1866b.) Circa novarum in studio Lichenum criterium chemicum. *Flora, Jena* 49, 198-201.

NYLANDER, W. (1866c). Collectio Lichenum ex insula Cuba. *Flora, Jena* 49, 289-295.

NYLANDER, W. (1867). Synopsis Lichenum Novae Caledoniae. *Bull. Soc. Linn. Normandie sér.* 2, 2, 39-140.

NYLANDER, W. (1868). Lichenes Angolenses Welwitschiani. *Bull. Soc. Linn. Normandie sér.* 2, 2, 508-521.

NYLANDER, W. (1869a). De reactionibus in genere *Physcia*. *Flora, Jena* 52, 321-322.

NYLANDER, W. (1869b). *Synopsis Lichenum* Vol. 2 (Martinet: Paris).

NYLANDER, W. (1870). Recognitio monographica Ramalinarum. *Bull. Soc. Linn. Normandie sér.* 2, 4, 101-180.

NYLANDER, W. (1872). Observata lichenologica in Pyrenaeis orientalibus. *Bull. Soc. Linn. Normandie sér.* 2, 6, 256-328.

NYLANDER, W. (1874). Addenda nova ad Lichenographiam europaeam. *Flora, Jena* 57, 6-16, 305-318.

NYLANDER, W. (1875). Addenda nova ad Lichenographiam europaeam. *Flora, Jena* 58, 6-15, 102-106, 297-303, 358-364, 440-448.

NYLANDER, W. (1881). Addenda nova ad Lichenographiam europaeam. *Flora, Jena* 64, 2-8, 177-189, 449-459, 529-541.

NYLANDER, W. (1882). Addenda nova ad Lichenographiam europaeam. *Flora, Jena* 65, 451-458.

NYLANDER, W. (1883). Addenda nova ad Lichenographiam europaeam. *Flora, Jena* 66, 97-109, 531-538.

NYLANDER, W. (1885). *Synopsis Methodica Lichenum Omnium huiusque cognitorum*. II (Lechevalier, Paris).

NYLANDER, W. (1888). *Lichenes Novae Zelandiae* (P. Schmidt: Paris).

NYLANDER, W. (1889). *Lichenes Insularum Guineensium* (Paul Schmidt: Paris).

NYLANDER, W. (1900). Lichenes Ceylonenses et additamentina ad lichenes Japoniae. *Acta Soc. Sci. Fenn.* 26(10), 1-33.

OSHIO, M. (1968). Taxonomical studies on the family Pertusariaceae of Japan. *J. Sci. Hiroshima Univ. sér.* B., *div.* 2, 8, 1-163.

PERSOON, C. H. (1794). Einige Bemerkungen über die Flechten, nebst Beschreibungen einiger neuen Arten aus dieser Familie der Aftermoose. *Ann. Bot. (Usteri)* 7, 1-32, 155-158.

PERSOON, C. H. (1811). Novae lichenum species. *Ann. Wetterauischen Ges. Gesammte Naturk.* 2, 9, 20.

PERSOON, C. H. (1826). Lichenes. In Gaudichaud, Botanique, *Voyage Autour du monde, exécute sur les corvettes de S. M. l'Uranie et la Physicienne pendant les années 1817-1820, 187-215.* (Pillet Aine: Paris).

POELT, J. (1952). Die Lecanora subfusca-Gruppe in Suddeutschland. *Bayeriche Bot. Ges.* 29, 58-69.

POELT, J. (1961). *Lichenes Alpium et Regionum Confinum.* Fasc. 7, no. 137.

POELT, J. (1965a). Über einige Artengruppen der Flechtengattungen *Caloplaca* und *Fulgensia. Mitt. bot. StSamml. Munch.* 5, 571-607.

POELT, J. (1965b). Zur Systematic der Flechtenfamilie Physciaceae. *Nova Hedwigia* 9, 21-32.

POELT, J. (1974) [1973]. Classification. *In* V. Ahmadjian and M. E. Hale, (eds.) *The Lichens:* Appendix A. (Academic Press: London).

RÄSÄNEN, V. (1932). Zur Kenntnis der Flechtenflora Feuerlands, sowie der Prov. De Magallanes, Prov. de Chiloë und Prov. de Nüble in Chile. *Suomal. elain-ja kasvit Seur van Julk.* 2(1), 1-68.

RÄSÄNEN, V.(1939). Contribucion a la Flora liquenologica Sudamericana. *An. Soc. cient. Argent.* 128, 133-147.

RÄSÄNEN. V. (1944). Lichenes novi I. *Suomal. elain-ja kasvit. Seur. van. Julk.* 20(3), 1-34.

RASSADINA, K. A. (1956). *Bot. Mater. Gerb. bot. Inst. V.A. Komarova* 11:

RICHARD, M. A. (1832). Essai d'une flora de la Nouvelle-Zélande. Lichens. *In* A. Lesson and A. Richard. *Botanique. In* Dumont D'Urville *Voyage de Decouvertes de l'Astrolabe pendant les annees 1826-1829.* 1, 23-28 (Paris).

ROGERS, R. W. (1971). Distribution of the lichen *Chondropsis semiviridis* in relation to its heat and drought resistance. *New Phytol.* 70, 1069-1077.

ROGERS, R. W. (1972a). Soil surface lichens in arid and subarid south-eastern Australia. II Phytosociology and geographic zonation. *Aust. J. Bot.* 20, 215-227.

ROGERS, R. W. (1972b). Soil surface lichens in arid and subarid south-eastern Australia. III The relationship between distribution and environment. *Aust. J. Bot.* 20, 301-316.

ROGERS, R. W. & R. T. LANGE (1972). Soil surface lichens in arid and subarid south-eastern Australia. I Introduction and Floristics. *Aust. J. Bot.* 20, 197-213.

ROGERS, R. W. (1974). Lichens from the T.G.B. Osborn Vegetation Reserve at Koonamore in arid South Australia. *Trans. R. Soc. S. Aust.* 98, 113-124.

RUNEMARK, H. (1956). Studies in *Rhizocarpon* I. Taxonomy of the yellow species in Europe. *Op. bot. Soc. bot. Lund.* 2(1), 1-152.

SANTESSON, J. (1966). Colour reactions of some stable Pd substitutes. *Lichenologist* 3, 215-217.

SANTESSON, R. (1943). The South American Menegazziae. *Ark. Bot.* 30A(11): 1-35.

SATO, M. (1936). Enumeratio lichenum Insula Formosae. *J. Jap. Bot.* 12, 426-432. (Original not seen).

SCHAERER, L . E. (1823-42). *Lichenum Helveticorum spicilegium.* 2 pts (A. Haller: Berne).

SCHRADER, H. A. (1794). *Spicilegium Florae Germanicae* (Ritscher: Hanover).

SCHREBER, J. C. D. (1771). *Spicilegium Florae Lipsicae* (Dyk: Lipsiae).

SCOPOLI, J. A.(1772). *Flora Carniolica.* 2nd Ed. (Krauss: Vindobonae).

SHEARD, J. W. (1967). A Revision of the Lichen genus *Rinodina* (Ach.) Gray in the British Isles. *Lichenologist* 3, 328-367.

SIERK, H. A. (1964). The genus *Leptogium* in North America, North of Mexico. *Bryologist* 67, 245-317.

SMITH, A. L. (1911). *A monograph of the British Lichens.* Vol. 2 (British Museum, London).

SMITH, A. L. (1918). *A monograph of the British Lichens.* Vol. 1. (British Museum, London).

SMITH, J. E. & J. SOWERBY (1790-1814). *English Botany* (London).

SOMMERFELT, S. C. (1826). *Supplementum Florae Lapponicae quam edit S. Wahlenberg.* (Christianiae: Borgianis).

SPECHT, R. L. (1972). The Vegetation of South Australia. Ed. 2. Handbooks of the Flora and Fauna of South Australia. (Government Printer: Adelaide).

SPRENGEL, C. (1827). Lichenes, IV. In *Systema Vegetabilium* (C. Linneus ed.), 237-310, 376-580.

SPRENGEL, K. P. J. (1805). *Anleitung zur Kenntniss der Gewächse. III: Einleitung in das Studium der cryptogamischen Gewächse.* (Jümmel: Halle).

STEINER, J. (1902). Sweiter Beitrag zur flechtenflora Algiers. *Verh. zool-bot. Ges. Wien* 12, 469-487.

STEVENS, G. N. & R. W. ROGERS (1978). The Macrolichen flora from the Mangroves of Moreton Bay. *Proc. R. Soc. Qd.* 90, 33-49, pl. 1.

STIRTON, J. (1877-78). On certain lichens belonging to the genus *Parmelia. Scott. Nat.* 4, 200-203, 252-254, 298-299.

STIZENBERGER, E. (1861). *Anzia*, eine neue Flechtengattung. *Flora, Jena* 44, 390-393.

SWARTZ, O. (1788). *Nova genera et species plantarum, seu prodromus descriptionum vegetabilium, maximam partem incognitorum quae sub itinere in Indiam occidentalem annis 1783-87 digessit* (Holmiae).

SWINSCOW, T. D. V. (1959). Toxicity Pd and Bd. *Lichenologist* 1, 120.

TATE, R. (1882a). A list of the Charas, Mosses, Liverworts, Lichens, Fungs and Algals of Extra-tropical South Australia. *Trans. Proc. and Rep. R. Soc. S. Aust.* 4, 5-24.

TATE, R. (1882b). Additions to the flora of South Australia. *Proc. R. Soc. S. Aust.* 5, 82-93.

TAVARES, C. N. (1966). The genus *Pannaria* in Portugal. *Port. Acta biol. ser.* B, 8, 1-16.

TAYLOR, T. (1844). Descriptions of some new Mosses and Lichens from the Australian colonies. *Phytologist* 1, 1093-1096.

TAYLOR, T. (1847). New Lichens, principally from the Herbarium of Sir William J. Hooker. *London J. Bot.* 6, 148-197.

THOMSON, J. W. (1950). The species of *Peltigera* of North America north of Mexico. *Am. Midl. Nat.* 44, 1-68.

THOMSON, J. W. (1963). The lichen genus *Physcia* in North America. *Beih. Nova Hedwigia* 7, 1-172.

THOMSON, J. W. (1967). The lichen genus *Baeomyces* in North America north of Mexico. *Bryologist* 70, 285-298.

THOMSON, J. W. (1968). *The lichen genus Cladonia in North America* (University of Toronto Press, Toronto).

TIBEL, L. (1969). The genus *Cyphelium* in Northern Europe. *Svensk bot. Tidsk.* 63, 465-485.

TIBEL, L. (1971). The genus *Cyphelium* in Europe. *Svensk Bot. Tidsk.* 65, 138-164.

TIBEL, L. (1975). The Caliciales of boreal North America. *Symb. bot. upsal.* 21 (2), 1-136.

TORNABENE, F. (1848). Lichenographia Sicula. *Atti Accad. Gioen.* Catania. (Original not seen).

TREVISAN, V. (1851-52). Memoria sul Tetranychus Passerinii. *Rivista Periodic Lavori I.R. Acad. Padua.*

TREVISAN, V. (1880). Sulle Garovaglinee, nuova tribu de Collemacee. *Rc. Ist. Lomb. Sci. Lett.* ser. 2, 13, 65-77.

TUCKERMAN, E. (1862). Observations on North American and other Lichens. *Proc. Am. Acad. Arts Sci.* 5, 383-422.

TUCKERMAN, E. A. (1882). *A Synopsis of the North American Lichens Part I.* (Cassino: Boston).

VERSEGHY, K. (1962). Die Gattung *Ochrolechia. Beihefte Nova Hedwigia* 1, 1-146.

VILLARS, D. (1786-89). *Histoire des plantes de Dauphine.* 3 Vols. (Villars: Grenoble).

WADE, A. E. (1965). The genus *Caloplaca* Th. Fr. in the British Isles. *Lichenologist* 3, 1-28.

WAINIO, E. A. (1887-97). Monographia Cladoniarum universalis. Part 1, *Acta Soc. Fauna Flora fenn.* 4, 1-509; Part 2, l.c. 10, 1-498; Part 3, l.c. 14, 1-268.

WAINIO, E. A. (1888). Notulae de synonymia lichenum. *Meddn Soc. Fauna Flora fenn.* 14, 20-30.

WAINIO, E. A. (1890a). Étude sur la classification naturelle et la morphologie des Lichens du Brésil. Pars Prima. *Acta Soc. Fauna Flora fenn.* 7(1), 1-247.

WAINIO, E. A. (1890b). Étude sur la classification naturelle et la morphologie des Lichens du Brésil. Pars Secunda. *Acta Soc. Fauna Flora fenn.* 7(2), 1-256.

WAINIO, E. A. (1898). Lichenes quos in Madagascaria centrali Dr. C. Forsyth-Major a. 1896 collegit. *Hedwigia* 37, (33)-(36).

WAINIO, E. A. (1899). Lichenes in Caucaso et in peninsula taurica annis 1884-1885 ab H. Lojka et M. a Dechy collecti. *Természetr. Füz.* 22: 269-343.

WAINIO, E. A. (1903). Lichens. In *Expédition Antarctique Belge. Résultats du Voyage du S.Y. Belgica en 1897-1899. Rapports Scientifiques, Botanique.* (J. E. Buschmann: Anvers).

WAINIO, E. A. (1921). Lichenographia fennica 1, Pyrenolichenes iisque proximi Pyrenomycetes et Lichenes imperfecti. *Acta Soc. Fauna Flora fenn.* 49(2), 1-274.

WEBB, P. B. and S. BERTHELOT (1824, 1836, 1840). *Histoire naturelle des Iles Canaries* (Bethune-Mellier: Paris).

WEBER, W. A. (1962). Environmental modification and taxonomy of the crustose lichens. *Svensk bot. Tidskr.* 56, 293-333.

WEBER, W. A. (1965). The lichen flora of Colorado: 2. Pannariaceae. *Univ. Colo. Stud. Ser. Biol.* 16, 1-10.

WEBER, W. A. (1968). A taxonomic revision of *Acarospora* subgenus *Xanthothallia*. *Lichenologist* 4, 16-33.

WEBER, W. A. and WETMORE, C. M. (1972). Catalogue of the Lichens of Australia exclusive of Tasmania. *Beih. Nova Hedwigia* 41, 1-137.

WERNER, R. G. (1932). Contribution a la flore cryptogamique du Maroc. Fasc. VI. *Bull. Soc. Sci. nat. Maroc.* 12(4/6), 156-163.

WETMORE, C. M. (1967). Lichens of the Black Hills of South Dakota and Wyoming. *Publs. Mich. St. Univ. Mus.* Biological Series 3(4), 209-464.

WETMORE, C. M. (1970). The lichen family Heppiaceae in America. *Ann. Mo. bot. Gdn.* 57, 158-209.

WIGGERS, F. H. (1780). *Primitiae Florae Holsatiae* (Bartsch: Kiliae).

WILLDENOW, C. L. (1787). *Florae Berolinensis Prodromus secundum systema Linneanum ab illustr. C.P. Thunbergio emendatum conscriptus* (W. Vieweg: Berlin).

WILLIS, J. H. (1953). *Australian Geographical Society Reports 1. The Archipelago of the Recherche.* Part 3. Plants.

WILSON, F. R. M. (1889). A description of Forty-one Victorian Lichens new to Science. *Victorian Nat.* 6, 61-69.

WILSON, F. R. M. (1891). On Lichens collected in the colony of Victoria, Australia, *J. Linn. Soc., Bot.* 28, 353-374.

WIRTH, M. & M. E. HALE (1963). The lichen family Graphidaceae in Mexico. *Contr. U.S. natn. Herb.* 36(3): 63-119.

YOSHIMURA, I. & A. J. SHARP (1968). A Revision of the genus *Gymnoderma*. *Am. J. Bot.* 55(5), 635-640.

YOSHIMURA, I. (1973). Notes on *Gymnoderma melacarpum* comb. nov. *J. Jap. Bot.* 48, 283-288.

ZAHLBRUCKNER, A. (1892). O. Kuntze's 'Revisio generum plantarum' unit Bezug auf einge flechtengattungen. *Hedwigia* 31, 34-38.

ZAHLBRUCKNER, A. (1902). Diagnosen neuer und ungenügend beschriebener kalifornischer Flechten. *Beih. Botan. Centralbl.* 13, 149-163.

ZAHLBRUCKNER, A. (1903-07). Lichenes *(Flechten)* B. Specialler Tiel. In *Die Natürlichen Pflanzenfamilien* (A. Engler and K. Prantl, eds.) 1: 49-249.

ZAHLBRUCKNER, A. (1908). New North American lichens. *Bull. Torrey Bot. Club* 35: 297-300.

ZAHLBRUCKNER, A. (1922-1941). *Catalogus Lichenum Universalis*, 10 Vols (Bortraeger: Leipzig).

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