

AUSTRALIAN SYSTEMATIC BOTANY SOCIETY

NEWSLETTER

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ASBS Council

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This publication, the official newsletter of the Society is produced four times each year and deadlines for copy are the last day of February, May, August and November.

Please send contributions, preferably typed in duplicate and double-spaced to the Editor, at the address below. Items from any source and of interest to members are acceptable. Items incorporated in the newsletter will be duly acknowledged.

Please note: Next deadline is 31 May 1980

Subscriptions for 1980	due 1st January.
(Members in Australia	\$8.00 if paid by 31st March
	\$10.00 thereafter
Overseas Members	US\$12.00 or equivalent).

Editor: Mr. A. S. George
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THE FLORA OF CENTRAL AUSTRALIA

The manuscript, of some 1500 pages, was completed early in the year and sent to the publisher on 15 January. A general introduction was written by Rodger Carolin, and a foreword by Lloyd Evans, President of the Academy of Science.

Each genus has been illustrated by at least one line drawing, mostly by Ludwik Dutkiewicz. For Atriplex and Mairean the fruit of most species has been figured.

Congratulations are due to all those involved for getting the project to this stage on schedule - a rare phenomenon in taxonomy. It is less than 4 years since it was proposed.

Unfortunately the Society has been unsuccessful in obtaining financial support so the flora will be expensive - possibly as much as \$35.00.

While royalties will not be paid to authors (there are more than 70) the Society does, despite an offer to waive royalties, stand to receive some royalties once the sales reach a predetermined level. Copies of the book will, however, be available to authors at half price.

J. Jessop, Chief Editor.

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GEOGRAPHICAL STATE SUBDIVISIONS

Most of the State Herbaria have adopted a system of geographical subdivisions for their own State. These are used by them for sorting their specimens in their collections, grouping them in published lists, and in other ways.

The difficulty in using these geographical regions is partly in establishing the basis for the regions, partly in determining on large-scale maps where the boundaries lie and partly in not knowing how permanent regions known to have been in use are considered by the respective herbaria to be.

To assist in making answers to questions of this sort available, each of the herbaria was approached for an account of their current regions. The intention is not to attempt in any way to encourage uniformity; only to inform.

The replies received are quoted at length, including sometimes comments on broader implications of the question.

WESTERN AUSTRALIA (J.W. Green)

"We have adopted J.S. Beard's latest map as a recommended standard for grouping lists of specimens in publications and for a possible future geographical arrangement of specimens in the Herbarium.

Beard divides the State into botanical provinces and districts, the original boundaries being drawn on the Mines Department base map at a scale of 1:2,500,000. A very small-scale version of the map has already been published (J.S. Beard, "Phytogeographic Regions" in J. Gentilli, "Western Landscapes", Univ. of W.A. Press, 1979), while the full-scale version is to be published in the next issue of our journal "Research Notes", with an explanatory paper. We also plan to print a limited number of extra copies of this map for use in herbaria, field work and other purposes. The base map is so detailed that it should be easy to determine the district into which any locality falls.

We hope that widespread acceptance of this new map will lead to the long-term stability which has been so lacking in the past. I see little likelihood of it being changed for many years to come.

Regarding a national system, I feel that a great deal more discussion of this complex topic would be needed before an acceptable national system could be developed. We are certainly not in a position to make recommendations at present".

NORTHERN TERRITORY

"Subdivisions in the NT used by the Herbarium of the NT (Alice Springs) and DNA (Darwin) are based on longitude and latitude. These divisions closely correspond with the Territory Pastoral divisions, and also with the national vegetation units.

There is no likelihood of any change, at least in the foreseeable future". (The "Darwin and Gulf", "Victoria River" and "Barkly Tableland" districts as used by Chippendale (Proc.Linn.Soc.NSW 96 (1972)209) are still recognized, with "Central Australia" divided into northern and southern districts along the 23^o line.)

SOUTH AUSTRALIA

All boundaries are defined by lines of longitude and latitude and are clearly marked on the map in the back of the J. Adelaide Bot. Gard. No consideration is being given to changing this system.

QUEENSLAND (R.W. Johnson)

"The geographical arrangement used for the herbarium collection is based on Pastoral Districts, which were officially designated soon after settlement. They are still used by our Department of Lands and represent an amalgamation of the hierarchy of Portions, Parishes and Counties. They were used for statistical purposes in Queensland until 1941. Since then a number of different systems have been proposed and used. The same Districts are the basis for geographical distributions outlined in taxonomic research and extension publications.

The Districts, though purely administrative, have some value as units for floristic subdivision. The boundaries are commonly along major dividing ranges so they have some geographical value. They are a standard feature of many of the maps printed by our State Government and it would be easy to obtain copies for any herbarium who required one. We will not be changing this system of subdivision for our herbarium collections regardless of what changes are made by other State Authorities; we cannot afford financially to change. We have no better biogeographic system available if we could afford the change.

For some other purposes, such as detailed biogeographical studies, assessment of the intensity of our collections, etc., we will be using smaller units. Though we have not done any of this work as yet, we are looking towards either the 1:250,000 map sheet subdivisions (1" by 1" 30') or simple 1" by 1" grids as the basic unit. Of these, I at present, prefer the former. If there are 10,000 species in Queensland and if we could see the herbarium holding 1 million specimens, i.e. an average of 100 sheets per species, then using $\frac{1}{130}$ map subdivisions seems more realistic than the $\frac{1}{180}$ degree grid squares.

The selection of a particular system for any particular purpose depends greatly on the amount of data available and the size of the area involved in the study.

Subdivision at too great an intensity is meaningless if there is insufficient data to support it while too many units, regardless of the available data, confuse understanding. Most States (NSW, Qld, WA, SA) seem to be using about 15 subdivisions at present. Using the traditional subdivisions for national projects would provide about 80 units. I make no comment about the appropriateness of the individual units but I would think many more units would lead to difficulties in comprehension for broad scale national projects. There are about 550 1:250,000 map sheets and this seems too many units to use for most purposes particularly over most of semi-arid and arid Australia. Individual degree grid squares would be less attractive.

Some form of amalgamation of these map sheet units (or grid squares) into about 26 groupings which is basically the system we looked at in Queensland and is similar to that supported by David Churchill may have merit where broad treatments of the flora of Australia are required.

NEW SOUTH WALES (B.G. Briggs)

*1. Ecogeographic regions determined largely by climatic conditions and described briefly in the introduction of Flora of New South Wales (Contrib. New S. Wales Natl. Herb. Fl. N.S.W. 1-18, (1961): 2-6). The boundary between the coast and tablelands is an altitudinal line ranging from approx. 600m in the south to almost 1000m in the north. The boundary between western plains and far-western plains is an approximate rainfall boundary. Other boundaries incorporate various combinations of altitude, rainfall and topography.

2. The system is used for incorporation on specimen labels, sorting within the Herbarium collections, recording of distribution in the recently compiled and soon-to-be-published census of plants of New South Wales and the citation of specimens in revisionary treatments. We recommend the use of our system in cases where it is compatible with that used by other States in a national context and where the units defined are appropriate for the information to be presented. The use of grid systems (e.g. the 250,000 map series) are appropriate to some other contexts and also have a real place.

Ideally, some changes could be made to our system to accord better with the flora and environment of, for example, the south-west. The boundaries between slopes, plains and far-western plains could appropriately be moved westwards in the region near the southern State border. However, we have now used our system so extensively, particularly in our recent census compilation, that we feel that any such change at this stage would be unsatisfactory and only produce confusion.

3. Small-scale maps showing the subdivisions are available in Flora of New South Wales, and are about to be published in the forthcoming census. A smaller map will be included (probably on the back cover) of the proposed new serial "Cunninghamia" which will include ecological articles and be published by the Herbarium. Inclusion of a small map as a regular feature in "Telopea" is being considered.

In the Herbarium we use copies of a map of New South Wales at a scale of 1:000,000 available from the N.S.W. Department of Lands, Sydney. We have traced our boundaries on to copies of this map and would be prepared to lend copies of a tracing or a dyeline. This map consists of 4 sheets (\$1.80 each of \$6 for the set).

4. No change in the boundaries is expected in the near future".

VICTORIA (D.M. Churchill)

"1. Latitude and longitude form the basis of our recorded locality information, for defining both point locations and areas. Metric Grids, Land Conservation Regions, Parishes, Shires and many other systems are available but not used by the National Herbarium for recording plant distribution data.

2. A. User orientation

- (i) Plant taxonomists and chemists who want to find plants require precise locality data.
- (ii) Popular writers who want to know the range of distribution with disjunctions of populations of species.
- (iii) Local Government authorities who require information about their local flora.
- (iv) Zoologists requiring flora lists and vegetation types for predicting animal distribution ranges.
- (v) Planning authorities who require the distribution of rare and restricted plants, and associations of plants.
- (vi) Management authorities (National Parks and Forestry) who require information on botanical quality through number expressed as a ratio of the plant introductions to native plants in an area.
- (vii) Latitude, longitude and unique species number provides easy data manipulation in computer storage for multiple use and retrieval at the cheapest cost compatible with service.

2. B. 1:250,000 maps versus other scales is not relevant to our operational side. Data recorded tends to be spot locations and these are drawn together at any scale.

3. The maps from which we obtain latitude longitude data from are:-

- 1:25,000 rarely
- 1:50,000 rarely
- 1:100,000 often
- 1:250,000 quite often

Computer generated maps are produced at 1,500,000 and 1:1,000,000. Species lists can be generated down to 1 minute of latitude longitude.

4. The system works very smoothly and is unlikely to change in the foreseeable future."

5. The basic units are shown in maps in Churchill & de Corona, "The distribution of Victorian Plants" (1972), where a system for further subdividing these units into 10' squares is also indicated.

TASMANIA (A.E. Orchard)

"This matter is at present under review. Our labels have been designed with a category for District, with the intention that eventually we would attempt to define more or less natural subdivisions of the State, probably along the lines of those used in New South Wales. However, this has not yet been done, and the only

District designations that we are using are Bass Strait Islands, and Macquarie Island (the latter, of course, gets little use). Both these regions come within the State boundaries but are obvious segregates.

At present, all new additions to the Herbarium are being given Latitude and Longitude co-ordinates as well as a verbal description of locality, and most loans that we are sending out have their labels updated before despatch, and where possible Lat. and Long. are added to these as well. As a general rule we try to give these co-ordinates to the nearest minute. This seems to us to be the most simple and satisfactory method, given our limited resources, as the collection locality can be pinpointed with a fairly high degree of accuracy by anyone who has access to a standard map or atlas".

CONFERENCES, SEMINARS

John Jessop.

1980 ANZAAS -- SECTION 12 (BOTANY)

The following information, which is probably relevant to most A.S.B.S. members, has been extracted from the complete programme for Section 12 (Botany).

Monday, 12th May	11.15 a.m.	Presidential address Dr. R.C. Carolin
Tuesday, 13th May	9-12.30 p.m.	A.S.B.S. Contributed paper session Chairman: Dr. J.P. Jessop
Wednesday 14th May	9-12.30 p.m.	Concurrent symposiums: 1. Man and the Murray Darling system. 2. Impact of man on inshore flora and fauna.
	7.45 p.m.	A.S.B.S. A.G.M. N.T. Burbidge Memorial Lecture Dr. H.T. Clifford.
Thursday 15th May	9-12.30 p.m.	Concurrent symposiums: 1. Australian rangelands - their use and conservation. 2. Co-evolution.
Friday 16th May	9-12.30 p.m.	Concurrent sessions: 1. Contributed papers: Studies on lower plants. Convenor: Dr. H.P. Ramsey 2. Symposium: Australian rangelands - their use and conservation (cont.)

Conference on the Biology of Banksia - advance notice

The Perth Chapter of the Australian Systematic Botany Society plans to convene a one-day conference on the biology of Banksia on Monday, 10 November, 1980. The venue will be at King's Park and Botanical Garden, Perth, W.A. It is hoped that the talks will cover aspects of taxonomy, animal/plant relationship, physiology, breeding systems, horticulture, diseases and general biology of the genus.

People interested in giving talks or attending are asked to contact the undersigned so that more detailed information can be made available.

John Scott, W.A. Herbarium, George Street, South Perth, 6151.

Steve Hopper, W.A. Wildlife Research Centre, P.O. Box 51,
Wanneroo W.A. 6065.

SECOND INTERNATIONAL CONFERENCE ON THE SOLANACEAE

Following the continued success of the series of International Conferences on the Umbelliferae, Asteraceae, Poaceae, Leguminosae and Solanaceae, it is expected that a second Solanaceae Conference will be held in Missouri in 1982. At this stage, planning has only just begun but the Conference may be organised by Dr. W.G. D'Arcy with a small committee, and may be held at the Missouri Botanic Garden. No precise date is yet available but it will be held in summer or late summer. Anyone likely to contribute or to attend is asked to get in touch with Dr. D'Arcy (MQ) or with D. E. Symon (ADW).

David Symon

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TAXONOMIC NOTICES

LILIALES STUDY GROUP

Most botanists are no doubt aware of the considerable confusion which surrounds supra-generic classification in the Monocotyledons, especially the basal group, the Liliales. No two taxonomists appear able to agree on the definition, composition or classification of the group, and I feel much of the confusion could be caused by botanists working in isolation.

John Jessop recently aired a proposal to form an informal association of botanists interested in the monocotyledons and especially the Lillies. However, due to numerous other commitments, he has been forced to terminate his offer of group coordinator and suggested I might consider attempting to organize the group.

At present, a yearly newsletter is envisaged dealing with research projects, ideas, requests for material etc. Perhaps an informal get together at the International Botanical Congress.

If you are interested in such an association, please contact me at the address below. A preliminary meeting is planned at the State Herbarium of South Australia on Monday, May 12, 1980, during ANZAAS in Adelaide.

G. J. Keighery
King's Park and Botanic Garden
West Perth, Western Australia 6005.

CALLISTEMON AND MELALEUCA

In Blumea 24(1) 119-122 (1978) J.W. Dawson proposed uniting Callistemon and Melaleuca using the species found in New Caledonia as a basis for his argument. A study of Australian material presently under these names would support this view.

Bentham in Flora Australiensis (1867) separated the two genera on the basis of the stamens being free in Callistemon and united into five bundles in Melaleuca. However he made an exception of the taxon called C. speciosus DC. which although having united stamens he placed in Callistemon because of its general appearance, stamen length and leaf venation. With additional intermediate species being described including C. viminalis and M. groveana the value of the traditional criteria for distinguishing these genera became very doubtful.

The combining of the two genera as originally proposed by Mueller can easily be justified but the resulting nomenclatural changes would compound the difficulties with this group which also has many taxonomic problems. For this reason I would like comment on the proposal that the two genera be separated arbitrarily as follows:-

- Stamens all free Callistemon
- Stamens fused into bundles, a ring or
a combination of fused stamens with
some free Melaleuca

This would require the transfer of some species such as C. speciosus and C. viminalis to the genus Melaleuca. In addition I would include the genus Sinoga in Melaleuca as its stamens are in a lobed ring and it is closely related to Melaleuca angustifolia.

N.B. Byrnes, Queensland
Herbarium

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PERSONNEL

National Herbarium of Victoria.

Mr. Philip Short has just (February) taken up an appointment as a botanist at the National Herbarium of Victoria. Philip graduated from the University of Adelaide in 1975, completed B.Sc. Honours there on Apium (Umbelliferae) in 1976, and is currently nearing the end of his Ph.D. work on Compositae (Inuleae) undertaken at Flinders University, Adelaide.

Helen Aston

Western Australian Herbarium

Kevin Kenneally has returned to the herbarium after spending six months in Britain, Europe and North America on a Churchill Fellowship.

The Fellowship was to enable him to study, as a botanist, methods of encouraging amateur participation in natural history data collecting. As the immediate past President of the Western Australian Naturalists Club Kevin had successfully involved amateurs in a biological survey of the Wongan Hills and in the establishment of the Tomato Lake Field Study Centre with a grant from the Schools Commission.

Kevin was based in the U.K. at the Royal Botanic Gardens, Kew, which afforded him every opportunity to talk to staff members there (as well as at the British Museum) who are involved with amateur groups. Visits were also made to the Biological Records Centre at Monkswood, Society for the Promotion of Nature Conservation, Royal Society for the Protection of Birds, Nature Conservation Council and the Scottish Field Study Centre at Kindrogan. The opportunity was also taken to join local naturalists on field excursions and to talk with them on how they perceived their role and what their expectations were as a result of being involved.

In Europe visits were made to Paris (Society for the Protection of Nature), Uppsala and Stockholm ("Project Linne" - mapping the Swedish Flora using amateurs), Helsinki and Oslo (Scandinavian flora projects), Copenhagen (Danish Nature Conservancy Council), Leiden (Mapping Netherlands flora) and Munich (mapping Bavarian flora).

In North America education programmes run by the New York Botanical Garden and the Toronto Science Centre were investigated. Studies were made of nature trails and the use of amateurs to collect natural history data in the Grand Canyon National Park and Muir Woods National Monument (Redwood, Sequoia sempervirens, reserve).

Kevin returned home via Hawaii (which enabled him to visit the Bishop Museum) and Fiji where he was able to study mangroves. A report of his Fellowship study tour will be prepared for the Churchill Trust. Some of the points that will be considered include:

1. The effective use of amateurs in "Base-line" biological surveys.
2. The European "Network System" in Australia - is it feasible?
3. Putting Natural history back into the school curriculum.
4. The energy crisis - its effects on conservation. Any member of A.S.B.S. who may be interested in the study should contact Kevin Kenneally at the Western Australian Herbarium.

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CHAPTER NEWS

ALICE SPRINGS

Andrew Mitchell was among a number of speakers at a recent Plant Introduction Workshop held at Alice Springs. While most speakers were concerned with useful grass, legume and fodder tree introductions for the pastoral industry, Andrew spoke on the need for more research and practical experimentation in the field of amenity horticulture. He outlined the history of gardening in Central Australia, its successes and failures, and detailed fruitful areas for further research.

Also Peter Latz returned to the Alice after an absence of 12 months. Peter has been in Canberra, part of the time with the ANU's School of Prehistory and has now completed the draft text for his new book on food plants of the desert Aborigines.

Andrew Mitchell

PERTH

A seminar was held at the W.A. Herbarium on 12 February. Dr. Peter Bridgewater presented the paper "Small area plant geography - a local case study." An abstract was published in ASBS Newsletter 21: 11, 12.

Stephen Hopper

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BOOK NOTICES

Passion to know, by Mitchell Wilson, Weidenfeld & Nicholson, London, 1972.

This very readable, semi-popular book is unlikely to be found in institutional libraries; it was found in a local council library. It is interesting as background reading on the national differences observed in scientists and their training and research, especially for younger scientists who, to give a minor example, probably do not know that Ph.Ds were only conferred by Australian universities after 1949.

The title is based upon the author's assertion that scientists belong to "that infinitely small number of men who enjoy their work, even with passion".

In turn, he examines the U.S.A., England, France, Germany, Israel, Russia, Japan, Australia and India, concentrating on the physical sciences (his training was in physics). For each country he traces the history of scientific enquiry, examining in particular the motivation, schooling and university systems, and other possible influences on future scientists. He looks at the social and political impact of discoveries, pointing out that the discoverer often had no idea of the possible applications of his concept. He also points out that inventions can only be suppressed temporarily. The sewing machine, the nuclear bomb, and the biro come to mind.

If one can judge from the Australian section, this book is generally accurate and well-researched, although to a botanist it is rather biased towards the physical sciences. One small quibble in that section is that prickly pear came from South America, not "probably from Africa". Mr Wilson frequently makes generalisations; two examples:- in Australia there is "hostility to any frame of mind not directly aimed at making money", and "the quality which Australians prize is being 'matey'". Unfortunately, such statements seem to contain at least a modicum of truth.

Karen Wilson.

Botany in China: Report of the Botanical Society of America Delegation to the People's Republic, May 20 - June 18, 1978. Published by the U.S. - China Relations Program, Stanford University: August 1979. Obtainable from Missouri Botanical Garden, 2345 Tower Grove Avenue, St. Louis, Missouri 63110, U.S.A., by remittance of \$US7.50 to "Missouri Botanical Garden", or by invoice with an additional \$US1.00 invoicing fee.

Most information of use to taxonomists gained by this delegation has been published by Bartholomew, Howard and Elias in Phytotaxonomy in the People's Republic of China (Brittonia 31(1):1-25(1979)). However, Botany in China reports on many diverse fields of botany, and places taxonomic and herbarium information into an overall view of the work of each of the 36 institutes visited. It might therefore be an interesting adjunct to the Brittonia article and members may appreciate this notification of its existence.

Helen Aston.

Weeds of Queensland

The Department of Primary Industries has recently released a book called "Weeds of Queensland" written by H.E. Kleinschmidt and R.W. Johnson of Botany Branch.

The book contains over 450 pages covering more than 350 weeds. Each weed has a brief description with its common and scientific name. Notes on its origin, distribution and control are also included. There are chapters on weed control, legislation, weed identification, weed description and native woody weeds combined with an index to find a particular weed of interest. All weeds have either a line drawing or black and white photograph, and in addition there are 57 colour photographs.

The book is available from Information Branch, Department of Primary Industries, G.P.O. Box 46, BRISBANE, Q. 4000. Personal shoppers can go to the 10th floor of Mineral House at 41 George Street, Brisbane.

Price is \$14.00 (including postage).

Lichens of South Australia, by Rex B. Filson and Roderick M. Rodgers. 197pp. Government Printer, South Australia. Published 1 November 1979. Price \$10.50.

This, the first regional lichen flora published in Australia this century, covers all lichens known to occur in South Australia as well as some from adjacent States which should occur in S.A. Introductory sections cover structure, terminology, chemistry, ecology, collection and curation of lichens. Such accounts are necessary and valuable since lichenology requires such a different approach from phanerogamic taxonomy. The writing is clear and concise. Artificial keys with well-contrasted leads are provided for the determination of families, genera and, in most cases, species. Diagnoses are given for most species, but for poorly known groups only generic details are given. Many species are illustrated by black and white or colour plates, and by line drawings of asci and ascospores. The 16 pages of colour are adequate but not well reproduced. Precise locality data are cited; while this is scientifically valuable, one hopes that unscrupulous lichen collectors will not deplete populations of uncommon taxa.

A. S. George

Eucalypts of Western Australia, by C.A. Gardner, edited by T.E.H. Aplin. 260pp.. Western Australian Department of Agriculture Bulletin 4013. Published 1979. Price \$8.

This presents in book form the series "Trees of Western Australia" published by Charles Gardner in "The Journal of Agriculture of Western Australia" between 1952 and 1966. The text is essentially that of Gardner, but minor additions and alterations have been made. The plates are well reproduced. 177 species are covered.

A. S. George

The Student's Flora of Tasmania. Part 4A Angiospermae. Orchidaceae, by Winifred M. Curtis. 138pp. Government Printer of Tasmania. Published 21 January 1980, vide A.E. Orchard (1979 on reverse side of title page). Available from Government Printer, G.P.O. Box 307c, Hobart, Tasmania 7001. Price \$14.00.

This provides keys to genera and species, detailed descriptions (through lacking measurements of many characters), brief notes on distribution, habitat and flowering times, and many illustrations. The line drawings are well-executed by D.I. Morris. There are 8 pages of colour photographs which vary in reproduction, some being slightly out of register. Three new infraspecific combinations are made,

and one new species described. The book is a great improvement on "Native Orchids of Tasmania" by M.J. Firth.

A. S. George

Acacias of South Australia, by D.J.E. Whibley (with assistance from N.N. Donner and illustrated by L. Dutkiewicz) Government Printer, South Australia, 29 February 1980. Price not available at the time of writing.

The 97 Acacia species currently recognised for South Australia are mostly admirably portrayed in this excellent book of 240 pages. In a genus the size of Acacia (around 700 species at present recorded for Australia) species identification is understandably an onerous task. Mindful of this fact the author provides ample assistance by giving not only the usual descriptive key to species but also an "illustrated key" comprising illustrations which render "matching taxonomy" a simple task. Species in both keys are arranged in seven different groups and are numbered so that after arriving at a name the identifier can check further details by turning to the text.

Each species in the text is beautifully illustrated both by a line drawing and a photograph (some in colour); a distribution map is also provided. Where available, common names are given and relevant synonymy indicated; etymology of each name and place of publication are also provided. Species descriptions are simple and cover salient features. Additional information such as flowering time, habitat notes, cultivation tips (including potential uses, rates of growth, etc.) and notes on related species are included.

This book is intended for both amateur and professional botanists as well as the layman. The content certainly satisfies all these needs in a very adept manner. My only disappointment is that not more Acacia species grow in South Australia so they too could come under the scrutiny of David and his colleagues.

Bruce Maslin

MISCELLANEA

Russian flowers fail to bloom in space

Soviet Union scientists have revealed that attempts to grow flowers in space by the last crew of its Salyut 6 orbiting laboratory were unsuccessful. This is not the first time cosmonauts have been unable to produce flowering plants in their "space garden" and Soviet scientists believe that the lack of gravity is responsible. One theory suggests that the plants are unable to get rid of waste products in space because of the lack of gravity, and are gradually poisoned by their own waste.

Some of the Soviet plant growth experiments have been successful. Wheat, for example, germinates better, reaching a length of about 300mm in just over two weeks. The last cosmonauts were also able to eat some of the spring onions they had grown. "Flight International", Vol. 116, no. 3683, page 1280, 20 October 1979.

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