

Australian Plants

Registered for posting as a periodical—

December, 1975 — VOL. 8, No. 65

Category B

Volume 8 will comprise Issues 61-68

50c



Photography by M. Baldwin

BORONIA MICROPHYLLA "Small-leaved Boronia"

This small pinnate leaved shrub is recorded in N.S.W. and southern Qld. In N.S.W. the species grows on sandstone or granite derived soils and is particularly common in the upper Blue Mountains. It is usually found in heath communities or as an understory shrub in dry sclerophyll forests. Within N.S.W. *Boronia microphylla* is recorded from the north and south coast, the north and central tablelands and the central western slopes. — Hybrids between *Boronia microphylla* and *Boronia floribunda* have been recorded from the Wentworth Falls area of the Blue Mountains.

The foliage of *Boronia microphylla*, like all other *Boronia* species, contains oil glands which emit a strong aromatic perfume when crushed. The delicately pink flowers can be seen from October to January — this being the normal flowering period for the species.

An introduction to the Plant Family Rutaceae

By Jim Armstrong, Botanist, Royal Botanic Gardens, Sydney

The Rutaceae are a large group of plants inhabiting the warmer regions of the earth. The family's name is derived from the European herb rue, commonly known as the 'herb of grace' (*Ruta graveolens*) and renowned since antiquity for its medicinal qualities.

—This remarkable herb was first mentioned in very early Greek and Roman poetry. At that time it was believed that Rue had been given by the gods to mankind to help him cure sickness and wounds, or to avert disaster. Confident in this belief it is not surprising that King Mithridates of Pontus took small daily doses of a mixture of rue and other herbs to gain immunity against the poisons he feared his rivals were using to assassinate him. Other curious practices of the day involved dipping the tips of arrows in juice extracted from rue to ensure that these weapons would never miss their targets.

—In Shakespeare's day the word rue meant sorrow or pity and came to be associated with repentance. During this time people in England lived in constant dread of bubonic plague which swept over the country in fierce epidemics. A number of herbs, including rue, were used to ward off this pestilence. This practice became so ingrained in the folklore of the times that even today, herbs such as rosemary and rue are still carried in the processions of the Lord Mayor of London as a traditional preventive against the plague.

From an economic viewpoint the family Rutaceae is well known for its edible fruits. The genus *Citrus*, with such familiar fruits as the oranges, lemons, etc., has been cultivated since remote times and is believed to be native to the tropical and sub-tropical regions of Asia and the Malay Archipelago. It is this genus more than any other in the plant kingdom that has contributed the finest fruits known to man.

—The table below lists the commonly cultivated species of *Citrus* grown commercially for the edible fruit markets of the world.

● GRAPEFRUIT	—	<i>Citrus paradisi</i>
● LEMON	—	<i>Citrus limon</i>
● LIME	—	<i>Citrus aurantifolia</i>
● MANDARIN	—	<i>Citrus reticulata</i>
● ORANGE — Seville or Sour	—	<i>Citrus aurantium</i>
● ORANGE — Sweet	—	<i>Citrus sinensis</i>
● POMELO or SHADDOCK	—	<i>Citrus grandis</i>

In the following series of articles the family will be discussed in much greater detail. The first article—'The Family Rutaceae'—serves as an introduction to the family in its world context (such matters as the distribution of the family throughout the world, the taxonomic classification and the distinguishing characteristics of the family are discussed in some detail). The second article—'The Family Rutaceae in Australia'—looks closely at those members of the family recorded naturally on the Australian continent.

One hopes that the information presented here will not only satisfy those people already growing the various members of this fascinating family, but may even stimulate an interest in those who have not as yet been adventurous enough to try!

CONTENTS OF THIS ISSUE

The issue is all about the *Boronia* plant family known as Rutaceae.

The main theme of this periodical is CULTIVATION OF AUSTRALIAN WILDFLOWERS.

Many species of *Boronia* have proved difficult to cultivate. While there is a major departure in this issue in devoting so much space to botanical work, the articles on cultivation are of very special value and may be applied to all the more difficult and showy wildflowers.

"The Growing of Rutaceae" by H. M. Hewett	Page 202
"Acradenia the Forgotten Genus"	Page 206 and Page 207

THE PLANT FAMILY RUTACEAE

It is proposed to provide a full reference to each plant family as has been done in this issue for Rutaceae. Further issues will deal with each genus at some length, the first in this series being "Acradenia the Forgotten Genus", page 207 of this issue. Your introduction to Rutaceae is contained in this issue:

"The Family Rutaceae" — Distribution, Classification and Characteristics	Page 195
Sub-Family and Tribal Classification	Page 213
"The Family Rutaceae in Australia" — The tribes and genera	Page 215
"The Current Status of the Sub-family Aurantioideae"	Page 226

THE FAMILY **RUTACEAE**

By *Jim Armstrong, Botanist, Royal Botanic Gardens, Sydney*

This is the first in a series of articles on the family Rutaceae. In this article an account is given of the family throughout the world, and such matters as distribution, family classification and the various family characteristics are discussed. An attempt has been made to synthesize a great deal of information abstracted from many sources and which is, for the most part, inaccessible to the general public.

This initial article sets the scene for the later articles, which will be concerned with the Australian members of the family.

THE DISTRIBUTION OF THE FAMILY

The Rutaceae have a very wide distribution ranging from the hotter to the temperate regions of the world (see Map below).

The family is a large one, and is considered by most authors to consist of 12 tribes* with a total of approximately 150 genera and 1,600 species. The distribution of these 12 tribes is particularly interesting, since it indicates those regions of the world where the Rutaceae are concentrated.

Two tribes in particular have an extensive distribution:

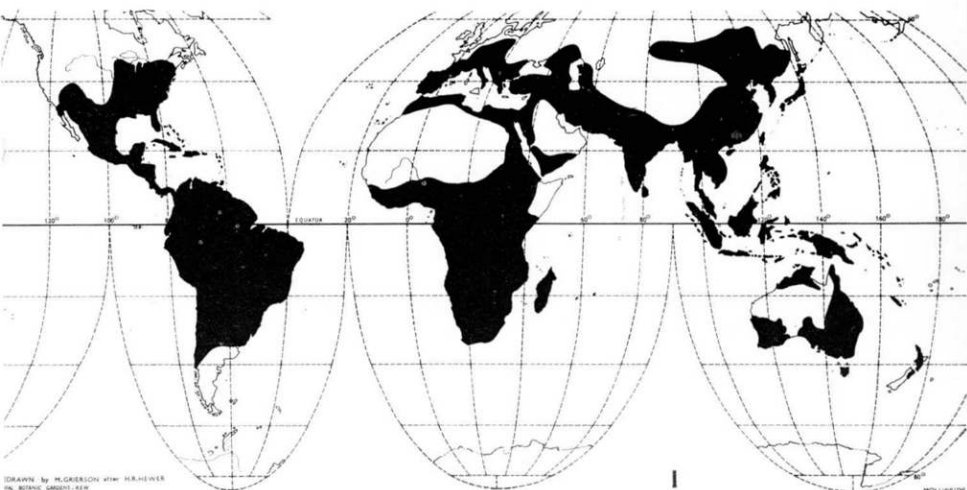
—The *Zanthoxyleae* are widely distributed throughout the tropics and sub-tropics of the old and new world, whilst the *Toddalieae* are scattered throughout temperate and tropical lands.

Five tribes have a very restricted distribution:

—The *Boroniaceae* are predominantly Australian; the *Diosmeae* are for the most part confined to the Cape of Good Hope; the *Dictyolomateae* are restricted to the north-eastern region of South America; the *Rhabdodendreae* are confined to the Amazon Valley of South America, whilst the *Spathelieae* are restricted to the West Indies.

Only one tribe (the *Ruteae*) has adapted to cooler climates and is distributed throughout the sub-tropical and temperate regions of the Northern Hemisphere.

The distribution of the remaining 4 tribes will be discussed in a later section.



Distribution of the Family Rutaceae throughout the world

* The term tribe, which will be used frequently, may be unfamiliar to some readers. It indicates a major subdivision within a family and is used botanically to refer to a group of genera which exhibit certain similar characteristics.

THE FAMILY CLASSIFICATION

For the purpose of this article, the classification of the family follows Engler (1931) and Swingle (1948). Although Engler's classification appears unsatisfactory in the light of present-day botanical knowledge, it is nevertheless the only comprehensive family treatment available in the 20th century. The major groupings recognized by Engler and Swingle, and used in this paper, are as follows (the tribes represented in the Australian flora are shown in *italics*):

RUTACEAE:

<i>Sub-Family</i>	<i>Tribe</i>
1. RUTOIDEAE	I. <i>Zanthoxyleae</i>
	II. Ruteae
	III. <i>Boronieae</i>
	IV. Diosmeae
	V. Cusparieae
2. DICTYOLOMATOIDEAE	VI. Dictyolomateae
3. FLINDERSIOIDEAE	VII. <i>Flindersieae</i>
4. SPATHELIOIDEAE	VIII. Spathelieae
5. TODDALIOIDEAE	IX. <i>Toddalieae</i>
6. AURANTIOIDEAE	X. <i>Clauseneae</i>
	XI. <i>Citreae</i>
7. RHABDODENDROIDEAE	XII. Rhabdodendreae

Throughout this paper the sub-divisions outlined below will be used frequently.**

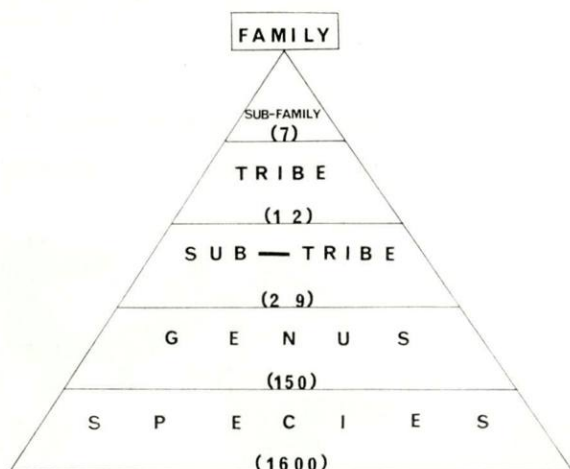


FIGURE 1:

The major subdivisions of the family recognised here. The number in parentheses refers to the number of units at that level of classification, e.g. there are 7 sub-families in the family Rutaceae.

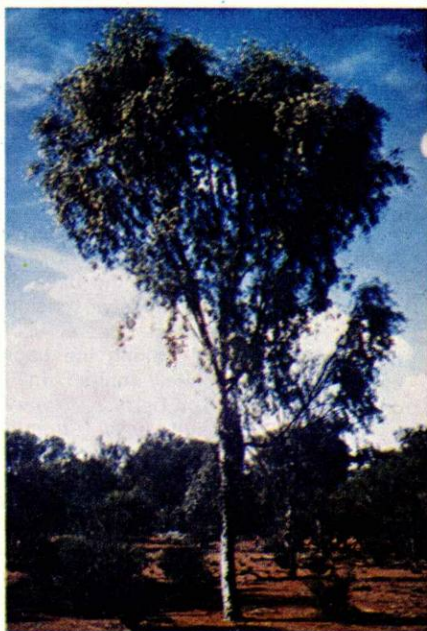
** FAMILY—Family names end in *aceae*. The family Rutaceae consists of the following subdivisions:—

★ SUB-FAMILY—A sub-division of a family based on common botanical characteristics. Sub-family names end in *oideae*. The family Rutaceae is divided into 7 sub-families.

★ TRIBE—A further sub-division of a sub-family. It indicates a major sub-division within a family and is used botanically to refer to a group of genera which exhibit certain similar characteristics. Tribe names end in *eae*. The family Rutaceae is divided into 12 tribes.

★ SUB-TRIBE—A further sub-division of a tribe. Sub-tribal names end in *inae*. The family Rutaceae is divided into 27 sub-tribes.

E.g.: The genus *Boronia* (family Rutaceae) is in the sub-family *Rutoideae*, tribe *Boronieae*, sub-tribe *Boroninae*.



FLINDERSIA MACULOSA — 'Leopard wood' Photography by John Pickard

UPPER: Flowering branch

LOWER LEFT: Mottled trunk

LOWER RIGHT: Flowering tree

The genus *Flindersia* was named by Robert Brown in honour of Captain Matthew Flinders, the well-known explorer of the Australian coastline. The specific name *maculosa* is Latin for spotted, and refers to the appearance of the bark.

THE DISTINGUISHING CHARACTERISTICS OF THE FAMILY RUTACEAE

It would certainly be fortuitous if every plant family possessed some unique characteristic that readily distinguished it from all others! Unfortunately, this is not the case in the family Rutaceae. Being a large widely distributed family, its members are adapted to variable conditions both climatic and otherwise. Hence it is not surprising that the Rutaceae are defined not by any single character, but by a great multiplicity of characteristics that, when considered together, delimit the family. The most useful characteristics are as follows:

FLOWERS: These are usually bisexual, very rarely unisexual (e.g. in the tribe *Zanthoxyleae*), mostly regular in shape but sometimes with a tendency towards zygomorphy (e.g. in the tribe *Ruteae*). Sometimes the flowers are solitary, but generally they are arranged in an inflorescence which is rarely a simple raceme, more often involving some cymose arrangement.

SEPALS: Generally small and either four or five in each flower, very rarely three. Their arrangement is either imbricate (i.e. with edges overlapping) or valvate (i.e. with edges touching).

PETALS: Usually longer than the sepals and equal in number to them. Either white, yellow, purple or pink, rarely blue and very rarely purplish-black. Usually the petals are free, but in a number of genera in the tribe *Cusparieae* and the tribe *Boronieae* (e.g. *Correa*, *Nematolepis*), the petals are fused. In only a few species are the petals absent altogether.

STAMENS: The stamens are either equal in number to the petals and alternate with them, or twice as many as the petals. In the latter case, the alternate stamens are usually shorter and often of a different size and shape. In some species, these shorter stamens are infertile. (In *Boronia megastigma* and its allies, an interesting case exists where the large purple or black anthers are barren, and pollen is produced only in the very small petaline anthers.) The anthers in the Rutaceae are two-celled and dehisce lengthwise.

CARPELS: Generally four or five in each flower. They are often free at the base and united above, and tend to be equal in number to the petals and opposite to them. Normally, each carpel has two ovules although some may have three or even four. (In the Australian tribes in which there are two ovules per carpel, only one of them develops to maturity in most cases, the other aborting.) In the Rutaceae, a conspicuous fleshy disc is found between the stamens and the carpels.

FRUITS: The fruit type varies greatly in this family. This variability is more or less related to the degree of union of the carpels. Generally, the carpels are only slightly united at the base or sides, the ovary forming a deeply lobed structure with the united styles rising from the centre. This type of structure, which is found in most genera, usually gives rise to a capsular fruit. Such fruits open by valves along the back or at the top of the carpel. When the carpels are completely united in the flower, the resulting fruit type is generally a drupe or berry.

In the *Citrus* sub-family (*Aurantioideae*), the fruit type is a berry. In the tribe *Toddalieae*, the fruit is often a berry or drupe, or may be an orbicular samara as in the genus *Ptelea*. These fruit types are defined below:—

CAPSULE: A dry dehiscent fruit of two or more fused carpels. The walls of the capsular fruits are divided into an exocarp (or outer layer) and an endocarp (or inner layer). In the tribe *Boronieae*, the endocarp separates elastically from the exocarp—this results in the seeds being "flicked" from the capsule.

BERRY: An indehiscent, succulent fruit. In *Citrus* fruits we find a very specialized berry known as the "hesperidium"—in this case, the pericarp (i.e. the wall of the fruit which has developed from the ovary wall after fertilization) is differentiated into three layers:—

Exocarp: A compact rind layer, containing oil glands.

Mesocarp: A spongy layer of loosely connected cells.

Endocarp: A compact layer which gives rise to the juice sacs. These sacs develop as multicellular hairs which enlarge at one end and become filled with juice.

DRUPE: A succulent indehiscent fruit, consisting of a fleshy outer wall (epicarp), a soft mesocarp and a stony endocarp.

SAMARA: A dry, usually one-seeded fruit with a thin flat wing which aids in dissemination by wind.

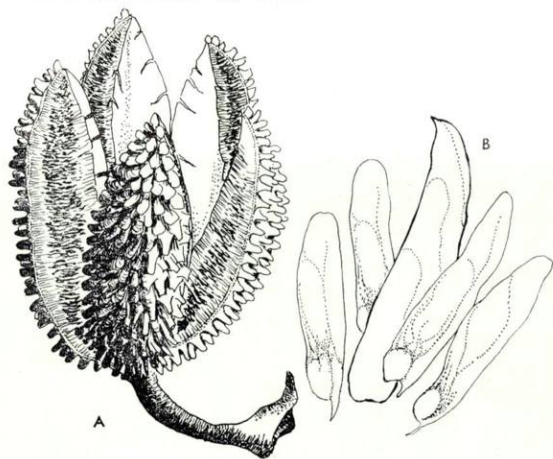


FIGURE 2: *Flindersia australis* — "Native Teak", a species with capsular fruits. A. Open Capsule (seeds have fallen), the capsule opens septically. B. Deciduous placenta (i.e. that part of the ovary to which the ovules are attached), with winged seeds — two on each side of the placenta.

(Drawn by Betty Maloney).

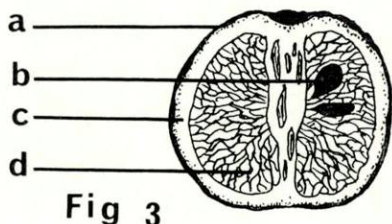


Fig 3

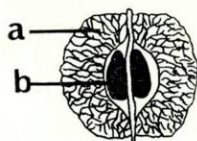


Fig 5

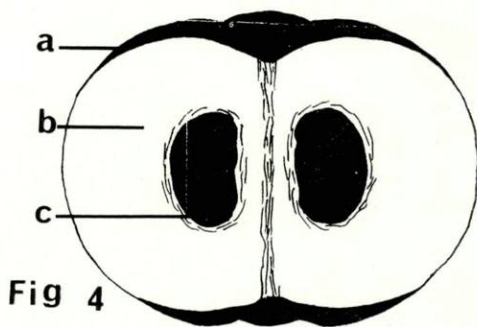


Fig 4

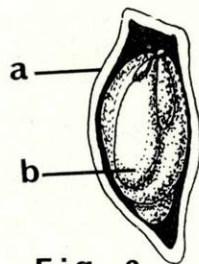


Fig 6

FIGURE 3: Vertical section of the hesperidium of *Citrus sinensis* "Sweet Orange". A. Compact rind layer (Exocarp). B. Seed attached to the placenta. C. Spongy layer (Mesocarp). D. Juicy central layer (Endocarp). (Drawn by Jim Armstrong).

FIGURE 4: Vertical section of the drupe of *Casimiroa edulis* "Mexican Apple". A. Fleshy outer wall (Epicarp). B. Soft Mesocarp layer. C. Stony Endocarp layer — the seed is within the endocarp. (After Engler, 1931).

FIGURE 5: Vertical section of the samara of *Ptelea trifoliata*. A. Fibrous wing. B. Seed attached to the placenta. (After Engler, 1931).

FIGURE 6: Longitudinal section of the seed of *Citrus aurantium* "Seville Orange", showing polyembryony. A. Testa of seed. B. One of the numerous embryos. (After Engler, 1931).

SEEDS: The seeds in the Rutaceae are generally solitary in each cell. The testa (or outer coat) of the seed may be spongy, pitted and glandular

Continued on Page 212.

TWO NAME CHANGES FOR WESTERN AUSTRALIAN BORONIAS

By Paul Wilson, A/Curator, Herbarium, Department of Agriculture, Perth, W.A.

A recent study of the *Boronias* of Western Australia has shown it to be necessary to change the commonly used names of two well-known species. They are as follows:—



Photography by D. Hockings

Boronia lanuginosa, Endlicher (1837). syn. *B. artemisiifolia*, F. Mueller (1859).

When Endlicher described this species in 1837 he stated that it was collected by Ferdinand Bauer at "King George's Sound". George Bentham (1863), who had not seen the Bauer specimen, assumed the species to be the same as that subsequently described by Bartling as *Boronia stricta*, which also comes from near King George Sound, and this assumption has

persisted up to the present. Recently it was possible to borrow the original Bauer collection from the Natural History Museum in Vienna, and it was then obvious that this belonged to the same species as the plant described by F. Mueller in 1859 as *Boronia artemisiifolia*. The specimen could not have been collected in King George's Sound, but was most likely found along the coast of Arnhem Land, an area which Bauer visited between January and March, 1803, when travelling with Matthew Flinders on the "Investigator".



Photography by K. Hubner

BORONIA STRICTA

Boronia stricta, Bartling (1844).

It follows from the above that the plant from the south coast of Western Australia, which has commonly but incorrectly been called "*Boronia lanuginosa*", has now to be *Boronia stricta*, the next available name.

THE GROWING OF *RUTACEAE*

By H. M. Hewett

In a society such as S.G.A.P. where the decorative value of Australian species is so well appreciated, it is almost superfluous to quote the virtues of the family Rutaceae. Unfortunately the problems associated with the garden growing of these plants, even by members with long experience, represent some of the major unrealised aims of our Society.

It is true of course that not all members of the family are "difficult", or even all species of a genus, such as *Eriostemon* or *Boronia*, but some of the most attractive have surely caused their share of heartbreak, e.g. *Eriostemon australasius* and *Boronia ledifolia*, *B. floribunda* and *B. serrulata* from the East Coast, *Boronia elatior* and *B. denticulata* from the west and *Boronia pilosa* from Southern regions of the Commonwealth. On the reverse side of the picture *Eriostemon myoporoides* and some of the *Correas* have proved themselves extremely reliable.

In the Sydney area the family generally is very prone to Nematode attack in our warm humid summer conditions. In "Australian Plants" Volume 6, No. 52, Sept. 1972, I covered this subject rather fully in an article entitled "A Discussion on Plant Collapse". I have discovered no evidence since to counter any of the control procedures proposed, but rather, results have confirmed that this hazard can be successfully controlled. I would not claim that in my own garden, losses from nematode attack have been completely eradicated in this period, but the incidence of loss is now relatively small, and represents not so much a reflection on the value of "Nemagon 90" as a soil sterilant, but a gamble on my part as to whether or not a certain section of the garden had become nematode infested or whether or not to give follow up treatment where control measures had previously been taken. I would therefore exclude the subject of nematode attack from the "unsolved problem" category and relegate it to the position where more experimentation and documentation is necessary in order to more completely understand control measures.

The other major hazard to which Rutaceae species seem to be subject, is attack by the collar rot group of fungi, viz. species of *Pythium* and *Phytophthora*. In my previous article, I referred to use of the product "Dexon" as being of significant value as a control medium, and as with the nematode hazard, subsequent experience continues to support my earlier comments. It should be made clear however as inferred earlier, that sensitivity to collar rot attack within the family Rutaceae is a matter of degree according to the individual species. One should go further and say that even within a species (*Phoebe squamulosum* immediately comes to mind) a greater degree of resistance to attack is evident with specimens propagated from some areas than it is with others; therefore to generalise becomes a questionable procedure. Nevertheless certain factors are significant and most of these were covered in my previous article.

Perhaps a few factors however deserve repetition or further discussion. Of these I would class the usage of mulches as of paramount significance. For many years members have reported successes by using mulches of various materials from leaf moulds and sawdust to gravels and have claimed that provision of a "cool root run" together with better moisture retention in the soil were the basic reasons for success.

From my experience and observations in Sydney gardens these success claims are almost invariably prematurely made and reflect a grower's satisfaction after maintaining a specimen for two flowerings or so. One seldom receives follow up information on longevity unless specifically requested and this frequently admits eventual collapse, with the qualified and erroneous comment that the species is generally short lived in any

case. Actually plants of *Boronia serrulata* have been observed in the natural environment to have lived for over thirty years, and *Eriostemon australasius* has frequently grown to a mature age with a hard barked stem exceeding four inches in thickness.

I believe that the success claims as above are frequently based upon a preconceived notion that by using a mulch, conditions emulating those existing in nature have been provided and further that the reports include an element of anticipated continuation of success as a consequence.

Many controls in ecological balance are not always readily apparent, and one of these could well be that in the natural environment of our East Coastal regions the surface stratum of the soil contains masses of the root systems from a wide range of plant species which can not only take up excess moisture quickly, but which are also very effective in restricting penetration into the soil of excess water. By way of contrast the soil in our gardens would have to be considered as being in a structurally unstable condition which permits more water penetration than occurs naturally. This contributes to moist surface conditions for a longer period after rain, thereby assisting the development of fungal attack.

The usage of mulch of any kind tends to restrict run-off and thereby allows excess water penetration of the soil.

As stated earlier the major problems in the growing of Rutaceae species in Sydney become evident in the wetter periods of the summer months. In drought periods garden maintenance is quite easy, given reasonable hand watering, and few casualties from collar rot occur. It should also be noted that these species have an inbuilt resistance to drought which is effective in maintaining them over very long dry periods.

In my own garden, I have been experimenting with the growing of collar rot sensitive species under "no mulch" conditions and although it is still a little early for results to be considered absolutely conclusive, I am pleased to report that I have maintained healthy specimens of such species as *Boronia gracilipes*, *B. elatior*, and *B. pilosa* and *Eriostemon australasius* under the extremely humid conditions of 1973/74, whereas on numerous previous occasions I have invariably lost them quickly to collar rot in late spring of the first season after planting.

Similar rewarding results have also been obtained with many other collar rot sensitive species apart from the family Rutaceae.

I have used "Dexon" when weather conditions suggested same to be appropriate but under mulched conditions, on previous occasions, this has affected only partial control.

The soil I am using for the above experimental growing is a whitish sandy subsoil containing little, if any discoloration from humus accumulation. I feel that this in itself could contribute to success in that absence of humus could reasonably be expected to be associated with absence of fungal spores.

I have made a practice of planting so that the soil level at the plant stem is slightly higher than for surrounding areas, and on planting I have removed the top inch or so of nursery soil and replaced with clean material. The soil surface has been allowed to cake thereby promoting run off of excess water away from the stem of the plant. I feel that the white colour of the soil with its better heat and light reflection also probably assists maintenance of healthy growth.

Although it has frequently been claimed that many sensitive species require partial protection from sunlight in order to survive, my experience certainly does not give confirmation. In fact I have formed the opinion that, given healthy root and soil conditions, and enough water to prevent

complete drying out by transpiration in dry periods, even our so called "sensitive" Australian plants show little, if any adverse effect from complete sunlight exposure.



Photography by F. Hatfield

BORONIA OVATA

This glabrous shrub or undershrub is endemic to Western Australia. It is recorded throughout the Darling district, and was first collected by Drummond on the banks of the Swan River.

Boronia ovata is an extremely attractive plant with simple ovate leaves borne on erect dichotomous branches. The delicately pink flowers are arranged in loose terminal cymes, and the flowering period, although predominantly spring, can extend from August through to November.

The genus *Boronia* was named by James Edward Smith in 1798, in honour of the young Italian botanist Francis Borone. Borone died tragically (by falling over a cliff) whilst on a botanical expedition in Athens.

Growing of the More Difficult Wildflowers

Growers are advised to read the article "The Growing of Rutaceae" by Max Hewett very carefully. You too can grow those beautiful small plants that have given you trouble in the past by following the advice for growing *Boronia*. Read the completion of his article over the page.



Photography by Max Hewett

BORONIA PILOSA

This heathland shrub is widespread in Victoria and is also recorded in South Australia and Tasmania. Although it is stated in a number of works that this species occurs in New South Wales, there are no specimens in the National Herbarium, Sydney, to substantiate this.

Boronia pilosa is a highly variable shrub in habit, leaf size and degree of hairiness. There are three varieties recognised at present, but a taxonomic revision is needed before the correct status of these varieties is known.

To counter the absence of nutriment in the soil described above, which would normally have been provided by decaying vegetable matter, I have used pellets of red Nitrophoska placed one inch deep into holes made by a pencil under the periphery of the specimen. I have generally used four pellets per specimen at monthly intervals, alternating to the square and diagonal positions. The holes are left open so that subsequent waterings, both natural and artificial, will continue to dissolve the pellets, and carry the nutriment down into the soil.

I believe that red Nitrophoska has now been used widely enough for it to be accepted as a satisfactory fertiliser for the family Rutaceae.

After the hazards of mulching, I consider the staking of collar rot sensitive species to be of major importance. This should be commenced on first planting out, and adequately maintained during the life of the plant unless intergrowth with adjoining foliage ultimately renders it unnecessary. The movement of plant stems in wind, with the consequent enlarged hole in the earth is frequently the forerunner to collapse from collar rot attack. Perhaps this is contributed to by abrasion of the stem, or by entry of fungal spores in wet weather, but in any case its significance should not be under-rated.

Many other factors could be suggested as being likely to contribute to the satisfactory growing of the Rutaceae such as limitation of the time that specimens are permitted to grow on in containers prior to final planting, the season final plantings are made, cleanliness of nursery potting soils, pre-planting exposure conditions, etc., all of which will require exhaustive researching before we are in a position to plant with a feeling of confidence. I am personally persuaded that if we can establish means of maintaining healthy soil conditions the battle will be as good as won, and this most desirable family of Australian plants can assume their rightful and more lasting place in our gardens and perhaps ultimately in general horticulture.

ACRADENIA

One in a series of articles on Tasmanian wildflowers by Alan Gray

A genus, with the one species *A. frankliniae*, confined to Tasmania where it occurs in wet forests and on river banks of the west coast. It has a superficial resemblance to *Zieria arborescens* but differs chiefly from that plant by having five to seven petals and twice as many stamens as the petals; it also does not have the unpleasant smell produced by *Z. arborescens*.

It is by no means a well known plant but is easily propagated from cuttings and would make an attractive shrub or small tree for a damp, shady position in the garden.

A large plant was growing in a bush-house at the old Botany department of the Tasmanian University and had rooted through the container into the ground. It became necessary to move specimens from the old bush-house when the Botany department moved into a new building but the *Acradenia* was too well established to move successfully, so cuttings were taken so that new plants could be grown in the new bush-house.

About a dozen slips were prepared, these being taken from late summer wood and cut with "heels"; no hormone preparations were used and the medium was made up of vermiculite, sand and peaty humus all of approx. equal proportions. Mist apparatus supplied humid conditions and no bottom heat was used. Eight weeks later eight or ten of the cuttings had calloused or had a good root system, the latter were potted and the others returned to the cutting pot to develop further.

The potting mix was made up from forest humus and coarse sand. All were successfully moved to the new Botany department where they were growing well when last I saw them.

ACRADENIA—THE FORGOTTEN GENUS!

By Jim Armstrong, Botanist, Royal Botanic Gardens, Sydney

There are many Australian native plants that have been completely forgotten by the Australian gardening public—*Acradenia frankliniae* is such a plant. Although horticulturally uninteresting plants are understandably overlooked the neglect of *Acradenia* is perplexing, especially when one realises that it has been cultivated in England for the last 130 years. The aim of this article is not so much to analyse the reasons for the plants unpopularity, but rather to present an informative account of the natural history of *Acradenia*—a genus which, for me, holds many fascinations.

Introduction:

Acradenia is restricted in its distribution to western Tasmania (see page 211-e) where it is confined to the drainage basin of the Macquarie Harbour area. Since *Acradenia frankliniae* is the only species known, the genus is said to be monotypic. In its native habitat the plant is an erect shrub of up to four metres high. It produces a mass of showy white flowers and its trifoliate leaves emit a very pleasant aroma when crushed. The plant is normally found growing along the banks of the rivers of the west Tasmanian coastline, particularly the Franklin, Gordon and Pieman rivers.

Botanical History of the Genus:

Acradenia was first discovered by Dr. J. Milligan the secretary of the Royal Society of Tasmania. The plant was collected in April 1842 while Milligan was on an expedition along the Franklin River with the Governor, Sir John Franklin, and Lady Franklin. Believing the plant to be a species of *Zieria* (a genus closely allied to *Boronia*) Dr. Milligan tentatively named his specimen *Zieria frankliniae* in honour of Lady Franklin. He wrote this name on a ticket attached to the specimen.

Within three years of its discovery *Acradenia* was growing under cultivation in England. The plant was first introduced into Britain in 1845 when seeds were sent to the Botanic Gardens at Kew by Dr. I. O. McWilliam. Since then *Acradenia* has been grown in a number of Botanic Gardens and private gardens throughout the British Isles.

Richard Kippist (1812-1882) is a name of some importance in the history of this genus. He had acquired a love of botany at an early age and developed an interest in Australian plants. In 1830 Kippist began his employment with the Linnean Society of London (at that time located in Sir Joseph Banks' former residence in Soho Square). In 1842 (the very year that Dr. Milligan discovered *Acradenia*), Kippist was appointed Librarian to the Society. This position enabled him to study at his leisure the botanical specimens that were housed with the Society.

Milligan's collection fascinated Kippist—particularly the specimen labelled *Zieria frankliniae*. Unfortunately this specimen lacked flowers and fruits, making the determination of its botanical relationships very difficult. To overcome this problem Kippist examined the living material that had been cultivated at the Botanic Gardens in Kew. He also wrote to Sir William Hooker in Tasmania for fresh flowering material.

An examination of the flowering material revealed to Kippist that '*Zieria frankliniae*' was significantly different to the typical members of the genus *Zieria*. The material was so different, in fact, that he decided to place '*Zieria frankliniae*' in a new genus. Thus on the evening of June 1st, 1852, Kippist delivered a dissertation to the Linnean Society of London, describing and naming *Acradenia frankliniae*. A brief synopsis of this dissertation was published in the Linnean Society of London's Proceedings in 1852 (Vol. II, p. 201). The whole dissertation was published in 1854 in the Society's Transactions (Vol. XXI, pp. 207-209, t. 22).

Richard Kippists' work on *Acradenia* was his most significant contribution to botany. Although a very active member of many botanical societies in London he did not publish a great number of botanical works. He died at Chelsea in 1882, one year after retiring from his post as Librarian with the Society.

This beautiful photograph by H. J. King will live on in thousands of homes in Australia and the major libraries throughout the world in memory of this noble man and all he has done for Tasmanian wildflowers. (Editors note on photographer.)



ACRADENIA FRANKLINIAE

Acradenia frankliniae is found only in Tasmania where it grows in the rainforest margins on the river banks on the west coast. In its native habitat the plant forms an erect shrub up to four metres high. It produces a mass of showy white flowers and its trifoliate leaves emit a very pleasant aroma when crushed.

The word *Acradenia* is derived from two Greek words: *akros* — summit, and *aden* — gland, referring to the five prominent glands on the top of the ovary. These glands are readily seen in the above photograph.

Description of the Genus:

Like the attractively perfumed *Boronias* and the economically important genus *Citrus*, *Acradenia* is a member of the family Rutaceae. The word *Acradenia* is derived from two Greek words; *akros*—summit, and *aden*—gland, referring to the five prominent glands on the top of the ovary.

In Tasmania the species is commonly known as 'whitey wood' and is readily distinguished from such genera as *Boronias* and *Zieria* by its five-membered floral parts and its more numerous stamens. In the vegetative state, however, *Acradenia* bears considerable resemblance to the larger-leaved species of *Zieria*. Because of this similarity Kippist had originally intended naming the plant *Acradenia zieroides*. After noting the name on the ticket attached to Milligan's specimen, he decided instead to name the plant *Acradenia frankliniae*—"in accordance with the wishes of its discoverer".

Acradenia's distinguishing feature is its ovary. The ovary is pentagonal in cross-section and consists of five carpels that are fused in the centre up to or beyond the middle. Each carpel is clothed in a minute white pubescence which does not quite reach the apex. At the apex the carpel supports a structure consisting of an ovoid or blunt conical appendage, containing a large internal gland. This appendage is readily visible to the naked eye (see Fig. 1).

Sir William Hooker's son, Joseph Hooker, published the following description of *Acradenia* in his 'Flora Tasmaniae' in 1860:—

"A shrub 8-12 feet high, glabrous, except the tips of the branches—*Branches* stout, pustular. *Leaves* evergreen, opposite, shortly petiolate, trifoliate; *leaflets* oblong-lanceolate, sessile, blunt, toothed towards the apex, covered with minute tubercles full of oil, shining, bright green. *Cymes* terminal, trichotomous, downy with short hairs, shorter than the leaves. *Flowers* pedicelled, white, $\frac{1}{2}$ inch broad, *Calyx-lobes* five, small, rounded, fleshy. *Petals* four or five, velvety. *Stamens* eight to ten, filaments, slender, glabrous, subulate. *Anthers* oblong. *Ovaries* five, on a sessile lobed disc, very villous, each terminated by a conspicuous gland; *Ovules* two, collateral. *Style* one, erect."

The Cultivation of *Acradenia*:

For those interested in growing unusual Australian plants, *Acradenia frankliniae* offers many fascinations. It is a tall erect shrub possessing aromatic leaves and producing showy white flowers, and is certainly worthy of cultivation.

Although interested English gardeners have grown this plant for the last 130 years, *Acradenia* has been completely neglected in Australia. It is only in recent years that *Acradenia* has been grown in Australia, the Canberra Botanic Gardens apparently being the first to cultivate it. It is more than a little disconcerting to realise that *Acradenia* was growing in a country some 12,000 miles from its place of origin only three years after its discovery, while it has taken at least 125 years for the plant to be introduced into cultivation in its native land.

The lack of Australian literature on the cultivation of this native plant is another embarrassment. To find any information on the methods of propagating *Acradenia* one must consult the numerous English gardening texts on this subject. Since many of these texts would be difficult for the general public to obtain, the following selected extracts are presented here:—

1880 'Loudon's Encyclopaedia of Plants'

"*Acradenia* is a genus nearly allied to *Zieria*, both in habit and character. It is a pretty shrub, with snowy white conspicuous flowers and trifoliate leaves. A compost of sand, loam, and peat will suit it, and cuttings will strike root if treated in the ordinary way. In fact, the culture of *Zieria* will answer for *Acradenia*."

—Loudon also lists a number of horticultural aspects of the plant that would be of interest to those growing the plant in England. He states that it is an evergreen shrub that would do best in the greenhouse. In cultivation it reaches a height of 4' and in England would flower from April-June (i.e.: Spring flowering in Australia). It is generally propagated by cuttings.

1885 Nicholson's 'Illustrated Dictionary of Gardening'

"An excellent, neat, and compact evergreen bush, suitable for the cool conservatory. It requires rich loam and leaf mould. Propagated by seeds, and by cuttings, inserted under a bell glass."

—Nicholson goes on to say that the white flowers are produced in great profusion in terminal clusters and the plant flowers in August. The leaves are fragrant and gland dotted.

1927 Curtis's 'Botanical Magazine'

"It is suitable for the cool-house, where it does well in a mixture of rich loam and leaf-mould. The Marquis of Headfort, to whom we are indebted for the communication of the plant portrayed in the plate, grows it in the open in his garden at Kells, Co. Neath, Ireland, and no doubt many a sheltered place on the west and south-west coast of England or Scotland would suit it equally well. In its home on the banks of the King, Gordon and Plean rivers, where it is locally common, it forms dense hedges up to over 3m high."

—There are a number of other works mentioned in the list of references at the end of this article, which could not be included here.

In April 1974 *Acradenia* cuttings were sent to the author from the Canberra Botanic Gardens and, in December 1974, a second parcel of cuttings was received from Mrs. Margaret Allen of Tasmania. These cuttings now form part of the author's research collection of native Rutaceous plants housed at the Royal Botanic Gardens, Sydney.

Acradenia struck well from cuttings using a propagating medium of 75 p.c. bush sand/25 p.c. peat moss. The cuttings were prepared without using rooting hormones and placed in a misting house until roots developed. It is not essential to use a misting house to strike this plant. Excellent results could be expected using any of the propagating techniques mentioned in the article by Alec Blombery, in *Australian Plants* (Aust. Plts., June 1973, Vol. 7, No. 55, pp. 98-100). It is a plant that should prove very successful in Australian gardens.

At present, there is unfortunately no Australian nursery or botanic gardens offering seeds of *Acradenia frankliniae*. The University of Exeter in Devon, England, did offer seed some years ago but has not included it in recent seed lists. Hopefully, seed of *Acradenia* may become available at some later date from Australian nurseries.

Acradenia frankliniae is a plant with many endearing qualities. Apart from its interesting botanical history, it is horticulturally a very desirable plant. It is worthy of much more attention from the Australian public.

—One hopes that *Acradenia* will be "re-discovered" horticulturally by Australian gardeners and will not remain forgotten for very much longer.

Acknowledgements:

I am indebted to Mr. John Wrigley of the Canberra Botanic Gardens for sending me cutting material of *Acradenia*. I would also like to thank Mrs. Margaret Allen and her daughter, both residents of Tasmania, for the living material they sent to me.

References:

- Anon (1882)—Obituary of Richard Kippist. *Proc. Linn. Soc. London*, 1881-2, p. 64.
 Anon (1882)—Obituary of Richard Kippist. *The Gardeners' Chronicle*, 1882, part 1, p. 91.
 Anon (1968)—Marshall Cavendish Encyclopedia of Gardening. Part 1, p. 11 (London, Marshall Cavendish Ltd.).
 Baillon, H. (1871)—The Natural History of Plants [translated by Marcus M. Hartog, Trinity College, Cambridge], Vol. 1, p. 394 and p. 470 (London, L. Reeve & Co.).
 Benthams, G. and J. D. Hooker (1862)—*Genera Plantarum*. Vol. 1, p. 281 and p. 292 (London, L. Reeve & Co.).
 Benthams, G. (1863)—*Flora Australiensis*. Vol. 1, p. 328 (London, L. Reeve & Co.), Fasc. ed. 1967.
 Bean, W. J. (1970)—*Trees and Shrubs Hardy in the British Isles*. Vol. 1, p. 241, eighth ed. (London, M. Bean and John Murray Ltd.).
 Blombery, A. (1973)—*Australian Plants*. June 1973, Vol. 7, No. 55, pp. 98-100.
 Britten, J. and G. S. Boulger (1893)—Richard Kippist. A Biographical Index of British and Irish Botanists, p. 98 (London, West, Newman & Co.).
 Curtis, W. M. (1956)—*The Students Flora of Tasmania*. Part 1, p. 102 (Hobart, L. G. Shea, Govt. Printer, Tasmania).
 Engler, A. (1931)—In Engler and Prant's *Die Natürlichen Pflanzenfamilien*. Band 19a, p. 253 (Leipzig, Verlag Von Wilhelm Engelmann).
 Hooker, J. D. (1855)—1860—*Flora Tasmaniae*, in *The Botany of the Antarctic Voyage*. Part III, Vol. 1, p. 68-69 (London, L. Reeve & Co.).
 Kippist, R. (1852)—In *Proceedings of Linnean Society*. London, Vol. 2, pp. 200-202.
 Kippist, R. (1854)—On *Acradenia*, a new Genus of Diosmeae. *Trans. Linn. Soc. London*, Vol. XXI, part 3, pp. 207-209, t. 22.
 Loudon, J. C. and J. W. (1880)—*Loudon's Encyclopaedia of Plants*. Part II, p. 1362 (London, Longmans, Green & Co.).
 Nicholson, G. (1885)—*Illustrated Dictionary of Gardening*. Vol. 1, p. 17 (London, L. Upcott Gill).
 Rodway, L. (1903)—*The Tasmanian Flora*, p. 23 plus illus. (Hobart, Govt. Printer).
 Stapf, O. & F. B. (1927)—*Acradenia frankliniae*; in Curtis's *Botanical Magazine*, Vol. 153, t. 9187 (London, Reeve, Benham & Reeve).
 Synge, P. M. (1956)—*The Royal Horticultural Society Dictionary of Gardening*. Vol. 33, Second ed. (Oxford, Clarendon Press).
 Wright, C. H. & O. D. Dewar (1894)—*Johnson's Gardener's Dictionary*, p. 12 (London, George Bell & Sons).

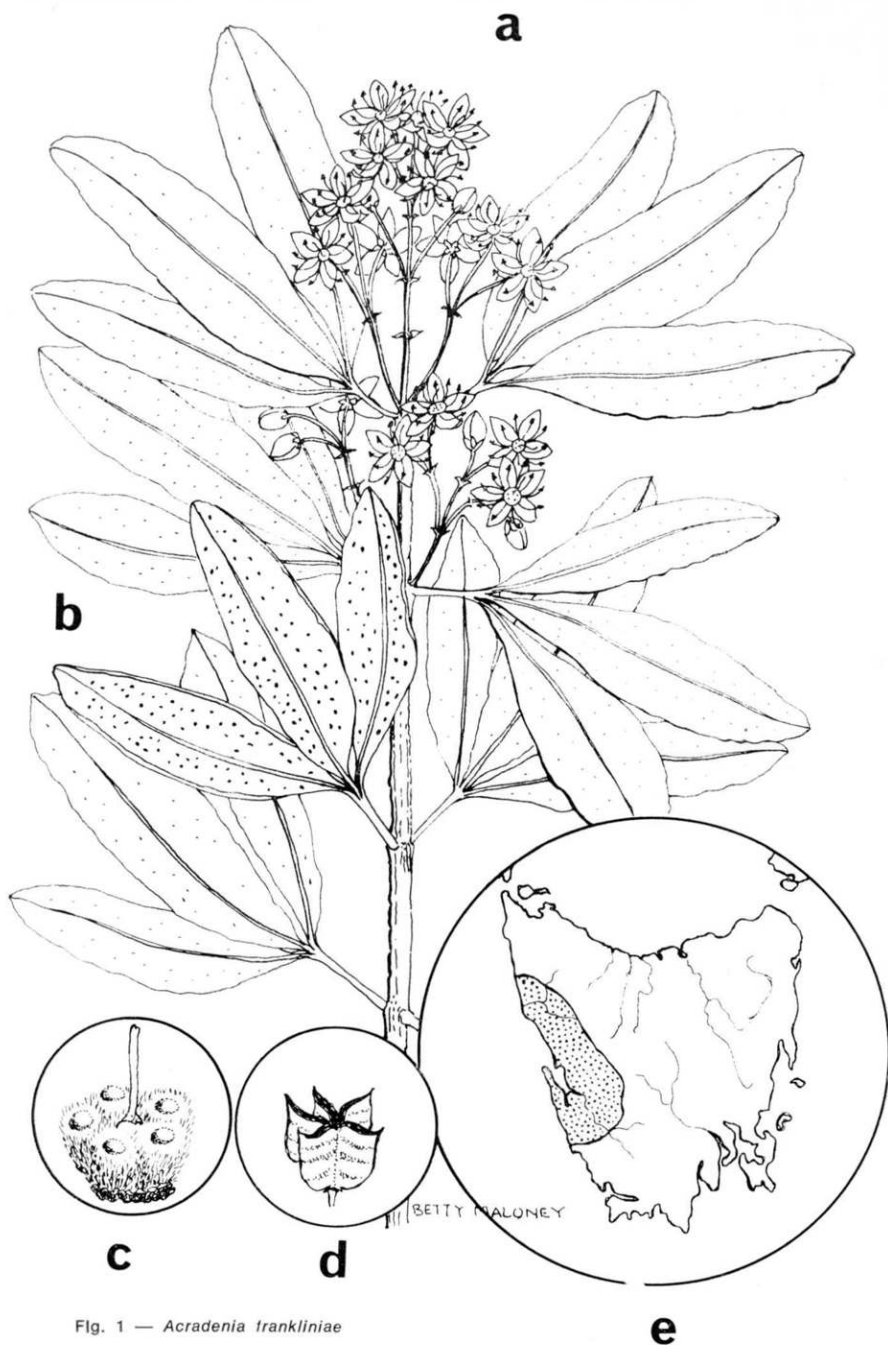


Fig. 1 — *Acradenia frankliniae*

A. Flowering Branch — natural size. B. Oil dotted undersurface of a trifoliate leaf — natural size. C. Five-carpellary ovary showing the conspicuous gland at the apex of each carpel. The style and stigma are also shown as well as the sessile lobed disc at the base of the ovary — magnified. D. Capsular fruit dehiscent — magnified. E. Map showing the distribution of *Acradenia*. The genus is recorded from the Macquarie Harbour area and along the banks of the Franklin, Gordon and Piegan rivers.

Distinguishing characteristics of the Family Rutaceae — cont. from page 199

or more often it is shiny with a hard covering. Endosperm is scanty or lacking in a large number of genera, but in the tribes Ruteae, Boronieae, Toddalieae and in most of the Zanthoxyleae, it is present in some quantity. The embryo is frequently curved, corresponding to the shape of the seed, or it may be straight where the latter is obovoid. A very abnormal condition prevails in the seed of the orange (tribe Citreae). Each seed contains not one, but two to four well developed embryos (a phenomenon known as polyembryony), together with a similar or even greater number of very small ones that are not viable (see fig. 6).

LEAVES: Gland dotted; estipulate; simple or compound.



Fig. 7 — *EUODIA ELLERYANA* — See Colour Plate on Rear Cover.

A. Inflorescence — a lateral cyme, growing out of last year's wood. B & C. Flower, in vertical section (B) and as seen from above (C): (a) Sepal, (b) Petal, (c) Stamen (inserted at base of nectary), (d) Fleshy Disc (nectary), (e) Ovary (consisting of 4 carpels). D. Petal. E. Stamens. F. Flower, with petals and stamens removed. G. Transverse section of ovary showing the 4 carpels. H. Fruiting Branch. I. A mature fruit showing 2 of the 4 carpels. K. A mature open carpel, containing 2 seeds. L. Seed. NOTE: Trifoliate leaves, oppositely arranged on the branch.

THE SUB-FAMILY AND TRIBAL CLASSIFICATION OF THE RUTACEAE

In the following section, a short description is given of each of the 7 sub-families in the Englerian system. Under each sub-family, the number of tribes and genera are listed, and an account given of the distribution of each tribe throughout the world.

All italicized tribes in this section are represented in the Australian flora.

1. Sub-Family RUTOIDEAE:

Carpels usually 4-5, seldom 1-3 or more than 5, free below but often united by the common style above. At maturity the carpels become more or less separated, they open inwards by each follicle splitting loculicidally to expose a dehiscent endocarp. Leaves, and the bark of twigs, with numerous oil glands. 5 TRIBES; 86 GENERA.

I ZANTHOXYLEAE (Tribe):

A widely distributed tribe throughout the tropics and sub-tropics of the old and new world.

This tribe is recorded in Australia and will be discussed in greater detail in the next article: 5 Sub-Tribes; 30 Genera.

II RUTEAE (Tribe):

Distributed throughout the sub-tropical and temperate regions of the Northern Hemisphere.

This is the tribe that contains the genus *Ruta*, the legendary medicinal herb that has been mentioned in an earlier section. *Ruta* is the type genus of the family.

No members of this family occur in Australia: 2 Sub-Tribes, 6 Genera.

III BORONIEAE (Tribe):

An almost exclusively Australian tribe—one species of *Phebalium* (*P. nudum*) occurs in New Zealand.

Since the tribe is recorded in Australia it will be discussed in greater detail in the next article.

NOTE: A number of small endemic genera from New Caledonia have at one time or another been placed in the tribe Boronieae (e.g. *Boronella*, *Zieridium*). Since there have been many opinions concerning the tribal status of these genera I have, for the purpose of this article, excluded them altogether. 5 Sub-Tribes, 18 Genera.

IV DIOSMEAE (Tribe):

A South African tribe that is for the most part restricted to the Cape of Good Hope.

No members of this tribe occur in Australia. 3 Sub-Tribes, 12 Genera.

V CUSPARIEAE (Tribe):

Consists primarily of woody plants from tropical and sub-tropical South America.

No members of this tribe occur in Australia. 2 Sub-Tribes, 19 Genera.

2. Sub-Family DICTYOLOMATOIDEAE:

Flowers actinomorphic. Stamens all similar and alternate with the petals, with bractlets at the base. Carpels united only at the base, each with several ovules. Fruits with dehiscent endocarp, 3-4 seeded. Small trees with doubly pinnate leaves. 1 TRIBE; 1 GENUS:

VI DICTYLOMATEAE:

A very small tribe, consisting of 2 species from South America—particularly Brazil and Eastern Peru.

There are no members of this tribe in Australia. 1 Genus.

3. Sub-Family FLINDERSIOIDEAE:

Trees and shrubs. Carpels 3-5, united, each with 2-8 ovules in 2 rows. Fruit a capsule which dehisces septicidally or loculicidally; the endocarp is

persistent. Seeds winged, without endosperm. Leaves dotted with oil glands.

1 TRIBE; 2 GENERA:

VII *FLINDERSIEAE* (Tribe):

This is a small tribe consisting of 2 genera. The genus *Chloroxylon* is distributed throughout southern India, Ceylon and Madagascar, whereas *Flindersia* has been recorded from the Moluccas (Ceram and Tanimbar Islands), New Guinea, New Caledonia and Eastern Australia south to south central New South Wales.

Since the tribe is recorded in Australia it will be discussed in greater detail in the next article. 2 Genera.

4. Sub-Family SPATHELOIDAE:

Carpels 3, completely fused, each with 2 pendent ovules. Fruit a winged drupe with a hard 3-loculed pit. Contains oil bearing secretory cells in the leaves, as well as in the bark and the pith. Lysigenous oil glands (i.e. oil filled cavities formed by the breakdown of cells) present in leaf margins.

1 TRIBE; 1 GENUS.

VIII SPATHELIEAE (Tribe):

A small tribe of 10 species, confined to the West Indies.

There are no members of this tribe in Australia. 1 Genus.

5. Sub-Family TODDALIOIDAE:

Carpels 2-5 completely or incompletely united, or else only 1, each with 1 or 2 ovules. The fruit type is variable, it can be a dry, winged, indehiscent fruit; or else a drupe with either a thick or thin mesocarp and a thick or thin endocarp; or the fruit can consist of 2-4 drupelets united only at the base, some of these drupelets occasionally abort. Seeds with or without endosperm.

1 TRIBE; 25 GENERA:

IX *TODDALIEAE* (Tribe):

This tribe is widely distributed in temperate and tropical lands.

Since the tribe is recorded in Australia it will be discussed in greater detail in the next article. 6 Sub-Tribes, 25 Genera.

6. Sub-Family AURANTIOIDAE:

Fruit a berry or hesperidium, with a leathery rind or hard shell; in the tribe *Citreae* pulp is present and is formed from juicy structures that arise on the carpellary walls. Seeds without endosperm, sometimes with 2 or more nucellar (false) embryos. Leaves and bark of twigs and young branches with oil glands. Small or sometimes large trees, rarely shrubs.

2 TRIBES; 3 GENERA:

X *CLAUSENEAE* (Tribe):

A tribe generally confined in its distribution to the monsoon regions of the world.

The tribe comprises the very remote Citroid fruit trees.

Since the tribe is recorded in Australia it will be discussed in greater detail in the next article. 3 Sub-Tribes; 5 Genera.

XI *CITREAE* (Tribe):

This tribe is confined to the monsoon regions of the old world.

The tribe comprises the *Citrus* and Citroid fruit trees.

Since the tribe is recorded in Australia it will be discussed in greater detail in the next article. 3 Sub-Tribes; 28 Genera.

7. Sub-Family RHABDODENDROIDAE:

Flowers with a bowl-shaped concave receptacle, with obliterated calyx, 5 petals and numerous stamens. Ovary free, ovoid, one locular, with 1 basal ovule. Pistil attached to the side of the ovary, with a long, lateral stigma. Fruit with a thin exocarp and endocarp. Leaves simple. 1 TRIBE; 1 GENUS:

XII RHABDODENDREAE (Tribe):

This small tribe, with c. 2 species, is confined to the Amazon valley of South America.

There are no members of this tribe in Australia.

1 Genus.

The Family Rutaceae in Australia

By *Jim Armstrong, Botanist, Royal Botanic Gardens, Sydney*

In this section the Australian members of the family are discussed. Each genus is briefly described, the number of species noted and an account given of the distribution throughout Australia. A more detailed account of the Sub-Family Aurantioideae then follows:—

TRIBES AND GENERA REPRESENTED IN AUSTRALIA

The family Rutaceae is very well represented in Australia when we compare the number of tribes, genera etc. represented here, with world figures

TABLE 1

	World	Australia	Percentage in Australia
Sub-Families	7	4	57%
Tribes	12	6	50%
Genera	150	40	27%
Species	1,600	335	21%

The tribes and genera recorded in Australia are listed below — it is easily seen that the two largest Australian tribes are the Boronieae, with 18 genera, and the Zanthoxyleae, with 11 genera.

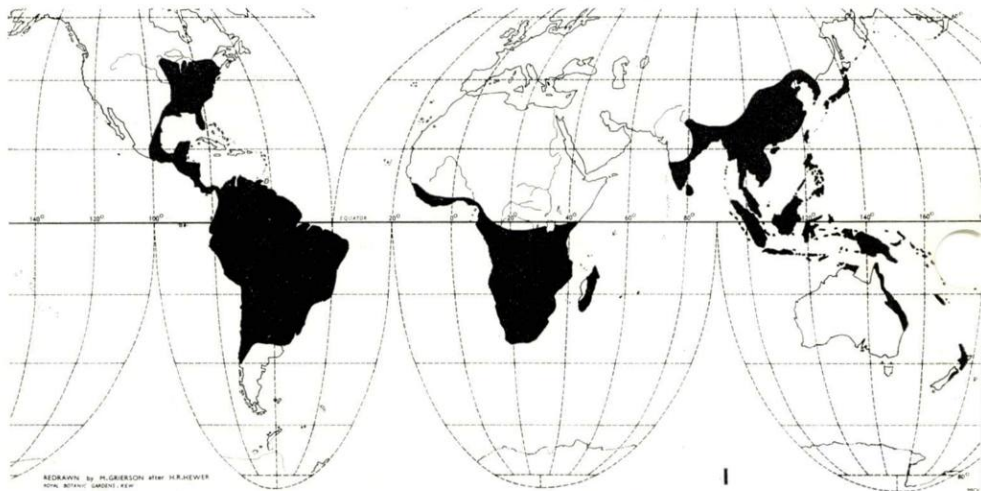
The genera asterisked below are endemic to Australia.

TRIBE	GENERA	
1. ZANTHOXYLEAE (Sub-Family Rutoideae)	*1. Bosistoa *2. Bouchardatia 3. Euodia 4. Evodiella 5. Geijera 6. Lunasia *7. Medicosma	8. Melicope *9. Pagetia *10. Pentaceras 11. Zanthoxylum — also:— * Brombya * Luerssenidendron?
2. BORONIEAE (Sub-Family Rutoideae)	*1. Acradenia *2. Asterolasia *3. Boronia *4. Chorilaena *5. Correa *6. Crowea *7. Diplolaena *8. Drummondita *9. Eriostemon	*10. Geleznovia *11. Microcybe *12. Muiriantha *13. Nematolepis 14. Phebalium *15. Philotheca *16. Rhadinothermus *17. Urocarpus *18. Zieria
3. FLINDERSIEAE (Sub-Family Flindersioideae)	1. Flindersia	
4. TODDALIEAE (Sub-Family Toddalioidae)	1. Acronychia 2. Bauerella 3. Halfordia	
5. CLAUSENEAE (Sub-Family Aurantioideae)	1. Clausena 2. Glycosmis	3. Micromelum 4. Murraya
6. CITREAE (Sub-Family Aurantioideae)	*1. Eremocitrus 2. Microcitrus 3. Paramignya	

TRIBE: ZANTHOXYLEAE

Trees and shrubs, mostly with small, greenish-white flowers which are always regular and often unisexual. Carpels seldom with more than 2 ovules. Embryo mostly with flat cotyledons in the endosperm — except in the genera *Bosistoa* and *Pagetia* (See Map 1).

11 GENERA IN AUSTRALIA; APPROX. 46 AUSTRALIAN SPECIES.



MAP 1. Distribution of the tribe Zanthoxyleae (30 genera) (after Engler)

In Australia the tribe Zanthoxyleae consists of approximately 46 species, making it the second largest Australian tribe. The endemism in this tribe is extremely high since 37 of the 46 species (i.e. 80%) are endemic here.

The Zanthoxyleae has 11 genera in Australia, 8 of these being restricted to the rainforests of the eastern states. An examination of the genera and species reveals 83% of the tribe is confined to rainforests of the east coast.

Genus 1. *Bosistoa*

This endemic* Australian genus of small to medium sized rainforest trees, consists of approx. 4 species. The genus is distributed throughout the rainforest areas of N.E. Qld. south to the north coast of N.S.W.

Genus 2. *Bouchardatia*

This Australian endemic monotypic** genus (i.e.: a genus with 1 species, confined to Australia), is a small to medium sized rainforest tree. *Bouchardatia neurococca* is distributed in rainforest areas of S.E. Qld. to N.E. N.S.W.

Genus 3. *Euodia*

This genus consists of approx. 120 species distributed throughout the old world tropics and sub-tropics. There are approx. 12 species in Australia, 8 or 9 of these being endemic. The Australian species are represented by small to medium sized rainforest trees distributed throughout the rainforest areas of N.E. Qld. to the N.E. and coastal N.S.W.

Genus 4. *Evodiella*

This genus consisting of 2 species of rainforest trees, is distributed in New Guinea and Eastern Australia. The one Australian species is confined in its distribution to the rainforests of N.E. Qld.

* Endemic:— an endemic is an entity that is confined in its natural distribution to a specified geographic area. E.g., the species *Crowea saligna* is only known to occur around the Port Jackson area of Sydney. We can say therefore that *Crowea saligna* is endemic to the Sydney District.— The genus *Correa* only occurs in Australia. i.e., the genus is endemic to Australia.

** Monotypic:— a monotypic genus is one which has only the one species.

Genus 5. *Geijera*

Geijera, a genus of approximately 6 species, is not endemic to Australia. There are two species recorded in New Caledonia and one of these, *G. balansae*, also extends to the Loyalty Islands. There are 4 species in Australia, 2 being restricted to the rainforests of the east coast of the continent — *G. salicifolia* is distributed throughout the rainforests of N.S.W. and Qld. (it also extends into New Guinea), whilst *G. paniculata** is recorded in the rainforests of Qld. and the far north coast of N.S.W.

The 2 remaining species in Australia differ markedly in their habitat preference. Both *G. parviflora* and *G. linearifolia* are recorded outside of the rainforest areas of the east coast, extending into the drier areas of the continent. *G. linearifolia*** seems to be the most aridity tolerant species. its distribution extending to the eremian region of southern W.A.



BOTTOM RIGHT: *Geijera salicifolia* "Bush Wilga" or "Green Satinheart" — a small to medium sized tree with rather scaly, dark-grey or brown bark, found commonly in rainforests from the Illawarra district of N.S.W. to Qld. A. Flowering twig. B. Flower. C. Flower opened out, showing (a) petals, (b) stamens, (c) disc, (d) pistil. D. Part of flower, showing stamen, disc and pistil with 5 carpels. E. Stamens. F. Transverse section of pistil. G. Calyx. H. Fruit. I. Narrow leaf form showing venation pattern. (From "The Forest Flora of New South Wales".)

TOP LEFT: *Geijera parviflora* "Wilga" — (Colour plate on page 232) a small to medium sized tree widely distributed in western areas, especially on red soils, deep sandy loams, and heavy alluvials. K. Flowering twig. L. Flower showing (a) petals, (b) stamens, (c) crenulated disc, (d) pistil. M. Pistil showing 5 carpels. N. Back of flower showing calyx. O. Fruiting twig showing the capsular fruits. (From "The Forest Flora of New South Wales".)

* *G. paniculata* was formerly known as *G. muelleri*.

** *G. linearifolia* is recorded in S.A. and W.A.

Genus 6. *Lunasia*

An almost entirely Malaysian genus of possibly 2 species of erect shrubs or small trees. One species (*Lunasia amara* var. *amara*) reaches Australia where it is restricted to Cape York Peninsula. Although it inhabits rainforests, it is not restricted to this habitat. In Australia, *Lunasia* ranges from the well-drained rainforest habitats to the rather dry thickets of Cape York Peninsula in northern Qld. (See Hartley 1967.)

Genus 7. *Medicosma*

This Australian endemic monotypic genus is a small rainforest tree. *Medicosma cunninghamii* ("Bonewood" or "Pinkheart") is distributed throughout the rainforest areas of S.E. Qld. to the north coast of N.S.W.

Genus 8. *Melicope*

A genus of approx. 50 species, distributed throughout the Philippines, Malaysia, New Guinea, New Zealand and Australia. The 10-12 species of tall shrubs and trees occurring in Australia are endemic and are confined to the rainforests of N.E. Qld. and the north coast of N.S.W.

Genus 9. *Pagetia*

This Australian genus of 2-3 species of small to medium sized trees, is distributed throughout the rainforest areas of eastern Qld.

Genus 10. *Pentaceras*

An Australian endemic monotypic genus, *Pentaceras australis* (the "Bastard Crow's Ash") is a rainforest tree up to 60 ft. high. It is restricted to rainforest areas of S.E. Qld. and the north coast of N.S.W.

Genus 11. *Zanthoxylum*

The genus *Zanthoxylum* with approx. 200 species, is one of the largest genera in the family Rutaceae. It has a wide pan-tropical distribution, and its numerous species are generally found growing in rainforests and thickets at low and medium altitudes. In Australia, there are 5 species of *Zanthoxylum*,* and these, for the most part, are confined to the rainforests of the east coast. The 3 rainforest species are *Z. brachyacanthum*, *Z. veneficum* and *Z. nitidum*. The 2 remaining Australian species are to be found in the monsoon forests of the tropical north. *Z. parviflorum* is distributed throughout West Irian and extends into the monsoon forests of the Northern Territory. *Z. ovalifolium* is a widely distributed species extending from India and Sikkim S.E. to Qld., and is recorded from the monsoon forests and thickets of these areas. (See Hartley 1966).

NOTE: There are at least 2 genera in the tribe Zanthoxyleae that have doubtful status — *Brombya* and *Luerssenidendron*.

— *Brombya* is a monotypic genus, endemic to the rainforest areas of N.E. Qld. *Brombya platynema* was recognised by Ferdinand von Mueller, but Adolf Engler synonymised it under the genus *Melicope*. The National Herbarium, Sydney, follows Engler in placing the genus *Brombya* under *Melicope*.

— *Luerssenidendron* is a monotypic genus, endemic to the rainforest areas of the north coast of N.S.W. *Luerssenidendron monostylis*, is a small to medium sized rainforest tree, endemic to the Hastings River area of N.E. N.S.W. It is apparently closely related to three other genera in the Tribe Zanthoxyleae — *Melicope*, *Pagetia* and *Pentaceras*. We do not recognise the genus *Luerssenidendron* at the National Herbarium, Sydney, *L. monostylis* being synonymised under the genus *Pagetia*.

The Australian genera in the tribe Zanthoxyleae are currently being revised by Dr. T. Hartley of the C.S.I.R.O.'s Herbarium Australlense in Canberra. The present confusion concerning the taxonomic status of a number of genera in this tribe should be clarified in the not too distant future.

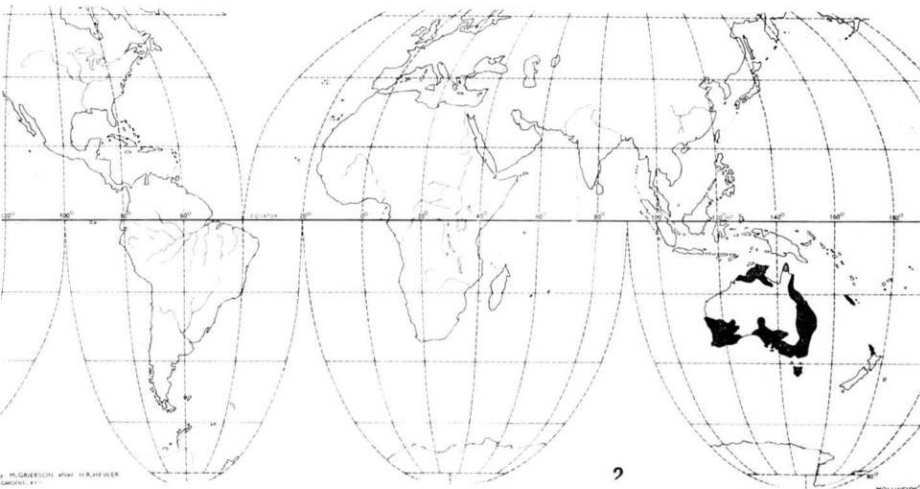
* One species, *Z. pinnatum*, occurs on Lord Howe Island.

TRIBE: BORONIEAE

Perennial herbs or shrubs. Carpels with only 1 or 2 ovules. Flowers always actinomorphic (i.e. regular), mostly perfect. Embryo usually straight, cylindrical, usually immersed in abundant fleshy endosperm. (See Map 2).

18 GENERA IN AUSTRALIA; APPROX. 242 AUSTRALIAN SPECIES.

NOTE: A number of small endemic genera from New Caledonia have at one time or another been placed in the tribe Boronieae (e.g. *Boronella*, *Zieridium*). Since there have been many opinions concerning the tribal status of these genera I have, for the purposes of this article, excluded them altogether.



MAP 2. Distribution of the tribe Boronieae (18 genera) (after Engler)

The Boronieae is one of the most remarkable tribes in the Australian Rutaceae, distinguishing itself in a number of ways:—

- It is easily the largest of the Australian tribes. In fact the 242 Australian species in this tribe represent 72% of the total number of Rutaceous species in Australia.
- It is the tribe with the greatest number of endemic species (all of the 242 species in Australia are endemic here).
- It has the greatest distribution range of any tribe in Australia and is the only tribe with representatives in each Australian state.
- Whereas the other tribes of the Australian Rutaceae are predominantly confined to the rainforests of the east coast, the tribe Boronieae has a much wider ecological tolerance, and is recorded from many diverse habitat types.

Genus 1. *Acradenia*

This monotypic genus is endemic to western Tasmania. *Acradenia frankliniae* is a shrub to 4 metres high and is restricted in its distribution to the banks of the King, Gordon and Pieman rivers, where it is locally common. See page 207 for a full description.

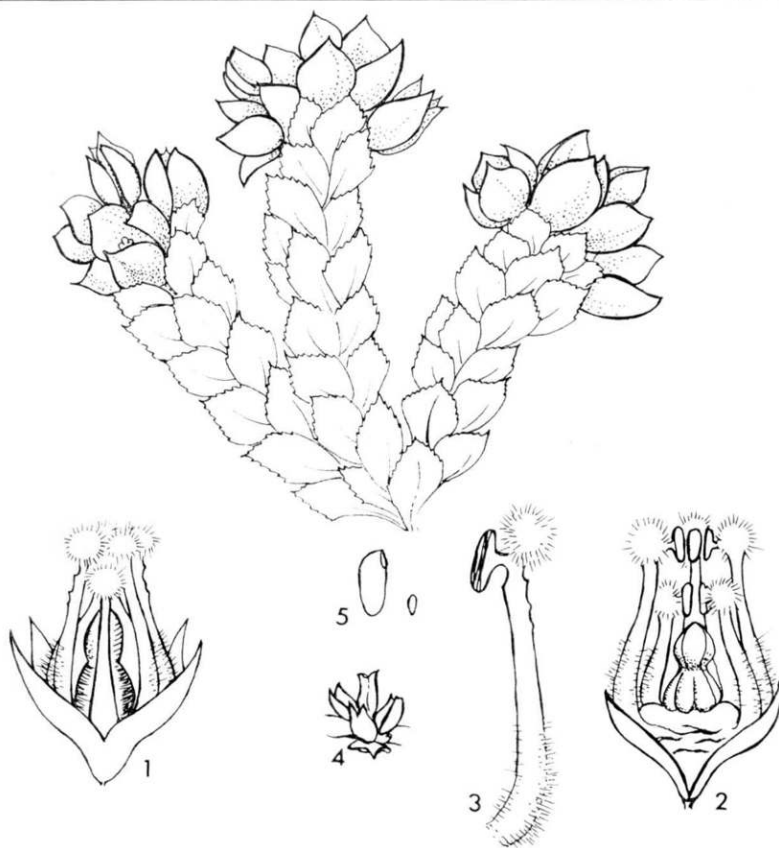
Genus 2. *Asterolasia*

An endemic genus of approx. 5 species of shrubs or under-shrubs. It has a distribution ranging throughout Victoria and eastern N.S.W. and extending into Qld.

NOTE: For those species recorded from S.A. and W.A. and previously referred to under this genus, see *Urocarpus*.

Genus 3. *Boronia*

This endemic genus of 34 species of shrubs or under-shrubs, is the largest genus in the tribe Boronieae. *Boronia* is recorded from every state in Australia, the largest concentration being in W.A. (approx. 48 species) and N.S.W. (approx. 29 species).



Boronia serrulata "Native Rose" — This small shrub with flat, rhomboidal, light-green toothed leaves produces highly perfumed pink flowers that are arranged in dense terminal clusters. *Boronia serrulata* is endemic to New South Wales. It is mainly confined to the Port Jackson district and is found in greatest abundance within 20 miles north and south of Sydney. Baron von Mueller stated that the "Native Rose" had been found at Wagga Wagga, over 300 miles to the south of Sydney. There are no specimens in the National Herbarium, Sydney, to verify this. 1. Flower (petals removed) showing calyx, stamens, ovary and stigma. 2. Flower (part of calyx, petals and three stamens removed) showing the ovary and the large 4-lobed stigma. The nectar secreting disc is visible below the ovary. 3. Stamen. 4. Capsular fruit — already dehiscent. 5. Seed. (Drawn by Betty Maloney and adapted from "Flowering Plants and Ferns of New South Wales".)

Genus 4. *Chorilaena*

This monotypic genus is endemic to W.A. *Chorilaena quercifolia* is a tall shrub with oak-like leaves and branches clothed with a dense velvety tomentum. The genus is restricted to the S.W. province of W.A.

Genus 5. *Correa*

An endemic genus of 11 species of shrubs (sometimes prostrate) that very rarely form small trees. The genus extends from S.E. Qld. through N.S.W. to Vic. and Tas. It is a common genus in the southern section of S.A. and one species (*Correa reflexa* var. *coriacea*) extends westward as far as the Culver district of S.E. W.A. (See Wilson 1961).

Genus 6. *Crowea*

An endemic genus of 3 species of glabrous shrubs or under-shrubs. One species (*Crowea angustifolia*) is recorded in the S.W. province of W.A. The two remaining species are recorded in the eastern states — i.e., from S.E. Qld. through N.S.W. to northern and eastern Vic. (See Wilson 1970).

Genus 7. *Diplolaena*

This fascinating genus of 6 species is endemic to W.A. These shrubs are characterized by their distinct inflorescence, which consists of a dense head of sessile flowers, surrounded by an involucre of broad imbricate bracts. The inflorescence of *Diplolaena* is very similar to that found in *Chorilaena*—in this genus however, the flowers are collected in dense pendulous cymes or heads that are surrounded by narrow bracts that gradually taper to a fine point. *Diplolaena* is restricted to the S.W. province of W.A.

Genus 8. *Drummondita*

An endemic genus of 4 species, 3 of these restricted to W.A. whilst 1 species is recorded from northern Qld. This represents the most disjunct distribution of any genus in the tribe Boronieae. *Drummondita* is closely allied to the genus *Philothea*—it differs from *Philothea* in having 5 of its 10 stamens aborted (See Wilson 1971).

Genus 9. *Eriostemon*

This large genus of 33 species, is endemic in Australia. It is a genus of woody perennial shrubs or small trees, that is recorded from W.A., S.A., Tas., Vic., N.S.W. and Qld.

NOTE: Ferdinand von Mueller proposed to unite a number of genera in the tribe Boronieae under the genus *Eriostemon*. He believed that genera such as *Phebalium*, *Microcybe*, *Geleznovia*, *Crocea*, *Philothea*, *Drummondita* and *Asterolasia* were so closely related that they should only be recognised as sections of the genus *Eriostemon*. Present day botanical opinion does not support Mueller's view, and although it is recognised that those genera mentioned by Mueller are very closely related, they are nevertheless considered to be generically distinct (See Wilson 1970).

Genus 10. *Geleznovia*

This Australian endemic monotypic genus is a bushy, rigid, glabrous shrub. *Geleznovia verrucosa* is restricted to the northern section of the S.W. province of W.A. (Irwin District). This remarkable plant has large brightly coloured petal-like bracts and sepals, that are persistent and much more developed than the yellow petals.

Genus 11. *Microcybe*

An endemic genus of 3 species of small heath-like shrubs. *Microcybe* is closely related to the genus *Phebalium* but differs in having fewer carpels (2 carpels in *Microcybe*, 5 carpels in *Phebalium*). The genus is distributed throughout the S.W. province of W.A., southern S.A., and western Vic. One of the three species (*Microcybe albiflora*) is restricted to the S.W. province of W.A.

Genus 12. *Muiriantha*

This monotypic genus is endemic to W.A. *Muiriantha hassellii* is closely related to two other monotypic genera from W.A. (*Chorilaena* and *Nematolepis*), and shows close affinities to the genus *Phebalium*. *Muiriantha* is restricted to the Stirling Ranges of the S.W. province of W.A.

Genus 13. *Nematolepis*

This monotypic genus is endemic to W.A. *Nematolepis phebalioides* is an erect, rigid, bushy shrub closely related to the genus *Phebalium*. It is apparently similar to *Correa* in its united petals and to *Chorilaena* in the morphology of its stamens. *Nematolepis* is recorded from Lake Grace to Israelite Bay in southern W.A.

Genus 14. *Phebalium*

This large genus of 45 species is almost completely restricted to Australia. One species (*Phebalium nudum*), is the only species in the genus found outside Australia or Tasmania—it is endemic to the North Island of New Zealand. The 44 remaining species are endemic to Australia and range in habit from under-shrubs to shrubs or small trees. The genus is recorded in W.A., S.A., Tas., Vic., N.S.W. and Qld. (See Wilson 1970).

Genus 15. *Philotheca*

An endemic genus consisting of 3 recognised taxa of erect, heath-like shrubs. One species, *Philotheca tubiflora*, is endemic to the western edge of the Great Victoria Desert in W.A. The remaining species *Philotheca salsolifolia* is recorded throughout N.S.W. (A variety of *P. salsolifolia* is recorded in N.S.W. and extends into Qld). *Philotheca* is very closely related to the genus *Eriostemon* and to the endemic W.A. genus *Drummondia*. (Those species once recorded in W.A. under the name *Philotheca* are now placed under *Drummondia*. See Wilson 1971).

Genus 16. *Rhadinothamnus*

This monotypic genus is endemic to W.A. *Rhadinothamnus euphemiae* is an under-shrub, and is closely related to three other genera in the tribe Boronieae — *Nematolepis*, *Phebalium* and *Chorilaena*. *Rhadinothamnus* is found near the south coast of W.A. from the Eyre Range east to Mt. Ragged. (See Wilson 1971).

Genus 17. *Urocarpus*

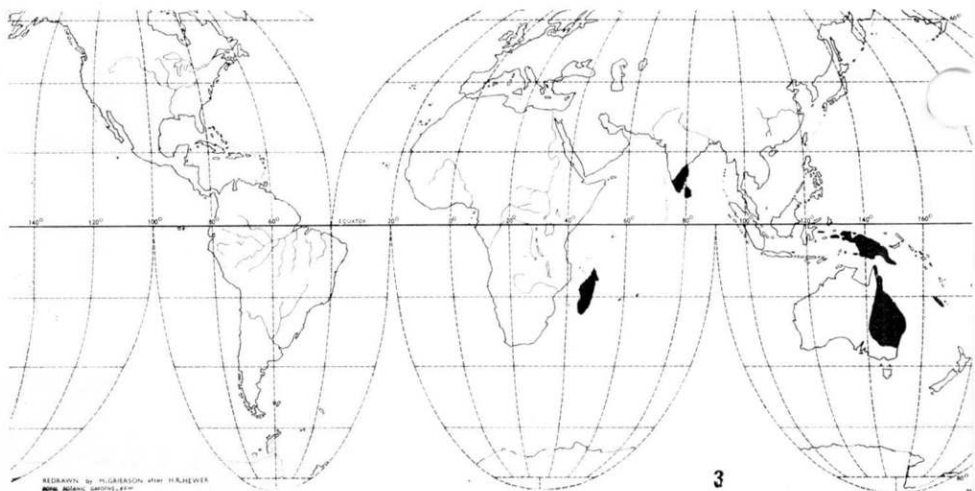
An endemic genus of 5 species of shrubs and under-shrubs. Four species are recorded in W.A., whilst the other species (*Urocarpus muricatus*) is restricted to S.A.

NOTE: In the past, these 5 species were placed under the name *Asterolasia*. Wilson (1971) states:—

"The correct generic name of the Western Australian species is *Urocarpus*, this being the earliest of the generic symptoms . . . The species of N.S.W. and Victoria could be considered sectionally or generically distinct for they have a consistently 5-carpellary ovary (as against 2-3 carpellary in the Western Australian species) and, according to Smith-White (1954), differ in chromosome number . . . Nomenclature changes for the species found in the eastern states must await a taxonomic study."

Genus 18. *Zieria*

This endemic genus of approx. 20 species is restricted to eastern Australia. It consists of undershrubs, shrubs and small trees, and is closely related to the genus *Boronia*. *Zieria* differs from *Boronia* in having 4 sepaline stamens inserted on the glandular disc. The genus ranges in distribution from N.E. Qld., through eastern N.S.W., eastern and southern Vic., southern S.A. and Tas.



MAP 3. Distribution of the tribe Flindersieae (2 genera) (after Hartley)

TRIBE: FLINDERSIEAE

Trees; carpels 5, united, each with 2-6 ovules in 2 rows. Fruit a 5-valved, 5-locular, septical capsule, without a persistent axis. Endocarp persistent. Seed winged, without endosperm, 2-6 per locule. Leaves basically alternate, but occasionally with opposite leaves. (See Map 3).

1 GENUS IN AUSTRALIA; APPROX. 14 AUSTRALIAN SPECIES.

The tribe Flindersieae is one of the smaller tribes in the family Rutaceae. The two genera in this tribe (*Flindersia* and *Chloroxylon*) have distinct distributions. *Chloroxylon* is not recorded in Australia—it is restricted to southern India and Ceylon. *Flindersia* does occur here, but it is not restricted to this continent—its distribution ranging from the Moluccas to New Guinea, New Caledonia and eastern Australia. In eastern Australia the genus extends as far south as south central N.S.W. (see Hartley 1969).

With 14 species in Australia, the tribe Flindersieae is the 4th largest Australian tribe. Ten of the species are endemic here—i.e. 71% of the species are endemic to Australia.

Genus 1. *Flindersia*

A genus of 16 species of small to large trees, distributed throughout eastern Australia, the Moluccas, New Guinea and New Caledonia. Of the 14 species in Australia, 10 are endemic. Most of the 14 species occurring here are trees of the high rainfall areas of N.E. Qld. and the north coast of N.S.W. There are 4 species that extend into the drier areas of these two states. (See Hartley 1969).



MAP 4. Distribution of the genus *Flindersia* in Australia (14 species) (after Hartley)

MAP 5. Distribution of the 10 *Flindersia* species restricted to the rainforests (after Hartley)

MAP 6. Distribution of the 4 *Flindersia* species that are not restricted to the rainforest habitats (after Hartley)

An examination of the habitats occupied by the 14 species of *Flindersia* reveals that at least 10 species are restricted to the rainforests of the east coast. The remaining 4 species are not confined to this habitat as the following list indicates.

- F. australis* — the rainforests and dry thickets of east central Qld. S to N.E. N.S.W.
- F. collina* — the rainforests and dry scrubs of S.E. Qld. and adjacent areas in N.S.W.
- F. dissosperma* — grows in the dry scrubs of east central Qld.
- F. maculosa* — grows in the dry open areas of central Qld. and N.S.W.

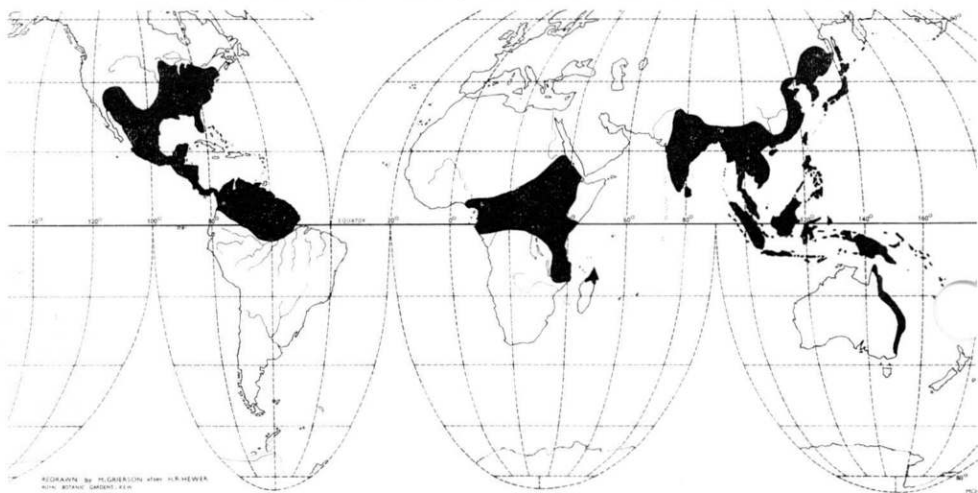
Of the 4 *Flindersia* species that are not restricted to the rainforest habitats of the east coast, *F. maculosa* ("Leopard Wood") is the most remarkable. It is the only species of *Flindersia* that is completely adapted to dry arid conditions. The juvenile stage of this medium sized tree is quite remarkable as the following account from J. H. Maiden's "Forest Flora" would suggest:—

"In its early stage it forms a tangled mass of long thin branches. These branches are not spinose or prickly, but form a hedge, so that while stock (chiefly sheep) prune the peripheral branches they cannot eat the whole of them. As growth advances, a leading shoot shows itself and is protected by the branchy entanglement which encircles the main stem for several feet. By degrees these tangled branches atrophy and leave more or less of the stout main stem with its characteristic blotchy or spotted bark." (See photographs on page 197.)

TRIBE: TODDALIEAE

Trees or shrubs. Ovary not lobed. Fruit several celled, indehiscent, or rarely loculicidally dehiscent. Seeds with endosperm. (See Map 7).

3 GENERA IN AUSTRALIA; APPROX. 20 AUSTRALIAN SPECIES.



MAP 7. Distribution of the tribe Toddalieleae (28 genera) (after Engler)

With 20 Australian species, the tribe Toddalieleae is the 3rd largest tribe in Australia. Sixteen species are endemic here — i.e. 80% of the species are endemic to Australia.

There is a great deal of taxonomic uncertainty about this tribe in Australia. The largest Australian genus is *Acronychia*, with 16 species recorded here. Hartley (1974) in his recent revision of the genus states:—

"*Acronychia* was placed in the sub-family Toddalioideae by Engler (1896 and 1931) but is probably better placed in the sub-family Rutoideae in view of its close relationship to *Melicope*, *Euodia*, *Evodiella*, and *Medicosa*."

Genus 1. *Acronychia*

A genus of 42 species ranging in distribution from tropical Asia to the S.W. Pacific. *Acronychia* is particularly abundant in New Guinea and throughout the rainforest areas of eastern Australia. There are 16 species in Australia, 15 of these being endemic.

Hartley (1974) in his recent revision of the genus states:—

"The genus *Acronychia* . . . is known to occur naturally from India east to southwest China and Taiwan, southeast throughout Malaysia to the Solomon Islands, New Caledonia and Lord Howe Island, and south in eastern Australia from Cape York Peninsula to eastern Victoria. Despite this rather wide distribution the genus is almost entirely eastern Australian and New Guinean, 15 of the 42 known species being endemic to the former and 24 to the latter."

NOTE: The monotypic genus *Pleiococca* endemic to rainforest areas of N.E. Qld. through to the north coast of N.S.W. is now synonymised under the genus *Acronychia* (Hartley, 1974).

Genus 2. *Bauerella*

This rainforest genus has a variable habit ranging from shrubs to small or medium sized trees. There are two recognized species. *B. simplicifolia* has the most extensive distribution—it ranges from eastern Australia to Lord Howe and Norfolk Islands, New Caledonia, the New Hebrides and Fiji. In Australia it is found in the rainforests of the east coast, from south eastern N.S.W. north to north eastern Qld; *B. leiocarpa*, the other species in this genus, is only known from New Caledonia.

Hartley (1975) in his recent paper on this genus, states:—

"In its distribution, *Bauerella* demonstrates, as do a significant number of other eastern Australian rain forest genera, a strong phytogeographic link between Australia and New Caledonia. Its further eastward presence in the New Hebrides and Fiji, however, coupled with its absence in New Guinea, is quite unusual."

Acronychia simplicifolium is treated as a synonym of *Bauerella simplicifolium*.

Genus 3. *Halfordia*

A genus consisting of 3-4 species distributed throughout tropical eastern Australia, New Guinea and New Caledonia. Of the 2 species in Australia, 1 is endemic. These Australian species are distributed from N.E. Qld. to the north coast of N.S.W.

**ACRONYCHIA ACIDULA**

UPPER: Flowering branch: *Acronychia acidula* — a tree to about 27 m. It grows in the upland rainforests of northeast Queensland, from the Atherton Tablelands south to the Eungella Range west of Mackay. The flowers consist of 4 sepals, 4 petals and 8 stamens.

LOWER: Fruiting branch: The fruits are white to cream in the fresh state, but turn brown to blackish when dry. Botanically, the fruit is a 4-loculate drupe, without septicidal fissures. Generally each locule contains 2 black seeds but occasionally one of these is aborted.

The Current Status of the Sub-Family Aurantioideae

By *Jim Armstrong*, Botanist, Royal Botanic Gardens, Sydney

The Australian members of the family Rutaceae have received attention from a number of Australian botanists, e.g.:—

Dr T. G. Hartley (Herbarium Australlense, CSIRO Canberra) — The rainforest members of the family, particularly the tribes Zanthoxyleae, Flindersleae and Toddaleae.
Mr P. Wilson (Herbarium, Perth W.A.) — The Western Australian members of the family, and the tribe Boronieae in particular.
Mr J. Armstrong (National Herbarium, Sydney N.S.W.) — The tribe Boronieae.

The only section of the family that is not at present being actively examined is the orange sub-family (the Aurantioideae). Since it will be some time before a revision of this section is available, the following notes on the current status of this sub-family are presented.*

SUB-FAMILY AURANTIOIDEAE:

The sub-family Aurantioideae is divided naturally and easily into 2 tribes, the Clauseneae including the remote relatives of *Citrus*, and the Citrae including *Citrus* and all its closer relatives. The genus *Citrus* is not native in Australia but a number of closely related genera are recorded here.

KEY TO THE TRIBES AND GENERA OF THE AUSTRALIAN MEMBERS OF THE SUB-FAMILY AURANTIOIDEAE

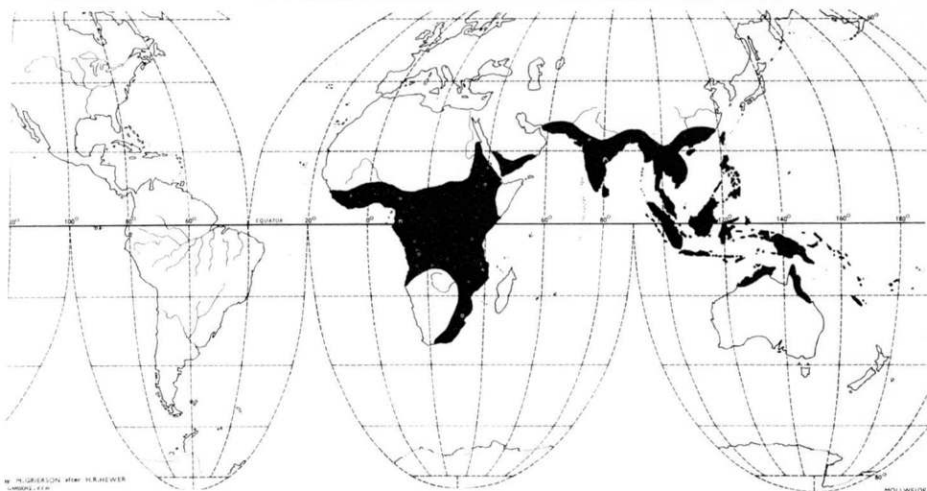
1. Twigs never bearing axillary spines; leaves usually odd-pinnate and then with leaflets always attached alternately to the nonarticulated rachis, rarely 3- or 1-foliate; rachis not breaking into segments when the leaves fall; ovary 2-5 locular, with 1 or 2 ovules in each locule; fruits small, with no pulp-vesicles in the locules, semi-dry or juicy berries. **CLAUSENEAE (Tribe)**
2. Petals valvate (placed edge to edge in the bud); ovary locules twisted; cotyledons thin, folded. **MICROMELUM**
- 2.* Petals imbricate (the edges overlapping in the bud); ovary locules not twisted; cotyledons thick, not folded.
3. Style persistent, thick, shorter than the ovary, which has 2-5 locules with only 1 pendent ovule in each locule; new growth always covered with dense fine-woolly, usually brownish pubescence. **GLYCOSMIS**
- 3.* Style deciduous, shorter than the ovary or rarely as long as the ovary, which has 2-5 locules with 2 ovules (rarely 1) in each locule; new growth usually not covered with dense fine-woolly pubescence.
4. Flower buds globose or broad-ovoid, never long and slender; ovary usually borne on a glabrous, hourglass-shaped gynophore; style short and thick; stigma flattened, scarcely broader than the style. **CLAUSENA**
- 4.* Flower buds cylindrical or long-ovoid; style long and slender, usually much longer than the ovary; stigma broader than the style, usually capitate. **MURRAYA**
- 1.* Twigs of young plants bearing single or paired spines; leaves often odd-pinnate and then with leaflets always attached to the articulated rachis in strictly opposite pairs, or 1-3 foliolate or simple; rachis of pinnate leaves breaking up into segments where the leaves fall; ovary usually 2-5 locular with 1 or 2 ovules in each locule, or 6-18 locular with 4-18 ovules in each locule, locules often containing pulp-vesicles that enlarge as the fruit develops and, with the seeds, fill the cavity completely; fruits small when few locular, or often large when multilocular with a well-developed glandular peel or hard shell. **CITREAE (Tribe)**
5. Fruits small (1-4 cm diam.); locules without pulp-vesicles, but usually containing mucilaginous gum; stamens twice as many as the petals; small trees or shrubs, or clambering woody vines. **PARAMIGNYA**
- 5.* Fruits often large; locule walls bearing sessile or stalked pulp-vesicles filled with juicy tissue; stamens 2-4 or more times as many as the petals, often cohering laterally more or less; small trees.
6. Leaves very thick, grey-green, with palisade tissue and stomata on both faces; stamens with free filaments; ovaries with 3-5 locules, each with 2 ovules. **EREMOCITRUS**
- 6.* Leaves thin or only moderately thick, with palisade tissue and stomata on the lower side only; ovaries with many ovules in each locule. **MICROCITRUS**

TRIBE: CLAUSENEAE

Trees or shrubs with persistent evergreen foliage. Twigs never bear axillary spines. Leaves usually pinnate, rarely 3 or 1 foliolate. Ovary 2-5 locula with 1 or 2 ovules in each locule. Fruits small, with no pulp-vesicles in the locules, semi-dry or juicy berries. (See Map 1).

4 GENERA IN AUSTRALIA; 5 AUSTRALIAN SPECIES.

* The keys and descriptions presented here are based on the work of Swingle (1948).



MAP 1. Distribution of the tribe Clauseneae (5 genera) (after Swingle)

At the National Herbarium, Sydney, the following species are recognized as belonging to the Australian members of the sub-family Aurantioideae.

CLAUSENEAE	GENUS	SPECIES IN AUSTRALIA
	1. CLAUSENA (ca.23)	1. <i>C. brevistyla</i>
	2. GLYCOSMIS (ca.35)	1. <i>G. pentaphylla</i>
		2. <i>G. trifoliata</i>
	3. MICROMELUM (ca.9)	1. <i>M. minutum</i>
	4. MURRAYA (ca.11)	1. <i>M. paniculata</i> Var. <i>ovatifoliolata</i>

NOTE: The number in parentheses refers to the total number of species in the genus.

Genus 1. *Clausena*

This genus of ca.23 species, has the widest ranging distribution of any genus in the sub-family Aurantioideae. It extends all the way from N.W. India to China and Formosa, south through the E. Indian Archipelago to Timor and on to New Guinea and northern Australia. There is also an interesting group of 3 species that covers a wide range in Africa. In Australia, 1 species (*Clausena brevistyla*), is endemic to Hope Island, a small island off the North Coast of Qld. Since this endemic plant is the only native species in Australia, it has the distinction of occupying the extreme south easterly portion of the generic range.

Genus 2. *Glycosmis*

This is a genus of closely related thornless shrubs or small trees. The number of species is uncertain, some authors describing up to 35. *Glycosmis* ranges from south eastern Asia and the East Indies to northern Australia. There are no endemic species in Australia, since the 2 recorded here are also found throughout Malaysia. In Australia, the genus is found in the tropical parts of northern W.A., the N.T. and northern Qld.

Glycosmis is an extremely confused genus taxonomically. Engler (1931) listed 1 species (*G. pentaphylla*) for Australia. Tanaka (see Swingle 1931, p. 155) recorded an additional species (*G. greenii*). Kurz (1876) divided *G. pentaphylla* into 10 species and only recorded *G. trifoliata* in Australia. At the National Herbarium, Sydney, 2 species are recognised:—

- *G. pentaphylla* — Distributed throughout tropical Australia (i.e. northern W.A. and the northern regions of the N.T.).
- *G. trifoliata* — Also with a tropical Australian distribution (i.e. northern W.A. through northern N.T. to northern Qld.).

Genus 3. *Micromelum*

A genus of small spineless trees with 9 recognized species ranging from S.E. Asia to Polynesia. The only species recorded in Australia (*M. minutum*) has an interesting distribution—Swingle states:

"It ranges farther east in Polynesia than any other species belonging to the orange sub-family. It alone reaches the Tongan and Samoan Islands. It also ranges far to the north, from northeastern Australia through New Guinea, Celebes, the Philippines, and reaches North Borneo and Sumbawa, but not Java and Sumatra according to Tanaka (1931c, p. 2), who stated, moreover, that Annam in French Indo-China is its westernmost limit."

In Australia, *Micromelum* ranges from the Montague Sound area of northern W.A. through to N.E. Qld. It extends from N.E. Qld. to the north coast of N.S.W.

Genus 4. *Murraya*

This genus of 11 species of thornless shrubs and small trees is distributed from S.E. Asia to the S.W. Pacific. There are 2 species recorded in Australia. One of these, *M. paniculata* var. *ovatifoliolata* is apparently endemic and ranges from N. tropical W.A. to tropical E. Qld. The remaining species, *M. crenulata*, is reported from tropical E. Qld., Java, Philippines, Celebes and New Caledonia.

Engler (1931) listed 2 species of *Murraya* for Australia — *M. paniculata* var. *ovatifoliolata* and *M. crenulata*. Swingle (1948) however, only records *M. paniculata* var. *ovatifoliolata* here. There are no specimens of *M. crenulata* from Australia in the National Herbarium, Sydney.

SOME CONCLUSIONS ABOUT THE TRIBE CLAUSENEAE

With 5 Australian species the tribe Clauseneae has the distinction of being the smallest tribe in Australia. These 5 species represent 1.5% of the total number of Rutaceae in Australia. The Clauseneae also has the least endemism of any of the 6 Australian tribes, since only 2 of the 5 species (i.e. 40%) are endemic here.

The habitats occupied by these 5 species are the tropical monsoon forests and monsoon scrubs of northern Australia. These vegetation types are closely related to the rainforests of the east coast, but differ in that they are drier and generally more open.

The tribe Clauseneae includes the more primitive genera of the orange sub-family. Many of the remote relatives of the economic genus *Citrus* belong to this tribe. The fruits of the Clauseneae are very small and unlike those of *Citrus* are usually semi-dry and entirely inedible. Nevertheless some of the members of this tribe have been found to produce promising rootstocks upon which to graft *Citrus*.

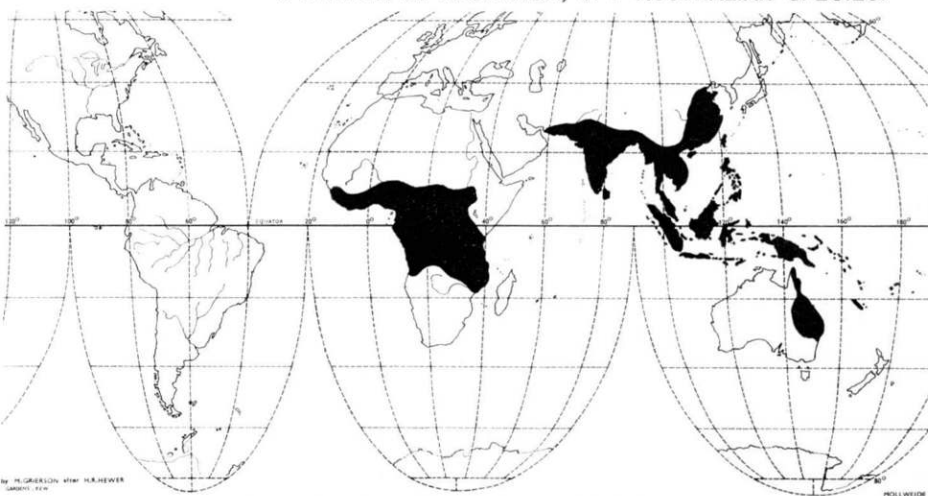
Micromelum is perhaps the most ancient genus in the tribe Clauseneae and hence in the sub-family Aurantioideae. *Micromelum minutum* is the only species represented in Australia.

The remaining genera — *Clausena*, *Glycosmis* and *Murraya*, exhibit very primitive flower and fruit structures. An examination of these genera reveals their very close similarity to a number of families related to the family Rutaceae—the flower and fruit characters are very similar to those of the Simarubaceae and the Meliaceae. In fact so closely allied are these families that the absence of oil glands in the leaves and fruits is almost the only character that separates some of the plants now placed in the Meliaceae from plants in the Rutaceae.

TRIBE: CITREAE

Trees or shrubs with persistent evergreen leaves. Twigs of young plants bearing single or paired spines. Leaves often pinnate, 1-3 foliate or simple. Ovary usually 2-5 locular with 1 or 2 ovules in each locule, or 6-18 locular with 4-18 ovules in each locule. Locules often containing pulp vesicles that enlarge as the fruit develops and, with the seeds, fill the cavity completely. Fruits small when few-locular, or often large when multilocular, with a well-developed glandular peel or hard shell. (See Map 2.)

3 GENERA IN AUSTRALIA; c. 7 AUSTRALIAN SPECIES.



MAP 2. Distribution of the tribe Citreae (28 genera) (after Swingle)

CITREAE**GENUS**

1. EREMOCITRUS (1)
2. MICROCITRUS (6)

SPECIES IN AUSTRALIA

1. *E. glauca*
1. *M. australasica*
- 1(a). *M. australasica* Var. *sanguinea*
2. *M. australis*
3. *M. garrowayi*
4. *M. inodora*
5. *M. maideniana*
1. *P. trimera*

3. PARAMIGNYA (ca.15)

NOTE: The number in parentheses refers to the total number of species in the genus.

Genus 1. Eremocitrus

This monotypic endemic genus is a dry country plant, distributed throughout central and southern Qld. and northern to northwestern N.S.W. *Eremocitrus* is one of the most remarkable genera in the orange sub-family (Aurantioideae). *E. glauca* ("Australian Desert Lime") or ("Australian Desert Kumquat") is typically found growing as a small tree or a large shrub—not infrequently it is a thorny bush only a few feet high. It is the most xerophytic plant in the Aurantioideae. Swingle (1948, p. 364) suggested that:—

"*Eremocitrus* has spread slowly westward in northeastern Australia over a long period of time, probably some 20 million years or more, during which time this plant has become adapted to withstand a semi-arid climate and to grow in soils having an appreciable saline content in the soil moisture."

In an earlier work, Swingle (1914, p. 1127) states that:—

"The fruits of this species are used by the Settlers in Australia for jam and pickles, and ade is made from the juice. The Australian desert kumquat is the hardest evergreen citrus fruit known besides being the only one showing pronounced drought-resistant adaptations; it bears in the wild state edible fruits with a pleasant acid juice and a mild-flavoured peel." (See Fig. 1).

The genus *Eremocitrus* differs from all other members of the orange sub-family, being the only pronounced xerophytic plant in the Aurantioideae. It is remarkably a semi-arid shrub or small tree, able to withstand severe cold in winter as well as burning heat and extremes of dryness, both of the soil and air, in summer. One immediately ranks *Eremocitrus* (Citreae) with the genera *Geijera* (Zanthoxyleae) and *Flindersia* (Flindersieae), when parallelling the development of semi-arid types in tribes that are fundamentally tropical in their distribution.



FIGURE 1: *Eremocitrus glauca* "Australian Desert Lime" — A shrub or small tree, varying in height from 2-5 metres and found in the Western Plains division (chiefly in the northern portion) of N.S.W.

A. Flowering twig. B. Bud. C. Flower. D. Portion of flower showing (a) calyx, (b) disc, (c) ovary, (d) style (e) stigma. E. Portion of flower, showing calyx and disc (with 2 stamens attached). F. Fruiting twig. G. Fruit (lemon shaped) — the fruit is a specialised berry (a hesperidium). H. Twig of young plant. I. portion of stem showing the large spines. (From "The Forest Flora of New South Wales").

Genus 2. *Microcitrus*

There are 6 known species of *Microcitrus*, 5 of which are found in eastern Australia (Qld. and northern N.S.W.) and the other (*M. warburgiana*) in S.E. New Guinea.

Microcitrus is a genus of small spiny trees or shrubs closely related to *Citrus* and *Eremocitrus*. It is confined to rainforest habitats and in Australia extends from Cape York Peninsula to the north coast of N.S.W. The common name for the genus is "The Australian Wild Lime".

Microcitrus is the only sizable genus in the Australian Citreae. The 5 Australian species are keyed out below:—

KEY TO THE AUSTRALIAN SPECIES OF MICROCITRUS

1. Spines often in pairs; leaves large, 8-20 x 4-10 cm; lateral veins very numerous, rather straight and nearly parallel.
2. Fruits ovoid or elongate-elliptical, apex not depressed.
M. inodora ('Large-leaf Australian Wild Lime' — recorded from NE Qld.)
- 2.* Fruits obovate-elliptical, apex deeply sunken.
M. maideniana ('Maiden's Australian Wild Lime' — known only from the rain forest along Harvey's Creek in NE Qld.)
- 1.* Spines, if present, always single; leaves medium-sized or small, 1.5-6 x 0.5-3 cm; lateral veins not very numerous and not usually parallel.
3. Fruits subglobose, with 5 (rarely 6-7) locules. Leaves broadly obovate or rhombic-ovate; fruits globose or subglobose, 2.5-5 cm diam.; pulp-vesicles long, tapering, and contorted near the tips.
M. australis ('Australian Round Lime' — distributed throughout north eastern Australia.)
- 3.* Fruits ovoid or cylindrical.
4. Fruits ovoid or ellipsoid, 6-7 x 2.3-5 cm, with 4-5 locules, peel rough, with large oil glands; leaves rhombic, 2.5 x 2-2.5 cm.
M. garrowayi ('Garrows Australian Wild Lime' — known only from Mt. White on Cape York Peninsula.)
- 4.* Fruits cylindric-fusiform (finger-shaped), 6.5-10 x 1.5-2.5 cm, smooth; leaves ovate or rhombic, 1.5-4 x 1.2-2.5 cm.
M. australasica ('Australian Finger Lime' — distributed throughout the coastal regions of southern Qld. and northern N.S.W.)
M. australasica var. *sanguinea* ('Red-Pulp Finger Lime' — distributed throughout SE Qld.)

Genus 3. *Paramignya*

A genus of evergreen climbing shrubs, with 15 recorded species, ranging in distribution from India through Asia to tropical North Australia. *P. trimera*, the only species recorded in Australia, has a wide ranging distribution. It is recorded from Java, the southern Philippines (Mindoro and Mindanao Islands), Timor and northeastern Australia. It is only known from the Montague Sound area of northern W.A.

SOME CONCLUSIONS ABOUT THE TRIBE CITREAE:

With 7 Australian species the tribe Citreae is similar to the Clauseneae in being one of the smallest Australian Tribes. Unlike the Clauseneae, however, some 6 of the 7 species (i.e. 86%) are endemic here.

NOTE: The status of the genus *Atalantia* (Tribe Citreae) in Australia is doubtful. Benthham (1863) listed *Atalantia* as occurring in Australia and recognised two species — *A. glauca* and *A(?) recurva*. Swingle (1948) however, did not recognise *Atalantia* as occurring here — he treated *Atalantia glauca* as a synonym of *Eremocitrus glauca* and did not mention *Atalantia recurva*. There is a recent mention of *A. recurva* in Chippendale's (1971) check list of Northern Territory Plants, and a specimen labelled *A. recurva* (collected at Yirrkale, Arnhem Land, by R. L. Specht) is in the collection at the National Herbarium, Sydney. Since there is so much confusion about the taxonomic status of this genus in Australia I have, for the purposes of this article, excluded it altogether.



GEIJERA PARVIFLORA — 'WILGA'

A small to medium sized tree distributed throughout SW and central Qld., N.S.W., NW Vic. and S.A. In N.S.W., it is widely distributed in western areas, especially on red soils, deep sandy loams and heavy alluvials.

The "Wilga" grows into a very handsome, pendulous shade tree. It is well worthy of cultivation as an ornamental tree, its drooping habit resembling the introduced willow. The leaves make a very satisfactory supplementary fodder for sheep in those areas where the plant grows, particularly during drought when grass is in short supply. Two distinct variants of this plant, differing only slightly in general morphology, appear to exist. One of these forms is readily eaten by sheep while the other, equally accessible, remains untouched. Lakey and MacLeod (1966) have shown that toxic coumarins are present in the leaves of the unpalatable form.

In the above photograph the nectar producing yellow disc is readily seen. The flowers consist of 5 sepals, 5 petals and 5 antesealous stamens.

Geijera was apparently named in honour of J. D. Geijer. The specific name *parviflora* refers to the smallish flowers produced by this species.



UPPER: Flowering branch of *Flindersia bennettiana* "Bennetts Ash"

Photography by Tony Rodd

LOWER LEFT: *Flindersia schottiana* "Cudgerie"

LOWER RIGHT: *Flindersia australis* "Native Teak" or "Crows Ash"

A medium sized tree up to 25 metres found growing in the rainforests and rather dry thickets of east central Qld. and north eastern N.S.W.

EPILOGUE

Apart from the Boronieae, the remaining 5 tribes of the Australian Rutaceae show their major concentration in the tropical and sub-tropical rainforests of eastern Australia.

It seems a feature of most Australian rainforest genera that:—

- 1) they have species or closely allied genera represented in the Malaysian area; and
- 2) they tend to be linked to the flora of arid and semi-arid inland Australia.

The distribution of the 5 Australian rainforest tribes dramatically illustrates this point, since they are all closely related floristically to the Malaysian area, and 3 of the 5 tribes have genera (*Geijera*, *Flindersia* and *Eremocitrus*) that venture into the more arid areas of inland Australia.

We have seen that the genus *Flindersia* (Flindersieae) is predominantly Australian with 14 of its 16 species occurring here, the majority in rainforest conditions. The genus is also native in the rainforests of the Moluccas, New Guinea and New Caledonia. Similarly, *Geijera* (Zanthoxyleae) and *Halfordia* (Toddalieae) occur in New Guinea and New Caledonia, as well as in Australia. This is in interesting parallel since *Flindersia*, *Geijera* and *Halfordia* whilst representing three distinct tribes, nevertheless possess a common New Guinean-New Caledonian-Eastern Australian distribution pattern.

Perhaps the most remarkable aspect of the family Rutaceae is its degree of endemism in Australia. No less than 94% of all the species and at least half the genera (53%) are endemic here (see Table below). Another important feature is the degree of "primitiveness" of many of the genera—*Micromelum* and *Microcitrus* having already been mentioned in this respect.

Tribe	Zanthoxyleae	Boronieae	Flindersieae	Toddalieae	Clauseneae	Citreae	Total
No. of Genera in Australia	11	18	1	3	4	3	40
No. of Genera Endemic in Australia	5	17	0	0	0	1	23
Percentage Endemic in Australia	45%	94%	0%	0%	40%	86%	58%
No. of Species in Australia	46	242	14	20	7	7	335
No. of Species Endemic in Australia	38	242	10	16	2	6	315
Percentage Endemic in Australia	83%	100%	71%	80%	0%	33%	94%

It has been the opinion of many Australian botanists that the rainforest genera in Australia have originated from South East Asian groups. A careful study of a number of rainforest genera in the family Rutaceae does not fully support this idea. Hartley (1974) in his recent revision of the genus *Acrornychia* states:—

"... It is evident that the largest number of apparently primitive species exist in Australia. It seems probable, therefore, that New Guinea was initially colonized by Australian species and that subsequent radiation has resulted in the comparatively large number of species on that island. Adaptive radiation appears still to be going on in New Guinea... Most of the Australian species, on the other hand, appear to occur as relic populations, probably as a result of the contraction and fragmentation of rain forest areas that is thought to have been going on there since the Tertiary..."

—Hartley also points out, however, that the spread of this genus has not been completely a "one-way" process (i.e.: from Australia to Malaysia). There are two Australian species that have been derived from extra-Australian stock (*Acrornychia acronychioides* and *A. imperforata*, both endemic to Qld., probably originated in the Malaysian area).

Although a great deal more evolutionary work needs to be done on the Australian rainforest genera, it would seem that non-rainforest tribes, such as the Boronieae, evolved from more primitive rainforest groups. The suggestion

is, therefore, that Australian rainforest genera have been the progenitors of species now occurring in the more arid regions of the continent.

REFERENCES

- Anderson, R. H. (1968) — The Trees of New South Wales. N.S.W. Dept. Agriculture, 4th Edition (Sydney, Govt. Printer).
- Bailey, F. M. (1883) — A Synopsis of the Queensland Flora, pp. 47-57, (Brisbane, Govt. Printer).
- Bailey, F. M. (1899) — The Queensland Flora. Part I, Rutaceae pp. 181-216 (Brisbane, Queensland Govt.).
- Bailey, F. M. (1913) — Comprehensive Catalogue of Queensland Plants. Rutaceae pp. 73-82, (Brisbane, Govt. Printer).
- Baillon, H. (1875) — The Natural History of Plants. Translated by M. M. Hartog Vol. IV, Rutaceae pp. 381-520, (London, R. Reeve and Co.).
- Beadle, N., O. D. Evans, and R. C. Caro (1972) — Flora of the Sydney Region, pp. 375-383. (Sydney, A. H. & A. W. Reed).
- Beard, P. S. (1965) — Descriptive Catalogue of West Australian Plants. Rutaceae pp. 54-57, (Society for Growing Australian Plants).
- Bentham, G. and J. D. Hooker (1862) — Genera Plantarum Vol. I, (London, L. Reeve & Co.).
- Bentham, G. (1863) — Flora Australiensis Vol. I, Rutaceae pp. 301-372, Facs. Ed. 1967, (London, L. Reeve and Co.).
- Black, J. M. (1963) — Flora of South Australia Part II. Second Edition, Rutaceae pp. 491-501, Photolitho Reprint, (Adelaide, Govt. Printer).
- Blackall, W. E. (1954) — How to Know Western Australian Wildflowers Part I, Rutaceae pp. 251-259. (University of Western Australia Press).
- Burbridge, N. (1963) — Dictionary of Australian Plant Genera (Sydney, Angus and Robertson).
- Chippendale, G. M. (1971) — Check List of Northern Territory Plants. Proc. Linn. Soc. of New South Wales, Vol. 96, Part 4 pp. 207-267, Rutaceae p. 243.
- Clifford, H. T. and G. Ludlow (1972) — Keys to the Families and Genera of Queensland Flowering Plants (Magnoliophyta). Rutaceae pp. 96-98 (St. Lucida, University of Queensland Press).
- Cronquist, A. (1968) — The Evolution and Classification of Flowering Plants. (London, Nelson).
- Curtis, W. M. (1956) — The Student's Flora of Tasmania Part I (Hobart, Govt. Printer).
- Eichler, Hanajörg (1965) — Supplement to J. M. Black's Flora of South Australia, (Second Edition 1943-1957) Rutaceae pp. 202-207, (Adelaide, Govt. Printer).
- Engler, A. (1896) — Über die Geographische Verbreitung Der Rutaceen in Verhältniss zu Ihrer Systematischen Gliederung. Maps. Reprint from König Preuss. Akad. der Wissenschaften-Abhandlungen pp. 1-27. (Berlin, 1896).
- Engler, A. (1931) — In Engler and Prantl's Die Natürlichen Pflanzenfamilien. Band 19a. pp. 187-358. Ed. 2, (Leipzig, Verlag Von Wilhelm Engelmann).
- Engler, A. (1964) — Syllabus Der Pflanzenfamilien Band Angiospermen. Über-sicht über du Floregebiete der Erde. pp. 262-266 (Berlin, Gebrüder Borntraeger).
- Ewart, A. J. (1930) — Flora of Victoria. Rutaceae pp. 692-711, (Melbourne, Govt. Printer).
- Francis, W. D. (1911) — Australian Rain-Forest Trees. Rutaceae pp. 171-196. (Commonwealth of Australia).
- George, A. S. (1971) — A New Species of *Philotheca*, *P. tubiflora* — the first record of the genus. *Sensu Stricto*, for Western Australia. *Nuytsia*, Vol. 1, No. 2, pp. 208-209, illustr.
- George, A. S. and K. F. Kennelly (1975) — The Flora of the Prince Regent River Reserve, North Western Kimberley, Western Australia. In *Wildlife Research Bulletin* No. 3, pp. 31-68 (Perth, Dept. Fisheries and Wildlife, Western Australia).
- Hartley, T. G. (1966) — A Revision of the Malesian Species of *Zanthoxylum* (Rutaceae). *Journ. Arnold Arb.* 47: 171-221.
- Hartley, T. G. (1967) — A Revision of the genus *Lunasia* (Rutaceae) *Journ. Arnold Arb.* 48: 460-475.
- Hartley, T. G. (1969) — A Revision of the genus *Flindersia* (Rutaceae) *Journ. of the Arnold Arb.* 50: 481-526.
- Hartley, T. G. (1974) — A Revision of the genus *Acronychia* (Rutaceae). *Journ. of the Arnold Arb.* 55: Nos. 3 and 4, July and October 1974, 469-567.
- Hartley, T. G. (1975) — The Taxonomic Status of the Genus *Bauerella* (Rutaceae). *Journ. of the Arnold Arb.* 56: 164-170.
- Hutchinson, J. (1959) — The Families of Flowering Plants. Vol. 1, Dicotyledons, pp. 353-354, (Oxford, Clarendon Press).
- Hutchinson, J. (1969) — Evolution and Phylogeny of Flowering Plants. Rutaceae, pp. 385-391, (London, Academic Press).
- Kurz, S. (1876) — On the species of *Glycosmis*. *Journ. Bot.* 14: 33-40. 2 pls.
- Maiden, J. H. (1904-1924) — Forest Flora of New South Wales. Vols. 1-8. (Sydney, Govt. Printer).
- Maiden, J. H. and E. Betche (1916) — A Census of New South Wales Plants. Rutaceae pp. 112-118 (Sydney, Govt. Printer).
- Moore, C. and E. Betche (1893) — Flora of New South Wales. Rutaceae pp. 39-51 (Sydney, Govt. Printer).
- Mueller, Ferdinand von (1881) — Census of the Genera of Plants known as indigenous to Australia. *Roy. Soc. N.S.W.-Jnl. and Procs.* Vol. 15, pp. 185-300.
- Mueller, Ferdinand von (1882) — First systematic census of Australian Plants. Part 1. — Vasculares. pp. 10. (Melbourne, Printed for the Victorian Govt.).
- Mueller, Ferdinand von (1889) — Second systematic census of Australian plants, with chronologic, literary and geographic annotations. Part 1. Vasculares, pp. 17-22. (Melbourne, McCarron, Bird & Co., for the Vict. Govt.).
- Rendle, A. B. (1963) — The Classification of Flowering Plants Vol. II, Dicotyledons. pp. 283-289, London, Cambridge University Press).
- Rodway, L. (1903) — The Tasmanian Flora. Rutaceae, pp. 20-25, (Hobart, Govt. Printer).
- Smith-White, S. (1954) — Chromosome numbers in the Boronleae (Rutaceae) and their bearing on the evolutionary development of the tribe in the Australian flora. *Aust. Journ. Bot.* 2: pp. 287-303.
- Specht, R. L. (1972) — The Vegetation of South Australia. 2nd Ed. (Adelaide, Govt. Printer).
- Swingle, W. T. (1914) — *Eremocitrus*, A New Genus of Hardy Drought-Resistant Citrus Fruits From Australia. Reprinted from *Journ. of Ag. Research*, Dept. of Ag., Vol II. Washington. D.C. No. 2, pp. 85-100.

- Swingle, W. T. (1914-1917) — *Citrus and Related Genera*. Reprinted from Bailey's "Standard Cyclopedia of Horticulture" 1914-1917, Vol. I to Vol. VI, (London, Macmillan and Co. Ltd.).
- Swingle, W. T. (1915) — *Microcitrus*, A New Genus of Australian Citrus Fruits. Reprinted from the Journal of the Washington Academy of Science, Vol. V, No. 16, pp. 569-578.
- Swingle, W. T. (1948) — The Botany of *Citrus* and its wild Relatives of the Orange Subfamily (Family Rutaceae, Subfamily Aurantioideae). In the *Citrus Industry* Vol. 1 History, Botany and Breeding, pp. 129-474. (Berkeley and Los Angeles, University of California Press).
- Takhtajan, A. (1969) — *Flowering Plants: Origin and Dispersal* — Translated from the Russian by C. Jeffrey, (Edinburgh, Oliver and Boyd).
- Wilson, P. G. (1961) — A Taxonomic Revision of the genus *Correa* (Rutaceae). Reprinted from Trans. Roy. Soc. South Australia, Vol. 85, pp. 21-53.
- Wilson, P. G. (1970) — A Taxonomic Revision of the genera *Crowea*, *Eriostemon* and *Phebalium* (Rutaceae). Nuytsia Vol. 1, No. 1, pp. 1-155.
- Wilson, P. G. (1971) — Taxonomic Notes on the family Rutaceae, principally of Western Australia. Nuytsia Vol. 1, No. 2, pp. 197-207.
- Willis, J. H. (1972) — A Handbook to Plants in Victoria. Vol. II, Dicotyledons. Rutaceae pp. 326-341. (Melbourne, Melbourne University Press).
- Willis, J. C. (1973) — A Dictionary of the Flowering Plants and Ferns. Eighth Edition, Cambridge University Press.

BOOKS ON WILDFLOWERS

Designing Australian Bush Gardens.

Price: \$1.95 plus 55c post.

More About Bush Gardens.

Price: \$1.95 plus 55c post.

Both of these beautiful little books by Betty Maloney and Jean Walker have been published in the past in various forms, but the demand has been such that they have sold out very quickly. Each of 126 pages (9 cm x 13 cm), these delightfully presented books will guide you in the establishment of a bushland setting in your home garden. There is no pretence to mislead the reader with pretty colour plates, the authors using their artistic talents to present line, form and texture both in the book and in the garden.

Students' Flora of North Eastern New South Wales.

Available only from Dept. of Botany, University of New England, Armidale, 2351. Part I. Pteridophytes plus glossary — 64 pp. Price: \$2.50 plus 30c post. Part II. Gymnosperms — Key to the families of the angiosperms and 46 families with keys and species. Price: \$3.50 plus 30c post.

NEW BOOK ON WILDFLOWERS

Flowers and Plants of New South Wales.

Price: \$18.95 plus \$2.05 post.

Wildflower enthusiasts will be familiar with the quality of books in this series, previous ones being given below. This would be the best. The objective of the book is to show in the 556 very good colour illustrations arranged in plant communities, the range and beauty of the flora of N.S.W. and southern Queensland. This has been achieved very capably and the person who knows very little about wildflowers may now safely and confidently identify a vast range of wildflowers.

We are familiar with the superb photography of Ted Rotherham and the colour reproduction here is really outstanding. However, it is the careful, simple, but accurate text by the three botanists Barbara Briggs, Roger Carolin and Don Blaxell that has impressed me. An excellent team effort and book.

Books in this series are easily the best available on wildflowers.

Flowers and Plants of Victoria.

Price: \$16.95 plus \$2.05 post.

Flowers and Plants of Western Australia.

Price: \$16.95 plus \$2.05 post.

AUSTRALIAN PLANTS—FAULTY COPIES—Editor Reports

I have received hundreds of letters of congratulations on the standard of our periodical from all over the world. Members have also commented on the noticeable improvement in the standard of colour printing. Despite this, there is a very active group demanding my replacement. Criticism is the inevitable reward for any one who does anything and I have not been unduly concerned as the majority of people are reasonable and fair, judging on positive achievement.

However, the last two issues had a serious defect: the holes were incorrectly drilled in a number of them. This is the first time in 16 years, but the walling is automatic with some people. If your copies are incorrectly drilled and you cannot rectify the items so that they will go on your binders, please post them back and they will be replaced. If you find any other defects at any time, please let me know and the defective issue will be replaced. None of us is perfect and there must be a few defects from time to time.

I wish to publicly acknowledge the diligence and keen sense of involvement by the staff of our printer who make every effort to produce a publication that you, and they, can be proud of.

—Editor

DO YOU VALUE YOUR JOURNAL ?

Binders of excellent quality are available from the Editor for \$3.00 plus 60 cents postage. They are sturdy, vynex covered, gold lettered and assemble to appear like a bound book on your book shelves. They are available with gold numbers 7, 8 or 9 on the spines, or without numbers. They sell at almost cost price as a service to you.

FACILITIES AVAILABLE TO MEMBERS

Meetings of members in local suburban or town groups. Regular meetings with illustrated addresses in capital cities and major regional centres, free supply of seed and advice on cultivation, field trips, flower shows, publications (*Australian Plants* as well as State news journals) and participation in Study Groups into cultivation of selected groups.

ERICIFOLIA NATIVE PLANT NURSERY

6 GAME STREET, BLACKBURN, VIC. 3130.

TELEPHONE: 878-3889

**Austraflores Nursery**W. & J. MOLYNEUX NURSERIES
PTY. LTD.

BELFAST RD., MONTROSE, VIC. 3765

The largest range in Australia from which to select. Mail orders catered for within Australia and Overseas.

Retail only.

Open 9-5.30 Mon.-Sat.; 12-5.30 Sun.
during Spring and Autumn.Agencies in Canberra A.C.T. and
Millicent S.A.1975 catalogue — 60c at Nursery,
\$1.00 posted**ALEXANDER PLANT FARM**

(Doug Twaits, Prop.)

2 Winifred Street, ESSENDON, VIC.
3040

Phone: 379-5163

EVERYTHING FOR THE GARDEN
Specialising in Australian Native Plants**Nindethana Native Plant
Seeds**By Packet, Ounce or Pound
Large selection. Send for free list.**NINDETHANA**

Box 129, Wellington, 2820

BELBRA NURSERYIn the heart of the Gramplans
LARGE RANGE OF AUSTRALIAN
NATIVES

Closed Wednesday only

BOX 12, HALL'S GAP, VIC. 3381

Greenbriar Drive-in Nursery

AUSTRALIAN NATIVE PLANTS

Large and Varied Selection

195-7 MOUNTAIN VIEW RD.,

BRIAR HILL, VIC. 3088

Phone: 43-1468 — Open Weekends

**MICHIE'S KENTLYN NATIVE
PLANT NURSERY**

Specialising in Australian Plants

Beth & Bob Michie invite you to call

96c GEORGE'S RIVER ROAD,

KENTLYN, N.S.W. 2560

Phone: Campbellton 25 1583

Closed Tuesday & Wednesday only

NAROOMA NATIVE NURSERY

(H. & N. RYAN, Proprietors)

15 TILBA STREET, NAROOMA, N.S.W.

2546 — Phone 132

Good variety of native plants.

Catalogue Available 10 cents.

WIRRIMBIRRAHume Highway between Tahmoor and
Bargo, N.S.W.**AUSTRALIAN PLANTS**

Wide Range — Phone: 841112 Bargo

OPEN SEVEN DAYS A WEEK

**"CHIVERS' NATIVE PLANT
NURSERY"**26 Cowper Road, Black Forest, S.A.
5035 — Phone: 93-7808

Open April-May — Catalogue Available

From March 1st—Send 10 cent stamp

No Interstate Orders



COLLECTORS

NURSERIES

NATIVE PLANT SPECIALIST

KEVIN REED

Cnr BELLEVUE CRES. and SEAFORD RD. SEAFORD VIC. 3198

Huge Selection from ground cover to trees, rare and the common, sizes large or small

Open Saturday and Sunday

(Closed Mon. & Tues.)

PRESERVATION BY CULTIVATION

Closed Tuesdays

FLORALANDS

KARIONG, via GOSFORD, N.S.W. 2250 — Prop. Brian & Lyn Parry

A large variety of the most popular native plants at nursery

PHONE: Gosford 25-1142

Send self addressed envelope for plant list.

Clearview Nursery—W. Cane, Box 19 Maffra, Victoria, 3860. Specialist in developed plants.

FOR A DIFFERENT SELECTION OF NATIVE PLANTS
ALBION PARK NURSERY

150 PRINCES HIGHWAY, ALBION PARK RAIL, N.S.W. 2527 - PHONE: (042) 562865

No Mail Orders — Closed Tuesday and Thursday

Lakkari Native Plant Nursery

Russell & Sharon Costin

Wide range of all common varieties,
 many interesting and hard to get plants,
 new introductions from North Queens-
 land and other tropical areas.

477 REDLAND BAY ROAD,
 CAPALBA, 4157 — 206-4119
 (closed Thursdays)

PARSONS NATIVE PLANT

NURSERY

Trees, Shrubs, Ground Cover, Climbers
 Specialising In Grevilleas

Open Thur., Frid., Sat. 9-5; Sunday 9-1
 Research—Warrandyte Rd., Research
 3095

SUPPORT YOUR
 SPECIALIST
 WILDFLOWER
 NURSERYMEN

AUSTRALIAN PLANTS CENTRE

Visit the best range of native plants on
 the Gold Coast

SORRY—NO MAIL ORDERS

PINE RIDGE ROAD, COOMBAH,
 QLD. 4215 — Closed Mondays

DEANES ORCHID NURSERY

Specialising in Australian Native Orchids

Please send for descriptive list. Plants sent anywhere.

Nursery open every weekend—weekdays, phone 86-3446

157 BEECROFT ROAD, BEECROFT, N.S.W. 2119



**FOREST
 NATIVE
 NURSERY**

(02) 450 1785

NO MAIL ORDERS

9 Namba Road, Duffy's Forest, N.S.W.
 (beside Waratah Park, via Terrey Hills)

**MAGAZINES, BOOKS, BROCHURES, PRICE LISTS,
 CATALOGUES, OFFICE STATIONERY, LETTERHEADS,
 INVOICES, STATEMENTS, ENVELOPES, BUSINESS CARDS**

Consistent quality and unbeatable service together with reasonable
 costs remove most of the problems confronting people purchasing
 printing at . . .

SURREY BEATTY & SONS

43 RICKARD ROAD, CHIPPING NORTON, N.S.W. 2170

Telephone: 602-7404, 602-3126 S.T.D. 02

PAST ISSUES OF "AUSTRALIAN PLANTS" AVAILABLE

Because of the vast wealth of our flora there is very little repetition.

VOLUME No. 1 Issues 1-12 — to be reprinted in 1977. Watch for announcements.

VOLUME No. 2 Issues 13-20, all available only fully bound at \$8.00 plus 80c postage, including "A Descriptive Catalogue of Western Australian Plants".

VOLUME No. 3. Issues 21-28, all available only fully bound at \$8.00 plus 80c postage, including also "Catalogue of Cultivated Australian Native Plants" valued at \$4.50.

VOLUME No. 4. Issues 29-36, all available only fully bound at \$8.00 plus 80c postage, including "Western Australian Plants for Horticulture—Part I" valued at \$4.50.

VOLUME No. 5. Issues 37-44, all available only fully bound at \$8.00 plus 80c postage, including "The Language of Botany", a valuable reference to words and terms.

VOLUME No. 6. Issues 45-52, all available only fully bound at \$8.00 plus 80c postage, including "Western Australian Plants for Horticulture—Part II" valued at \$4.50.

VOLUME No. 7. Issues 53-60, all available only fully bound at \$8.00 plus 80c postage, including "North Australian Plants" valued at \$4.50. Available Nov. 1975.

"Australian Plants" is produced as a continuing series each issue adding to the information recorded over the past issues. The most valuable and complete reference.

OTHER BOOKS OF THE SOCIETY

West Australian Plants for Horticulture. Parts 1 & 2 each available at \$4.50 plus 40c postage from the Editor. On the right-hand pages of these books there is a full colour plate of a W.A. wildflower and on the page opposite is a description of this plant together with another plant or plants from the same genus. The descriptions are clear and in simple terms with a special section on propagation and horticulture treatment and potential. Part 2 recently published carries 42 colour plates never before presented—excellent value.

West Australian Plants—A Descriptive Catalogue (2nd Edition)

This is the only complete reference to the flora of Western Australia. Thousands of species are listed and many shown in full colour. Against each species is recorded the height of the plant, the flower colour, the period of flowering and the native locality. Available from the Editor for \$4.50 plus 40c postage.

NORTH AUSTRALIAN PLANTS — 1 by Jenny Harmer. Price \$4.50 plus 50c post.

This is the first book giving a reasonable coverage to the flora in the North of Australia and will be an authoritative reference to it. There is a reference to 380 species. While this is a lot of flowering plants it is still a long way short of the Northern Australian Flora. As such it is Part 1 of a series and describes those plants of horticultural interest that are to be found in the Darwin area and Arnhem Land, known locally as the "top-end" of the territory.

This book will be of interest to all. On each right hand page is a large full colour plate of a wildflower usually showing the tree or shrub, and a detail of the flower. Opposite is a reference to the plant family in which it belongs together with other genera in the same family that occur in the area, a description of the genus together with all other species of the same genus occurring in the area followed by a clear description of the plant pictured, its distribution and economic value. Of special interest, on each page there is a separate paragraph on Cultivation.

THE SOCIETY FOR GROWING AUSTRALIAN PLANTS

"AUSTRALIAN PLANTS" IS AUSTRALIA'S NATIONAL PRESERVATION JOURNAL

(A non-profit making venture, produced quarterly, dedicated to preservation by cultivation)

This Journal is published by The Publishing Section on behalf of:

SOCIETY FOR GROWING AUSTRALIAN PLANTS—N.S.W. REGION:

President: Mr. G. E. Parker, 7 Blackbuts Rd., Frenchs Forest, N.S.W. 2086.

Secretary: Mr. Ray Page, 21 Robb Street, Revesby, N.S.W. 2212.

SOCIETY FOR GROWING AUSTRALIAN PLANTS—QLD. REGION

President: Mr. J. Smith, Roger Street, Birkdale, Qld. 4152.

Secretary: Mrs. D. Brown, 79 Birley Street, off Wickham Terrace, Brisbane, Qld. 4000.

SOCIETY FOR GROWING AUSTRALIAN PLANTS—SOUTH AUSTRALIAN REGION: INC.:

President: Mr. L. Russell, 26 Chapman Street, Blackwood, S.A. 5051.

Secretary: Mr. C. J. Winn, Box 1592 G.P.O., Adelaide, S.A. 5001.

SOCIETY FOR GROWING AUSTRALIAN PLANTS—TASMANIAN REGION:

President: Mr. R. Wyatt, 7 Cedar Street, Lindisfarne, Tasmania 7015.

Secretary: Mr. G. Peters, G.P.O. Box 1353P, Hobart, Tasmania 7001.

SOCIETY FOR GROWING AUSTRALIAN PLANTS—VICTORIAN REGION:

President: Mr. D. B. Fletcher, 247 Waverley Road, East Malvern, Victoria 3145.

Secretary: (Sister) E. R. Bowman, 4 Homebush Crescent, Hawthorn East, Victoria 3123.

Please do not phone or call at private home—enquiries by mail only.

SOCIETY FOR GROWING AUSTRALIAN PLANTS—CANBERRA REGION:

President: Mr. Brian Muffet, 23 Marulda Street, Aranda, A.C.T. 2614.

Secretary: Mrs. J. Benyon, P.O. Box 207, Civic Square, A.C.T. 2608.

WEST AUSTRALIAN WILDFLOWER SOC. (Inc.):

President: Mrs. M. Wittwer, P.O. Box 64, Nedlands, W.A. 6009.

Secretary: Mrs. K. Edmonds, P.O. Box 64, Nedlands, W.A. 6009.

Seed is in very short supply—try the commercial seedsmen, not W.A. Society.

Membership is open to any person who wishes to grow Australian native plants.

Contact the Secretary of the Society for your State for information without obligation.

PUBLISHING SECTION FOR SOCIETIES—Produced as a non-profit venture.

Managing Editor: W. H. Payne, assisted by P. D. Leak; Despatch by E. Hubner, H. Jones

with families. Stencils Miss R. Mashford. No telephone enquiries please.

MAIL—Address mail to the Editor, 860 Henry Lawson Drive, Picnic Point, N.S.W. 2213.

Please do not telephone or call at private home—enquiries by mail only.

SUBSCRIPTION—Members: Apply to State Secretary above.

NON-MEMBERS: You may receive the next 4 issues direct to your home by forwarding

an annual subscription of \$2.00. Overseas subscription \$2.70 Aust., £1.80 in new English

currency or \$4.00 U.S.



Photography by M. Hodge

EUODIA ELLERYANA

This species forms a small to medium sized tree, occasionally reaching 20 metres in height. It has a very wide distribution ranging from the north coast of N.S.W. through to northern Qld. and extending to Papua New Guinea. It is often found growing in rainforests on rather rich alluvial soils not far from the sea.

The opposite leaves are trifoliate, each leaflet being broadly ovate or elliptical and up to 20 cm long. The flowers are pink and produced in short dense panicles or cymes, the individual flowers consisting of 4 sepals, 4 petals and 4 antepetalous stamens. The fruit is a capsule consisting of 4 or fewer carpels. Each carpel splits open when mature and exposes the black shiny seed.

Euodia elleryana is a very desirable tree for ornamental purposes. It grows into a well shaped tree and its masses of pink coloured flowers are very attractive. It should do well in cultivation in sheltered areas.