THE WESTERN AUSTRALIAN DEPARTMENT OF CONSERVATION AND LAND MANAGEMENT/WORLD WILDLIFE FUND AUSTRALIA

ENDANGERED POISON PLANTS OF WESTERN AUSTRALIA

FINAL REPORT WWF PROJECT P105

by

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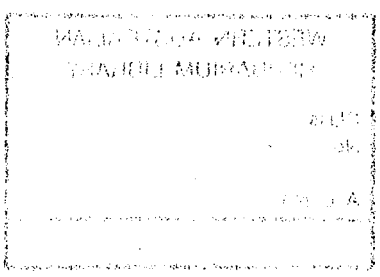

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INTRODUCTION

The Need for Conservation

Western Australia has a flora that is exceptionally rich in localised and rare endemic plant species. Many endangered species are concentrated in the wheatbelt and other areas where there has been extensive clearing and modification of the native flora so effective conservation and management is particularly important. Threats to the State's flora presently include land clearing, fire, mining, exotic weeds, grazing, pests and disease, recreation, roadworks and the inappropriate use of herbicides.

The toxic species of *Gastrolobium* R. Br. are a unique group of poison plants which caused economic loss to stock raisers in the early days of settlement in Western Australia. In the 1930's they were the main reason for which the Government Botanist, Charles Gardner, was appointed. The toxin that members of this genus contain is monofluoro-acetate, the sodium salt of which the well known '1080' poison is used extensively for rabbit control. A remarkable feature of these poison plants is that the local native herbivores are immune to the effects of the toxin whereas the same animal species from other areas succumb. It is possible that poison plants may contain other important as yet undiscovered chemicals.

Many *Gastrolobium* species occur in the wheatbelt area of Western Australia where remnant vegetation is now confined to roadside verges and small scattered nature reserves. Poison plants are even more susceptible to extinction than most wheatbelt plants because they have been selectively destroyed. As recently as 1967, the eradication of poison plants was being recommended before areas were used for grazing stock and the Western Australian Herbarium still receives requests for identifications of poison plants from landowners wanting to know whether they should remove the plants.

The legislative basis and guide-lines for conservation of Western Australia's indigenous flora and fauna are described in the State Conservation Strategy, Wildlife Conservation Act (1950-1985) and the Conservation and Land Management Act (1984-1987). The Department of Conservation and Land Management (CALM) is responsible under the Wildlife Conservation Act for the protection of flora and fauna on all lands and waters throughout the State. Under Section 23F of the Act (Appendix I), the Minister for CALM has a statutory responsibility for classes of flora declared to be rare. Three of these species included in this survey are classified as Declared Rare Flora, *Gastrolobium appressum*, *Gastrolobium glaucum* and *Gastrolobium tomentosum*. CALM Policy Statement No. 9, Conservation of Endangered Flora in the Wild (Appendix II), describes legislation, departmental policy and criteria for gazettal of Declared Rare Flora.

Accurate information on a species' distribution is required to assess its conservation status and as a basis for management. One of the first steps toward conservation, therefore, is a survey of the distribution of a species .

The Endangered Poison Plants of Western Australia project was undertaken with the assistance of volunteer botanists to survey the distribution of fourteen rare poisonous *Gastrolobium* species. A second objective was to establish a seed bank for these plants in order that they could be introduced to cultivation. It was hoped that the survey would both provide information upon which to base conservation and management strategies and, through public involvement, highlight the plight of these much maligned plants.

Survey methodology

The Endangered Poison Plants of Western Australia project was a volunteer-based survey of fourteen of the State's rare pea-flowered *Gastrolobium* species administered by a half-time co-ordinator.

The Survey Co-ordinator was based at the Department of Conservation and Land Management's Wildlife Research Centre and was responsible for the administration of the project, preparation of interim and final reports and field work.

The structure of the Survey was based primarily on that of *The Banksia Atlas* (Taylor and Hopper 1988) and the CALM Survey of Rare and Poorly Known Eucalypts. Administrative duties included preparation of a Volunteer Recording Kit, recruitment of volunteers, answering volunteer queries, checking record sheets and entering records onto the data base, and dispersal of seed collections to storage and cultivation facilities.

Recruitment Active recruitment of volunteers began in May 1989 and continued until September 1989. Volunteers were recruited by several methods based on the experience gained in previous surveys.

A press release was prepared by CALM Public Affairs and it appeared in several rural newspapers and on both government and commercial radio networks. A news report on the progress of the survey was broadcast on the government rural radio network in November. Personalised invitations to participate in the survey were sent to CALM District Officers, Department of Agriculture Officers, Bushwalkers Clubs, Wildflower Societies and Naturalist Groups in regions where the species occurred. Letters were also sent to volunteers who were active collectors in other CALM surveys. Information about the Survey was provided to the Country Women's Association of Western Australia for circulation to their members in the hope that this would encourage the involvement of farming families and other members of the rural community. A short talk was presented to interested groups to encourage members to participate.

Forty seven persons participated in the Survey of Endangered Poison Plants, 15 were from CALM, two from the Department of Agriculture, two from Main Roads Department and 28 were private individuals. One naturalist club, one bushwalking club and three wildflower societies participated. Fifteen of these contributors sent in records for survey species but many others are known to have contributed although they did not find any of the survey plants.

Recording kit for volunteers The known distributions of survey species were documented by examining specimens from the Western Australian Herbarium and CALM records. Many of the herbarium records were old, repetitive and provided inadequate information on the location of the collection site. The method of recording data allowed for some of the vagaries of this information by including a site resolution code but some records had to be excluded. The information was entered onto the FLORAPLOT computer system which allows point plotting of locations according to specified criteria e. g., by species, geographic area.

A Field Guide for volunteers was produced based on these data, surveys of the literature and through consultation with other botanists and a taxonomists.

The Field Guide was based on the most recent taxonomic revisions of the Mirbelieae (Crisp and Weston 1987) and contained background information on the survey together with advice on obtaining collector's permits and collecting, pressing and labeling specimens. Also included was a description of each species highlighting characteristics which distinguish it and which help to differentiate it from species with which it is commonly confused, maps of known locations generated using FLORAPLOT, and illustrations of each species. These illustrations were drawn specifically to highlight distinctive characteristics so as to assist volunteers with identification. A glossary and a key from Blackall and Grieve (1981) was also included.

A Recording Kit was prepared containing:

1 Introductory letter
2 Field Guide
3 Instruction Booklet. *Banksia Atlas Instruction Booklet and Supplementary Field Guide* (Taylor and Hopper 1984) prepared for the Banksia Atlas Survey.

Contained detailed instructions and worked examples showing how to fill in Sight Record Sheets

4 Poison Plant Supplement. Detailed modifications and additional requirements for the Endangered Poison Plant Survey (Appendix III)
5 Computer based Sight Record Sheets
6 Field Note Book
7 Map showing the 1:100 000 Topographic Series for south Western Australia

The Sight Record Sheets and *Banksia Atlas Instruction Booklet and Supplementary Field Guide* (Taylor and Hopper 1984) were used both because there were copies remaining and because they required only a few modifications for this survey.

Volunteers were asked to send in properly collected, pressed and labeled specimens in the following circumstances:

- For any population a significant distance from the nearest known location of the species;

- Whenever the volunteer was unsure of identification;

- For unusual or new variants of species.

Specimens were usually collected by the co-ordinator at new locations. All specimens were labelled and lodged at the Western Australian Herbarium.

Communication with volunteers As recommended in the *Banksia Atlas* (Taylor and Hopper 1988), a high priority was given to personal communication during the project. A personal letter and information sheet was sent following an initial enquiry if the person was not known to the co-ordinator. If the volunteer was still interested, the full Recording Kit was sent. Volunteers were also assisted with applications for Permits to Take Declared Rare Flora and were encouraged to come to the Wildlife Research Centre to identify specimens and discuss any difficulties.

Field Work Surveys to locate populations of the species included in the survey were carried out by the co-ordinator between July 1989 and November 1989 were concentrated in areas not covered by volunteers and on species that were under extreme threat.

Field trips to collect seed were undertaken between October and December 1989. Volunteers were asked to collect and keep separate seed pods from individual plants. When this was done, each sample was labeled and half sent to Kings Park and Botanic Garden to be added to the Living Collections and to be propagated. The second half was sent to CALM Seed Centre for long-term storage.

Conservation status

The Wildlife Conservation Act (1950-1985) protects all classes of flora throughout the State. Section 23F of the Wildlife Conservation Act (1950-1985) gives special protection to Declared Rare Flora which are taxa (species, subspecies, varieties) considered by the Minister for CALM to be:

- Rare, less than a few thousand adult plants of the taxon existing in the wild.

- Endangered (in danger of extinction), the taxon is in serious risk of disappearing from the wild state within one or two decades if present land use and other causal factors continue to operate.

or

- In need of special protection, the taxon is not presently in danger of extinction but is at risk over a longer period through continued depletion, or largely occurs on sites likely to experience changes in land use which could threaten its survival in the wild.

Protection is achieved by declaring species to be rare by notice published in the *Government Gazette*. To qualify for inclusion in the schedule of Declared Rare Flora, plants (not including hybrids) must satisfy certain requirements as described in CALM Policy Statement No. 9:

- the taxon (species, subspecies, variety) must be well-defined, readily identifiable and represented by a voucher specimen in a State or National Herbarium. It need not be formally described under conventions in the International Code of Botanical Nomenclature, but such a description is preferred and should be undertaken as soon as possible after, listing on the schedule,

- the taxon must have been thoroughly searched for in most likely habitats in the wild by competent botanists during the past five years,

- the searches have established that plant in the wild is either rare, endangered or deemed to be threatened and in need of special protection.

Under the provisions of Section 23F, the 'taking' of Declared Rare Flora is prohibited by any person on any category of land throughout the State without the written approval of the the Minister. A breach of the Act is liable to a penalty of up to $10 000. The legislation refers only to wild growing populations and applies equally to Government officers and private citizens on Crown and private land.

To 'take' in relation to any flora includes 'to gather, pluck, cut, pull up, destroy, dig up remove or injure the flora or to cause or permit the same to be done by any means'. This includes not only direct destruction or injury by human hand or machine but also such activities as allowing grazing by stock, introducing pathogens, altering water tables so as to inundate or deprive the flora of adequate soil moisture, allowing air pollutants to harm foliage and burning.

Many species do not meet all the criteria required for listing in the schedule, particularly the survey requirement. These taxa may still be in need of special protection and are divided into the following categories:

- Poorly Known Species

  Priority one — Species which are known from only one or a few localities on lands under immediate threat, e. g., road verges, urban areas, active mineral leases, areas grazed by feral animals, etc. These species are under consideration for declaration as rare flora but are in need of urgent high priority further survey.

  Priority two — Species which are known from one or a few localities on lands not under immediate threat, e. g., nature reserves, national parks, vacant crown land, water reserves, etc. These species are under consideration for declaration as rare flora but are in need of urgent high priority further survey.

  Priority three — Species which are known from several localities, some of which are on lands not under immediate threat. These species are under consideration for declaration as are flora but are in need of further survey.

- Taxa presumed extinct

  Priority four — Species which have not been collected or reliably observed in the wild over the past fifty years, or whose total known wild population has been destroyed more recently.

- Taxa for high priority monitoring

Priority five	Species which are considered to have been adequately surveyed and are not endangered or in need of special protection, but could be if present circumstances change. These species are usually represented on reserves.

ENDANGERED POISON PLANTS IN WESTERN AUSTRALIA

Fifty one records were made for the survey species including 31 definite new populations. A substantial amount of 'negative' information was also received about areas that were surveyed by volunteers but in which no plants were found. This information represents a significant addition to knowledge about the present distributions of these species.

Information collected during the survey together with that compiled from references, herbarium records, CALM departmental files and discussions with volunteers and other botanists was used to compile species descriptions, distributions and habitats.

An illustration, a map of the recorded locations, and the present and recommended conservation status are provided for each of the survey species. The impact of certain management techniques (fire, mechanical disturbance, weed invasion, grazing, dieback and canopy cover) is noted and recommendations made for management and research action necessary to ensure and enhance the survival of the taxa.

Conservation status was determined from field observations, discussions with other botanists and examination of locational details and CALM departmental files. The existence of a seed collection was also noted. A table lists details of populations represented by herbarium specimens as well as populations located in this and other surveys. Highly repeated records were not included unless they were the only records or were made over long time intervals.The date of collection, general location, land status and size of the population are given when available. If they are not known the area is left blank. Precise locality details are contained in confidential Rare Flora registers, departmental files and on herbarium records.

The impact of fire, soil disturbance, weed invasion, dieback, canopy cover and grazing was noted (when known) from field observations, discussions with other botanists and volunteers and by consulting references. Management and research requirements were determined on the basis of the conservation status and from the information available on the biology and distribution of the species.

***Gastrolobium appressum* C. A. Gardner**

Scale-leaf poison

Declared Rare Flora

G. appressum is a dense, branched shrub up to 30 cm high, with young branches covered with dense white hairs. The leaves are shortly stalked, leathery, ending in a fine point, sometimes slightly hooked, hairless and pale green. The flowers are about 1 cm long, borne in several whorls of three on silky-hairy pedicels arising in the leaf axils and clustered into small bunches at the ends of branchlets. The petals are two-toned: orange-yellow and reddish-purple. Each flower has a lobed, two-lipped, hairless calyx with the three lobes of the lower lip lanceolate and pointed at their tips. Flowering occurs between September and November.

G. appressum is distinguished by its leaves which are up to 1 cm long and 0.3 cm wide, borne in whorls of three, closely pressed against the stem and often overlapping the adjacent leaf whorls thus obscuring the stem itself. There are no stipules.

Distribution and Habitat

G. appressum is distributed as isolated populations within the remaining native vegetation on a geological fault that runs approximately north-south between Watheroo and Coorow. It prefers substrates of quartz gravel, quartz-derived sand, or disturbed gravel and sand. It grows on slopes or crowns of small hills, around gravel pits and in firebreaks and is usually associated with low heath or scrub communities dominated by *Casuarina campestris*.

At the time this survey began the species was known from 14 sites between Watheroo and Marchagee within a geographical range of 21 km. Isolated outcrops of quartz gravel also occur as far north as Three Springs but a survey north of Marchagee failed to locate any further populations.

No new locations for *G. appressum* had been recorded since the survey of Burgman (1983). In this survey, efforts were concentrated on looking for new populations rather than monitoring existing populations. Nine populations including two new ones were reported. All occurred on road verges.

Conservation Status

- Present Declared Rare Flora
- Recommended Declared Rare Flora

This species is rare and endangered. A total of 2 659 plants were recorded in 14 populations by Burgman (1983) of which one population on private property has since been destroyed. In 1984, eight of the roadside sites were marked for the Main Roads Significant Site program. Reliance on small areas of protected habitat may not fulfil the requirements for conservation of *G. appressum* in the medium to long-term since field observations indicate the species does not tolerate canopy cover and thrives in disturbed locations such as the edges of gravel pits. The species may die off over time in small areas of protected habitat.

Two new, very small populations(one and three plants) on road reserves were found in this survey and seven previously known populations were relocated. Determination of specific numbers of larger populations was not within the scope of this survey but it seems likely that the total number of plants remaining in the wild is still around 2000

G. appressum therefore remains a rare species not represented on any conservation reserve. Burgman (1983) recommended that the possibility of acquiring the railway reserve between

Marchagee and Gunyidi as a flora conservation reserve be investigated and this suggestion remains a high priority.

Burgman (1983) reported that all the seed had fallen by the end of December but ripening time must vary substantially between years\because in 1989, all pods had dehisced by mid November. Therefore, seeds were not collected from *G. appressum*.

Response to fire - not known

Response to soil disturbance - observed growing well in disturbed roadside soil, firebreaks and around gravel pits

Susceptibility to weed invasion - not known

Susceptibility to dieback - not known

Grazing impact - Reported to be poisonous to stock but the species has not been tested for the presence of monofluoro-acetate. Plants growing on private land are often short and bunched with many branches at ground level indicating that the plant is grazed.

Influence of canopy cover - Prefers open situations. Appears to be excluded from adjacent mid-dense stands of *Casuarina* spp.

Recommended management requirements

- collect and maintain seed in long-term storage
- establish in cultivation
- exclude from prescribed burning until response to fire is known
- maintain and install further rare flora marker pegs when required
- inspect populations annually

Recommended research requirements

- investigate acquisition of railway/ road reserve as a nature reserve
- set up permanent monitoring quadrats
- conduct research on fire and life history

TABLE 1 Summary of the recorded locations of *Gastrolobium appressum*

Date	Shire	Population	Land Status	No. of plants
HERBARIUM RECORDS				
-/9/57	Moora	N of Watheroo		
-/10/57	Coorow	Gunyidi		
-/9/61	Coorow	Gunyidi		
10/9/62	Coorow	N of Watheroo		
5/10/65	Moora	Gunyidi		
21/11/73	Coorow	Miling		
20/9/82	Coorow	10.7 km SSW of Marchagee		21 - 50

TABLE 1 continued

Date	Shire	Population	Land Status	No. of plants
9/11/82	Coorow	19.8 km N of Watheroo	Road verge	86
11/11/82	Moora	10.7 km N of Watheroo	Road verge	54
11/11/82	Moora	18.8 km SSW of Gunyidi	Road verge	48
11/11/82	Moora	11.4 km N of Watheroo	Road verge, private	28
12/11/82	Coorow	5.9 km S of Marchagee	Railway reserve	396
12/11/82	Coorow	5.7 km S of Marchagee	Private	217
12/11/82	Coorow	7.7 km S of Marchagee	Railway reserve	27
15/11/82	Coorow	7.3 km SSW of Marchagee	Road verge , private	263
15/11/82	Coorow	8.2 km SSW of Marchagee	Road verge, private	100
16/11/82	Coorow	5.7 km S of Marchagee	Road verge	59
16/11/82	Coorow	5.4 km S of Marchagee	Road verge, private	124
16/11/82	Coorow	5 km S of Marchagee	Road verge	1 214
16/11/82	Coorow	5.2 km S of Marchagee	Private	36
16/11/82	Coorow	2.2 km N of Marchagee	Road verge	7
PRESENT SURVEY				
31/8/89	Moora	8.8 km SSW of Gunyidi	Road verge	
31/8/89	Moora	6 km SSW of Marchagee	Road verge	
*31/8/89	Moora	4.05 km NW of Gunyidi	Road verge	1
31/8/89	Moora	7.2 km SSW of Marchagee	Road verge	
31/8/89	Moora	8.9 km SSW of Gunyidi	Road verge	
31/8/89	Coorow	5.2 km SSW of Marchagee	Road verge	
*31/8/89	Coorow	5.2 km SSE of Marchagee	Road verge	3
31/8/89	Coorow	7.3 km SSE of Marchagee	Road verge	
31/8/89	Coorow	5.7 km SSW of Marchagee	Road verge	

* New population

References

Burgman (1983), Everist (1974), Gardner (1964), Rye and Hopper (1981)

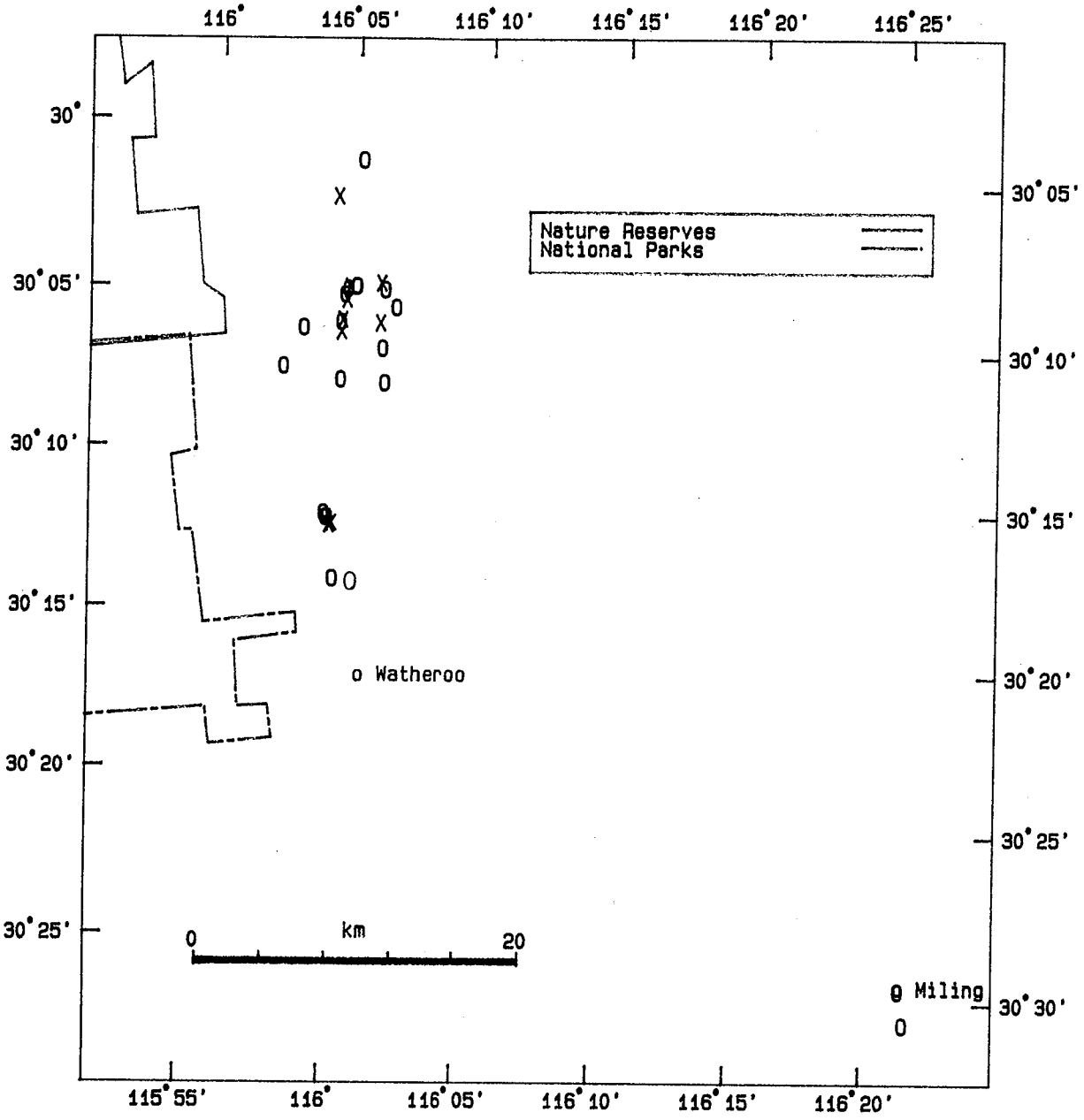

FIGURE 1 Recorded locations of *Gastrolobium appressum*
O Herbarium record, X Survey record

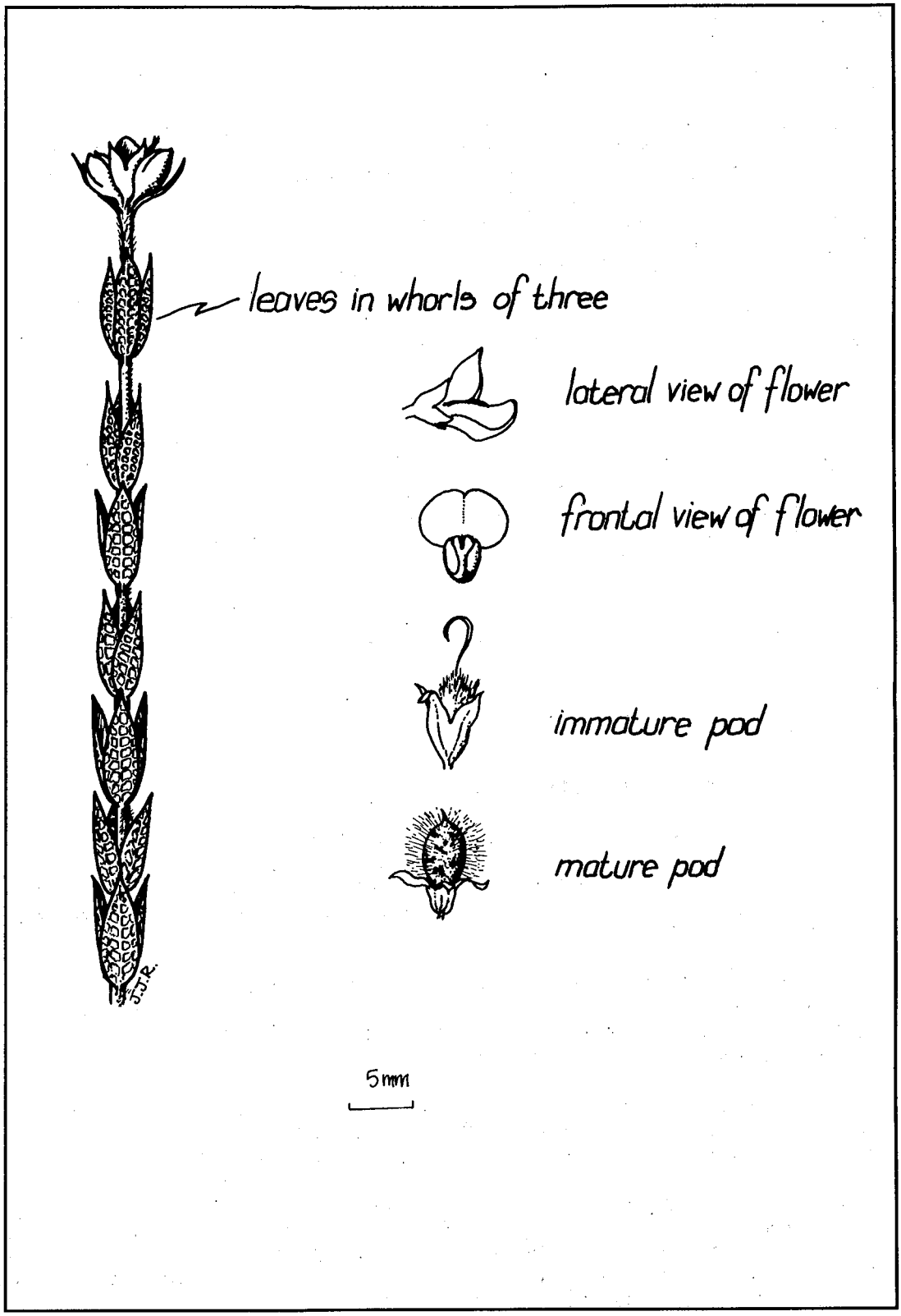

FIGURE 2 *Gastrolobium appressum*

Gastrolobium callistachys Meissn.

Rock poison

Gastrolobium callistachys is a shrub from 1 m to 3 m with erect branches. The leaves are narrow, usually erect, 5 cm long, 1 - 3 mm broad, blunt or notched at the tip with a very small, fine point, tapering at the base into a short stalk. Stipules are small or absent or falling off very early. The flowers are yellow streaked with red, irregularly arranged in terminal, erect, rigid racemes 15 - 22 cm long. The species' name is derived from the Greek *kallistos*, very beautiful, *stachys*, spike. The leaves of *G. calllistachys* are alternate and separated by leafless areas rather than whorled, although sometimes they are grouped in loose clusters so as to appear whorled. Other species of *Gastrolobium* with similar long, narrow leaves either have strictly whorled leaves or shorter inflorescences. *G. callistachys* flowers between September and November. The pod is egg-shaped and bluntly pointed.

Distribution and Habitat

This species is distributed as small populations on granitic soils usually around granite outcrops and therefore has only been reported at restricted localities from the Irwin River southwards to the Dale River and eastwards to Mount Stirling, south of Kellerberrin. It has been reported in woodland plant communities associated with *Eucalyptus wandoo*, *Casuarina* spp. and *Melaleuca redula* and in communities of small shrubs associated with *Leptospermum* spp., *Beyeria* sp. and *Grevillea* sp.

There is one record of *G. callistachys* from Esperance but this is the result of an incorrect identification of a specimen of *Gastrolobium parviflorum*.

Conservation Status

- Present — No formal status
- Recommended — Declared Rare Flora

G. callistachys has been known to be toxic since the early days of settlement in Western Australia and as late as 1973, the Department of Agriculture was publishing a bulletin which recommended that plants should not only be removed but should be heaped and burned because of their high toxicity. This species has therefore been subject to substantial pressure.

G. callistachys is naturally rare in the wild. It occurs in small populations in a relatively rare granite rock habitat much of which occurs within agricultural areas of south Western Australia. Granite rock habitats have been surveyed extensively by CALM staff and it is unlikely that many more populations of *G. callistachys* will be found.

The majority of the herbarium records for this species are old and vague and their land status could not be assessed. Many are in intensive land use areas. The populations probably no longer exist but one population was known to occur on a conservation reserve.

Three new populations were located during the survey, one of which is on a conservation reserve. The population on private property is not considered to be under immediate threat since it is in an area of fenced, uncleared land which has never been stocked. The ownership of the land has, however, recently changed and there may be increased pressure to clear the land for cropping. The possibility of acquiring this land as a conservation reserve should be investigated.

Seed pods were collected from one population of *G. callistachys* and sent to Kings Park for propagation and to the CALM Seed Centre for storage.

Response to fire - not known

Response to soil disturbance - not known

Susceptibility to weed invasion - not known

Susceptibility to dieback - not known

Grazing impact - Monofluoro-acetate has been isolated from this species and it is known to be highly toxic

Influence of canopy cover - Observed growing in woodland and appears to tolerate canopy cover

Recommended management requirements

- inclusion on the schedule of Declared Rare Flora
- close liaison with shires and land owners of the locations of populations to prevent accidental destruction
- exclude populations from prescribed burning
- install rare flora marker pegs on road side population
- maintain seed in long-term storage
- establish in cultivation

Recommended research requirements

- investigate the possibility of acquiring sections of Private Blocks M1520 and M1229 as a nature reserve
- further surveys of suitable habitats
- conduct research on fire and life history

TABLE 2 Summary of the recorded locations of *Gastrolobium callistachys*

Date	Shire	Population	Land Status	No. of plants
HERBARIUM RECORDS				
	Dandaragan	Hill River		
-/11/1877	Mingenew	Upper Irwins River		
-/9/1903	Three Springs	Arrino		
-/9/29	Bruce Rock	S of Merredin		
24/10/34	Northam	Spencers Brook		
23/10/43	Quairading	Mount Stirling	Nature Reserve	
26/9/44	Three Springs	Arrino		
-/9/48	Three Springs	Yandanooka		
20/9/55	Dandaragan	Dandaragan		
4/10/59	Northam	Spencers Brook		
-/9/61	Dandaragan	Jurien Bay		
-/8/61	Northam	S of Spencers Brook		
18/10/61	Northam	S of Spencers Brook		

TABLE 2 continued

Date	Shire	Population	Land Status	No. of plants
11/9/63	Gingin	Regans Ford		
20/11/64	Northam	Spencers Brook		
22/10/64	Quairading	Mount Stirling	Nature reserve	
24/10/64	Quairading	Mount Stirling	Nature reserve	
6/10/65	Northam	Spencers Brook		
-/9/68	Moora	W of Moora		
8/10/68	Esperance	Lort River		
-/8/70	Dandaragan	Jurien Bay		
7/10/81	Wongan	Dog Rock	Private	
16/9/87	Moora	SSW of Watheroo		
PRESENT SURVEY				
*14/8/89	Moora	NE of Watheroo	Private	10 - 20
*7/11/89	Kellerberrin	Mt Caroline	Nature reserve	4
*28/11/89	Wongan	7.9 km ENE of Kalguddering	Road verge	≅ 20

* New population

References

Aplin (1973), Everist (1974), Gardner and Bennetts (1956)

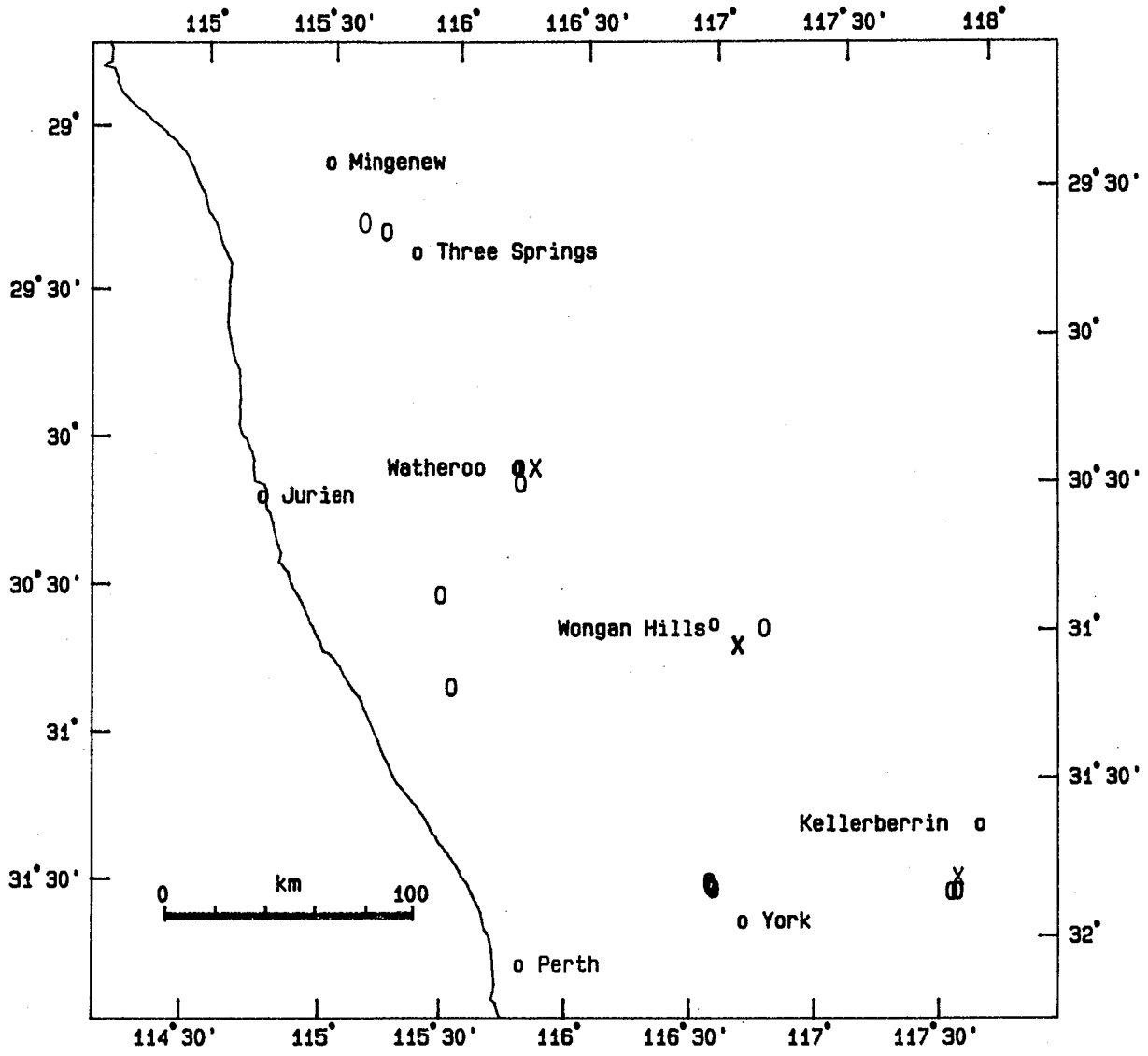

FIGURE 3 Recorded locations of *Gastrolobium callistachys*
O Herbarium record, X Survey record

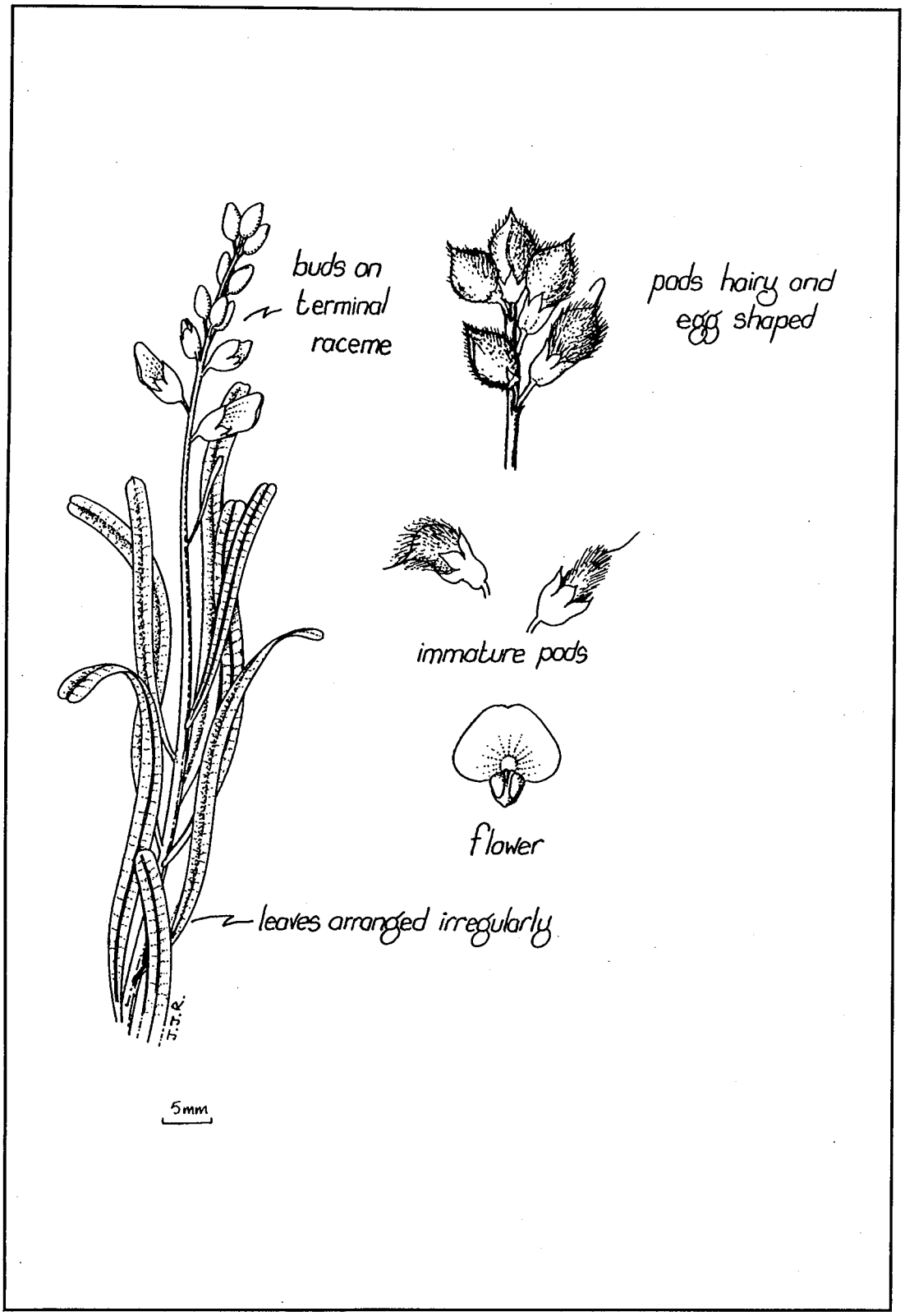

FIGURE 4 *Gastrolobium callistachys*

Gastrolobium densifolium C. A. Gardner

Mallet poison

Gastrolobium densifolium is a shrub 45 - 60 cm high. The branches spread outward from the base and are then erect. The leaves are usually in threes, crowded on the stems, rigid, tough, narrowly elliptic or lance-shaped, tapering at the tip to a fine point which is turned outward, bright green with a yellow midrib which is expanded at the base and flanked by a pair of dark stipules which taper to a fine point. The flowers are yellow with a reddish centre, crowded into racemes at the ends of the branches, the calyx and young pods are covered with long spreading silky hairs. *G. densifolium* may be distinguished from other species by the branches which are marked by the persistent remains of leaf bases and the bases of stipules. This characteristic is not seen in any other *Gastrolobium* except *Gastrolobium rotundifolium*. Flowering occurs between September and November.

Distribution and Habitat

G. densifolium is a geographically restricted species which was originally found from near Dudinin towards Kukerin and eastwards to Lake Grace. It occurs on gradual slopes and in flat areas mainly in red to brown sandy loam. It is reported to usually be associated with lowland brown mallet (*Eucalyptus astringens*) and sometimes *Eucalyptus salmonophloia* but was also found in shrub communities with scattered *Eucalyptus albida* in this survey.

Conservation Status

- Present Priority two
- Recommended Priority two

The new populations of *G. densifolium* located by this survey are the only records to be made for this species in the past 25 years. Not all the new records are included in TABLE 3 as several were made in different parts of the same population. *G. densifolium* is not under any immediate threat since it is represented on a conservation reserve and there are uncleared areas of a similar habitat within its distribution range. It is likely that more populations would be located by further surveys.

G. densifolium has been selectively destroyed by farmers wishing to avoid stock losses yet Aplin (1973) states that the toxic compound usually found in this genus was not isolated from this species. There is a need to determine whether the species is toxic or not since this could help prevent further destruction of plants.

Seed pods were collected from *G. densifolium* and sent to Kings Park for propagation and to CALM Seed Centre for storage.

Response to fire - not known

Response to soil disturbance - observed growing in disturbed roadside soil

Susceptibility to weed invasion - not known

Susceptibility to dieback - not known

Grazing impact - Reported to be toxic but gave a negative result when tested for mono-fluoro-acetate

Influence of canopy cover - not known

Recommended management requirements

- maintain seed in long-term storage
- establish in cultivation

Recommended research requirements

- further surveys of suitable habitats, particularly conservation reserves are needed to clarify the conservation status
- test for the presence of monofluoro-acetate
- conduct research on fire and life history

TABLE 3 Summary of the recorded locations of *Gastrolobium densifolium*

Date	Shire	Population	Land Status	No. of plants
HERBARIUM RECORDS				
-/10/25	Wickepin	Dudinin		
4/11/34	Wickepin	Dudinin		
3/9/52	Dumbleyung	Kukerin		
3/10/59	Dumbleyung	Kukerin		
-/4/63	Lake Grace	Lake Grace		
PRESENT SURVEY				
*29/9/89	Dumbleyung	W of Lake Grace South	Nature reserve	10 - 20
*9/10/89	Dumbleyung	NW of Tarin Rock	Road verge, private	51 - 100
*9/10/89	Dumbleyung	ESE of Harrismith	Road verge	10 - 20
*15/11/89	Dumbleyung	NW of Tarin Rock	Road verge, private	>500
*15/11/89	Dumbleyung	SE of Harrismith	Road verge, private	21 - 50
*15/11/89	Dumbleyung	N of Tarin Rock	Road verge, private	51 - 100
*15/11/89	Dumbleyung	W of Tarin Rock	Nature reserve	51 - 100

* New population

References

Aplin (1973), Gardner and Bennetts (1956)

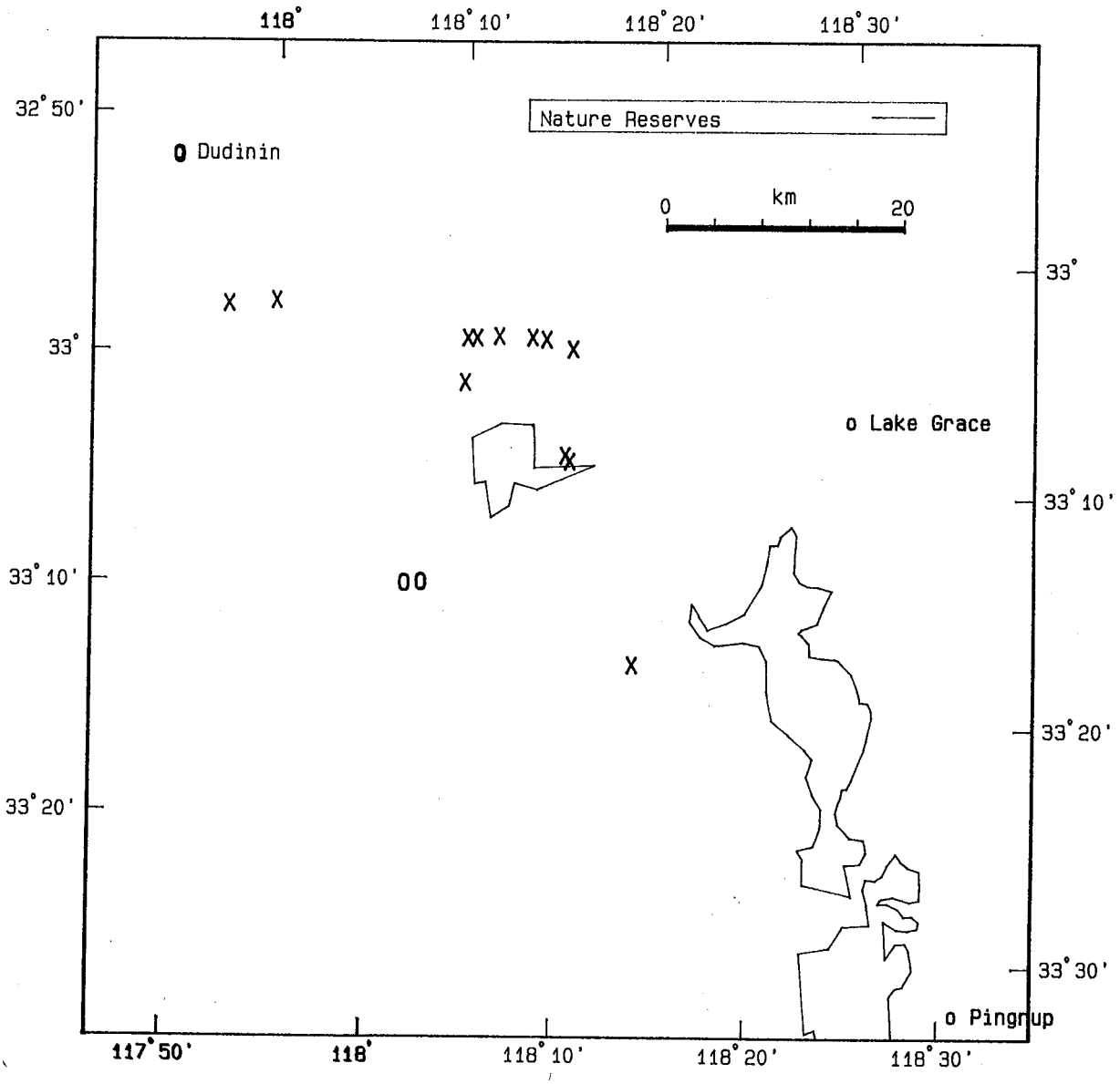

FIGURE 5 Recorded locations of *Gastrolobium densifolium*
O Herbarium record, X Survey record

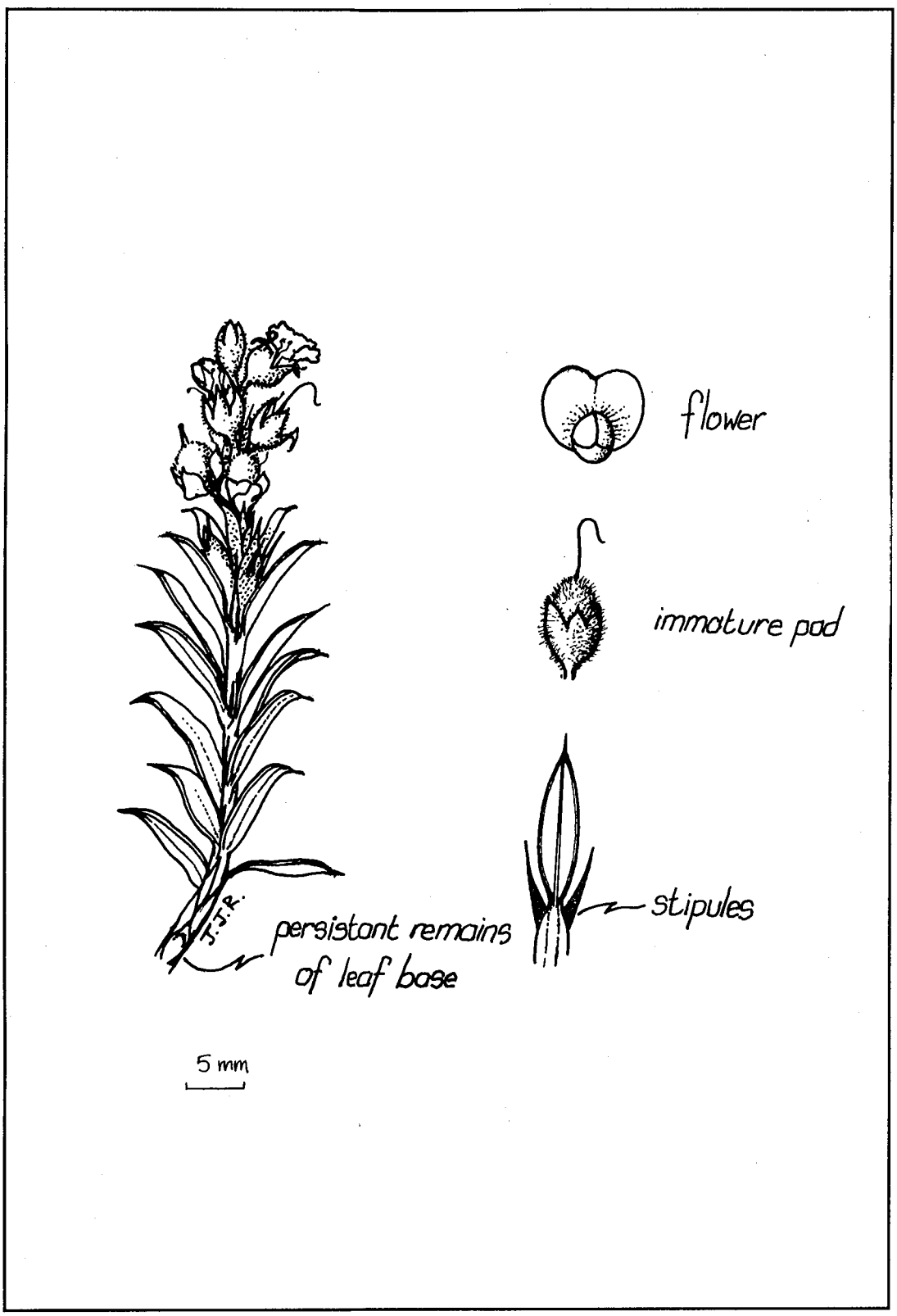

FIGURE 6 *Gastrolobium densifolium*

***Gastrolobium glaucum* C. A. Gardner**

Spike or Wongan poison

Declared Rare Flora

Gastrolobium glaucum is a compact shrub with many stems up to 60 cm high arising from a woody stock. The leaves are arranged in whorls of three and held erect, up to 1.7 cm long and 1.3 cm wide. They are blue-green or almost grey in colour, varying in shape from almost circular to elliptic or obovate, flat, rather thick and rigid with a very blunt tip bearing a hard prickly point. The flowers are orange and red, well under 1 cm long, in closely clustered whorls of three, borne above the leaves. The sepals and flower stalks are densely hairy. It is distinguished from other *Gastrolobium* species by the leaves and small, black stipules. Flowering occurs between August and September.

Distribution and Habitat

G. glaucum has been found around Wongan Hills on small rises of mixed soils which contain sand, gravel, loam and clay. It occurs in low shrubland communities with *Melaleuca* sp., *Hakea scoparia* and *Hakea incrassata*. but does not occur in undisturbed *Casuarina campestris* thickets. At one site, it is found with *Gastrolobium hamulosum*.

Conservation Status

- Present. Declared Rare Flora

- Recommended. Declared Rare Flora

G. glaucum is rare and endangered. It is a colonizer and is likely to have always been rare. Rye (1980) suggested that its preference for unusual mixed soils may explain its restricted distribution. It remains known from only three populations comprising less than 300 plants, none of which are on conservation reserves. The largest population at the type locality comprises about 1 ha of uncleared but disturbed vegetation on a Department of Agriculture Experimental Farm. Numerous plants were observed growing on the road verges around this population in about 1970 but none were observed on road verges in 1980. In the present survey, a few plants were observed growing on very weedy verges but it is not known whether this represents re-colonization or is the result of road widening.

Seed pods were collected from *G. glaucum* and sent to Kings Park for propagation and to CALM Seed Centre for storage.

Response to fire - probably killed by fire

Response to soil disturbance - colonizer, prefers disturbed habitats

Susceptibility to weed invasion - reported to decline in weed infested road verges

Susceptibility to dieback - not known

Grazing impact - not known

Influence of canopy cover - probably does not tolerate canopy cover

Recommended management requirements

- continued liaison with the Department of Agriculture, Water Authority and shire to ensure protection

- acquisition of Department of Agriculture Reserve No. 18672
- exclude from prescribed burning until response to fire known
- control weed species
- install rare flora marker pegs
- inspect populations annually
- maintain seed in long-term storage
- establish in cultivation

Recommended research requirements

- research on fire and life history
- set up permanent monitoring quadrats

TABLE 4 Summary of the recorded locations of *Gastrolobium glaucum*

Date	Shire	Population	Land Status	No. of plants
HERBARIUM AND CALM RECORDS				
5/9/24	Wongan	Wongan Hills		
8/9/59	Wongan	Wongan Hills		
23/8/63	Wongan	Wongan Hills		
5/10/64	Wongan	N of Wongan Hills		
28/10/80	Wongan	N of Wongan Hills	Dept. of Agriculture reserve	≅ 200
27/10/83	Wongan	N of Wongan Hills	Water reserve	6
27/8/85	Wongan	E of Wongan Hills	Road reserve	
PRESENT SURVEY				
9/10/89	Wongan	N of Wongan Hills	Dept. of Agriculture reserve	101 - 500

References

Everist (1974), Gardner and Bennetts (1956), Rye (1980), Rye and Hopper (1981), Leigh *et al.* (1984)

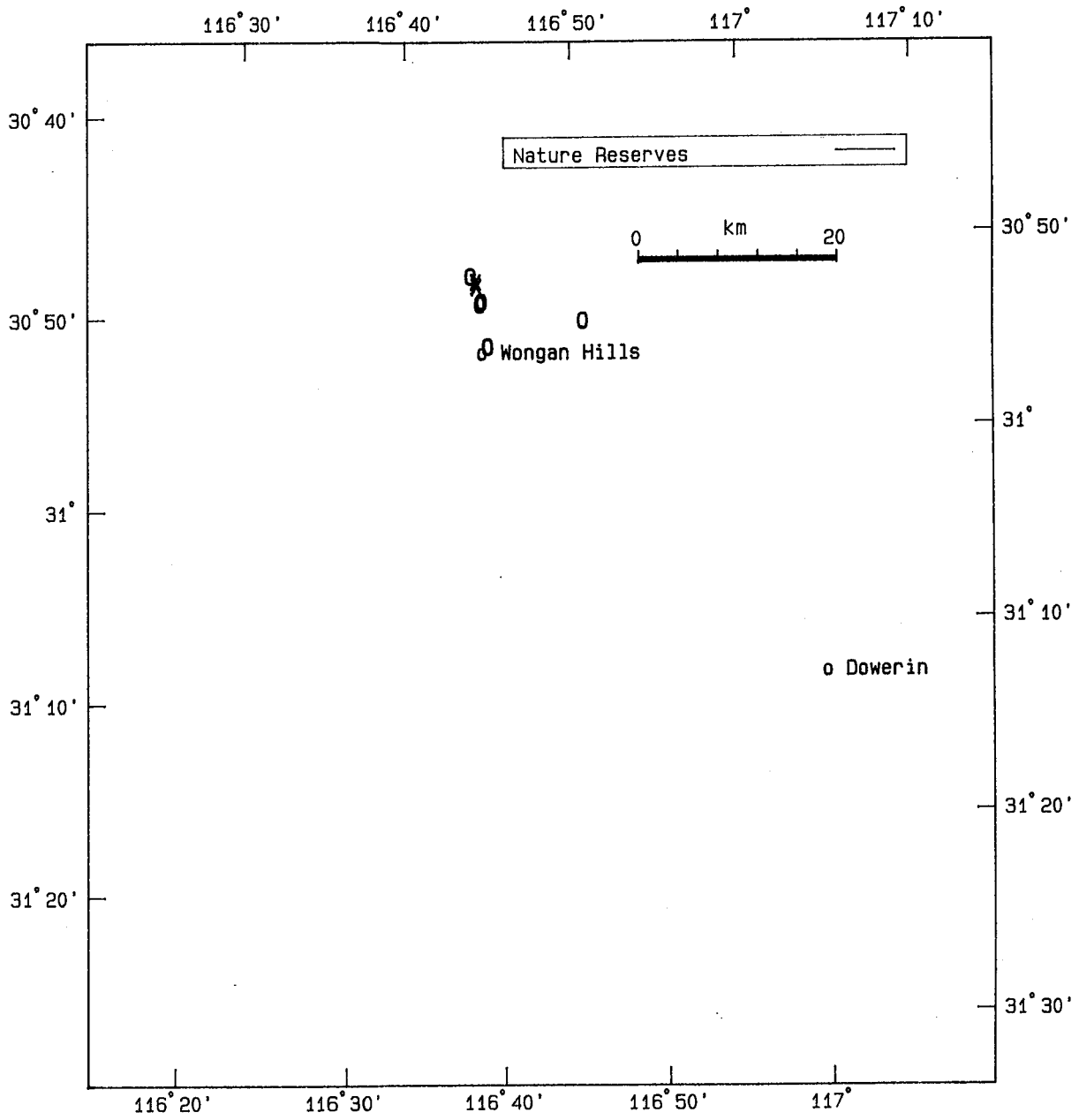

FIGURE 7 Recorded locations of *Gastrolobium glaucum*
O Herbarium record, X Survey record

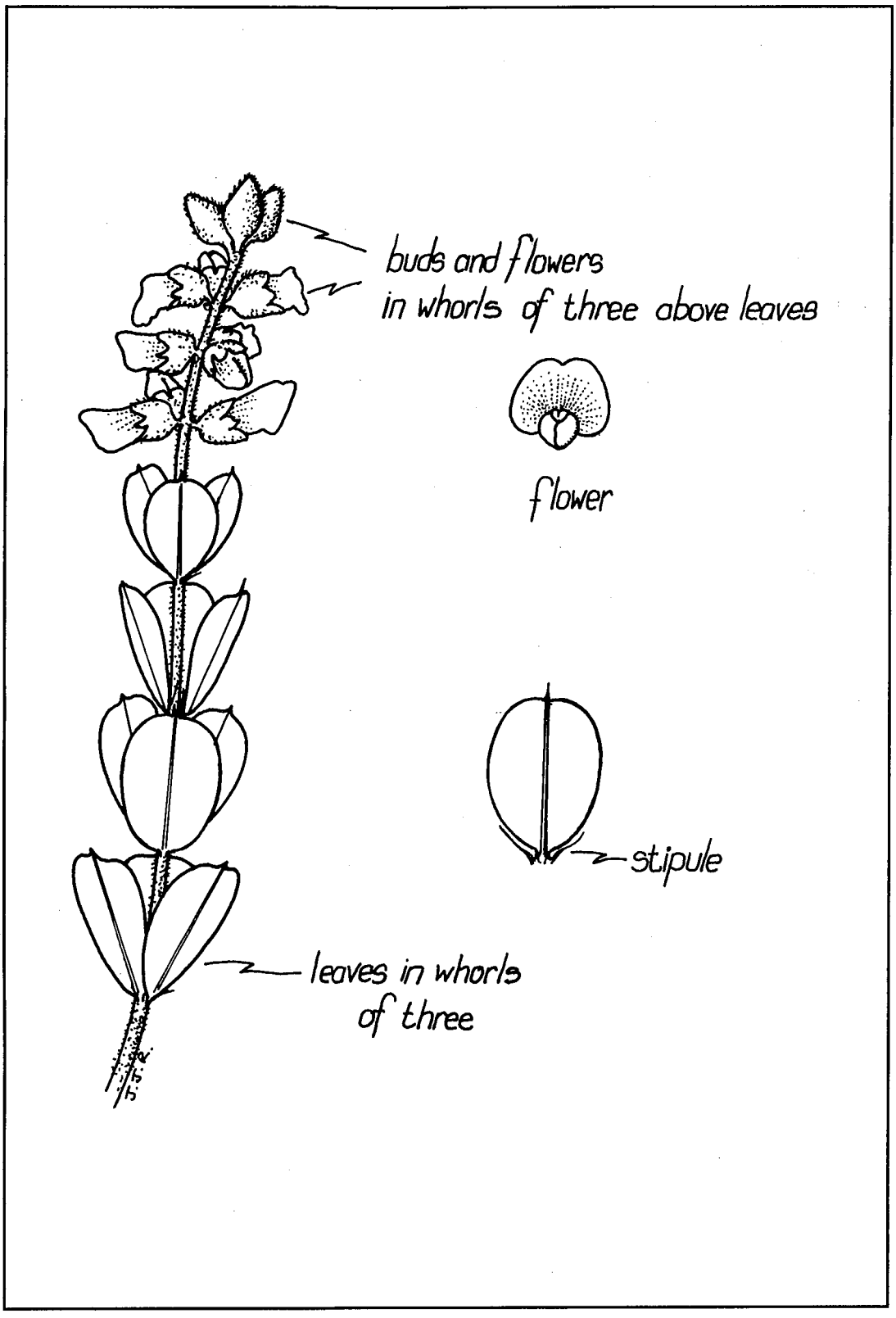

FIGURE 8 *Gastrolobium glaucum*

***Gastrolobium graniticum* (S. Moore) Crisp**

Granite poison

Formerly *Oxylobium graniticum*

G. graniticum is an erect shrub commonly 0.9 - 1.2 m tall but may grow up to 2.5 m. The branchlets are purple, leaves opposite, obovate, deep green to grey-green, rather thick, net-veined, flat, 2.5 - 6 cm long, tapering at the base into a short stalk and usually blunt or slightly notched at the tip. The flowers are yellow and deep red, occurring in large elongated racemes which are mostly at the ends of branches, the calyx is glabrous except for a minute woolly fringe on the lobes. The pods are woody, stalked, glabrous, 12 mm long and purplish-black when ripe. It is distinguished by its long obovate leaves, borne in opposite pairs, tapering into a petiole and by the minute woolly fringe on the calyx lobes. Flowering occurs between September and October.

Distribution and Habitat

G. graniticum is restricted to the eastern goldfields of Western Australia around Coolgardie. There was one record of the species several hundred kilometres to the north-west at Paynes Find but this was due to mis-identification. It is found as small populations in sandy or sandy loam soils around granite rocks in large shrub or woodland communities including species such as *Allocasuarina huegeliana*, *Acacia lariocalyx* and *Eucalyptus eremophila*.

Conservation Status

- Present Priority two
- Recommended Declared Rare Flora

G. graniticum is an extremely rare species presently known from less than 50 plants. Populations are very small and therefore highly susceptible to rapid extinction. It is confined to a rare granite rock habitat and has only been recorded at six locations within a range of 100 km. It has been found on one conservation reserve. It was apparently abundant at one time around Bullabulling (Gardner and Bennetts 1956) but only one plant was seen there in 1989. These authors also reported that it was at Mount Hunt near Kalgoorlie but there are no herbarium records for this site. This survey established that the Gnarlbine Rocks population, one of the earliest recorded sites, no longer exists but one previously unknown population was discovered. Granite rock habitats have been extensively surveyed by CALM staff and since *G. graniticum* is confined to a small area, it seems unlikely that many further populations will be found.

Seeds were collected from *G. graniticum* and sent to Kings Park for propagation and to CALM Seed Centre for storage.

Response to fire - not known

Response to soil disturbance - unknown

Susceptibility to weed invasion - unknown

Susceptibility to dieback - not known

Grazing impact - not known

Influence of canopy cover - may tolerate some canopy cover

Recommended management requirements

- inclusion on the schedule of Declared Rare Flora
- exclusion from prescribed burns until the impact of fire is known
- inform operations staff of locations of flora to prevent accidental destruction
- maintain seed in long-term storage
- establish in cultivation
- protect from recreational damage
- inspect populations annually

Recommended research requirements

- conduct research on fire and life history
- further surveys of suitable habitats

TABLE 5 Summary of the recorded locations of *Gastrolobium graniticum*

Date	Shire	Population	Land Status	No. of plants
HERBARIUM				
12/10/1899	Coolgardie	Gnarlbine Rocks	Private	
-/9/1899	Coolgardie	Coolgardie		
11/10/31	Coolgardie	Bullabulling		
13/9/34	Coolgardie	Bullabulling		
-/11/36	Coolgardie	Bullabulling		
20/11/47	Coolgardie	Bullabulling		
-/11/48	Coolgardie	Bullabulling		
7/9/61	Coolgardie	Bullabulling		
22/9/62	Coolgardie	Victoria Rocks	Nature reserve	
25/8/68	Coolgardie	Bullabulling		
PRESENT SURVEY				
29/9/89	Coolgardie	Bullabulling Rock	VCL	1
4/10/89	Coolgardie	Victoria Rocks	Nature Reserve	11 - 20
*10/9/89	Coolgardie	Caenyie Rock	VCL	11 - 20

* New population, VCL Vacant Crown Land

References

Aplin (1973), Crisp and Weston (1987), Everist (1974), Gardner and Bennetts (1956)

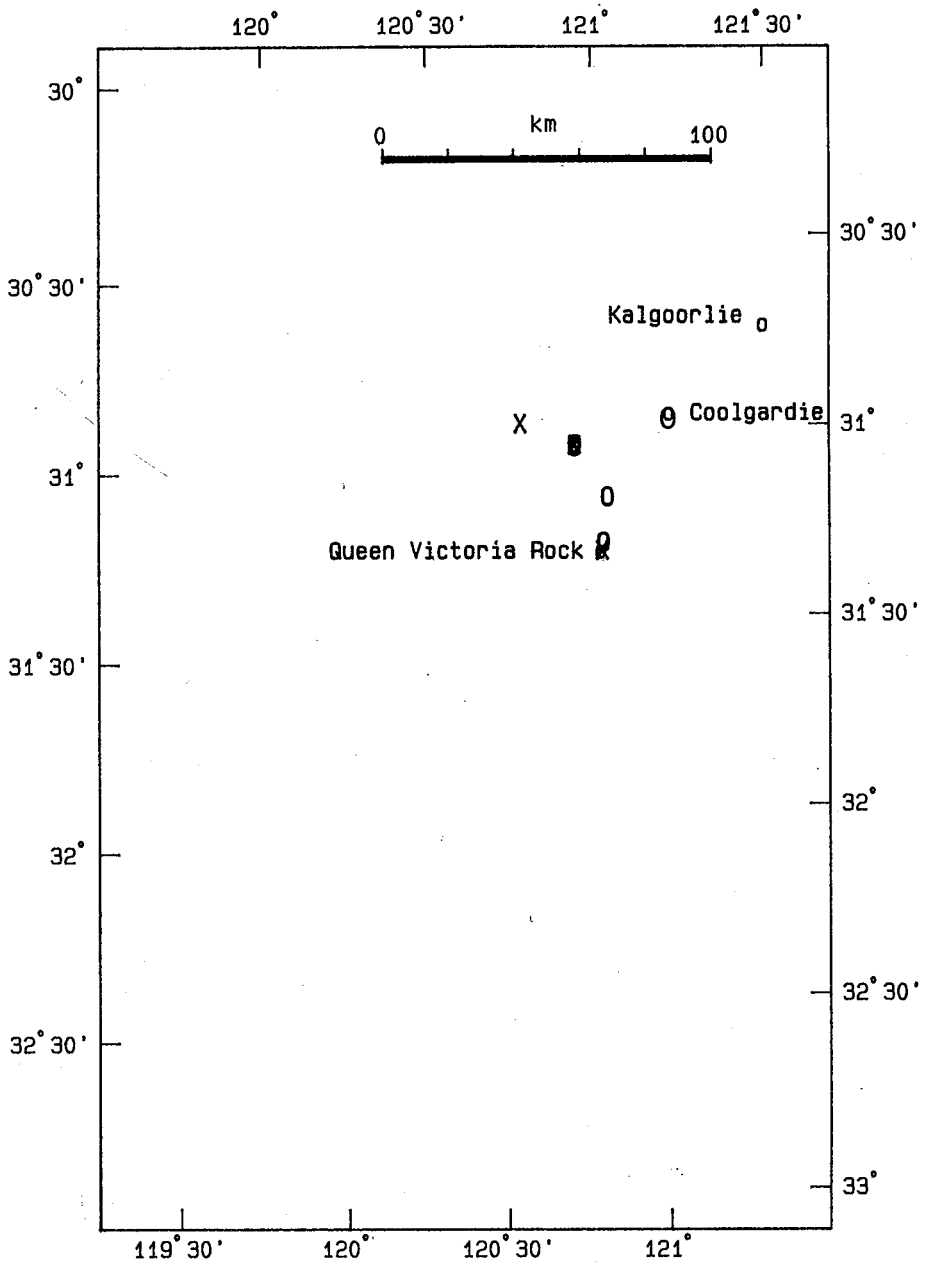

FIGURE 9 Recorded locations of *Gastrolobium graniticum*
O Herbarium record, X Survey record

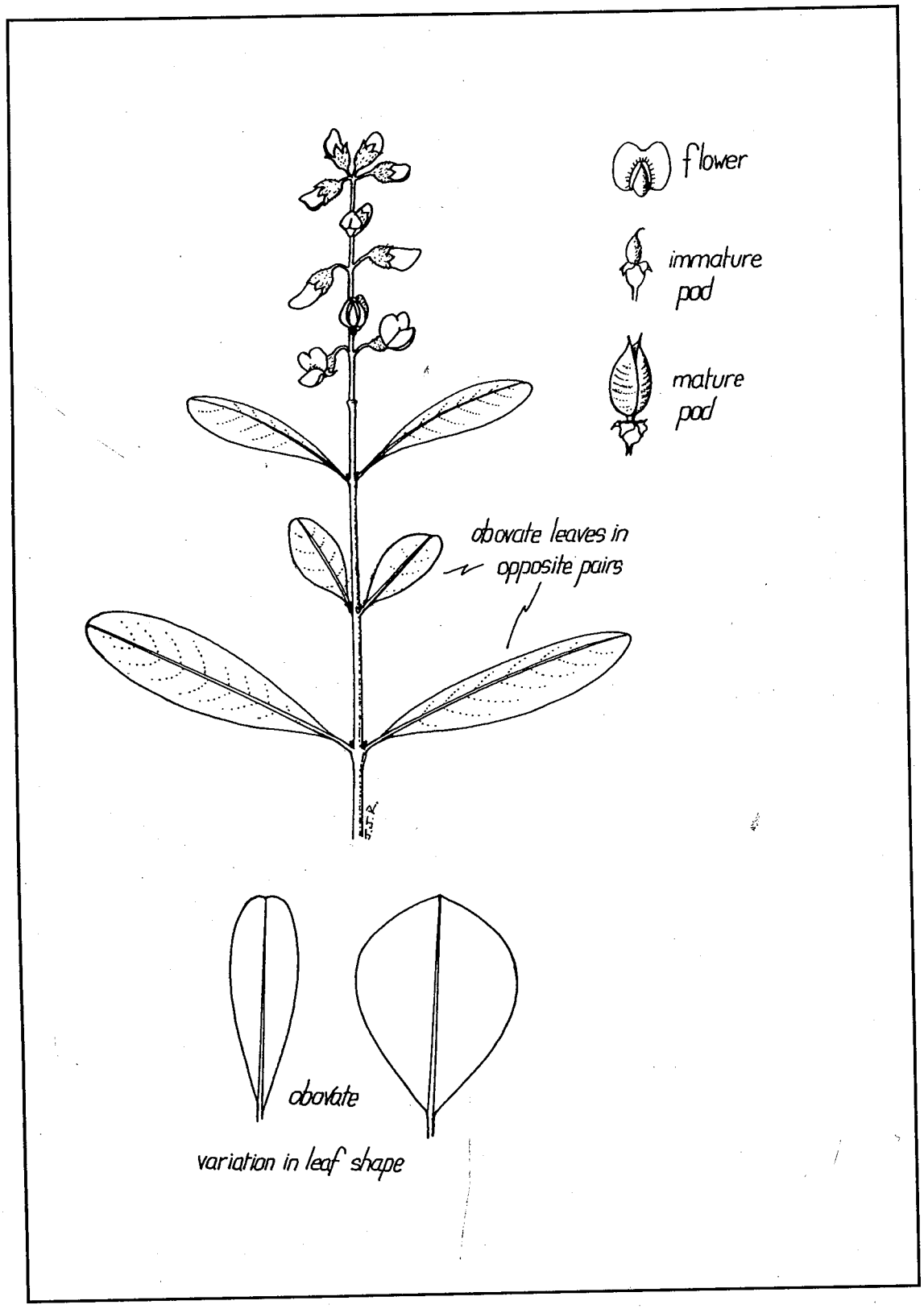

FIGURE 10 *Gastrolobium graniticum*

***Gastrolobium hamulosum* Meissn.**

Hook-point poison

Gastrolobium hamulosum is a small, erect shrub which grows up to 45 cm with somewhat straggling growth. It has numerous slender branchlets covered with short dense white conspicuous hairs. The leaves occur in whorls of three, blue-green conspicuously net-veined with the midrib raised beneath, obovate, the tip blunt and wide and having a small characteristic hooked point. Flowers occur in groups along fairly short racemes at the ends of the branches. The petals are golden yellow streaked with red, the calyx silky-hairy with long hairs, lobes deeply divided and tapering to a long fine points. Flowering occurs between August and October.

Distribution and Habitat

G. hamulosum occurrs mainly around Calingiri and Wongan Hills but it has been recorded once north of Moora. It occurs in gravelly soils sometimes overlain with sand, on quartzite ridges and on clay flats, mainly in scrub communities which often include *Hakea, Melaleuca, Leptospermum* and *Acacia* species. There is one report of it associated with *Eucalyptus wandoo*.

Conservation Status

- Present Priority two
- Recommended Declared Rare Flora

G. hamulosum is both rare and endangered. It was apparently once common on the clay flats around Calingiri (Gardner and Bennetts 1956) but is now known from only four plants located within a few metres of each other on a weed infested road reserve. These plants have probably only survived because they are adjacent to a population of the Declared Rare Flora *G. glaucum*. Searches in 1980 around Wongan Hills and around previously known localities around Carani failed to locate any populations although Leigh *et al.* (1984) reported that a few plants were known to occur on an uncleared patch of private property. There are very few areas set aside for the conservation of flora in the Carani-Calingiri area, which has been cleared extensively for agriculture. If there are any remaining populations they are probabaly confined to road verges and private property. The four plants on the only known population were reported to be in good condition in 1980. Two of the four bushes located in 1989 were in poor condition, presumably due to competition from the numerous weeds, one was large and old and the fourth on the bank of soil pushed up by the road grader at the edge of the road. The conservation status of these plants has therefore deteriorated.

Seeds were collected from *G. hamulosum* and sent to Kings Park for propagation and to CALM Seed Centre for storage.

Response to fire - probably killed by fire

Response to soil disturbance - probably a colonizer, grows in disturbed area

Susceptibility to weed invasion - becomes excluded from weed infested road verges

Susceptibility to dieback - not known

Grazing impact - not known

Influence of canopy cover - probably does not tolerate canopy cover

Recommended management requirements

- inclusion on the schedule of Declared Rare Flora
- acquisition of Department of Agriculture Reserve No. 18672
- liaison with shire and Department of Agriculture to ensure protection
- exclusion from prescribed burning until the impact of fire is known
- inform operations staff of locations of flora to prevent accidental destruction
- install rare flora marker pegs

  control weed species
- further seed collection, maintain seed in long-term storage
- establish in cultivation
- inspect populations annually
- re-establish in suitable habitat preferably on conservation reserves

Recommended research requirements

- further surveys of suitable habitats within geographical distribution, liaison with local farmers to locate any remaining plants on private property
- research on fire and life history

TABLE 6 Summary of the recorded locations of *Gastrolobium hamulosum*

Date	Shire	Population	Land Status	No. of plants
HERBARIUM				
-/9/23	Victoria Plains	Calingiri		
5/10/26	Victoria Plains	Calingiri		
13/9/32	Moora	N of Moora		
17/10/34	Victoria Plains	Calingiri		
11/10/34	Victoria Plains	Calingiri		
21/9/55	Wongan	N of Wongan Hills		
22/9/55	Victoria Plains	E of New Norcia		
16/9/64	Victoria Plains	E of Carani		
PRESENT SURVEY				
22/11/89	Wongan	N of Wongan Hills	Road verge	4

References

Aplin (1969a), Everist (1974), Gardner and Bennetts (1956), Leigh *et al.* (1984), Rye (1980)

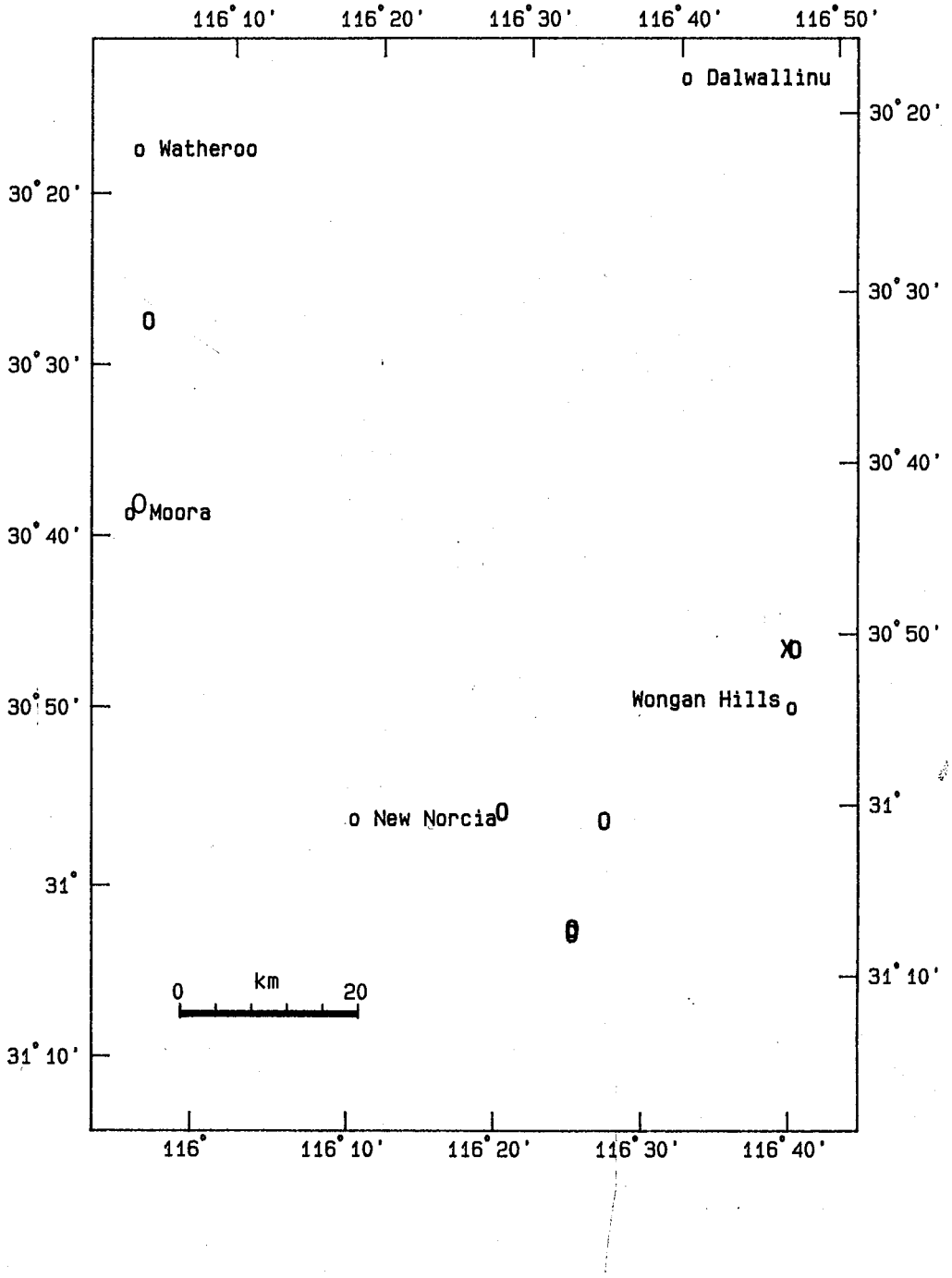

FIGURE 11 Recorded locations of *Gastrolobium hamulosum*
O Herbarium record, X Survey record

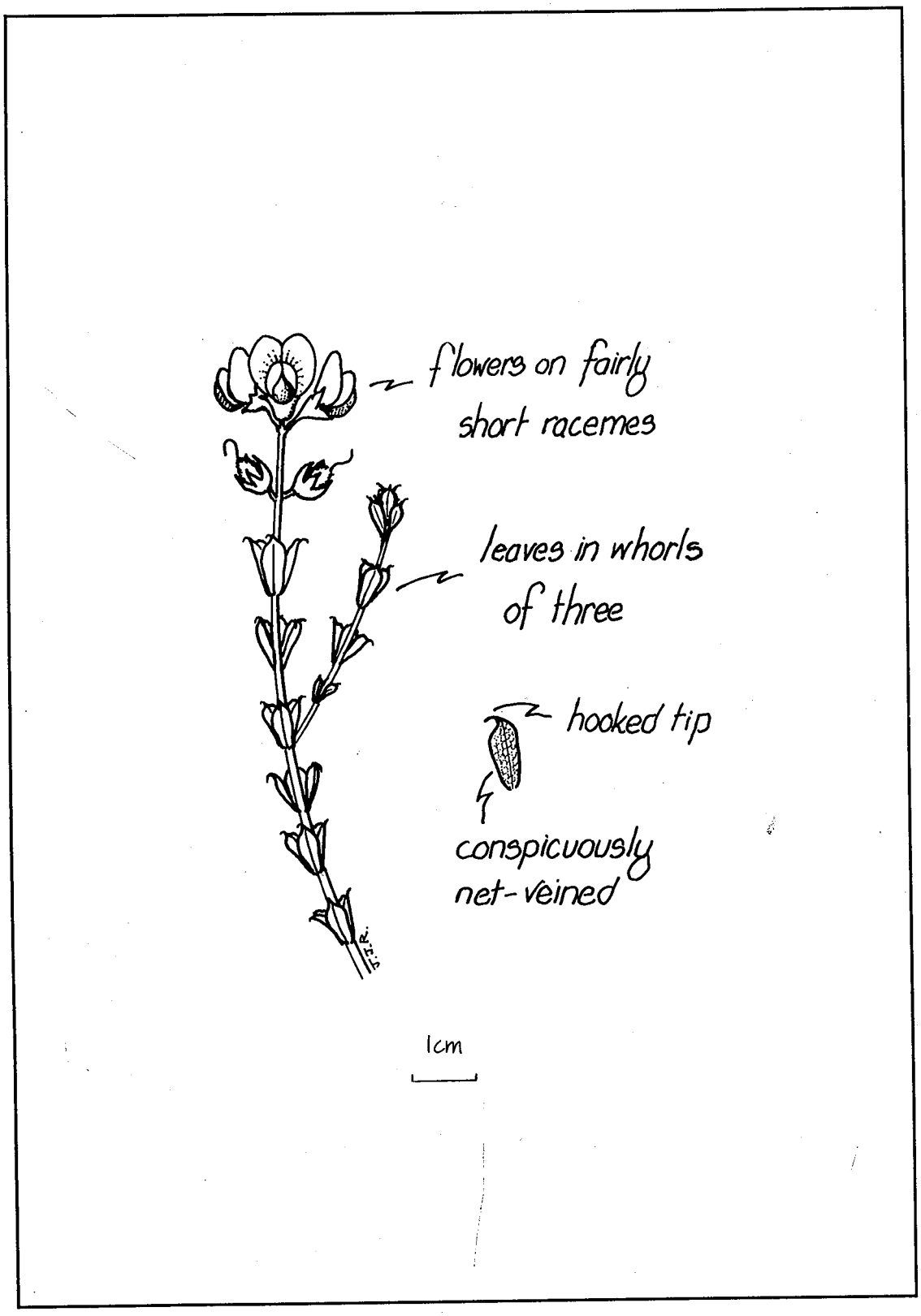

FIGURE 12 *Gastrolobium hamulosum*

***Gastrolobium heterophyllum* (Turcz.) Crisp**

Slender poison

formerly *Oxylobium heterophyllum*

Gastrolobium heterophyllum is a little known shrub first collected by Drummond in the vicinity of the Phillips River. The stems are slender, prostrate or trailing and have conspicuous fine stipules which are longer than the leaf stalks. The leaves are coarsely or conspicuously open-net veined on the dark green, hairless upper surface, paler underneath with spreading hairs especially on the midrib. Hairs are absent on the older foliage. The seed pods are obovoid. *G. heterophyllum* is similar to the widely distributed species, *Gastrolobium parviflorum* (Box poison, formerly *Oxylobium parviflorum*) but it is distinguished by its shorter racemes with few flowers and its slender, trailing rather than erect stems and its conspicuous fine stipules. It flowers between September and October.

Distribution and Habitat

G. heterophyllum has been recorded in the south-coastal region of Western Australia from around the Phillips River and the West River eastward to Gibson. It has been collected from gravelly soil around rivers and from sheltered positions in heavy red soils on flats and from a gradual slope in red clay-gravel amongst mallees of *Eucalyptus preissiana*.

Conservation Status

- Present Priority two
- Recommended Priority two

There are only a few reports of this species but one (Young River) and possibly a second (Phillips River) are from conservation reserves. The species has been reported from a variety of habitats but a three day survey between Ravensthorpe, Hopetoun and Esperance failed to find any specimens. The survey did, however, illustrate the extreme variation found in its close relative, *Gastrolobium parviflorum*. Further surveys and taxonomic research are required to clarify the conservation status of this species.

Response to fire - not known

Response to soil disturbance - not known

Susceptibility to weed invasion - not known

Susceptibility to dieback - not known

Grazing impact - not known

Influence of canopy cover - not known

Recommended management requirements

- relocate documented populations
- collect herbarium specimens

Recommended research requirements

- further surveys of suitable habitats particularly within conservation reserves

- confirmation of taxonomic status

TABLE 7 Summary of the recorded locations of *Gastrolobium heterophyllum*

Date	Shire	Population	Land Status	No. of plants
HERBARIUM				
	Esperance	Mouth of the Young River	National Park	
26/9/41	Ravensthorpe	Phillips River near Hopetoun		
-9/61	Esperance	Gibson		
22/10/79	Ravensthorpe	Munglinup		
22/9/79	Ravensthorpe	Mt Desmond	Shire common	

References

Aplin (1969b), Crisp and Weston (1987), Everist (1974), Gardner and Bennetts (1956)

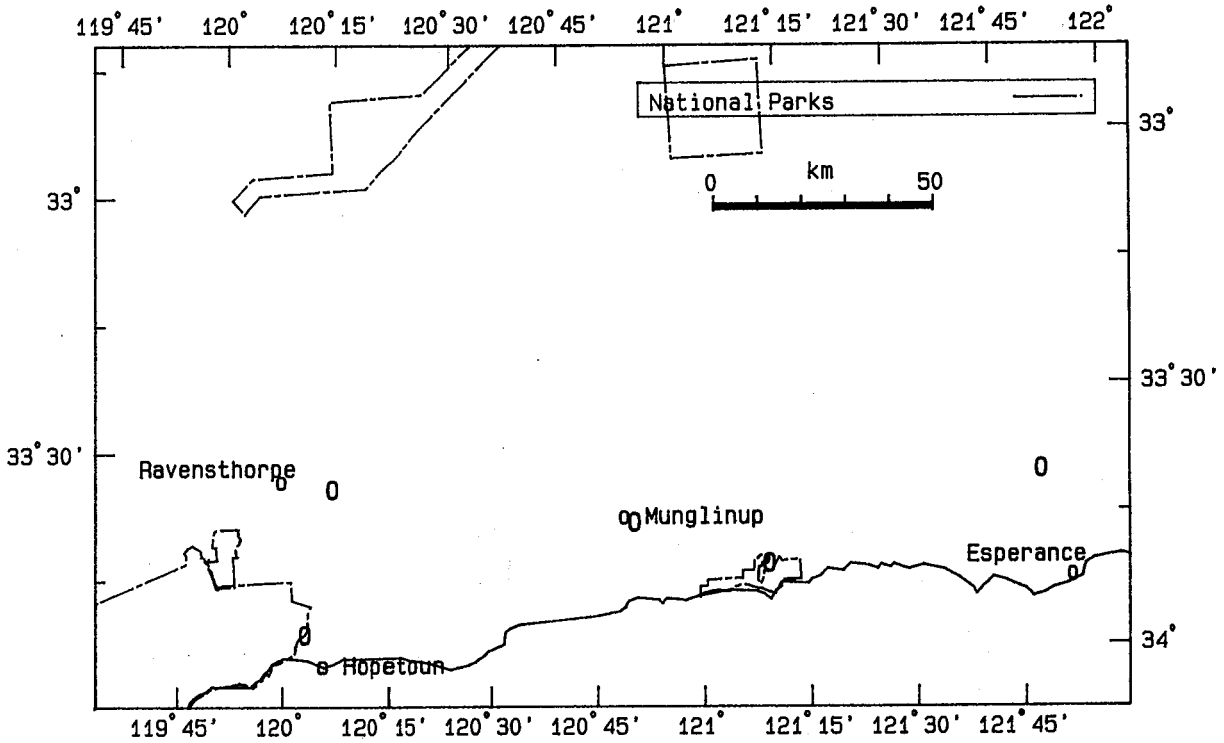

FIGURE 13 Recorded locations of *Gastrolobium heterophyllum*
O Herbarium record, X Survey record

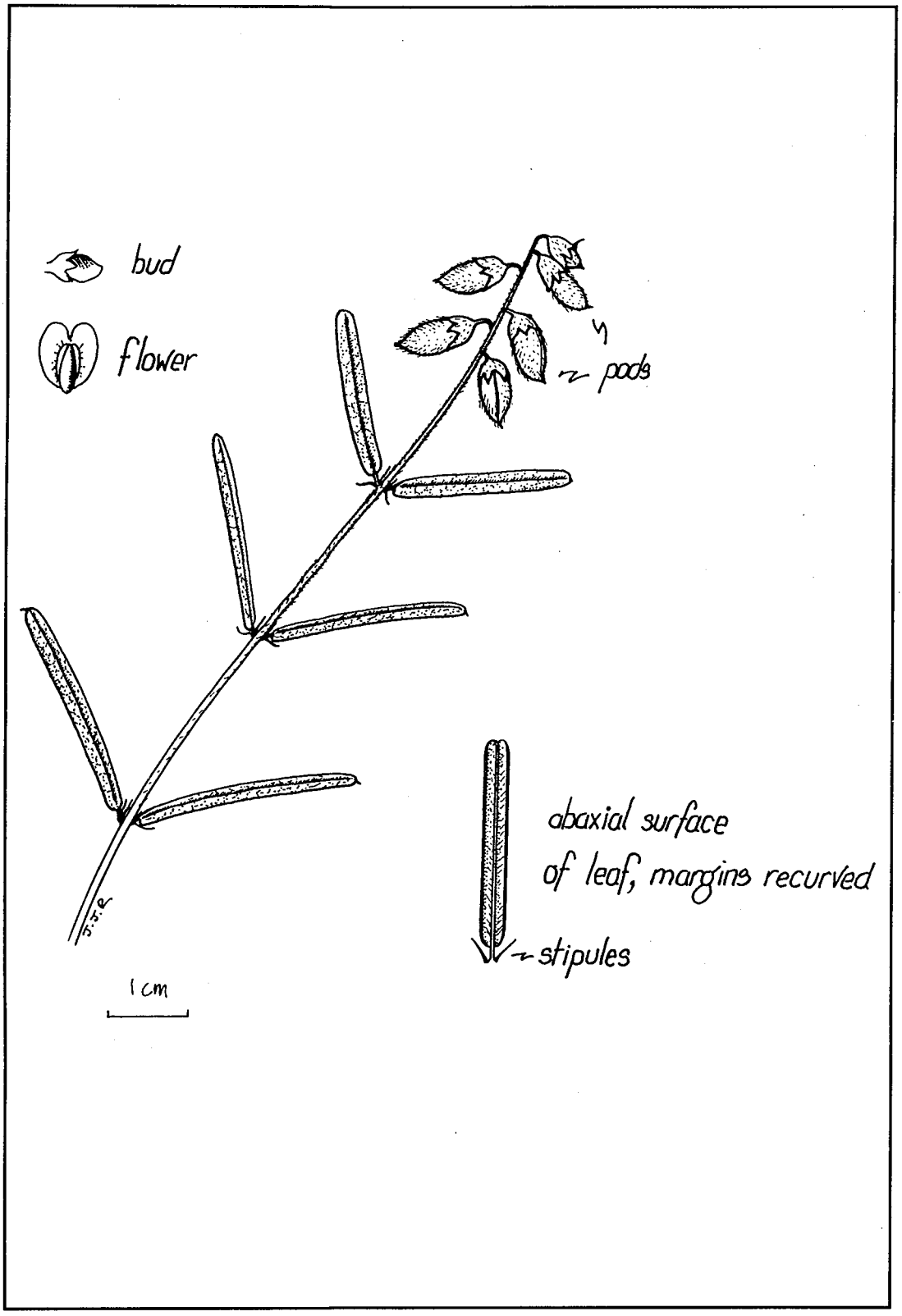

FIGURE 14 *Gastrolobium heterophyllum*

***Gastrolobium ovalifolium* Henfr.**

Runner poison

Gastrolobium ovalifolium is a low spreading shrub with prostrate stems which are rarely more than a few centimetres high, forming flat bushes up to about 2 m in diameter. The small branches and branchlets are covered in a thin cottony wool. The leaves are in pairs, are flat and almost circular in outline, 1.2 - 2.0 cm in diameter, green above but much paler beneath. They have prominent net-venation especially on the under-surface, the spaces between the veins appearing as small pits with thick marginal veins. The flowers are yellow and purple and occur in long racemes at the ends of branches. The axis of the racemes and the pedicels are velvety-hairy. The calyx lobes are acute and almost equal. The stipules are thin and pointed and often covered with cottony hairs. The species flowers between August and October.

G. ovalifolium is similar to the Declared Rare Flora *Gastrolobium tomentosum* but is distinguished by its prostrate habit and its flat leaves which are not crinkled or undulate. Furthermore, the under-surface of the leaf is virtually glabrous (in contrast to *G. tomentosum*). Several populations of an undescribed *Gastrolobium,* intermediate in form between *G. ovalifolium* and *G. tomentosum*, were discovered during this survey.

Seeds were collected from *G. ovalifolium* and sent to Kings Park for propagation and to CALM Seed Centre for storage.

Distribution and Habitat

G. ovalifolium is known from small, scattered populations from Narrogin and Williams south to Kojonup. It has been found on gradual slopes and flat areas in sandy loam and sandy gravel soils in woodland associated with *Eucalyptus astringens, Eucalyptus wandoo, Eucalyptus calophylla, Gastrolobium parviflorum, Dryandra sessilis* and *Casuarina heugeliana.*

Conservation Status

- Present Priority two
- Recommended Priority two

Leigh *et al.* (1984) reported that most of the known populations of *G. ovalifolium* were thought to be extinct and that the species was rare and known only with certainty from between Narrogin and Williams where it was confined to road reserves. Significant new populations of this species were located during this survey including one on a conservation reserve and a large population on a proposed reserve. In the Dryandra State Forest *G. ovalifolium* is confined mainly to firebreaks and road verges.

Response to fire - not known

Response to soil disturbance - observed growing in disturbed roadside soil and firebreaks

Susceptibility to weed invasion - not known

Susceptibility to dieback - not known

Grazing impact - not known

Influence of canopy cover - may tolerate some canopy cover

Recommended management requirements

- complete change-of-use of reserve 14300 to nature reserve
- inform operational staff of the locations of populations and liaison with shire and MRD to prevent accidental damage to populations
- exclude from prescribed burning until the effects of fire are known
- install rare flora marker pegs
- maintain seeds in long-term storage
- establish in cultivation

Recommended research requirements

- further surveys of typical habitats
- investigate the phylogenetic relationship between *G. ovalifolium, G. tomentosum* and the undescribed species referred to above
- conduct research on fire and life history

TABLE 8 Summary of the recorded locations of *Gastrolobium ovalifolium*

Date	Shire	Population	Land Status	No. of plants
HERBARIUM				
21/10/1897	Kojonup	Kojonup		
16/7/22	Kojonup	Muradup		
31/8/34	Narrogin	W of Narrogin		
31/8/34	Narrogin	Narrogin		
-/10/58	Narrogin	E of Williams		
16/10/62	Boddington	E of Boddington		
PRESENT SURVEY				
* -/-/89	Narrogin	S of Narrogin	Road verge	10 - 20
*27/8/89	Williams	NW of Williams	Nature reserve	> 300
*13/9/89	Narrogin	ESE of Williams	State forest	100 - 500
* 5/9/89	Narrogin	W of Cuballing	Road verge, state forest	≅ 250
* 7/9/89	Narrogin	WNW of Narrogin	Proposed nature reserve	≅ 2000

* New population

References

Crisp and Weston (1987), Everist (1974), Gardner and Bennetts (1956), Leigh *et al.* (1984)

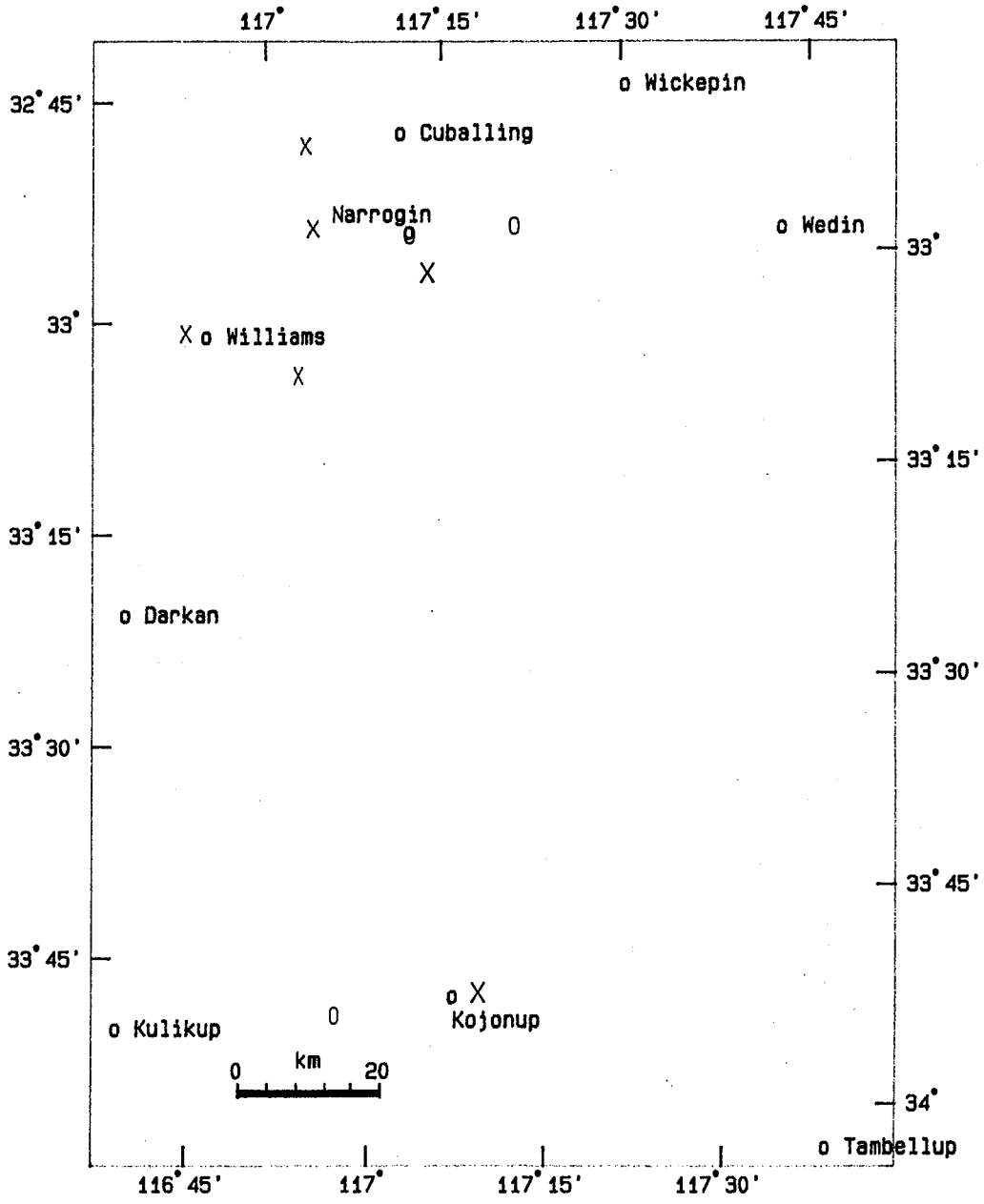

FIGURE 15 Recorded locations of *Gastrolobium ovalifolium*
O Herbarium record, X Survey record

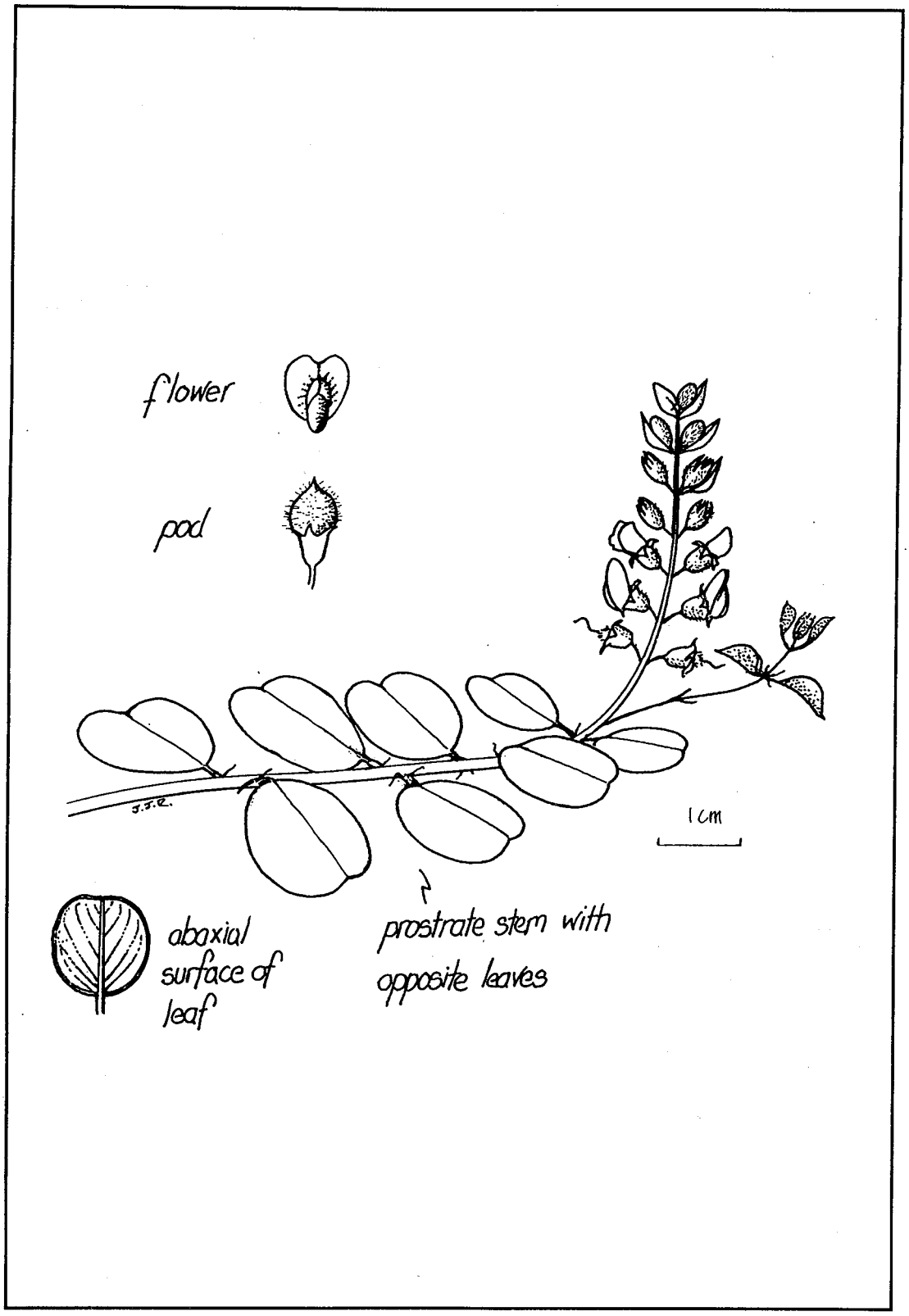

FIGURE 16 *Gastrolobium ovalifolium*

Gastrolobium propinquum C. A. Gardner

Hutt River poison

Gastrolobium propinquum is a shrub which grows up to 1.2 m with slender, erect or spreading branches and dark coloured bark and angled branchlets. The leaves are mostly in whorls of three, 4 - 5 cm long, olive green to blue-green, narrowly lanceolate, slightly folded upwards, tapering at the tip to a fine sharp point, abruptly contracted at the base into a short, slender stalk whose base is continued downward as a rib or angle along the stem. The stipules are fine and black and wither as the leaf amatures. The flowers are borne in long slender racemes which are much longer than the leaves and mostly occur around the ends of branches or in the axils of the upper leaves. The calyx is less than 6 mm long and sparsely hairy and the petals are orange-yellow. Two forms of the species have been collected. The form found around Mullewa is a much larger shrub and has longer, flatter olive green to blue-green leaves which are rounded rather than tapering at the base. Flowering occurs mainly between July and September but sometimes until November.

Distribution and Habitat

The smaller form of *G. propinquum* which Aplin (1973) describes as true Hutt River poison occurs along the Hutt River, at White Peak and Isseka and to the south-east of Geraldton, extending east to Walkaway. The second taller form has been found around Mullewa. It occurs in sandy or clay soils in flat winter-wet areas in shrub communities including *Melaleuca uncinata*, *Callitris canescens* and *Acacia* sp.

Conservation Status

- Present Priority two
- Recommended Priority one

G. propinquum has not been collected frequently and was described by Leigh *et al.* (1984) as formerly widespread but rather uncommon. Five new records of the Hutt River form of this species were found during this survey including one large population. However, none were on conservation reserves. Much of the area this species occupies has been cleared for farming and many known populations occur on land which is under immediate threat (road verges). The species could be considered rare since it is known from less than 200 plants in the wild but further surveys, especially on conservation reserves, are required to confirm its conservation status.

Seeds were collected from *G. propinquum* and sent to Kings Park for propagation and to CALM Seed Centre for storage.

Response to fire - not known

Response to soil disturbance - observed growing in disturbed roadside soil

Susceptibility to weed invasion - not known

Susceptibility to dieback - not known

Grazing impact - not known

Influence of canopy cover - not known

Recommended management requirements

- establish in cultivation

- maintain seed in long-term storage

Recommended research requirements

- further surveys of suitable habitats particularly within conservation reserves
- confirmation of taxonomic status of the two forms

TABLE 9 Summary of the recorded locations of *Gastrolobium propinquum*

Date	Shire	Population	Land Status	No. of plants
HERBARIUM				
1/9/59	Mullewa	Mullewa		
20/8/59	Northampton	Northampton		
-/11 59	Northampton	Northampton		
11/9/62	Mullewa	Mullewa		
-/1/62	Geraldton	Geraldton		
PRESENT SURVEY				
*29/7/89	Northampton	NW of Port Gregory		> 500
* 9/8/89	Northampton	SW of Gregory		1
* 9/8/89	Northampton	WNW of Northampton	Road verge	15
* 9/8/89	Northampton	E of Port Gregory	Road verge	4
* 9/8/89	Northampton	E of Pt Gregory	Road reserve	5

* New population

References

Aplin (1969b), Crisp and Weston (1987), Everist (1974), Gardner and Bennetts (1956)

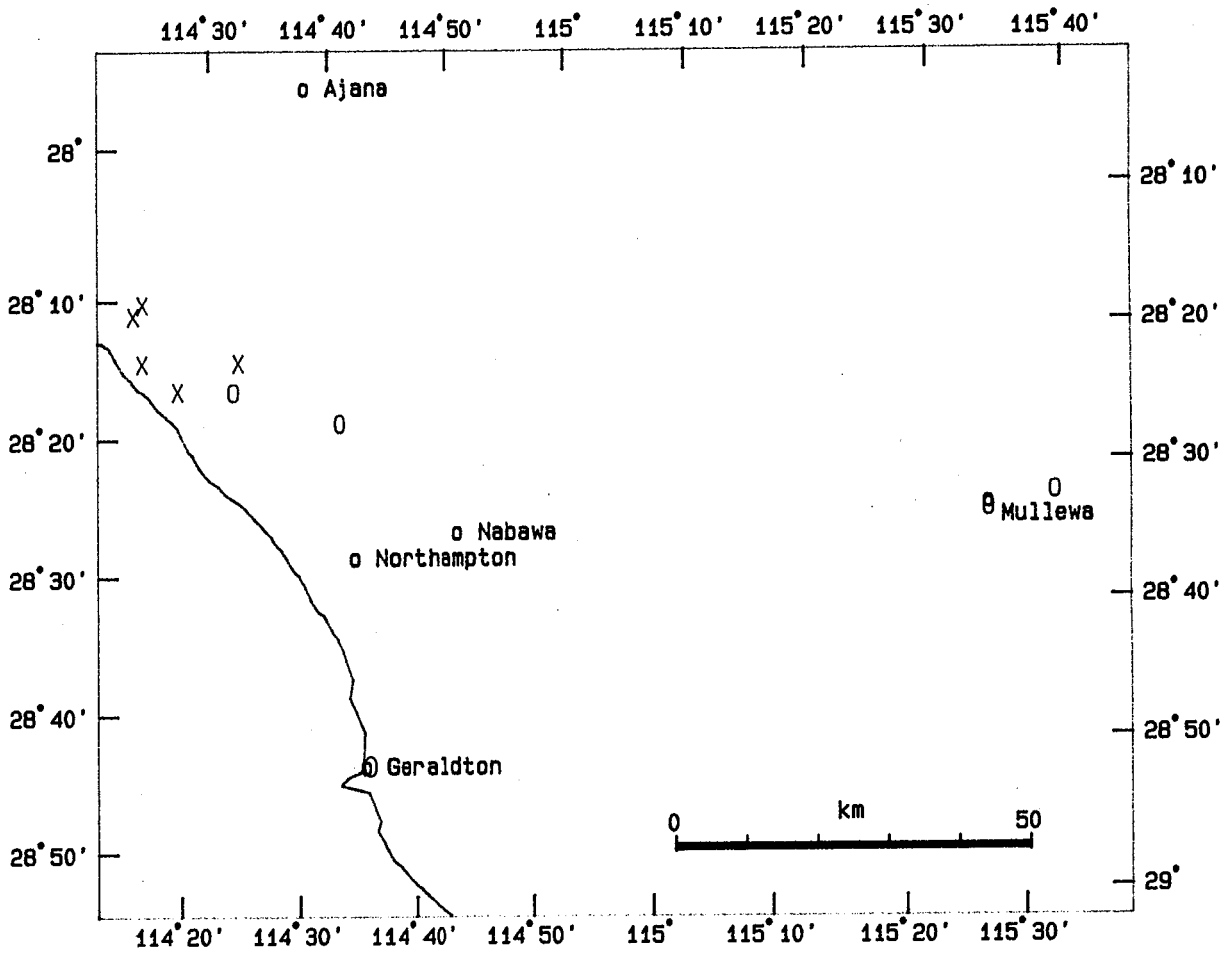

FIGURE 17 Recorded locations of *Gastrolobium propinquum*
O Herbarium record, X Survey record

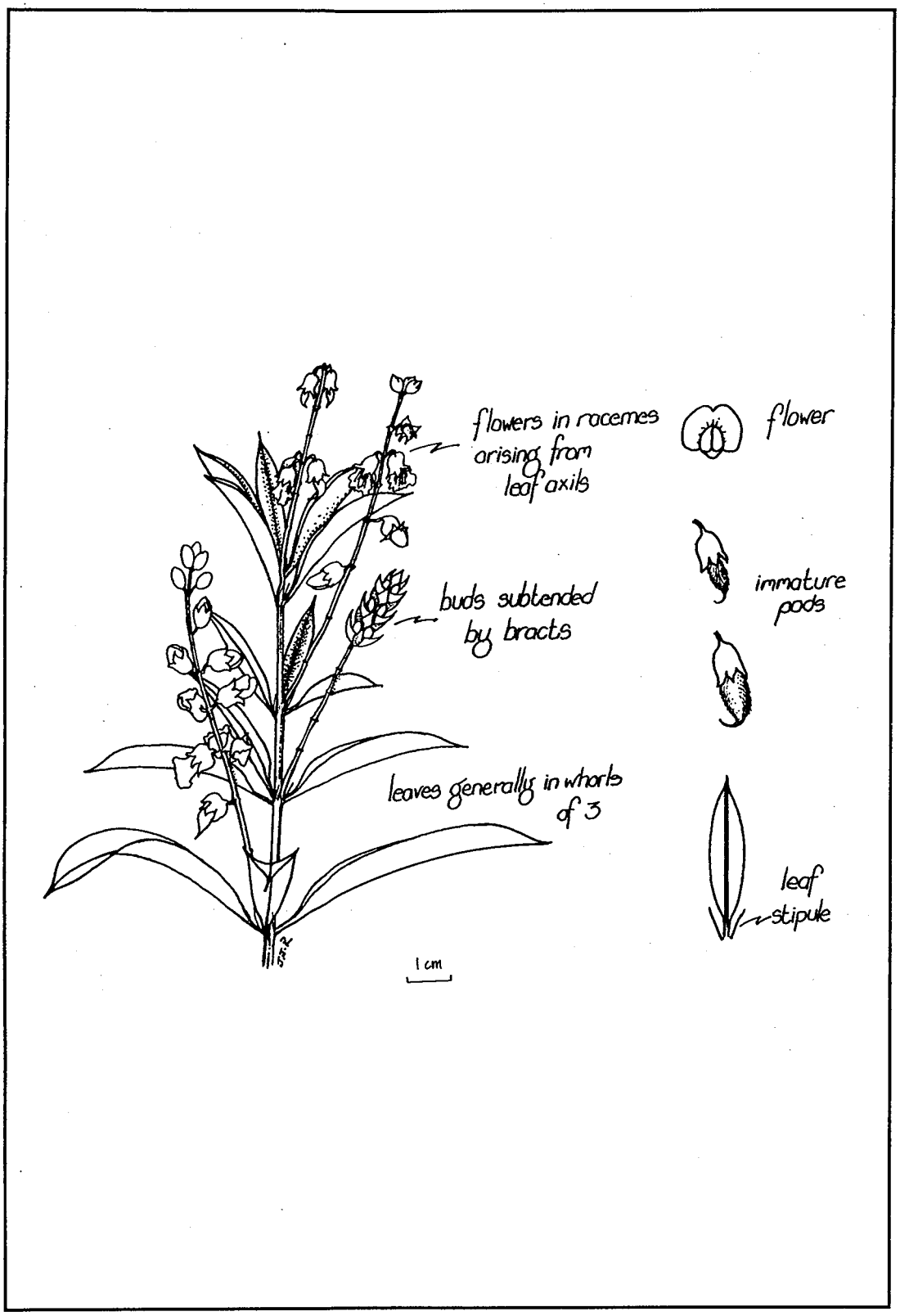

FIGURE 18 *Gastrolobium propinquum*

Gastrolobium racemosum (Turcz.) Crisp

Net-leaf poison

formerly _Oxylobium racemosum_

Gastrolobium racemosum is an erect shrub 60 - 120 cm high, glabrous except for a woolly fringe on the margin of the calyx lobes. The branches are purplish and the leaves opposite, erect, dull green, leathery, quite flat with a thick prominent midrib and a network of secondary veins, mostly 4 cm long, narrowly eliptical or oblong, shortly stalked, rounded at the base and blunt at the tip. The flowers are orange-red and occur in elongated racemes which are much longer than the uppermost leaves. The pedicels are about as long the as the calyx. The two uppermost lobes of the calyx are united into a lip. The pod is hard, dark purple or black and contains six to eight seeds. Flowering occurs between October and November.

Distribution and Habitat

G. racemosum occurs in the south-coastal region of Western Australia where it is found from around the Gairdner River eastwards to Ravensthorpe Ranges and south to Hopetoun. It growns in clay soils and is asociated with mallee or shrub plant communities.

Conservation Status

- Present Priority three
- Recommended Priority three

G. racemosum is a geographically restricted species but was described by Gardner and Bennetts (1956) as common. Surveys of this species were relatively limited but it was found in both disturbed and undisturbed roadsides. There are several records in conservation reserves and there are several conservation reserves within its range. It seems unlikely that it is under any immediate threat although further surveys are required to confirm its conservation status.

A volunteer has undertaken to send in seed of *G. racemosum* when it ripens.

Response to fire - not known

Response to soil disturbance - observed growing in disturbed roadside soil

Susceptibility to weed invasion - not known

Susceptibility to dieback - not known

Grazing impact - toxic to stock, monofluoro-acetate has been isolated from this species

Influence of canopy cover - prefers open situations

Recommended management requirements

- collect seed and maintain in long-term storage
- establish in cultivation

Recommended research requirements

- further surveys of suitable habitats particularly within conservation reserves

TABLE 10 Summary of the recorded locations of *Gastrolobium racemosum*

Date	Shire	Population	Land Status	No. of plants
HERBARIUM				
-/11/32	Ravensthorpe	N of Hopetoun		
23/8/39	Ravensthorpe	Middle Mt Barren	National park	
1/10/59	Ravensthorpe	Ravensthorpe		
28/8/62	Ravensthorpe	Ravensthorpe Range		
30/9/63	Ravensthorpe	N of Ravensthorpe		
11/8/63	Jerramingup	N of Mt Maxwell	National park	
15/10/64	Ravensthorpe	S of Ravensthorpe		
-/11/65	Ravensthorpe	Ravensthorpe		
31/10/65	Ravensthorpe	S of Mt Short		
7/10/65	Ravensthorpe	Ravensthorpe		
20/12/70	Ravensthorpe	Naendip	Nature reserve	
18/12/70	Jerramungup	Fitzgerald River	National park	
17/9/76	Ravensthorpe	SSE of Ravensthorpe		
26/5/83	Lake Grace	N of Ravensthorpe		
19/10/83	Jerramungup	E of Jerramungup		
27/9/83	Ravensthorpe	SSE of Ravensthorpe		
19/5/83	Ravensthorpe	NW of RAvensthorpe		
PRESENT SURVEY				
9/10/89	Ravensthorpe	WNW of Ravensthorpe	Private property	≅ 50
8/11/89	Ravensthorpe	NW of Ravensthorpe	Road verge	≅ 100
8/11/89	Ravensthorpe	WNW of Ravensthorpe	Road verge	9
8/11/89	Ravensthorpe	NW of Ravensthorpe	Road verge	1
8/11/89	Ravensthorpe	NW of Ravensthorpe	Road verge	6
8/11/89	Ravensthorpe	NW of Ravensthorpe	Road verge	≅ 20

References

Aplin (1973), Crisp and Weston (1987), Everist (1974), Gardner and Bennetts (1956)

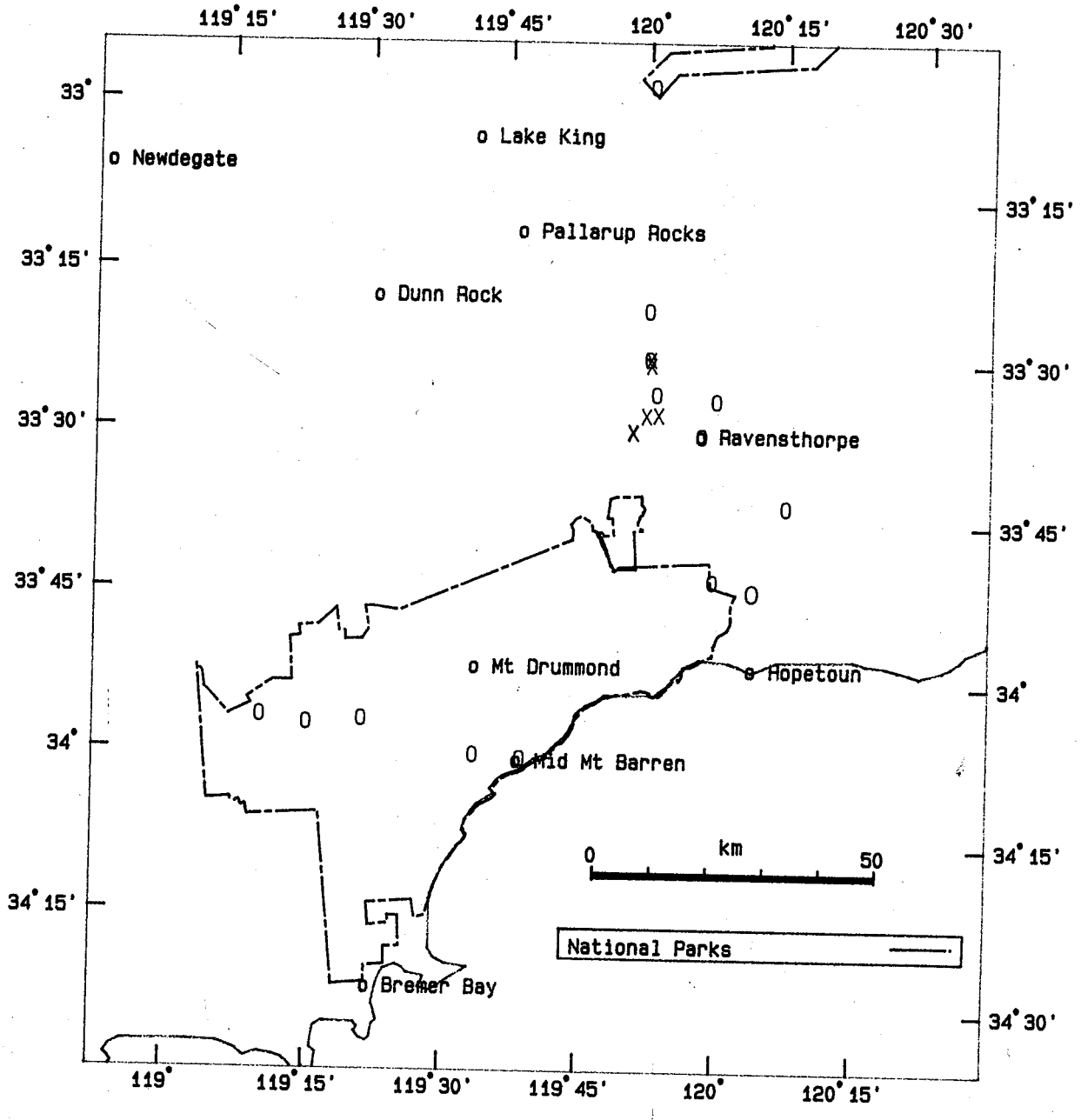

FIGURE 19 Recorded locations of *Gastrolobium racemosum*
O Herbarium record, X Survey record

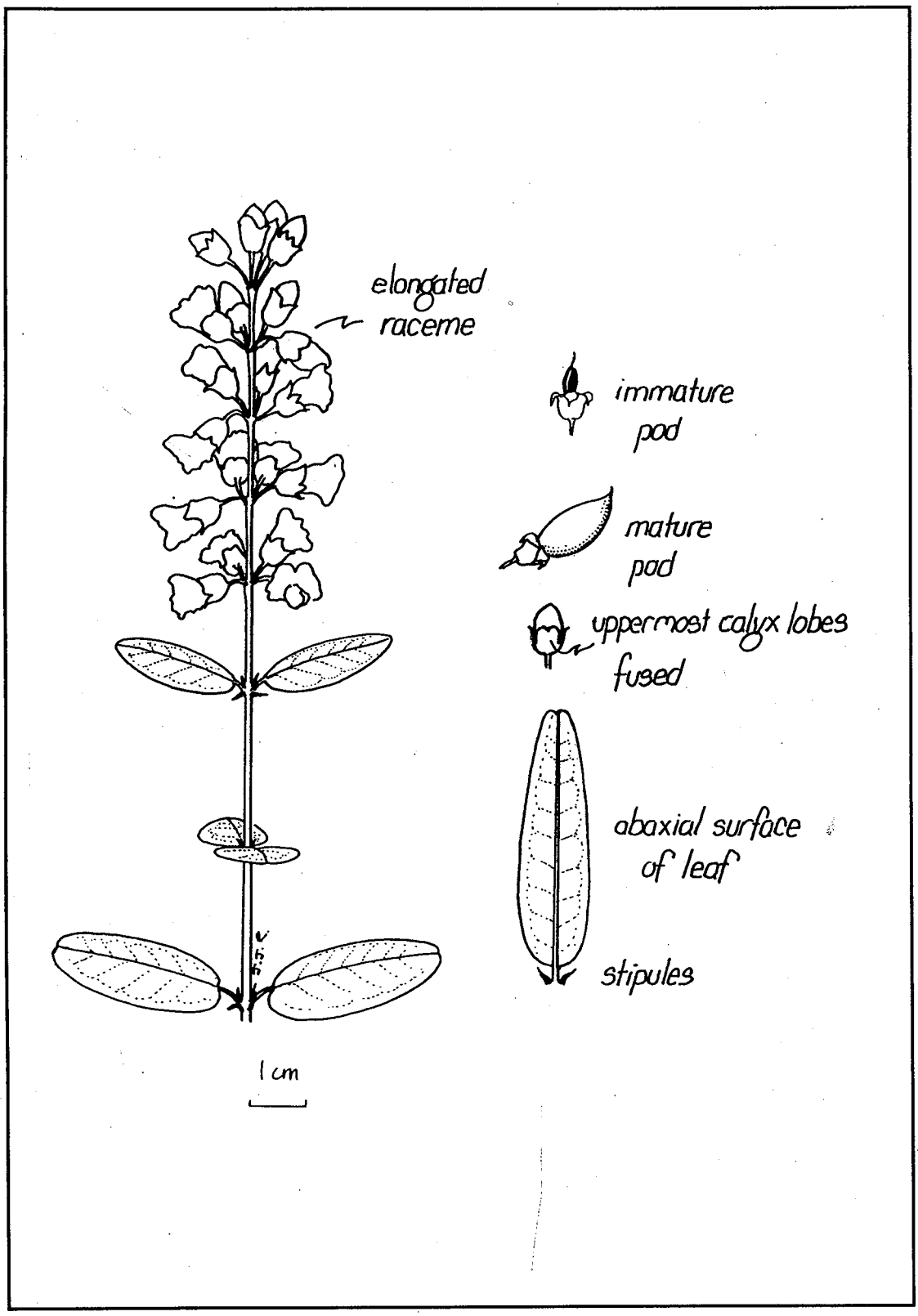

FIGURE 20 *Gastrolobium racemosum*

***Gastrolobium rigidum* (C. A. Gardner) Crisp**

Rigid-leaf poison

Formerly *Oxylobium rigidum*

Gastrolobium rigidum is a low shrub usually about 30 cm high but one form grows to 90 cm. The stems arise from a woody root stock and are repeatedly forked. The leaves are opposite on short petioloes, blue-green in colour, oblong-ovate in shape, rigid and flat with a prominent yellow midrib. The branchlets also have prominent yellow midribs and are very wiry. The racemes are short with ony a few flowers which are yellow and borne on short pedicels. The pods are stalked and silky hairy. Flowering occurs between October and November.

Distribution and Habitat

The typical form of this species has been known from Kalgarin southeast to Mt. Gibbs and Mt. Madden in open sandplain country. Aplin (1973) stated that a larger form occurs in the mallee country around Tarin Rock. It has been recorded in sandy clay, gravel and loam in low heath communities with scattered mallees of *Eucalyptus phaenophylla,*

Conservation Status

- Present Priority two
- Recommended Priority two

G. rigidum has not been collected often but searches along roadsides north of Ravensthorpe in this survey revealed new populations of several hundred plants and represent a southward extension of the species range. The Tarin Rock form was also located but was on average about 0.5 m high. *G. rigidum* has been reported on two conservation reserves and is not under immediate threat. It seems likely that further surveys may reveal more populations and it could then be revised to priority three.

A small collection of *G. rigidum* seed was made and sent to Kings Park for propagation and to CALM Seed Centre for storage.

Response to fire - not known

Response to soil disturbance -.observed growing in disturbed roadside soil and around gravel pits

Susceptibility to weed invasion - not known

Susceptibility to dieback - not known

Grazing impact - contains traces of monofluoro-acetate and is toxic to stock

Influence of canopy cover - probably would not tolerate canopy cover

Recommended management requirements

- collect seed and maintain in long-term storage
- establish in cultivation

Recommended research requirements

- further surveys of suitable habitats particularly within conservation reserves

TABLE 11 Summary of the recorded locations of *Gastrolobium rigidum*

Date	Shire	Population	Land Status	No. of plants
HERBARIUM				
20/10/61	Lake Grace	Mt Madden		
29/11/64	Ravensthorpe	Mount Gibbs	National park	
9/11/64	Ravensthorpe	E of Lake King	National park	
7/10/65	Lake Grace	E of Lake King	National park	
-/8/69	Lake Grace	SE of Hyden		
10/12/71	Ravensthorpe	W of Salmon Gums	National park	
11/7/78	Lake Grace	Frank Hann National Park	National park	
13/11/79	Lake Grace	SSW of Mount Gibbs	National park	
PRESENT SURVEY				
*22/9/89	Ravensthorpe	Jackson Rock	Nature reserve	20 - 50
8/10/89	Dumbleyung	Tarin Rock	Road verge	10 - 20
10/10/89	Ravensthorpe	E of Lake King	National Park	> 100
*8/11/89	Ravensthorpe	NNW of Ravensthorpe	Road verge, private	≅ 200
*8/11/89	Ravensthorpe	N of Ravensthorpe	Road verge, private	> 500

* New populations

References

Aplin (1973), Crisp and Weston (1987), Everist (1974)

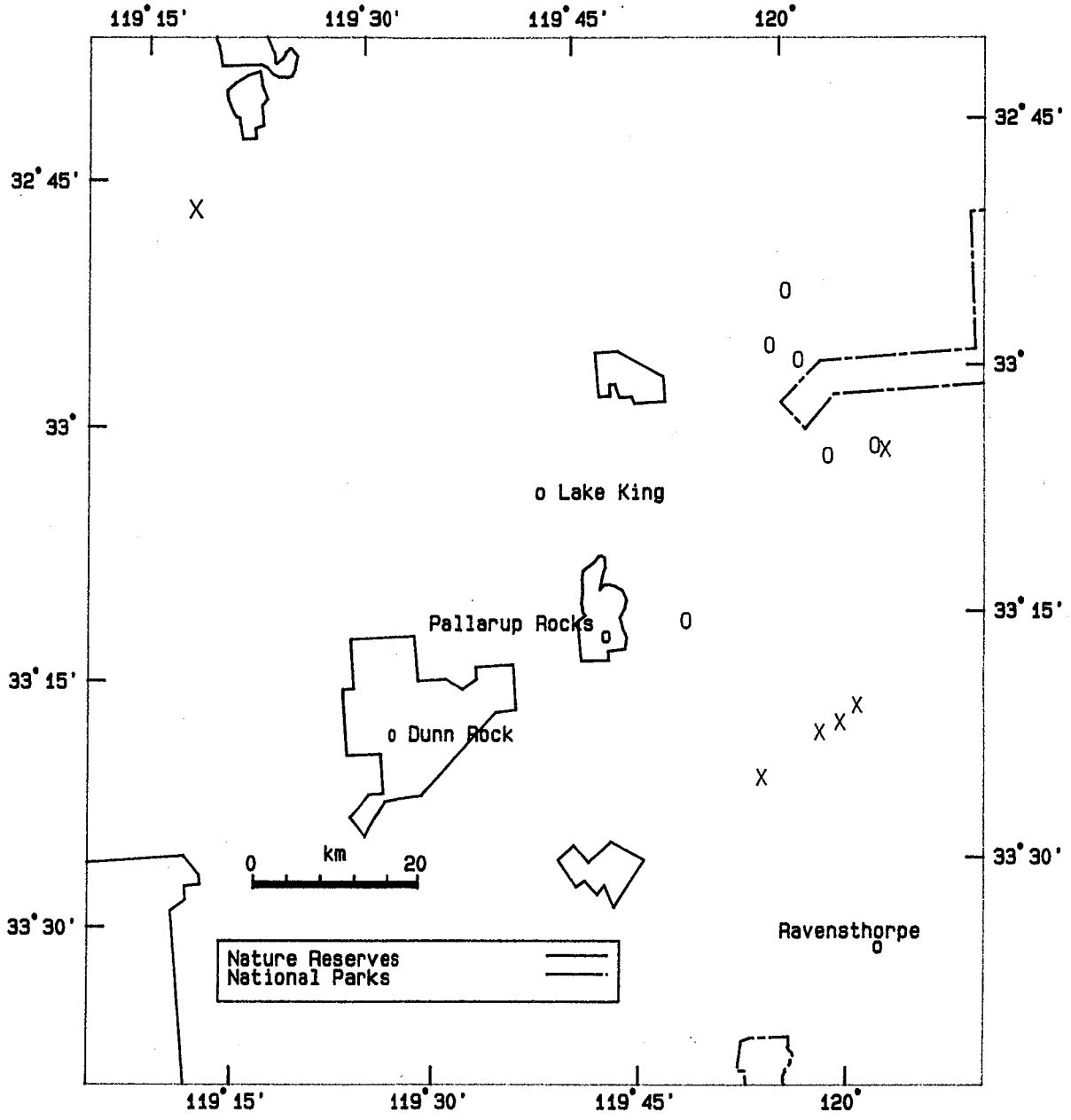

FIGURE 21 Recorded locations of *Gastrolobium rigidum*
O Herbarium record, X Survey record

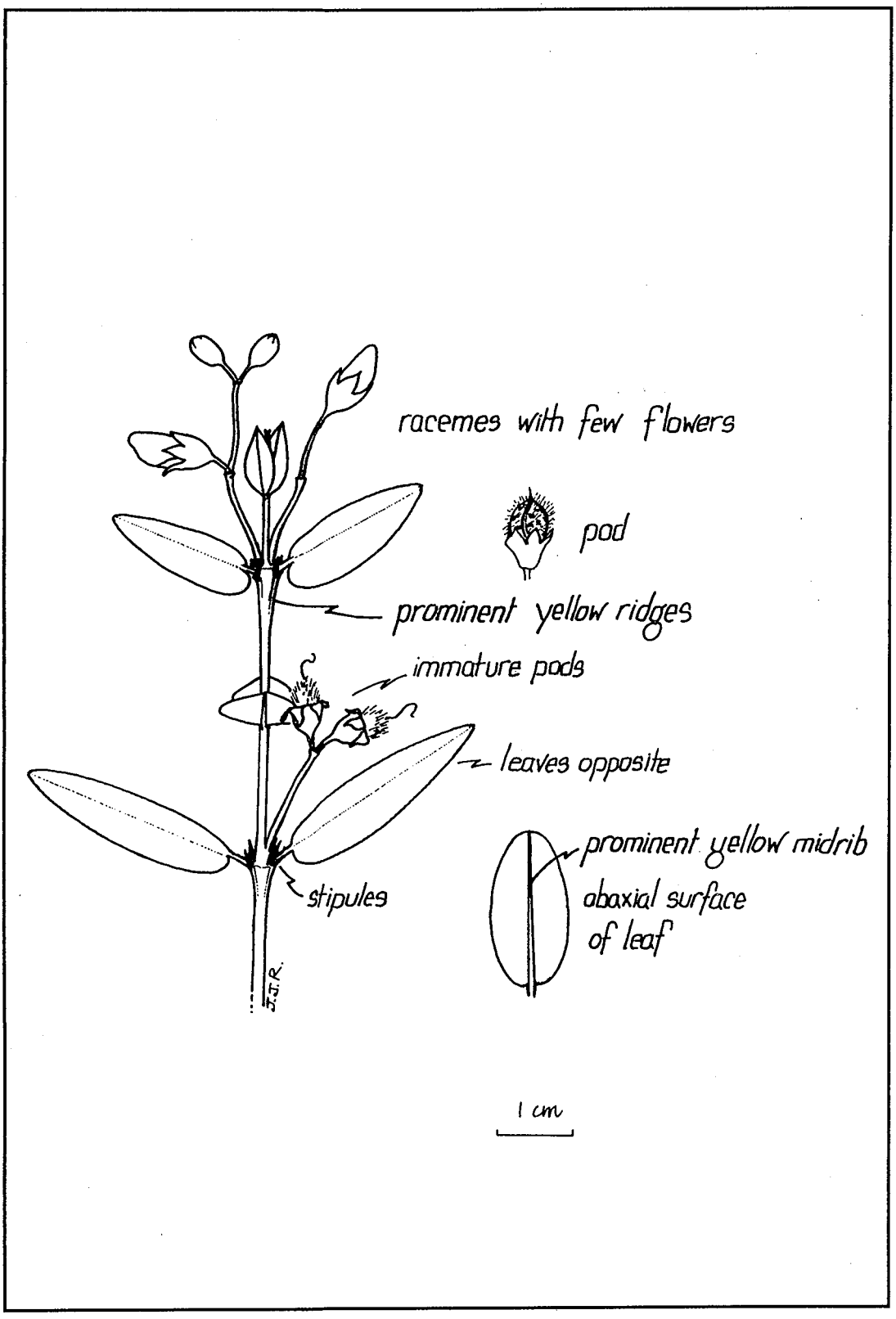

FIGURE 22 *Gastrolobium rigidum*

***Gastrolobium rotundifolium* Meissn.**

Gilbernine poison

Gastrolobium rotundifolium is an erect, dense, rigid, bushy shrub which grows to about 60 cm. The branches and young leaves are hairy but become hairless with age. The leaves occur in pairs and are dark green, hairless above, pale underneath and in the typical form usually undulate, with recurved margins,broadly oblong shape, tapering rather shortly at the tip into a long fine point, and rounded at the base into a short stalk. A narrow leaved form has been recorded between Miling and Walebing in which the leaves are longer and narrower with the edges rolled under. The flowers are yellow and purple, crowded in spike-like racemes at the ends of branches. The bracts are large and brown and conceal the buds. They persist until flowering. The stipules are persistent, erect, long and pointed, united with the leaf stalk in the lower part and with broad membranous margins toward the base. Flowering occurs between August and September.

Distribution and Habitat

G. rotundifolium was once a widespread species which was found from Mingenew to Wagin with the major distribution between Watheroo and Calingiri. It occurred on shallow rises where the soils are sandy or gravelly loams and is usually associated with *Eucalyptus wandoo-Eucalyptus loxophleba* woodland with a shrubby understorey.

Conservation Status

- Present Priority two
- Recommended Priority one

G. rotundifolium was a widespread species described by Gardner and Bennetts (1956) as common in the Narrogin-Wagin District. All records of this species are in the wheatbelt, an area subject to extensive land clearing. Leigh *et al.* (1984) stated that the only recent records for the species were in the Watheroo area where it is confined to small areas of unstocked private property and fenced road verges. It is likely that these were the populations relocated in this survey. There are no known records on conservation reserves and the uncleared area set aside on private property for the conservation of wildflowers referred to by Leigh *et al.* (1984) has recently changed ownership. Although the same conservation-minded family still operate the property, the pressure to clear the area is likely to increase. *G. rotundifolium* could be considerd rare if judged only on the plants known to exist but the habitat that this species occupies is relatively common within the wheatbelt. The species does apparently still occur on private property in the area because it has been listed as present by farmers seeking assistance from CALM to fence remnant vegetation. Further surveys, particularly of remnant vegetation on private property, may reveal further populations.

The area of uncleared private property referred to above also contains *G. callistachys* and acquisition of this area could significantly improve the conservation status of both species.

Seeds were collected from *G. propinquum* and sent to Kings Park for propagation and to CALM Seed Centre for storage.

Response to fire - not known but the plant apparently will sucker if cut off at ground level so it may survive fires

Response to soil disturbance - not known

Susceptibility to weed invasion - not known

Susceptibility to dieback - not known

Grazing impact - contains monofluoro-acetate and is toxic to stock

Influence of canopy cover - prefers open spots (Gardner and Bennetts 1956) but grows in woodland

Recommended management requirements

- close liaison with shires and land owners to prevent accidental destruction
- establish in cultivation
- collect and maintain seed in long-term storage

Recommended research requirements

- survey and assessment of uncleared section of Private Blocks M1520 and M1229 as a potential nature reserve
- further surveys of suitable habitats to locate populations

TABLE 12 Summary of the recorded locations of *Gastrolobium rotundifolium*

Date	Shire	Population	Land Status	No. of plants
HERBARIUM				
-/9/30	Moora	Bindi Bindi		
27/8/40	Three Springs	W of Arrino		
1/10/45	Moora	Tootra		
20/9/55	Moora	Miling		
16/9/64	Victoria Plains	E of Carani		
3/10/76	Moora	E of Watheroo		
PRESENT SURVEY				
31/10/89	Moora	ENE of Watheroo	Road verge	54
14/8/89	Moora	NE of Watheroo	Private	1
14/8/89	Moora	NE of Watheroo	Private, road verge	≅ 45

References

Aplin (1969c), Everist (1974), Gardner and Bennetts (1956), Leigh *et al.* (1984)

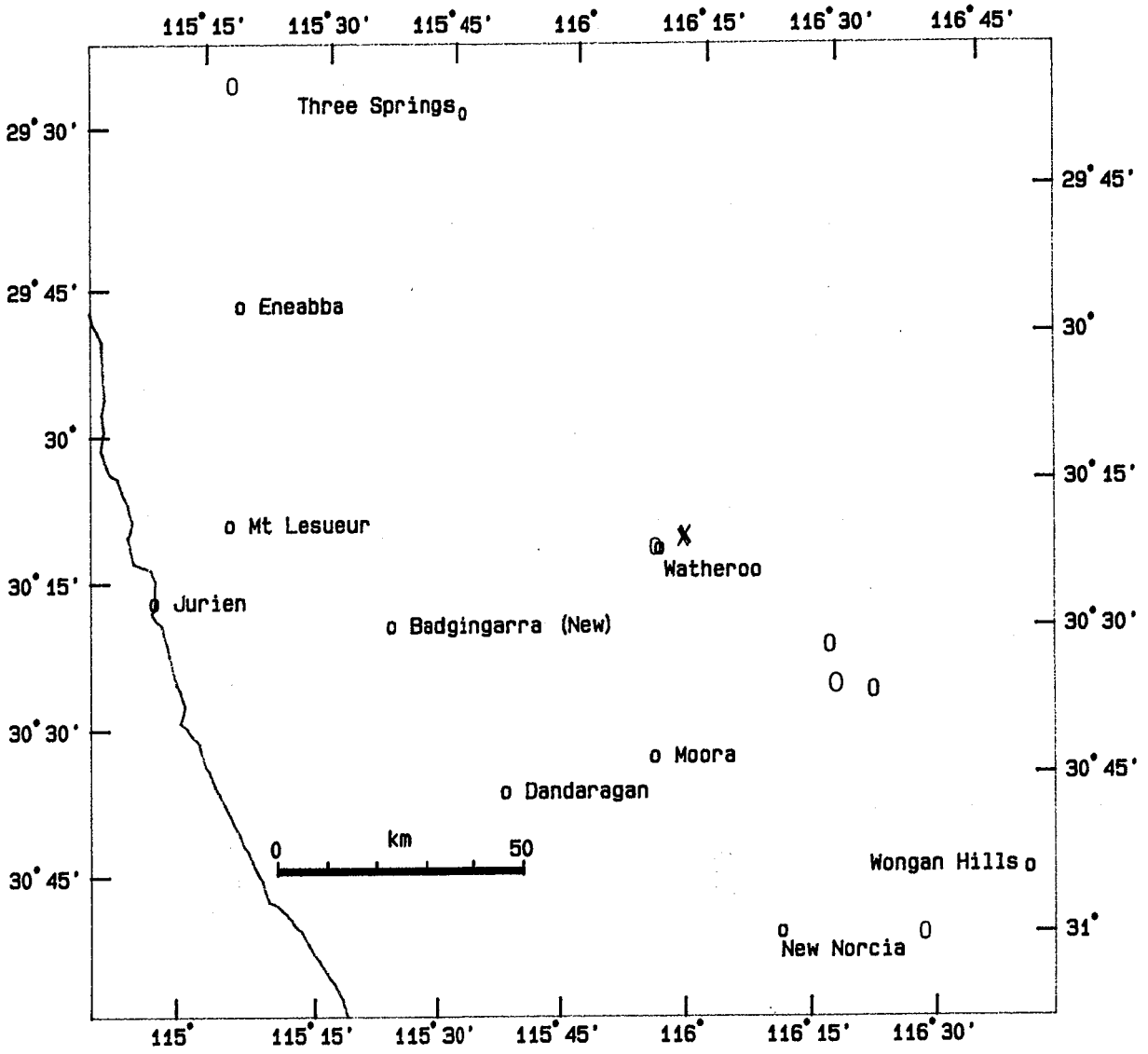

FIGURE 23 Recorded locations of *Gastrolobium rotundifolium*
O Herbarium record, X Survey record

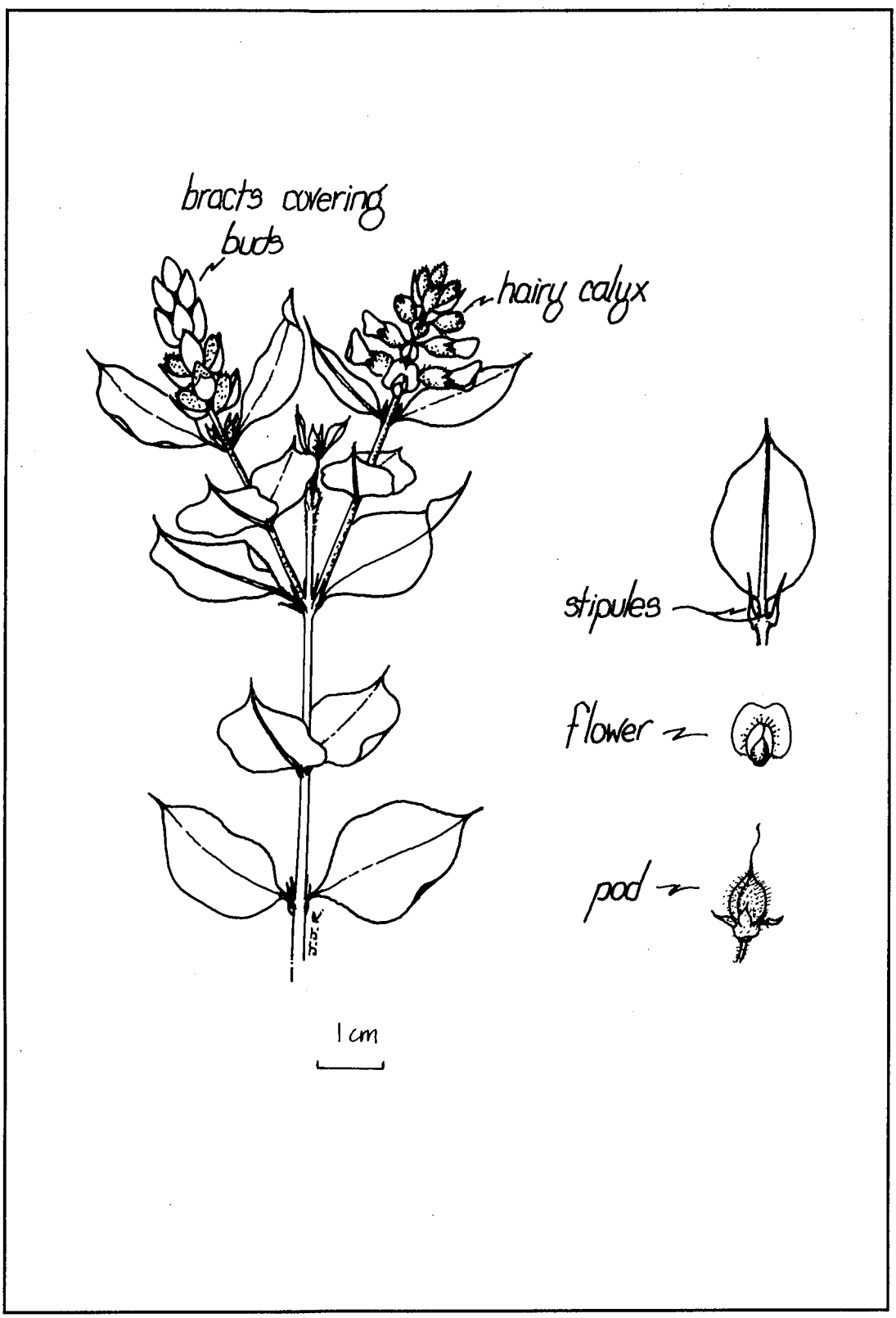

FIGURE 24 *Gastrolobium rotundifolium*

Gastrolobium stenophyllum **Turcz.**

Narrow-leaf poison

There are three forms of *Gastrolobium stenophyllum* which may be three different taxa. The three forms are all shrubs, either low and spreading or erect and 1.8 - 2.4 m tall and densely foliaged. The leaves are in opposite pairs, whorls of three or irregularly arranged in groups of two or three. They are crowded on the stems, pale green (Fitzgerald River), dark green (Phillips Range) or greyish green (Shakelton district), deeply concave and folded lengthwise, blunt at the tips with a fine and slender point which is sometimes prickly. The stipules are slender. The flowers are pale yellow (Fitzgerald River) to deep yellow (Shakelton district), and differ in size in the different forms. They are loosely arranged in long racemes (Fitzgerald River and Shackelton district) and crowded into short racemes at the ends of branches (Phillips Range). Flowering occurs between October and November.

Distribution and Habitat

The three forms of the species occur in different areas but are known from only a few locations: the first form is found around the Fitzgerald River, the second around the Phillips River near East Mt. Barren and the third form extends from the Shackelton district to Doodlakine and Narembeen. The Fitzgerald River form grows among sandstone rocks and in sand in the stream bed. In this survey, the Phillips River form has been found on river banks and in sandy loam near exposed granite.

Conservation Status

- Present Priority three
- Recommended Priority three

There are several records of the Fitzgerald River and Phillips River forms in the Fitzgerald National Park but there is no record of the Narembeen form on conservation reserves. A collector from the Narembeen area failed to find any specimens of this species. The population found on private property during this survey is not under any immediate threat. The area has been fenced by the owners who have no intention of clearing it at present and have undertaken to send in seed when it had ripened.

G. stenophyllum is known at present from several locations some of which are on land not under immediate threat. However, this species is poorly collected and more specimens are needed to resolve the taxonomic status of the three forms. Until this occurs the conservation staus cannot be adequately determined.

Response to fire - not known

Response to soil disturbance - not known

Susceptibility to weed invasion - not known

Susceptibility to dieback - not known

Grazing impact - monofluoro-acetate has been isolated only from the Fitzgerald form

Influence of canopy cover - not known

Recommended management requirements

- relocate populations in the Fitzgerald River National Park

- collect seed and maintain in long-term storage
- establish in cultivation

Recommended research requirements

- further surveys to locate populations and collect specimens from all three forms
- conduct research to clarify taxonomic status of the three forms

TABLE 13 Summary of the recorded locations of *Gastrolobium stenophyllum*

Date	Shire	Population	Land Status	No. of plants
HERBARIUM				
-/11/33	Ravensthorpe	East Mt Barren	National park	
24/10/70	Ravensthorpe	Upper Fitzgerald River estuary	National park	
18/12/70	Jerramungup	E of Roes Rock	National park	
19/9/79	Narembeen	ESE of Bruce Rock		
20/11/79	Ravensthorpe	Twertup Creek	National park	
PRESENT SURVEY				
* -/10/89	Ravensthorpe	Hammersley River	National park	≅ 5
*9/10/89	Ravensthorpe	WNW of Ravensthorpe	Private property	≅ 50

* New population

References

Aplin (1973), Everist (1974), Gardner and Bennetts (1956)

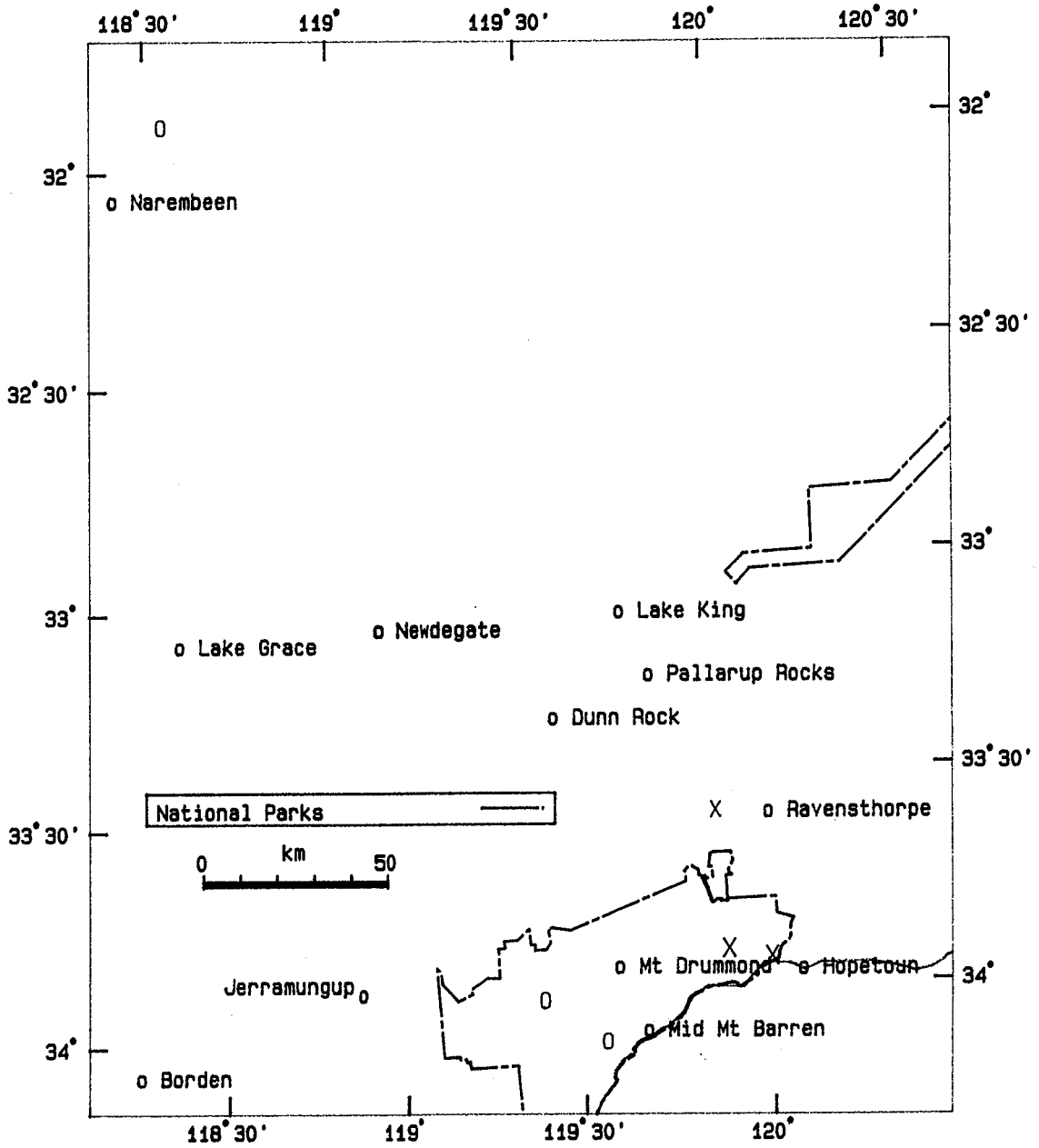

FIGURE 25 Recorded locations of *Gastrolobium stenophyllum*
O Herbarium record, X Survey record

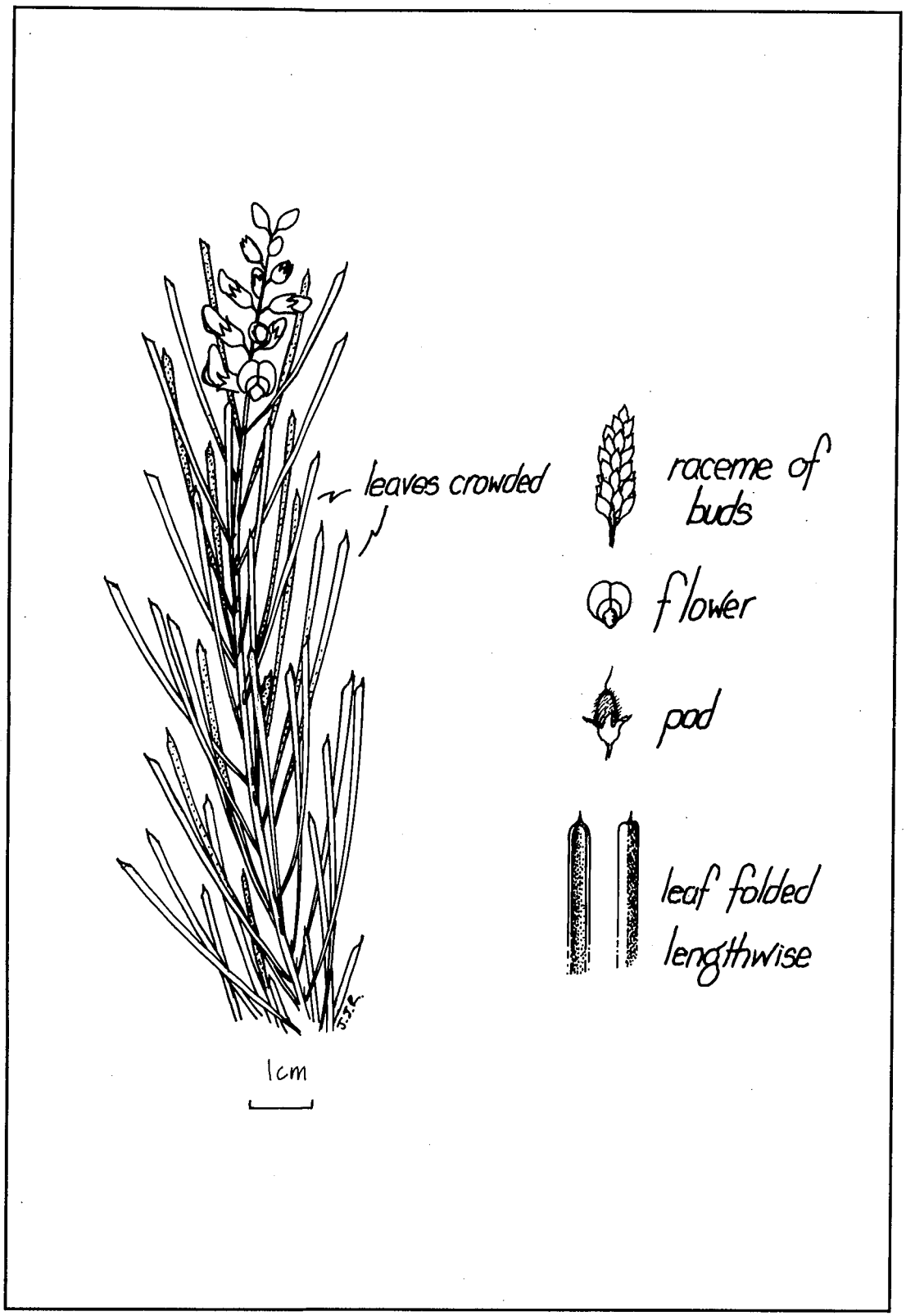

FIGURE 26 *Gastrolobium stenophyllum*

***Gastrolobium tomentosum* C. A. Gardner**

Woolly poison

Declared Rare Flora

Gastrolobium tomentosum is a low compact shrub with stiff, erect branches to 60 cm high. The leaves are borne in opposite pairs, they are rounded, undulate, dark-green above and densely covered with white felt-like hairs beneath, broadly elliptic in outline and rounded at both ends. The stipules are small and fall away early. The flowers occur in short, narrow racemes arising at the ends of the branches. The calyx is covered with fine silky hairs and has five equal or subequal lobes. The petals are deep yellow and purple and are only slightly longer than the calyx. Flowering occurs between September and October.

Distribution and Habitat

G. tomentosum is a highly restricted species found mainly over a range of about 15 km between Dardadine and Williams. There is also a record about 60 km to the NE near Yilminning and another from Cordering, some 30 km to the SW. *G. tomentosum* occurs on rises in gravelly-clay soil usually in *Eucalyptus wandoo* woodland

Conservation Status

- Present Declared Rare Flora

- Recommended Declared Rare Flora

G. tomentosum is presently known from nine locations. It has been searched for by competent botanists several times in the past 10 years and therefore the location of a new population in a proposed nature reserve is a significant discovery. In this reserve, most of the plants were located between two operational gravel pits. The species remains rare in the wild since it is still known from less than 2000 plants.

Seeds were collected from *G. tomentosum* and sent to Kings Park for propagation and to CALM Seed Centre for storage.

Response to fire - not known

Response to soil disturbance - observed growing in disturbed roadside soil and in firebreaks

Susceptibility to weed invasion - not known

Susceptibility to dieback - not known

Grazing impact - contains monofluoro-acetate and is reputed to be toxic to stock

Influence of canopy cover - occurs in woodlands

Recommended management requirements

- continued liaison with the shire and operations staff to ensure protection

- inform shires and operations staff of population on timber reserve 19107 and gravel reserve 29611 and cease removal of gravel

- complete change-of-use of reserve 19107 and 29611 to nature reserve

- exclude from prescribed burning until response to fire known
- install rare flora marker pegs
- inspect populations annually
- collect and maintain seed in long-term storage
- establish in cultivation

Recommended research requirements

- research on fire and life history
- set up permanent monitoring quadrats
- investigate the phylogenetic relationship between *G. ovalifolium, G. tomentosum* and the undescribed species referred to in the section on *G. ovalifolium*

TABLE 14 Summary of the recorded locations of *Gastrolobium tomentosum*

Date	Shire	Population	Land Status	No. of plants
HERBARIUM				
	West Arthur	Cordering		
20/7/47	Narrogin	Narrogin		
23/10/64	West Arthur	E of Dardadine		
23/10/64	Williams	E of Dardadine		
8/10/65	West Arthur	E of Dardadine		
23/9/70	Williams	Dardadine		
23/12/70	Narrogin	Yiliminning		
8/12/82	Williams	SSE of Williams	Road verge	200
8/12/82	Williams	SSW of Williams	Road verge	
8/12/82	Williams	S of Williams	Road verge	≅ 160
8/12/82	Williams	S of Williams	Road verge	≅ 400
-/2/84	West Arthur	E of Williams	Road verge	40 - 60
-/2/84	Williams	S of Culbin Siding	Road verge	100 - 120
-/2/84	Williams	S of Culbin Siding	Road verge	150 - 200
	Williams	E of Williams	Nature reserve	≅ 400 - 600
PRESENT SURVEY				
27/8/89	Williams	SSW of Culbin	Road verge	> 100
*18/9/89	Narrogin	WSW of Narrogin	Timber reserve, gravel reserve, proposed nature reserve	≅ 180

* New population

References

Aplin (1973) Everist (1974), Gardner and Bennetts (1956), Leigh *et al.* (1984)

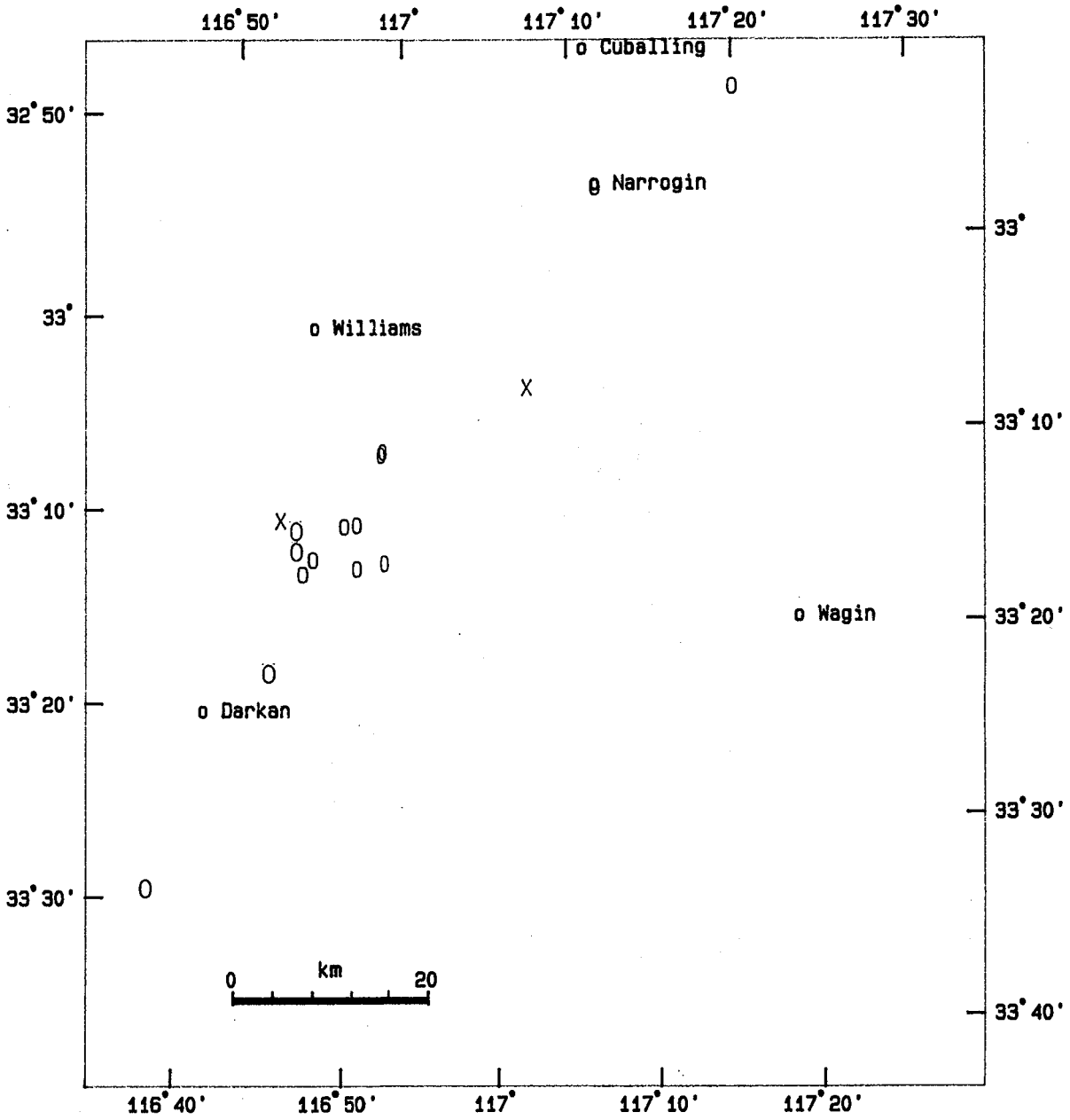

FIGURE 27 Recorded locations of *Gastrolobium tomentosum*
O Herbarium record, X Survey record

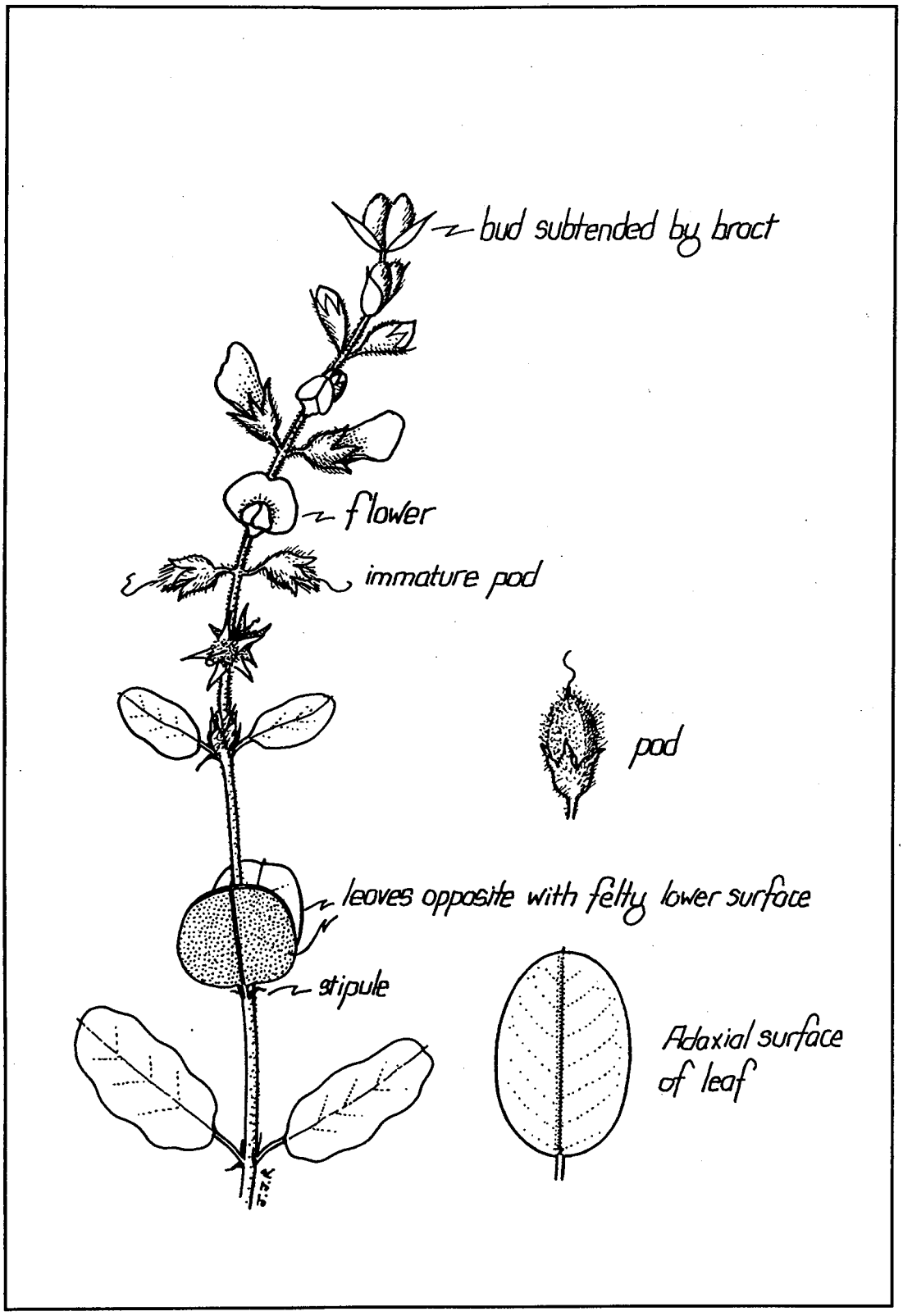

FIGURE 28 *Gastrolobium tomentosum*

PRIORITIES FOR RESEARCH AND MANAGEMENT

The procedure for determining management and research priorities follow those outlined by Kelly *et al.* (1990) and are summarised below.

The objective of management by CALM is to ensure and enhance the continued survival in the wild of populations of Declared Rare Flora and other plants in need of special protection.

Determining priorities

Each species was ranked on a scale from one to three under 15 categories which represent either potential threats or protection and management requirements (table 15). These rankings were made on the basis of the management and research recommendation made in the previous section. Species with a low priority for research or management are ranked '1' and those with a high priority are ranked '3'. Where the category was not considered directly appropriate or satisfactory management action had been taken, species were marked '-'. Scores were compiled for each species to give a total which summarises the perceived threats and management and research requirements. Species were then ranked by their total priority score (table 16).

TABLE 15 Survey of Endangered Poison Plants of Western Australia species ranked (1 - 3) according to the degree of threat or urgency of management or research action

	Location of other populations	Liaison with landowners	Research	Fire exclusion	Vulnurability - small population size	Linear marking	Firebreak/ road construction	Propogation	Seed collection	Monitoring quadrats	Recreational damage	Land acquisition	Fencing/ grazing control	Re-establishment	Weed control	Total
Gastrolobium appressum	1	3	2	3	3	1	3	1	3	3	-	3	1	-	-	27
Gstrolobium callistachys	3	2	3	3	3	3	3	3	3	1	-	1	-	-	-	28
Gastrolobium densifolium	1	1	3	1	1	1	1	1	1	1	-	-	-	-	-	12
Gastrolobium glaucum	3	3	3	3	2	3	3	3	3	3	-	3	-	2	3	37
Gastrolobium graniticum	3	3	3	3	3	-	-	3	3	1	3	-	2	-	-	27
Gastrolobium hamulosum	3	3	3	3	3	3	3	3	3	3	-	3	-	3	3	39
Gastrolobium heterophyllum	3	-	3	-	-	-	-	-	-	-	-	-	-	-	-	6
Gastrolobium ovalifolium	2	2	3	3	1	3	3	2	1	1	-	-	-	-	-	21
Gastrolobium propinquum	3	-	3	-	2	1	2	2	2	-	-	-	-	-	-	15
Gastrolobium racemosum	2	-	3	-	2	-	1	1	1	-	-	-	-	-	-	10
Gastrolobium rigidum	2	-	3	-	1	-	1	1	1	-	-	-	-	-	-	9
Gastrolobium rotundifolium	3	3	3	3	3	3	3	3	3	1	-	1	2	1	1	33
Gastrolobium stenophyllum	3	1	3	1	2	-	-	3	3	-	-	-	-	-	-	16
Gastrolobium tomentosum	3	3	3	3	2	3	3	3	3	3	-	2	-	-	-	31

TABLE 16 Survey of Endangered Poison Plants of Western Australia species ranked in order of priority for management and research action

1	*Gastrolobium hamulosum*
2	*Gastrolobium glaucum*
3	*Gastrolobium rotundifolium*
4	*Gastrolobium tomentosum*
5	*Gastrolobium callistachys*
6	*Gastrolobium appressum*
6	*Gastrolobium graniticum*
7	*Gastrolobium ovalifolium*
8	*Gastrolobium stenophyllum*
9	*Gastrolobium propinquum*
10	*Gastrolobium densifolium*
11	*Gastrolobium racemosum*
12	*Gastrolobium rigidum*
13	*Gastrolobium heterophyllum*

Difficulties encountered during the survey

There were three main difficulties encountered during the survey. Firstly, participation by the farming community was disappointing. Specific efforts were made to interest the farming community ranging from personalised letters to information circularised by the Country Women's Association with no response. The lack of response may have been because farmers are particularly busy during spring but it may also be due to misconceptions within rural communities about CALM, in particular rare flora protection and the acquisition of land.

The second difficulty arose because the survey involved rare species. Volunteers were not asked initially to report all the areas they surveyed so that it was sometimed difficult to assess the conservation status of species.

Finally, some volunteers sent in numerous specimens from non-survey species. Significant amounts of time were spent identifying these specimens and communicationg the results to the volunteers to ensure their goodwill. Although this may stimulate a general interest in the flora it reduced the time available for more directly productive work.

Budget expenditure

TABLE 17 Summary of budget expenditure

Item		Expenditure	Budget
Salary	20/3/89 29/6/89	$5 000.00 $5 000.00	$15 000.00
Travel		$4032.31	$5 000.00
Total		$14032.31	$20 000.00

A final salary payment of $5 000.00 remains to be paid.

CONCLUSIONS AND SUMMARY

In total, fifty-one new records of the fourteen *Gastrolobium* species included in the Endangered Poison Plant of Western Australia survey were made through the combined efforts of the 47 contributors. There were around 200 records of these species prior to the survey, so the survey has made a significant addition to knowledge about the current status of these species in the wild.

Thirty-one reports were for previously unrecorded populations, three of these were for Declared Rare Flora and eight were on existing or proposed nature reserves. The discovery of a relatively large population of the Declared Rare Flora, *G. tomentosum*, on a proposed nature reserve is a significant improvement in its conservation status although it remains rare in the wild.

Outlying populations of two species, *G. graniticum* at Paynes Find and *G. callistachys* at Munglinup, were found to be the result of mis-identifications. The geographical ranges of these two species have therefore been reduced significantly.

In addition to new information about the survey species, a new species of *Gastrolobium*, intermediate in form and distribution between *G. tomentosum* and *G. ovalifolium* was discovered during this survey and a collector from Hopetoun sent in specimens of another undescribed *Gastrolobium*.

Changes of conservation status were recommended for five species. Three of these species, *G. callistachys*, *G. hamulosum* and *G. graniticum* were recommended for inclusion on the schedule of Declared Rare Flora and immediate action is required to protect the existing populations. Conservation status was not revised down for any species but this is a likely outcome for *G. racemosum* and possibly *G. rigidum* following further surveys.

Seed was collected from 10 of the species and passed on to Kings Park and Botanic Garden and the CALM Seed Centre for long-term storage. Seed remains to be collected from *G. racemosum* and *G. stenophyllum* and a volunteer has promised to do this. Kings Park and Botanic Garden have undertaken to propagate the seed.

Specific recommendations for management and research were made for each species including five to investigate or acquire areas as nature reserves. Species were also ranked in order of an overall priority for action, with the top seven being *G. hamulosum, G. glaucum, G. rotundifolium, G. tomentosum, G. callistachys, G. appressum* and *G. graniticum.*

There are also several general areas where there is scope for future research and action. Firstly, there is a continuous need for surveys to maintain current information on conservation status of species. Secondly, very little is known about the ecology, genetic systems and population biology of these species. Research in these areas could be fostered by, for example, providing financial support to co-operative projects between World Wildlife Fund Australia, CALM and tertiary education institutions. Thirdly, the taxonomy of the *Gastrolobium* group requires urgent investigation in order that effective and rational systems of conservation can be developed. Finally, there is a need for public education. A commonly asked question during this survey was 'If they are poisonous, why conserve them?' The booklet produced by the Western Australian Herbarium on poisonous plants is due for revision providing an opportunity to inform the public about the value of conserving this important and interesting part of the State's flora.

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APPENDIX I

SECTION 23F OF THE WILDLIFE CONSERVATION ACT

Rare or endangered species of flora. Added by No. 86 of 1976, s. 17 (As amended by No. 28 of 1979, s. 7.).

23F. (1) In this section "rare flora" means flora for the time being declared to be rare flora for the purposes of this section.

(2) Where the Minister is of opinion that any class or description of protected flora is likely to become extinct or is rare or otherwise in need of special protection, he may, by notice published in the *Government Gazette* declare that class or description of flora to be rare flora for the purposes of this section throughout the State.

(3) The Minister may vary or revoke a notice published under subsection (2) of this section by subsequent notice or notices published in the *Government Gazette.*

(4) A person shall not, whether or not he is—

(a) the holder of a license issued under this Act to take protected flora;

(b) the owner or occupier of private land on which rare flora exists; or

(c) authorised by the owner or occupier of land on which rare flora exists,

take any rare flora unless—

(d) where he is not the holder of a license issued under this Act, he first obtains the consent thereto in writing of the Minister;

(e) where he is the holder of a license issued under this Act, he first obtains the further consent thereto in writing of the Minister.

(5) [*This subsection was in section 23F. as added by No. 86 of 1976, however it was repealed by No. 28 of 1979 at the time section 23F. came into operation.*]

(6) A person who takes any rare flora contrary to the provisions of this section is liable on conviction to a penalty not exceeding one thousand * dollars.

(7) Where an owner or occupier of private land who has been refused consent to take rare flora on that land satisfies the Minister that he will suffer loss of use or enjoyment of the land by reason of that refusal, the Minister shall inform the Treasurer in writing accordingly and the owner or occupier shall be paid compensation for that loss at such rate or rates per annum as—

(a) is agreed between the owner or occupier and the Treasurer; or

(b) in default of agreement, is determined by a valuer appointed by agreement between the Treasurer and the owner or occupier, or in default of agreement on such an appointment, by a valuer appointed by the Minister,

for such period, not exceeding five years, as the loss continues.

(8) Where compensation has been paid under subsection (7) of this section for a period of five years in respect of any particular land, the Minister shall not refuse an application by the owner or occupier of that land to take rare flora on that part of the land for the loss of use or enjoyment of which compensation has been so paid.

(9) Notwithstanding that compensation has been paid under subsection (7) of this section, whether for a period of five years or for a lesser period, for the loss of use or enjoyment of any land, that land may at any time be taken by the Governor under and subject to the Public Works Act, 1902 for any of the purposes of this Act.

* amended to $10 000 on 28 Oct. 1985

APPENDIX II

DEPARTMENT OF CONSERVATION AND LAND MANAGEMENT

POLICY STATEMENT NO. 9

CONSERVATION OF ENDANGERED FLORA IN THE WILD

SEPTEMBER 1987

1. BACKGROUND

(N.B. Existing legislation uses the term "rare flora". It is necessary to continue to use this term when quoting the legislation but the term "endangered flora" is to be used generally, as it will replace the other term when the Act in amended.)

The Department of Conservation and Land Management has statutory responsibilities for endangered flora conservation. This is a major concern because:

i) Western Australia has a flora that is exceptionally rich in localised and rare endemic plant species. Moreover, areas where rare species are concentrated coincide predominantly with the wheatbelt and other areas when there has been extensive clearing or modification of the native flora.

ii) Section 23F of the Wildlife Conservation Act prohibits the taking (injury or destruction) of declared rare flora by any person on any land throughout the State without the consent in writing of the Minister. A breach of this provision may lead to a fine of up to $10 000. The flora provisions of the Act are binding on the Crown.

Officers of the Department need to know how to identify declared endangered flora, to know where it occurs, and to know how best to manage it. Moreover, the Act prescribes that endangered flora be protected on all categories of land throughout the State. Hence, the legislation requires officers of the Department to advise and otherwise deal with a broad spectrum of land owners and users. Endangered flora conservation is thus an issue of high public profile, and one where the Department's activities are subject to intense public scrutiny.

Legislation

Rare flora is defined in subsection 23F(1) of the Wildlife Conservation Act as "flora for the time being declared to be rare flora for the purposes of this section." Further clarification is provided in subsection 23F(2):

> "Where the Minister is of opinion that any class or description of protected flora is likely to become extinct or is rare or otherwise in need of special protection, he may, by notice publish in the Government Gazette declare that class or description of flora to be rare flora for the purposes of this section throughout the State".

The Schedule of Declared Rare Flora

The schedule of Declared Rare (Endangered) Flora is reviewed annually.

Plants (not including hybrids) which are protected flora declared under the Wildlife Conservation Act may be recommended for gazettal as declared rare (endangered) flora if they satisfy the following criteria:

i) The taxon (species, subspecies, variety) is well-defined, readily identified and represented by a voucher specimen in a State or National Herbarium. It need not necessarily be formally described under conventions in the International Code of Botanical Nomenclature, but

such a description is preferred and should be undertaken as soon as possible after listing on the schedule.

ii) Have been searched for thoroughly in the wild by competent botanists during the past five years in most likely habitats, according to guidelines approved by the Executive Director (see Appendix).

iii) Searches have established that the plant in the wild is either:

a) rare;

or

b) in danger of extinction;

or

c) deemed to be threatened and in need of special protection.

(Plants which occur on land reserved for nature conservation may be considered less in need of special protection than those on land designated for other purposes.)

The status of an endangered plant in cultivation has no bearing on this matter. The legislation referes only to the status of plants in the wild.

Plants may be deleted from the schedule of declared rare (endangered) flora where:

i) recent botanical survey as defined in (ii) above has shown that the taxon is not rare, in danger of extinction or otherwise in need of special protection;

ii) the taxon is shown to be a hybrid;

iii) the taxon is presumed to be extinct (has not been collected or reliably observed over the past 50 years, or all known wild populations have been destroyed more recently).

or

iv) the taxon is no longer endangered because it has been adequately protercted by reservation of land where it occurs, or because its population numbers have increased beyond the danger point.

"Taking" Endangered Flora

In the Wildlife Conservation Act (subsection 6(1)) the following definition is tgiven:

> "to take" in relation to any flora included to gather, pluck, cut, pull up, destroy, dig up, remove or injure the flora or to cause or permit the same to be done by any means;"

Thus, taking declared endangered flora would include not only direct injury or destruction by human hand or machine but such activities as allowing stock to graze on the flora, introducing pathogens that attack it, altering water TABLEs such that the flora is deprived of adequate soil moisture or is inundated, allowing air pollutants to harm foliage etc.

In the case of endangered plants which need fire for regeneration, burning at an appropriate time may not adversely affect the survival of the population. However, burning would injure existing plant and constitutes "taking" under the Act. Therefore, Ministerial approval is required prior to conducting a burn which involves any species of endangered flora.

2. OPERATIONAL OBJECTIVE

To conserve endangered flora in the wild in Western Australia and to comply with Section 23F of the Wildlife Conservation Act.

3. POLICY

The Department will:

3.1 Identify, locate and seek to conserve endangered flora.

3.2 Undertake research into the taxonomy, population biology, ecology, protection and propagation of endangered flora.

3.3 Implement management practices to conserve endangered flora and it habitat.

3.4 Publicise the need for conservation of endangered flora, and encourage involvement in conservation from all sectors of the community.

3.5 Liaise with other land management and research agencies and private land owners to enhance the study and conservation of endangered flora.

3.6 Develop and manage a geographic data base for endangered flora at its headquarters and at regional and district offices.

4. STRATEGIES

To accomplish the Department objective and policies, staff will:

4.1 Undertake training in Departmental obligations to conserve and manage endangered flora.

4.2 Nominate Endangered Flora Officers (additional to District Wildlife Officers) in each region and district who shall be responsible for identifying, locating, mapping, training staff, overseeing management programs and providing liaison and adviice on endangered flora.

4.3 Establish and maintain field herbaria, photographic collections, map records and other aids concerning endangered flora at each Ranger station and district and regional office.

4.4 Arrange an inspection to establish whether declared endangered flora are present before undertaking any activity on CALM land that involves permanent destruction (i,e, clearing for road-making, building, mining or other purposes) of native flora.

4.5 Ensure that any burning program (for fire protection purposes) will not cause irreparable damage to species of endangered flora known to be susceptible to fire.

4.7 Observe other operational guidelines for protection of endangered flora on CALM lands as detailed in Administrative Instruction No. 24 "Protection of Endangered Flora in Departmental Operations".

4.8 Monitor known populations of endangered flora.

4.9 Maintain a geographic and biological data base on endangered flora.

4.10 Develop management programs for species of endangered flora.

4.11 Collect seed and propagate endangered flora in Departmental nurseries. Replant propagated material in the wild under approved management programs.

4.12 Undertake research on the distribution, taxonomy, genetic systems, population biology, ecology, protection and propagation of endangered flora.

4.13 Assist private property owners and other land management agencies in the protection and conservation of endangered flora.

4.14 Acquire land through donation, exchange or purchase to protect endangered flora where land and/or funds are available.

4.15 Maintain a system for listing and delisting flora on the declared endangered schedule.

4.16 Establish a consultative committee with the Western Australian Herbarium, Kings Park Board, tertiary institutions and other relevant organisations to ensure that research and management of declared endangered flora are co-ordinated.

4.17 Publicise information on endangered flora (without disclosing precise locations) and encourage community involvement in the conservation of endangered flora.

4.18 Maintain, through the Wildlife and Land Administration Branch, central records of all correspondence, basic information on susceptibility to fire or dependence on fire for regeneration, applications for ministerial permits and other matters to do with declared endangered flora.

4.19 Refer enforcement matters regarding the taking of declared endangered flora to the appropriate District Wildlife Officer.

GUIDELINES FOR SURVEYS OF PLANTS PROPOSED FOR ADDITION OR DELETION TO THE SCHEDULE OR DECLARED ENDANGERED FLORA

These guidelines were developed in conjunction with new criteria for additions and deletions to the Schedule of declared endangered flora.

Criterion (ii) for additions states:

> The taxon "have been searched for thoroughly in the wild by competent botanists during the past five years in most likely habitats, according to guidelines approved by the Executive Director."

The intensity of survey necessary to understand the conservation status of a plant varies according to a number of factors. Important considerations are:

1 Geographical range

A taxon extending over 10km of terrain will take less time to survey than one that occurs over 100km.

2 Area of available habitat

Taxa confined to specific localised habitats (e.g. granite outcrops) will require less time to survey than those more catholic in habitat preference.

3. Plant Size

Large conspicuous perennial plants (e.g. eucalypts) can be identified and counted more quickly than small inconspicuous annuals.

4 Seasonality and identification

Some plants are identifiable and conspicuous on vegetative features at any time of year. Others only stand out during flowering or fruiting, which may be confined to just a few weeks in the year, and may also be dependent on good seasonal conditions.

5 Disturbance opportunism

Some plants only germinate and/or flower following disturbance events such as bushfire or earthworks, and hence can only be surveyed after such events.

Based on these considerations, and the accumulated survey experience of many botanists and other CALM officers who have searched for hundreds of Western Australian plants over the past decade, the following matrix provides guidelines as to the duration of search necessary for plants to be considered for addition or deletion to the schedule of declared endangered flora.

Extremes of plant taxa in terms of ease and seasonality of identification are given.

Geographical Range	Area of available habitat	Recommended period of full time field survey	
		*Taxon easily identifiable any time	#Taxon identifiable with difficulty over short flowering period in certain years
<50km	small	0.5-1 month	1-2 months over several years
	large	1-2 months	3-6 months over a decade
50km	small	3-6 months	6-12 months over a decade
	large	6-12 months	?not possible

*e.g. large perennial plants identifiable any time on vegetative characteristics - *Eucalyptus crucis, Banksia tricuspis.*

#e.g. short-lived small annuals with inconspicuous flowers - Hydrocotyle spp., annual sedges etc.

Having completed surveys according to the above guidelines, the next phase in considering listing on the schedule is described under Criterion for additions (iii).

"Such recent botanical survey has shown that the taxon in the wild is either rare, or in danger of extinction or in need of special protection".

These three categories of endangered flora are defined below.

Rare

Less than a few thousand adult plants of the taxon exist in the wild.

In danger of extinction

The taxon is in serious risk of disappearing from the wild state within one or two decades if present land use and other casual factors continue to operate.

In need of special protection

The taxon is not presently in danger of extinction but is at risk over a longer period through continued depletion, or largely occurs on sites likely to experience changes in land use which would threaten its survival in the wild.

APPENDIX III

SAMPLE OF THE POISON PLANT SUPPLEMENT

WELCOME TO THE SURVEY OF ENDANGERED POISON PLANTS

The aim of this survey is to establish the distribution of fourteen species of poisonous plants for which there are very few records. Some of these species are thought to be rare and endangered so the survey also aims to determine the species' conservation status, to establish a seed bank and to introduce the plants to cultivation. The Endangered Poison Plants Survey is funded by The World Wildlife Fund Australia and the Western Australian Department of Conservation and Land Management.

Some people may have already taken part in the successful surveys undertaken for The Banksia Atlas and for Rare and Poorly Known Eucalypts of Western Australia. We are hoping that both experienced and new volunteers will want to become involved in another worthwhile project. The participation of farmers and their families will be invaluable since they are familiar with the plants on their properties. CALM and Department of Agriculture staff will also be involved in the project as much as possible because they have a good knowledge of their areas and are constantly out and about in them.

There are fourteen species of pea-flowered legumes included in this survey. All are poisonous and are from the genus *Gastrolobium*. These species were selected because our knowledge of their distributions is very limited and because many are thought to be becoming increasingly rare. Some volunteers will already be familiar with the survey species, however, a Field Guide which summarises the known distributions and has brief descriptions and drawings has been produced to assist with identification.

HOW THE SURVEY WORKS

A great deal of useful information about how to run surveys has been accumulated during the previous work on The Banksia Atlas and the Rare Eucalypt Survey. The Endangered Poison Plants Survey will use the same record sheets and 'how to' books as were used in these surveys.

We ask contributors to fill out records sheets indicating species, location and habitat details following a format described below and in the 'Banksia Atlas Instruction Booklet'. The sheets are sent to the survey co-ordinator for checking and incorporation into a computerised database. Detailed species maps can then be generated using a computer and copies sent to contributors regularly. Where possible, liaison with contributors in the field will be carried out in order to follow up leads or to check identifications.

USING THE BANKSIA ATLAS RECORD SHEETS FOR THE POISON PLANTS SURVEY

The sight record sheets developed for the Banksia Atlas have proven to be useful and easily understood by most volunteers in both the Banksia and Rare Eucalypt surveys. The same sight record sheets are are being used again for the Endangered Poison Plant Survey because:

(1) there are a number left over from the Banksia Atlas and Rare Eucalypt surveys; and
(2) because little change is required to adapt them for the current purpose.

Instructions for completing the sight record sheets are provided in the Banksia Atlas Instruction Booklet (pages 6-26). However, a few changes and additions to coding have been made for the Endangered Poison Plant Survey. These changes also apply to the Field Note Books.

HOW TO FILL IN A RECORD SHEET

General Instructions
As in the Banksia Atlas Booklet (p 7) except for items 3 and 5.

3. This section needs to be qualified since we **do not** want to infer that incomplete record sheets are unacceptable. Incomplete sheets may be submitted as long as they contain the following core data - Observer code, Date, Location Details (including Lat. and Long.), Name of Poison Plant (even if uncertain).
5. Since the herbarium records of the poison plants are so scanty and because we are also aiming to produce a seed bank, we will require voucher specimens more often than is indicated in the Banksia Atlas Instruction Booklet. Full details of when and how to collect and label specimens are provided in the accompanying Field Guide.

Observer Code
Unless otherwise informed this will simply be your three initials. If you do not have a middle name use 'X'.

State Code
Although the survey is confined to Western Australia, please put WA in the box provided.

Date of observation, Locality number for day
As in the Banksia Atlas Instruction Booklet (p 9).

Map used and scale
As accuracy is important for mapping rare plants, it is hoped to base map readings on maps of 1:100 000 or better. Maps may be obtained from:

Central Map Agency
Department of Land Administration
Cathedral Avenue
PERTH 6000
☎ 323 1370

For mail orders you will need to state the individual map number. This is easily worked out from the index leaflet (enclosed).

Locality
See the Banksia Atlas Instruction Booklet (p 9-13). Rare flora mapping requires detail so a resolution code of at least 3 should be aimed at.

Habitat
The only changes here are the addition of extra soil type codes and one extra vegetation code. As soil type variations seem to be almost infinite it is recommended that contributors choose the most accurate description of the soil at a record location. Use 'XX' in the boxes and elaborate below if the soil is particularly unusual.

EXTRA SOIL TYPES

Z	=	sandy loam
F	=	sandy gravel
A	=	sandy clay
W	=	clay loam
B	=	clay gravel
Y	=	gravelly loam

E = peaty sand
M = loam over rock

EXTRA VEGETATION CODE
MH = mallee heath. This may be low or tall shrubland with emergent mallees. Where there is only the odd scattered mallee, use SS or LS, where mallees are predominant, use MA.

Banksias Present
This should be read **Poison Plants Present**. The species codes for use in the Poison Plants Survey are given in the accompanying Field Guide. They are also easy to remember because they are the first three letters of the species name. If there are any other *Gastrolobium* or *Oxylobium* species at a location where one of the Survey species is found, enter their names in this section as this information may be of use in determining other possible locations. Codes for species that are not part of the survey will be entered by the survey co-ordinator.

Population Code
More detailed information on population sizes is required for rare plants. There are therefore new population codes for use in the Poison Plant Survey.

NEW POPULATION CODES

When a population is less than 10	-	specify the actual number (e. g. 1-9)
" " 10-20	-	use code A
" " 21-50	-	use code B
" " 51-100	-	use code C
" " 101-500	-	use code D
" " more than 500	-	use code E

Flower Codes
These have been modified due to the experience of the Banksia Atlas and the the Rare Eucalypt Survey, and the requirement for different terminology.

NEW FLOWER CODES
C = A majority of plants in the population **not** in bud or flower
B = A majority of plants in the population in bud
F = A majority of plants in the population in flower
A = A majority of plants in the population with old flowers and/or immature fruits

The remainder of instructions for filling out boxes can be found in the Banksia Atlas Instruction Booklet. The general rule is for 'banksia' read 'poison plant'.