

# **CURVED-LEAF GREVILLEA**

*(GREVILLEA CURVILOBA SUBSP. CURVILOBA)*

## **INTERIM RECOVERY PLAN**

**2000-2003**

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Photograph: A. P. Brown

September 2000

Department of Conservation and Land Management  
Western Australian Threatened Species and Communities Unit (WATSCU)  
PO Box 51, Wanneroo, WA 6946



## **FOREWORD**

Interim Recovery Plans (IRPs) are developed within the framework laid down in Department of Conservation and Land Management (CALM) Policy Statements Nos. 44 and 50.

IRPs outline the recovery actions that are required to urgently address those threatening processes most affecting the ongoing survival of threatened taxa or ecological communities, and begin the recovery process.

CALM is committed to ensuring that Critically Endangered taxa are conserved through the preparation and implementation of Recovery Plans or Interim Recovery Plans and by ensuring that conservation action commences as soon as possible and always within one year of endorsement of that rank by the Minister.

This Interim Recovery Plan will operate from September 2000 to August 2003 but will remain in force until withdrawn or replaced. It is intended that, if the taxon is still ranked Critically Endangered, this IRP will be replaced by a full Recovery Plan after three years.

This IRP was approved by the Director of Nature Conservation on day, month, 2000. The provision of funds identified in this Interim Recovery Plan is dependent on budgetary and other constraints affecting CALM, as well as the need to address other priorities.

Information in this IRP was accurate at September 2000.

## SUMMARY

**Scientific Name:** *Grevillea curviloba* subsp. *curviloba*

**Common Name:** Curved-leaf grevillea

**Family:** Proteaceae

**Flowering Period:** September to October

**CALM District:** Perth

**CALM Region :** Swan

**Shire:** Swan

**Recovery Team:** Swan Region Threatened Flora and Communities Recovery Team (SRTFCRT)

**Illustrations and/or further information:** Brown, A., Thomson-Dans, C. and Marchant, N. (Eds). (1998). *Western Australia's Threatened Flora*. Department of Conservation and Land Management, Western Australia; Olde, P.M. and Marriott, N.R. (1995). *The Grevillea Book 2*: 107-108. Kangaroo Press, Kenthurst N.S.W.

**Current status:** *Grevillea curviloba* subsp. *curviloba* was declared as Rare Flora in March 1998 and was ranked in December 1999 as Critically Endangered (CR). It currently meets World Conservation Union (IUCN 1994) Red List Category 'CR' under criterion B1+2bc, as there are only five populations with a total of 208 mature plants with continuing decline in the quality of the habitat. The main threats are weed invasion, inappropriate fire regimes, trampling, grazing, dieback disease and threats associated with road and rail maintenance.

**Habitat requirements:** The subspecies is very geographically restricted, with a range of less than 20 km. This subspecies is generally associated with the Muchea Limestone community which is ranked as Endangered due to threats associated with its restricted nature. The community is characterised by a suite of species including *Melaleuca huegelii*, *M. systema* ms and *Acacia saligna*.

**Critical habitat:** The critical habitat for *Grevillea curviloba* subsp. *curviloba* comprises: the area of occupancy of the known populations, areas of Muchea Limestone with remnant vegetation within 200 metres of known populations, the local catchment for the surface waters that provide the wetland habitat of the subspecies, corridors of remnant vegetation that link populations, and additional occurrences of the ecological community 'Shrublands and Woodlands on Muchea Limestone of the Swan Coastal Plain' that do not currently contain the subspecies.

**Existing Recovery Actions:** The following recovery actions have been or are currently being implemented:

1. Relevant land managers have been informed of the subspecies location and the associated legal obligations.
2. Declared Rare Flora (DRF) markers have been installed at all populations.
3. Dashboard stickers and posters that illustrate DRF markers and describe their purpose have been produced and distributed.
4. An A4 sized poster that provides a description of the subspecies and information about threats and recovery actions has been produced.
5. Negotiations are underway to establish conservation reserves at the site of Populations 3 and 4, and Public Open Space at Population 2.
6. Approximately 605 seeds were collected in 1998 for CALM's Threatened Flora Seed Centre (TFSC).
7. The Swan Region Threatened Flora and Communities Recovery Team is overseeing the implementation of this IRP.
8. Staff from CALM's Perth District office regularly monitor the populations.

**IRP Objective:** The objective of this Interim Recovery Plan (IRP) is to abate identified threats and maintain or enhance *in situ* populations to ensure the long-term preservation of the subspecies in the wild.

### Recovery Criteria

**Criterion for success:** The number of individuals within populations and/or the number of populations have increased.

**Criterion for failure:** The number of individuals within populations and/or the number of populations have decreased.

#### Recovery actions

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|---|---|
| 1. Coordinate recovery actions.                                       | 9. Develop and implement a fire management strategy.  |
| 2. Notify and liaise with relevant land managers.                     | 10. Collect seed and cutting material.  |
| 3. Negotiate with land managers to establish conservation reserves.   | 11. Obtain biological and ecological information.   |
| 4. Undertake weed control.  | 12. Start translocation process.  |
| 5. Fence Population 4.  | 13. Promote awareness.  |
| 6. Establish appropriate walk trails and erect signs at Population 2. | 14. Incorporate recovery actions into Interim Management Guidelines (IMGs) for new conservation reserves. |
| 7. Monitor populations.   | 15. Write full Recovery Plan.   |
| 8. Conduct further surveys.   |   |

## 1. BACKGROUND

### History

*Grevillea curviloba* subsp. *curviloba* was first collected in the late 1830s by James Drummond. D.J. McGillivray named the taxon *Grevillea curviloba* in 1986, a name which replaced *G. diversifolia* var. *rigida* that had been attached by Meissner in 1845 to the specimen collected by Drummond. The name *curviloba* refers to the inwardly curved leaf lobes (McGillivray 1986).

*Grevillea curviloba* subsp. *curviloba* was originally collected from the Muchea-Bullsbrook area, and is still only known from a range of less than 20 km.

### Description

*Grevillea curviloba* subsp. *curviloba* has leaves that are 1.5 to 5 cm long and have mostly oval, wedge-shaped lobes cut about half way to the mid rib. The inflorescences are 1 to 3 cm long and 3 cm wide. The flowers occur on short stalks, usually in the leaf axils. The individual flowers are 7 to 10 mm long by 0.5 mm across, and are creamy white. The fruits are 10 to 13 mm long and 6 to 9 mm wide with a wrinkled surface. The shiny seed is 7 to 9 mm long by 3 to 3.5 mm wide (Brown *et al.* 1998; Olde and Marriott 1995).

*Grevillea curviloba* subsp. *curviloba* differs from narrow curved-leaf grevillea (*G. curviloba* subsp. *incurva*) in having broader, slightly cupped primary leaf lobes that are generally more than 1.5 mm wide, rather than leaf lobes that are narrow and prominently incurved (Brown *et al.* 1998).

*Grevillea curviloba* subsp. *curviloba* is extremely variable in form. It can occur as a prostrate shrub with broad dark green leaves, or a tall erect shrub to two metres tall with greyish green leaves.

### Distribution and habitat

The species is very geographically restricted, with a range of less than 20 km. The subspecies is associated with the Muchea Limestone community, which is ranked as Endangered as the habitat has been mostly cleared for agriculture and the remaining area is under threat from weed invasion, clearing, and inappropriate fire regimes. The habitat is typically winter wet, deep peaty grey sands over limestone at depth. The subspecies occurs with a suite of shrubs including *Melaleuca huegelii*, *M. systema* ms and *Acacia saligna* that are more commonly associated with limestone soils near the coast (English and Blyth 2000).

### Critical Habitat

Critical habitat is habitat identified as being critical to the survival of a listed threatened species or listed threatened ecological community. Habitat is defined as the biophysical medium or media (a) occupied (continuously, periodically or occasionally) by an organism or group of organisms; or (b) once occupied

(continuously, periodically or occasionally) by an organism, or group of organisms, and into which organisms of that kind that the potential to be reintroduced. (sections 207A and 528 of Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)).

The critical habitat for *Grevillea curviloba* subsp. *curviloba* comprises:

- the area of occupancy of the known populations,
- areas of Muchea Limestone with remnant vegetation within 200 metres of known populations (these provide potential habitat for natural range extension),
- the local catchment for the surface waters that provide the wetland habitat of the subspecies (the subspecies occurs in seasonal wetland areas and is dependent on maintenance of local surface hydrology),
- corridors of remnant vegetation that link populations (these are necessary to allow pollinators to move between populations and are usually road and rail verges),
- additional occurrences of the ecological community 'Shrublands and Woodlands on Muchea Limestone of the Swan Coastal Plain' that do not currently contain the subspecies (these represent possible translocation sites).

### Biology and ecology

While the biology of many grevillea species is well researched, the biology of *Grevillea curviloba* subsp. *curviloba* is poorly known. Like many other grevilleas, the subspecies regenerates from soil-stored seed, but has also been observed to resprout from root stock after fire or loss of foliage by other means such as grazing and slashing. It is pollinated by insects, possibly native bees (Olde and Marriott 1995).

The subspecies is relatively hardy in most conditions but has not been widely cultivated for the horticultural industry (Olde and Marriott 1995).

### Threats

*Grevillea curviloba* subsp. *curviloba* was declared as Rare Flora in March 1998 and ranked in December 1999 as Critically Endangered (CR). It currently meets World Conservation Union (IUCN 1994) Red List category 'CR' under criterion B1+2bc as there are only five populations with a total of 208 adult plants, and continuing decline in the quality of the habitat. The main threats are weed invasion, inappropriate fire regimes, trampling, grazing, dieback disease and threats associated with road and rail maintenance.

- **Weed invasion** is a threat to all populations. Weeds suppress early plant growth by competing for soil moisture, nutrients and light. They also exacerbate grazing pressure and increase the fire hazard due to the easy ignition of high fuel loads, which are produced annually by many grass weed species.
- **Road, rail and firebreak maintenance activities** threaten plants and habitat at Populations 1 and 5 that are located on road verge and rail reserves. These include actions such as grading the road verge, constructing drainage channels and mowing the roadside vegetation to improve visibility. These disturbance events also often encourage weed invasion into adjacent habitat.
- **Inappropriate fire regimes** may affect the viability of populations, as seeds of *Grevillea curviloba* subsp. *curviloba* probably germinate following fire. If this is the case, the soil seed bank would rapidly be depleted if fires recurred before regenerating or juvenile plants reached maturity and replenished the soil seed bank. It is likely, however, that occasional fires are needed for reproduction of this species from seed. It is also likely that the subspecies can produce suckers from underground root stock following disturbance such as fire, and this would reduce the adverse impact of frequent fires on populations.
- **Trampling** by walkers is evident throughout the habitat at Population 2. The area is adjacent to a housing development, and is used as a recreation area by local residents. Further development of the surrounding area is proposed, and this is likely to increase recreational impacts. This is likely to result in increasing degradation of the habitat, weed invasion and possibly increased fire frequency and trampling of plants, unless residents of the local area are provided information about the significance of the subspecies and the need to manage the habitat.

- **Grazing** of *Grevillea curviloba* subsp. *curviloba* plants by kangaroos (*Macropus fuliginosus*) has had an impact on Populations 3 and 4. Grazing may have an impact on the establishment of *Grevillea curviloba* subsp. *curviloba* seedlings thereby limiting the natural recruitment of the subspecies.
- **Dieback disease** is a threat to the habitat of all populations. Dieback (*Phytophthora* spp.) are pathogens that causes the roots to rot and result in the plant dying of drought stress. *Grevillea curviloba* subsp. *curviloba* populations are inundated over the winter months favouring the establishment and spread of *Phytophthora* species. Although initial testing by CALM Research has found that *Grevillea curviloba* subsp. *curviloba* may not be susceptible to this pathogen (Colin Crane<sup>1</sup>, pers comm.), other species in the habitat may be susceptible and therefore the pathogen has the potential to indirectly impact on the subspecies. The spread of dieback into the area should therefore be prevented.

#### Summary of population information and threats

Pop. No. & Location	Land Status	Year/No. plants	Condition	Threats
1A. Bullsbrook	Shire road reserve	1997 20 1998 20 1999 40 (20)*	In disturbed habitat, but healthy	Road maintenance, weed invasion, inappropriate fire, dieback disease
1B. Bullsbrook	Westrail rail reserve	1999 40 (20)* 2000 70 (30)	In disturbed habitat, but healthy	Rail maintenance, weed invasion, inappropriate fire, dieback disease
2. The Vines	Private property	1996 40 1998 40 (20)	In disturbed habitat, but healthy	Weed invasion, inappropriate fire, trampling, dieback disease
3. The Vines	Private property	1996 44 1998 10	In disturbed habitat, but healthy	Weed invasion, inappropriate fire, grazing, dieback disease
4. The Vines	Private property	1996 4 2000 23 (30)	In disturbed habitat, but healthy	Weed invasion, grazing, inappropriate fire, dieback disease
5. Bullsbrook	Shire road reserve	2000 25	In disturbed habitat, but healthy	Road maintenance, weed invasion, inappropriate fire, dieback disease

Numbers in brackets are seedlings.

#### Guide for decision-makers

Section 1 provides details of current and possible future threats. Developments in the immediate vicinity of any of the populations or within the defined critical habitat of *Grevillea curviloba* subsp. *curviloba* require assessment. No developments should be approved unless the proponents can demonstrate that they will have no significant impact on the subspecies, its habitat or potential habitat, or on the local surface hydrology.

## 2. RECOVERY OBJECTIVE AND CRITERIA

### Objective

The objective of this Interim Recovery Plan is to abate identified threats and maintain and/or enhance *in situ* populations to ensure the long-term preservation of the taxon in the wild.

**Criterion for success:** The number of individuals within populations and/or the number of populations have increased.

**Criterion for failure:** The number of individuals within populations and/or the number of populations have decreased.

## 3. RECOVERY ACTIONS

<sup>1</sup> Colin Crane- Senior Technical Officer, CALMSscience

## Existing recovery actions

Most relevant land managers have been formally notified of the presence of the *Grevillea curviloba* subsp. *curviloba* populations on their lands. These notifications detailed the Declared Rare status of the taxon and the associated legal responsibilities.

Declared Rare Flora (DRF) markers have been installed at all populations. These alert people working in the area to the presence of significant flora, helping to prevent accidental damage during maintenance operations. Awareness of the significance of these markers is being promoted to relevant bodies such as local government authorities. To this end, dashboard stickers and posters have been produced and distributed. These illustrate DRF markers, inform of their purpose and provide a contact telephone number to use if such a marker is encountered.

An A4 sized poster that provides a description of the subspecies and information about threats and recovery actions has been developed for *Grevillea curviloba* subsp. *curviloba*. It is hoped that the poster will result in the discovery of new populations.

Negotiations are underway to establish conservation reserves at the site of the Populations 3 and 4. Population 2 is proposed as bushland Public Open Space as part of Perth's Bushplan (Government of Western Australia, 1998).

Approximately 605 seeds were collected for CALM's Threatened Flora Seed Centre (TFSC) in 1998. An initial germination rate of 95% was recorded.

The Swan Region Threatened Flora and Communities Recovery Team (SRTFCRT) is overseeing the implementation of this IRP and will include it in its annual report to CALM's Corporate Executive and funding bodies.

Staff from CALM's Perth District Office regularly monitor the populations.

## Future recovery actions

Where populations occur on lands other than those managed by CALM, permission has been or will be sought from the appropriate land managers prior to recovery actions being undertaken.

### 1. Coordinate recovery actions

The SRTFCRT will continue to oversee the implementation of the recovery actions for *Grevillea curviloba* subsp. *curviloba* and will include information on progress in its annual report to CALM's Corporate Executive and funding bodies.

<b>Action:</b>	Coordinate recovery actions
<b>Responsibility:</b>	CALM (Perth District) through the SRTFCRT
<b>Cost:</b>	\$5,700 per year

### 2. Notify and liaise with relevant land managers

Managers of land on which Population 5 occurs will need to be officially notified of the presence of DRF. Staff from CALM's Perth District will continue to liaise with the managers of land on which the taxon occurs and managers of adjacent lands to ensure the populations are not accidentally damaged or destroyed.

An information kit will be developed that illustrates the importance of the subspecies' conservation, the role of DRF markers in the conservation of declared rare species, contact names and numbers, and specific information about this subspecies. Due to the potential susceptibility of the habitat of the subspecies to dieback caused by *Phytophthora* spp., the need for the application of dieback hygiene procedures will be included in information provided. This will stress the need to restrict the movement of soil into the habitat of the populations.

**Action:** Notify and liaise with relevant land managers  
**Responsibility:** CALM (Perth District) through the SRTFCRT  
**Cost:** \$500 per year

### 3. Negotiate with land managers to establish conservation reserves

Staff from CALM's Swan Region will continue to negotiate with the land owners at Populations 3 and 4 to establish conservation reserves to protect plants and their habitat.

**Action:** Negotiate with land managers to establish conservation reserves  
**Responsibility:** CALM (Swan Region) through the SRTFCRT  
**Cost:** \$500 in the first year

### 4. Undertake weed control

Weeds are a major threat to all populations. The following actions will be implemented:

1. Selection of appropriate herbicides after determining which weeds are present.
2. Controlling invasive weeds by hand removal or spot spraying around *Grevillea curviloba* subsp. *curviloba* plants when weeds first emerge.
3. Scheduling weed control to include spraying at other threatened flora populations within the district.

The tolerance of associated native plant species to herbicides at the site of *Grevillea curviloba* subsp. *curviloba* is not known and weed control programs will be undertaken in conjunction with research (see Recovery Action 11).

**Action:** Undertake weed control  
**Responsibility:** CALM (Perth District, CALMScience) through the SRTFCRT  
**Cost:** \$700 per year

### 5. Fence Population 4

Kangaroos are grazing *Grevillea curviloba* subsp. *curviloba* seedlings at Population 4. A fence will be erected around the population including a buffer of surrounding habitat.

**Action:** Fence Population 4  
**Responsibility:** CALM (Perth District) through the SRTFCRT and relevant land manager  
**Cost:** \$1,600 in the first year

### 6. Establish appropriate walk trails and erect signs at Population 2

Walk trails will be sited to discourage trampling of Population 2 and its habitat. Signs will also be erected that indicate the site is environmentally sensitive and suggests that users stay on the designated pathways.

**Action:** Establish appropriate walk trails and erect signs at Population 2  
**Responsibility:** CALM (Perth District) through the SRTFCRT and relevant land manager  
**Cost:** \$1,600 in the first year

### 7. Monitor populations

Monitoring of factors such as weed invasion, habitat degradation (including the impact of dieback), salinity levels and population stability (expansion or decline), pollinator activity, seed production, recruitment, and longevity are essential. The populations will be inspected annually.

**Action:** Monitor populations  
**Responsibility:** CALM (Perth District) through the SRTFCRT  
**Cost:** \$1,300 per year



## 8. Conduct further surveys

Further surveys will be conducted during the species' flowering period (September to October). Local volunteers such as members of naturalists clubs and wildflower societies will be encouraged to be involved in surveys supervised by CALM staff.

**Action:** Conduct further surveys  
**Responsibility:** CALM (Perth District) through the SRTFCRT  
**Cost:** \$1,900 per year

## 9. Develop and implement a fire management strategy

Frequent fire may prevent the accumulation of sufficient soil stored seed to allow regeneration of the population, and may deplete underground stores if the subspecies reproduces by suckering. A fire management strategy will be developed to determine fire control measures and fire frequency.

**Action:** Develop and implement a fire management strategy  
**Responsibility:** CALM (Perth District) through the SRTFCRT  
**Cost:** \$2,400 in the first year and \$1,000 in subsequent years

## 10. Collect seed and cutting material

A small quantity of seed has been collected from Population 1. Additional seed will be collected as required. Cuttings will also be collected to establish a living collection of genetic material at Botanic Garden and Parks Authority (BGPA).

**Action:** Collect seed and cutting material  
**Responsibility:** CALM (Perth District, TFSC) and BGPA, through the SRTFCRT  
**Cost:** \$2,800 per year

## 11. Obtain biological and ecological information

Increased knowledge of the biology and ecology of the subspecies will provide a scientific basis for management of *Grevillea curviloba* subsp. *curviloba* in the wild. Investigations will include:

1. Study of the soil seed bank dynamics and the role of various factors including disturbance, competition, rainfall and grazing in recruitment and seedling survival.
2. Determination of reproductive strategies, phenology and seasonal growth.
3. Investigation of the mating system and pollination biology.
4. Investigation of population genetic structure, levels of genetic diversity and minimum viable population size.
5. Investigation of the impacts of dieback disease and control techniques on *Grevillea curviloba* subsp. *curviloba* and its habitat.

**Action:** Obtain biological and ecological information  
**Responsibility:** CALM (CALMSscience, Perth District) through the SRTFCRT  
**Cost:** \$14,500 per year

## 12. Start translocation process

Translocation is essential for the conservation of this subspecies, as the total number of extant plants is low, and the only known populations are not secure from threats including disease and fire. The urgency of this action will be reduced following reservation of areas that contain populations of the taxon. (refer Recovery Action 3). Although translocations are generally undertaken under full Recovery Plans, it is possible to develop a translocation proposal and start propagating plants within the time frame of an Interim Recovery Plan. This will be coordinated by the SRTFCRT. Information on the translocation of threatened animals and plants in the wild

is provided in CALM Policy Statement No. 29 *Translocation of Threatened Flora and Fauna*. All translocation proposals require endorsement by the Director of Nature Conservation.

**Action:** Start translocation process  
**Responsibility:** CALM (CALMScience, Perth District) through the SRTFCRT  
**Cost:** \$4,500 in the third year

### 13. Promote awareness

The importance of biodiversity conservation and the protection of the Critically Endangered *Grevillea curviloba* subsp. *curviloba* will be promoted to the public. Formal links with members of groups such as local naturalists clubs and wildflower societies, and interested individuals will also be encouraged.

**Action:** Promote awareness  
**Responsibility:** CALM (Perth District) through the SRTFCRT  
**Cost:** \$100 per year

### 14. Incorporate recovery actions into Interim Management Guidelines (IMGs) for new conservation reserves

The recovery actions for *Grevillea curviloba* subsp. *curviloba* will be addressed in the IMGs produced for new conservation reserves created around the taxon.

**Action:** Incorporate recovery actions into Interim Management Guidelines (IMG) for new conservation reserves  
**Responsibility:** CALM (Perth District) through the SRTFCRT  
**Cost:** \$400 in the second year

### 15. Write full Recovery Plan

At the end of the three year term of this Interim Recovery Plan, the need for further recovery will be assessed. If the species is still ranked Critically Endangered, a full Recovery Plan will be developed to describe action required for long-term maintenance. A Recovery Plan will be prepared with the benefit of knowledge gained over the time frame of this Interim Recovery Plan.

**Action:** Write full Recovery Plan  
**Responsibility:** CALM (WATSCU, Perth District) through the SRTFCRT  
**Cost:** \$17,600 in the final year

## 4. TERM OF PLAN

This Interim Recovery Plan will operate from September 2000 to August 2003 but will remain in force until withdrawn or replaced. It is intended that, if the taxon is still ranked Critically Endangered, this IRP will be replaced by a full Recovery Plan after three years.

## 5. ACKNOWLEDGMENTS

The following people have provided assistance and advice in the preparation of this Interim Recovery Plan:

Ken Borland	Previously Operations Officer, CALM Perth District
Anne Cochrane	Manager, CALM Threatened Flora Seed Centre
Colin Crane	Senior Technical Officer, CALMScience
Rebecca Evans	Project Officer, CALM Swan Region
Sophie Juszkievicz	Propagator, Kings Park and Botanic Garden
Greg Keighery	Principal Research Scientist, CALMScience
Stephen King	Field Officer, CALM Perth District
David Mitchell	Program Leader Nature Conservation, CALM Swan Region

Lyndon Mutter	Program Leader Nature Conservation, CALM Perth District
Sue Patrick	Senior Research Scientist, CALM W.A. Herbarium
Les Robson	Previously Operations Officer, CALM Swan Region
Amanda Shade	Horticulturalist, Botanic Gardens and Parks Authority
Gillian Stack	Technical Officer- DRF Database, CALM Swan Region

Thanks also to staff of the W.A. Herbarium for providing access to Herbarium databases and specimen information, and CALM's Wildlife Branch for their extensive assistance.

## 6. REFERENCES

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- Western Australian Herbarium (1998). FloraBase - Information on the Western Australian Flora. Department of Conservation and Land Management, Western Australia. <http://www.calm.wa.gov.au/science/>

## 7. TAXONOMIC DESCRIPTION

- Olde, P.M. and Marriott, N.R. (1993). New species and taxonomic changes in *Grevillea* (Proteaceae: Grevilleoideae) from south-west Western Australia. *Nuytsia*, 9 (2): 237-304.

***Grevillea curviloba* subsp. *curviloba*** has leaves 1.5 to 5 cm long, mostly pinnatifid, obovate-cuneate and coarsely divided either with apical toothing or more deeply cleft with strongly ascending lobes, rarely simple, entire and linear; simple leaves or leaf lobes mostly 1.5 to 2 mm wide, triangular to narrowly so, occasionally a deeply cleft lobe with –fid division of the apex; undersurface exposed over most of its area, glabrous or sparsely tomentose; pistil 3.5 to 4.5 mm long.