INTERIM RECOVERY PLAN NO. 79

GILLHAM'S BELL

(*DARWINIA OXYLEPIS*)

INTERIM RECOVERY PLAN

2001-2003

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Photograph: B & B Wells

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Western Australian Threatened Species and Communities Unit
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Natural Heritage Trust
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DEPARTMENT OF Conservation AND LAND MANAGEMENT
Conserving the nature of WA

THE GOVERNMENT OF WESTERN AUSTRALIA

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This Interim Recovery Plan will operate from January 2001 to December 2003 but will remain in force until withdrawn or replaced.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 12 April, 2001. 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 January 2001.

SUMMARY

Scientific Name: ***Darwinia oxylepis***
Common Name: Gillham's Bell
Family: Myrtaceae
Flowering Period: August to November
CALM Region: South Coast
CALM District: Albany
Shire: Gnowangerup
Recovery Team: Albany District Threatened Flora Recovery Team (ADTFRT)

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; Keighery, G. and Marchant, N. (1993) *Mountain Bells*, in Mountains of Mystery. Department of Conservation and Land Management, Western Australia; Marchant, N.G. and Keighery, G.J. (1980) *A new species and a new combination in Darwinia (Myrtaceae) from Western Australia*. Nuytsia, 3(2): 179-182.

Current status: *Darwinia oxylepis* was declared as Rare Flora in October 1996 and ranked as Critically Endangered (CR) in February 1997. However, it was recommended for downlisting in November 2000 by the Threatened Species Scientific Committee (TSSC) and currently meets World Conservation Union (IUCN, 1994) Red List Category Endangered (EN) under criteria B1+2c due to it being known from less than five locations and due to a continuing decline in habitat quality and area. The main threats are disease, tourist activities, inappropriate fire and drought.

Habitat requirements: *Darwinia oxylepis* is endemic to Western Australia where it is confined to gullies near the lower slopes of mountains in the Stirling Range National Park (SRNP). The species grows in mallee heathland on acid, sandy, clay soil on rough, rocky ground in seasonally moist gullies (Blake, 1981; Keighery & Marchant, 1993).

Critical habitat: The critical habitat of *Darwinia oxylepis* comprises the area of known populations, adjacent areas of similar habitat within 200 metres of populations, corridors of remnant vegetation that link populations, and other nearby occurrences of suitable habitat that are not currently known to contain populations of the species but which may be suitable for translocations.

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

1. Seed was collected from Population 1 in 1994 and 1996 by staff of the Threatened Flora Seed Centre (TFSC). Germination was found to range between 0 and 17% in the first year and 11 to 33% after one year in storage.
2. The Botanic Gardens and Parks Authority (BGPA) currently have around 230 plants from 19 different clones.
3. Monitoring of the impact of *Phytophthora cinnamomi* and trampling on *Darwinia oxylepis* was established at Population 1 in March 1999.
4. Counters were installed at Population 1 in September 1999, to monitor the number of vehicles and people visiting the area.
5. Bollards and no parking signs were placed at Population 1 to discourage tourists from parking on the road and walking into the population.
6. CALM Albany District staff completed a park note on *Darwinia* species in SRNP in April 2000.
7. Testing conducted by CALMScience staff in 1993 found that plants of *Darwinia oxylepis* in Population 1 were infected with *Phytophthora cinnamomi*.
8. Hand spraying of phosphite of selected areas within Population 1 commenced in 1994 and aerial spraying was undertaken in March and April 1999.
9. Staff from CALM's Albany District Office regularly monitor the effectiveness of phosphite application and the impact of *Phytophthora cinnamomi*.
10. The Albany District Threatened Flora Recovery Team (ADTFRT) is overseeing the implementation of this IRP and will include it in its annual report to CALM's Corporate Executive and funding bodies.
11. Staff from CALM's Albany District Office regularly monitor populations and search for new populations.

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

Recovery criteria

Criteria for success: The number of individuals within populations and/or the number of populations have increased.
Criteria for failure: The number of individuals within populations and/or the number of populations have decreased.

Recovery actions

1. Coordinate recovery actions.
2. Apply phosphite.
3. Monitor the impact of phosphite application.
4. Develop and implement a fire management strategy.
5. Monitor populations.
6. Conduct further surveys.
7. Develop and implement a management plan for park visitors at Populations 1 and 3.
8. Collect seed and cutting material.
9. Obtain biological and ecological information.
10. Promote awareness.
11. Write a full Recovery Plan.

1. BACKGROUND

History

James Drummond first collected *Darwinia oxylepis* from the Stirling Ranges in 1848. The species was described in 1852 by a Russian botanist Turczaninow, as a species of *Genetyllis*. Domin, in 1923, placed it in the genus *Darwinia* (as *D. lejostyla*). However, Marchant & Keighery regarded *D. lejostyla* and *D. oxylepis* as distinct species and formally described *D. oxylepis* in 1980. The common name is in honor of a local resident and *Darwinia* enthusiast A. Gillham[1]. (Keighery & Marchant, 1993).

Further Collections were made in 1935 by C.A. Gardner from Ross Peak, and in 1980 from SSW of Mondurup Peak by G. Keighery[2]. The Keighery collection (Population 4) was confirmed in October 2000. Despite several surveys of the other collection site no plants were found.

In 1998 CALM staff conducted surveys near Mondurup Peak and Baby Barnett Hill, however, no plants were located.

In summer 1983 a fire burnt most of area containing populations 1, 2, 3 and 4 with good natural regeneration occurring post fire. In October 2000 *Darwinia oxylepis* was known from four populations containing a total of around 6000 plants. However, a major fire burnt all populations in October 2000 and there are currently no *in situ* plants remaining. It is thought that natural regeneration will occur in Autumn-Spring 2001 and these areas will be monitored for signs of recovery.

Description

Darwinia oxylepis is a small upright shrub with erect branches and short branchlets. Its scattered leaves are glabrous, approximately 1 cm by 0.1 cm in size, linear, trigonous to almost terete, initially erect and often spreading to recurved when mature. The pendent flower bracts, which are on short recurved branchlets, are bell-shaped, 3 cm by 2 to 3 cm and nearly all red with some white (Elliot & Jones, 1984).

Darwinia oxylepis can be distinguished from the common bell *D. lejostyla* by its taller stature, longer leaves, larger, acute-tipped, scarlet outer bracts, larger bracteoles and larger flowers. *D. oxylepis* is also restricted to a small area in the western part of the Stirling Range, whereas *D. lejostyla* is more widespread in the eastern part of the Stirling Range (Marchant & Keighery, 1980).

Distribution and habitat

Darwinia oxylepis is endemic to Western Australia where it is apparently confined to lower drainage areas at the base of the range. The species grows in mallee heathland on acid, sandy, clay soil on rough, rocky ground in seasonally moist gullies (Blake, 1981; Keighery & Marchant, 1993).

Associated species include *Eucalyptus marginata*, *Hakea ambigua*, *Lambertia ericifolia*, *Hakea baxteri*, *Kunzea montana*, *Banksia oreophila*, *Calothamnus sanguineus*, *Adenanthos filifolius*, *Conospermum coerulescens* subsp. *dorrienii*, *Banksia baxteri*, *Andersonia echinocephala*, *Isopogon latifolius*, *Eucalyptus erectifolia*, *Eucalyptus preissiana*, *Xanthorrhoea preissii*, *Eucalyptus staeri*, and *Agonis parviceps*.

Critical Habitat

Critical habitat is habitat identified as being critical to the survival of a listed threatened species or community. Habitat means 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 have the potential to be reintroduced. (*Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)).

[1] Alf Gillham, Cranbrook resident.
[2] Greg Keighery, Principal Research Scientist, CALMScience

The critical habitat for *Darwinia oxylepis* comprises:

- The habitat of known populations.
- Similar habitat within 200 metres of known populations (these provide potential habitat for natural recruitment).
- Corridors of remnant vegetation that link populations with other nearby areas of apparently suitable habitat that do not currently contain the species.
- Areas of similar habitat that may be used for future translocation.

Biology and ecology

The genus *Darwinia*, which is distantly related to *Chamelaucium* (wax plants) and *Verticordia* (feather flowers), is endemic to the southwest and southeast Australia. The bracts surrounding the inflorescence of *Darwinia* species is shaped like a bell and the common name refers to this feature.

Monitoring of plots, established at Populations 2 and 3 following a 1983 fire, showed that most adult plants of *Darwinia oxylepis* are killed by hot fire, with recruitment occurring from seed. This concurs with Keighery and Marchant (1993) who suggested that *Darwinia* species regenerate from soil-stored seed, forming dense, local stands. They also suggested that Stirling Range *Darwinia* species flower two to four years after germination and reach maturity in seven to ten years. Therefore, it would be detrimental to the species if fire re-occurs within a 1-5 year period.

It is believed that *Darwinia oxylepis* is pollinated by nectar feeding birds although ants have also been seen on flowers (personal communication S. Barrett[3]). The flowers are quite large and pendulous (to keep rain from the nectar) and positioned so that birds can perch on them or probe up from the ground. *Darwinia* seeds have no specialised means of dispersal and remain stored in the soil below adult plants until the next fire (Keighery & Marchant, 1993). Occasional predation of seed by insects has been observed (personal observation A. Cochrane[4]).

Darwinia oxylepis appears to be relatively easy to grow from cuttings and is available at some nurseries.

Darwinia oxylepis is known to be susceptible to dieback caused by *Phytophthora cinnamomi* (Keighery, 1992). In the Stirling Range and Porongurup National Parks Management Plan the species has been identified as flora that requires urgent management intervention as all populations occur in susceptible habitat (CALM, 1999).

Threats

Darwinia oxylepis was declared as Rare Flora in October 1996 and ranked as Critically Endangered (CR) in February 1997. However, it was recommended for downlisting in November 2000 by the Threatened Species Scientific Committee (TSSC). It currently meets World Conservation Union (IUCN, 1994) Red List Category 'EN' under criteria B1+2c due to it being known from less than five locations and due to a continuing decline in habitat quality and area. The main threats are disease, tourist activities, inappropriate fire and drought.

- **Dieback** (*P. cinnamomi*) is a threat to all *Darwinia oxylepis* populations and has been confirmed from the area of Population 1.

- **Inappropriate fire regimes** may adversely affect the viability of populations. Although a fire in 1983 stimulated germination of soil stored seed it killed many adult plants. If further fires occur before seedlings have reached maturity there is a significant risk of depleting the soil seed store.

- **Tourist activities** may result in trampling and illegal picking. Populations 1 and 3 of *Darwinia oxylepis* are located at popular scenic and wildflower view points.

[3] Sarah Barrett, Conservation Officer, CALM Albany District
[4] Anne Cochrane, Manager, Threatened Flora Seed Centre

- **Drought** may directly impact on the species by causing a reduction in flowering, seed set and population recruitment, and an increased mortality rate of adult plants and seedlings.

Summary of population information and threats

Pop. No. & Location	Land Status	Year/No. plants	Condition	Threats
1. Baby Barnett Hill	National Park	1999 1000+ 10/2000 2000+ [1 dead] 11/2000 0	Burnt Oct 2000	Disease (infested site), fire, trampling
2. NE Mondurup Peak	National Park	1998 300+ 10/2000 2000+ 11/2000 0	Burnt Oct 2000	Disease, fire
3. Red Gum Hill	National Park	10/2000+ [10+ dead] 11/2000 0	Burnt Oct 2000	Drought, disease, fire, trampling, fire
4. SSW Mondurup Peak	National Park	10/2000 30+ 11/2000 0	Burnt Oct 2000	Disease, fire
5. Ross Peak	National Park	No plants found		

Note: Population 4 was originally a 1980 G. Keighery Herbarium collection. Population 5 is a 1935 CA Gardner Herbarium collection.

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 *Darwinia oxylepis* require assessment. Developments should only be approved if the proponents can demonstrate that they will not have an impact on the species, its habitat or potential habitat, or have the potential to spread or amplify dieback disease.

2. RECOVERY OBJECTIVE AND CRITERIA

Objectives

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

Criteria for success: The number of individuals within populations and/or the number of populations have increased.
Criteria for failure: The number of individuals within populations and/or the number of populations have decreased.

3. RECOVERY ACTIONS

Existing recovery actions

Approximately 17 seeds were collected from Population 1 in February 1994 and 616 seeds in November 1994. These are stored at CALM's TFSC at -18°C. The viability of the seed was tested after one year in storage. The initial germination rate of *Darwinia oxylepis* seed was found to be 0% initially and 11% after one year in storage. Another collection of 772 seeds was made in December 1996 also from Population 1. The initial germination rate was 17% initially and 33% after one year in storage (unpublished data, A. Cochrane).

The BGPA currently have around 230 plants of *Darwinia oxylepis* from 19 different clones. The species appears to propagate easily from cuttings with a strike rate between 50 and 100%, depending on the quality of the material. Although not as successful as cuttings, the species has also been grafted (personal communication A. Shade).

In March 1999 trials were established at Population 1 to monitor the impact of *Phytophthora cinnamomi* and trampling by park visitors. Measurements were taken to provide an indication of any increase in visitor activity.

In September 1999 a road counter was installed at Population 1 to monitor the number of vehicles in the area. In October 1999, a second counter was installed to monitor the number of people entering the gully area. Results so date indicate that approximately 100 people visit the site each year.

Bollards have been placed at Population 1 to prevent visitors from parking on the road. No Parking signs have been placed on the roadside to stop people parking on the verge.

In April 2000, CALM Albany District staff completed a park note on *Darwinia* species in Stirling Range National Park. This note provided information on Mountain Bells in the Stirling Range, explaining the need for conservation. The park note was distributed to the Stirling Range Retreat, Caravan Park, Bluff Knoll Café and tourist bus operators (personal communication G. Harnett[5]).

Testing conducted by CALMScience staff in 1993 found that samples of *Darwinia oxylepis* taken from Population 1 were infected with *Phytophthora cinnamomi* (personal communication J. Webster[6]). Hand spraying of phosphite in selected areas in Population 1 commenced in 1994. Aerial spraying of phosphite at Population 1 (3 hectares) was then undertaken in March and April 1999. General monitoring is done on all other populations.

Due to the continuing threat of dieback CALM Albany District staff will regularly spray these areas as part of CALM's phosphite spraying program. CALM staff also monitor populations in relation to the impact of *Phytophthora cinnamomi* and the effectiveness phosphite application.

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

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 ADTFRT is overseeing the implementation of recovery actions for *Darwinia oxylepis* and will include information on progress in its annual report to CALM's Corporate Executive and funding bodies.

Action: Coordinate recovery actions
Responsibility: CALM (Albany District) through the ADTFRT
Cost: $400 per year

2. Apply phosphite

Darwinia oxylepis and its habitat are threatened by dieback. CALM will continue applying phosphite to areas that are currently infected. Where other populations of *Darwinia oxylepis* show signs of dieback infection, spraying will also be applied there. Phosphite application will have the added benefit of protecting a number of other threatened plant species in the area.

Action: Apply phosphite
Responsibility: CALM (Albany District, Dieback Disease Coordinator) through the ADTFRT
Cost: $2,200 in second year

3. Monitor the impact of phosphite

Following the application of phosphite, monitoring its impact on *Phytophthora cinnamomi* and any detrimental effects on *Darwinia oxylepis* species is required.

[5] Geoff Harnett, CALM Ranger in Charge, Stirling Range National Park
[6] Janet Webster, Technical Officer, CALMScience

Action: Monitor the impact of phosphite
Responsibility: CALM (Albany District, Dieback Disease Coordinator) through the ADTFRT
Cost: $1,100 per year

4. Develop and implement a fire management strategy

Fire kills most adult plants of the species with regeneration mainly occurring from germination of soil stored seed. Frequent fire may result in few plants reaching maturity and therefore insufficient soil stored seed for regeneration. Fire should be prevented from occurring again in areas containing *Darwinia oxylepis* for at least 6 years. A fire management strategy that defines fire control measures will be developed in consultation with relevant authorities and land managers.

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

5. Monitor populations

Monitoring of post fire recruitment is needed following a fire that burnt all known populations in October 2000. Other factors, such as habitat degradation (including the impact of dieback), population stability (expansion or decline), weed invasion, pollinator activity, recruitment, seed production, longevity and predation, will also need to be monitored annually.

Action: Monitor populations
Responsibility: CALM (Albany District) through the ADTFRT
Cost: $1,800 per year

6. Conduct further surveys

CALM staff will conduct further surveys with the assistance of local naturalists and wildflower society members during the species' flowering period (August to November). In particular, the location of an old herbarium collection that has not been relocated will be investigated.

Action: Conduct further surveys
Responsibility: CALM (Albany District) through the ADTFRT
Cost: $3,400 per year

7. Develop and implement a management plan for park visitors at Populations 1 and 3

Careful management of park visitor activities is essential for the long term conservation of Populations 1 and 3. A management strategy will be developed and implemented in liaison with relevant visitors to the site, such as tourist operators.

Possible actions include:

- Re-routing a track up Red Gum Hill to avoid *Darwinia oxylepis*.
- Closing and rehabilitating tracks to discourage park visitors walking into populations.
- Placing signs that highlight the sensitiveness of these sites.
- The development of a conservation plan for Baby Barnett Hill.
- Liaising with relevant tourist companies.

Action: Develop and implement a management plan for park visitors at Populations 1 and 3
Responsibility: CALM (Albany District) through the ADTFRT
Cost: To be determined

8. Collect seed and cutting material

Seed has been collected from Population 1 but is required from other populations. Unfortunately, due to the recent fire that burnt all populations, it will not be possible to collect seed until populations have reached maturity in 6-7 years. Cutting material may be available in 3-4 years. Further surveys may uncover new populations and both seed and cutting material may be obtained from them.

Action: Collect seed and cutting material
Responsibility: CALM (Albany District, TFSC) and the BGPA, through the ADTFRT
Cost: $3,300 per year

9. Obtain biological and ecological information

Increased knowledge of the biology and ecology of the species will provide a scientific basis for management of *Darwinia oxylepis* in the wild. Investigations will include:

1. Determination of reproductive strategies, phenology and seasonal growth.
2. Study of the soil seed bank dynamics and the role of various factors including disturbance (such as fire), competition, and rainfall, grazing in recruitment and seedling survival.
3. Investigation of population genetic structure, levels of genetic diversity and minimum viable population size.
4. Investigation of the impacts of dieback disease and control techniques on *Darwinia oxylepis* and its habitat.

Action: Obtain biological and ecological information
Responsibility: CALM (CALMScience, Albany District) through the ADTFRT
Cost: $17,700 per year

10. Promote awareness

The importance of biodiversity conservation and the need for the long-term protection of the Critically Endangered species *Darwinia oxylepis* in the wild will be promoted to the community by a publicity campaign through the local print and electronic media and poster displays. Formal links with local naturalist groups and interested individuals will also be encouraged. An information sheet, which includes a description of the plant, its habitat type, threats, management actions and photos will be produced.

Due to the susceptibility of the habitat of this species to dieback, the need for dieback hygiene procedures will be included in information provided to visitors to sites where the species occurs.

Action: Promote awareness
Responsibility: CALM (Albany District, Corporate Relations) through the ADTFRT
Cost: $1,400 in first year and $700 in subsequent years

11. Write a full Recovery Plan

At the end of the second-year of this IRP, the need for further recovery will be assessed. *Darwinia oxylepis* is currently ranked Endangered but this ranking will be re-assessed if there is poor regeneration following the recent fires. If ranked as Critically Endangered at that time a full Recovery Plan will be developed that prescribes actions required for its long-term recovery.

Action: Write a full Recovery Plan
Responsibility: CALM (WATSCU, Albany District) through the ADTFRT
Cost: $18,000 in third year

4. TERM OF PLAN

This Interim Recovery Plan will operate from January 2001 to December 2003 but will remain in force until withdrawn or replaced. It is intended that, if the taxon is ranked Critically Endangered at the end of 2003, this IRP will be replaced by a full Recovery Plan.

5. ACKNOWLEDGMENTS

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

Sarah Barrett	Flora Conservation Officer, CALM Albany District
Anne Cochrane	Manager, CALM Threatened Flora Seed Centre
Rebecca Evans	Former Project Officer, WA Threatened Species and Communities Unit
Geoff Harnett	CALM Ranger in Charge, Stirling Range National Park
Greg Keighery	Principal Research Scientist, CALMScience
Amanda Shade	Horticulturalist, Botanic Garden and Parks Authority
Russell Smith	Ecologist, CALM Central Forest
Gillian Stack	Former Project Officer, WA Threatened Species and Communities Unit
Janet Webster	Technical Officer, CALMScience

We would like to thank the 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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7. TAXONOMIC DESCRIPTION

Elliot, W.R. and Jones, D.L. (1984) Encyclopaedia of Australian Plants, Volume 3. Lothian Publishing Company Pty Ltd, Melbourne.

Darwinia oxylepis is a small upright shrub; branches erect; branchlets short; leaves about 1 cm by 0.1 cm, linear, trigonous to almost terete, scattered, glabrous, initially erect, often spreading to recurved when mature; flower-heads bell-shaped, 3 cm by 2 to 3 cm, nearly all red with some white, terminal, pendent, on short recurved branchlets.

Blake, T.L. (1981) A Guide to *Darwinia* and *Homoranthus*. S.G.A.P. Maroondah Group, Victoria.

Darwinia oxylepis is an upright, dense, bush 1-1.5 m by 1 m wide. The thickened leaves generally recurved and densely arranged on the stems. Similar flower heads to *D. meeboldii*- typically 'Bell-shaped' and magnificently displayed. Each head hangs from the curved terminal tip of branchlets and is 3 cm by 2.5 to 3 cm wide. 10 to 12

individual flowers are well enclosed by the bracts. The outer bracts are green becoming red towards the apex of the head and very recurved. The inner bracts are 1 to 1.2 cm long by 3 to 7 mm wide and the largest of these enclosing bracts is 2.5 by 1 cm wide. Once the upper bracts are lifted white is revealed below, but this can be variable on different shrubs and the white extend below the upper bracts. Each flower has a pair of bracteoles enclosing the calyx tub. The inner bracts, 14 mm long, white, extend 2 to 3 mm beyond the calyx which is 10 to 12 mm long, smooth with the lower half yellow and the upper half deep red. The calyx lobes are 3 mm long with the style extending 15 mm beyond them.