

**PTILOTUS
FINAL REPORT**

Australian Flora Foundation Inc.

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Project title: Identification of *Ptilotus* species (Mulla Mulla) suitable for domestication and breeding for the cut and dried flower trade

The project commenced in November 1993 with the accessioning of seed and plant material from a range of habitats. This report discusses the material studied and reviews progress made under the following headings: Accessions, Propagation, Cultivation, Hybridization, Floristry and Horticultural merit. Future directions are also addressed.

Ptilotus is a member of the cosmopolitan family Amaranthaceae. At present there are 90 species recognised, all of which occur in Australia, 2 of these have been recorded outside Australia. There has been some difficulty in obtaining reliable keys and taxonomic information. The information that is available is usually of a regional nature with broad descriptions and is difficult to use as a positive means of identification.

ACCESSIONS

There are 116 accessions (Appendix Table 1) in the PBI collection covering thirty two species. Sixty seven were collected from their natural habitats with known provenance details.

The collections have come from: The University of Sydney staff, Royal Botanic Gardens Mt. Annan, Kings Park and Botanic Gardens Perth. Private collectors John McCarthy and Zyllis Ashby. Commercial seed sources: Royston Petrie Seeds, NSW; Kimberly Seeds, D. Orriell Seed Corporation, Vaughans Wildflower Seeds and Nindethana Seed Service, all of Western Australia. A 10-day field trip through central Australia added to our understanding of their biology, 15 species were identified and accessioned. Material has been accessioned from all states except Victoria and Tasmania.



PROPAGATION

Seed

Seed is usually harvested from the natural habitat and supplied as flowers with the seed enclosed. We have found significant fluctuations in seed set from field collections and commercial seed sources (Table 1). The range in one species, *P. exaltatus*, was 2% - 70%. Pollination vectors and environmental factors would be the major influences on seed set. An added complexity is the variation in the viability of 'set' seed (0-100%). The germination rate of extracted seed was far more reliable than that achieved from sowing the flower/seed bulk, indicating either a physical or chemical barrier in the flower.

TABLE 1: PTILOTUS SEED SET COUNTS

ACC. #	GENUS	SPECIES	SEED No. / SAMPLE No.	Mean Set %
P/9517	Ptilotus	? decipiens	42/50	84
P/9437	Ptilotus	arthrolasius	9/20, 11/20, 7/20	45
P/9409	Ptilotus	astrolasius, ex cult.	4/20	20
P/9314	Ptilotus	auriculifolius	12/20, 12/20, 8/20, 8/20, 49/100	49.4
P/9428	Ptilotus	auriculifolius	13/20, 12/20 11/20, 25/50, 12/20	55.4
P/9404	Ptilotus	auriculiformis	6/20, 7/20, 7/20, 7/20, 6/20	33
P/9311	Ptilotus	axillaris	3/100, 4/100, 7/100, 3/100, 4/100	4.2
P/9441	Ptilotus	caespitosus	3/20, 3/20, 3/20	15
P/9316	Ptilotus	calostachyus	22/50	44
P/9449	Ptilotus	chamaecladus	11/20, 10/20	52.5
P/9413	Ptilotus	clementii	0/20, 0/20, 1/20, 1/20	2.5
P/9426	Ptilotus	clementii	12/20, 13/20, 12/20	61.7
P/9523	Ptilotus	clementii	29/50	58
P/9315	Ptilotus	clementii, ex cult.	3/20, 4/20, 3/20, 2/20, 2/20, 3/20	14.2
P/9313	Ptilotus	exaltatus	18/100	18
P/9406	Ptilotus	exaltatus	3/20, 4/20, 4/20	18.3
P/9444	Ptilotus	exaltatus	1/20, 1/20, 2/20, 0/20, 3/20	7
P/9462	Ptilotus	exaltatus	1/20, 2/20, 2/20, 1/20, 2/20	8
P/9507	Ptilotus	exaltatus	32/50, 25/35	67.1
P/9511	Ptilotus	exaltatus	21/50, 24/50, 26/50, 10/25	46.3
P/9313	Ptilotus	exaltatus, ex cult.	15/20 14/20, 11/20, 12/20, 12/50, 18/50, 16/50	42.6
P/9414	Ptilotus	exaltatus, ex cult.	1/20 0/20, 0/20	1.6
P/9422	Ptilotus	exaltatus, ex cult.	17/25, 21/25, 10/20, 9/12	69.5
P/9432	Ptilotus	exaltatus, ex cult.	17/20, 10/20, 14/20	68.3
P/9445	Ptilotus	fusiformis	7/20, 5/20, 6/20	30
P/9435	Ptilotus	gaudichaudii		~ 50
P/9312	Ptilotus	helipteriodes	16/100	16
P/9403	Ptilotus	helipteriodes	4/20, 6/20, 7/20	28.3
P/9512	Ptilotus	helipterioides	55/110, 31/50	53.8
P/9530	Ptilotus	helipterioides	31/50	62
P/9519	Ptilotus	incanus	31/50	62
P/9443	Ptilotus	macrocephalus	10/20, 12/20, 8/20	50
P/9516	Ptilotus	macrocephalus	39/70, 13/30	52
P/9526	Ptilotus	macrocephalus	15/50, 11/30	32.5
P/9416	Ptilotus	nobilis	12/20, 10/20, 7/18	50

P/9524	Ptilotus	nobilis	18/50, 6/20, 7/50, 1/10	24.6
P/9416	Ptilotus	nobilis ex cult.	7/20, 9/20, 1/7	36.2
P/9317	Ptilotus	obovatus	48/50	96
P/9418	Ptilotus	polakii	5/50, 3/50, 3/50	7.2
P/9439	Ptilotus	polakii	2/20, 1/20, 2/20, 2/20	11.7
P/9419	Ptilotus	polystachyus	nil, immature	0
P/9424	Ptilotus	poiystachyus	nil, immature	0
P/9318	Ptilotus	rotundifolius	23/100, 5/50, 11/50	19.5
P/9402	Ptilotus	rotundifolius	nil, immature	0
P/9464	Ptilotus	schwartzii	8/20, 5/20, 6/20, 7/20	32.5
P/9466	Ptilotus	schwartzii	2/20, 2/20, 8/20, 4/20, 3/20	19
P/9501	Ptilotus	sessilifolius	7/20, 5/20, 1/20	21.7
P/9522	Ptilotus	sessilifolius	16/50, 14/50	30
P/9527	Ptilotus	sessilifolius	0/50, 3/50, 8/120	5
P/9465	Ptilotus	sp	11/20, 13/20, 13/20, 12/20, 8/12	62

The efficacy of commercial collection strategies was investigated. This was done as a conscious part of the field work in central Australia. The conclusion was drawn that a large portion of the inflorescence was collected, which included immature seed and even unopened flower buds. This is supported by field observation showing that the mature flowers with ripe seed detach very quickly from the inflorescence. It was noted that in the field, only a small amount of ripe flower (with ripe seed) was available at any one time for collection. Another indicator was the bleaching of the mature flowers from our field collection compared to the rest of the developing inflorescence. This meant that seed counts (by extraction) generally showed a significant increase over counts from material supplied commercially. A number of collections from commercial sources yielded no seed.

Seed was germinated in nursery flats in a medium of washed river sand and peat moss (2:1). Initial germination occurred in 7-21 days although some species (e.g. *P. obovatus*, *P. exaltatus*.), continued to germinate for up to three months.

All species have so far exhibited a high level of susceptibility to 'damping off' whilst very young. Pasteurisation and fungicide drenches have not reliably controlled the problem. Pricking out the seedlings into plugs with a very porous (approx. 25-30% AFP) medium and a reduction in watering to an absolute minimum has proven effective.

A seed germination protocol was developed to overcome some of the above propagation problems. This method involved germinating seed in petrie dishes on pasteurised moist peat moss. The lid was replaced and the germination monitored. The small seedlings were pricked out and potted into tubes and grown on normally.

Seed samples were sent to the research department of Kings Park in Perth for trials on 'smoke' treatment. Due to low seed viability the results were inconclusive.

In vitro germination of seed was not used. Protocols do exist (Williams et.al.), and had our attempts at hybridization been successful, these methods would have been employed.

Cuttings

Both soft tip and semi-hardwood cuttings have been used successfully to produce clonal replicates. High humidity and temperature stability are considered the most important environmental factors.

Our system consists of a 'tent' within a controlled environment room. The room was set at 25°C (considered to be an appropriate temperature). The 'tent' has a controlled level of humidity (90-95%). The humidity is in the form of a "fog" generated from a 'Uni Fogger' ultrasonic humidifier.

Soft, herbaceous tip and stem cuttings from cultivated plants worked well with most species. *P. polystachys* and *P. obovatus* gave a strike rate of better than 90%. Older woody material such as is found in the natural habitats was usually more difficult to strike. Early removal of cuttings from the propagation system after rooting was found best, as prolonged exposure to higher levels of moisture often allowed fungal attack. With the exception of *P. polystachys*, the use of flower scapes as stem cuttings was unsatisfactory due to their reluctance to produce roots and lateral shoots. 'Ex wild' material from central Australia proved difficult to propagate vegetatively, with the best success being from actively growing (herbaceous) tips.

In vitro micropropagation has proven successful with a selection of *P. exaltatus*. There were two reasons for the micropropagation of this species: 1) to test for initiation (into culture) problems, and 2) to produce a better plant type (eg. multi tillering).

Transplants

Regeneration of plants and rootstocks through transplants has proven to be a very successful method of establishing *Ptilotus* spp in the field. The provision of humidity reduced transplant shock to the point where, in many cases, very little delay in plant establishment occurred.

CULTIVATION

Being from the drier inland regions of Australia, it was assumed that the basic water requirements would be low. This was certainly true in practice.

Containers

Container grown plants, both glasshouse and shadehouse, produced weak root systems when the media water content was kept at a constant high level. However, the division between 'too wet' and 'too dry' was critical, so the most reliable production method involved improving the air-filled porosity of the medium.

Field

Field beds were prepared to provide information on the performance of *Ptilotus* spp. in a 'garden' or 'crop' situation. These consisted of our local alluvial soil formed as a bed one metre wide and raised 125mm above ground level. These beds were mulched to a depth of approximately 30 mm with 'Vita Mulch' to help retain water and retard weed growth. Watering was carried out by a network of drippers that operated manually. This method appears to be very effective.

Plants of several species have proven to be quick to establish and are quite hardy in the field. Even considering the recent drought, the field plantings required very little supplementary water. The best performers at this stage are *P. obovatus.*, *P. exaltatus*, *P. nobilis*, *P. calostachys* and *P. polystachys*.



Ptilotus exaltatus growing in the field

P. clementii, *P. polakii*, *P. ledifolia*, *P. macrocephalus*, and *P. rotundifolius* were weak growers in the field.

HYBRIDIZATION

So far, all attempts at controlled crossing have failed. Simple experiments attempting to germinate pollen on artificial media are inconclusive. A better understanding of the reproduction biology of *Ptilotus* spp. is needed to ensure success in future attempts at deliberate hybridization.

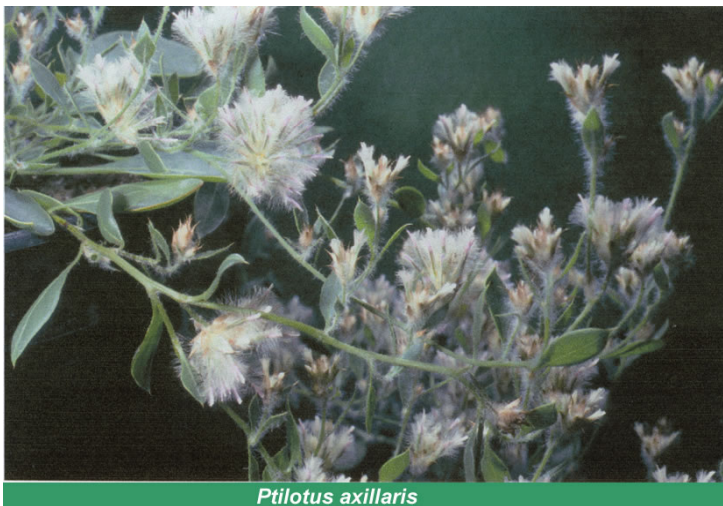
FLORISTRY

Flower Morphology

Flowers within the *Ptilotus* inflorescence consist of persistent bracts surrounding a sometimes hairy perianth with 5 segments. The 5 stamens are frequently reduced to only 2 fertile stamens due to the production of staminodes. This could be one explanation for the often poor production of seed in nature.

Inflorescence

The inflorescence is usually a cylindrical, ovoid or globose spike. It is mostly set terminally with the occasional axillary spike. The scapes vary in length up to half a metre depending on the species and environmental conditions (Table 2).

*Ptilotus exaltatus**Ptilotus polystachyus**Ptilotus axillaris*

Colour

Flower colour in *Ptilotus* is rarely considered intense, being usually pastel shades of pink, mauve, green, pale yellow and also white (see above). They are however most striking due to the numbers of flowers produced and the size of the inflorescence. The overall floral presentation is often enhanced by long scapes presenting the inflorescence on or above the plant.

Uses and Performance

At present there would be three areas within the existing flower markets for *Ptilotus* spp. Dried material, fresh flowers for mixed bunches and fresh flower 'fillers'. Initial trials into vase life were very encouraging. Inflorescences from 7 species were been cut and placed into distilled water, see Table 2. All lasted at least 14 days, with *P. polystachyus* maintaining condition for a full 7 weeks (49 days). This species, although not an attractive colour (green) could be used in the same manner as grasses in floristry.

Table 2: *Ptilotus* floristry.

Acc. No.	Species	Flower colour	Vase life	Stem length	For drying	Comments
P/9313	exaltatus	Mauve	2 - 3 weeks	200-300 mm	Yes	
P/9317	obovatus	Pink/ Mauve	2 weeks	150 - 300 mm	Yes	Grey foliage
P/9311	axillaris	Pale Pink	2 - 3 weeks	100 mm Drooping	No	Trailer
P/9309	polystachyus	Green	7 weeks	300-400 mm	No, stems brittle	
P/9310	leucocoma?	Pink / Mauve	2 - 3 weeks	100 - 150 mm	No, stems brittle	
P/9316	calostachyus	Pink	2 - 3 weeks	100 - 200 mm	No, stems brittle	
P/9315	clementii	Green / White	2 weeks	100 - 200 mm	No	Heads droop
P/9415	macrocephalus	Green / White	2 weeks	300 - 400 mm	No, shatters	Perfumed

There is currently a lack of fill in the floristry industry. *P. obovatus* has great potential to provide material in this area. It has a compound, branching inflorescence with globular flower heads of 10 – 15 mm in diameter, in colours from white through pink to mauve. Some forms present the flowers on scapes of up to 300 mm long which could be considered adequate.

HORTICULTURAL MERIT

Ptilotus spp. have ornamental appeal; they exhibit a range in plant form from prostrate/trailing through erect herbs to small shrubs. Leaf colour varies from bright green to silver/grey; the flower colour range and inflorescence form has been mentioned above. This variation provides plant form and foliage contrast not found in existing landscape species. This all points to a group of plants that if found adaptable to horticulture could fill a range of floristry needs.

Merit testing within existing and developing gene pools has continued. Observations of the following traits were taken:

1. Container and in ground performance.

Container production in a controlled environment is without doubt the most reliable method of production. Growth is usually rapid with *P. exaltatus* being a possible 8 week plant when under production. In drier climates many *Ptilotus* spp. will perform very well in the field.

2. Susceptibility to pests and diseases.

Soil borne fungal disease is the biggest hurdle to overcome. The use of supplementary water and fertilizer certainly increases the growth rate, but this also increases the plant's susceptibility to fungal attack. Plants being grown in the glasshouse can be attacked by insect pests. Aphids and white fly have been observed causing damage to a number of species.

3. Flower presentation, production and timing.

Ptilotus spp. vary greatly in their floral presentation. Several species including: *P. clementii*, *P. fusiformis*, *P. polakii* and *P. chamaecladus* are of little ornamental value floristically. They are either shy flowerers, poor flower presenters or have nondescript colours. Many species mature and flower quickly in cultivation. Many will begin flowering from seed in 8-10 weeks. This may continue for 2-3 months (or more) with some species.

4. Plant form and end use.

Applied selection to ensure the most appropriate forms for particular markets is of a high priority. The weakest or most untidy forms should not be grown. *P. obovatus* shows significant variation both within and across collections and has the potential to provide forms for landscaping, containers and floristry.

5. Ease of propagation.

Of the previously outlined methods, seed propagation is a relatively straightforward means of production. Vegetative propagation via cuttings provides only minor problems with appropriate material and conditions. *In vitro* micropropagation provides the most satisfactory method of mass production of single clones.

The establishment and growth of plants with minimal water, under zero maintenance conditions has been quite successful. Although generally hardy to mild frosts, many species were killed by a very severe frost during July 1995. There are opportunities to develop selections for the mass container markets both in Australia and overseas. These could be multiple stemmed, or compact free flowering types, or possibly hanging basket plants such as *P. axillaris*.

FUTURE

1. During this project we have concentrated on setting up a comprehensive gene pool as a foundation for detailed work on *Ptilotus* spp. Continued development of propagation and cultural protocols has assisted greatly in the ongoing expansion of our collection. One of our aims is to increase the diversity of our collection and hence provide a broader genetic base from which to select. This will also provide the opportunity to improve our currently rudimentary understanding of the taxonomy of *Ptilotus*.

2. The deliberate crossing of selections to produce a specific plant/flower form is still of high priority. The development of *in vitro* techniques will be important:

- a). For quick high volume propagation for trials etc. and
- b). To ensure germination of hybrid seed.

The development of hybrids is particularly important as it provides the opportunity to 'design' a plant for industry, horticulture and floristry needs, rather than adapt what

currently exists. Several good traits exist in our collection e.g. good straight stems, vigour, good colour and extended vase life.

3. Some contact has been made with people in both the nursery and floristry industries, for the purpose of procuring material and getting advice on what their markets would require. Further contact will continue and so improve our understanding of industry requirements and provide awareness of our work with *Ptilotus*. It has been suggested by exporters in both Perth and Adelaide that a market of 50,000 bunches of *P. exaltatus* per year (from each centre) is available immediately. A selection of *P. exaltatus* made during 1995 is being multiplied for trials in N.S.W. and S.A. as a test of market interest.
4. A joint project with Western Australian Agriculture has been submitted to Rural Industries Research and Development Corporation (RIRDC) for funding over 2 years. The aim is to look specifically into four species of *Ptilotus* for the cut/dried flower markets.
5. Two papers are proposed to be published covering the details obtained over the two years this project has run. One will be a general Identification, cultivation overview for 'Australian Plants'. The other, targeting commercial prospects and propagation for production, will be submitted to 'Australian Horticulture'.
6. We are also looking into the possibility of appointing a student to continue our study of *Ptilotus* under an Australian Post Graduate Award with Industry. This would be a three year intensive investigation of reproduction and breeding strategies. This approach will require some industry input.

We would like to thank the Australian Flora Foundation for their support of this project. We believe that the commercial future of *Ptilotus* looks promising.

BIBLIOGRAPHY

Black, J.M. 1924. Flora of South Australia. Part II., pp 209-216.

Cunningham, G.M., Mulham W.E., Milthorpe, P.L. and Leigh, J.H. 1981. Plants of Western N.S.W., pp 285-289.

Toelken, H. 1983. Flowering Plants in Australia, Amaranthaceae, pp 79-81.

Wrigley, L.W. and Fagg, M. 1983. Australian Native Plants, p 130.

Blombery, A. 1989. Wildflowers of central Australia pp 15-17.

Jacobs, S.W.L. 1990. Flora of New South Wales, Vol. I, *Ptilotus*, pp 256-260.

Williams, R. and Taji, A. 1990, Australian Horticulture, Vol. 90 (2) February 1990
Propagation of *Ptilotus exaltatus* pp 83-84.

Bennell, M.R. and Williams, R. 1992. *Scientia Horticulture* 51. Cultivation of the pink Mulla Mulla *Ptilotus exaltatus* nees. 2. Nutrition and growth regulation, pp 107-110.

Jacobs, S.W.L. 1994. National Herbarium, Sydney. Pers.Comm.

Makinson, R.O. 1994. Herbarium of Australian National Botanic Gardens, Canberra. Pers. Comm.

Williams, R. ASRRF Conference Paper, Propagation of *Clianthus* and *Ptilotus*.

Appendix Table 1: *PTILOTUS* ACCESSIONS IN SPECIES ORDER

ACC #	GENUS	SPECIES	SUPPLIER	DATE	LOCALITY	STATE
P/9525	Ptilotus	??? possibly Amaaranthus	Peter Abell	8/07/95	*PGA 825 FGNP	NT
P/9517	Ptilotus	?decipens	Peter Abell	4/07/95	*PGA 810	NT
P/9307	Ptilotus	2A	Z. Ashby (2a)	21/11/93	60 k S Bourke on Mitchell Hwy	NSW
P/9305	Ptilotus	2ii	Z. Ashby (2ii)	21/11/93	60 k S Bourke on Mitchell Hwy	NSW
P/9306	Ptilotus	2iii	Z. Ashby (2iii)	21/11/93	60 k S Bourke on Mitchell Hwy	NSW
P/9408	Ptilotus	aeroides	Nindethana Seeds	3/03/94	RMB 939, Woogenilup	WA
P/9438	Ptilotus	aeroides	Kings Park & Botanic Gdn.	14/4/94	*5136/93	WA
P/9437	Ptilotus	arthrolasius	Kings Park& Botanic Gdn.	14/4/94	*310/86	WA
P/9409	Ptilotus	astrolasius	Nindethana Seeds	3/03/94	RMB 939, Woogenilup	WA
P/9451	Ptilotus	astrolasius	Kings Park & Botanic Gdn.	14/4/94	*91/89	WA
P/9461	Ptilotus	atriplicifolius	Prof. Burgess, K. Gott.	23/6/94	*Deep Well, Northern Territory.	NT
P/9501	Ptilotus	atriplicifolius	John McCarthey (JMc)	Jan-95	*	SA
P/9410	Ptilotus	auriculifolius	Nindethana Seeds	3/03/94	RMB 939, Woogenilup	WA
P/9428	Ptilotus	auriculifolius	Vaughans Wildflr. Seeds	3/03/94	Gingin	WA
P/9314	Ptilotus	auriculifolius	Royston Petrie Seeds	30/11/93	Kenthurst	NSW
P/9404	Ptilotus	auriculiformis	Kimseed	3/01/94	Aust. Revegetation Corp. Ltd.	WA
P/9311	Ptilotus	axillaris	Royston Petrie Seeds	30/11/93	Kenthurst	NSW
P/9425	Ptilotus	axillaris	Vaughans Wildflr. Seeds	3/03/94	Gingin	WA
P/9446	Ptilotus	axillaris	Kings Park Botanic Gdn.	14/4/94	*1857, 554/93	WA
P/9441	Ptilotus	caespitosus	Kings Park & Botanic Gdn.	14/4/94	*1860, 439/91	WA
P/9529	Ptilotus	calostachys	John McCarthey (JMc)	3/09/95	*JMc 95/4. 50km S of Tennant Creek	NT
P/9447	Ptilotus	calostachys var. calost.	Kings Park & Botanic Gdn.	14/4/94	*5102/92	WA
P/9316	Ptilotus	calostachyus	Royston Petrie Seeds	30/11/93	Kenthurst	NSW
P/9407	Ptilotus	calostachyus	Kimseed	3/01/94	Aust. Revegetation Corp. Ltd.	WA
P/9411	Ptilotus	calostachyus	Nindethana Seeds	3/03/94	RMB 939, Woogenilup	WA
P/9429	Ptilotus	calostachyus	Vaughans Wildflr. Seeds	3/03/94	'Gingin	WA
P/9440	Ptilotus	calostachyus	Kings Park & Botanic Gdn.	14/4/94	*1861, 89/89	WA
P/9412	Ptilotus	carinatus	Nindethana Seeds	3/03/94	RMB 939, Woogenilup	WA
P/9449	Ptilotus	chamaecladus	Kings Park & Botanic Gdn.	14/4/94	*1864, 5491/93	WA
P/9315	Ptilotus	clementii	Royston Petrie Seeds	30/11/93	Kenthurst	NSW
P/9413	Ptilotus	clementii	Nindethana Seeds	3/03/94	RMB 939, Woogenilup	WA
P/9426	Ptilotus	clementii	Vaughans Wildflr. Seeds	3/03/94	Gingin	WA
P/9442	Ptilotus	clementii	Kings Park & Botanic Gdn.	14/4/94	*1865, 15/93	WA
P/9521	Ptilotus	clementii	Peter Abell	6/07/95	*PGA 818	NT
ACC #	GENUS	SPECIES	SUPPLIER	DATE	LOCALITY	STATE
P/9523	Ptilotus	clementii	Peter Abell	6/07/95	*PGA 820	NT

*Indicates collections of documented wild origin

Appendix Table 1: *PTILOTUS* ACCESSIONS IN SPECIES ORDER

P/9450	Ptilotus	conicus	Kings Park & Botanic Gdn.	14/4/94	*1865A, 158/89	WA
P/9601	Ptilotus	declinatus	Nindethana Seeds	2/03/96	Albany	WA
P/9454	Ptilotus	erubescens?	Mt. Annan Botanic Gdn.	2214194	*890257	
P/9313	Ptilotus	exaltatus	Royston Petrie Seeds	30/11/93	Kenthurst	NSW
P/9406	Ptilotus	exaltatus	Kimseed	3/01/94	Aust. Revegetation Corp. Ltd.	WA
P/9414	Ptilotus	exaltatus	Nindethana Seeds	3/03/94	RMB 939, Woogenilup	WA
P/9422	Ptilotus	exaltatus	Vaughans Wildflr. Seeds	3/03/94	Gingin	WA
P/9432	Ptilotus	exaltatus	D. Oriell Seed Exporters	22/3/94	Mt. Yorkine, Perth.	WA
P/9444	Ptilotus	exaltatus	Kings Park & Botanic Gdn.	14/4/94	*1871, 51581/92	WA
P/9507	Ptilotus	exaltatus	Peter Abell	30/06/95	*PGA 784	NT
P/9511	Ptilotus	exaltatus	Peter Abell	1/07/95	*PGA 799	NT
P/9508	Ptilotus	exaltatus (purple)	Peter Abell	30/06/95	*PGA 788	NT
P/9457	Ptilotus	exaltatus var. semilanatus	Mt. Annan Botanic Gdn.	22/4/94	*890255	
P/9504	Ptilotus	exaltatus var. semilanatus	Greg Steenbeake	Feb-95	*	NSW
P/9513	Ptilotus	exaltatus var. semilanatus	Peter Abell	1/07/95	*PGA 801	NT
P/9445	Ptilotus	fusiformis	Kings Park & Botanic Gdn.	14/4/94	* 1873, 80/89	WA
P/9435	Ptilotus	gaudichaudii	Kings Park & Botanic Gdn.	14/4/94	*1874, 5735/92	WA
P/9455	Ptilotus	gaudichaudii var. gaud.	Mt. Annan Botanic Gdn.	22/4/94	*893031	
P/9405	Ptilotus	gomphrenoides	Kimseed	3/01/94	Aust. Revegetation Corp. Ltd.	WA
P/9421	Ptilotus	gomphrenoides	Nindethana Seeds	3103/94	RMB 939, Woogenilup	WA
P/9430	Ptilotus	gomphrenoides	Vaughans Wildflr. Seeds	3/03/94	Gingin	WA
P/9512	Ptilotus	helipterioides	Peter Abell	1/7/95	*PGA 800	NT
P/9514	Ptilotus	helipterioides	Peter Abell	2/07/95	*PGA 802	NT
P/9530	Ptilotus	helipterioides	John McCarthey (JMc)	2/09/95	*JMc 95/5. Stuart Wells, 80km S of Alice Springs.	NT
P/9312	Ptilotus	helipteroides	Royston Petrie Seeds	30/11/93	Kenthurst	NSW
P/9403	Ptilotus	helipteroides	Kimseed	3/01/94	Aust. Revegetation Corp. Ltd.	WA
P/9431	Ptilotus	helipteroides	Vaughans Wildflr. Seeds	3/03/94	Gingin	WA
P/9467	Ptilotus	incanus	Prof. Burgess, K. Gott.	28/6/94	* Western ridge top above Little Palm Ck. FGNP	NT
P/9519	Ptilotus	incanus	Peter Abell	4/07/95	*PGA 812	NT
P/9452	Ptilotus	lanatus	Kings Park & Botanic Gdn.	14/4/94	*1882, 5623/92	WA
P/9436	Ptilotus	latifolius	Kings Park & Botanic Gdn.	14/4/94	*1883, 90/89	WA
P/9510	Ptilotus	latifolius	Peter Abell	1/07/95	*PGA 798	NT
P/9456	Ptilotus	leucocoma	Mt. Annan Botanic Gdn.	2214194	*893037	
ACC #	GENUS	SPECIES	SUPPLIER	DATE	LOCALITY	STATE
P/9310	Ptilotus	leucocoma?	Z. Ashby (3iv)	21/11/93	*16kS Charleville	QLD
P/9301	Ptilotus	macrocephalus	J.Roake		*	NSW
P/9302	Ptilotus	macrocephalus	D. Kull/C. Wellings	11/03/93	*3k E Urana	NSW

*Indicates collections of documented wild origin

Appendix Table 1: Ptilotus Accessions in Species Order

P/9319	Ptilotus	macrocephalus	Z. Ashby	12/03/93	7 k W of Oaky on Warrego Hwy.	QLD
P/9415	Ptilotus	macrocephalus	Nindethana Seeds	3/03/94	RMB 939, Woogenilup	WA
P/9443	Ptilotus	macrocephalus	Kings Park & Botanic Gdn.	14/4/94	*1886	WA
P/9503	Ptilotus	macrocephalus	John McCarthey (JMc)	Jan-95	*Naracoorte Caves, SA	SA
P/9516	Ptilotus	macrocephalus	Peter Abell	3/07/95	*PGA 805	NT
P/9526	Ptilotus	macrocephalus	John McCarthey (JMc)	3/09/95	*JMc 95/1, 50km S of Tennant Creek	NT
P/9448	Ptilotus	murrayi	Kings Park & Botanic Gdn.	14/4/94	*1887, 344/92	WA
P/9416	Ptilotus	nobilis	Nindethana Seeds	3/03/94	RMB 939, Woogenilup	WA
P/9462	Ptilotus	nobilis	Prof. Burgess, K. Gott.	23/6/94	*Deep Well, Northern Territory.	NT
P/9515	Ptilotus	nobilis	Peter Abell	2/07/95	*PGA 803	NT
P/9524	Ptilotus	nobilis	Peter Abell	7/07/95	*PGA ex Gas Well site	NT
P/9317	Ptilotus	obovatus	Royston Petrie Seeds	30/11/93	Kenthurst	NSW
P/9401	Ptilotus	obovatus	Kimseed	3/01/94	Aust. Revegetation Corp. Ltd.	WA
P/9417	Ptilotus	obovatus	Nindethana Seeds	3/03/94	RMB 939, Woogenilup	WA
P/9423	Ptilotus	obovatus	Vaughans Wildflr. Seeds	3/03/94	Gingin	WA
P/9433	Ptilotus	obovatus	D. Oriell Seed Exporters	22/3/94	Mt. Yorkine, Perth.	WA
P/9453	Ptilotus	obovatus	Kings Park & Botanic Gdn.	14/4/94	*1888, 186/91	WA
P/9502	Ptilotus	obovatus	John McCarthey (JMc)	Jan-95	*	SA
P/9520	Ptilotus	obovatus	Peter Abell	5/07/95	*PGA 813	NT
P/9528	Ptilotus	obovatus	John McCarthey (JMc)	3/09/95	*JMc 95/3, 50km S of Tennant Creek	NT
P/9303	Ptilotus	obovatus var. obovatus	Z. Ashby (1)	21/11/93	*126 k S Bourke on Mitchell Hwy	NSW
P/9418	Ptilotus	polakii	Nindethana Seeds	3/03/94	RMB 939, Woogenilup	WA
P/9439	Ptilotus	polakii	Kings Park & Botanic Gdn.	14/4/94	*1890, 83/89	WA
P/9304	Ptilotus	polystachyus	Z. Ashby (2i)	21/11/93	*60 k S Bourke on Mitchell Hwy	NSW
P/9309	Ptilotus	polystachyus	Z. Ashby (3ii)	21/11/93	*16 k S Charleville	QLD
P/9419	Ptilotus	polystachyus	Nindethana Seeds	3/03/94	RMB 939, Woogenilup	WA
P/9424	Ptilotus	polystachyus	Vaughans Wildflr. Seeds	3/03/94	Gingin	WA
P/9505	Ptilotus	polystachyus (purple)	Peter Abell	30/06/95	*PGA 780	NT
P/9509	Ptilotus	polystachyus (purple)	Peter Abell	1/07/95	*PGA 795	NT
P/9434	Ptilotus	rotundifolia	D. Oriell Seed Exporters	22/3/94	Mt. Yorkine, Perth.	WA
P/9318	Ptilotus	rotundifolius	Royston Petrie Seeds	30/11/93	Kenthurst	NSW
ACC #	GENUS	SPECIES	SUPPLIER	DATE	LOCALITY	STATE
P/9402	Ptilotus	rotundifolius	Kimseed	3/01/94	Aust. Revegetation Corp. Ltd.	WA
P/9420	Ptilotus	rotundifolius	Nindethana Seeds	3/03/94	RMB 939, Woogenilup	WA
P/9427	Ptilotus	rotundifolius	Vaughans Wildflr. Seeds	3/03/94	Gingin	WA
P/9466	Ptilotus	schwartzii	Prof. Burgess, K. Gott.	28/06/94	Western ridge top above Little Palm Ck. FGNP	NT
P/9518	Ptilotus	schwartzii	Peter Abell	4/07/95	*PGA 811	NT

*Indicates collections of documented wild origin

Appendix Table 1: Ptilotus Accessions in Species Order

P/9506	Ptilotus	sessilifolius (syn: atriplicifolius)	Peter Abell	30/06/95	*PGA 781	NT
P/9522	Ptilotus	sessilifolius (syn: atriplicifolius)	Peter Abell	6/07/95	*PGA 819	NT
P/9527	Ptilotus	sessilifolius (syn: atriplicifolius)	John McCarthey (JMc)	2/09/95	*JMc 95/2, Stuart Wells, 80km S of Alice Springs	NT
P/9458	Ptilotus	sp.	Mt. Annan Botanic Gdn.	22/4/94	*852354	
P/9460	Ptilotus	sp.	Mt. Annan Botanic Gdn.	22/4/94	*882132	
P/9463	Ptilotus	sp	Prof. Burgess, K. Gott.	28/06/94	*	NT
P/9464	Ptilotus	sp.	Prof. Burgess, K. Gott.	28/06/94	*	NT
P/9465	Ptilotus	sp.	Prof. Burgess, K. Gott.	28/06/94	*Western ridge top above Little Palm Ck. FGNP	NT
P/9459	Ptilotus	spathulatus	Mt. Annan Botanic Gdn.	22/04/94	*913126	

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