

PROGRESS REPORT
Australian Flora Foundation Inc.

Project Name: **Identification of *Ptilotus* species (Mulla Mulla) suitable for domestication and breeding for the cut and dried flower trade**
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This project commenced in November, 1993 with the accessioning of seed and plant material from a range of habitats. This first progress report itemises the material so far studied and discusses progress under the following headings: Accessions, Propagation, Cultivation, Floristry and Horticultural merit. Our plans for the next twelve months are also discussed.

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

ACCESSIONS

Listed in Table 1 are 86 collections of 28 species we have accessioned to date. Thirty seven of the accessions can be considered as collections from the wild with known provenance details.

The collections have come from University of Sydney staff, Royal Botanic Gardens, Mt. Annan, Kings Park and Botanic Gardens Perth, private collections, and the following commercial sources: Royston Petrie Seeds NSW, Kimberly Seeds, D. Orriell Seed Corporation, Vaughans Wildflower Seeds and Nindethana Seed Service, all of Western Australia. The collections have been made in all states except Victoria and Tasmania).

PROPAGATION

Seed

Seed is usually harvested and supplied as flowers with the seed enclosed. Checks of seed set through hand extraction found significant fluctuations between collections and sources of seed. The range in one species, *P. obovatus*, was 5% - 100%. Pollination vectors would be considered as having a major effect on seed set as would environmental factors. An added complexity is viability of 'set' seed. This showed notable variation, but not to the same degree as did seed set. There is little doubt that germination of extracted seed was more reliable than that achieved from sowing the flower/seed bulk, indicating either a physical or chemical barrier in the flower.

Generally, seed germination took place in a conventional manner using nursery flats with washed river sand and peat moss (2:1). Initial germination was found to be quick (2-3 wks.) with some species (e.g. *P. obovatus*, *P. exaltatus*), continuing 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 controlled the problem.

TABLE 1. *PTILOTUS* ACCESSIONS IN SPECIES ORDER.

ACCESSION NO.	GENUS	SPECIES	SUPPLIER	DATE	LOCALITY	STATE
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/9438	Ptilotus	aeroides	Kings Park & Botanic Gdn.	14/4/94	* 5136/93	WA
P/9408	Ptilotus	aeroides	Nindethana Seeds	3/3/94	RMB 939, Woogenilup	WA
P/9437	Ptilotus	arthrolasius	Kings Park & Botanic Gdn.	14/4/94	* 310/86	WA
P/9451	Ptilotus	astrolasius	Kings Park & Botanic Gdn.	14/4/94	* 91/89	WA
P/9409	Ptilotus	astrolasius	Nindethana Seeds	3/3/94	RMB 939, Woogenilup	WA
P/9461	Ptilotus	atriplicifolius	Prof Burgess, K. Gott.	28/6/94	* Deep Well, Northern Territory	NT
P/9410	Ptilotus	auriculifolius	Nindethana Seeds	3/3/94	RMB 939, Woogenilup	WA
P/9428	Ptilotus	auriculifolius	Vaughans Wildflr. Seeds	3/3/94	Gingin	WA
P/9314	Ptilotus	auriculifolius	Royston Petrie Seeds	30/11/93	Kenthurst	NSW
P/9404	Ptilotus	auriculiformis	Kimseed	1/3/94	Aust. Revegetation Corp. Lid.	WA
P/9446	Ptilotus	axillaris	Kings Park & Botanic Gdn.	14/4/94	* 1857, 554/93	WA
P/9311	Ptilotus'	axillaris	Royston Petrie Seeds	30/11/93	Kenthurst	NSW
P/9425	Ptilotus	axillaris	Vaughans Wildflr. Seeds	3/3/94	Gingin	WA
P/9441	Ptilotus	caespitosus	Kings Park & Botanic Gdn.	14/4/94	*1860, 439/91	WA
P/9447	Ptilotus	calostachys var. calost.	Kings Park & Botanic Gdn.	14/4/94	*5102/92	WA
P/9407	Ptilotus	calostachyus	Kimseed	1/3/94	Aust. Revegetation Corp. Ltd.	WA
P/9440	Ptilotus	calostachyus	Kings Park & Botanic Gdn.	14/4/94	*1861, 89/89	WA
P/9411	Ptilotus	calostachyus	Nindethana Seeds	3/3/94	RMB 939, Woogenilup	WA
P/9316	Ptilotus	calostachyus	Royston Petrie. Seeds	30/11/93	Kenthurst	NSW
P/9429	Ptilotus	calostachyus	Vaughans Wildflr. Seeds	3/3/94	Gingin	WA
P/9412	Ptilotus	carinatus	Nindethana Seeds	3/3/94	RMB 939, Woogenilup	WA
P/9449	Ptilotus	chamaecladus	Kings Park & Botanic Gdn.	14/4/94	* 1864, 5491/93	WA
P/9442	Ptilotus	clementii	Kings Park & Botanic Gdn.	14/4/94	* 18651 15/93	WA
P/9413	Ptilotus	clementii	Nindethana Seeds	3/3/94	RM13 939, Woogenilup	WA
P/9315	Ptilotus	clementii	Royston Petrie Seeds	30/11/93	Kenthurst	NSW
P/9426	Ptilotus	clementii	Vaughans Wildflr. Seeds	3/3/94	Gingin	WA
P/9450	Ptilotus	conicus	Kings Park & Botanic Gdn.	14/4/94	* 1865A, 158/89	WA
P/9454	Ptilotus	erubescens?	Mt. Annan Botanic Gdn.	22/4/94	* 890257	NSW

*Indicates collections of documented wild origin.

TABLE 1 (ctd). *Ptilotus* accessions in species order

P/9432	<i>Ptilotus</i>	exaltatus	D. Oriell Seed Exporters	22/3/94	Mt. Yorkine, Perth.	WA
P/9406	<i>Ptilotus</i>	exaltatus	Kimseed	1/3/94	Aust. Revegetation Corp. Ltd.	WA
P/9444	<i>Ptilotus</i>	exaltatus	Kings Park & Botanic Gdn.	14/4/94	* 1871, 51581/92	WA
P/9414	<i>Ptilotus</i>	exaltatus	Nindethana Seeds	3/3/94	RMB 939, Woogenilup	WA
P/9313	<i>Ptilotus</i>	exaltatus	Royston Petrie Seeds	30/11/93	Kenthurst	NSW
P/9422	<i>Ptilotus</i>	exaltatus	Vaughans Wildflr. Seeds	3/3/94	Gingin	WA
P/9457	<i>Ptilotus</i>	exaltatus var. semilanatus	Mt. Annan Botanic Gdn	22/4/94	* 890255	NSW
P/9445	<i>Ptilotus</i>	fusiformis	Kings Park & Botanic Gdn	14/4/94	* 1873, 80/89	WA
P/9435	<i>Ptilotus</i>	gaudichaudii	Kings Park & Botanic Gdn.	14/4/94	* 1874, 5735/92	WA
P/9455	<i>Ptilotus</i>	gaudichaudii var. gaud.	Mt. Annan Botanic Gdn.	22/4/94	* 893031	NSW
P/9405	<i>Ptilotus</i>	gomphrenoides	Kimseed	1/3/94	Aust. Revegetation Corp. Ltd.	WA
P/9421	<i>Ptilotus</i>	gomphrenoides	Nindethana, Seeds	3/3/94	RMB 939, Woogenilup'	WA
P/9430	<i>Ptilotus</i>	gomphrenoides	Vaughans Wildflr. Seeds	3/3/94	Gingin	WA
P/9403	<i>Ptilotus</i>	helipteroides	Kimseed	1/3/94	Aust. Revegetation Corp. Ltd.	WA
P/9312	<i>Ptilotus</i>	helipteroides	Royston Petrie Seeds	30/11/93	Kenthurst	NSW
P/9431	<i>Ptilotus</i>	helipteroides	Vaughans Wildflr. Seeds	3/3/94	Gingin	WA
P/9452	<i>Ptilotus</i>	lanatus	Kings Park & Botanic Gdn.	14/4/94	* 1882, 5623/92	WA
P/9436	<i>Ptilotus</i>	latifolius	Kings Park & Botanic Gdn.	14/4/94	* 1883, 90/89	WA
P/9456	<i>Ptilotus</i>	leucocoma	Mt. Annan Botanic Gdn.	22/4/94	* 893037	NSW
P/9310	<i>Ptilotus</i>	leucocoma?	Z. Ashby (3 iv)	21/11/93	* 16 k S Charleville	QLD
P/9302	<i>Ptilotus</i>	macrocephalus	D. Kull/C. Wellings	3/11/93	* 3 k E Urana	NSW
P/9301	<i>Ptilotus</i>	macrocephalus	J.Roake		*	NSW
P/9443	<i>Ptilotus</i>	macrocephalus	Kings Park & Botanic Gdn.	14/4/94	* 1886	WA
P/9415	<i>Ptilotus</i>	macrocephalus	Nindethana Seeds	3/3/94	RMB 939, Woogenilup	WA
P/9319	<i>Ptilotus</i>	macrocephalus	Z. Ashby	3/12/93	* 7k W of Oaky on Warrego Hwy.	QLD
P/9448	<i>Ptilotus</i>	murrayi	Kings Park & Botanic Gdn.	14/4/94	* 1887, 344/92	WA
P/9416	<i>Ptilotus</i>	nobilis	Nindethana Seeds	3/3/94	RMB 939, Woogenilup	WA
P/9308	<i>Ptilotus</i>	nobilis	Z. Ashby (3i)	21/11/93	* 15 k N Bourke past Gidgee Bore Camp	NSW
P/9433	<i>Ptilotus</i>	obovatus	D. Oriell Seed Exporters	22/3/94	Mt. Yorkine, Perth	WA
P/9401	<i>Ptilotus</i>	obovatus	Kimseed	1/3/94	Aust. Revegetation Corp. Ltd.	WA
P/9453	<i>Ptilotus</i>	obovatus	Kings Park & Botanic Gdn.	14/4/94	* 1888, 186/91	WA
P/9417	<i>Ptilotus</i>	obovatus	Nindethana Seeds	3/3/94	RMB 939, Woogenilup	WA

*Indicates collections of documented wild origin.

TABLE 1 (ctd). *Ptilotus* accessions in species order

P/9317	<i>Ptilotus</i>	obovatus	Royston Petrie Seeds	30/11/93	Kenthurst	NSW
P/9423	<i>Ptilotus</i> ,	obovatus	Vaughans Wildflr. Seeds	3/3/94	Gingin	WA
P/9303	<i>Ptilotus</i>	obovatus var. obovatus	Z. Ashby (1)	21/11/93	* 126 k S Bourke on Mitchell Hwy	NSW
P/9439	<i>Ptilotus</i>	polakii	Mugs Park & Botanic Gdn.	14/4/94	* 1890, 83/89	WA
P/9418	<i>Ptilotus</i>	polakii	Nindethana Seeds	3/3/94	RMB 939, Woogenilup	WA
P/9419	<i>Ptilotus</i>	polystachyus	Nindethana Seeds	3/3/94	RMB 939, Woogenilup	WA
P/9424	<i>Ptilotus</i>	polystachyus	Vaughans Wildflr. Seeds	3/3/94	Gingin	WA
P/9304	<i>Ptilotus</i>	polystachyus	Z. Ashby (2i)	21/11/93	* 60 k S Bourke on Mitchell Hwy	NSW
P/9309	<i>Ptilotus</i>	polystachyus	Z. Ashby (3ii)	21/11/93	* 16 k S Charleville	QLD
P/9434	<i>Ptilotus</i>	rotundifolia	D. Oriell Seed Exporters	22/3/94	Mt. Yorkine, Perth.	WA
P/9402	<i>Ptilotus</i>	rotundifolius	Kimseed	1/3/94	Aust. Revegetation Corp. Lid.	WA
P/9420	<i>Ptilotus</i>	rotundifolius	Nindethana Seeds	3/3/94	RMB 939, Woogenilup	WA
P/9318	<i>Ptilotus</i>	rotundifolius	Royston Petrie Seeds	30/11/93	Kenthurst	NSW
P/9427	<i>Ptilotus</i>	rotundifolius	Vaughans Wildflr. Seeds	3/3/94	Gingin	WA
P/9458	<i>Ptilotus</i>	sp.	Mt. Annan Botanic Gdn.	22/4/94	* 852354	
P/9460	<i>Ptilotus</i>	sp	Mt. Annan Botanic Gdn.	22/4/94	* 882132	
P/9462	<i>Ptilotus</i>	sp.	Prof. Burgess, K. Gott.	28/6/94		NT
P/9463	<i>Ptilotus</i>	sp.	Prof. Burgess, K. Gott.	28/6/94		NT
P/9464	<i>Ptilotus</i>	sp.	Prof. Burgess, K. Gott.	28/6/04		NT
P/9459	<i>Ptilotus</i>	spathulatus	Mt. Annan Botanic Gdn.	22/4/94	* 913126	

*,Indicates collections of documented wild origin.

Pricking out the seedlings into plugs early (before the first true leaves) and a reduction in watering to an absolute minimum have proved effective.

Seed samples were sent to the research department of Kings Park in Perth for trials on 'smoke' treatment but results have not yet been released to us.

In vitro germination of seed has not yet been used. Protocols exist (Williams et.al.) and when deemed necessary will be used.

Cuttings

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

Our system consists of a 'tent' within an environmental control room. The room is set at 25°C, providing what is considered to be an appropriate temperature. The 'tent' has a supply of 'fog' to provide a controlled level of humidity (90 - 95%). The fog is provided by a 'Uni Fogger' that allows for regulation of the output to control the humidity level.

Soft, herbaceous tip and stem cuttings work well with most species tried. *P. polystachys* and *P. obovatus* will strike at a rate of better than 90%. Older woody material is usually more difficult to strike. Early removal of cuttings from the propagation system after rooting is advised as prolonged exposure to higher levels of moisture often allows fungal attack. With the exception of *P. polystachys*, the use of flower scapes as stem cuttings is being avoided due to their reluctance to produce roots and lateral shoots.

In vitro micropropagation has not yet been tried but if any difficulty is encountered using cutting propagation methods these techniques will be adopted.

Transplants

Regeneration of plants and rootstocks through transplants has proven to be a very successful method of propagating *Ptilotus spp.* The provision of humidity reduces transplant shocks to the point where in many cases, very little delay in plant establishment occurs.

CULTIVATION

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

Containers

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

Field

Field beds have been prepared to provide information on the performance of *Ptilotus spp.* in a 'garden' or 'crop' situation. The beds consist of our local alluvial soil formed into beds, 1 metre wide and raised 125mm above, the normal ground level. These beds are mulched to a depth of approximately 30mm with 'Vita Mulch' to help retain water and retard weed growth. Watering is carried out by a network of drippers that at present operate manually. This method appears to be very effective. Plants of several species have shown to be quick to establish and at this preliminary stage are quite tough in the field. Even considering the current drought, the field plantings require very little supplementary water. The best performers at this stage are *P. obovatus*, *P. exaltatus*, and *P. polystachys*.

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 with environment and species up to half a metre.

Colour

Flower colour in *Ptilotus* is rarely considered intense, being mostly pastel shades of pink, mauve, green, pale yellow and white. They are however most striking due to the numbers of flowers produced, 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 are very encouraging. Seven species have thus far been cut and placed into distilled water, see Table 2. All lasted at least 14 days, with *P. polystachys* 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. 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 - 15mm diameter, in colours from white through pink to mauve. Some forms present the flowers on scapes of up to 300mm long which could be considered adequate.

TABLE 2. PTILOTUS. FLORISTRY

ACC. NO.	SPECIES	FLOWER COLOUR	VASE LIFE	STEM LENGTH (mm)
P/9313.	exaltatus	Mauve	12 - 3 weeks	200 - 300
P/9317	obovatus	Pink / Mauve	2 weeks	150 - 300
P/9311	axillaris	Pale Pink	2 - 3 weeks	100 Drooping
P/9309	polystachyus	Green	7 weeks	300 - 400
P/9310	leucocoma?	Pink / Mauve.	2 - 3 weeks	100 - 150
P/9316	calostachyus	Pink	2 - 3 weeks	100 - 200
P/9315	clementii	Green / White	2 weeks	100 - 200

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 is from bright green to silver/grey and 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 commenced. Observations and measurements will be taken of the following traits:

1. Container and in ground performance
2. Susceptibility to pests and disease
3. Flower presentation, production and timing
4. Plant form and end use
5. Ease of propagation.

Emphasis will be placed on 'zero maintenance': of the establishment and maintenance of plants with minimal water and care. There are also opportunities to develop selections for the mass container markets both in Australia and overseas. These would be multiple stemmed or compact free flowering types or possibly hanging basket plants such as *P. axillaris*.

FUTURE

During 1993/94 this project has concentrated on setting up a comprehensive gene pool as a foundation from which to work on *Ptilotus spp.* in detail. 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*.

The deliberate crossing of selections to produce a specific plant/flower form is now of high priority. To achieve this it is appropriate to develop *in vitro* propagation techniques for:

1. For quick high volume propagation for trials etc. and
2. To ensure germination of hybrid seed.

The development of hybrids is particularly important as it provides the opportunity to 'design' a plant around 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.

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 would continue and so improve our understanding of industry requirements and provide awareness of our work with *Ptilotus*. To this end it is envisaged that a seminar could be run at the end of year 2 at which our findings could be disseminated.

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