MULGA RESEARCH CENTRE

Occasional Report no.3

Acacia Species of the Hamersley Ranges, Pilbara Region of Western Australia

J.E.D. Fox and J.N. Dunlop

November 18th 1983

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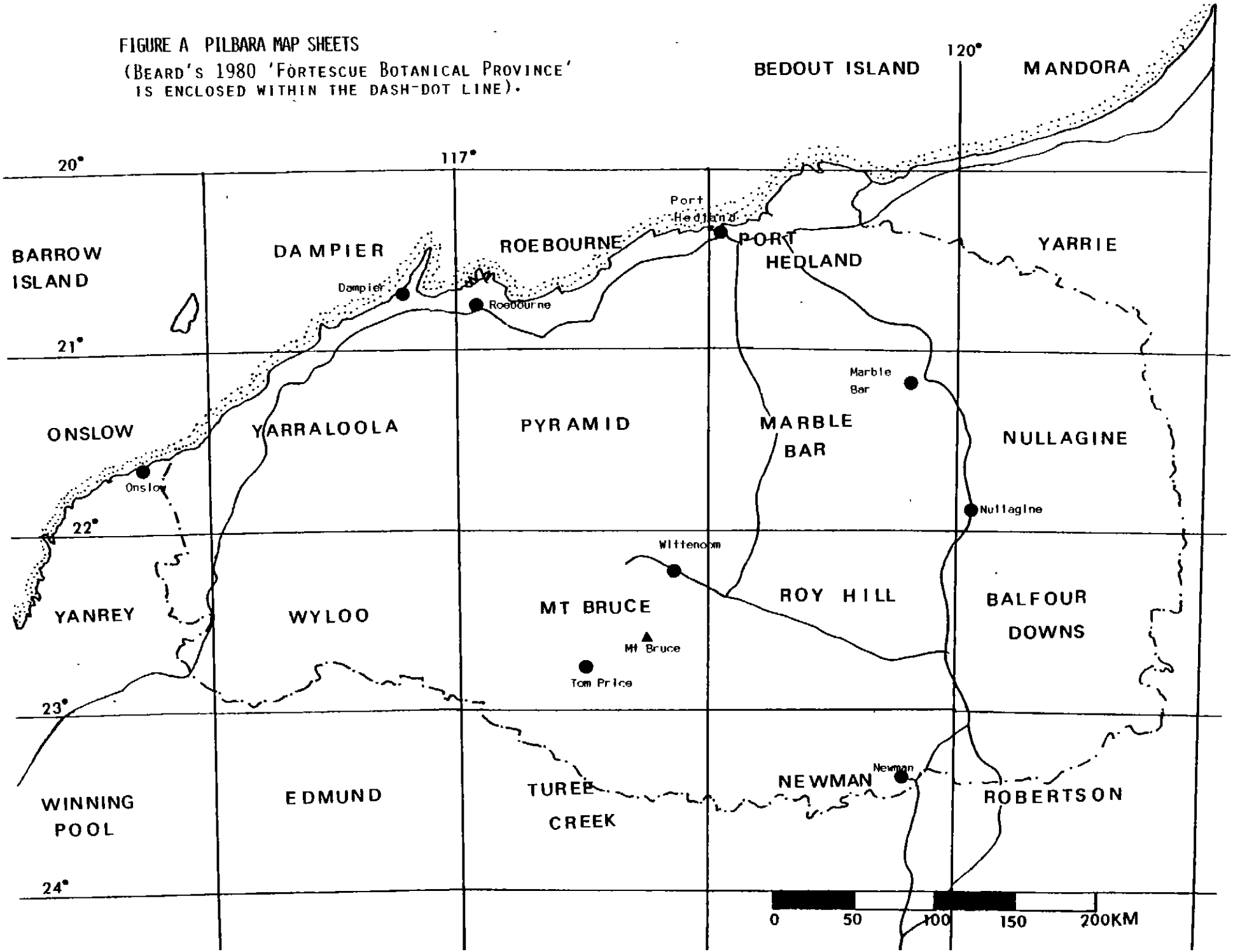
INTRODUCTION

The genus Acacia has some 835 Australian species and constitutes the largest plant genus in Australia. Of these some 717 have been described (Maslin and Hopper 1982). A description of 46 species found in the Hamersley Ranges, together with a key to identification, is given in Maslin (1982).

The present account summarises available information on some 60 species with occurrences in the Pilbara area (Maslin and Pedley 1982). The map sheets used refer to the 1:250,000 coverage (1°30'E x 1°S) west of 121°30'E and north of 24°S. The sheets defining the Pilbara area for inclusion are shown in Figure A and mainly comprise the area referred to as the Fortescue Botanical Province by Beard (1980). It excludes the sheets Quobba to Buller in the south, included in the Pilbara account of Beard (1975). Particular attention is given to fire response, germination behaviour and general ecology.

FIGURE A PILBARA MAP SHEETS
(BEARD'S 1980 'FORTESCUE BOTANICAL PROVINCE' IS ENCLOSED WITHIN THE DASH-DOT LINE).



DATA COLLECTION

Observations on fire response and general ecology are based on observations made during a number of field trips to the central part of the Pilbara 1976-1983. Documented fire histories for the West Angelas area were provided by Cliffs International Inc.

Germination test reports are based, in the main, on seed provided by K.J. Walker, Mt Newman Mining Co. Each trial involved 4 batches of 50 seed. In most cases seeds were given a heat pre-treatment. Boiling water was poured on the seeds contained in a test tube and this was allowed to cool to room temperature. Seeds of Acacia farnesiana and Acacia sclerosperma are thick-walled. These were subjected to treatment with a dentist's drill to expose cotyledons. Seed of these species were then shaken in a 3 per cent 'Milton' solution for two minutes to provide surface sterilization. The seeds were then placed on filter paper covering moistened vermiculite in petri dishes. These dishes were then introduced to dark growth cabinets set at 10, 15, 20 and 25 degrees celsius, one dish to each cabinet. Seeds were inspected daily and watered with deionized water as required. Any seed which had germinated (germination defined as 2 mm radicle protrusion) were counted and removed.

Characteristics presented in the germination tables are as follows:

1. Final germination percentage
2. Days required to reach the final germination percentage
3. Germination rate (after Hartmann and Kester 1975). This is calculated as follows:

$$\text{germination rate (mean days)} = \frac{(n_1 \times t_1) + (n_2 \times t_2) + \ldots + (n_x \times t_x)}{\sum_1^x n}$$

where: $n1$ = number of germinants at first day of observed germination

t_1 = time (days) from initiation to first germination

$n2$ = number of germinants at second day of observed germination

$t2$ = time (days) from initiation to second day of germination

x = number of days to final germination observed, i.e. on completion of trial

$\sum_1^x n$ = total number of seed germinated over the time of the trial.

4. Peak value. This is a measure of the steepest point in the germination gradient as determined by the maximum value for the following expression:

$$\frac{\text{cumulative germination percentage}}{\text{number of days from start}}$$

Peak value and mean daily germination are used to derive the germination value of Czabator (1982).

5. Mean daily germination (M.D.G.). This is taken as the final germination percentage divided by the number of days required to reach that percentage.

6. Germination value (G.V.). This is a combination of germination rate and peak value as determined by:

$$PV \times MDG = GV$$

7. Energy % 7/28. This is a measure of the strength of the seed (Edmiston and Ryan 1977). It is here calculated as the percentage germination after seven days divided by the germination percentage at twenty-eight days times 100. The actual number of days used to calculate 'energy' may be varied between tests (Loneragan 1978).

8. Germinative capacity. This is the germination percentage corresponding to the period of time used to calculate 'energy', in the present report 28 days.

9. Vigour. This is a value derived from the last two values and may be considered as an objective measure of the strength of the seed, at least for seed of high viability. It is calculated as:

$$\frac{\text{Energy}}{\text{G. Capacity}}$$

For each graph symbols are given to denote the temperature treatment given. The symbols used are:

■ 10°C

● 15°C

□ 20°C

○ 25°C

Species descriptions are given in alphabetical order.

Acacia acradenia F. Muell.

This species is described by Pedley (1978) as a spindly, little-branched shrub reaching 4 m tall with dull green foliage. Phyllodes are thick, elliptic to obovate and 4.5–11 cm long, 1–3 cm across. The pod is linear, straight to 9 cm long, and terete in section. In Queensland the foliage may be confused with Acacia umbellata A. Cunn. ex Benth. It occurs in rocky spinifex country often along creeks (Maslin 1981), e.g. minor creek beds in Abydos Plain (Beard 1975), and also in gorges.

Distribution of this species is through the arid zone, northern and eastern subtropical zones of Maslin and Hopper (1982). Its closest relative is Acacia curvicarpa W.V. Fitzg. Acacia acradenia has been recorded from the following Pilbara sheets: Roebourne, Port Hedland, Pyramid, Marble Bar, Nullagine, Mt Bruce (Maslin and Pedley 1982).

Collections: 5066, 5136

Acacia adoxa Pedley

This is a low (to 60 cm) spreading shrub with whitish hair on phyllodes and branches. Phyllodes are whorled, 6–10 per whorl, 2–5 x less than 1 mm in size. Pods 6 cm x 6–8 mm. This species occurs on rocky soil (Maslin 1981). It has been recorded from the following sheets Mandora, Port Hedland, Yarrie, Pyramid, Mt Bruce, Roy Hill, Edmund and Newman (Maslin and Pedley 1982).

Acacia adoxa may be confused with Acacia chippendalei Pedley in Queensland (Pedley 1978) which is also its closest relative (Maslin and Hopper 1982). Both species are found in the arid zone and northern sub-tropical zones of the latter authors.

Collections: 4563, 5101

Acacia adsurgens Maiden et Blakely

This species is an erect, multi-stemmed shrub to 4 m tall. It has coriaceous linear phyllodes 6-18 cm long and 2-4 mm wide, pale bluish. Pods are linear about 9 cm long, papery and raised over the seeds. It commonly occurs on sand plain with spinifex (Pedley 1978, Maslin 1981).

It is mainly confined to Central Australia and its closest relative is Acacia rhodophloia (Maslin and Hopper 1982). In the Pilbara it has only been recorded from the Mt Bruce, Roy Hill and Newman sheets (Maslin and Pedley 1982).

Acacia ampliceps Maslin

A bushy shrub or tree to 7 m tall with yellowish branchlets. Phyllodes linear to narrowly elliptical 7-25 cm long and 7-30 mm broad, flaccid and light green with yellowish midrib and marginal nerves. Pods hard, brittle, constricted betweeen seeds 7-10 cm x

5 mm. Seeds have scarlet arils. This species is typically found along watercourses where it often forms dense stands (Maslin 1981) as along the Marillana River in association with Eucalyptus camaldulensis and Melaleuca leucadendron (Coll. 5210). The closest relative of A. ampliceps is Acacia ligulata A. Cunn. ex Benth. a widely distributied Australian species (Maslin and Hopper 1982). A. ampliceps overlaps with it in the north-west and A. ampliceps has been recorded there from all sheets except for Wyloo, Yarrie, Minyla, Winning Pool, Newman and Robertson (Maslin and Pedley 1982).

Collection: 5210

Acacia anaticeps Tindale

This is another species to the north-east, present on Mandora and Yarrie sheets only, and then to the north and east.

Acacia ancistrocarpa Maiden et Blakely

This shrub has bright olive-green foliage and may grow to 4m in height. Phyllodes are slightly curved 9-18 cm long and 2-9 mm wide with one prominent, and up to 2 other, yellowsih longitudinal nerves. Pods are woody, slightly sticky, flat and raised over the seeds, about 7.5 cm long (Pedley 1978). It often occurs in or near creeks.

It is a species of the arid and northern subtropical zones, whose closest relative is **Acacia proxima** Maiden (Maslin and Hopper 1982). It is recorded right across the Pilbara from all map sheets except Nullagine and Balfour Downs (Maslin and Pedley 1982). It is common in central Australia where is is found in red sand or on stony spinifex plains.

Collections: 4574, 5034

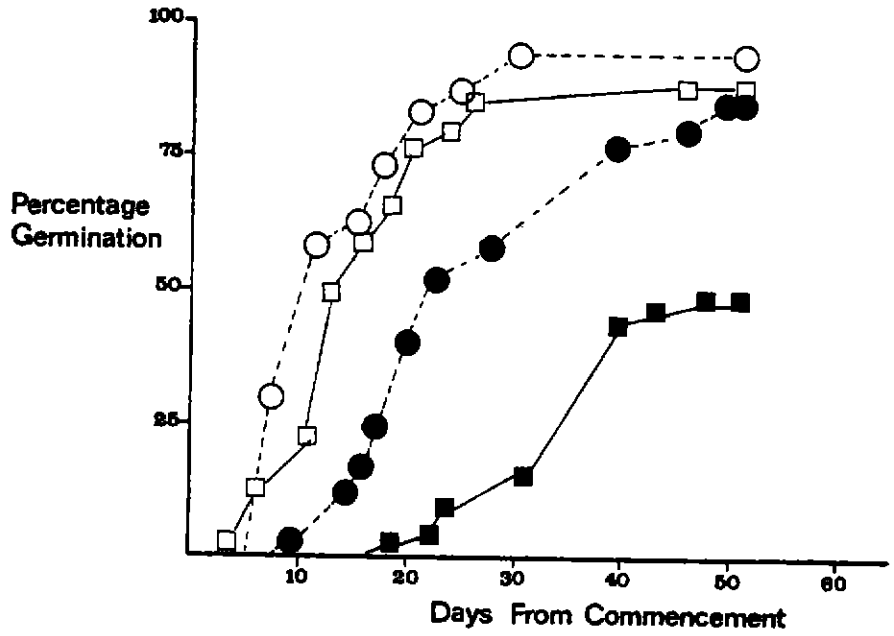
Maslin (1983) reports a hybrid **Acacia ancistrocarpa** x **A. trachycarpa** from three localities in the Pilbara. It has grey bark which exfoliates not unlike **A. trachycarpa**. It appears restricted to rocky watercourses.

Germination of **A. ancistrocarpa** showed marked temperature effects. Viability was highest at 25°C, with 92 per cent in 30 days (Figure 1). Germination characteristics varied directly with temperature. Germination rate, M.D.G. and germinative capacities were highest at 25°C and became progressively lower with decreases in temperature (Table 1).

Table 1. Germination Measurements for **Acacia ancistrocarpa**

Germination Measurement	Temperature °C 10	15	20	25
1. Final %	48	80	88	92
2. Days to 1	47	47	45	30
3. Germination rate	39	23.1	14.7	12.2
4. Peak value	1.1	2.5	4.1	5.4
5. M.D.G.	1	1.7	1.9	3.1
6. G.V.	1.1	4.2	7.8	16.7
7. Energy % 7/28	–	–	17.6	31.1
8. Germinative capacity %	10	62	85	90
9. Vigour	–	–	0.2	0.3

Figure 1. Time course of germination for Acacia ancistrocarpa



Initial germination was retarded at lower temperatures with the first seeds at 10°C germinating after 17 days. Continued germination at 10°C was prolonged and viability was comparatively low (48 percent). The best temperature for germination was 25°C. Germination did not quite reach 100 per cent, the four remaining seeds may have been damaged by insects or bacteria.

The same seed was tested at Newman, 5 percent germinated with no hot water treatment, and 99 percent germinated after hot water treatment, with 92 percent after 12 days. The ambient temperature for these tests was 20-25°C (K.J. Walker, personal communication).

Acacia aneura F. Muell. ex Benth. Mulga

The mulga tree has a variety of forms in the Pilbara. These include the fairly common terete phyllode form, but also narrow, broad and intermediates. Rather less common is the terete weeping form, and rare, the terete 'Christmas Tree' form.

Mulga grows in many habitats. In those areas where it is co-dominant with, or adjoins, a hummock grassland stratum it is vulnerable to fire. Scorched trees may regrow new phyllodes but trees with the bole burnt die off. Several cases of root sprouts from dead trees have been observed in the Pilbara. The usual regeneration however is from seed (Fox 1980).

Hodgkinson (1979) suggests that Acacia aneura will resprout when the stem is cut at ground level - some 80 percent of shrubs more than 1 m tall survived cutting. However the resprouting ability is comparatively poor after fire and may only appear from buds on the stem below ground level (Hodgkinson and Griffin 1982). It has been observed that mulga generally exists in stands of more or less even size and presumed age (see Lange 1966) and probably only regenerates from seed in any quantity at irregular intervals (Maconochie 1982). Regeneration from seed after fire is noted by Hodgkinson and Griffin (1982), Fox (1980).

Some evidence presented by Hodgkinson and Griffin (1982) suggest that at Coolabah, New South Wales, mulga shows a higher survival from spring fire as opposed to summer fire.

In the Pilbara it is well distributed in southern areas but has not been formally recorded north of the Roy Hill and Balfour Downs sheets or west of Yarraloola and Wyloo sheets (Maslin and Pedley 1982). It has been recorded as a tree to 15 m tall in low lying basin sites on comparatively heavy, fine-textured soils. Tall specimens also occur on some south facing sheltered gorge sites. In hummock grasslands individuals may have shrub or tree form.

The closest relative of mulga is Acacia ayersiana Maconochie (Maslin and Hopper 1982).

Germination

Two batches of seed were tested. These were from 2 distinct variants (see Fox 1981 for other tests on southern material).

a) Narrow phyllode variant

Three germination trials were undertaken (Tables 2-4).

The results of one trial (Table 4) are unreliable as the 10°C test was aborted and drying out was evident at the other three temperatures. The other two trials produced similar results except at 10°C where viability was very low (26 percent, Table 3) in one test and high (74 percent, Table 2) in the other. Highest viability in both tests was at 20°C although there was little difference between all temperatures except at 10°C in the 2nd trial (Figure 3). There was some evidence of drying out at 25°C in the second test also which may have affected viability

slightly.

Rate of germination was related to temperature with the seeds at the highest temperatures germinating fastest (Table 2). Initial germination occurred first at the higher temperatures with the 10°C treatment delaying initial germination (Figures 2,3). M.D.G. and seed vigour was highest at the 3 higher temperatures and not significantly different between them (Tables 2,3).

Table 2. Germination Measurements for Acacia aneura (narrow) Trial 1

Germination Measurement	Temperature °C 10	15	20	25
1. Final %	74	68	80	70
2. Days to 1	39	9	9	8
3. Germination rate	14.9	6.3	3.8	3.3
4. Peak value	3.7	8.2	18.6	17.5
5. M.D.G.	1.9	7.6	8.9	8.8
6. G.V.	7.0	62.3	165.5	154
7. Energy % 7/28	-	76.5	95	94.3
8. Germinative capacity %	70	68	80	70
9. Vigour	-	1.1	1.2	1.3

Table 3. Germination Measurements for Acacia aneura (narrow) Trial 2

Germination Measurement	Temperature °C 10	15	20	25
1. Final %	26	78	82	66
2. Days to 1	36	36	27	42
3. Germination rate	22.3	6.7	9	8.4
4. Peak value	0.8	9.3	10	16
5. M.D.G.	0.7	2.2	3	1.6
6. G.V.	0.6	20.5	30	25.6
7. Energy % 7/28	-	76.3	56.1	67.7
8. Germinative capacity %	22	76	82	62
9. Vigour	-	1	0.7	1.1

Table 4. Germination Measurements for Acacia aneura (narrow) Trial 3

Germination Measurement	Temperature °C 10	15	20	25
1. Final %		88	64	88
2. Days to 1		36	26	35
3. Germination rate		11.6	9.1	13.5
4. Peak value		8.6	7.3	5.3
5. M.D.G.		2.4	2.5	2.5
6. G.V.		20.6	18.2	13.2
7. Energy % 7/28		66.7	71.9	39.0
8. Germinative capacity %		84	64	82
9. Vigour		0.8	1.1	0.5

Figure 2. Time course of germination for A. aneura (narrow) Trial 1

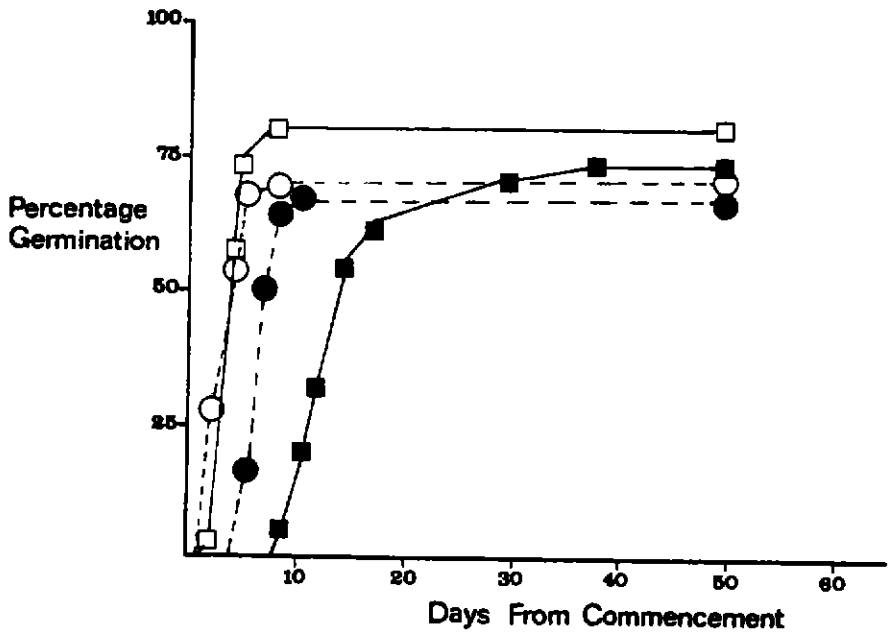


Figure 3. Time course of germination for A. aneura (narrow) Trial 2

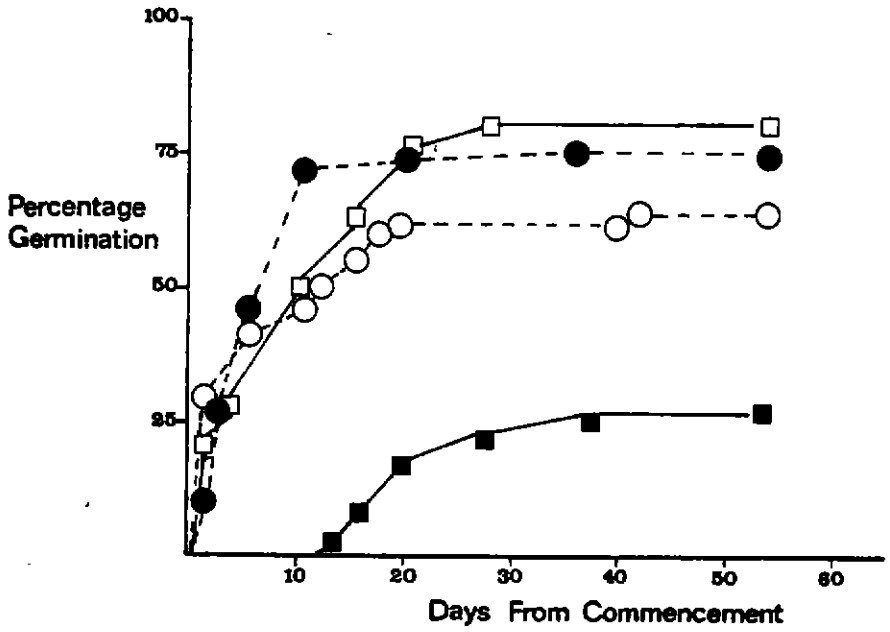
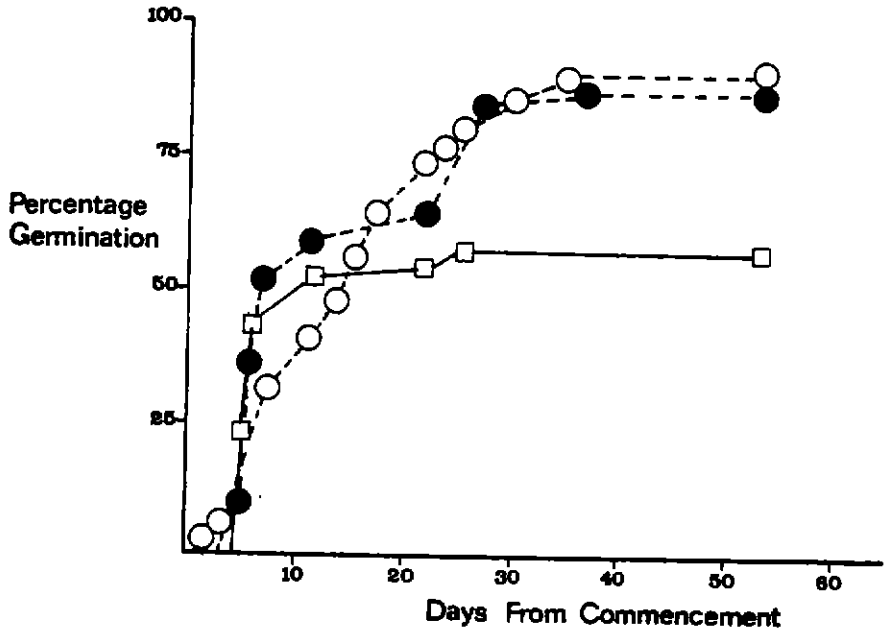


Figure 4. Time course of germination for A. aneura (narrow) Trial 3



b) Broad phyllode variant

Two germination tests were carried out on this variety.

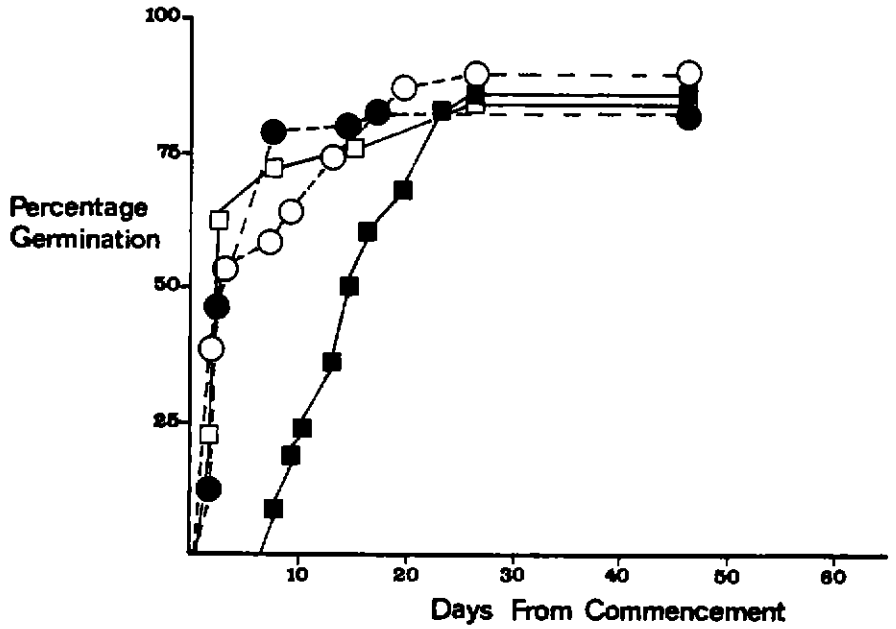
The first test consisted of a conventional trial with seeds receiving a heat pre-treatment by boiling. Seeds germinated rapidly at 15, 20 and 25 degrees, whilst germination at 10°C was slower (Table 5). Although temperature governed the rate of germination there was no significant difference in the germinative capacity at the different temperatures (Table 5).

Table 5. Germination Measurements for Acacia aneura (broad) Test 1

Germination Measurement	Temperature °C 10	15	20	25
1. Final %	86	84	86	90
2. Days to 1	27	17	27	27
3. Germination rate	15.2	5.1	5.1	7
4. Peak value	3.8	15.3	20.6	19
5. M.D.G.	3.2	4.9	3.2	3.3
6. G.V.	12.2	75	65.9	62.7
7. Energy % 7/28	-	95.2	83.7	64.4
8. Germinative capacity %	86	84	86	90
9. Vigour	-	1.1	1	0.7

The second test consisted of 4 trials each given a different heat pe-treatment.

Figure 5. Time course of germination for A. aneura (broad) Test 1



The first of these trials used seeds which were not given any heat pre-treatment (Figure 6, Table 6). This trial produced very poor results with only 16-24 percent of seeds germinating. This very poor viability when compared with that of seeds which were boiled emphasises the species' considerable degree of dormancy.

The second trial involved pre-treating the seed by boiling for 5 seconds. This treatment was most similar to that of the first test (Table 5) and the results are also close. Seeds germinated rapidly at 15, 20 and 25 degrees to a fairly high viability (Figure 7). Germination at 10°C was slower but seeds still reached a fairly high viability, not significantly different from those at the higher temperatures.

Table 6. Germination Measurements for A. aneura (broad) Test 2. No heat treatment

Germination Measurement	Temperature °C 10	15	20	25
1. Final %	16	16	24	18
2. Days to 1	10	8	10	38
3. Germination rate	7.9	3.9	2.9	6
4. Peak value	1.6	3.3	9	8
5. M.D.G.	1.6	2	2.4	0.5
6. G.V.	2.6	6.6	21.6	4
7. Energy % 7/28	37.5	87.5	91.7	100
8. Germinative capacity %	16	16	24	16
9. Vigour	2.3	5.5	3.8	6.2

Figure 6. Time course of germination for A. aneura (broad) Test 2. No heat treatment

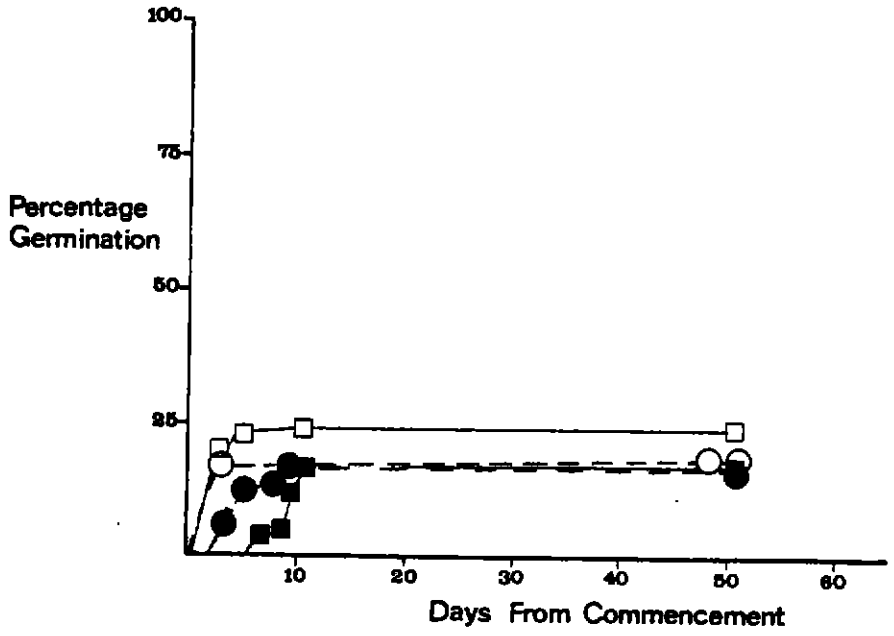
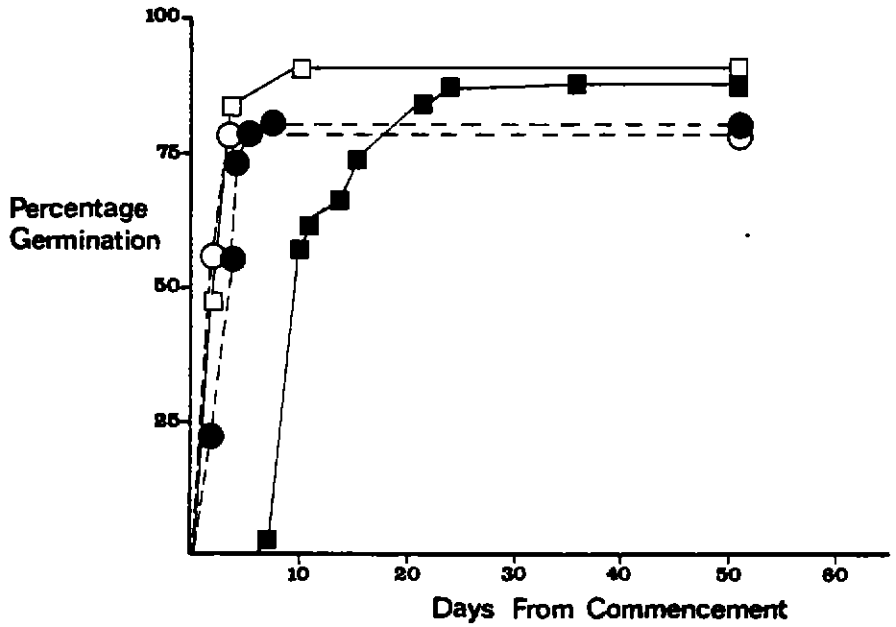


Table 7. Germination Measurements for A. aneura (broad) Test 2. Boiled for 5 seconds

Germination Measurement	Temperature °C 10	15	20	25
1. Final %	88	80	90	78
2. Days to 1	37	6	10	3
3. Germination rate	11.2	3.1	2.7	2.3
4. Peak value	6.4	18.7	27.3	26
5. M.D.G.	2.4	13.3	9	26
6. G.V.	15.4	248.7	245.7	676
7. Energy % 7/28	25.6	100	97.8	100
8. Germinative capacity %	86	80	90	78
9. Vigour	0.3	1.2	1.1	1.3

Figure 7. Time course of germination for A. aneura (broad) Test 2. Boiled for 5 seconds



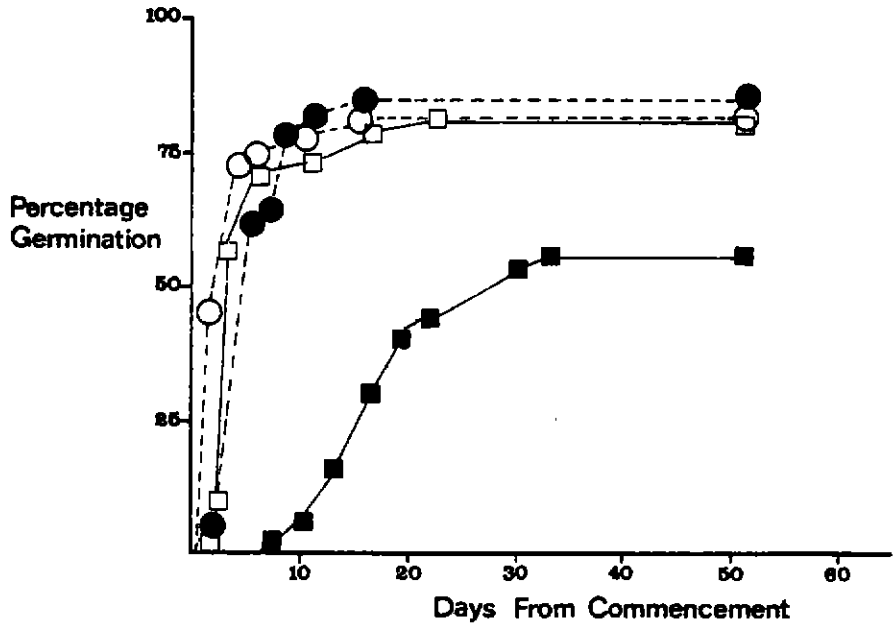
Extending the boiling period to 30 seconds in the third trial did not change the germination characteristics greatly from the 5

second trial, except at 10°C where germination was prolonged and the viability reduced to 56 percent (Table 8). Germination at the higher temperatures showed similar characteristics of germinative capacity, M.D.G. and germination rate.

Table 8. Germination Measurements for A. aneura (broad) Test 2. Boiled for 30 seconds

Germination Measurement	Temperature °C 10	15	20	25
1. Final %	56	84	80	78
2. Days to 1	31	16	23	16
3. Germination rate	18.2	5.2	6.2	3
4. Peak value	2.1	13.2	11.6	24
5. M.D.G.	1.8	5.2	3.5	4.9
6. G.V.	3.8	68.6	40.6	117.6
7. Energy % 7/28	4.2	85.7	80	94.9
8. Germinative capacity %	48	84	80	78
9. Vigour	0.1	1	1	1.2

Figure 8. Time course of germination for A. aneura (broad) Test 2. Boiled for 30 seconds



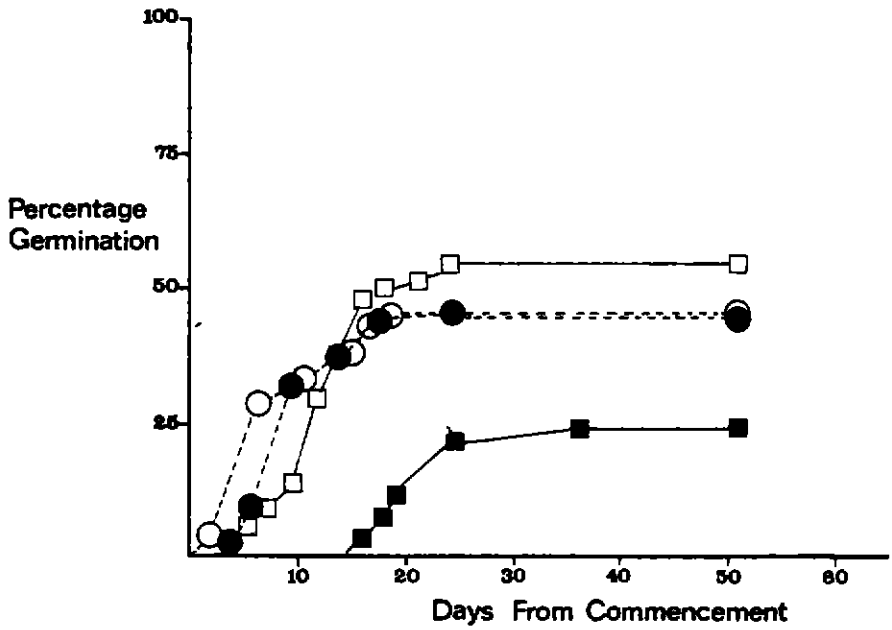
The fourth trial extended the boiling pre-treatment to 60 seconds and the results (Figure 9) show that many seeds were killed by this extended period of boiling. Germination rate was slowed at all temperatures, particularly 10°C, and viability greatly reduced at all temperatures.

Table 9. Germination Measurements for A. aneura (broad) Test 2. Boiled for 60 seconds

Germination Measurement	Temperature °C 10	15	20	25
1. Final %	26	44	56	44
2. Days to 1	37	24	24	16
3. Germination rate	21.2	9	12.8	7.4
4. Peak value	1	3.4	3	4.8
5. M.D.G.	0.7	1.8	2.3	2.8
6. G.V.	0.7	6.1	6.9	13.4
7. Energy % 7/28	-	40.9	14.3	63.6
8. Germinative capacity %	24	44	56	44
9. Vigour	-	0.9	0.2	1.4

The results show the best treatment for the seeds is to boil for about 5 seconds and incubate at 15-25°C thus producing the maximum viability in the shortest time.

Figure 9. Time course of germination for A. aneura (broad) Test 2. Boiled for 60 seconds



Acacia arida Benth.

This species has been recorded from map sheets Dampier, Roebourne, Yarrie, Onslow, Nullagine, Ningaloo, Yanrey, Wyloo, Mt Bruce, Edmund and Newman (Maslin and Pedley 1982). It also extends into the Kimberley. It is a low shrub distinguished by flat puncticulate phyllodes to 5 mm across. Pods are woody. It is a close relative of Acacia orthocarpa (Maslin and Hopper 1982).

It has been collected in hills and gorges amongst Triodia (Collections 5103, 5133).

Four percent of non-treated seed germinated in a test at Newman, compared with 87 percent following hot water treatment. Germination was rapid with 71 percent germination after 6 days (K.J. Walker, personal communication).

Acacia arrecta Maslin

This species has only recently been formally described (Maslin 1982). It is a low spreading flat-topped shrub to 1 m tall. Phyllodes are terete 2–4 cm long and curved upwards. Pods are erect, 4–5.5 cm x 4–6 mm, woody. It is recorded from the Millstream, Wittenoom and Nullagine areas, favouring low rocky hills and stony flats in shrub-steppe dominated by spinifex. It is distinguished from the similar, related species A. arida, A. hilliana and A. orthocarpa by its globular flower heads (Maslin 1982).

Acacia atkinsiana Maslin

This is another species recently described by Maslin (1982) from which this description is derived. It occurs as an open rounded shrub to 3.3 m tall. Phyllodes are narrowly elliptic 6–14.5 cm x 5–10 mm, slightly curved. Pods are slightly curved to 10 cm long and 4–6 mm wide, somewhat papery. It is recorded from the Mt Bruce area and north-west to the North West Coastal Highway. It occurs on rocky loam on spinifex plains. It will form dense regrowth stands in disturbed sites and burnt areas. **A. atkinsiana** is most closely related to **A. rhodophloia** from which it differs in not having mineritchie bark (see **A. monticola** description). It is also related to **A. adsurgens**, **A. kempeana** and **A. stowardii** (Maslin 1982).

Collection: 5138

Acacia bivenosa DC

A. bivenosa is a shrub to about 2.5 m tall. Foliage is often bluish or grey and in the Pilbara is similar to the northern variant of Pedley (see Pedley 1979 p. 273). In the Pilbara it is more frequently found on calcrete and other alkaline soils than it is elsewhere, with **Trlodia wiseana**. Phyllodes are 2–5 cm long, 8–15 mm wide often with 2 longitudinal nerves. The pods tend to be thick and woody to 8 cm long and 9 mm wide. Seeds are conspicuous with a red aril and often remain in the pod after dehiscence. Maslin (1982) notes the occurrence of a single-stemmed variant with pendulous branchlets. Small plants may

differ in leaf colour at the same locality from light green to bluish.

It is recorded throughout the Pilbara region (Maslin and Pedley 1982) and extends, in the north, to the western part of the northern subtropical zone of Maslin and Hopper (1982).

It occurs on limestone at Barrow Island, and in coastal communities in the Mandora Coastal Plain as thickets. Acacia bivenosa is common in lower lying areas.
Collections: 5016, 5040.

The larger plants usually occur as multi-stemmed clumps although seedlings can be found with single main stems.

Clumps of regeneration tend to occur around the base of dead stumps, apparently the "parent" plant which has died as a result of burning. It is not known whether the plants are formed from root stock or seeds. Their size indicates that they may be formed directly from root stock and if not that germination was uniform.

Measurements from plants growing as clumps probably after fire some 5 years earlier are shown in Table 10.

Table 10. Measurements of A. bivenosa 5 yrs + growth

Clump No.	No. of plants in clump	Average height (m)	Average crown (m)	Clump diameter (m)
1	8	1.52	1.13	2.60
2	4	1.09	0.68	2.30
3	8	1.50	1.29	3.30
4	5	1.55	1.33	2.70
5	6	1.33	1.18	2.20

These plants were growing on stony soil, associated with **Triodia wiseana** and **Triodia pungens**.

A large **A. bivenosa** measured 3.62 m height, 2.20 m crown and stem diameter of 4.7 cm. This particular plant was a fairly straggly bush which had been partly burnt one year earlier and had one living stem remaining. It was growing between a number of mulga trees which may explain why the plant had grown so tall compared with other individuals nearby.

Height and crown measurements taken for individual seedlings in an area burnt three years earlier are given in Table 11.

Table 11. **A. bivenosa** Three years from fire

Plant No.	Height (m)	Crown (m)
1	1.07	0.83
2	1.00	0.82
3	1.00	1.20
4	0.98	0.99
5	1.04	0.57
6	1.02	0.52
7	1.03	0.54
8	1.04	0.55

In calcrete areas A. bivenosa grows as a tall straggly plant with few low branches. Regeneration after fire leads to a dense growth of seedlings on some calcrete sites, particularly near water. No seed germinated without hot water treatment (K.J. Walker, personal communication).

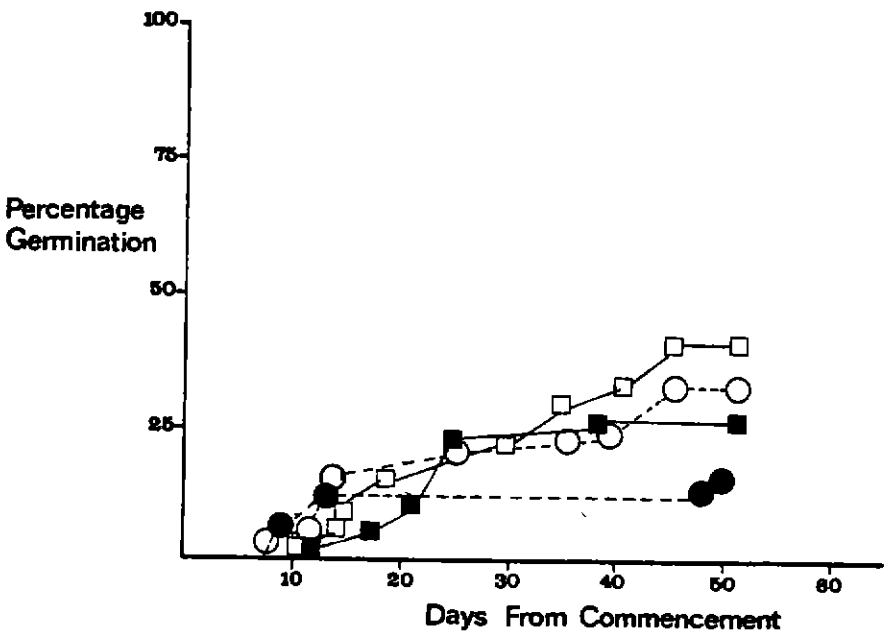
A single germination test showed poor results at all temperatures. It is possible that seed may not have survived storage well. Germination at 10°C was prolonged and viability was low compared to 20°C where the total germination was higher and germination rate and M.D.G. were higher (Table 12).

These trends indicate some separation in characteristics at the higher and lower temperatures and further trials should be carried out to obtain reliable results at 15 and 25 degrees. Seeds at both these temperatures appeared to undergo a second surge of germination after a long period of inactivity culminating in a low viability for both (Figure 10). Seed tested 6 months earlier at Newman from the same batch had a high viability (99 percent) with 77 percent germinating after 12 days at 20–25°C (K.J. Walker, personal communication).

Table 12. Germination Measurements for Acacia bivenosa

Germination Measurement	Temperature °C 10	15	20	25
1. Final %	28	32	46	32
2. Days to 1	68	66	57	44
3. Germination rate	26.3	40	29.9	23.4
4. Peak value	0.9	1	0.9	1.1
5. M.D.G.	0.4	0.5	0.8	0.7
6. G.V.	0.4	0.5	0.7	0.8
7. Energy % 7/28	-	-	-	20
8. Germinative capacity %	22	12	24	20
9. Vigour	-	-	-	1

Figure 10. Time course of germination for A. bivenosa



Acacia citrinoviridis Tindale et Maslin. River Jam

Acacia citrinoviridis is restricted in its distribution to floodplains close to major rivers and creeks and upon adjoining river banks. These major creeks have coarse gravel in their beds. This indicates water available at depth and suggests the species has a high water demand and probably a high transpiration rate. Soils of these sites tends to be fine textured suggesting retention of available soil moisture.

On such floodplains A. citrinoviridis is associated with a number of species such as Acacia aneura, A. pruinocarpa, Cassia desolata, Sida sp., Santalum lanceolatum, Pittosporum phylliraeoides, Themeda australis and Triodia pungens.

On river banks Acacia citrinoviridis and Eucalyptus microtheca dominate with some scattered Canthium latifolium and with Triodia pungens providing most ground cover.

It has narrow, falcate phyllodes 8–12 cm x 0.5–1.2 cm silvery especially when young, to greyish green. Pods are 8 cm x 0.8–1.6 cm, yellowish hairy when young, hard and brittle.

It is the closest relative of the central Australian species Acacia olgana Maconochie (Maslin and Hopper 1982).

It is well distributed in the Pilbara and has been recorded from all map sheets except the north coastal ones and Marble Bar, Nullagine, Balfour Downs in the eastern area, and Minilya,

Winning Pool in the west. It extends southwards into the inland Murchison (Maslin and Pedley 1982). It lines all major rivers in the Stuart Hills (Beard 1975).

Acacia citrinoviridis is a large tree. The tallest specimen measured was 15 metres high with a crown of 4.5 metres and a stem diameter of 30.7 centimetres. The tree grows with a single straight stem branching into a spreading crown at the top.

Table 13 summarises pod and seed measurements taken in December at West Angelas.

Table 13. **A. citrinoviridis** Pod size, seed nos and sizes.

Pod No.	Pod size (cm)	Seed Number	Seed size (mm)
1	11.0	7	7.0
2	13.0	6	7.0
3	9.0	4	5.5
4	11.5	6	5.5
5	10.0	4	5.0
6	9.5	5	6.0
7	7.5	4	6.0
8	6.5	3	4.8
9	9.5	4	5.0
10	9.0	9	5.0
$\bar{X}$	9.7	5	5.7

No examples of recently burnt stands of this species have been noted. However the large size of trees suggests a) long interval between fires or b) such riverine sites are not burnt at all. Seedlings are observed in river gravel after floods.

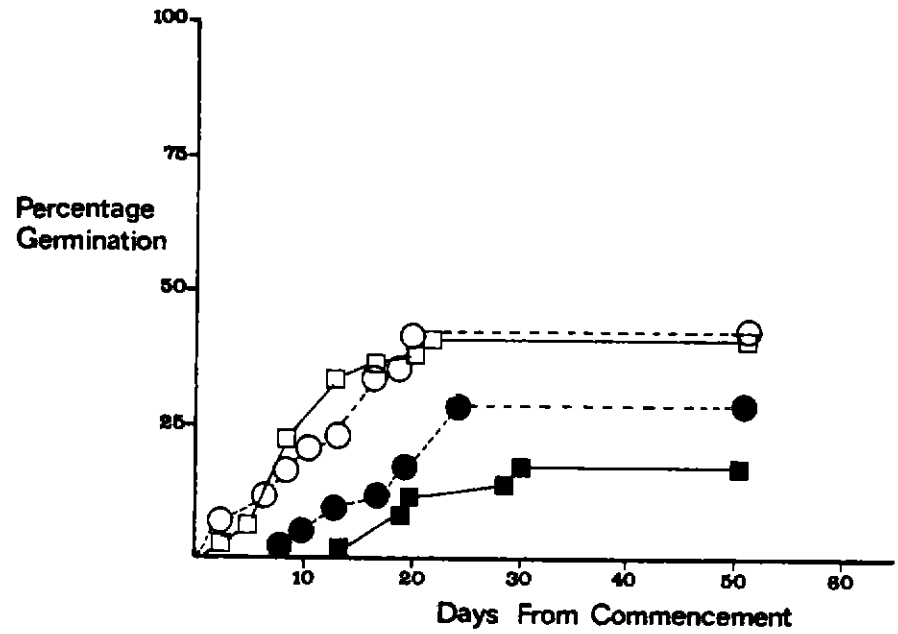
One seed of 100 tested germinated with no hot water treatment compared with 81 percent from a treated batch at Newman (K.J. Walker, personal communication). In a test 6 months later at Bentley the overall viability for this species was very poor, with the highest germination being at 25 and 20 degrees, both reaching 38 percent. Low viability tends to suggest that seed of this species does not keep well. Even though viability was low germination followed a clear trend with respect to temperature. There was a marked difference between the lower and higher temperatures. Viability at 10 and 15 degrees was only 16 and 18 per cent respectively (Table 14). Figure 11 shows how the germination capacities of the two high temperatures and the two lower temperatures are grouped together.

The germination rates for these seeds were similarly grouped. The germination rates for 20 and 25 degrees were 7.6 and 7.3 respectively and 20.4 and 14.4 at 10 and 15 degrees (Table 14). These figures show a prolongation of germination and a reduction in viability at the lower temperatures.

Table 14. Germination Measurements for **Acacia citrinoviridis**

Germination Measurement	Temperature °C 10	15	20	25
1. Final %	16	18	38	38
2. Days to 1	29	24	21	20
3. Germination rate	20.4	14.4	9.2	10.4
4. Peak value	0.9	0.8	2.8	3
5. M.D.G.	0.6	0.8	1.8	1.9
6. G.V.	0.5	0.6	5	5.7
7. Energy % 7/28	-	-	47.3	42.1
8. Germinative capacity %	14	18	38	38
9. Vigour	-	-	1.2	1.1

Figure 11. Time course of germination for Acacia citrinoviridis



Acacia coriacea DC. Desert Oak

This species is a graceful, slender tree with pendulous foliage. It is generally found along the edges of larger watercourses with Eucalyptus camaldulensis. It occurs in the Pindan in coastal thickets as a small tree (Beard 1975). At its best development along rivers well grown specimens may reach 10 m in height. The bark is grey, phyllodes terete to flat to 25 cm long and 4 mm wide. The pods are long (15-20 cm) woody, twisted and constricted beween the large seeds which have a bright orange aril.

Seed tested at Newman showed 13 percent germination wth no hot

water treatment and 38 percent with treatment (K.J. Walker, personal communication).

Maconochie (1982) notes that this species will regenerate from adventitious buds on sand plains and dunes. It is fire resistant with thick bark and epicormic buds (Beard 1975). It is the closest relative of Acacia stenophylla A. Cunn. ex Benth. It is widely distributed through the arid, northern and eastern subtropical zones (Maslin and Hopper 1982). In the Pilbara it has been recorded throughout except for Yarraloola, Pyramid and Wyloo sheets (Maslin and Pedley 1982).
Collections 4567, 5131

Acacia cowleana Tate

This species is generally a much branched shrub to 4 m tall though Pedley (1978) notes that it may grow as a spindly tree. Phyllodes are 8–16 cm long x 9–18 mm, curved and tapering to the base. The pods are flat, papery, raised over the seeds, 7 cm x 3 mm. The seeds have yellow arils. According to Maslin (1981) this species is not particularly common and formal records from the Pilbara area are from the Dampier, Port Hedland, Yarraloola, Pyramid, Mount Bruce, Roy Hill and Newman sheets (Maslin and Pedley 1982). Its closest relative is Acacia holosericea A. Cunn. ex G. Don and it occurs across nothern Australia through the arid and northern subtropical zones (Maslin and Hopper 1982).
Collection 4557.

Acacia cuspidifolia Maslin

This is an outlier species to the south. It occurs from the Gascoyne region northwards to the southern part of the Hamersley Ranges where it is not common. It has been recorded in the Pilbara from Minilya, Winning Pool, Turee Creek and Robertson map sheets (Maslin and Pedley 1982). It favours open floodplain areas of finer textured soils (Maslin 1982).

It occurs as a dense bushy shrub or gnarled tree 3-7 m tall. Phyllodes are narrowly oblong 3-6 cm x 2.5 mm straight to slightly curved. It differs from the very similar A. victoriae by the pointed tip to the phyllode. Pods are narrowly oblong 5-9 cm x 1-2 cm, papery, flat and raised over the seeds (Maslin 1982).

Acacia cuthbertsonii Luehmann

A sliver-grey spreading shrub to 3 m. Phyllodes are narrowly oblong 4-9 cm x 3-11 mm. Pods woody, curved yellowish to 16 x 2 cm. This species favours rocky ground (Maslin 1981).

A. cuthbertsonii occurs in the arid and northern subtropical zones of Maslin and Hopper (1982). Its closest relative is Acacia wanyu Tindale. In the Pilbara records have been noted from the Mount Bruce, and Edmund sheets only, though it extends further south to the Murchison (Maslin and Pedley 1982).

Acacia daweana Maslin

This species is endemic to the Hamersley Range area where it is found near Mt Bruce and Juna Downs Station. Its total distribution may not be very great. Maslin (1982) in describing it notes that it is a low spreading flat-topped shrub to 1 m tall. Phyllodes are narrowly elliptic 4-5.5 cm x 6-10 mm and olive-green in colour. Mature pods have not been described. A. **daweana** is found among spinifex on rocky red loam on lower scree slopes and along associated creek lines. It occurs sympatrically with A. **effusa** but has no apparent close relatives in the region.

Acacia dictyophleba F. Muell.

This is a shrub to 3 m tall readily distinguished by the phyllodes which are oblanceolate 4-7 cm x 9-18 mm and are coarsely veined with prominent reticulation and often sticky. The phyllodes are leathery, bright green on new growth and whitish on older growth, there are 2-3 longitudinal nerves. Pods are narrowly oblong to 9 x 1.5 cm, papery and flat.

A. **dictyophleba** is widely distributed through central Australia in the arid and eastern subtropical zones. It overlaps the narrower ditribution of its closest relative Acacia **jensenii** Maiden (Maslin and Hopper 1982). In the Pilbara it is recorded from coastal sheets Mandora, Roebourne and Yanrey and across the centre in Wyloo, Mount Bruce, Roy Hill, Balfour Downs, Newman and Robertson (Maslin and Pedley 1982).

Collection: 5195.

A. dictyophleba occurs in similar sites to A. bivenosa. Regeneration from root stock is found. Plants which have apparently regenerated from root stock tend to be larger than those plants growing from seeds which germinated after fire. A range of heights for each form was taken from an area burnt 21 months earlier:

7 seedlings measured height range: 0.56–1.23 m.

12 root stock plants in clumps with 8–20 stems height range: 0.91–1.54 m.

Measurements of plants from a site at the base of low hills along a dry creek not burnt for at least five years were as in Table 15.

Table 15. A. dictyophleba "mature" specimens

Plant No.	Height (m)	Crown (m)	Distance to nearest A. dictyophleba (m)
1	2.66	1.60	7.6
2	2.09	1.60	0.8
3	2.29	0.80	8.2
4	1.76	2.1	4.6
5	1.36	1.00	8.7
6	3.42	2.2	

This site contained a range of species, perhaps typical of the occurrence of A. dictyophleba. Species associated with A. dictyophleba were: A. bivenosa, A. inaequilatera, E. gamophylla, E. patellaris, Canthium lineare, Triodia pungens, Capparis lasianthum and Alyogyne pinoniana.

The seeds of this species germinated early and to a fairly high viability although germination was not as rapid as in **A. farnesiana** and **A. sclerosperma**. Germination at 25°C produced the best results, with 98 percent of seeds germinating in 18 days (Table 16). Germination was strongly influenced by temperature with seeds at 20°C producing the next highest level of germination (82 percent in 20 days). Germination characteristics were very similar at 10 and 15 degrees with the seeds at 15°C germinating a little quicker (Figure 12).

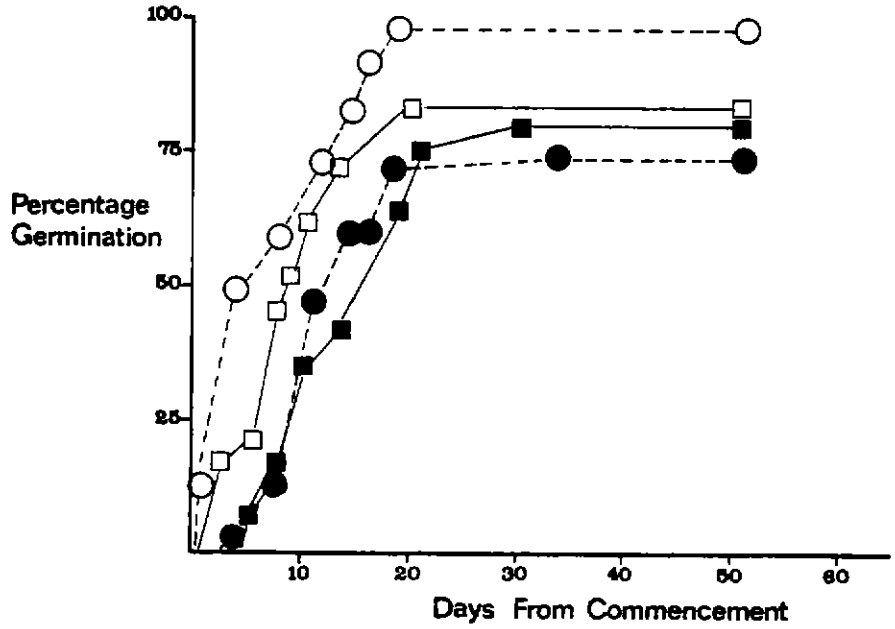
The rate of germination varied directly with temperature in all trials with the fastest rate of germination at 25°C.

Table 16. Germination Measurements for **Acacia dictyophleba**

Germination Measurement	Temperature °C 10	15	20	25
1. Final %	78	74	82	98
2. Days to 1	30	34	20	18
3. Germination rate	13.1	11.4	7.6	7.3
4. Peak value	3.7	4.2	6.6	13.3
5. M.D.G.	2.6	2.2	4.1	5.4
6. G.V.	9.6	9.2	27.1	71.8
7. Energy % 7/28	21	19.4	56.1	65.3
8. Germinative capacity %	76	72	82	98
9. Vigour	0.3	0.3	0.7	0.7

Four percent of seed germinated with no hot water treatment in a test at Newman (K.J. Walker, personal communication).

Figure 12. Time course of germination for A. dictyophleba



Acacia distans Maslin

This recently described species (Maslin 1983) is a tree 5–8 m tall, with linear to falcate phyllodes 6–11 cm long, 4–10 mm wide. It has long, straight pods to 9.5 cm x 3–5 mm. In appearance it may be mistaken for A. citrinoviridis. Its distribution is between the Murchison and Gascoyne Rivers, with one record from Towera at 23°22'S, 114°58'E.

Acacia drepanocarpa F. Muell.

This is a northern sub-tropical and tropical species found in the northeast of the Pilbara at Mandora and at Port Hedland, Yarrie and Nullagine sheets (Maslin and Pedley 1982).

Acacia effusa Maslin

This is a species recently described by Maslin (1982). It is related to A. trachycarpa with which it shares characteristic mineritchie bark (see A. monticola). Its distribution and habitat are as for A. daweana, and it may be equally as uncommon. It occurs as a low dense shrub to 1 m tall. Phyllodes are asymmetrically elliptic with a terminal point, 9–15 mm long x 3–7 mm wide. Pods are curled, 6–8.5 cm x 7–8 mm, leathery and flat but raised over the seeds.

Acacia eriopoda Maiden et Blakely

This is a northwestern sub-tropical species. In the Pilbara it has been recorded from Yanrey, Mandora, Port Hedland, Yarrie, Nullagine and Robertson sheets (Maslin and Pedley 1982).

Acacia exilis Maslin

This is another species recently described by Maslin (1982) from which the following description is taken. It occurs as a shrub or small tree 3–4 m tall. The terete phyllodes are 14–18 cm long, ascending, the phyllode stalk is orange. Pods are narrowly oblong, flat, papery, 7 cm x 4–5 mm, raised over the seeds. A. exilis occurs on low undulating rocky hills on soils derived from ironstone formations. It is known only from the Hamersley Range area. It is distinguished from the closely related A. tenuissima

by its longer phyllodes (6–15 cm in A. tenuissima) and taller habit. It may be confused with A. aneura but has longer, lighter green phyllodes and longer, narrower pods.

Acacia farnesiana (L) Willd. Mimosa bush.

This species is found in low lying sites on riverbanks and floodplains near major streams. Individual plants tend to be widely separated some 20–60 m between plants, see Table 17 for sizes.

Table 17. Measurements of A. farnesiana

Plant No.	Height (m)	Crown (m)
1	2.67	2.58
2	2.34	2.05
3	2.35	1.44
4	1.34	1.13
5	1.90	1.74
6	2.61	1.80
7	3.2	4.0

This species is the only Acacia in the region with pinnate foliage and spines. It is pantropical in distribution and is believed to have been introduced to Australia prior to or soon after settlement (Pedley 1979). It is a spreading, intricately branched shrub to 3 m tall but may be taller in cultivation (e.g. at Wittenoom). The leaves have 2–6 pairs of pinnae. Pods are about 6 cm length, cylindrical, curved, woody and dry black.

Seeds are large and thick-walled.

Plants are straggly with thorns present on all branches. The bi-pinnate leaves are large and strikingly green although tending to be sparse on the crowns. Most of the plants observed of this species had pods on them. A collection was made and seed count taken (Table 18).

Table 18. Seed count for A. farnesiana

Pod No.	No. Seeds
1	9
2	12
3	9
4	10
5	9
6	11
7	9
8	9
9	11
10	11
11	10
12	9

The mean number of seeds per pod was 9.9.

The main associates of Acacia farnesiana are A. citrinoviridis and Eucalyptus microtheca. Other species associated with it include: A. aneura, Santalum lanceolatum, E. dichromophloia and Canthium lineare.

Its Australian distribution is very extensive, extending through the arid, eastern and northern sub-tropical, northeastern tropical and eastern tropical/temperate overlap zones of Maslin

and Hopper (1982). In the Pilbara formal records exist from sheets Yarrie, Onslow, Pyramid, Nullagine, Wyloo, Mount Bruce, Winning Pool, Edmund, Turee Creek and Newman (Maslin and Pedley 1982).

Collection: 4573.

As **A. farnesiana** is only found on or near banks, and floodplains of streams it is assumed that it is a species requiring a large amount of moisture for survival. Such sites also are rarely burnt, seedlings are not common but presumably come up after flooding.

Each plant has a large number of galls on terminal branches, forming large protruberances from the stem and in some cases the seed pods as well.

The species flowers in June–September, flowering being influenced by rain or soil moisture. Large fragrant flowers are produced and these have been used in the perfume industry.

This species has a very hard seed coat and seeds had to be scarified using a dentist's drill to induce germination. These seeds were not boiled. In nature seed coat abrasion may occur by microbial and mechanical action against the seed in the soil, or the seed coat may be damaged during chewing and ingestion of the seeds by mammals or birds, (sheep have been reported to eat the pods) Only one out of a batch of 100 untreated seed germinated,

after 63 days, in a test conducted at Newman (K.J. Walker, personal communication).

The seeds germinated quickly at the higher temperatures, 100 percent germination being attained after only 8 days at 20°C. The fastest M.D.G. was at 25°C (Table 19) and became progressively slower at each of the lower temperatures. Germinative capacity was very high at 15, 20 and 25 degrees producing 92, 100 and 96 percent germination respectively at 28 days.

Table 19. Germination Measurements for Acacia farnesiana

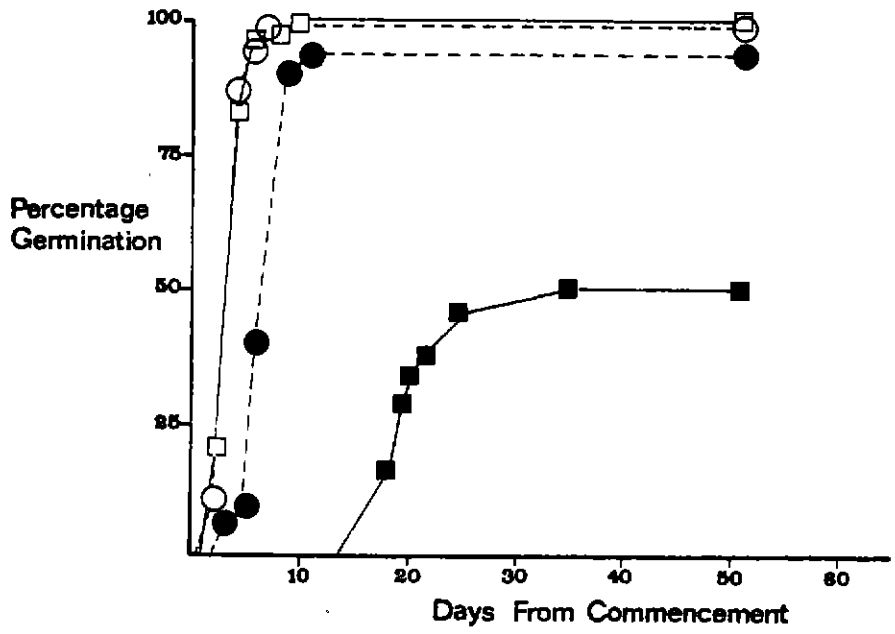
Germination Measurement	Temperature °C 10	15	20	25
1. Final %	50	92	100	96
2. Days to 1	29	11	8	6
3. Germination rate	20.4	6.9	3.1	3.5
4. Peak value	1.5	10	27.3	21.5
5. M.D.G.	1.7	8.4	12.5	16
6. G.V.	2.6	84	341.2	344
7. Energy % 7/28	-	63	98	100
8. Germinative capacity %	44	92	100	96
9. Vigour	-	0.7	1	1

At temperatures of 15° and over this is a failure of only 5 in 150 seed. This may be attributed to the seeds being damaged by insects or during the scarifying process, or at 25°C to a fungal infection.

The seed appears to have a critical level for successful germination above 10°C because although seeds at 15°C germinated

a little slower than at the higher temperatures, high viability was still attained. At 10°C germination was greatly prolonged and viability reduced, with only 50 percent of seeds germinating after 29 days and the first germination did not occur until the 17th day (Figure 13). A. farnesiana has been reported not to be able to withstand frosts which occur farther south of its habitat. Treatment with boiling water was much less successful, with 49 percent germination (30 percent after 12 days) in a test conducted at Newman (K.J. Walker, personal communication).

Figure 13. Time course of germination for A. farnesiana



Acacia grasbyi Maiden

This 'mineritchie' species (see A. monticola) mainly occurs further south in the Gascoyne and Murchison. It has been recorded from Yanrey map sheet (Maslin and Pedley 1982). It is often confused with A. rhodophlola.

Acacia gregorii F. Muell.

This is a coastal species of the northwest corner of the Pilbara. It is recorded from the Dampier to Minilya and Winning Pool sheets (Maslin and Pedley 1982).

Acacia hamersleyensis Maslin

This recently described species (Maslin 1982) is known only from the Hamersley Range. It occurs from Mt Whaleback, through Mt Newman, Rhodes Ridge, Mt Bruce to Tom Price, where it is apparently restricted to soils on the iron formations, of ridges and upper slopes of the ranges. It is a shrubby or spindly tree to 4 m tall. Phyllodes are slightly falcate 8-14 cm x 1-2 cm, bluish with a distinct stalk wrinkled, orange, 5-10 mm. Pods are narrowly oblong to 8 cm long, 5-8 mm wide hairy.

A. hamersleyensis has affinities with A. tumida, A. citrinoviridis and A. xiphophylla (Maslin 1982).

Collection: 4573

The viability of untreated seed was 7 percent, and that for seed treated with hot water 98 percent (58 percent after 12 days) in a test conducted at Newman (K.J. Walker, personal communication). Lower viability was evident in seed tested 6 months later, from the same batch, at Bentley. The pattern of germination for this species was similar to that of A. **ancistrocarpa** in that germination was relatively slower than in other species but a reasonable viability was attained at the higher temperatures. Temperature affects were marked with viability, germination rate, M.D.G. and germinative capacity all varying directly with temperature (Table 20), the best results being at 25°C, the highest temperature.

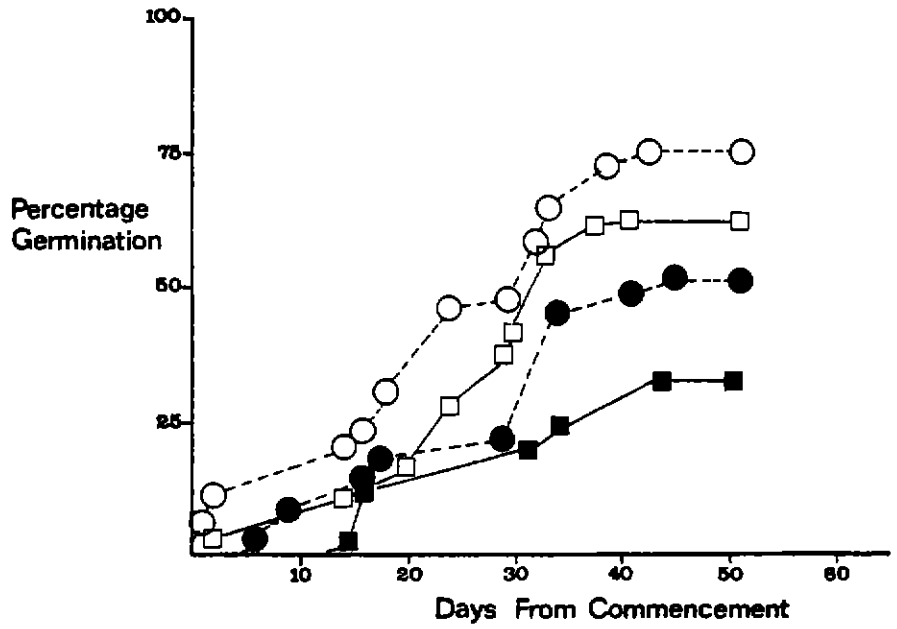
Table 20. Germination Measurements for A. **hamersleyensis**

Germination Measurement	Temperature °C 10	15	20	25
1. Final %	34	52	64	76
2. Days to 1	43	44	41	42
3. Germination rate	28.3	25.8	25.3	15.6
4. Peak value	0.8	1.3	2	6
5. M.D.G.	0.8	1.2	1.6	1.8
6. G.V.	0.6	1.6	3.2	10.8
7. Energy % 7/28	-	30	16.7	33.3
8. Germinative capacity %	12	20	36	48
9. Vigour	-	1.5	0.5	0.7

Interestingly although it took longer for the first germinants to appear at the lower temperatures the peaks of germination for each were reached at about the same time (41–44 days). This along with the prolonged rate of germination (Figure 14) at all temperatures may indicate that optimum conditions were not given

to the seeds and a higher temperature, perhaps 30°C, may give better results. The higher viability attained at Newman may have been partly a temperature response. Any subsequent germination trial should include one to at least 30°C to examine the effect of a higher temperature on germination.

Figure 14. Time course of germination for A. hamersleyensis



Acacia hilliana Maiden

This species is a flat topped sticky shrub generally less than 1m tall though Pedley (1978) notes that it may reach 3 m. Phyllodes are flat, 2-5 cm long and terete. The flat, woody, pod is sticky and opens at the top. It has distinct margins and is 2-5 cm x 4-6 mm. A. hilliana may be confused with A. arida (Pedley 1978), it favours rocky soil in open spinifex (Maslin 1981). It is

distributed through the arid, northern subtropical and northern tropical zones. Its closest relative is Acacia abbreviata Maslin (Maslin and Hopper 1982). In the Pilbara it occurs in the east from Mount Bruce and in Newman, Roy Hill, Balfour Downs, Marble Bar, Nullagine, Port Hedland, Yarrie, and Mandora map sheets (Maslin and Pedley 1982).

Collections: 4571, 5089.

Acacia holosericea A. Cunn. ex G. Don.

Pedley (1978) describes this species as a shrub or tree to 5 m usually found on sandy or gravelly creek banks. The phyllodes are long, to 25 cm and 15-95 mm broad, with 3 prominent longitudinal nerves and distinct reticulate secondary venation. The pod is coiled, papery and constricted between seeds.

This species is found right across northern Australia in the arid, northern and eastern subtropical, northern and northeastern tropical zones. Its closest relative is Acacia pellita O. Schwarz (Maslin and Hopper 1982). In the Pilbara it has been recorded from Onslow and to the east and north (except Roebourne) and at Mount Bruce and Roy Hill sheets (Maslin and Pedley 1982).

Acacia holosericea occurs in small tree thickets in the Pindan, in gullies in the Great Sandy Desert and as a small shrub in Abydos Plain (Beard 1975).

Acacia inaequilatera Domin. Ranji Bush

A. inaequilatera is a very common plant in the region somewhat unrestricted in its topographical distribution. It is more frequently observed on higher, drier, ground rather than in the more dense growth in the plains and creeks. Thus A. inaequilatera is hardy and well adapted to drought conditions with not a very high water demand, or is outcompeted by faster growing species on moist sites. It is generally shrubby and characteristic of the shrub-steppe and hummock grasslands. Beard (1975) notes that the species is a common one on the Onslow Coastal Plain on hard, red, alkaline soil, on Abydos Plain, on sandplain in the Fortescue Valley, granite in Oakover Valley and on basalt and alkaline soils of the Chichester Plateau.

It grows in both fine grained floodplain soil as well as the very coarse gravel and stony soils of the hills. On hillsides Acacia inaequilatera is associated with Triodia species, Hakea suberea and Acacia bivenosa. In river beds and floodplains A. inaequilatera is associated with Acacia tetragonophylla, Acacia pruinocarpa, Eucalyptus gamophylla, Acacia maitlandii and Sida sp. Acacia inaequilatera tends to be larger in size on the more isolated hilly sites and smaller in floodplain areas.

A set of measurements were taken up a hillside unburnt for at least 5 years, with plant 1 at the bottom of the hill and plant 10 at the top (Table 21).

Table 21. Unburnt A. inaequilatera up a hillside

Plant	Height (m)	Crown (m)	Stem diameter (cm)	Distance to next tree (m)
1	3.22	3.55	12.0	24.8
2	3.67	3.33	13.2	21.6
3	2.46	2.80	5.5	10.0
4	3.42	2.30	10.0	2.5
5	4.42	2.80	14.4	20.5
6	4.22	1.80	13.7	4.3
7	3.72	2.50	11.2	21.0
8	2.64	3.30	8.9	16.3
9	2.64	2.00	6.5	6.8
10	1.99	1.8	2.9	

In shape A. inaequilatera is a rather gnarled tree. The tallest plants reach about 4.5 metres. The phyllodes are often bluish and have a waxy cuticle. They are semicircular to elliptic in shape with a large spine at the tip to which runs an eccentric midrib dividing the phyllode into unequal halves. Phyllode size is 2.5-7 x 1.5-3.5 cm. Branchlets are whitish. The species has thick bark and can produce epicormic shoots all over the crown.

The seed pods are papery and curved around the seed, and raised over it, to 12 cm or more in length.

Measurements taken of pods are given in Table 22.

Table 22. Pods and seed of A. inaequilatera

Pod	Pod size (cm)	No. of Viable seed*	Seed size (mm)
1	9.0	5	4.0
2	7.7	8	5.0
3	9.0	3	4.0
4	6.0	1	5.0
5	6.5	5	4.0
6	7.5	8	4.0
7	7.5	4	4.0
8	8.0	7	4.5
9	7.0	1	4.0
10	5.0	3	4.0
	73.2	45	42.5
$\bar{X}$	7.32	4.5	4.25

* Seeds suffering insect or fungi attack or malformed (e.g. too small) were not counted.

Regeneration after fire was noted from both seed and rootstock with up to 20 stems regenerating from the base of dead burnt trees. Larger trees readily grow new foliage after burning. Acacia inaequilatera appears to show no signs of any animal grazing on it. This could be due to the spines on the leaves and also the waxy cuticle being unpalatable. Galls are relatively frequent.

Collections: 5052, 5054, 5056.

The closest relative of Acacia inaequilatera is Acacia pyrifolia DC. The former extends from the Pilbara east into the arid zone, whereas the latter has a more northwesterly distribution in the northern subtropical zone (Maslin and Hopper 1982). A. inaequilatera has not been formally recorded from coastal sheets Bedout Island, Mandora, Barrow Island, Onslow, Yarraloola,

Ningaloo and Minilya. In the inland Pilbara it is not reported for Edmund and Robertson sheets, but is present elsewhere (Maslin and Pedley 1982). Seed viability was low in a test conducted at Newman, with 5 percent germination following no treatment and 38 percent after hot water treatment (K.J. Walker, personal communication).

Acacia intorta Maslin

This is a recently described species from the upper Ashburton between Mt Vernon and Bulloo Downs 118–120°E and 24°S (Maslin 1983). It is a gnarled shrub to 3 m tall with sharp pointed terete phyllodes 5–10 cm long. It has papery pods 4–9 cm x 5–8 mm, raised over the seed. This species is closely related to A. xiphophylla (Maslin 1983).

Acacia kempeana F. Muell.

This species is a spreading shrub or small tree to 5 m tall. Phyllodes are straight or sharply curved 3–6 cm x 4–10 mm. Pods are 3–6 cm long and 10–15 mm wide. The seed is narrow-ovoid and small (0.13–0.19 g) and responds to hot water treatment (Maconochie 1982).

Pedley (1978) records it as a species of stony hillsides or

coarse alluvium. It appears difficult to confirm its identity in Western Australia and there is a possibility that intermediates between A. kempeana and A. stowardii occur in the Hamersley Range area (Maslin 1982). The latter species is its closest relative (Maslin and Hopper 1982). Acacia kempeana is widely distributed in the arid zone and extends into the south-western semi-arid zone of Maslin and Hopper (1982). In the Pilbara it has been formally reported from Nullagine, Wyloo, Mount Bruce, Roy Hill, Edmund and Turee Creek map sheets (Maslin and Pedley 1982).

It has been observed to sprout from sub-surface laterals (Maconochie 1982).

Acacia ligulata A. Cunn. ex Benth.

This is a widespread species throughout arid Australia. In the Pilbara it has been recorded from Dampier, Roebourne, Marble Bar, Nullagine, Yanrey, Balfour Downs, Newman and Robertson sheets (Maslin and Pedley 1982). It is a small shrub on Abydos Plain (Beard 1975). Seed has high viability (K.J. Walker, personal communication).

Acacia maitlandii F. Muell. Maitland's wattle

Acacia maitlandii occurs on stony hillsides and also in flushes or dry creek beds, in valleys and other lowlying areas where water is more available. Many plants show a brownish tinge to phyllodes suggesting water stress. In its creek-bed habitat Acacia maitlandii occurs with A. tenuissima, A. aneura, A. bivenosa, Eucalyptus leucophloia and Triodia pungens. It is locally common on hillslopes after fire, regenerating from seed. Acacia maitlandii grows as a shrub with several stems from the base. It is sparsely branched and sticky. The tallest specimen measured was 3.92 m with a crown of 75 cm and a stem diameter of 1.5 cm.

Acacia maitlandii has small linear phyllodes (8 to 25 mm long) arranged in a spiral manner. On some specimens epinasty of the stem occurs. This is unequal growth of the stem on one side resulting in the stem appearing twisted and swollen. It is usually caused by a viral or insect attack. No other pest attacks or grazing were noted. Pods are 4 cm x 4 mm and narrowly oblong. Collections: 5017, 5060, 5174A.

Maitland's wattle is readily recognised by its phyllodes arranged fairly close on the few, adscending branchlets. There are no close relatives and it is found throughout the arid and into the eastern subtropical zone (Maslin and Hopper 1982). In the Pilbara it has been recorded from the following map sheets: Dampier, Pyramid, Marble Bar, Nullagine, Mount Bruce, Roy Hill, Balfour Downs, Edmund, Turee Creek and Newman (Maslin and Pedley

1982).

Acacia marramamba Maslin

This species is a spreading shrubby tree to 3 m recently described by Maslin (1982). The phyllodes are asymmetrically elliptic with the midvein terminating in a spike. Phyllodes are leathery 2–4 cm x 1–2 cm. Pods are narrowly oblong to 7.5 cm x 8 mm, papery, slightly curved and raised over the seeds. This species occurs from the Ashburton into the Hamersley Range where it occurs on low hills, favouring skeletal ironstone soils. it is closely related to Acacia inaequilatera and differs from that species in not having whitish branchlets or corky bark (Maslin 1982). It has been recorded from Mount Bruce, Turee Creek and Newman sheets in the Pilbara (Maslin and Pedley 1982).

Collection: 5008

Acacia monticola J.M. Black

A. monticola is one of the species with 'mineritchie' bark – the inner bark is reddish and the outer bark peels off in thin narrow strips, curling at the ends (Pedley 1978). Phyllodes are somewhat sticky 1.5–2.5 cm x 7–10 mm, oblong in shape with a sharp tip, 3–5 nerves and reticulation between. The pods are flat and sticky, raised over the seeds, 4–9.5 cm long and 1 cm broad. This species usually grows as an open shrub not more than 5m tall, often on rocky soil (Maslin 1981). It has no close relatives and is found through the arid, northern tropical and

northern sub-tropical zones (Maslin and Hopper 1982). In the Pilbara it has been recorded from Mandora, Port Hedland, Yarrie, Marble Bar, Mount Bruce, Roy Hill, Balfour Downs and Newman map sheets (Maslin and Pedley 1982).

Measurements were taken of regrowth after 2 years in a site where a large number of A. monticola and A. tenuissima were observed in a small gully (wet flush) running alongside a track. A 1 m quadrat was randomly placed at 5 m intervals going up slope through the gully. The number of A. monticola in each of these squares was counted and average height taken for plants in that square (Table 23).

Table 23. Density of A. monticola in wet flush (2 years after fire)

Square	No. plants	Average height (m)
1	13	0.66
2	11	2.05
3	4	1.45
4	2	2.0
5	1	1.29 (dead)
6	1	1.60
7	-	-
8	-	-
9	1	1.51
10	1	1.83
11	-	-
12	1	1.25
13	-	-
14	1	0.87 (stressed)
15	-	-
16	-	-
17	2	1.63
18	1	0.70 (stressed)
19	7	1.57 (stressed)
20	1	1.11
= 20 m^2	= 37	

In another two year burn site four A. monticola seedlings were measured (Table 24).

Table 24. Seedling measurements for A. monticola (2 years after fire)

Seedling No.	Height (m)	Crown (m)
1	1.10	1.10
2	1.53	1.20
3	2.00	1.20
4	1.64	0.67

Seed pods were collected from mature plants in the same area. For each of these pods a number of measurements was taken (Table 25).

Table 25. Seed count for A. monticola

Pod	Length (mm)	No. Seeds	Average seed size (mm)
1	32	2	4
2	42	1	4
3	53	1	5
4	52	4	4.5
5	49	2	5.5
6	58	6	6
7	15	1	3

Species that tended to occur in the same areas as A. monticola were: E. leucophloia, Acacia tenuissima, A. pachyacra, A. pruinocarpa, A. aneura, and Triodia species.

Acacia murrayana F. Muell. ex Benth.

This species is mainly recorded from arid regions and also in the southwestern semi-arid. In the Pilbara it has been formally recorded from Yanrey sheet (Maslin and Pedley 1982).

Acacia orthocarpa F. Muell.

This small shrub (to 2 m) is similar to A. arida but differs from it in having terete phyllodes, and is also difficult to distinguish from Acacia tenuissima when in flower (Pedley 1978). Phyllodes are punctulate and sticky 5-10 cm x 0.6-0.8 mm. The pod is thick woody, opens from the top, sticky, to 9 cm long and 3-5 mm across. This species occurs on rocky hills and sandy flats (Maslin 1981).

Acacia orthocarpa is found in the arid, northern tropical and northern sub-tropical zones. Its closest reative is Acacia arida Benth. (Maslin and Hopper 1982). In the Pilbara it has been recorded from sheets Dampier, Roebourne, Yarraloola, Pyramid, Marble Bar, Nullagine, and Mount Bruce (Maslin and Pedley 1982).

Acacia pachyacra Maiden et Blakely

This species usually has a shrubby habit but older specimens may become tree-like. 5m is about its height limit. The foliage is bright dark green and gives the plant a striking appearance amongst greyer-green mulga and spinifex. Phyllodes are long more

or less terete 9-15 cm. Pods are narrowly oblong to 8 cm x 8 mm, papery, raised over the seed. It is closely related to **A. murrayana** F. Muell. ex Benth. (Pedley 1979, Maslin 1981). **A. pachyacra** is a species of the western arid zone (Maslin and Hopper 1982) extending into sheets Newman, Roy Hill, Mount Bruce, Wyloo of the Pilbara (Maslin and Pedley 1982). It favours sandy soils (Beard 1975).

Acacia pachyacra will produce sprouts from sub-surface lateral roots (Maconochie 1982). In the Pilbara, it has been observed to grow from rootstock as well as seeds. This observation was made in an area burnt some 8 years earlier where **A. pachyacra** was associated with: **Triodia pungens, A. aneura** and **A. inaequilatera.** Rootstock and seedling plants measured in this area are shown in Table 26.

Table 26. Seedling and rootstock measurements for **A. pachyacra**

Plant	Height (m)	Crown (m)
Seedling (1)	0.42	0.33
(2)	0.92	0.28
(3)	0.84	0.33
(4)	1.49	1.29
Rootstock (1)	2.10	2.00 (2 stems)
(2)	0.78	0.35

Distribution appears to be somewhat patchy. However the bright green foliage of the species stands out well in areas of recently

burnt Acacia aneura and Triodia pungens grasslands in Marillana Flats. In the Hamersley Ranges it grows on a range of soils including loams and red earths. A number of A. pachyacra were observed in an area unburnt for at least 5 years on low lying rocky soils, in close proximity to a dry stream bed. Seeds and pods were collected from a number of plants in this area and measured (Table 27).

Table 27. Seed counts of A. pachyacra

Length of Pod (mm)	No. of Seeds	Average Seed Length (mm)
43	4	2.5
45	6	4.5
37	4	4.5
24	3	4.0
34	5	4.0
38	6	3.5

A. pachyacra is not found on higher, rocky slopes.

Collection: 5001.

Seed viability for untreated material was high (14 percent) compared to other species tested. At Newman 76 percent germination followed hot water treatment, with 70 percent germinating after 6 days (K.J. Walker, personal communication).

Under controlled conditions at Bentley the seeds of this species germinated quickly at 15, 20 and 25 degrees to a moderate viability (Figure 15). Seeds at these temperatures had similar germination characteristics (Table 28). Values for M.D.G., energy and germinative capacity were much the same, but the

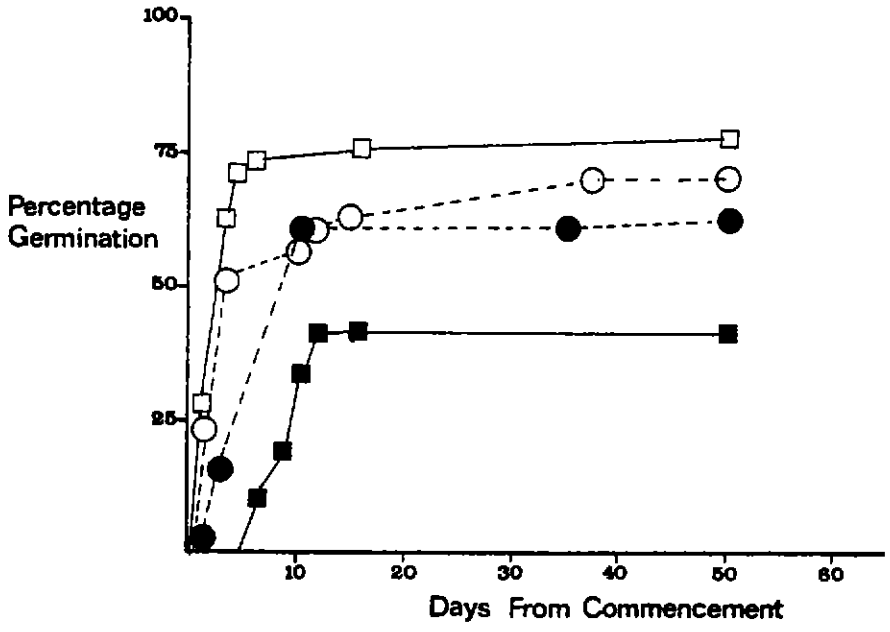
temperature did have an effect on the germination rate. Germination was fastest at 20 and 25 degrees with 15°C a little slower and prolonged at 10°C.

The 10°C treatment retarded growth and reduced the viability of the seed with only 46 percent of seed germinating.

Table 28. Germination Measurements for Acacia pachyacra

Germination Measurement	Temperature °C 10	15	20	25
1. Final %	46	70	78	70
2. Days to 1	56	53	50	37
3. Germination rate	12.5	9.1	4.3	5.2
4. Peak value	3.4	14	22.6	17.3
5. M.D.G.	0.8	1.3	1.6	1.9
6. G.V.	2.7	18.2	36.2	32.9
7. Energy % 7/28	47.6	90.3	97.4	82.4
8. Germinative capacity %	42	62	76	68
9. Vigour	1.1	1.4	1.3	1.2

Figure 15. Time course of germination for Acacia pachyacra



Acacia pachycarpa F. Muell. ex Benth.

This species is of limited occurrence in the Pilbara. It has been recorded from the Onslow sheet and then north and east of Nullagine (Maslin and Pedley 1982). It occurs as a small tree thicket in the Pindan, on Abydos Plain and in the sandplain of the Fortescue Valley. In the Great Sandy Desert it regenerates densely after fire (Beard 1975).

Acacia palustris Luehm.

An uncommon species only recorded from map sheet Turee Creek and three other sheets further south (Maslin and Pedley 1982).

Acacia proxima Maiden

This species has been recorded from Roebourne, Port Hedland, Pyramid and Mt Bruce sheets only (Maslin and Pedley 1982).

Acacia pruinocarpa Tindale. Gidgee

Acacia pruinocarpa has a wide distribution throughout the area being frequent in most habitats including gullies, flats and hills. The species shows no restriction in distribution and occurs on all soil types in the region, from finer river-bed gravel to sandy and large stony soils of the hills.

Gidgee is a tree to 10 m tall. The branches are often whitish. The foliage is a conspicuous bright green. Phyllodes are linear and generally straight 6-17 x 1-3 cm with a prominent midrib. Pods are flat, narrowly oblong but raised over seeds, and papery in texture to 12 x 1.5 cm.

A. pruinocarpa is a species of the arid zone whose closest relative is Acacia ensifolia Pedley which is distributed in lower central Western Queensland (Maslin and Hopper 1982). In the Pilbara gidgee has been recorded from Mount Bruce, Roy Hill, Turee Creek and Newman sheets. Further south in Western Australia it occurs into the Murchison (Maslin and Pedley 1982).

Due to its wide distribution Acacia pruinocarpa is associated with a number of species including: Acacia aneura, A. citrinoviridis, A. inaequilatera, A. bivenosa, Eucalyptus gamophylla, E. leucophloia and E. oleosa. A number of A. aneura communities feature this species as a co-dominant which, since it is relatively fire resistant, may be increasing relative to the mulga. On some slopes it is the most frequent tree with the mallee E. gamophylla. The tallest specimen was measured at 10.46 m with a crown of 6.04 m across and a stem diameter of 17.2 cm.

After fire A. pruinocarpa regenerates from rootstock as well as seed. It regenerates quickly and prolifically from the root with many stems at first emerging and then, after a while, one stem becoming dominant. The bark of Acacia pruinocarpa is hard grey and shiny, able to reflect light, and, to a certain extent,

resist fire. As a seedling A. pruinocarpa grows with a single stem. It then tends to branch early into a large umbrella-like crown. The phyllodes are large and straight with a prominent central vein.

As for A. pachyacra some seed must be comparatively 'soft' as 12 percent germination was attained without hot water treatment in a test at Newman, from a batch which gave 91 percent viability with hot water treatment (K.J. Walker, personal communication).

Acacia ptychophylla F. Muell.

A small shrub to 1m tall. Phyllodes are narrow, oblong-elliptic to 4 x 1 cm. Pods are flat, woody 6 cm x 6-8 mm. It is an uncommon species on sand plain with spinifex (Maslin 1981).

This is a species of the arid zone with its closest relative Acacia drepanocarpa F. Muell. (Maslin and Hopper 1982). Its distribution is mainly in the Pilbara from where it is recorded at Port Hedland, Yarrie, Marble Bar, Nullagine, and Mount Bruce map sheets (Maslin and Pedley 1982).

Acacia pyrifolia DC. Ranji Bush

Acacia pyrifolia is a spindly glabrous shrub to 6 m tall, with whitish branches. Phyllodes are elliptic 3-5.5 x 1.5-4 cm

generally bluish with a central midrib terminating in a spine. Spiny stipules are present. Pods are curved, papery, 6-8 cm long. This species is easily confused with A. inaequilatera (Maslin 1981) but the latter has an eccentric midrib. A. pyrifolia favours habitats which probably receive more moisture. It is a species of the arid and northern sub-tropical zones (Maslin and Hopper 1982). In the Pilbara it has been recorded from all map sheets except Bedout Island, Yarrie, Onslow, Minilya and Winning Pool (Maslin and Pedley 1982). In a floodplain area surrounding a number of dry stream beds in an area burnt 3 years earlier the tallest specimen of A. pyrifolia was measured at 6.06 m tall with a crown of 3.9 m and stem diameter of 3.5 cm. This specimen presumably missed being burnt. A. pyrifolia appears to be restricted to lower foothills and floodplains occurring on rocky or clay soils, associated with streams.

Collections: 4568, 5031

Other species associated with A. pyrifolia include: Eremophila fraseri, Triodia pungens, Triodia basedowii and E. leucophloia.

A number of A. pyrifolia have galls present on the terminal branches.

A. pyrifolia is not a dominant species in any area. Seed pods were collected for measurement (Table 29).

Table 29. Seed count for A. pyrifolia

Length of pod (mm)	No. of seeds	Average seed size (mm)
35	7	2.5
28	4	6
38	5	4
35	5	6
40	5	4
30	2	5
40	6	5
25	3	5.5
40	6	5.5
39	3	4.5

In a germination test at Newman 97 percent germination was attained at 16 days following hot water treatment. Only 2 percent germinated with no treatment (K.J. Walker, personal communication).

Acacia retivenia F. Muell.

This species is comparatively uncommon. It grows as a shrub to about 2.5 m and is distinguished by light green foliage with orbicular, hairy phyllodes. These are 3-7.5 cm long x 2.5-4 cm across, with 3-4 longitudinal nerves and a coarse, raised network of intermediate reticulate venation. Pods are flat, woody to 5 x 1.5 cm and also often hairy.

Collection: 4572

A. retivenia is found in the arid and northern sub-tropical

zones. Its closest relative is Acacia auricoma Maslin (Maslin and Hopper 1982). Maslin and Pedley (1982) record A. retivenia at map sheets Yarrie, Mount Bruce, Balfour Downs, and Edmund in the Pilbara region. It appears to favour moist sites e.g. Beard (1975) notes that it occurs in the Great Sandy Desert in gullies or run-on areas.

Acacia rhodophloia Maslin

This species takes its name from the characteristic bright red mineritchie-type bark (see description for A. monticola above). It usually grows as a spreading shrub to 4 m tall with branches ascending from the base. An undescribed variant occurs in the Pilbara which is of tree form, to 8 m tall (Maslin 1980). This grows on granite at Pilga, Shaw River (Beard 1975).

Phyllodes are linear 2-10 cm x 2-5 mm (sometimes broader) rigid and slightly curved. Pods are straight hard and brittle to 9 cm x 4 mm (Maslin 1981). In the Hamersley Range area phyllodes are narrowly elliptic 4.5-6.5 cm x 5-8 mm wide. It may be distinguished from A. stowardii with similar phyllodes by the absence of mineritchie bark in the latter (Maslin 1982).

Its distribution is in the arid, and south-western semi-arid zones. Its closest relative is Acacia nelsonii Maslin (Maslin and Hopper 1982). In the Pilbara A. rhodophloia has been

formally recorded from Mount Bruce, Roy Hill, Balfour Downs, Turee Creek and Newman map sheets (Maslin and Pedley 1982).

Acacia rhodophloia is locally common in the region, often occurring in large clumps. It is found in a number of habitats including drier hillsides and tops and the moister flats, on sand or on rocky ground. Distribution appears little affected by soil type as it grows equally well in a range of soils.

Clumps are often surrounded by **Triodia pungens** but no other plants grow near or in the denser clumps of **A. rhodophloia**. Where it is scattered its common associates are **A. aneura** and **A. pruinocarpa**. The tallest measured was 3.62 m with a crown of 2.94 m. Measurements of **A. rhodophloia** in two areas are presented in Table 30. Both sites were in an area burnt 3 years before measurement. Site 1 is on an upper hill slope and Site 2 at the base of a hill. The mean height for plants in Site 1 was 3.02 metres and in Site 2 it was 2.82 metres.

Table 30. Dimensions and spatial distribution of A. rhodophlola in clumps

	Tree	Height (m)	Crown (m)	Distance to next tree of same species (m)
Site 1	1	3.2	2.95	1.3
	2	3.33	3.4	1.88
	3	2.98	2.4	0.41
	4	2.93	1.8	1.69
	5	2.74	1.9	3.95
	6	2.34	2.0	
	7	2.72	2.3	
	8	2.94	3.5	
	9	2.42	2.45	
	10	2.62	2.85	3.78
Site 2	1	2.15	2.21	7.8
	2	2.51	1.00	0.3
	3	2.72	1.95	0.3
	4	2.67	1.90	8.2
	5	2.92	2.74	2.2
	6	3.37	2.46	3.2
	7	3.40	3.51	3.0
	8	3.52	4.55	7.5
	9	3.30	1.35	2.7
	10	3.62	2.94	

These data show that the clump with a more favourable moisture regime had individuals closer together perhaps accounting for lower overall height. However this tree appears to grow rather slowly and it must be assumed that both sets escaped the particular fire. The clumped distribution suggests that regeneration is good and usually from seed.

Acacia sclerosperma F. Muell.

This shrub favours moister sites where it may grow to 3 m or more in height. Phyllodes are lax, terete to flat more than 7 cm long, and the pods are long, broad, hard and woody with constrictions between the seed. Seeds are large and thick walled, hence the name.

A. sclerosperma is distributed mainly in the north-western segment of Western Australia from the Pilbara coast south to the Murchison. Beard (1975) records its presence with mulga on calcareous flats of Davis River, Oakover Valley and on flood out areas of the Fortescue. It is not recorded from Bedout Island, Mandora, Barrow Island, Yarrie, Nullagine, Ningaloo, Balfour Downs and Robertson sheets, all at the extremities of its main range (Maslin and Pedley 1982).

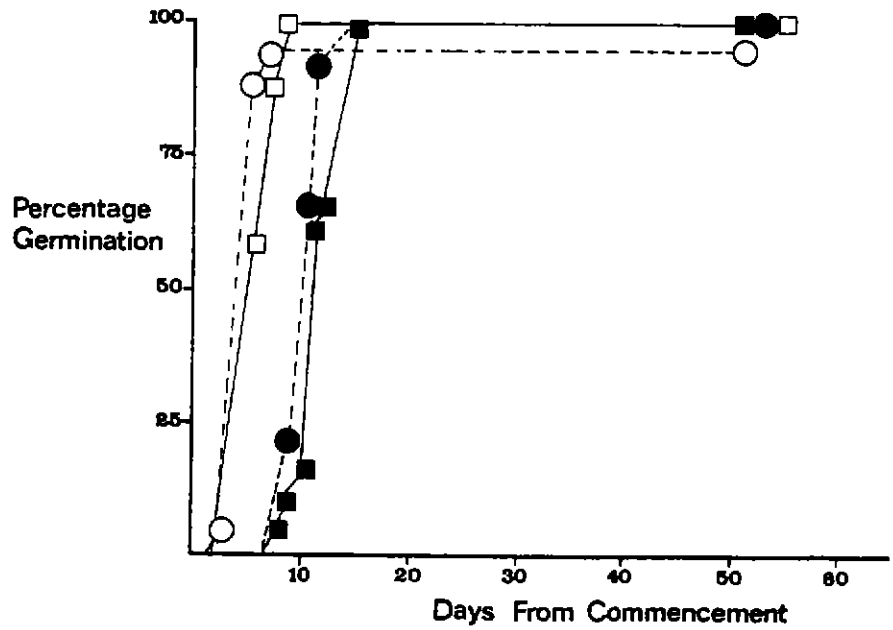
Seeds were treated in the same manner as with those of A. farnesiana using a dentist's drill to scarify the seed coat to permit germination. Seeds germinated quickly to a high viability at all temperatures (Figure 16). 100 percent germination was recorded at 10, 15 and 20 degrees and 92% at 25°C (Table 31). This is only a failure of 3 seeds to germinate at 25°C and this is possibly due to a fungal or bacterial infection which these thick, hard coated seeds are susceptible to at higher temperatures due to a gelatinous mucus associated with the seed. The rate of germination, although fast at all temperatures, varied directly with temperature (Table 31) with the rate of germination increasing with temperature. The seeds at 20 and 25

degrees reached their peak of germination in only 7 days giving them the maximum possible energy (100 percent). Untreated seed had 14 percent viability and seed subjected to hot water treatment were 95 percent viable in tests of the same batch conducted at Newman (K.J. Walker, personal communication).

Table 31. Germination Measurements for Acacia sclerosperma

Germination Measurement	Temperature °C 10	15	20	25
1. Final %	100	100	100	92
2. Days to 1	14	14	7	6
3. Germination rate	11.6	9.8	5.5	4.9
4. Peak value	7.1	8.2	14.5	17.4
5. M.D.G.	7.1	7.1	14.3	15.3
6. G.V.	50.4	58.2	207.4	266.2
7. Energy % 7/28	5	5	100	100
8. Germinative capacity %	100	100	100	92
9. Vigour	0.05	0.05	1	1.1

Figure 16. Time course of germination for A. sclerosperma



Acacia sibilanus Maslin

One record of the occurrence of this newly described species comes from the Pilbara region, 15 km south of Roy Hill Station (Maslin 1983). It mainly occurs from Shark Bay to the upper Murchison and occurs on plains and alluvial flats over limestone. This species has thread-like phyllodes, 10–17 cm long and terete. Pods are beaded to 20 cm long. The large seed (12 x 6 mm) have prominent yellow arils. The species is closely related to A. coriacea.

Acacia sphaerostachya E. Pritzel

A species of limited, coastal, occurrence, it has been recorded from Dampier and from two map sheets further north of the Pilbara (Maslin and Pedley 1982).

Acacia spathulifolia Maslin

This species occurs in coastal regions north of Perth to Yanrey, and is also present at map sheets Minilya and Winning Pool in the Pilbara (Maslin and Pedley 1982).

Acacia spondylophylla F. Muell.

This is a low spreading shrub usually less than 1 m tall. It is

distinguished by the small whorled phyllodes, 8-12 in a whorl. These are 5-10 mm long and less than 1 mm broad, straight and flattened. Pods are sticky, flat, papery 5 x 1 cm. This species is found on shallow sand or stony soil (Maslin 1981).

A. spondylophylla is an arid zone species, recorded from Port Hedland, Yarrie, Nullagine, Mount Bruce, Roy Hill and Newman sheets in the Pilbara, and also in central Northern Territory (Maslin and Pedley 1982).

Collection: 4562.

Acacia steedmanii Maiden et Blakely

This is a white stemmed shrub to 3 m tall. Phyllodes are narrow elliptic 5-10 x 1-3 cm. Pods are firm papery 11 x 1 cm. This is a species of the arid and south-western semi-arid zones. Its closest relative is Acacia validinervia Maiden et Blakely (Maslin and Hopper 1982). The nearest formal record to the Pilbara is the Rudall sheet, to the east of Balfour Downs (Maslin and Pedley 1982).

Acacia stowardii Maiden. Bastard mulga

Closely allied to A. kempeana it is a shrub to 3 m tall with linear to narrowly elliptic phyllodes 3-10 cm x 2-4 mm. Pods are to 5.5 cm in length and 4-9 mm broad, papery in texture. This species may be distinguished by its grey bark from Acacia rhodophloia but there is considerable variation in the Hamersley

Range area and Maslin (1982) suggests that two variants occur with narrow linear and broad linear phyllodes respectively. Some specimens of the latter variant exfoliate bark in a similar manner to A. rhodophloia. Acacia stowardii is a widespread species of the arid and eastern sub-tropical zones. Its closest relative is A. kempeana (Maslin and Hopper 1982). Formal Pilbara records exist for Mount Bruce, Turee Creek and Newman sheets only (Maslin and Pedley 1982).

The following collections are assigned to A. stowardii: 5009, 5041, 5051

Acacia tenuissima F. Muell.

A shrub to 4 m tall with smooth stems. Phyllodes are thick, flat, linear 6.5–15 cm long and 0.7–1.1 mm wide, ascending. Pods are papery, flat, coiled, constricted between the seeds and about 5 cm long and 3 mm wide. The aril is yellowish. Flowers are often heavily galled (Pedley 1978). This is a species of the arid and northern sub-tropical zones, with unknown affinities (Maslin and Hopper 1982). Its Pilbara distribution includes map sheets Yarraloola, Pyramid, Mount Bruce, Roy Hill and Newman (Maslin and Pedley 1982).

Collections: 4564, 5067, 5096

Although it does occur on steep hills (e.g. upper Oakover Valley - Beard 1975) largest numbers of this species seem to occur on wet flush sites, often apparently in association with A.

monticola. Similar measurements (see Table 23) were taken for A. tenuissima with individuals counted in metre squares at 5 m intervals up the slope of a flush. The density of A. tenuissima in this site was about four plants per square metre, about twice as many as for A. monticola.

Table 32. Density of A. tenuissima in wet flush

Square	No. Plants	Average height (m)
1	8	1.07
2	13	0.66
3	8	1.13
4	1	0.76
5	10	0.83 (stressed)
6	1	0.84
7	4	1.00
8	3	1.06
9	3	0.94
10	-	-
11	6	1.03
12	4	0.91
13	3	0.94
14	5	1.39 (stressed)
15	2	1.11 (stressed)
16	3	0.84 (stressed)
17	-	-
18	3	1.29 (stressed)
19	3	0.98 (stressed)
20	1	1.32

Three trials were carried out at Bentley on the seed of this species and all produced very poor results (Figures 17, 18, 19) compared with tests conducted 6 months earlier at Newman. Then viability of 89 percent was recorded, with 51 percent germinating after 12 days. The seed did not respond to no pre-treatment (K.J. Walker, personal communication).

Two trials were carried out initially and in these two tests no batch of seeds germinated to greater than 22 percent (Tables 33, 34).

Table 33. Germination Measurements for Acacia tenuissima Trial 1

Germination Measurement	Temperature °C 10	15	20	25
1. Final %	18	22	6	20
2. Days to 1	56	56	13	61
3. Germination rate	38.5	26	9.7	22.6
4. Peak value	0.3	0.8	0.5	0.6
5. M.D.G.	0.3	0.4	0.5	0.3
6. G.V.	0.1	0.3	0.2	0.2
7. Energy % 7/28	–	–	–	28.6
8. Germinative capacity %	6	14	6	– 14
9. Vigour	–	–	–	2

Figure 17. Time course of germination for Acacia tenuissima Trial 1

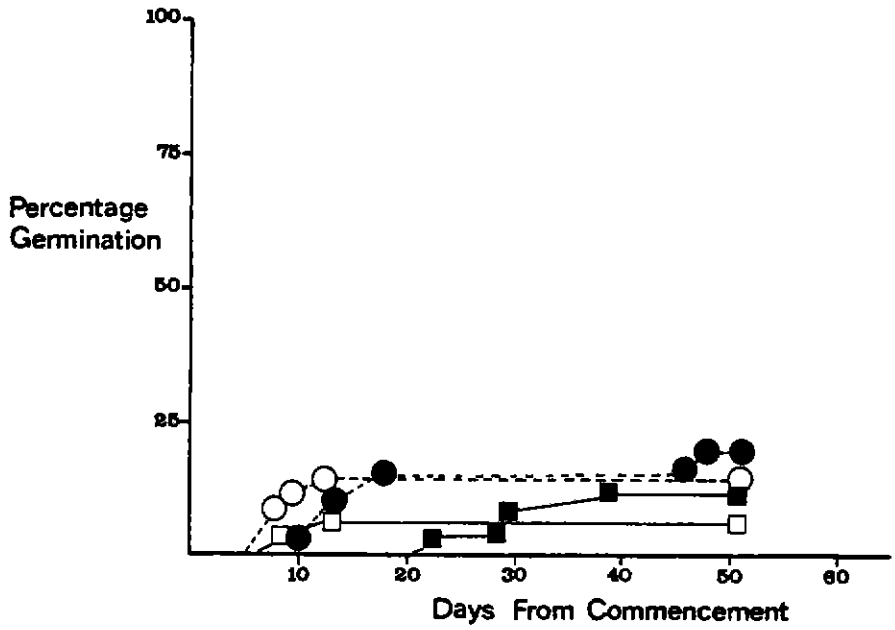
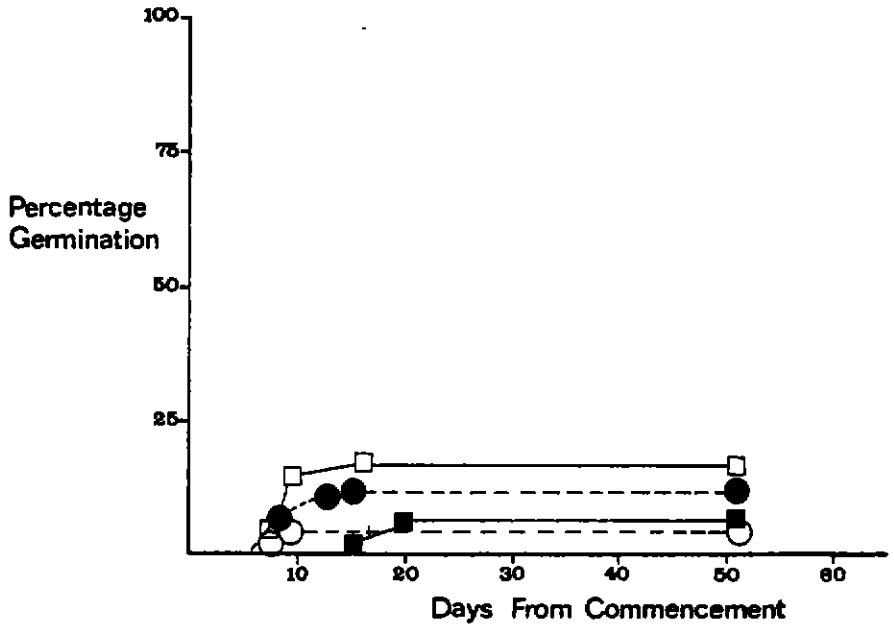


Table 34. Germination Measurements for Acacia tenuissima Trial 2

Germination Measurement	Temperature °C 10	15	20	25
1. Final %	8	12	16	4
2. Days to 1	24	16	17	8
3. Germination rate	19.2	10.5	9.0	7.5
4. Peak value	0.4	0.8	1.5	0.5
5. M.D.G.	0.3	0.8	0.9	0.5
6. G.V.	0.1	0.2	1.4	0.2
7. Energy % 7/28	-	-	25.0	50.0
8. Germinative capacity %	8	12	16	4
9. Vigour	-	-	1.6	12.5

Figure 18. Time course of germination for Acacia tenuissima Trial 2



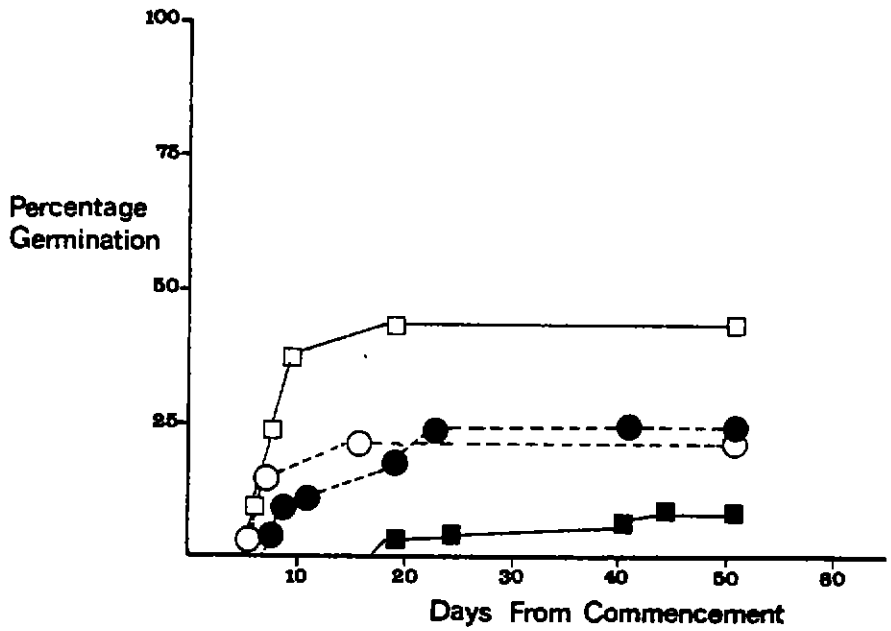
The subsequent third trial produced slightly better germination and this may be attributed to the seeds receiving a longer exposure to boiling water in the heat pre-treatment. Viability was still lower than the results attained at Newman, suggesting

poor keeping properties of the seed. The third trial (Figure 19, Table 35) shows temperature dependent rate of germination with the fastest germination at 25°C, and a great prolongation of germination at 10°C. Highest viability and M.D.G. was at 20°C (42 percent), and at this stage this appears to be the most suitable temperature for germination. Viability was greatly reduced at 25°C, but as results were poor this may not be attributable to the temperature. More work is needed on seed of this species to determine precise effects of immersion times in boiling water.

Table 35. Germination Measurements for **Acacia tenuissima** Trial 3

Germination Measurement	Temperature °C 10	15	20	25
1. Final %	10	24	42	20
2. Days to 1	44	41	20	15
3. Germination rate	34.2	14.4	8.6	7.3
4. Peak value	0.2	1.6	3.6	2.3
5. M.D.G.	0.2	0.6	2.1	1.3
6. G.V.	0.04	1	7.6	3
7. Energy % 7/28	–	9.1	52.4	80
8. Germinative capacity %	4	22	42	20
9. Vigour	–	0.4	1.2	4

Figure 19. Time course of germination for Acacia tenuissima Trial 3



Acacia tetragonophylla F. Muell. Kurara

This species is a diffuse tree to about 5 m tall. The narrow, sharply-pointed phyllodes are straight 17-25 mm long and tend to be crowded on branchlets. Pods are coiled, woody and constricted between the seed. Pods are 10 cm x 5 mm; the seeds have orange arils and can persist on the pods, but they are heavily predated by finches even when green.

Acacia tetragonophylla is a widespread species of the arid and south-western semi-arid zones (Maslin and Hopper 1982). In the

Pilbara it is reported from Onslow, Nullagine, Ningaloo, Yanrey, Mount Bruce, Roy Hill, Balfour Downs, Turee Creek, Newman and Robertson map sheets (Maslin and Pedley 1982). It occurs in valleys or flats often with mulga. It is found on neutral red earths of the Onslow Plain and appears (together with Acacia victoriae) to be replacing mulga in the Fortescue valley (Beard 1975).

In the Hamersley Range area it appars mainly in well-drained soils near water courses. In an area burnt 8 years earlier A. tetragonophylla was measured regenerating from rootstock. The largest plant had 15 shoots emerging from the burnt stem, up to 1.30 m tall and the mass of crown 1.20 m across. Some 23 stems were noted emerging from another burnt stem.
Collection: 5075.

Two germination trials were carried out on this species. One trial produced very disappointing results with only 22 percent of all seeds germinating (Figure 21, Table 37). The seeds swelled but very few germinated. Several seeds were dissected and it was found that the embryo had rotted. It is assumed that the seeds were not given the optimum heat pretreatment to break the dormancy as the same seed tested at Newman was 95 percent viable.

The other trial produced better resuls although seed viability was still low (Figure 20). Overall germination was best at 20°C which poduced the highest final germination of 56 percent (Table 36). Germination was similar at 15 and 20 degrees. Germination

rate, M.D.G. and germinative capacity were much the same at these temperatures. Response at 10°C was very poor with only 20 percent of seeds germinating.

Table 36. Germination Measurements for Acacia tetragonophylla

Germination Measurement	Temperature °C 10	15	20	25
1. Final %	20	36	56	40
2. Days to 1	31	34	37	34
3. Germination rate	15.5	16.6	12.9	14.8
4. Peak value	1.4	1.8	3.6	2
5. M.D.G.	0.6	1	1.5	1.2
6. G.V.	0.8	1.8	5.4	2.4
7. Energy % 7/28	28.6	6.6	44	38.9
8. Germinative capacity %	14	30	50	36
9. Vigour	2	0.2	0.9	1.1

Table 37. Germination Measurements for Acacia tetragonophylla

Germination Measurement	Temperature °C 10	15	20	25
1. Final %	15	23	33	18
2. Days to 1	86	91	76	83
3. Germination rate	21.2	33	35	61.9
4. Peak value	1.4	0.9	0.8	0.5
5. M.D.G.	0.2	0.2	0.4	0.2
6. G.V.	0.3	0.2	0.3	0.1
7. Energy % 7/28	76.9	38.5	33.3	100
8. Germinative capacity %	13	13	15	3
9. Vigour	5.9	3	2.2	33.3

Figure 20. Time course of germination for A. tetragonophylla (as for Table 36).

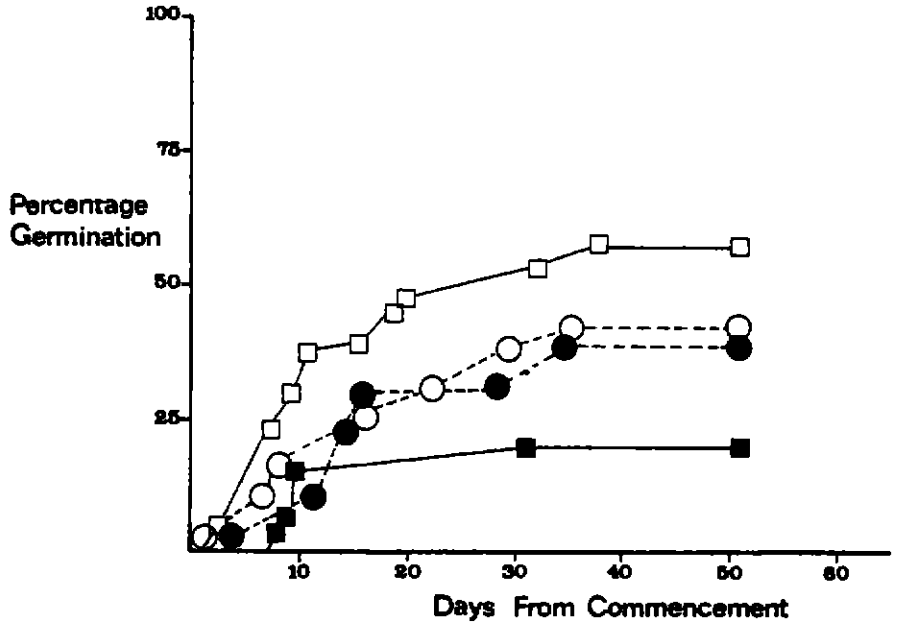
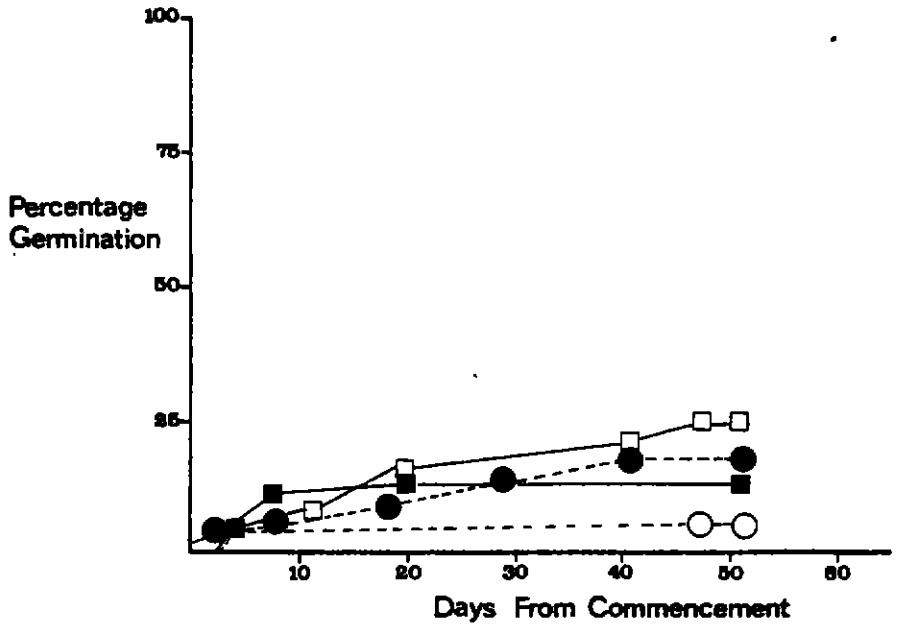


Figure 21. Time course of germination for A. tetragonophylla (As for Table 37).



A. tetragonophylla seed contains a comparatively high (9 percent in a test at Newman) proportion of soft seed which may be damaged by hot water treatment. More testing is suggested to determine an appropriate pre-treatment.

Acacia trachycarpa E. Pritzel

This species has mineritchie bark and is particularly common along creeks and rivers of the Pilbara (Maslin 1982). It is a small tree or tall shrub. Phyllodes are narrow, linear 1-3 mm wide with 1-3 nerves present.

A. trachycarpa is almost wholly a Pilbara species, with no formal records only from Bedout Island, Mandora, Barrow Island, Ningaloo, Minilya, Winning Pool, Edmund, Turee Creek and Newman (Maslin and Pedley 1982). Acacia lysiphloia is a close relative (Maslin and Hopper 1982). It is an important constituent of coastal Pindan communities in small tree thickets (Beard 1975). Collection: 5095.

Acacia translucens A. Cunn. ex. Hook.

This species is mainly of northern tropical and sub-tropical distribution. It is recorded from coastal map sheets in the Pilbara from Winning Pool to Mandora and inland to Marble Bar (Maslin and Pedley 1982). It is generally a shrub of 1-2 m and forms locally important communities in the Pindan; it is also found on the Abydos Plain (Beard 1975).

A. tumida F. Muell. ex Benth.

A shrub or tree to 7 m tall with a bushy crown often with white branchlets. Phyllodes are falcate, tapered at both ends, 10-16 x

1.2-2.2 cm. Phyllodes have 3 or more prominent nerves and are often whitish. Pods are straight sub-woody 10 x 0.8 cm (Maslin 1981). In the Hamersley Range area it is confined to watercourses coming away from the ranges or at the sides of upper gorges.
Collection: 5027.

It is widely distributed across north-western Australia in the arid, northern sub-tropical and northern tropical zones. Its closest relative is **Acacia difficilis** Maiden (Maslin and Hopper 1982). Records exist in the northern Pilbara for all sheets except Bedout Island, coastal locations west and south of Roebourne and west of Mount Bruce. It is absent south of latitude 23°S (Maslin and Pedley 1982).

Acacia validinervia Maiden et Blakely

A white-branched shrub to 3 m tall similar to **A. steedmanii**. Phyllodes obliquely curved, 5-13 x 1.5-5 cm, leathery. Pods to 14 x 1 cm, papery.

This species of spinifex sand plain and rocky hills is mainly confined to central Australia's arid zone (Maslin and Hopper 1982). Formal records for the Pilbara are for Mount Bruce and Roy Hill map sheets only (Maslin and Pedley 1982). On the ranges it is usually a small shrub (Beard 1975).
Collections: 4570, 5122, 5174.

A. validinervia is reported to be capable of sprouting from

adventitious buds and may thus be able to grow after fire (Maconochie 1982).

Acacia victoriae Benth. Bohemia bush

This species is a straggly tree to 5 m (and much taller elsewhere) often well branched from fairly low down. The foliage is light green. Phyllodes are flattened and thin with a prominent mid rib, 2-8 cm long x 2-10 mm wide, with a terminal point. Spiny stipules are present. Pods are 3-8 cm long, 1.2-2.0 cm wide, papery and raised over the seed. Pedley (1979) notes that it is related to A. pachyacra and that it favours fine-textured soils (Pedley 1978). Its closest relative is A. dempsteri F. Muell. of southern central Western Australia (Maslin and Hopper 1982).

It is widespread through Australia's drier country in the arid, eastern and northern sub-tropical, south-eastern semi-arid, north eastern tropical, and eastern tropical/temperate overlap (Maslin and Hopper 1982).

In the Pilbara it is present in most areas but has not been recorded for Bedout Island, Yarrie, Marble Bar, Nullagine, and Robertson sheets (Maslin and Pedley 1982).

A. victoriae has high seed numbers in soil and low resprouting

ability (Hodgkinson and Griffin 1982). Seed are globular (0.38 g) and respond reasonably well to dry heat (Maconochie 1982). Beard (1975) has noted that it appears to be replacing mulga in the Fortescue Valley. It has some potential for reclaiming degraded pastoral areas further south (Fox and Davies 1983).

Two germination trials were carried out on Pilbara seed of this species. Overall germination was poor the maximum germination being only 52 percent and 60 percent respectively. This may have been due to sub-optimal treatment with hot water, as seed of the same batch tested at Newman was 84 percent viable (K.J. Walker, personal communication). The seeds at 15, 20 and 25°C germinated early with the seeds at 10°C germinating about a week later. Rate of germination was temperature dependent with the seeds at 25°C germinating the fastest (Tables 38, 39).

The two diagrams (Figures 22, 23) present conflicting results as to which temperature produced the best percentage of germination. Graph 19 shows 25°C having the highest viability (52 percent) with the other three temperatures grouped between 34 and 38 percent, inferring that 25°C is the best temperature. In the second trial whilst the seeds at 25°C germinated to a similar value as in the first trial, the seeds at the other three temperatures increased some 16 percent to group between 56-60 percent viability.

Table 38. Germination Measurements for Acacia victoriae Trial 1

Germination Measurement	Temperature °C 10	15	20	25
1. Final %	38	34	34	52
2. Days to 1	24	24	12	26
3. Germination rate	11.1	7.6	5.8	7.7
4. Peak value	2.5	2	4	5.5
5. M.D.G.	1.6	1.4	2.8	2
6. G.V.	4	2.8	11.2	11
7. Energy % 7/28	15.8	76.5	76.5	61.5
8. Germinative capacity %	38	34	34	52
9. Vigour	0.4	2.2	2.2	1.2

Acacia victoriae seed appears to possess similar characteristics to A. tetragonophylla. At Newman 14 percent of seed germinated with no pretreatment and may be classed as 'soft' (K.J. Walker, personal communication). Scarification may have achieved better results (see Fox and Davies 1983).

Figure 22. Time course of germination for Acacia victoriae Trial 1

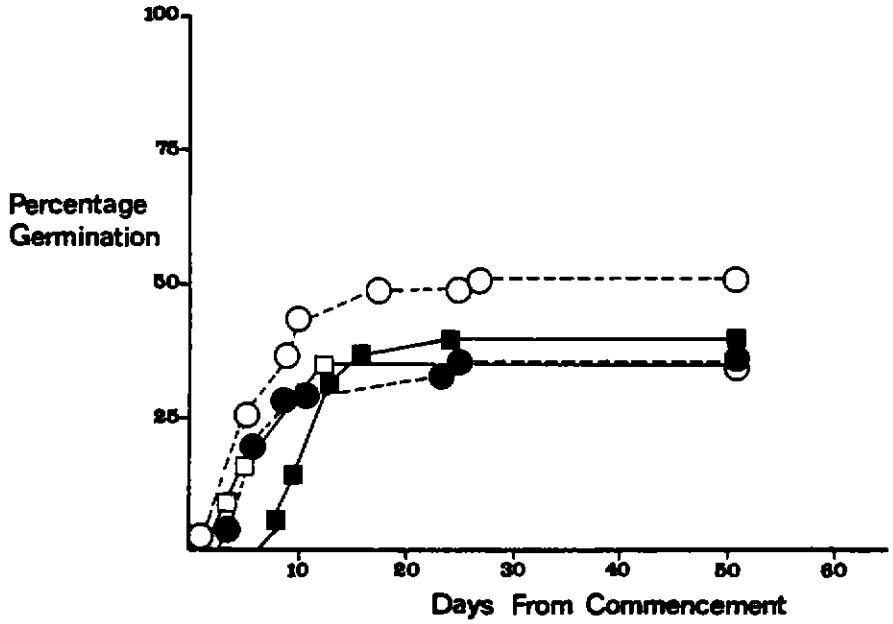
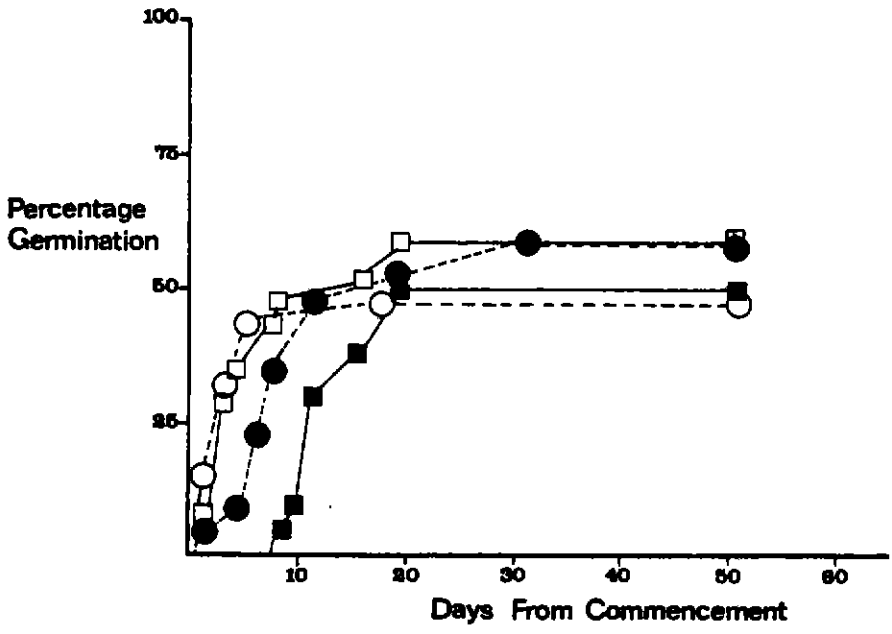


Table 39. Germination Measurements for Acacia victoriae Trial 2

Germination Measurement	Temperature °C 10	15	20	25
1. Final %	56	60	60	46
2. Days to 1	64	64	20	17
3. Germination rate	17.7	11.2	6.4	3.9
4. Peak value	2.6	4.8	9.3	10.6
5. M.D.G.	0.9	0.9	3	2.7
6. G.V.	2.3	4.3	27.9	28.6
7. Energy % 7/28	-	60.7	70	91.3
8. Germinative capacity %	50	56	60	46
9. Vigour	-	1.1	1.2	2

Figure 23. Time course of germination for Acacia victoriae Trial 2



Acacia wanyu Tindale

A bushy shrub or tree to 4 m tall often found on rocky soil near watercourses. Phyllodes terete 7 to 17 cm long and silvery grey-green. Pods constricted between seeds, woody and wrinkled when dry, to 17 x 1 cm. This species is allied to A. cuthbertsonii (Maslin 1981).

It is a species of the arid zone, confined to the general Pilbara area, but not widespread. In the Pilbara sheet sets under consideration it has been formally recorded from Yarraloola, Wyloo, Balfour Downs, Edmund, Turee Creek and Newman and two outlying sheets each to the south and east (Maslin and Pedley 1982).

Acacia xiphophylla E. Pritzel. Snakewood

This species is almost entirely confined to the north-west corner of Western Australia. It has not been recorded from coastal sheets Barrow Island, Onslow and Ningaloo, but is present to the east of these to 118°30'E, and south to 24°S. It is present further south than the sheets under consideration (Maslin and Pedley 1982).

It is a gnarled spreading tree to 4 m. Phyllodes are silvery, leathery, rigid and straight more than 8 cm long. Pods are 21 cm x 1-1.5 cm with large seed.

The species is locally common on lowlying alluvial flats and is associated wih mulga in the Fortescue Valley. It occurs on neutral red earths of the Onslow Plain with Triodia pungens and T. wiseana and the wattles A. tetragonophylla and A. victoriae (Beard 1975).

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