



**ASSOCIATION OF SOCIETIES FOR GROWING AUSTRALIAN
PLANTS**

**ACACIA STUDY GROUP NEWSLETTER
No. 95 May 2005**

Dear Members

It is membership renewal time again and I will include renewal forms with this newsletter where necessary. Subscription rates remain the same at \$5 if the newsletter is sent by email, \$8 for a posted hardcopy in Australia and \$12 overseas.

Please keep in mind that I will be giving up the leadership next year. May 2006 will be my last newsletter. Is anyone willing to take over? I will be very happy to contribute articles and any help I can to a new leader.

I seem to mention the weather in every newsletter and this one is no exception. It appears that the 'big dry' is upon us. Queensland has just experienced its driest March quarter in over 100 years – 130 years in some areas. Unfortunately the weather forecasters can see no relief in sight.

It is hard to believe that until recently water tanks were illegal in Brisbane and only the odd old tank stand is still around. I gather that was something to do with the idea that all tanks housed breeding mosquitos. The ruling has been reversed now with rebates paid to people who install tanks and talk of tanks being mandatory in new houses. Of course, in Brisbane the water collected from roofs will not be drinkable because of pollutants on the roofs but it will curtail the waste of drinkable water on gardens and for flushing toilets etc.

Our first tank arrives tomorrow.

For now, I have stopped growing acacia seedlings and am no longer watering seedlings at Booie. Water levels in all three dams are low and we are entering our driest time of year. Six very large (over 1m in diameter) Angophoras within sight of the house have died recently and I presume this is something to do with the prolonged dry. Fortunately at this stage younger specimens look fine. It will be very interesting to see which species cope until the next rains.

We had a brief respite a couple of weeks ago with 56 ml of rain falling. Again I was amazed at the toughness of the locals. Half dead looking plants suddenly revived and sprouted substantial new growth. The really frustrating part is the survival of some of the weeds. Just as I think the lantana has finally died we have rain and the odd bush revives. However the numbers are falling.

It is time to review the past year and give sincere thanks to the members who have supported the group with letters, articles, photos and trials of seed. Also to those who have taken the time to collect, clean and send seed to the seed bank.

Last Year

Membership

Membership remains at fifty individual members and nine group or branch memberships. This does not include the state branches or their office bearers who receive newsletters.

Photo Library

The scanning of the photo library has been completed and it now includes over 1000 images of acacias.

Acacia Displays

Again, a number of individual members have participated in displays of acacia flowers in spring and the ASG presented a display at the Redcliffe Botanic Gardens at the beginning of August.

Seed Testing

Three members have sent in results of seed testing and Bonnie Addison-Smith completed her comparison of the vigour of seedlings from old and recent seed. Many thanks to these members.

Thanks also to the members who reported wrongly labeled seed. This continues to be a problem.

Seed Bank

Two bar fridges were acquired to house the seed bank.

127 lots of seed were sent out and 12 fresh lots were added. These figures no doubt reflect the effects of the 'dry'. Certainly I was unable to harvest any worthwhile amounts of seed this summer.

Letters and emails

In some cases I have included my reply or comments - in italics. Any further comments would be much appreciated

Heather Brownlie , Sunshine Coast, Qld

I'm an Honours student at the University of the Sunshine Coast and my research project is on the Conservation Genetics and Population Ecology of the Vulnerable *Acacia attenuata*, which is endemic to SE QLD. I am an SGAP member and just found out about the Acacia Study Group and wondered whether anyone in this group may have some knowledge of this species and where it might occur in SE QLD. I have been investigating distributional data for the species which I obtained from the QLD herbarium, but I understand that a lot of valuable local knowledge is out there and hasn't been documented, and so I was wondering if your group knows anything about this species. Any assistance would be greatly appreciated.

Werner Kutsche, SA (a new member)

In response to the article on Extra Floral Nectaries, I have observed bees buzzing around my *Acacia menzelii* when there have been no flowers present. Also observed on *Dodonea subglandulifera* at various times of the year.

On a different topic, I have *Acacia araneosa* growing which flowers quite regularly throughout the year. I also have *Acacia rivalis* growing nearby. I have collected seed from the

Acacia araneosa and germinated them while they were still a bit green. The resulting seedlings which are currently about 10cm tall have flattened phyllodes rather than terete ones, indicating probably a hybrid. I have heard that hybrids between these 2 species do occur. Would it be plausible that in order to get pure *Acacia araneosa* offspring, I should prune off all *Acacia rivalis* buds/flowers long enough for the *A araneosa* to set seed ?? (this may prove a bit difficult as the *A rivalis* is now 3-4m tall).

*Your idea of pruning the *A .rivalis* is the way to go. Your hybrids sound interesting. I would love to know what they are like when they start to flower. It seems to me that a good acacia hybrid is what is needed to bring acacias back into the public eye and favour. On principle I frown a little on hybrids but one must look at what they have done for grevilleas.*

Second email from Werner

I am not sure where I am going to plant these hybrids as I don't wish to compound the hybrid problem with *araneosa*. I have attached an excel file which has a list of *Acacia* sp which I am growing on my property at Ponde. The number in the first column has the following format : yyymm### where yy is the year and mm is the month of the oldest plant. The last column indicates whether sp is still alive. An A or X means alive.

The property is about 13 acres in area and is located just south of Mannum on a south facing hill. The soil ranges from a sandy loam to limestone with pH approx 8.5-10. Need to do some proper tests to get a more accurate fix on the pH range. The plantings are arranged into areas of Australia e.g. Sandplain WA, Goldfields, SA mallee, Central Australia, Top End etc. Indigenous acacias to the property are *A. ligulata* and *A. oswaldii*. When we bought the property, we had a 50-100yr+ *A. oswaldii* alive. For quite a while this was the only source of shade on the property. Unfortunately it died not long afterwards as it had already succumbed to @\$@#!# borers. There is a ring of younger plants around the parent tree. These flower from time to time and do set seed. Other species nearby include *A. hakeioides*, *A. rigens*, *A. sclerophylla* and *A. nyssophylla*.

This should give you some idea of what we are doing with acacias. I have also included a photo of *Acacia strongylophylla* in bud. (see photos)

Genus	Cat.	Species	Status
Acacia	0204073	acanthoclada	Dead 04/01/03
Acacia	9404037	acinacea	A
Acacia	0103047	acuminata	A
Acacia	9804040	adsurgens	Dead
Acacia	9604022	amblyophylla	X
Acacia	9507087	anaticeps	Dead 23/12/96
Acacia	9510052	anceps	A
Acacia	9407062	aneura	A
Acacia	9710051	aphylla	X
Acacia	9503035	araneosa	A
Acacia	9310047	argyrophylla	A
Acacia	9804070	ashbyae	X
Acacia	0106002	bailyana	A
Acacia	9407118	beckleri	A
Acacia	9507086	bivenosa	Dead 23/12/96
Acacia	9604036	blakeyi	X

Genus	Cat.	Species	Status
Acacia	0204071	longiphylloidea	Dead 05/04/2003
Acacia	9510050	macrodenia	A
Acacia	9805049	maitlandii	Dead 16/1/99
Acacia	9905177	melvillei	A
Acacia	9407103	menzielii	A
Acacia	9506018	merinthophora	X
Acacia	9611015	microbotrya	A
Acacia	0305120	microcarpa	A
Acacia	0404010	minyura	A
Acacia	9307020	montana	Dead 21/08/94
Acacia	9610109	multispicata	Dead 08/01/97
Acacia	9707046	murrayana	A
Acacia	9905069	notabilis	A
Acacia	0203010	nyssophylla	A
Acacia	9610104	oncinophylla	Dead 07/03/97
Acacia	9309022	papyrocarpa	A

Acacia	9704001	burrkittii	A		Acacia	9507017	paradoxa	A
Acacia	9904020	calamifolia	A		Acacia	9610015	pellita	Dead 19/01/97
Acacia	9707045	cibaria	A		Acacia	9505062	pendula	A
Acacia	9507082	citrinoviridis	X		Acacia	9505063	pendula	A
Acacia	9706006	confluens	A		Acacia	0204040	peuce	A
Acacia	9610051	continua	A		Acacia	9309036	pinguifolia	A
Acacia	9706036	coriacea	A		Acacia	9407032	podyralifolia	Dead 26/2/95
Acacia	9906028	covenyi	A		Acacia	9610171	prainii	Dead 07/03/97
Acacia	0302020	craspedocarpa	A		Acacia	9706041	pruinocarpa	A
Acacia	9512001	cretacea	A		Acacia	9309023	pycnantha	A
Acacia	9504073	cyperophylla	A		Acacia	9610017	pyrifolia	X
Acacia	9604011	denticulosa	X		Acacia	9610092	quornensis	A
Acacia	0409013	dictyoneura	A		Acacia	9308026	retinodes	Dead
Acacia	9610069	dictyophleba	Dead 18/10/96		Acacia	9610047	rhetinocarpa	A
Acacia	9706072	dodonaefolia	A		Acacia	9707044	rhigiophylla	Dead 07/02/98
Acacia	0301001	dolichophylla	A		Acacia	9504051	rigens	A
Acacia	9504042	estrophiolata	A		Acacia	9510041	rivalis	A
Acacia	9509009	gillii	A		Acacia	0304034	rossii	Dead 01/01/2004
Acacia	9509013	glandulicarpa	A		Acacia	9506010	salicina	A
Acacia	0103038	glaucoptera	A		Acacia	9504050	sclerophylla	A
Acacia	9507072	gonophylla	X		Acacia	9507083	sclerosperma	X
Acacia	9610094	gracilifolia	A		Acacia	0304046	semilunata	Dead 22/11/2003
Acacia	9706103	gregorii	X		Acacia	9604017	spathulifolia	X
Acacia	0409028	hakeoides	A		Acacia	0301003	spilleriana	A
Acacia	0303052	harpophylla	A		Acacia	9610064	spinescens	A
Acacia	9604042	hermiteles	X		Acacia	0104068	stenophylla	A
Acacia	0008026	holosericea	Dead 24/11/00		Acacia	9706016	strongylophylla	A
Acacia	9509004	imbricata	A		Acacia	9510051	subtessaragona	X
Acacia	9806001	iteaphylla	A		Acacia	9503047	tarculensis	A
Acacia	9706026	jennerae	A		Acacia	9710001	tetragonaphylla	A
Acacia	9604069	jibberdingensis	Dead 08/01/97		Acacia	9706032	tetragonophylla	A
Acacia	9610014	juncifolia	Dead 23/12/96		Acacia	9504078	verticillata	Dead 7/1/96
Acacia	0008021	kempeana	Dead 24/11/00		Acacia	0304063	vestita	A
Acacia	0103112	ligulata	A		Acacia	9505020	victoriae	A
Acacia	9404040	lineata	A		Acacia	9510011	wattsiana	A
Acacia	9507039	linophylla	Dead		Acacia	9310071	wildenowiana	Dead
					Acacia	9907017	wilhelmiana	A

This list should be very useful to growers with similar conditions and will be added to the ASG archives.

Max McDowell, Vic

Over the years I have found quite a high percentage of mislabelled seed batches from various sources including ASG and 'a named commercial source'. These included seeds labelled "A. *delphina*" (actually A. *littorea*) , "A. *drewiana*" (actually A. *lateriticola*), "A. *cheelii*" (actually A. *debilis*) which I planted in my garden before I identified it and is now being annually pruned back to about 6 metres high), and "A. *rossei*" (actually A. *conferta* which flowers from March to May).

Selecting plants for propagating and planting on the basis of the published HxW ranges and flowering seasons is a bit of a gamble, unless one is familiar with those characters of the

original plant or population from which the seeds or cuttings were obtained. I have been astonished to read in the Encyclopaedia of the potential size of some species which I have regarded as small, while the size range listed for others is so large as to make the information virtually useless as a basis for deciding what to grow where. The listed flowering seasons for many species are often 2-4 times longer than the actual flowering period of individual plants, because flowering seasons differ from plant to plant, population to population and year to year. I have grown some plants which flowered well outside the published flowering periods for the species. I wrote an article for Bruce Clarke about *A. jibberdingensis* (identity verified) , which in my garden flowered from Feb to August, instead of the listed seasons May-Sept (Elliot & Jones) and June-Oct (Grieve). What a useful plant - although rather large, and not very tolerant of regular hard pruning!

It would be useful to know for each species and/or variants of such species what is the typical duration of flowering on individual plants from year to year. It could also be a useful project to select for cloning individual plants from a batch or population which flowered earlier or later than most

Yes, quoted sizes are a problem. It does make it hard to recommend species. I recommended A. gittinsii as a small plant as it is listed at 1-2 m. Imagine my horror when plants cultivated on a dry ridge grew to 3-4m. Getting all this information together with soil types is the answer I guess.

I have found a huge variation in flowering time and duration since the weather up here has become so unreliable. Some plants held off flowering until rain came or in some cases didn't flower at all. My A. leptoloba are supposed to flower in Dec/Jan but this year held off until March when we had some good rain. Cloning plants which flower out of the 'normal' season would be great. I find the spring flowering so overwhelming that I don't really appreciate individual plants the way I do when they flower out of season.

Second email from Max

On cross-checking your 2003 Seed List, I remembered, that it was "*A. chinchillensis*" (ASG) not "*A. cheelii*" that proved to be *A. debilis*. I shall have to check on the year of my supply to see if it was post 1991.

Have you checked the status of *Acacia drummondii 'grossus'*? It is not mentioned in the Flora of Australia and has no taxonomic status as a subspecies, unless Bruce Maslin has advised you otherwise. I have grown this seed and had a plant in my garden - quite a robust bush which needed frequent heavy pruning to keep it small enough for my location, and which has since died accordingly.

A.drummondii 'grossus' does not appear to have any status and I should not continue to list it as though it has. However members continue to request seed and seem to find it sufficiently different to be worth growing along with other 'varieties'. I will mention its uncertain status in the seed list in future.

Another acacia which I tried to sort out with Marion was bought about 1975 as *A. beckleri*, but which had smaller flower heads and bigger racemes than the *beckleri* which I knew and have growing. I still have a plant, cutting-grown, from the original, flowering time June-July. I had thought it was *A. gladiiformis*, but the published flowering time for the latter is said to be October-December, which makes that I.D. a bit dubious. There are buds on the plant already, so I shall try the Wattle CD. Other seed batches which I have grown and which

appear to have been wrongly identified were labelled *A. rostellifera* and *A. cupularis*. I displayed a vase of the latter at the Acacia Pollination Symposium in Melbourne in 1983, and Bruce Maslin said "It's not *A. cupularis*".

This problem of misidentification of acacias is a very big one. I have mentioned in the newsletter a couple of times that one should not trust the labels. I know quite a lot of seed in the ASG seed bank is wrongly labeled. Unfortunately where people will let me know the plant doesn't look' right' I rarely find out how different it is or what it actually is (a variant or a different species). As a result I have ended up with a lot of seed with queries. It would be very time and space consuming to grow and check all of these.

Thanks very much for your info I will take note.

Bob O'Neil, Vic

Wattles continue to exercise the full life cycle. I planted out another dozen plants recently, in the meantime a number have passed on or are looking seedy and will be removed once they have either flowered or perhaps die beforehand. The mild dry weather here has suited many plants and growth has been superb, especially with the newer plants. Already there is significant flowering so we anticipate a top show this season. Visitors expecting that wattles flower in the spring are surprised with the current show. A *drummondii* in its various subspecies is coming along nicely. At a guess we would have something like 200 plants, I do not really know and it is not really a worry.

Jeff Irons, UK

The issue of "The Garden" referred to in your latest Newsletter was a gigantic advert for a seminar about Australia that the Royal Horticultural Society will be holding on March 16th. It worked, because all 150 places were sold by the end of January. Although not a member of the RHS, I shall be attending. If you would like it, I'll send you an Acacia biased report. Incidentally, I think that membership is more likely to be 300 000 than 3000 000. The Australasian Plant Society will be offering a free packet of seeds to everyone attending the seminar. *Acacia costiniana* and *A. nano-dealbata* will be among those from which to choose. Each seed packet is attached to a piece of paper with a description and illustration of the species.

(*My apologies to members for that blue in number*)

I'm not too sure about the utility of acacias in British gardens. Mike Nelhams is Head gardener at Tresco, a garden in the Scilly Isles. They are off the Cornish coast and your nearest approach to their climate would probably be north west Tasmania. All kinds of plants grow there that would normally be expected to grow in gardens in the French or Italian Rivieras.

If the kind of winters that we experience now continue, then a wide range of acacias should be possible. However one has to remember that only a few miles inland, winter is still cold. Also our hinterland is not the Australian Centre but Siberia and cold winds do still blow. Winter soil temperatures are much lower than in Australia and they co-incide with maximum soil wetness. I live in what is supposedly one of the milder parts of Britain. Twenty years ago such species as *frigescens* and *kettlewelliae* would not overwinter. Recent attempts to overwinter such species as *hamiltoniana* and *flexifolia* have failed. It ain't easy! Another limiting factor is the small size of our gardens. Current government guidelines are that house should be built at 25 to 50 per hectare including roads and footpaths. You can calculate what size of garden that gives. Small plants are essential and they must give value for that space. However small

gardens in dense housing will mean that there is shelter and a high winter night minimum. So perhaps there is more scope than my doubting mind allows. With the British gardening public wedded to disposable plants (it turns over 25% of its plants every year) the future may lie in pot plants. There is already a sizeable trade in disposable 'mimosa' (*A. dealbata*) plants at an exorbitant £25-50 each. It would not be difficult to sell (say) *A. acinacea* as a pot plant.

My local botanic garden has just planted out the only seedling from the *A. blayana* seeds that you sent me along with 3 each of *A. paradoxa*, *terminalis* and *verniciiflora* that I collected at high levels. I'm sure that it would be pleased to grow any more high level known origin acacias that you can let me have.

(*I'm afraid I know very little about the acacias of the colder areas of Australia having never lived down south and not traveled there since I became interested in acacias . The nearest I come to cold tolerant species are those that grow on the granite belt in Queensland but they would rarely experience cold and wet at the same time. You do mention that you can't keep A. flexifolia going even though it grows down south as well.*

My attitude is to try anything from a similar climate (summer rainfall here) and hope to find the odd species that is very adaptable. This is OK if you have the space. There have been some notable successes eg species from Cape York that cope well with the below zero temperatures of Kingaroy but of course there have been many more failures.)

Can anyone help Jeff with seed from species that may be successful in the UK.

Ian Simons, Qld

Ian, who is a new member, is interested in setting up a permaculture operation with his chooks using acacia seed as part of their diet

I have been testing the seeds of various wattle species for years; feeding them to the assembled girls, seeing if they'll eat them. Have had little success.

They will eat the seeds of the local sally wattle. This is quite a turn up. It has meant that far from cutting these wattles out, I now treat them like honoured guests.

Does any other member have information on this topic? It does seem a great opportunity to utilise acacia seed.

New members

Welcome to new members

Ester Brueggemeier, Vic

Werner Kutsche, SA – see letters and emails

Ian Simons, Qld – see letters and emails

Kingaroy and Booie

Occassionally I mention Kingaroy and Booie. Kingaroy is a town in SE Qld just on the coastal side of the Great Divide. It usually has an annual rainfall of 770mm.

Booie is a nearby district where we have a property.

Black and white photos – coloured via email

Nos 1, 2 and 3 Another hybrid?

Seed was collected from acacia plants growing in Toohey Forest in Brisbane by Greening Australia Volunteers. The plants would not key out as a local species and it was eventually discovered that the SGAP had undertaken planting of ‘foreigners’ in the area many years ago. The plants keyed out to *A. uncifera* which has a limited distribution in the Pentland district of Qld and 500 km to the south. I planted some of the seed and the resulting seedlings were of two distinct types.

No 1. These seedlings appear to be indistinguishable from those of *A. uncifera*.

No 2. Seedlings with a totally different appearance.

No 3 *A. conferta* which also grows in the area and on appearances could be the second parent of the seedlings in photo **No 2.**

These apparently hybrid seedlings are very vigorous and have done well in the dry infertile soil of Booie as does *A. conferta* which is a local there. *A. uncifera* in contrast has not performed well.

I am hoping the seedlings will cope with the increasing dry. They have an attractive branching habit at this stage and I am looking forward to their flowering. Unfortunately, unlike *A. conferta*, they have not flowered at an early stage.

As mentioned above I don’t really approve of hybrids but can’t help thinking of what they have done for grevilleas.

No 4 *A. strongylophylla* This photo sent in by Werner Krutsche shows the striking foliage of the species.

According to the ‘Wattle’ disc it occurs primarily in the rocky ranges of central Australia. It grows in shallow red soil on rocky slopes, in valleys and near watercourses, in tall shrubland with other acacias and eucalypts.

No 5 and 6 Larva and pupa of a ladybird beetle.(Family Coccinellidae) These are part of a large family of good guys. Only the members of one genus eat plants (not acacias anyway). All the rest are predators, both as adults and larvae. They eat other insects such as aphids, mealy bugs and scale insects as well as some mites. Some species are important in the biological control of Australian scale insects that have become pests overseas.

No 5. A ladybird beetle larva which had been feeding on mealy bugs on an acacia.

No 6 A ladybird beetle pupa attached to a phyllode.

Nos 7, 8 and 9 A species of mealy bug (Family Margarodidae, Genus Monophlebulus) which is common on acacias. In the last newsletter I mentioned ants protecting a variety of plant sucking bugs which produce honey dew. Any busy collection of ants on a plant is well worth investigating for this reason. At present the most common groups of insects paying their protection money to ants in honey dew are leafhoppers and mealy bugs. In some cases the insects are so small that they could easily be overlooked if it were not for the presence of ants.

No 7 Young mealy bugs and their attendant ants.

No 8 Maturing mealy bugs. At these concentrations they obviously cause problems to the host plant and are not easy to remove by scraping off.

No 9 A reproducing female adult. These are wingless. Juveniles can be seen under the edge of the body.



Coloured Plates

Acacia amblygona This may be a shrub to 1m but is commonly cultivated in a prostrate form. As can be seen in the photo this form can easily be lost in long grass but in a garden setting it can be an attractive ground cover.

The phyllodes are sessile, short and prickly and the flower heads occur in pairs or singly in the axils along the stems. It flowers late winter to spring.

According to the 'Wattle' disc it grows from Temora in NSW to the Expedition Range and Peak Downs in Qld. There has also been a report near Ravensthorpe in WA.

It grows in eucalypt forest or mallee communities, in stony skeletal soils, in undulating ridge country or on the footslopes of mountain ridges.

It grows around Kingaroy in poor shallow soil. It is frost hardy and so far copes with dry periods. A prostrate plant grew and flowered well on a very inhospitable road verge.

Pl 1 *A. amblygona* - prostrate form

Pl 2 *A. amblygona* - close up of phyllodes and flowers

A. dictyoneura This is a small shrub up to 1.5m high with about a 1m spread.

It has small phyllodes (to 1.5mm) and the flower heads are single or in pairs in the axils along the stems.

According to the 'Wattle' disc it is known only from drainages of Pallinup and Fitzgerald Rivers in SW of WA. It grows in loamy or sandy soils.

The plants in the photos were grown from seed in the ASG seed bank and in general fit the description on the 'Wattle' disc. The flowers however are larger than the 5mm stated there. These plants are growing at Kingaroy in infertile, shallow, sandy soil. This is a summer rainfall area as opposed to the winter rainfall area where they are native. In spite of this they are looking very healthy and seem to be unpalatable to the local insects. This is an attractive species which appears to be a very adaptable and is frost and drought hardy.

Pl 3 *A. dictyoneura* - habit

Pl 4 *A. dictyoneura* - close up of phyllodes and flowers

A. montana This species is said to grow from 1 to 4m high. These plants are just over 1m and all I have grown are multistemmed. The phyllodes are up to 4cm long and the flower heads occur singly or in pairs in the axils along the stems.

According to the 'Wattle' disc *A. montana* occurs in SE Australia from the Eyre Peninsula in SA, through Vic and NSW to Stanthorpe in Qld. It is most common on the inland slopes of the Great Divide and the adjacent plains in NSW and Vic.

The specimens I have grown at Booie in Qld have done well in the sandy, infertile soil. They survive dry periods but along with many of the locals look a bit off colour until the rains come. Another attractive frost and drought hardy acacia.

Pl 5 *A. montana* - habit

Pl 6 *A. montana* - close up of phyllodes and flowers

A. fimbriata dwarf Plants under this name have been available in the nursery trade for some time and at one stage they were quite popular. Presumably they are cutting grown. They differ from the wild form in more than size. The habit is very dense and bushy and the flowers are cream in colour rather than the normal golden.

This plant is about 1.5m in height and is growing in black, cracking soil.

I believe the form lost some popularity because it didn't always remain dwarf. I have never grown it and would like any comments from members.

Pl 7 *A. fimbriata* dwarf – habit

Pl 8 *A. fimbriata* dwarf – close up of phyllodes and flowers



1.



2.



3.



4.



5.



6.



7.



8.