Zealand and Australia, since these flowers are magnificently beautiful with long-lasting qualities.

LATHYRUS

New Zealand has produced various cultivars of *Lathyrus odoratus* with long stems, and there is demand for *Lathryus* both in Europe as well as in the United States. Florists are familiar with them, and the new color variation and combinations that have been developed in New Zealand should be promoted and used more as an export crop.

In conclusion, New Zealand and Australia can offer the world market these flowers that are common in these two countries, but are exotic and exquisite flowers to the world market. New Zealand and Australia should concentrate on becoming specialists and leaders in these crops, rather than trying to develop crops that are already grown and marketed by other countries.

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PROPAGATION OF CHILEAN BELLFLOWER

WAYNE D. WILLIAMS

Whakatane District Council
Parks Department
Private Bag, Whakatane

Chilean bellflower (*Lapageria rosea* Ruiz & Par.) a not so distant relative of Australasian flora, both geographically and botanically has been a fascination for me, often bordering on an obsession. This, in conjunction with some other work which grew out of it, was prompted by a note from L. H. Bailey, "propagated by layering, cuttings, and seed."(2)

The work on Lapageria rosea (red and pink), and L. rosea var. *albaiflora* Hook., was undertaken between 1981 and 1984 in Dunedin, New Zealand.

SEED

The red flower seems to self pollinate and set seed unassisted during warm conditions, although the amount of fruit set and size (which I take to be indicative of effective pollination), was greatly

improved by personal assistance.

Pollination and Timing. Collection of anthers proved to be the easiest method, collecting only those anthers from which the pollen was noticeably beginning to shed easily. This was taken as a sign of readiness. I also waited for a period when there would be warm, settled weather for a number of days, the reason being, I believe, that pollen tube growth and fertilization is assisted under such conditions. Pollination in the cold seemed to reflect this theory with often less fruit set, and those which set were of an inferior size and atypical shape.

Stigma receptivity. It was noticed that the optimum time for fertilization seemed to coincide with stigma receptivity. This I took to be when the stigma appeared to swell slightly and a clear sticky secretion appeared. This appeared to be reflected subsequently also by fruit set, as stigmas that were pollinated, which had not exhibited the secretion, showed a corresponding lack of fruit set or incomplete fertilization. Thereafter I assumed this was the case.

Methods. In applying pollen a small paint brush (camel hair) was used but, prior to dabbing the pollen on, where possible the flower and stigma were warmed by holding the flower in my hand and exhaling into it, and more importantly on to the stigma for 30 to 60 seconds. Then the pollen was applied. When the stigma was well covered the warming was repeated; this I dubbed "the Hot Breath Technique". In warmer districts this may not be needed.

Fruit harvest. Fruit was harvested after taking up to nine months or more to mature. Size and colour were indicative of ripeness. Generally the fruit began to lighten as they ripened. Ripe fruits were generally 50 mm long when picked.

Fruit processing and seed sowing. Immediately after picking, ripe fruit was opened over a fine sieve and washed, removing skin and pulp; seed was then sown in a John Innes seed mix. I used clay pans, plastic trays, and seed boxes to sow in, depending on volume and container availability. Terrazole fungicide was included in the mix.

Seed was covered by 1 to 2 times its own thickness with soil and tamped flat, then covered with a single layer of washed quarry dust, watered in with a fine nozzle and placed on a hot bench at 20°C, then covered with glass. On another occasion I used washed river sand to cover the soil mix. Seed was kept very moist until germination, then watered as required. Germination began four to five weeks after sowing and was usually complete in 12 weeks. Sowing was undertaken in 1981, '82, '83 and '84, and in some years a number of sowings took place. Germination percentages averaged 90%. In 1982, when some seed was sown in a cold frame, erratic germination took place over four to seven months and a lot of seed decayed. Germination was approximately 20%. I also found an old fruit which had shrivelled and shrunk considerably and sowed the seed

on the hot bench. Germination was only 5%.

Recently I found a Thompson and Morgan catalogue (8) which recommended to soak old seed for three days, changing the water three to five times per day.

The pink flower seemed to self pollinate only intermittently when unassisted, but with my 'Hot Breath Technique' pollination was much improved and easy.

The myth of the white. The white-flowered cultivar leaves me still somewhat confused. Word of mouth and Aldworth (1) states the need to be cross-pollinated from a different white flowered plant. This I was not able to do with another white plant due to the unavailability.

I was seemingly able to effect pollination on the white plant with its own pollen using the dreaded "technique" on tagged flowers. Anthers were emasculated and pollen was taken from the resulting pool. Isolation of flowers after pollination was not done due to public location. The red-flowering plants were some distance away and no great insect activity was observed, hence it was assumed that red to white crosses were not occurring on the white-flowered plant I was working with.

Further work would need to be undertaken to isolate white stigmas to ensure no cross pollination took place with the red plants and that would prove the white plant I worked with was self-fertile.

A comparison would be needed to compare the white-flowered plant I used with another to compare purity. A visitor felt that the particular plant I used had a slight pinkish tinge on some flowers. Burbidge (4), says he has had white flowering plants produced from seed taken from flowers pollinated by artificial means under glass, but he does not mention pollen donors and mother plants. However he does mention reds, whites, and pinks, which seems to suggest a red/white cross. As the plant I used may be a result of a red/white cross, this may have an ability to be self fertile as is borne out by the pink.

Progeny have not flowered to date. This will help to resolve some of the conjecture.

Handling seedlings. Seedlings were potted into peat pots and polythene bags (75's), after second leaves appeared with as little root damage as possible, using an ericaceous soil mix, then grown on under cover with a minimum temperature of 12 to 15°C.

CUTTINGS

Media, containers and mist. I tried several rooting media with different proportions of shredded pine needles and sand ranging from 4 to 1, down to 1 to 1, and in reverse. Cuttings were placed on a hot bed at 15°C, 20°C, 25°C, or were unheated, with and without mist. Several containers were tested, e.g. pots, plastic, terracotta,

and hygiene trays. Cuttings were placed under plastic tents on heat, or in a cold frame with a plastic tent, and without heat. The same treatments and proportions were tested with peat as a rooting medium.

Methods. I took random cuttings from plants with red and white flowers, cut with a knife early in the morning. Cuttings were placed into moist paper then into plastic bags. They were subsequently dipped in a captan/benomyl solution, then dried slightly and either hormone-dipped in 0.1%, 0.5%, or 0.8% IBA, or not dipped in hormone.

A variety of types of cuttings were taken, i.e. basal cuts, nodal, and internodal, old wood, previous years' and current wood cuttings, with and without leaf area reductions; usually 2 to 3 node cuttings, tips being pinched, though to no avail.

Leaf-bud cuttings also seemed to die readily in all seasons. In summary, no particular method gave any indication of the cuttings rooting.

During theses times I took consolation in, and was inspired by a well known Dunedin plantsman's (Mr. Chas. McLachlan) description of seeing a box of Chilean bellflower cuttings, healthy as ever with the roots emerging from the bottom in a tangled mass when he was a young man. His honesty and integrity need no vouching, yet he has no recollection of how this was attained. On leaving Dunedin and being in close proximity to good stock, I have pondered this greatly and have come to some conclusions.

Having such profuse stock, I have never used mother plants cultivated under glass, nor thought of the need to have, as they grew so well outside. Later I was to find that McMillan-Browse (7) suggests growing stock plants under glass as well as using leaf-bud cuttings, this possibly being an avenue worth further investigation. I also never used young plants and here again lies another avenue of investigation, i.e. whether juvenile cuttings root better than mature ones.

Burbidge, 1876 (4), confirmed one thing for me, that "Cuttings of *Lapageria* do not form plants readily. They root in about nine months, but it is essential that ripened growth only be selected. Insert them in boxes of sand/earth in a warm glasshouse temperature". He then goes on to say, "plant out and train near the glass". Thus I was thrilled to have this confirmation at least. They can be rooted from cuttings if the mother stock was under glass.

LAYERING

The plant often did this naturally, when stems which trailed down were covered by mulch. I did this in spring and autumn. Internodes that had been nicked produced a greater number of nodes with roots. It is important not to be too anxious in lifting and separating at internodes. When I did this a couple of times roots

were well developed, but shoots were not, and it proved to be premature because when the plants were placed in peat pots they subsequently died without any further root development or shoot growth.

Layering being the traditional method of propagation and the only method of cultivar promulgation, there is quite a lot of literature from the northern hemisphere on this, with stock plants growing under glass, either in pots or in, preferably, specially prepared beds which confine the rootstock (5,7). It was suggested that strong second wood coiled around a pot, box, or bed be used.

MacSelf (6) suggests to nick the internodes and peg down firmly in either spring or autumn, then be patient as this process is notoriously slow. When ready, sever new plants from the mother plant and place them singly in small pots of light peaty soil.

MERISTEM CULTURE

In Chile there has been work done on meristem culture, particularly with plants producing white flowers which are becoming very rare in the wild.

In New Zealand I know of one group of people who are investigating this avenue of propagation, so no doubt in the not too distant future the resulting stock will be available.

CONCLUDING REMARKS

Hopefully many of the cultivars of the past can be successfully relocated and propagated.

Some of these cultivars are:

1. 'Alba', pure white and very chaste. (6)
2. 'Ilseman', larger flowered, more vigorous, brighter and more freely flowering. (5)
3. 'Nash Court', soft pink, slightly marbled flowers, [1st Class Cert, RHS, 1884. (1)]
4. 'Rubra', red. (6)
5. 'Splendens', rich rose. (6)
6. 'Superba', rich brilliant crimson. (6)
7. 'Warnham Court', rosy red, mottled with greyish white, [1st Class Cert, RHS, 1897. (9)]

In parting, imagine Dr. Wilfred Fox, who when travelling in Chile in 1932 found a form of *Lapageria* where the flowers were striped lengthways with crimson (3) and had not been introduced into cultivation.

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PROPAGATION OF HYDROPONICALLY-GROWN LETTUCE

C. J. ALLISON

Hortisystems, Inc.
4034 S.W. 328th Street
Federal Way, Washington 98023, USA

MICHAEL D. McKAY

Waterfield Farms[1]
Route 1, Box 453-C
Rapidan, Virginia 22733, USA

Abstract. Hydroponically-grown Butterhead-type lettuce is propagated from pelleted seed. Cultivars are selected for superior growth and yield under the environmental conditions available as well as the marketability of the finished product. Seed is sown in mineral wool starter cubes and germinated in a dark, temperature and humidity-controlled chamber. Seedlings are grown under supplemental light until large enough to transplant to gutters where they are grown to harvestable size. The nutrient film technique (NFT) of hydroponics is employed during the grow-out phase.

INTRODUCTION

After a year of pilot production in about 5,000 square meters of greenhouse, the Weyerhaeuser Company entered commercial production of hydroponically-grown lettuce in October, 1984. About three hectares of double-poly greenhouses in central Virginia produce five to seven million heads of Butterhead-type lettuce annually. Known as Waterfield Farms, the facility is located within 300 kilometers of several major population centers including Washington, D.C., Baltimore, and Philadelphia.

[1] Waterfield Farms is a division of the Weyerhaeuser Company, Tacoma, Washington, 98477