# ALSTERWORTHIA INTERNATIONAL

## THE SUCCULENT ASPHODELACEAE JOURNAL

*Haworthia* 'Ollasonii'

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# Selected *Haworthia* cultivars

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Photographs by Jos Verhoeven of plants in Cok Grootscholten's collection

Cultivars of *Haworthia truncata* and its hybrids are seemingly without limit. Many are based on varied leaf-end patterns with accentuated combinations of the basic facial features of the species. Others are selected colour forms, including variegation and different leaf arrangements resulting from hybridisation, some of which are featured in this short article.

Variegation is an attractive feature of many haworthias and *Haworthia truncata* is no exception. Figure 1 shows a plant with white variegation, which is essentially confined to the sides of the leaves. Figure 2 shows more extensive pinky-yellow variegation and the lack of chlorophyll in the leaf ends influences the colour. The leaf ends are also influenced by lack of chlorophyll in the beautiful orange-yellow coloured *H. truncata* in figure 6. *Haworthia truncata* 'Lime Green', figure 3, is a plant selected for its unusual lime-green colour.

In figure 4 distichous leaves are replaced with a rosette indicative of the influence of another species, hybridisation. The leaves are pink variegated. Figure 5 also illustrates a hybrid with *truncata.* Thick, truncata-like leaves are curved, have rounded ends and are in the form of a rosette under the influence of the other (unknown?) parent. The leaves have an olive-green colour - compare with *H.* 'Lime Green'.

*H. truncata* 'Frosty Tips' figure 8, page 4 is another hybrid selected for the (mild) frosty appearance of the leaf tips. As this is a cultivar of a hybrid it should be named *Haworthia* 'Frosty Tips', not as a cultivar of one of the parents. The arrangement of the leaves suggests that there is a battle between a distichous leaf arrangement and a rosette arrangement. If you look carefully at figure 8 you should be able to detect a longitudinal arrangement of somewhat offset, distichous, outer leaves with a rosette forming in the centre with latitudinal, somewhat offset, distichous leaves. *H. truncata* 'Sandra' (correctly *Haworthia* 'Sandra' for the reasons stated above) figure 7, page 4 is a complex hybrid. The parents are [*H. emelyae* v. *major* (Garcia Pass) x *H. pygmaea* (crystalline form from Klein Brack] x [*H. truncata* x *H. maughanii* (Oudtshoorn)]. The cross was made by Cok Grootscholten. The selection illustrated was named 'Sandra' after his eldest daughter. Cok propagates this clone by leaf cuttings.

The yellow variegated *H. correcta* (now *emelyae* though this name is also in dispute) with green leaf ends with yellow to white reticulation makes an attractive plant, figure 9, page 4.

The creamy-white variegated *H. pygmaea,* figure 10, page 4, though not without its attractions, does look a little insipid in comparison with the yellow variegated *H. correcta,* but the selected *H. pygmaea,* figure 11, page 4 with rugose leaves, blushing red, with whitish facial lines is eye catching.

*Haworthia* "H 16", figure 12, page 4 is an out-of-this-world hybrid, in form not too dissimilar from *Haworthia* 'Sandra'. Both have extensive, but different bold, leaf adornments which have great visual appeal.

As well as admiring cultivars or their photographs, people like to have information about the plants, the parentage of hybrids, how variegation occurred etc, but because cultivar names can be published almost anywhere, including in short lived catalogues, in any language, with the briefest information and there is no central record, locating information and checking names is difficult, if not impossible. If you are able to supply any additional information for any of the plants illustrated do please let the editor know.

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Fig. 12 (below)
*Haworthia* "H 16"

# A GLASS AND A HALF
## (or why is it so)

Field observations concerning co-occurrence and naturally occurring hybrids within the genus *Haworthia* Duval.

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Why is it so that, after thousands of years of cohabitation, the genus *Haworthia* does not present us with many homogeneous 'species' of hybrid origin? The ease of hybridisation, or lack of any incompatibility mechanisms, has been mentioned (Cumming 1984, 1999). There are no demonstrable physical or genetic barriers, at least within each of the three recognised subgenera (Bayer 1984), other than perhaps flower periodicity and pollination syndrome. The only remaining barrier to help maintain species integrity is geographic separation; how little distance is required? The following are a few observations made over the last four years.

**Alicedale.** A few kilometres E. of Alicedale there occurred a population of *H. cooperi*, which had a leaf shape approaching *cymbiformis* (a *cymbiformis* with the colouration of *cooperi* Bayer (1999)). They grew in cracks in large rock-slabs mostly finding shade among tussocks of grass. To the west of the main body of this population is a population of *H. angustifolia* v. *altissima* separated by a distance of only two hundred and sixteen metres. During 1999 four visits were made, between February and the last week of October. At all times a number of *H. angustifolia* v. *altissima* were to be found in flower, the *H. cooperi* flowered mid October to the first week of November, thus there was an overlap in flowering times. A reasonable search of the area was undertaken and no site-specific hybrids were observed within or between the populations. It was found that four single plants of *H. cooperi* that were located at varying distances from the main body, 40 metres to the W, 67 metres to the SW, 57 metres to the NE and 69 metres ENE, had failed to set any seed indicating lack of fertilisation or visitation by any bearer of gifts.
The average in the main population is 84% pollination compared with zero percent for plants separated by as little as forty metres. This would point to non-flying pollinators such as ants, rather than bees, at this locality. It has been observed that many *H. coarctata* can be found growing in or on small anthills and that 'often' ant nests can be found among the roots of *H. cooperi.* Since writing this in 1999, the above population no longer exists. It is the only population that I know of in the Eastern Cape to have been completely wiped out by commercial collection.

| Percentage of seed capsules formed in main population | | | |
|---|---|---|---|
| Sample | No. of flowers | No. seed capsules | % |
| 1 | 17 | 16 | 94 |
| 2 | 25 | 18 | 72 |
| 3 | 22 | 20 | 91 |
| 4 | 19 | 15 | 79 |
| 5 | 24 | 19 | 79 |
| 6 | 25 | 22 | 88 |
| 7 | 18 | 16 | 89 |
| 8 | 20 | 16 | 80 |
| 9 | 21 | 19 | 90 |
| 10 | 18 | 16 | 89 |

**Brandekraal.** North of Brandekraal, NW of Kareedouw, on the slopes of the Joubertskraal River valley, a few *H. fasciata* were found among a large population of a robust *H. viscosa.* The distances between *H. fasciata* and *H. viscosa* were as little as two metres. A few large clumps of what were obviously hybrids between these two plants were found along with a few smaller plants that displayed characteristics more approaching *H. viscosa.* The distance between the hybrids and the nearest *H. fasciata* was twelve metres, but only a few centimetres from *H. viscosa*. *H. fasciata* was in flower in late November. Flowering time is given by Scott as November/ December. A few *H. viscosa* were also in flower. Flowering time is given by Scott as July/ August.

**Ribbonkop**. A large population of *H. reticulata* occurs approximately five hundred metres from a small population of *H. herbacea.* The *H. reticulata* are to be found in large clumps on an exposed NW facing slope of a hill and the *H. herbacea* on a low ridge in S, E & N aspects in the shade of low bushes. There is an overlap of flowering periods by approximately two weeks. The intervening area between the populations is not conducive to either of these haworthias. Being flattish without much vegetation to afford shelter, no hybrids could be found in this area nor within the *H. reticulata* population in the small amount of time spent in this area. However at the NE corner of the *H. herbacea* population there were a few plants that appeared to be *H. reticulata* as well as a number of obvious hybrids between these two species. This conclusion could be arrived at because of the distinct morphology and coloration of *H. herbacea* flowers, which was lacking in the hybrids seen. The overall plant morphology was intermediate between the two populations.

**Coetzeespoort** west of Oudtshoorn. Here *H. mucronata* and *H. blackburniae* cohabit within one or two metres of each other on a steep SW facing slope. After much searching one plant of intermediate morphology with roots similar to *blackburniae* was found. It happened, but only once?

**Grootriver**. Some kilometres to the WSW of Ladismith there are populations of *H. mucronata* v.

*inconfluens*, *H. arachnoidea* v. *setata* and *H. arachnoidea* v. *nigricans*. These grow together, side by side, under the same low bushes or are separated by no more than a metre. Flowering times are given by Scott (1985) as October-November for the first mentioned and November-December for the last mentioned, thus we have these three species in close contact flowering together, yet no discernible hybrids could be found. It has been stated that, being of hybrid origins, seed cannot find conditions suitable for germination and growth. This seems a comment without much foundation, as it is unlikely the offspring would be more demanding than the parents that occupy the same locality. To this one can add that usually there is robustness etc. due to 'hybrid' vigour rather than hybrid degeneracy, which could occur if the plants were very closely or only extremely distantly related.

**Huntsdrift.** Here we have two populations, one of *H. gracilis*, the other of *H. tenera*, one to the NW and another to the SE, separated by three kilometres and the Great Fish River. Outwardly these populations are indistinguishable. The only tangible difference is in flowering times. The SE population flowers four weeks after the other has ceased. This has been observed to be the case over a four-year period both in habitat and in cultivation. The NW population has been found to be 'more difficult' in cultivation than the other.

From the aforementioned it can be seen that there are many opportunities for interspecific hybrids to occur where cohabitation exists, which, in itself, is not all that rare an occurrence, though not common. In the examples given there are overlaps in flowering periods and in some populations odd plants flower outside the 'normal' time.

The observed Ladismith situation should have resulted in a stabilised monomorph, but it has not. There must, therefore, be a barrier in place to preserve species identity. At this stage of knowledge, the only one has to be that of vector specificity. There must therefore be a vector specific pheromone analogue or other attractant produced by the flower. Can we therefore conclude that in general haworthias are pollinated by non-flying insects, most likely ants, that are attracted to a species by vector specific pheromone and that the occasional interspecific hybrid that is found is caused by some occasional non specific pollinator. I believe this to be the case in stapeliads, but probably not for haworthias, as all I can see pollinating all my haworthias outside are solitary bees!

At Huntsdrift are we starting to see 'speciation'? Does this show that there is generally little or no interchange of genetic material between populations and that each population given time will evolve/develop less 'similarities' to each other, glory be a new species? Is this what has happened in the Gamtoos River Valley with all the 'gracilis' derived species? Which route should we take in the taxonomic treatment of this group of plants, one with a 'super' species with 101 varieties or one with many species. Can we find an intoxicated fortune teller?

Conclusions ??

**References**


BAYER MB 1982 The New Haworthia Handbook
BAYER MB 1999 Haworthia Revisited
CUMMING D 1984 The affinities of *Haworthia bruynsii*
CUMMING D 1999 New nothogenera proposed for four trigeneric hybrids within *Aloaceae*



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**Policy**

To promote and facilitate the distribution of information on subjects relative to the genera of the Asphodelaceae family without favour. Articles are normally published in regular issues of this journal, Alsterworthia International, but special issues can be produced at the request of authors for subjects which require more detailed coverage, including more photographs than can be accommodated in one issue of the journal. The special issues will be financed by Alsterworthia International.

In order to keep down the selling price, special issues will be produced in the same style and format as the journals i.e. strong gloss A4 paper with a soft cover. They will normally be sold at about cost price to members and made available to the public at cost plus a margin. Good quality at a low price seems to be an effective way of distributing information widely. This was certainly so with Special Issue No. 1 by Ingo Breuer, which had three printings to meet demand.

The major article *Bulbinella in New Zealand,* free to members in this expanded issue, was also published as Alsterworthia International Special Issue No. 2. ISBN 0 9534004 3 3. Twelve A4 pages with larger photographs. Price £4 inclusive of p & p.

# PUBLICATION OF TWO NEW CULTIVARS

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Fig. 13. *Haworthia* 'Ruby Star' H.C.K. Mak n.cv.

***Haworthia* 'Ruby Star' H.C.K. Mak n.cv.** [HAM 1474]
(*Haworthia mirabilis* v. *badia* x *Haworthia retusa*)

As an observant reader of this journal, you may already be very familiar with this cultivar [Alsterworthia International 2(1)8)]. It is a hybrid sent to me from Japan by Mr. Kobayashi. A large-growing and solitary *Haworthia retusa* is thought to be one of the parents. Another parent is a nice, big form of *Haworthia mirabilis* v. *badia*. Overall the hybrid looks like a *retusa* with extremely large windows. The "*badia*" character is reflected by its leaf tips and reddish brown colour in full sun in summer. Each rosette can grow to more than 10 cm across without any offset. Its leaves are about 3cm wide, 4 cm long and 2.5 cm thick. There are up to 12 whitish lines running towards the tip of the leaves with bristle about 6mm long. The window area is slightly rough. Like its parents, it is quite slow-growing. As it is more or less solitary, propagation is best achieved by leaf-cutting. Several plantlets can be produced from a single leaf within 1-2 years. This cultivar is named for its reddish brown colour (Ruby) and its shape (Star).

***Haworthia* 'Rose Green' Hort. ex H.C.K. Mak n.cv. [SPT 1021]**

In 1996, I obtained a plant (ABCN 3978) named as *Haworthia truncata* x *Haworthia asperula* from Abbey Brook Nursery (UK). Two years later I obtained an identical plant named as *Haworthia* 'Green Rose' from Peter Bent, the curator of the J.R. Brown collection for The Succulent Plant Trust (SPT). Although recognised by C.L. Scott, *Haworthia asperula* is widely considered as a doubtful name. Most commonly, *Haworthia asperula* is applied to those large, rough forms of *Haworthia magnifica.* This cultivar is one of the nicest *truncata* hybrids. A mature plant may reach a size of 8 -10 cm across and with numerous offsets. Each rosette looks like a green rose with leaves resembling rose petals. The leaf tip is windowed and with a bristle of about 2 mm long. It stays green even in strong light. Leaves are rough and very thick, 1-1.5 cm. When grown in small pots, it offsets readily. In larger pots it grows bigger, but is slow to offset. This cultivar is widely grown and distributed and hence deserves a proper name. However, no cultivar name has been formally established for it. As "Green Rose" has long been used, it would be best to retain it as the cultivar name, but that name is not allowed in that form under Art. 17.13 of the 1995 ICNCP. I therefore name this cultivar 'Rose Green'.

Fig. 14. *Haworthia* 'Rose Green' Hort. ex H.C.K.Mak n.cv.

# Variation within *G. carinata*

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Ernst van Jaarsveld endeavoured to sort out the multitude of previous names and confusion within the genus *Gasteria* in his 1992 revision (Aloe 29(1)). He rightly points out that much of the earlier confusion has come about from naming species based on minor vegetative characteristics, describing plants from live rather than herbarium specimens and the chameleon nature of the species.

The chameleon nature of *Gasteria* is well known to most of us. We have probably all observed that many *Gasteria* look quite different in their juvenile form, when compared to their adult form. Well-known examples of this are *G. acinacifolia*, *G. batesiana* and *G. pulchra*. These have tubercle covered, strap like leaves arranged distichously while juvenile, but in the adult form the leaves form a rosette, are smooth (except *G. batesiana*) and become cylindrical (*G. pulchra*) or triangular (*G. acinacifolia* and *G. batesiana*). Juvenile leaves of *G. batesiana* can also be up to two thirds longer than those of the adult plant. *G. nitida* var. *nitida* is another well-known changeling. The juvenile form typically looks like *G. nitida* var. *armstrongii* - being distichous, dark green, unpatterned, with tubercles and distichous leaves. However, as an adult, the plant forms rosettes with larger, smooth, triangular leaves patterned with green splotches. In fact, most of the rosette forming *Gasteria* look different in their juvenile forms. The key message is that it often takes five to seven years for many *Gasteria* to reach the beginnings of their adult form. Therefore, naming a plant that has been observed in cultivation for a shorter period than this is fraught with hazards.

Another occupational hazard gasteriaphiles have to contend with is the variation in the plants themselves along with the variation that different cultivation regimes can bring about. We have probably all seen the larger than normal plants of many species that good care under cultivation can bring about. I have a few *G. acinacifolia* and *G. excelsa* that I thought were quite large in their pots, but they more than doubled their size when I put them in the garden. Conversely, placing *G. pillansii*, *G. batesiana*, *G. bicolour* and *G. carinata* in the garden commonly results in plants becoming far more compact, often more than halving their size and coming to look quite different from their hothouse cared for originals. These effects should not be surprising. They simply mean that the larger plants can grow to their maximum size with a free root run outside of the confines of their pots while the other plants revert to a more 'natural' form in the presence of higher light intensities and a less regimented feeding/watering regime.

While all Gasteria are subject to growing larger under reduced light conditions, *G. carinata* seem to be particularly affected by this condition. This leads to the situation where the same plant grown under different light and cultural conditions forms a variety of shapes, sizes and characteristics. To compound the problem, *G. carinata* is also one of the most variable species in the genus, so for a number of reasons there is a natural desire to differentiate them, as many are particularly attractive. Van Jaarsveld, acknowledging this variation, has named the following as varieties in their own right – *G. carinata* var. *carinata*; and var. *retusa*; and var. *verrucosa*; and var. *glabra*; and var. *thunbergii*. He also recognised a number of local variations and forms and distinguished them based on their locality, such as 'Kykodie', 'Mossel Bay', 'Malgas', 'Infanta' and so on. However, even here a degree of care needs to be taken. A simple example is the 'Infanta' form. There are perhaps four or five very distinctly different var. *verrucosa* forms that have been collected within 20 km from the town of Infanta (e.g. Kg729/71, 730/71, DMC 4224 & 4234). Only one of these actually matches the description of the 'Infanta' plant that Ernst van Jaarsveld describes (e.g. EVJ 8906). So simply having a plant with a label that says it is from Infanta is no guarantee that it is the one and only form from 'Infanta.'

Relative consistency, in terms of little variation, amongst *G. carinata* appears to occur only in a couple of varieties, such as the variety *thunbergii* and the variety *retusa*. In some respects it is disappointing that there is little interest in the genus *Gasteria.* If *Haworthia* folk were to have looked at this species, there would probably be quite a number of *Gasteria carinata* that, in all probability, would be named as varieties or even species by now.

To demonstrate the variation among the varieties of *verrucosa*, in a more practical sense, I hope to show a number of the forms in cultivation in upcoming editions of Alsterworthia International.

**Can you help?**

Now in its third year, Alsterworthia International has come a long way. Improvements have been made as more subscribers and authors have joined. More can always be achieved, particularly if income continues to increase. With greater income more photographs etc and more pages can be included.

Anything you can do to encourage people to join will be very helpful. Please direct your friends/clubs to our agents, our web site http://www.cactus-mall.com/alsterworthia/index.html or to the editor (page 6). Leaflets (obtainable from Harry Mays) can be supplied by e-mail, or post in the absence of e-mail. One leaflet is enclosed. Review copies of Alsterworthia International can be sent to editors who require them.

# Conservation, International Trade and the ISI

Harry Mays
International Succulent Introductions (ISI) agent for the European Union

**Conservation.**
Conservation is a very desirable objective. There is an urgent need not only to prevent the destruction of habitats and the flora and fauna associated with them, but also to use the skills of botanical gardens, nurseries, collectors etc to propagate plants. Propagation, particularly of documented plants, provides an increasing supply to satisfy international demand and, as a consequence, helps to reduce the pressure on habitat plants.

Laws and rules to promote conservation are necessary and policing of them is necessary, but all too often bureaucracies erected to administer and police them become obstacles to conservation rather than aids. They are ponderous, they are inflexible, they deal with the letter of the law rather than the principles, they produce conflicting interpretations, they provide a working framework for prolonged "legal" discussion. It all becomes times consuming and expensive for those who wish to trade in plants and taxpayers and conservation do not get a good deal either.

**International trade.**
By definition, CITES listed plants are the most vulnerable from a conservation point of view, but international trade in nursery propagated CITES plants, which is of major importance in countering the destruction of habitat populations, is frustrated by bureaucratic procedures. The number of nurseries engaging in international trade has declined greatly since CITES introduced control by permits.

**International Succulent Introductions.**
Only one botanical garden has continued to propagate documented plants, including CITES listed plants, for the international market, with a different plant list each year. That botanical garden is the Huntington, which distributes plants through its International Succulent Introduction (ISI) programme. Alas, this will not continue. The Huntington's John Trager states that "due to the excessively burdensome permit process we are no longer able to ship CITES plants overseas." CITES listed plants will now be available from the Huntington only in the USA, but non-CITES plants including those propagated from documented stock can still be exported. As aloes are CITES listed, those made available by the ISI, many of which are propagated from documented stock, will no longer be available outside the USA, but all the other genera of the Asphodelaceae family, including the popular haworthias and gasterias, will be.

**International Succulent Introductions 2003 plant list.**
The full 2003 ISI list for the European Union may be viewed at, and down loaded from < http://www.cactus-mall.com/isi/index.html >. It may also be obtained as a file attached to e-mail from Harry Mays. E-mail: hmays@freenetname.co.uk. A printed copy may be obtained by sending a SAE for UK addresses or an addressed envelope and one Intentional Reply Coupon for other EU addresses to Harry Mays, Honorary ISI Agent for the EU, Woodsleigh, Moss Lane, St Michaels on Wyre, Preston, PR3 0TY, UK. Non-EU residents please see < http:://www.huntington.org >.

Three haworthias on the 2003 ISI list may be of interest to readers. One is a new cultivar, the other two are species with documented parents.

***Haworthia* 'Grey Salt' ISI 2003-28**
The slow growing and slowly offsetting *Haworthia truncata* with hard, truncate, distichous leaves with parallel faces has made a contributions to many haworthia hybrids. It is one of the parents of *H.* 'Grey Salt', fig. 15 page 10. The other is *H. angustifolia,* a somewhat variable and totally different plant made up of a rosette of elongated, more or less vertical leaves with a propensity to offset. *H. angustifolia* contributes its tendency to offset tempered by the slow nature of *H. truncata.* In other words it offsets slowly! The leaf forms of the two parents combine to produce clean, greyish-green foliage resembling a lushly gown *Ariocarpus scapharostrus.* Fine white papillae near the leaf tips appear crystalline, but in addition they seem to exude salts toward the apex leaving fine mineral deposits on older leaves. This along with the epidermal colour suggested the cultivar name for this hybrid.

The parents and the cultivar have strong root systems. Careful, controlled watering is required to avoid rot. If you have a plant affected by rot, all is not lost provided you can save a few leaves or thick roots free form rot. You can trim them to achieve this. Before you pot them up, let the leaves dry for a week or so depending on the weather, but pot up the roots with the cut end just above compost level tight away. With time and a degree of luck both leaf and the root cuttings will produce offsets.

***Haworthia sordida* Haw. var. *sordida* ISI 2003-29**
*Haworthia sordida* var. *sordida* has hard, rough, more or less vertical leaves in the form of a rosette. The colour is mainly charcoal grey, but according to growing conditions it may have a reddish to blackish-grey appearance. It is slow growing and it offsets sparingly. Quicker growth cannot be encouraged by greater applications of water, but rot of the thick, white roots certainly can be. Careful watering is required to avoid rot and good light is required to retain/promote the leaf colour.

*Haworthia sordida* Haw. var. *sordida* ISI 2003-29, fig. 16 have been produced from the controlled pollination of plants collected about 60 km. ESE of Steytlerville, Eastern Cape, South Africa, where it occurs in arid areas.

Fig. 15. *Haworthia* 'Grey Salt' ISI 2003-28

Fig. 16. *Haworthia sordida* Haw. var. *sordida*
Collected about 60 km. ESE of Steytlerville, Eastern Cape

***Haworthia springbokvlakensis* C.L. Scott, ISI 2003- 30**.
The species was named after a place name, Springbokvlakte, which means "flats where the springboks are found" but as Springbok are far ranging there are many places named Springbokvlakte. You need more than that name to locate from where a plant has come! The species was actually named after Springbokvlakte in the dry interior of the Western Cape around Oudtshoorne where rain is scant, occurring in winter or summer.

*Haworthia springbokvlakensis* is one of he most desirable retuse-leaved haworthias, with broad, translucent windows ornamented with a pattern of striations at the tips, at least in the popular cultivated forms, of purplish, few-leaved rosettes. Forms lacking the surface markings are known. It has thick roots which are inclined to pull the rosette into the soil in dry conditions, fig. 17. In cultivation careful watering of this species is necessary if rot is to be prevented. Some shade may also be in order as plants typically grow in the protection of shrubs.

*Haworthia sringbokvlakensis* ISI 2003 - 30 have been produced from the controlled pollination of habitat plants, also collected about 60 km ESE of Steytlerville, Eastern Cape, South Africa.

Fig. 17 (main picture) & Fig. 17a (inset). *Haworthia springbokvlakensis*
Fig. 17. Two plants, almost without surface markings. Fig. 17a neighbouring plant with surface markings. Only the retuse leaf ends are above the ground. The growing points are buried in sand and gravel. Springbokvlakte, Steytlerville.

F i g . 1 8 . S p r i n g b o k

Reference: ISI 2003 notes by John Trager. Photographs: Figures 15-16. John N. Trager. Figures 17-18. Harry Mays.

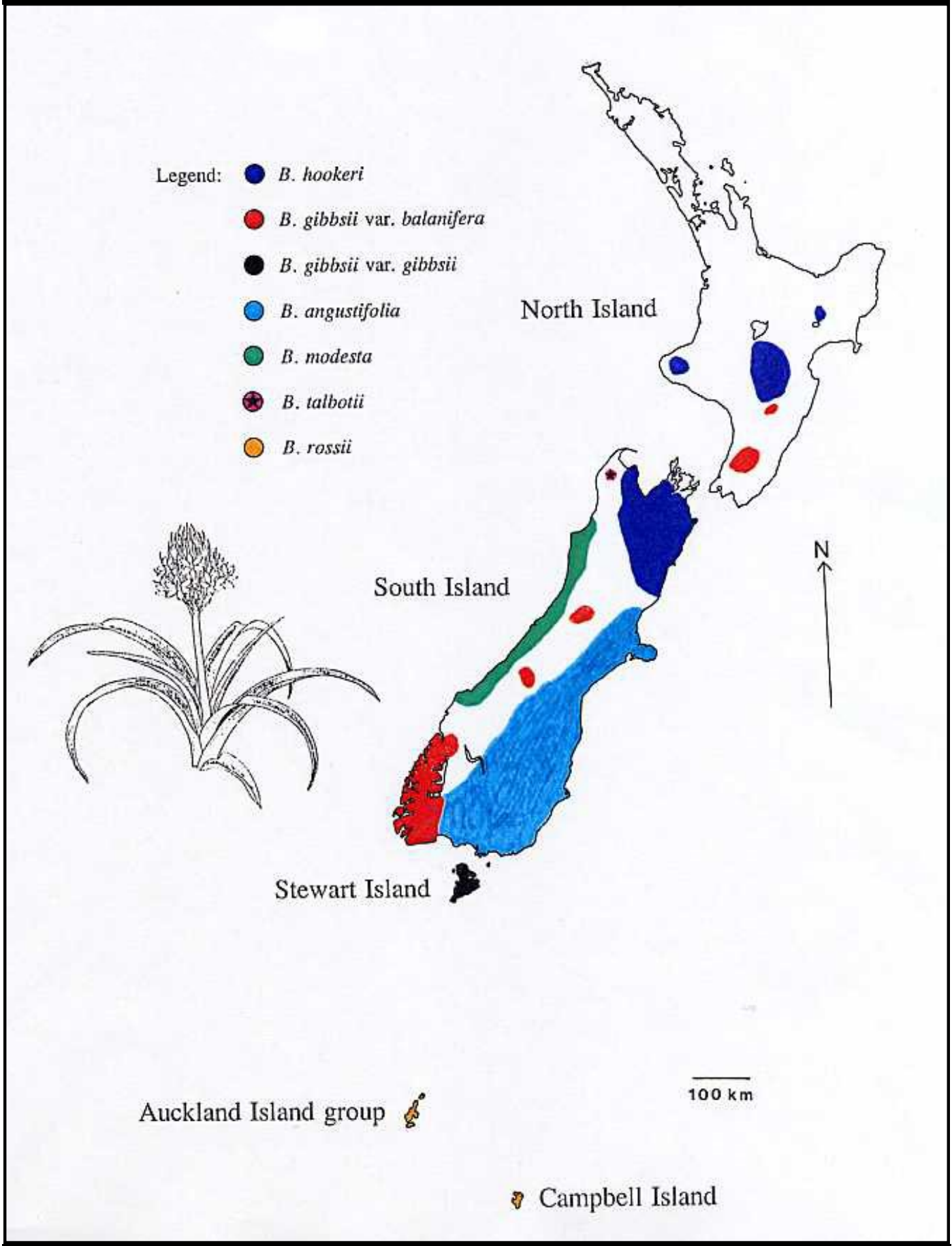


Figure 19
The geographic areas where the six species of *Bulbinella* have been reported in New Zealand.

# *Bulbinella* in New Zealand

Features of the genus *Bulbinella* in New Zealand

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*Bulbinella* plants in New Zealand produce fields of yellow stars among the grasses of the sub-alpine meadows. Such spectacular displays can be seen in mountain areas of New Zealand and on two Sub-Antarctic islands. Vast fields of *Bulbinella* can be seen in South Africa. These fantastic plants are endemics in the Southern Hemisphere. As the New Zealand *Bulbinella* species are probably not familiar to many readers, let me tell you about them.

**Distribution and habitat**

The six species of *Bulbinella* are almost entirely allopatric in New Zealand (figure 19). Further information on the ranges of each species is presented under the specific names.

A common feature of the habitats of all six species is their high water content. Examples of suitable habitats include permanent bogs, the banks of streams or rivers and seepage sites in wet grassland usually on shaded slopes.

**Morphology**

Plants of all six species have the following basic appearance: The crown of each plant produces a rosette of up to 12 strap-shaped leaves, which show prominent longitudinal ribbing in some species. Although the leaves are more fleshy in some species that in others, they are not considered succulent. The stem, which is erect with leaf insertions crowded over a short length, continues as the fleshy, leafless peduncle, varying in height. The peduncle bears the flowers, which are yellow in all New Zealand species. Flowers have a star-like appearance with two whorls each of three perianth segments (tepals) and two whorls each of three anthers. Flowers are borne on flexible pedicels, subtended by small, leaf-like bracts (Moore 1964). The number of individual flowers contained in one inflorescence varies from 10 or less to more than 100 depending on the species. While in some species the peduncle elongates considerably as the flowers open, raising the inflorescence well above the rosette of leaves, in other species it remains short making the inflorescence barely visible unless looking vertically down on the plant. Ovaries are green in flowers and young ripening capsules, changing through amber to brown and drying prior to dehiscence. One capsule may contain up to six seeds, which are triangular in cross section. The new roots, which are produced each year, function as storage organs and swell to a long fusiform shape. These tubers are tough, similar to those of commercial ginger, and appear to resist rotting or fungal attack. Shrunken roots of previous seasons may be retained by their remaining attached to the plant.

**IMPORTANT FEATURES OF THE INDIVIDUAL SPECIES**

***B. hookeri*** (Fig. 20)

This species is found in the North Island: Urewera Country, Mount Egmont (Mount Taranaki), parts of the Volcanic Plateau and the Ruahine Range; and the South Island: north of Waiau, North Canterbury, Marlborough and Nelson, in wet tussock grassland down to 150m. *B. hookeri* is hermaphroditic. Generally flowering occurs between November and January (Moore and Edgar 1970). Field observations indicate that most populations flower during December and January. Racemes of flowers, which are easily visible above the erect leaves, usually contain more than 50 flowers. Some populations, notably those of Mount Stokes (Marlborough Sounds) and the Cobb Valley (North-West Nelson), have a blue-green coloration (glaucous sheen) to their leaves and peduncles.

***B. gibbsii***

*B. gibbsii* var. *balanifera* (figs. 21 & 22) shows a widely disjunct distribution pattern. This plant occurs in the North Island: Tararua Range and parts of the Ruahine Range; and in the South Island: in the mountains of the

Fig. 20. *B. hookeri* on Mt. Stokes, Marlborough Sounds, South Island. Note glaucous sheen on leaves and peduncles.

Fig.21. *B. gibbsii* var. *balanifera* above Carroll Hut, Arthurs Pass Natinal Park, South Island.

Fig. 22. Alpine meadow above Carroll Hut, *B. gibbsii* var. *balanifera* and *Ranunculus lyallii* in flower.

Southern Alps from Arthur's Pass south to Fiordland, in wet tussock grassland. Most racemes contain more than 50 flowers but ones with fewer flowers are seen. Inflorescences are prominently cone-shaped when the lowermost flowers are just open. Some populations experience "non-flowering" years, when only two or three plants produce flowers and seed out of a population of several hundred. Plants which flower without setting seed are also encountered.

*B. gibbsii* var. *gibbsii* is restricted to Stewart Island (fig. 23). Generally plants of this variety are smaller than those on the mainland and produce fewer flowers per raceme (40 or less).

Both varieties of *B. gibbsii* are gynodioecious [populations contain both hermaphroditic and functional female plants (Moore 1964)], and flower during January and February (Moore and Edgar 1970). Field observations of *B. gibbsii* var. *balanifera* and *B. gibbsii* var. *gibbsii* indicate that flowering generally occurs during December and January and seed set has begun by February.

***B. angustifolia***

*B. angustifolia* (figs. 24) is locally common south of Waiau (South Island) in the eastern hills of Canterbury, Otago and Southland, in damp tussock grassland, but is absent from the western mountains. This species is hermaphroditic. Flowering occurs during November and December (Moore and Edgar 1970). Generally plants of this species are smaller overall than those of *B. hookeri*,

Fig. 23. *B. gibbsii* var. *gibbsii* on Mt. Allen, Stewart Island.

but not in all cases. Most plants produce racemes having 50 flowers or less, but ones with more flowers do occur.

***B. modesta***

*B. modesta* (Fig. 25) is confined to the West Coast of the South Island from Buller District as far south as Jackson Bay where it produces a carpet of yellow stars in damp lowland areas especially pakihi land. [The soil of pakihi land is extremely leached. In low-lying areas when drainage is impeded by both the iron pan and the nature of the relief, the ground is exceedingly wet, often approaching semi-bog conditions (Rigg 1962)]. Of the eight populations I studied, three are growing near tidal estuaries close to the sea. Some of the plants in one of these three populations are completely submerged at high tide! *B. modesta* is hermaphroditic. Flowering occurs during December and January (Moore and Edgar 1970). However, all of the eight study populations began flowering in November and had virtually finished by the end of December by which time they were setting seed. The leaves are similar in length to those of *B. hookeri*, but considerably thinner and tend to lie flat along the ground (prostrate) rather than erect like those of the three previously described species. The prostrate habit demonstrated by live plants was not obvious from the study of herbarium specimens belonging to this species. Peduncles are spindly and delicate. The racemes of most populations contain 10-20 flowers, although ones with more flowers are observed.

***B. talbotii***

*B. talbotii* is now known for certain only from the Gouland Downs, North-West Nelson, in open, boggy areas (fig. 26, page 18). This species is also hermaphroditic. Flowering occurs during December and January (Moore and Edgar 1970). When straggling up through the abundant *Gleichenia* of the bog, the leaves of this species are long and thin. However, leaves are short, thin and prostrate when plants are growing in an open habitat. In both situations, the peduncles bearing inflorescences are so short that they almost remain hidden among the leaf bases, even at fruiting. Most racemes contain only about 10 flowers.

***B. rossii***

*B. rossii* (Fig. 27, page18) is endemic to the herbfields of the Auckland Island Group and Campbell Island. This species is dioecious (Moore 1964). Flowering is most common during December, but can occur as early as October or as late as January (Moore and Edgar 1970). Obvious differences are observed between plants of different sexes which were transplanted originally from Campbell Island. While flowers of male plants possess prominent anthers but no ovary, style or stigma; flowers of female plants completely lack anthers but have a prominent gynoecium. The inflorescences of *B.*

Fig. 24 .
*B. angustifolia* on Flagstaff Hill above Dunedin, South Island.

Fig. 25.
*B. modesta* Tiropahi river track, West Coast, South Island.

*rossii* are cylindrical in shape, as opposed to conical in the other five species, and generally contain more than 50 flowers with short (1cm) pedicels. The flowers are so closely crowded that the peduncle is almost invisible.

**Pollination and seed dispersal**

The flowers of all New Zealand *Bulbinella* species are brightly-coloured (yellow) and produce a faint scent. None have the feathery anthers typical of wind-pollinated species. Representatives of several different insect families were observed on flowers of some populations of *B. hookeri, B. gibbsii, B. angustifolia* and *B. modesta* in the wild. The insects observed included honey bees, flies and bugs, suggesting that insects are likely to be involved in *Bulbinella* pollen transport. It was therefore considered likely that in nature wind-pollination occurred only if pollination by insects (the primary method) did not take place. Although Moore (1964) described the seeds of some species as "winged", these seeds were still too heavy to be carried far by wind. Personal observations indicate that seed dispersal is achieved by wind shaking seeds from their capsules on to the ground in the vicinity of the parent plant. Webb et al. (1990) suggested that seed dispersal was accomplished by wind. Because seeds were usually dispersed into the immediate vicinity of the parent, it was considered likely that pollen was often transferred between related individuals.

**CULTIVATION OF NEW ZEALAND *BULBINELLA***

**Mature Plants**

Mature plants from some study populations were collected by permit. After being carefully dug out in the field, intact plants were placed in labelled plastic bags. A large ball of wet soil was left around the roots to increase the chance of the material surviving transportation. Most plants were collected in late summer, when they had begun to die back in preparation for winter dormancy, to give material the best chance of survival.

As a peaty, acid soil resembling as closely as possible that of the natural habitat was appropriate, the following mixture was used:

Mature plants were planted out in the above soil mixture in appropriately sized pots and covered with bark chips to deter weed growth and to help retain moisture. At the planting stage, the young leaf shoots for the next season could usually be seen between the remains of the current season's rosette of leaves. These young shoots were easily damaged, so care was required.

Once potted, the plants were placed in a south-facing, enclosed garden/grass area, which received strong, direct sun only during summer, for about four months of the year. During the winter it was completely in shade. This situation was the best available to mimic the natural habitat of most plants. Plants from areas which experienced the wettest and coldest conditions; those from Fiordland, Stewart Island and the sub-antarctic islands, were placed against a wall facing south, which was the dampest and coolest part of the garden. Temperature readings taken in a pot against this wall varied from 4°C or less in winter to 20°C in summer. Plants of *B. angustifolia* could tolerate slightly drier

| Compost constituents - mature plants | | | | |
|---|---|---|---|---|
| Component | peat | coarse river sand | compost (commercial) | potting mix (commercial) |
| Proportion (parts) | 10 | 3 | 1 | 1 |

conditions and higher temperatures than the other species, but they still required a regular supply of water.

Varying success was experienced with the collection and cultivation of mature plants. As predicted, those from the more extreme cooler climates; namely *B. rossii* and *B. gibbsii* were the most difficult to grow successfully. Plants of these species were more prone to infection by fungi which was treated by local application of a commercial fungicide at the first sign. Plants with the more fleshy leaves; namely *B. hookeri* and *B. angustifolia* were particularly prone to aphid attack during the summer, especially if placed in a windy environment. Regular application of detergent diluted in water proved to be the best method of control.

A cool damp situation was recommended by Cartman (1985) for the cultivation of New Zealand *Bulbinella* plants. He also mentioned that they resent being dug up and divided and therefore suggested that seedlings should be planted out in their permanent positions as soon as possible and not disturbed thereafter.

**Propagation from seed**
Seed collected from the wild was harvested in late summer when ripe (capsules dark brown) before the capsules split. The seed heads were placed upside down in labelled paper bags for storage.

A number of methods and variations thereof were attempted to try to germinate *Bulbinella* seeds. The more successful of these are described below. Considering the boggy nature of the natural habitat of this genus in New Zealand, the key factors for germination induction were likely to be low temperature and moisture.

**Surface sterilisation**
Seed obtained commercially may not require surface sterilisation. It is a good idea to check the seed packet. Seed collected from the wild did require surface sterilisation before attempting germination method 2 - plating out. This is not as critical if using germination method 1 - sowing, but did no harm. The following regime was used for the surface sterilisation of *Bulbinella* seeds:
(1) The seeds were rinsed in 10% household janola (or bleach) for 10 minutes.
(2) The bleach was tipped off and the seeds were rinsed in tap water for 10 minutes.
(3) Step (2) was repeated two more times giving a total of three rinses in tap water.
(4) The seeds were sown or plated out as described below.

**Germination method 1 - Sowing**
Seeds could be planted fresh in Autumn outdoors in the following mixture:
Some seeds germinated the following spring. Low germination success (⟨10%) was generally found using this regime in Wellington, New Zealand. I suspect that this was influenced by mean winter temperature. Greater success may be experienced in colder climates, which would mimic the natural conditions experienced over winter in the sub-alpine habitat of the plants.

**Germination method 2 - Plating out**
(1) Sterile glass or plastic petri dishes were prepared by lining each sterile dish with a piece of filter paper or blotting paper.
(2) The filter paper was wetted with sterile distilled water if available, otherwise sterile (boiled, then cooled) tap water could be used.
(3) The filter paper was pressed flat against the dish ensuring there were no air bubbles underneath, and about 20 surface-sterilised seeds were placed in each dish using forceps.
(4) The dishes were then wrapped in aluminium foil (to keep seeds in the dark) and placed in a refrigerator at about 4°C.
(5) Once a week the seeds were watered and checked for germination.

| Compost constituents - seed sowing | | | |
|---|---|---|---|
| Component | peat moss | coarse river sand | commercial seed-raising mixture |
| Proportion (parts) | 2 | 1 | 1 |

Seeds plated out fresh in autumn using this method may germinate in the fridge after several weeks - several months. Seeds which had not germinated by spring were removed from the fridge and placed at room temperature around 20°C in their dishes and kept in the dark. Sometimes this stimulated them to germinate.

A variation on this method was to keep seeds dry over winter then plate them out as described above in spring. In my experience, these seeds germinated faster and with greater success (>50% germination) than those sown or plated out fresh in autumn. Plants grown from seed generally took at least 4 years to produce flowers.

**General Information / Summary.**
In my experience the most suitable of the New Zealand *Bulbinella* species for cultivation are *B. hookeri, B. angustifolia, B. modesta* and *B. talbotii*, with the latter two being smaller and less showy. *B. gibbsii* and *B. rossii* are more difficult to grow because conditions in their natural habitat are hard to imitate in a garden situation.
The New Zealand species of *Bulbinella* are rarely grown in private gardens here. Native plant enthusiasts sometimes have *Bulbinella* plants in their collections if they live in a suitable climate. As a number of the species are sub-alpine, and any of the species could easily be overlooked in their natural habitat if not in flower, the genus is not as widely known as some other plants in the New Zealand flora.

The more showy species are grown in some botanic gardens in New Zealand. The most popular species for this purpose are *B. hookeri* and *B. angustifolia.* I have also seen *B. rossii* growing in public gardens and nurseries in Invercargill (far south, South Island).

Fig. 26. *B. talbotii.* Gouland Downs, North-West Nelson, South Island.

Although *B. rossii* is a very spectacular plant, it is particularly difficult to grow in cultivation because it requires the cool, humid conditions found in the natural habitat of this species on the Sub-Antarctic islands.

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Fig. 27. *B. rossii* in cultivation.

Errata

Alsterworthia International 3(1)18 Map.

Amend Onaggaskop to Quaggaskop
Amend Gardenriver to Groenriver.

# Oom Japie: Die kenner van Riversdal
# (Uncle Japie the expert from Riversdale)

**Essie Esterhuizen**

This was the heading of an article on Japie Dekenah in the Overberg (Local newspaper in the Southern Cape) on 9/1/76. In the article they wrote about this keen collector who contributed so much to the Genus *Haworthia*. The following is a summary of the salient points.

If ever you drive through Riversdale, please stop at the town's Africana museum, the Versfeldhuis in Lang Street. You will definitely find it interesting and exciting. When the curator, Mr. Japie Dekenah, shows you around with such enthusiasm you will recognize what a special person you are dealing with. "Oom Japie", as he is generally known in the town, is a very interesting figure and an expert on this region.

Mr. Dekenah was born in 1907 in Riversdale where he attended school. At the age of 12 years he started to work after school with a photographer, Mr. M.A. Jonker. He became so interested in photography that his schoolwork became a side issue. He progressed to matric but his schoolwork was interrupted to such a degree by his photography and other interests that, in 1926, he could not pass a single subject in the matric examinations.

After school he started to work full time for Mr. Jonker and later on at a shop in the town. Three years later he joined a travelling photographer. These was very difficult days for Mr. Dekenah and during 1936 he resigned working with a photographer in Fort Beaufort and started an interest in plants.

At the end of the 30's his longing for Riversdale and its mountains took him back to that town, where he practiced as the local photographer for 33 years. During his stay in Fort Beaufort he became interested in botany and started, in co-operation with the East London Museum, to do research on the Genus Haworthia. Back in Riversdale he located 200 different localities of *Haworthia* in the Riversdale, Heidelberg, Albertinia and Ladismith districts of which 11new species were described. One, *H. dekenahi*, is named in his honor. At his request the only healthy locality of *H. marginata* is conserved in the Werner Frehse Nature Garden.

At one time the *Aloe* expert, Mr. Reynolds, visited Mr. Dekenah to discuss certain *Aloe* species in the Riversdale district. Mr. Dekenah gave him photographs, some of which are published in Mr. Reynolds book on aloes. Every year during Riversdale's flower show, experts were speechless about Mr. Dekenah's botanical knowledge and the ease and correctness with which he named the 400 species.

Two botanist of the University of Uppsala in Sweden visited Mr. Dekenah after Kirstenbosh Botanical Gardens referred them to him. They were very impressed with his knowledge of the plants in the region and the fact that he took them directly to a plant, on which they were doing their research, in the Blombos, Jongensfontein region. Mr. Dekenah has a complete collection of colour slides on the flowers of Riversdale which he donated to the East London Museum. He then started a new collection, which can be seen in the Africana Museum.

Botany is not the only interest of Mr. Dekenah. His friendship with the well-known archaeologist, the late Dr C.H.T.D. Heese, encouraged his interest in archaeology. Mr. Dekenah has an extensive collection of shells. He also started to study the birds in the garden of the museum.

The article ended by saying that one day when he will not be with us anymore, the residents of Riversdale will recognize the rich heritage he left for them and the country.

Japie Dekenah died some years after the publication of this article.

# Four selected hybrids

Harry C.K. Mak

Fig. 28. *Haworthia emelyae* v. *major* x *Haworthia bayeri*

***Haworthia emelyae* v. *major* x *Haworthia bayeri***
(*Haworthia* "Yumendono") [Ham 1249]

Japanese are famous for their great enthusiasm for cultivars, which have remarkable features incomparable to those usually found in nature. They achieve this by selecting and crossing extreme natural forms of species to enhance certain characters or by hybridizing different species. The high market values of the exceptional new cultivars is one of the reasons for the birth of so many wonderful cultivars in Japan. The desire for perfection is another reason. "Yumendono" group is one of the very best of the early hybrids. In Japan, "Yumendono" literally means "Dream Temple". It is in fact one of the dream *Haworthias*. This name is collectively applied to all hybrids made from the cross of *Haworthia emelyae* v. *major* and *Haworthia bayeri*. "Yumendono" cannot be regarded as cultivar name. Due to the occurrence of so many different forms of their parents, there is a wide range of cultivar variation. The plant depicted here is one of the most beautiful forms with plenty of papilla tubercles and deep greenish lines on windows. As expected, its growth is very slow and it seldom offsets. It can grow up to 10cm across. When in full sun, the colour of its body turns to reddish. In the hottest summer period, it simply stops growing and its contractile root draws the plant slightly into the soil. The plant here was obtained in 1996 from my friend Mr. T.K. Li in Hong Kong ex Japan.

***Haworthia emelyae* v. *comptoniana* x *Haworthia truncata* [Ham 1140]**

Fig. 29. *Haworthia emelyae* v. *comptoniana* x *Haworthia truncata* [Ham 1140]

Even without knowing its parents, we may guess that *Haworthia truncata* or *Haworthia truncata* v. *maughanii* must be one of its parents. By carefully noting the line and its pattern on the windows, we can imagine that *Haworthia emelyae* v. *comptoniana* is the other parent. The overall bigger size of this hybrid is inherited from *comptoniana*. It is one of the prettiest *truncata* hybrids. It shows spiral growth pattern. The windows on the leaves are quite rough and have various patterns of lines on them. Like their parents, it always stays green and is painstakingly slow-growing. During hot summers, its roots draw part of the plant body into the soil. This plant was obtained in Hong Kong ex Japan in 1996. Up till now, it is still solitary without any sign of offsetting. I expect it will offset when reaching a size of around 10 cm across. Leaf and root-cuttings seem to be the more convenient ways of propagation.

**x *Gastroloba* cv. [Ham 189]**

Fig. 30. x*Gastroloba* cv. [Ham 189]

The nothogenus name, x *Gastroloba* Cumm., was established in Bull. Afr. Succ. Pl. Soc. 9:36 in 1974. However, there are very few cultivars in cultivation. This is the only one I have ever come across. This rare cultivar was given to me by Dorothy Minors ex Brookside. From its general appearance, it cannot be mistaken other than as a hybrid between *Gasteria* and *Astroloba*. The variegation pattern on leaves and hard texture is characteristic of *Gasteria*. Whereas, the tough texture and extremely sharp leaf tips are typical of *Astroloba.* The leaves are arranged more or less in five columns. Each light-green rosette is around 10 cm tall and 7 cm across. It offsets readily. Inflorescences normally emerge in December and it flowers from February. Its flowers are essentially *Astroloba*-like. Propagation is normally by removing offsets. Its small size and well-marked foliage make it an attractive, choice plant in a collection.

***Haworthia retusa* x *Haworthia springbokvlakensis* [Ham 1152]**

A glance at this plant reminds us of a large-growing, *H. retusa*. A closer look reveals an indication of its other parent - *Haworthia springbokvlakensis*, the interconnected network of lines in the windows can be related to those in *springbokvlakensis*. The leaves are rather broad, very chunky and always stay green. This plant is big enough to fit nicely into a 4-inch square pot without offsetting. Again, it is of Japanese origin and was obtained in 1996 from Mr. T.K. Li in Hong Kong. One of the Japanese ways of propagating solitary, large plants is by cutting the whole plant into four quarters in two clean cuts with a very sharp knife. Each quarter should have its own roots and stem tissue. After drying for one or two weeks, they are potted separately. Sometimes, several plantlets can be produced from each quarter. I did try this method with *Haworthia emelyae* v. *comptoniana* with great success. However it requires courage. If this plant is reluctant to offset, I shall try this method together with leaf and root-cuttings. Another method is encouraging offsets by damaging the growing point.

Photographs by the author.

Fig. 31. *Haworthia retusa* x *Haworthia springbokvlakensis* [Ham 1152]

# Shedding light on the genus *Haworthia*

Notes about cultivation, propagation and the use of artificial lighting.

Nando Cozzolino
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I live in Portici (Naples) a village in the south of Italy. I am 40 and have collected haworthias for more than 15 years. I grow them in a cold house of about 35 square meters. At first I collected several genera, but eventually I decided to devote myself entirely to haworthias. At the moment I have about 3,000 plants, many of which have locality data. Some have come from specialised nursery owners and some from exchanges. In collecting them I was helped by the creation of the site Haworthia Planet, through which I met other fans all over the world. With them I have exchanged not only plants but also ideas and advice. From among them I would like to thank Christian and Francoise Prud'hon. For some time my collection has included a good many hybrids and variegated plants, some were bought, some produced by myself. They are very beautiful, especially the variegated ones.

If haworthias are exposed to excessive sunlight, the leaf apices of some may be burnt and some will tend to become reddish. Even if the colour appears to be fine they do suffer a little. This dislike of excessive sun means that people who live in places where the sun intensity is not so great can cultivate haworthias more easily. In summer I am used to shielding the roof of my greenhouse with shade nets, so that the haworthias receive direct sunlight only during the early hours of the morning and at sunset. Haworthias, in common with all succulents, do not like stagnant air. They should be given access to good ventilation.

I grow my plants in a light and well drained compost consisting of one part pumice-stone and one part volcanic lava with a size ranging between 2 and 5 mm, one part garden soil, which here is very sandy because of the influence of Vesuvius and one part leaf mould soil, as I have noticed that many haworthias appreciate it.. This compost provides good drainage. For plants with taproots, the quantity of pumice stone and lava has to be increased. I am accustomed to prepare my compost with materials easy to find in my zone, as some composts I read about in several magazines have recipes of difficult-to-find ingredients. Recently I have also been using a new compost because some haworthias, which are difficult to grown, fortunately only a few, lost their roots. This compost is made up of inert, very fine lava and rice-grain size expanded clay. In this case I add a little liquid fertiliser to the water. I have noticed very good development of the root systems and good growth of the plants.

Baked clay or plastic pots can be used for haworthias. The first are suitable for damp climates, but if, on the other hand, haworthias are grown in dry climates the latter are preferable. I use the square ones which are light, easily cleaned and, because of their shape, provide greater volume than round pots without taking up more room. They also have a larger surface area and provide more room for the plants, which flourish. I start watering my plants in spring for quick vegetative revival. I let the soil dry out between watering and use tap water which has stood for at least ten days in a tank inside the greenhouse. In this way water and plants temperatures are alike. I do not water my haworthias from above. I use a watering can with a thin spout and water only the compost round the plant. This is a very tiring operation and difficult to carry out but, by watering in this way, I do not have any trouble with rot resulting from water accumulating in rosettes. With the arrival of summer the night temperature in the greenhouse is excessive and growth stops. I suspend watering, but on alternate days I spray the plants at sunset in order to give them a little refreshment. I start watering again in September and stop at the end of November. In winter I do not let them dry out completely. I live in the south and near the sea, where temperatures seldom drop below zero. During sunny days I spray in the early hours of the morning. The plants are completely dry by the evening. My plants do not wither much during the winter.

Sowing seed in spring in the glasshouse does not present

any great problems. Germination takes place readily. It is sufficient to prepare a well-drained sandy compost and always keep it damp. I put the seed-pots in flowerpot saucers and pour in a finger of water. The pots are removed from the saucers only after germination. Propagation by offsets is easier and quicker. When offsets are produced, I cut them from the mother plant with a sharp knife and let them dry for at least a week in an airy and shady spot. Then I pot them up and water in the same way as for the other plants. They develop their own roots in a short time. I reproduce those which rarely produce offsets by leaf-cuttings. I pull some outer leaves from the adult plant. For this method to succeed only leaves with a good reserve of water in their tissues should be taken. I let the cut surface dry in the same manner as for offsets. When dry, the cut surface of the leaf is placed on compost. After a while roots will grow from the cut surface and later new little plants will develop until the leaf withers.

Haworthias are plants very resistant to pathogens. In only a few cases could I notice the presence of cochineal, which were eliminated manually. I do not use any insecticides.

For a long time I have also been interested in aquariums and in particular in the cultivation of aquatic plants. As years went by this led me to document experiments with artificial lighting. Later this knowledge has been useful for building a propagator for sowing *Haworthia* seed in winter. For succulents, photosynthesis starts with a light intensity equal to 3,000 lux and it becomes very active with a value of 20,000 lux. In nature, during sunny days, the light intensity is over 100,000 lux, but days are not always sunny, they may be cloudy or foggy, then a value next to 20,000 is a good approximation.

When you build a propagator, you have to consider that the 36 w fluorescent lamp, 120 cm long, gives the best performances both in terms of output and consumption, but this does not prevent alternatives being of use. When deciding on the size of a propagator and the number of neon tubes to use, we need to remember that light output is measured in lumens and that the name of the lumen which arrives on a surface of one square meter is the lux (a lux = 1 lumen per a square meter). The further the light source from the object the less the intensity will become. For this reason the distance between the neon lamp and the little plants should be about 20 cm. Another point to be considered is that the walls of the propagator should be covered with reflecting mirrors. A neon lamp with an external reflector increases the available light at the point of measurement by 122 % compared with a lamp without a reflector, for example a TLD 840 Philips without a reflector has a lighting of 880 lx, with an external reflector it has 1960 lx.

When selecting a neon tube do not choose one with a greater output than is required in an inappropriate range. The sight of the human eye is very limited. The human eye will see brighter illumination because it is tuned into yellow-green radiation which, even if more intense, is less important for photosynthesis. The leaves of many plants with chlorophyll appear green because green light is reflected and so not absorbed at all. The human eye is blind to infrared and ultraviolet radiation, which are essential for the plant's biological functions. In other words, in the measurement of light flux in lumen, blue-red and UV radiation, essential for succulents, take a back seat compared with yellow-green radiation, which is less important for biological processes even though its intensity may be greater to the human eye. Radiation between 400-500 nm (blue/green) and 600-700 (orange/red) are essential for plants.

The choice of neon lamps should not tend to one model. If we used tubes with only orange/red radiation, plants would grow faster, but they would elongate compared with compact growth produced under lamps with blue/green radiation. Leaflets with the characteristics of the lamps, light spectrum and so forth, are available from shops and manufacturers. I find the Philips TLD 860 combined with the Osram 11 860 are good, but other lamps with appropriate characteristics can also be combined. Lamps produced for aquarium plants are often suitable. The sequence of switching on lamps is red first to reproduce the soft light of the morning and blue second to produce the intense light of midday. Switching off is in the reverse order to change from high light intensity to the soft light of evening. Simple timers are the most convenient way of controlling the lamps.

My propagator, which is kept in the cellar, stands on and is heated by a "heater mat" (sold for under floor heating of reptile cages.) which is covered with sand. Seed is sown in little plastic pots, which are put on this hot bed to take advantage of the milder climate. It is thermostatically controlled to maintain a constant temperature. This is a great advantage for winter seed sowing, as seedlings do not experience the excessive light and temperature which seedlings from spring-sown seed suffer in summer. I also use this propagator for rooting *Haworthia* offsets and leaves in winter.

I have been fortunate enough to live near a great fan of succulents, my friend Pasquale Ruocco. It was at his house that I first saw haworthias. Many species were represented and he also had numberless publications and texts. For me it was love at first sight. I thank him for having introduced me to this fascinating genus.

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Fig, 32 (far left), 33 (left) and *Haworthia* 'Ollasonii' (front cover) of plants in the authors collection. Photos by the author.