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Pterostylis brumalis near Warkworth

Contents

The kauri orchids

by E.D. Hatch, Laingholm, Auckland

In the spring of 1946, I was poking about the beautiful kauris in the Trounson State Forest, just south of Waipoua, and was surprised at the debris which had piled up round the bases of the trees, sometimes to a depth of a metre, and even more surprised at the number and size of the *Pterostylis rubricaulis* which were growing, as it were, on these natural compost heaps. I had long been familiar with the pole-kauri groves of the Waitakere Ranges, where the debris layer is to be measured in millimetres, but had never before considered the nutritional aspect of the orchids which grew there.

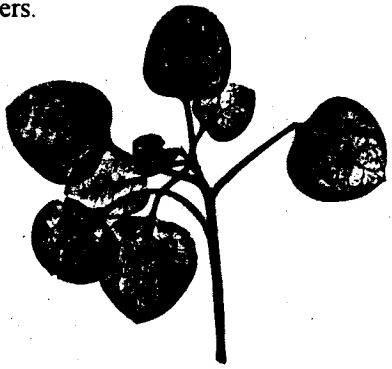
When Lucy Moore described *Pterostylis brumalis* in 1968, it occurred to me that I had never seen either of these orchids growing away from the immediate vicinity of the kauri, and I settled down to study the whys and wherefores of the matter.

I had discovered the mycorrhizome of *Pt.brumalis* in Laingholm, way back in August 1946, but had no idea then what it was. I wrote in *TRSNZ* 77:245 t30 fJ (1949) - "...the vegetative form [of *brumalis*] is worth remarking. It consists of a pseudobulb at the surface, bearing two orbicular leaves on long petioles, and three-five very long roots with terminal tubers". By 1959, when I wrote *Auckland's Orchids,* I had come to realise that this curious thing was the seedling, protocorm, or mycorrhizome stage of *brumalis* and had changed my description to "one-three trowel-shaped leaves". I was progressing! It must be realised that no work at all had been done in NZ on the germination and development of the seed in these plants (and still hasn't). I was blundering about in the dark. There is no apparent connection between these orchids and the kauri. The fungus (could it be perhaps the *Endogone* which forms the nodules on the kauri rootlets?), is stimulated by the piled up decaying debris, while the orchids respond to the combination of the abundant fungi and the easily penetrated, moisture retaining layer of leaves, twigs, moss and shattered cones.

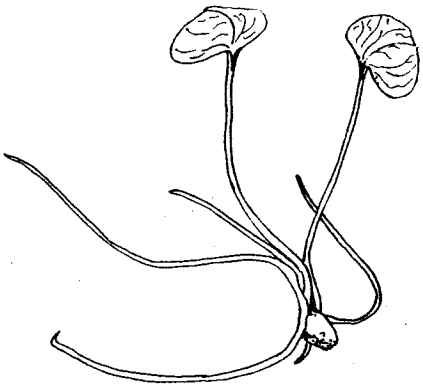
Pt.brumalis has been recorded with kauri from Waipoua forest in the north, down the east coast and through the Waitakere and Hunua Ranges to the Coromandels, with an odd outlier at Mauku in South Auckland. It flowers from April to July. The plant has two forms. A juvenile rosette on a distinct stem, of orbicular-petiolate leaves, and a mature flowering form with rather broad, linear-bracteate leaves usually bunched near the top of the stem; a cobra-hooded flower with the petals placed at right angles to the dorsal sepal; and a very prominent lobe in the sinus of the lateral sepals. The form the plant takes depends on the size of the tubers, i.e. on the amount of food reserve available. Tubers up to 5mm diameter will produce only rosettes. Flowering plants need tubers at least 7mm diameter. Where the debris layer

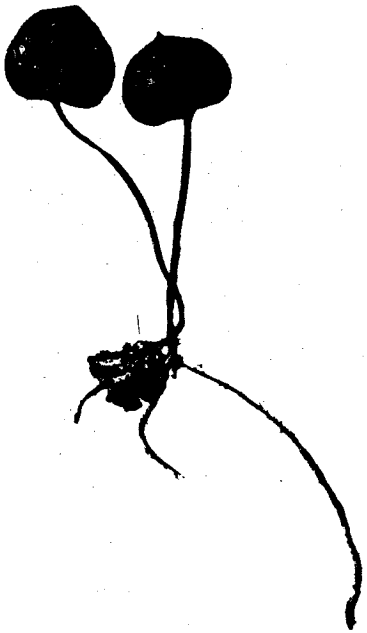
is sufficiently deep (in excess of 45mm in the Waitakeres) the base of the stem becomes swollen and develops root hairs, and I assume that this is a response to the mycorrhizal fungi.

The mycorrhizome in this species is very distinct (indeed probably unique in *Pterostylis*), and consists, as I have mentioned above, of a more or less oblong tuber lying on the surface of the soil beneath the debris layer, with one-three orbicular or trowel-shaped leaves on long petioles, and several very long, wandering rhizomes which develop terminal tubers (swollen nodes), which will the following season, grow into juvenile rosettes, or if large enough, into flowering plants - two years from seed to seed. This tuber-size/plant-form ratio is constant. If a mature plant for example is chewed off or otherwise damaged and produces only small tubers, these will the following season grow into juvenile rosettes. The rosette form which the small plants assume, provides a maximum area of green leaf for photosynthesis and results in the rapid formation of flowering-sized tubers.



Pterostylis brumalis- juvenile form





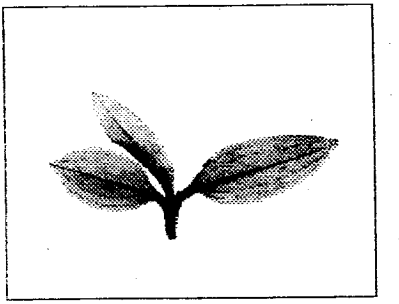
Pterostylis brumalis - mycorrhizomes

This variation in form does not affect species with basal rosettes (*Pt.nutans* etc.) since maximum leaf development is always present.

Pt.rubricaulis is a grass-leaved species, related to *Pt.montana*. It has a semi-rosetted juvenile stage with two-three elliptical leaves, but the difference from the adult form is nowhere near as obvious as in *brumalis*. The three-four leaves tend to be at right angles to the stem and the labellum-tip is unevenly constricted. It has a wider distribution than *brumalis*, literally that of the kauri, from the North Cape to the Kaimai Ranges above Te Puke, and flowers later, from July to September. It also develops a swollen, root-haired stem base like that of *brumalis*, I assume for the same reason.

There are of course other orchids which enjoy living in the kauri debris, *Cyrtostylis oblonga*, *Acianthus sinclairii* and the *Caladenias* for example, but they can grow elsewhere and are not, like the two pterostylids, confined to the kauri debris environment.

Pterostylis brumalis - half-size



Pterostylis rubricaulis - juvenile form

Caleana minor: will it survive in New Zealand?

by Chris Ecroyd, New Zealand Forest Research Institute, Private Bag 3020, Rotorua

Abstract

Caleana minor, the small duck orchid, is a critically threatened species in New Zealand. A member of a small genus of about five species, the small duck orchid is widespread, but not common, in Australia. It was first recorded in New Zealand in 1890 when Rev. F.H. Spencer found it at Rotorua. A few years later it was recorded by R.H. Matthews near Kaitaia. There are no records of it in New Zealand between 1924 and 1979, when a single plant was found by the author in Rotorua.

The Rotorua site has been monitored over the last 15 years and the number of plants has gradually increased to 57 by October 1991. However, over the last four years the number has declined and only 37 plants were found in 1994. Since 1990 no plants have flowered. It is suggested that the lack of flowering and decline in plant numbers is mainly due to a successional change in the habitat from very open shrubland with numerous small clearings to dense shrubland. It is hoped that by clearing away the competing vegetation the vigour of the remaining small duck orchid plants will be increased and the downhill trend reversed. But, should we endeavour to save this plant in New Zealand, since it is not an endemic species and could be considered just a temporary Australian migrant?

Introduction

Caleana minor, the small duck orchid, is a critically threatened species in New Zealand (Cameron et al 1995). However, it is more widespread in Australia, occurring in six States (Blaxell 1972; Jones 1988). Of the five species in the genus, *Caleana minor* is the only one found outside Australia (Jones 1988) and it probably established in New Zealand from seed wind-blown across the Tasman Sea (Hatch 1951).

The first record of *Caleana minor* in New Zealand was in 1890 when Rev. F.H. Spencer discovered it near Rotorua township (Cheeseman 1892, Kirk 1892). A few years later it was found by R.H. Matthews near Kaitaia (Auckland Institute and Museum Herbarium specimen, AK 3482), and in 1902 by H.J. Matthews at Waiotapu (AK 50592). There appear to be no published records or herbarium specimens of *Caleana minor* from New Zealand between November 1924 and December 1979, when one plant was found near Rotorua by the author (Ecroyd 1981).

This plant was growing with *Calochilus paludosus* and *C. robertsonii* on acid soil in open shrubland near a thermal area, a habitat very similar to that in which others had been found in Rotorua more than 50 years ago. Spencer, in a letter to T. F. Cheeseman, written in January 1891 (Auckland Institute and Museum archives), describes the site in which he found *Caleana minor* as - "on low lying ground, in poor soil amongst manuka"

and K.W. Allison in 1924 as - "On poor land amongst short open manuka" (AK 24833). In Australia *Caleana minor* has been found growing on coastal heaths (Cameron 1986), in sclerophyll forest growing on ridges and slopes on open gravelly soils, and in open woodlands amongst low shrubs and grasses (Jones 1988).

The flower of *Caleana minor* is unusual and is orientated the correct way up, whereas in most other orchids the flower is inverted. It is shaped like a duck, hence the common name "duck orchid". The labellum has the appearance of a duck's head and at its base there is a hinge-like structure resembling the duck's neck. The wings are represented by the downward pointing broad column which is expanded to form a cup. A small insect alighting on the hinged labellum activates the hinge mechanism and is shut in the pouch formed by the column. After a struggle which should dislodge the pollinia and pollinate the flower, the insect escapes. The mechanism for the resetting of the labellum is unknown.

This complex pollination system may be completely superfluous. Brian Molloy has suggested that *Caleana minor* flowers produce seeds without the union of sex cells in a process called apomixis (Molloy 1990). Molloy grew a plant from Victoria in isolation and it produced abundant seed without pollination and fertilisation and he noted that old herbarium specimens from Kaitaia and Rotorua include plants with seed-filled capsules but with pollinia still intact. Jones (1988) suggests that two of the five *Caleana* "species" are freak apomictic developments of *Caleana minor*.

Methods

Since the *Caleana minor* plant was first found in 1979 the immediate site has been intensively searched on a number of occasions. The site has been visited several times every year and a record has been kept of the number of *Caleana* leaves, flowers and pods observed on each visit. Although some tubers may be inter-connected when first formed, each plant usually has only one leaf and the number of leaves present has been used to estimate the number of plants.

To protect the plants from collectors their location has not been publicised and insecticides and fine mesh netting have been used in an effort to prevent insect damage.

The two *Calochilus* species and *Caleana minor* grow in close proximity at the Rotorua site and presumably these species have similar habitat requirements. The type of management used at other *Calochilus* sites in Rotorua is therefore considered relevant to that of *Caleana minor*. One *Calochilus* site has been maintained in low vegetation by occasional mowing, while another was allowed to revert to dense manuka shrubland. *Calochilus robertsonii* has disappeared from the site which was allowed to revert but at the mown site it has increased from 1306 plants counted in 1985 to 1473 plants counted on 17 November 1994.

Fig. 1. The number of *Caleana minor* plants found from 1979-1994

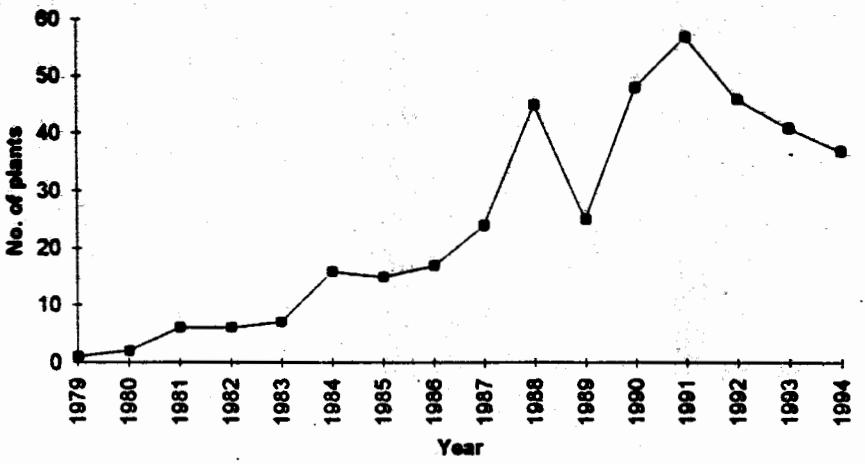


Fig. 2. The flowering season of *Caleana minor* 1979 - 1994

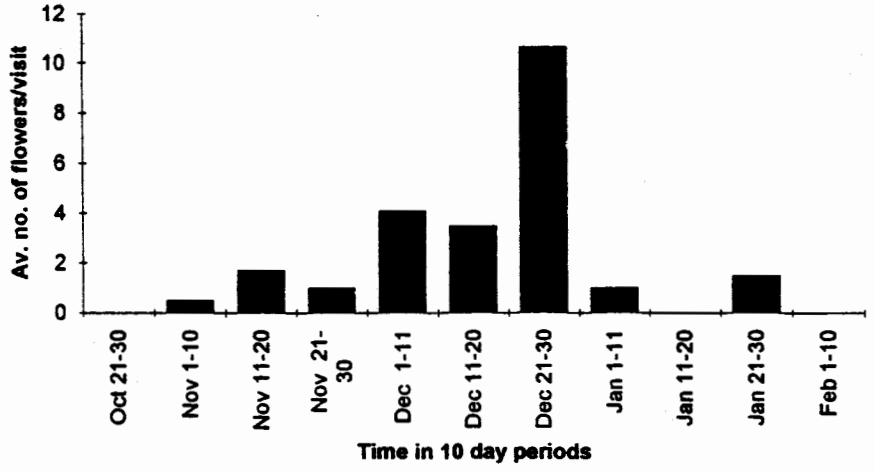


Fig. 3. The flowering of *Caleana minor* in New Zealand 1979-1994

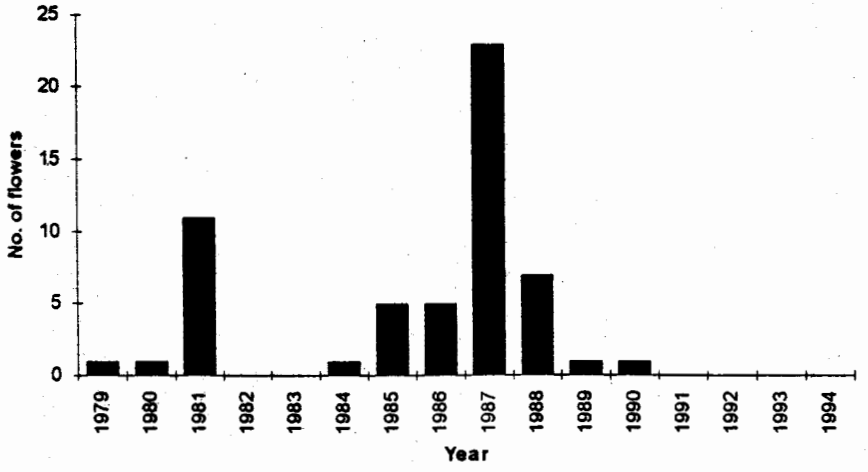
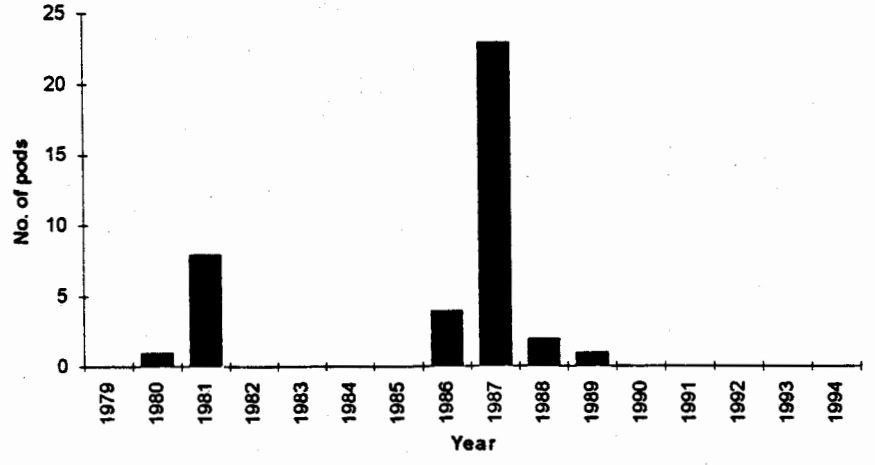


Fig. 4 *Caleana minor* pod production 1979-1994



Very small clearings, less than a metre wide, have been maintained around the *Caleana minor* plants since 1979 but the surrounding shrubland was left to develop naturally until November 1994 when all the shrubs and taller vegetation were removed over an area of ca 100 m^2. To monitor changes in the habitat all the plants present within a 5m diameter plot were recorded before the clearance and the site was photographed before and after clearing. The plot was centred on the main clump of *Caleana minor* plants.

Results

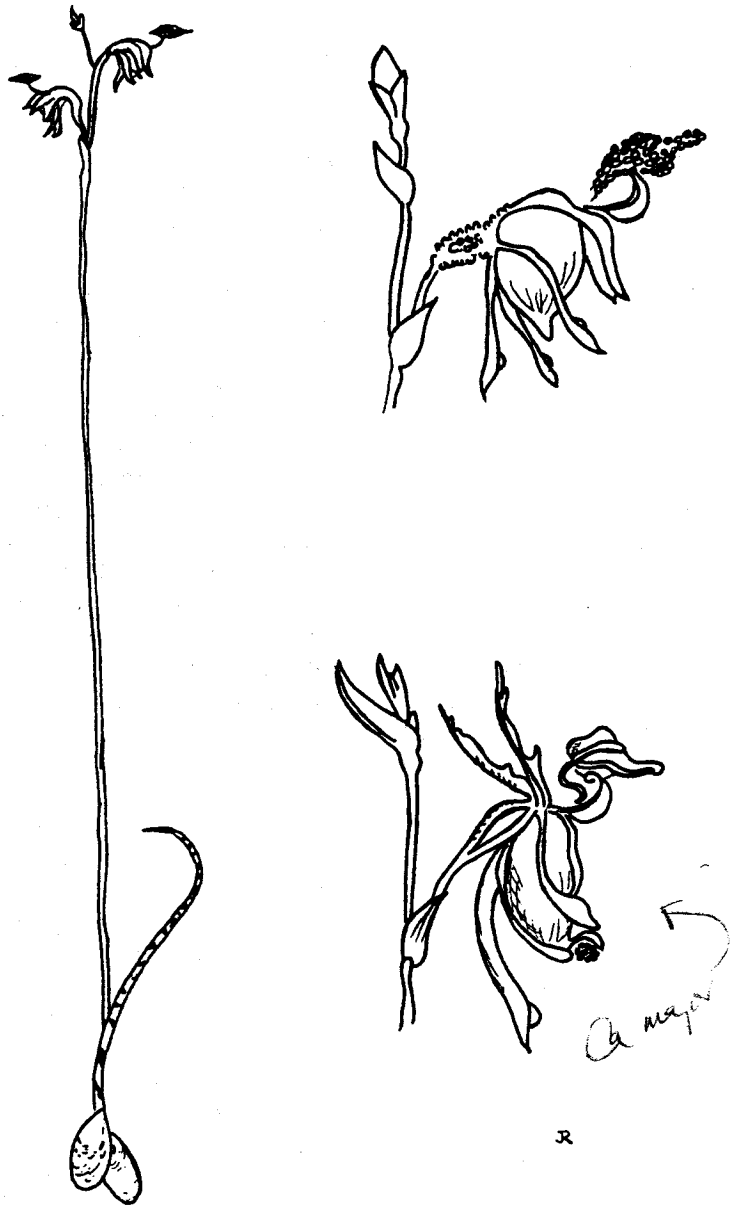
Over the last 15 years the number of plants recorded has gradually increased to reach a maximum of 57 in October 1991 (Fig. 1). One plant was accidentally killed with herbicide in 1989. The decline recorded for that year may have been due to insects consuming leaves early in the season, rather than a decline in the number of plants present. However since 1991, the *Caleana minor* population has shown a consistent decline in number of plants and flowers, and only 37 plants were found in 1994. Two plants grow several metres away from the plant found in 1979 and must have established from seed. The other new plants are all within 15 cm of the original plant and are close enough to have developed by vegetative reproduction from its underground tuber.

Over the last fifteen years the habitat at the *Caleana minor* site has changed from open shrubland dominated by blueberry (*Dianella nigra*) to dense shrubland dominated by manuka and mingimingi. There were 113 stems of shrubs over 0.5 m in height within the 20 m^2 plot in 1994.

Caleana minor has been observed in flower (Fig. 2) from 6 November to 28 January over the years 1979 to 1995 with December the peak month. Up to six flowers per inflorescence have been produced sequentially and each flower has remained open for about six days. Insect damage to the flowers and flower stalks has caused flowers to prematurely wilt and die in some years. The greatest number of flowers was produced in the 1987/88 summer, when 15 of the 24 plants flowered and 23 flowers were recorded (Fig. 3). There has been no flowering since the 1990/91 season. Production of seed pods (Fig. 4) closely relates to flowering with all 23 flowers producing pods in 1987. There have been no pods formed since 1989.

Discussion

Although *Caleana minor* was not seen in Rotorua for 55 years after the 1924 sighting by K.W. Allison, it was undoubtedly present during this time. The plant found in 1979 was only about a kilometre from one of the earlier recorded sites and the plants are so inconspicuous they could have been there but remained unnoticed. Even the largest plants are difficult to see and small plants with leaves only one centimetre long and a millimetre wide are extremely inconspicuous.



Caleana minor

This population of *Caleana minor* has increased from one known plant in 1979 to 57 in 1991 but it now appears to be in decline due to the dense growth of competing shrubs and other plants around the site. No seed has been produced since 1989 and the earlier population increase could be almost entirely from vegetative reproduction. However, for long-term survival and for the colonisation of new sites, establishment of new plants from seeds is necessary. The seeds are very small and there must be an enormous potential number of new plants which could be produced from just one pod.

Conservation of this interesting species would appear to require no more than a few hours each year spent clearing competing vegetation and monitoring the plants. Without this management the species will almost certainly die out at this site. Other threats such as browsing by insects, possums and other animals, and detrimental disturbance by humans (eg. herbicide) could affect its survival.

Caleana minor like nearly half of our native orchid species has arrived and established in New Zealand from seed wind blown across from Australia (Hatch 1951). There are many other examples of native plants and animals, especially birds such as the white heron, which have blown across the Tasman Sea and established in New Zealand. The term "native" needs careful definition and in this context includes species arriving in New Zealand and establishing unassisted by human activity.

There are about 20 threatened native plants inhabiting "inland scrub" (Wilson and Given 1989) and even if protected in reserves many of these species will diminish in numbers as their now very limited area of habitat changes naturally. Active management of these shrubland habitats may be necessary for the survival of many of these species. Such management could include burning, mowing, or other mechanical methods of clearing the vegetation. The use of fire is a well-researched management tool for maintaining shrubland habitats in Western Australia but to my knowledge has not been deliberately used in New Zealand to conserve native plant species. Most of the open shrubland habitat around Rotorua which was suitable for *Caleana minor* has gone with the development of the city and active management is necessary to maintain the very small area still occupied by this plant.

Should this species, which is not considered threatened in Australia, continue to be granted threatened plant status in New Zealand? Should we attempt to prevent its extinction here? Do we accept the view of Molloy (1993) that "Trans-Tasman migrant orchids that are widespread, common, and protected in Australia, do not justify continued threatened plant status in New Zealand", and do nothing? In my opinion these non-endemic species should be rated as "threatened" New Zealand plants and while first priority must go to species only found in New Zealand (endemics), we should be

prepared to spend some resources saving the non-endemics regardless of how common they are in other countries, otherwise, New Zealand risks losing more of its native species and hence it's natural richness in biological diversity.

Can we be certain that New Zealand populations of these non-endemic species are not significantly different? Is *Corybas carsei*, for example, endemic or is it conspecific with an Australian species? Should species which are only regionally threatened be totally neglected? Isn't conservation of species at their distribution limits considered important? The Rotorua site is the eastern limit for the distribution of the genus *Caleana*. In my view the most important issue is precisely how to rank the threatened non-endemics compared to the endemic species, and then resources can be allocated accordingly. I think this is a problem that requires further discussion.

Conclusion

Although *Caleana minor* was not found in New Zealand from 1924 until 1979 it has almost certainly been in the district constantly for the last 100 years and probably much longer. It may have originally established in the Rotorua district from seed windblown across the Tasman Sea but there can be only speculation on when this occurred. Much of the suitable shrubland habitat has now disappeared but we hope that by actively managing its present site this interesting species will survive in New Zealand.

Acknowledgements

I would like to acknowledge funding from the "Yates Green Earth Threatened Plants Sponsorship" for this project (Yates Project 94/Two), the Royal Forest and Bird Protection Society for organising the sponsorship and members of the Rotorua Branch for assisting with clearing the shrubs from around the *Caleana minor* plants. The Auckland Institute and Museum Herbarium provided historical information on *Caleana minor* from specimens and archives. Dr. Mike Carson, John Hutcheson, Barbara Knowles, and Elizabeth Miller provided useful comments on the text.

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Vagrancy within New Zealand threatened orchids: what are our conservation priorities?

by Peter J. de Lange, Department of Conservation, Auckland, and
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Orchids have occupied a prominent place in recent lists of New Zealand threatened plants (e.g., Given 1981; Cameron et al. 1993). In the latest listing, Cameron et al. (1995) recognise 12 orchid species and four unnamed taxa as threatened, using IUCN Red Data Book categories. In addition, four species and two unnamed taxa are ranked as "Local" (not an IUCN category), giving a current total of 16 orchid species and six unnamed orchid taxa considered to be under some level of threat in New Zealand.

Out of this total, four orchid species and all six unnamed taxa are currently regarded as endemic to New Zealand and should be given first priority in the Crown's conservation strategy. In contrast, the other 12 species (Table 1) are shared with Australia where, with one exception (*Thelymitra matthewsii*), they are relatively common and not recognised as threatened (cf. Briggs & Leigh 1988). These 12 species (along with others in our orchid flora) are immigrants from eastern Australia as a result of periodic, long-distance dispersal of seed by the prevailing west to east winds. They are examples of a fluctuating element of the New Zealand flora *sensu* Lloyd (1985), and some are, by their very nature, ephemeral. Compared to successful orchid immigrants such as *Thelymitra carnea*, *T. pauciflora*, *Pterostylis foliata*, and *Genoplesium pumilum*, for example, these 12 species, especially those ranked in the higher categories of threat, have remained scarce in New Zealand through their inability to reproduce here, or to successfully utilise the range of habitats available (see especially Godley 1979; Lloyd 1985; Molloy 1990). The question is, should our limited conservation resources be channelled towards their protection. In our opinion the short answer is no. Rather, we suggest that unless such orchids are recognised as globally at risk, e.g., *Thelymitra matthewsii*, their conservation management within New Zealand is unnecessary and not a priority.

We would go further and suggest that all the species listed here in Table 1, with the possible exception of *T. matthewsii*, should be removed from the New Zealand threatened and local plant lists because they give a false impression of the true extent of our threatened flora, and detract from endemic orchids which would benefit from conservation management. Three of the orchids in Table 1, *Chiloglottis formicifera*, *Pterostylis nutans* (both

inappropriately ranked as "Extinct"), and *Chiloglottis valida* are insect-pollinated and are constrained in New Zealand by the apparent absence of their specific pollinators. For this reason these three species (and no doubt others in the past) have failed to establish themselves beyond their points of introduction. We regard them as examples of a distinctive vagrant element in our orchid flora, and part of an on-going process of immigrant orchids arriving at different times, barely establishing a foothold, and disappearing at comparable rates.

Other species listed in Table 1, e.g., *Caleana minor*, *Pterostylis nana*, *P. tasmanica*, *Thelymitra matthewsii*, and the three species of *Calochilus* are not constrained by their reproductive biology but rather by their habitat requirements, more especially their respective micorrhizal needs. Two of these species, *Caleana minor* and *Thelymitra matthewsii*, have barely established a foothold in New Zealand at different times in their recorded history here, while the others have had varying though limited success in extending their range. We regard these species also as vagrants.

Vagrancy is after all part of a natural process whereby the range of species is extended, and some vagrant terrestrial orchids dispersed from eastern Australia do become established over time. The New Zealand orchid flora, as already noted above, contains several examples, some clearly of long-standing. Two comparatively recent arrivals, *Cryptostylis subulata* and *Thelymitra malvina* (Table 1), are very good modern cases of vagrant species which have successfully colonised New Zealand. They demonstrate the contribution some immigrants have made to the diversity of our orchid flora. In summary, we note that more than half the orchids recognised as threatened in New Zealand, especially those ranked in the higher categories of threat, are vagrant immigrants from Australia where, with possibly one exception, they are not known to be threatened. We accept that these vagrant orchids have a value in the lessons they can teach us about long-distance dispersal, colonisation processes, and so forth. While their protection is to be encouraged, we believe this should go no further than protecting the land on which they occur. In this way the natural processes of colonisation and establishment can be observed. The conservation management of such taxa should not be a priority unless the vagrant is known to be at risk internationally. Even then, the conservation of our endemic threatened orchids must be our first priority.

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Table 1
Conservation status of New Zealand threatened orchids shared with Australia (extracted from Cameron et al. 1995).

Orchid species	Conservation status
Chiloglottis formicifera	extinct
Pterostylis nutans	extinct
Caleana minor	critical
Pterostylis nana	critical
Thelymitra matthewsii	critical
Calochilus paludosus	rare
Chiloglottis valida	rare
Pterostylis tasmanica	rare
Calochilus herbaceus	insufficiently known
Calochilus robertsonii	local
Cryptostylis subulata	local
Thelymitra malvina	local

The Australasian genus *Drymoanthus*

by Ian St George

1769: Banks and Solander found near Whitianga in the North Island of New Zealand a plant that Solander later called in his unpublished manuscript *Epidendrum adversum* [1].

1810: Robert Brown described the genus *Sarcochilus* from Australia - the Type species was *S. falcatus* [2].

1853: JD Hooker formally described Solander's *Epidendrum adversum* as *Sarcochilus adversus* [3].

1906: Rudolph Schlechter described *Sarcochilus minimus* from New Caledonia [6].

1943: WH Nicholls described the genus *Drymoanthus* from Queensland. He noted that it differed from *Sarcochilus* by its "... *entire* labellum, which is *sessile* at the *immediate base* of column; absence of any callosities or glands on the labellum disk".- the Type species was *D. minutus* [4].

1967: Alick Dockrill saw that the New Zealand *Sarcochilus adversus* was more like a *Drymoanthus* than a *Sarcochilus*, and gave the new combination *Drymoanthus adversus* [5]. He noted that both genera are small epiphytes, with racemes of flowers. *Sarcochilus* flowers are showy and fragrant, but the main structural differences are in the labellum. Those of *Sarcochilus* species are articulated at the apex of a column-foot, have three lobes, and are spurred in front: the lateral lobes are large and more or less erect, and the labellar calli are distinctive. The labellums of *Drymoanthus* species are immovably attached to the base of the column, which does not have a foot; they are neither three-lobed nor spurred.

1972: Leslie Garay reclassified the New Caledonian *Sarcochilus minimus* as *Drymoanthus minimus* [7, 8]. He wrote that it was "characterised by the short, entirely footless column to which the sessile lip is firmly adnate at a right angle". Nicholas Halle drew it in 1977.

1992: Oswald Blumhardt of Whangarei registered *Sarcomoanthus* Maungatapere, a triploid hybrid between *Drymoanthus adversus* and *Sarcochilus fitzgeraldii*.

1993: Malcolm Campbell of Hamilton registered *Sarcomoanthus* Emarcy Gem, a hybrid between *Drymoanthus adversus* and *Sarcochilus ceciliae* [9].

1994: *Drymoanthus flavus* was described from New Zealand [10].

The species are thus *Drymoanthus minutus, D. minimus, D. adversus* and *D. flavus*. The hybrids are *Sarcomoanthus Maungatapere* and *S. Emarcy Gem*.

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9. Campbell M. Hybrids using *Drymoanthus adversus. NZNOG J* 1994; 52: 13-14.
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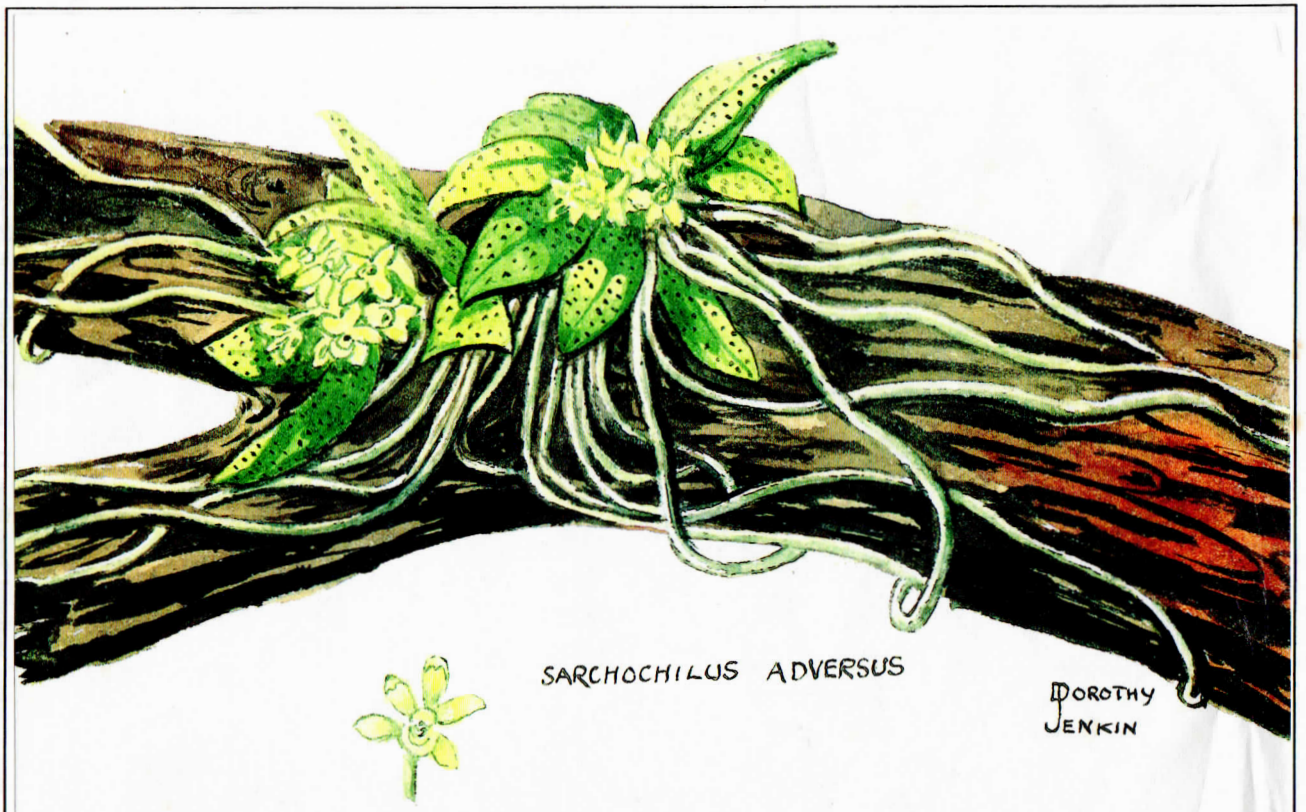
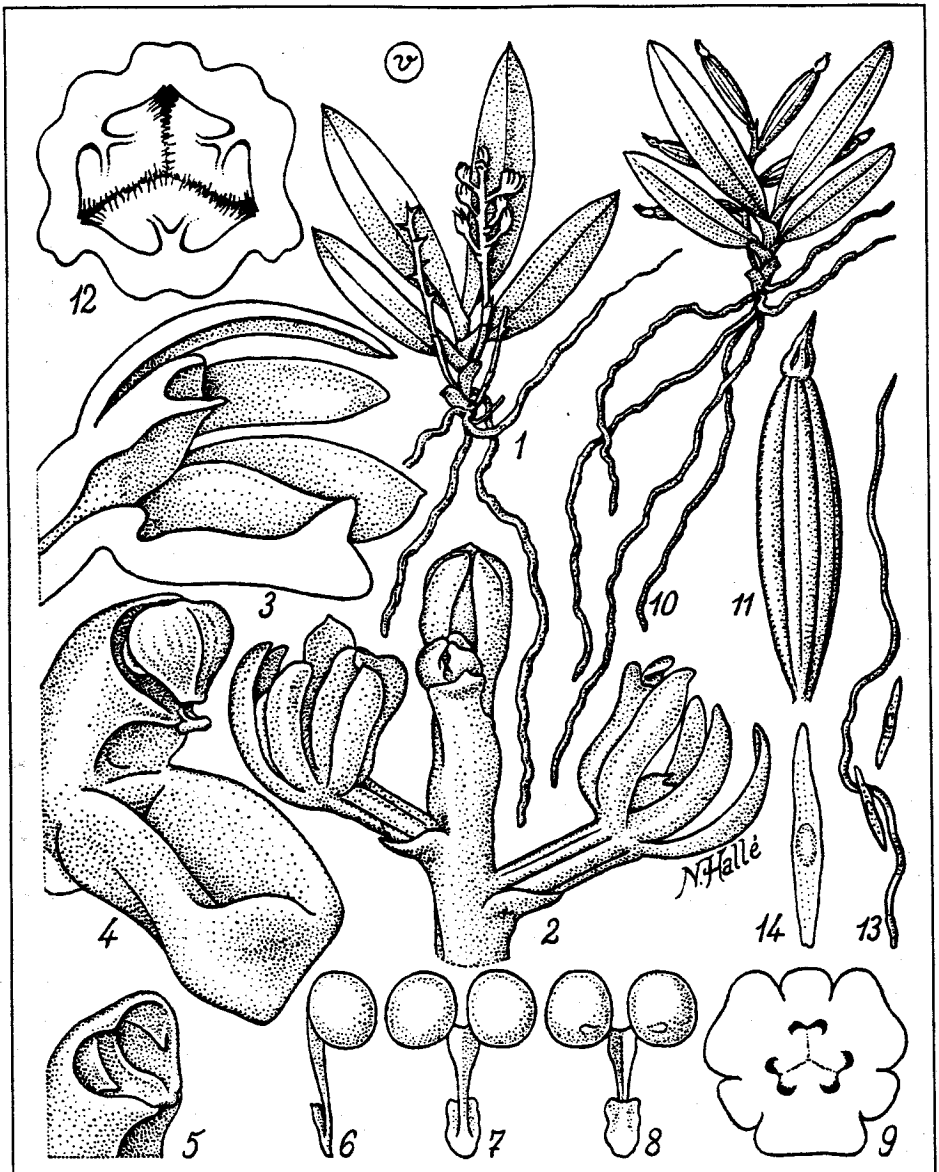
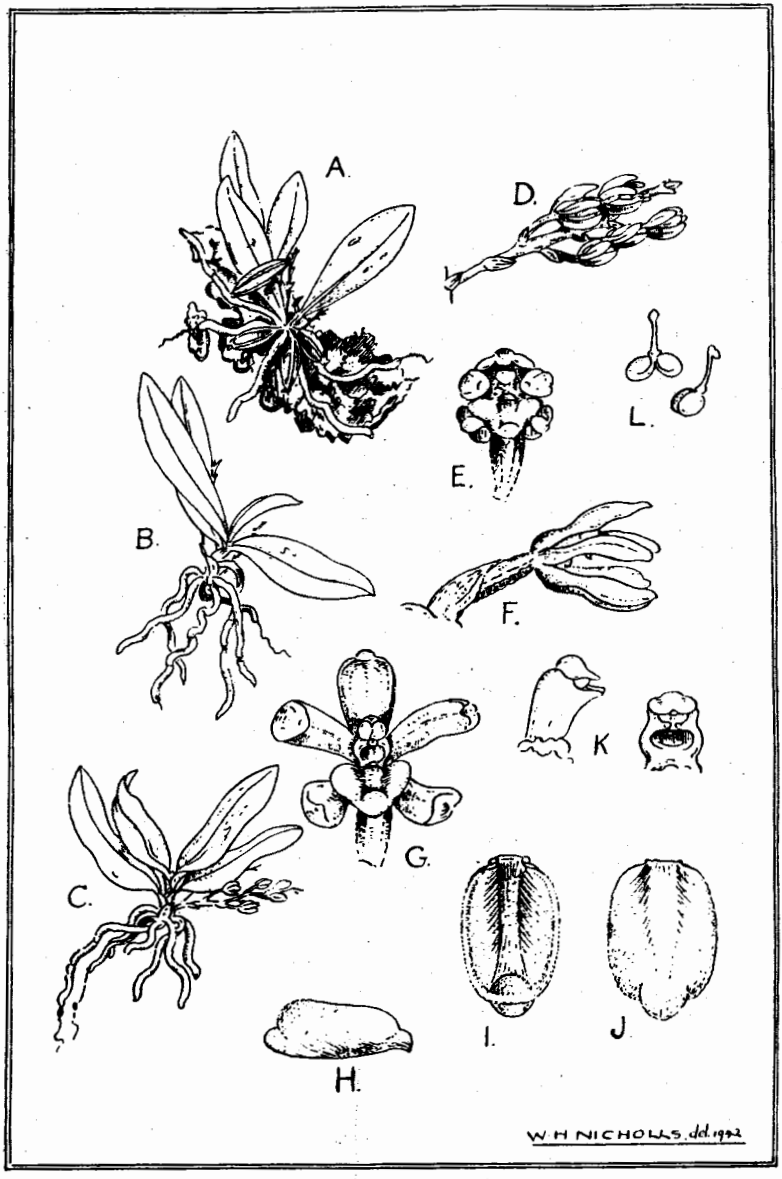


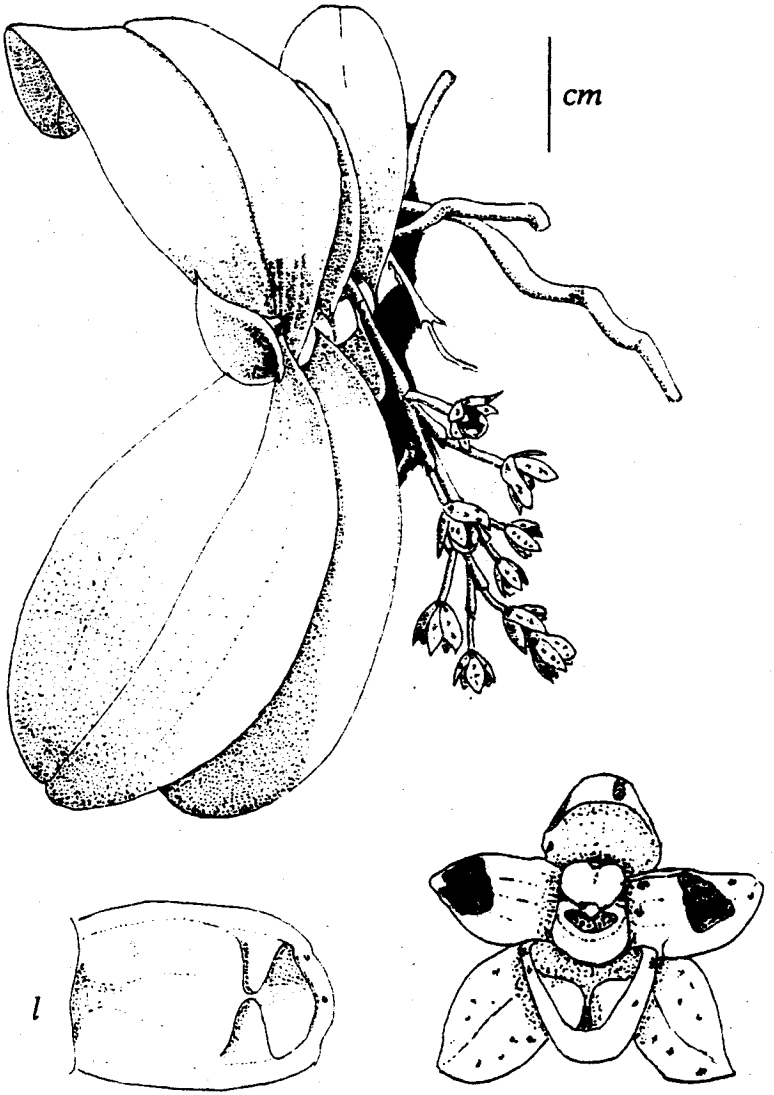
Drymoanthus flavus, watercolour by Dorothy Jenkin, Stewart Island, *c.* 1960. Although the painting is labelled *Sarcochilus adversus,* the yellow flowers and spotted leaves are typical of the common Stewart Island species, *D. flavus.*



Drymoanthus minimus, New Caledonia:. Halle's key reads: 1 = general view; 2 = part of the inflorescence; 3 = sectioned flower, sepals 2mm; 4 = column & labellum; 5 = top of the column with out the anther; 6, 7, 8 = pollinia from side, above & below, 3mm parts; 9 = sectioned ovary, 0.6mm diam; 10 = plant in fruit; 11 = fruit; 12 = fruit, sectioned, 3mm diam; 13 = hair from inside fruit; 14 = seed, 0.3mm.



Drymoanthus minutus, Queensland. Nicholls' key reads: A = plant with capsules; B-C = typical specimens; D = raceme of flowers; E = flower expanding its segments; F = flower from side; G = flower from front; H = labellum from side; I = lab. from above; J = lab. from below; K = columns, from side and front; L = pollinia.



Drymoanthus adversus, Martins Bay, southern New Zealand.

Notes

Tasks for this season. Tired of just taking photographs of orchids? got them all now? why not branch out - try to photograph and capture insect pollinators (you may have to try some of the techniques described in *Australian notes* by Bower in this issue, and you may have to hang about in the evening with fast film). Come to think of it, *why* are we so ignorant of the identity of the insects that do pollinate those of our orchids that are insect-pollinated? Are they night-fliers? Should we be watching at night with night-glasses? Should we be checking the pollinia night and morning?

Other tasks: which orchid flowers are scented? Adopt a colony, and record each year ***which*** plants appear, which flower and which set fruit. Take some longitudinal observations - over time - to record ***when*** plants emerge, flowers open, close, fruit sets, seed capsules break open. Count the ***number*** of flowers in a colony; count the number from which the pollinia have been removed; count the number that set fruit. Dye the pollen of some plants with ink, and later see whether the blue pollen has been deposited on other plants. There is a lot we do not know about the NZ orchids, that could be addressed by simple, cheap, non-expert (but time-consuming, and uncomfortable) observations.

Pat Enright has supplied his diary of field trips - as usual, a fascinating account: ***"29 Oct 1994 Taita Scientific Reserve***: this foray was to look for *Pterostylis tasmanica* and *P. nana* which were listed in Tony Druce's paper on the reserve. We were disappointed by not finding either species but did see some very nice flowering specimens of other species. *Pterostylis graminea* was very common and in full flower. *P banksii* was in contrast found in only the one spot near the bush edge. *P. alobula* and *P. trullifolia* were in seed, the former being much more common. *Corybas oblongus* was found in isolated patches with few flowers, but one notable patch had cream coloured flowers. Near this patch were the only plants of *Caladenia* sp. that we saw unfortunately not yet in flower. In a grassy clearing *Thelymitra longifolia* and *Microtis unifolia* were in bud. Other species noted as single species were *Earina mucronata* and *Chiloglottis cornuta*. This reserve is not open to the public and permission must be obtained before going in. The tracks are now a bit overgrown but still passable. Our trip was rather rushed and I am sure that a more thorough search especially under the manuka may produce the elusive *Pterostylis* although Tony Druce advises that most of the suitable habitat may now have been lost to the gorse.

"Another visit on 19/11/94 establised the *Caladenia* sp. as "green column" and turned up *Thelymitra decora* just coming

into flower amongst the scrub and *Earina autumnalis* on a rocky bank. *Pterostylis banksii* was also found in greater abundance in the damper bush in the lower gully.

"29 November 94 Maungakotukutuku valley: *Drymoanthus adversus* in flower was very common on a number of large Tawa which had been brought down by the wind. It was also found growing on *Lophomyrtus bullata*. On both species of tree they favoured the upper branches or other places where there was little competition from other epiphytes such as *Pyrrosia eleagnifolia* or *Phymatosorus* sp. There was also a lot of both *Earina* sps. and *Dendrobium* blown down onto the ground. *Pterostylis banksii* was relatively common on the bush floor. *Microtis uniflora* in flower and *Thelymitra longifolia* in bud were common on the grassy road verges.

"29 November 94 Eastbourne: on a trip to see Wellington's only known plant of *Peraxilla tetrapetala* with Tony Silbury as guide *Drymoanthus adversus* and *D. flavus* were both seen growing in close proximity on Kamahi and Beech. Also noted just past main flowering was *Caladenia* aff. *carnea (catenata)* and just coming into flower, *Thelymitra longifolia*.

"3 December 94 Cape Palliser and Palliser Bay: not a great place for orchid variety but a very interesting place for some other species of the Wairarapa's rare and endangered plants. *Thelymitra longifolia* was reasonably common on the cliffs and around the rocky shore. It obviously flowers earlier on this coast as there were no flowers only seed capsules. Around Wellington the flowering season is just getting under way. Around a pool of water that is fed from a seepage on the rocky coast there was a patch of *Corybas macranthus* with a couple of seed pods showing and nearby under a bit of *Olearia solandri* and *Cassinea* scrub a few pale flowered plants of *Pterostylis banksii* were growing. The only other orchid noted was *Microtis unifolia* which was found in most locales and habitats.

"28 December 94 - 6 January 95 Cobb Valley and surrounds N. W. Nelson: this was the annual field trip of the Wellington Botanical Society. This is very interesting place for orchids and for the photographers the timing could not have been better as most species were in full flower. The first species encountered was *Pterostylis irsoniana* which until I was shown the distinguishing characteristics I thought was a version of *P. graminea* (It always pays to get down and have a good look before making a pronouncement as to what you have found). Further up the old access road to the asbestos mine *P. oliveri*, *P.* aff *montana* and *P. australis* were flowering on the verge. This seemed to be a favoured site for these orchids as they were quite plentiful along the verges of the road to the magnesite mine as well. *Caladenia lyallii* was the most widespread orchid being found from beech forest, scrub on ultamafic rock to open tussock land above the bushline on the way to Lake Sylvester. In the beech forest *Adenochilus gracilis* was past it's main flowering but there were some nice patches still in flower. Val Smith was lucky enough to spot *Acianthis viridis* growing in the moss. The vegetation on the ultamafic rock was much reduced and

into flower amongst the scrub and *Earina autumnalis* on a rocky bank. *Pterostylis banksii* was also found in greater abundance in the damper bush in the lower gully.

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sparser than the surrounding countryside but *Chiloglottis cornuta* and *Thelymitra pulchella* were growing and flowering quite happily there. Most of the *Corybas* orchids had finished flowering but on the bank of a creek draining Peat Flat there was a patch of *Corybas rivularis* with one flower which keyed out to 'Waiouru' according to the key in Bruce Irwin's article in the Botsoc. bulletin. *Corybas trilobus* was widespread but not all that common in the beech forest and *C. macranthus* was only seen by me along the wet banks of the lakeside road leading to Lake Sylvester. Another orchid that favoured the wet banks alongside the road was *Microtis oligantha. Thelymita longifolia* was past flowering and the other terrestial orchids noted were *Microtis unifolia* and *Prasophyllum colensoi* and a small patch of *Aporostylis bifolia* growing on the edge of the path around Peat Flat. There was very little sign *of Earina mucronata, E autumnalis* or *Dendrobium cunninghanii* until we dropped down a little in altitude with the odd plant of *E. autumnalis* growing on rock above Sam's Creek and a solitary plant of *Dendrobium* beside the Takaka river. On the last trip to Gabbro creek however, there were some huge rock outcrops above the creek with all three orchids growing on the same rock along with a select ion of filmy ferns."

Val Smith reported the same ***Acianthus viridis***, "My major 'find' on the Cobb Valley trip was one plant of *Acianthus viridis* in beech forest towards the top of a ridge. The two flowers at the top of the stem were not quite open, but nevertheless were duly photographed, for it was a personal first and the only plant of that species found on the whole trip."

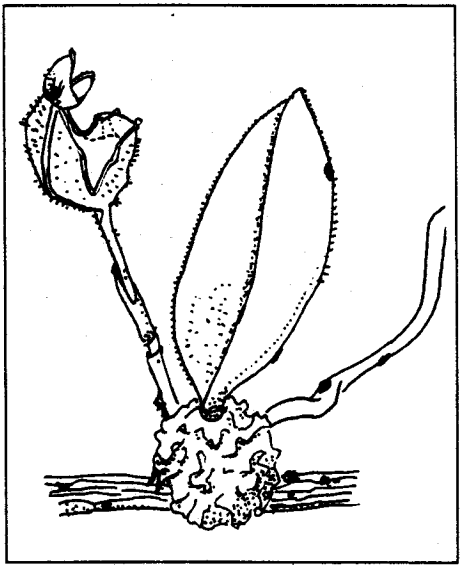
Val reported, "The Iwitahi Native Orchid Conference, with its shared wealth of knowledge and ideas, was also memorable for me for the natural light photo of *Calochilus robertsonii* that I achieved, thanks to Bob Talbot offering me his Benbo tripod to try. I may have to invest in one yet....

"A week or two later, a phone call from Margaret Menzies took Bob Talbot and me, along with camera gear, to the Ngaere Swamp area where Bruce Irwin had found *Thelymitra formosa* back in the 1940s. Amazingly it is still there, in just the same place as on his map - just two plants in a rough patch of farmland in the midst of highly productive, drained dairying land. The flowering plant was much taller and more robust than any other *Thelymitra* I have seen, and the flowers, quite a dark blue with reddish cilia, were soon being photographed from evey possible angle."

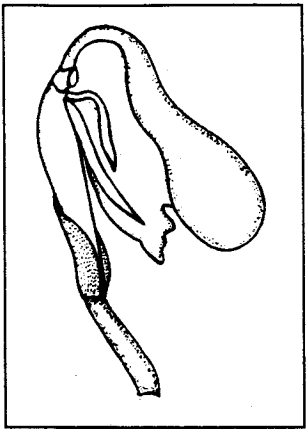
Errors in print are always rather an embarrassment - but editors, like surgeons and airline pilots, do make mistakes, and our policy is to correct them openly. In *J54,* p19, on Bruce Irwin's rediscovery of *Acianthus viridis*, I mixed two of his stories: Bruce found *A. viridis* above the Waitonga Falls, higher than where Owen Gibson had found it years before, and he knows of *P.* "aff. *patens*" in exactly the spot at Tangiwai that Dan Hatch had found it years

before. In *J55*, p13, in "Vulnerable", *Pterostylis* "aff. *patens*" should have been *Prasophyllum* "aff. *patens*".

The shrivelled flower still clung to the dehisced seed capsule of ***Bulbophyllum pygmaeum*** at Days Bay, Wellington, on 8 July, six months after flowering. ⇓



Is *Corybas carsei* the same orchid as the Australian *Corybas fordhamii*? Dan Hatch thinks so (J52, page 25, with Bruce Irwin's drawing). Chris Ecroyd hints as much (this issue page 12), and Peter de Lange and Brian Molloy's silence on the matter suggests that they regard it too as a vagrant Australian species. David Jones included New Zealand in the distribution of *C. fordhamii* in 1988.



Corybas fordhamii drawn by Jones D.L. *Native orchids of Australia.* Frenchs Forest, Reed Books, pp318-9.

Bert Donaldson wrote (12 July) from Dargaville, "I have just come back from a short walk to a native reserve at a small place called Aropuhe just out of Dargaville. The bush was very wet but interesting - *Pterostylis trullifolia,* and *P. alobula* were in full flower and very plentiful - everywhere I looked they were there. *Acianthus sinclairii* also in full flower in their thousands. Came across two patches of *Corybas cheesemanii* well hidden under the leaves; also in full flower. *Caladenia minor* was just showing through the moss. *Pterostylis rubricaulis* - also very plentiful under the kauri trees, and just showing flower spike. This piece of bush is one of a few up here that show a lot of promise for the future as they are closed to cattle."

Allan Ducker kindly sent specimens of July-flowering ***Corybas trilobus*** from three sites near Auckland. All have a long notched dorsal sepal, a notched fimbriate edge to the labellum (which was hairy in some specimens), and a <1cm squarish leaf. The *C. trilobus* variations begin to seem as complex as *C. rivularis*! ***Please send specimens - the only way to sort them out is to keep looking. I am keen to see late-flowering large forms - Ed.***

Orchid artist

Sheila Natusch (1926-)

At Half Moon Bay on Stewart Island an interest in wild things was bred in the bone, and it was here that Sheila Traill, daughter of R.H. Traill (for many years Caretaker of Reserves on Stewart Island, and a staunch friend to visiting naturalists) had her primary education.

Later at Southland Girls' High School she won a special prize in a Cheeseman Memorial competition, for watercolour sketches of plants collected at Ruggedy flats and Island Hill run on Stewart Island.

She began gathering land snails and sedges for collectors and for a year at home familiarised herself with Stewart Island plants, using Laing and Blackwell as a guide. Expeditions to far points on the Island made a big impact on her. Experts like Lucy Moore and others who went on collecting trips with her father helped and encouraged her.

She left for Dunedin and Training College, took subjects at the University and learned a good deal of botany. She joined the Dunedin Naturalists' Field Club and the University Tramping Club, and tramped with friends who were keen naturalists - it was, she says, a marvellous learning period.

She took school parties out orchid hunting, following in Miss Dalrymple's footsteps; she taught Darwinian evolution to a Standard Three class, until an enraged parent came one afternoon and accused her of unpresbyterian activities. Teaching and extramural work proved too much, and she worked to an M.A. by dint of long hours - among other places, tending the native plant section at the Botanical Gardens, and minding subantarctic plants sent up by Sorensen. George Simpson was a great support to her in these Dunedin days.

After another spell at the Island, collecting with Averil Lysaght and others, she moved to Wellington and worked for a time in the Botany Department at the Dominion Museum.

She wrote and illustrated lessons on natural history for the Correspondence School. Married by now, she began writing on her own account, on her favorite subjects - Stewart Island fauna, flora and geology, later moving into biography and history.

Her *A bunch of wild orchids* [1] was suggested by a neighbour, the late Mrs Leask, a good plant collector (the Leasks owned Island Hill Station on the Mason Bay side of the Island). The booklet succeeded Helen Dalrymple's *Orchid hunting in Otago*, by then out of print, and was at the time the only readily available work on the New Zealand orchids.

Her almost twenty published books include those on natural history and biographical subjects.

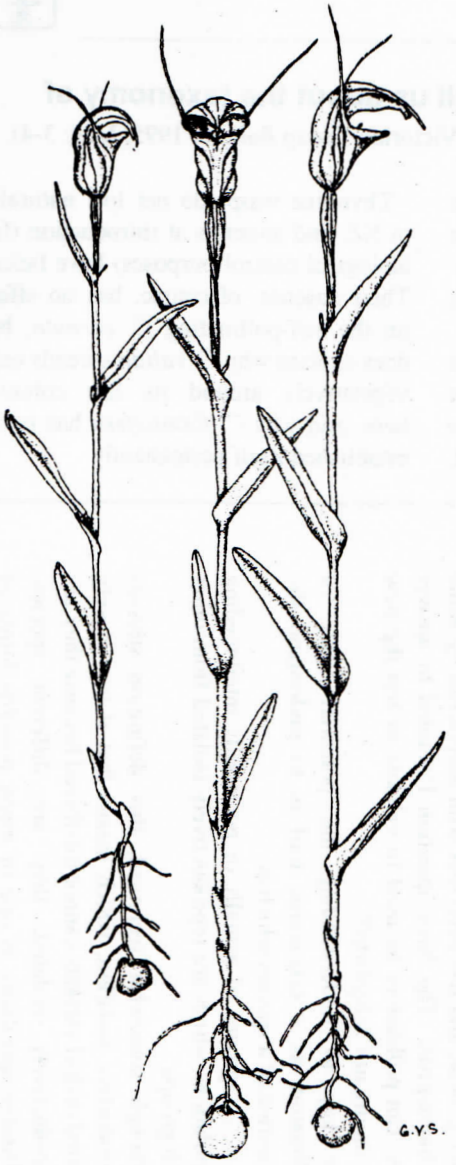
Sheila Natusch says her art was too "popular" to be regarded as scientific. But with Dorothy Jenkin and later Hugh Wilson, she established the high repute of Stewart Island for wild orchids.

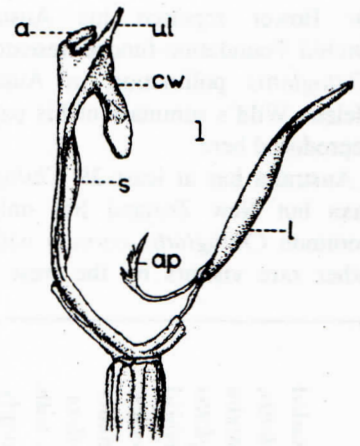
Reference

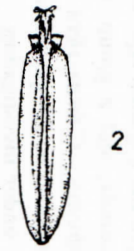
1. Natusch, Sheila. *A bunch of wild orchids.* Christchurch, Pegasus, 1968.

A bunch of wild orchids, watercolour sketch by Sheila Natusch. Shown are *Corybas macranthus* , *Pterostylis venosa, Aporostylis bifolia, Caladenia* "green column", *Thelymitra cyanea* and *Prasophyllum colensoi*, all common Stewart Island orchids.

Close relations: orchids like ours







PTEROSTYLIS OBTUSA R.Br.

line drawing by G.V. Scammell, from Rupp HMR. *The orchids of New South Wales.* 1943. Facsimile edition, National herbarium of NSW, Sydney, 1969. p93.

Australian notes

Pollinators: what can they tell us about the taxonomy of *Chiloglottis?* C. Bower (A.N.O.S. Victorian Group *Bulletin* 1995; May: 3-4).

Dr Bower reported his Australian Orchid Foundation-funded research on *Chiloglottis* pollination in Australia: Helene Wild's summary of his paper is reproduced here.

Australia has at least 29 *Chiloglottis* taxa but New Zealand has only the common *Chiloglottis cornuta* with two other rare visitors on the west wind.

Thynnine wasps do not live naturally in NZ, and attempts at introduction (for biological control purposes) have failed. Their absence, of course, has no effect on the self-pollinating *C. cornuta*, but does explain why *C. valida* spreads only vegetatively around its few colonies here, and why *C. formicifera* has never established itself permanently.

Introduction

Over the past few years I have been conducting detailed investigations of the pollinators of the genus *Chiloglottis*, a group of terrestrial orchids confined to eastern Australia and New Zealand. Prior to 1987, the genus *Chiloglottis* was regarded as consisting of five species and one hybrid in two major groups; the *C.gunnii* type with two species, *C.gunnii* and *C.cornuta*, and a group of three smaller species, *C.trapeziformis*, *C.formicifera* and *C.reflexa*. There are now thought to be 29 species in the genus with several other taxa under investigation. This seemingly radical change in thinking has also occurred in many other genera, and has been met with scepticism by some orchidologists. The basic question I wanted to answer was: can pollinators be used to validate or test the new taxonomy in *Chiloglottis*?

The key to understanding the potential value of pollinators as a taxonomic tool is to understand the definition of a species which is:

" ..... groups of actually or potentially interbreeding populations which are reproductively isolated from other such groups".

Although somewhat technical, this definition stresses reproductive isolation, which means that if two closely related orchid variants cannot interbreed because they are reproductively isolated, they are different species. Pollinator specificity is one of many possible forms of

reproductive isolation. In other words, if two orchids consistently attract different species of insects for pollination, they cannot interbreed and their integrity as separate species is maintained.

Pollination of *Chiloglottis*

Chiloglottis species are pollinated exclusively by small male wasps belonging to the subfamily Thynninae. They are attracted to flowers by wind borne odours or pheromones similar to those emitted by female wasps to attract males for mating. When the males arrive at the flower they attempt to mate with the calli on the labellum, which in the smaller species bears a remarkable resemblance to an insect. In attempting to mate with the labellum, the male may remove pollinia from the anther, or deposit any he brought on the stigma thereby effecting pollination or fertilisation of the flower. This mechanism of pollination involving the sexual deception of male insects is called the pseudocopulation or sexual deceit pollination syndrome.

Flowers of sexually deceptive orchids are usually dull coloured and offer no nectar, in contrast to the bright colours and nectar rewards of many bee pollinated flowers. In addition, previous research has suggested each sexually deceptive orchid species is pollinated by only one specific wasp species. It was this pollinator specificity which prompted me to explore the potential of pollinators as a taxonomic tool for sexually deceptive orchids.

Biology of thynnine wasps

The exploitation of thynnine wasps by some 130 Australian orchids seems to be related to the wasps' unique lifecycle. In contrast to the males, the female wasps are wingless and spend most of their time in the soil searching for grubs to parasitise. The female first stings the grub to paralyse it, before laying an egg on it. The thynnine grub then feeds on the paralysed host at its leisure. Periodically the females emerge from the soil and climb a grass stem where they call for males via their sex pheromones. Males in the vicinity respond very rapidly, the first to arrive quickly mates with the female and flies off with her in copula before other males arrive. The pair go to nectar sources where the male assists the female to feed before returning her to near where she was picked up, or so the story goes. The orchids mimic the calling female and exploit the urgent need of males to mate quickly and depart before the competition arrives.

Methods

To attract wasps in the field, *Chiloglottis* flowers were placed in small glass vials mounted in a wooden block and placed on the ground. Wasps visiting flowers were captured in an insect net after recording their behaviour on the flower. To test whether orchids from two or more populations attract the same or different insects, they are exposed simultaneously at the same sites in choice tests. Several designs of choice tests may be used in order to produce unequivocal data.

Results

Some 153 successful choice experiments have been conducted on 19 *Chiloglottis* taxa resulting in the capture of over 2,500 wasps. From this large body of data has emerged the first comprehensive picture of pollination in *Chiloglottis*. The data have shown a number of unexpected results and a much more complex situation than revealed by previous smaller studies.

The first surprise was that most *Chiloglottis* species attracted more than one thynnine wasp species. So far, the most, eleven, has been attracted by *Chiloglottis pluricallata*. This raises the question of whether all the wasps attracted are capable of effecting pollination. Observations of wasp behaviour on flowers can be used to define their pollinator status. The behavioural responses of the visitors to flowers varies enormously within and between wasp species. The weakest responders approach the flowers briefly in flight before quickly retreating. The strongest responders mate with the labellum and may remove or deposit pollinia. Most visiting wasp species respond only weakly and are not likely to effect pollination. Therefore, behavioural criteria were established for accepting thynnine visitors to flowers as pollinators.

Wasp species which attempted mating with the labellum calli were the only ones potentially able to effect pollination and are termed "potential pollinators". Wasps arriving at test flowers with pollinia from local natural populations of the orchid are called "putative pollinators". A wasp species is a "confirmed pollinator" if it is observed to remove pollinia from the anther, or deposit some on the stigma, of a test flower. Among confirmed pollinators the proportion of visitors which complete all the behavioural steps leading to removal of pollinia is quite low, around five percent or less. Potential, putative and confirmed pollinators are collectively termed "major responders", in contrast to "minor responders" which do not have potential as pollinators. Another important criterion for pollinator status is that the wasp species must occur within the distribution and habitats of the orchid. Some major responders occur outside the distribution or habitats of the orchid to which they respond in tests and therefore cannot be pollinators.

In all cases but one, which is still under investigation, each *Chiloglottis* species was found to have only one potential, putative or confirmed pollinator. The same wasp was found to be the pollinator throughout the range of the orchid.

Examples of the results of field pollinator choice experiments were presented which showed they can be used to demonstrate that two different orchid populations consistently attract different pollinators and must therefore be different species.

Conclusions

- Pollinator choice experiments can be used to prove two orchid taxa are different species
- Choice experiments are useful for separating inter and intra specific variation. Considerable variation occurs within some *Chiloglottis* taxa, e.g. *C.reflexa*, *C.diphylla* and *C.seminuda*
- Choice experiments can also reveal the presence of cryptic species which are difficult to distinguish morphologically and might be dismissed as variants within other species.
- The pollinator studies have shown that all the new species described by David Jones and Mark Clements, which have been tested so far, have different specific pollinators and are valid species.

The Native Orchid Society of South Australia (NOSSA) has sent an official invitation to the New Zealand Native Orchid Group to attend the **Third Australasian Native Orchid Conference** and Show at Flinders University in Adelaide 26-30 September 1996: "It will be a tremendous event and we promise a great time for all who attend.... We are hoping to be able to present the largest and most spectacular display of native Australasian orchids ever staged; one that will be talked about for years to come". NOSSA would be keen (1) to have a ***display of NZ natives*** - I am not sure how possible that is what with international quarantine regulations, CITES, etc, but if anybody is keen we can find out; (2) to have **a *Conservation Officer*** there from each group - NZNOG does not currently have a Conservation Officer, so if anyone is interested in attending in that capacity, please write to your editor; (3) to have a ***poster display*** from each group. - it would be good if someone could do this. (4) There is a ***raffle*** (tickets $1) for a bound copy of WH Nicholls's original three volumes of *Orchids of Australia.* Your editor has raffle tickets, instructions for the poster display, forms for exhibitors, entry forms for the photographic competition, and conference registration information.

You have to feel excited for the Aussies, what with **all the new species** being separated off from old identities. Some of their ANOS-affiliated societies' Newsletters seem rarely to mention a name that is not "aff." something. The Wollongong & District Native Orchid Society's July 1995 *Bulletin* listed rare orchids in southern NSW - *Calochilus* (sp 1) aff. *campestris, Calochilus* (sp 2) aff. *campestris, Prasophyllum* aff. *sylvestris, Burnettia cuneata, Caladenia tessellata, Caladenia* aff. *fitzgeraldii.*

Back to Basics: Iwitahi 1995

The Iwitahi Native Orchid Weekend, jointly organised by the Taupo Orchid Society and the New Zealand Native Orchid Group, will be held during the weekend of 8-10 December at the Iwitahi Outdoor Recreation Centre. There will be the usual mix of field and science, but this year the scientific emphasis will be on basic tasks for the native orchid watcher.

Programme

Friday 8 December:

- arrive, meet informally and chat.

Saturday 9 December:

- 9am to 1pm **THE BASICS**: five stations running concurrently,
  How to count and plot a stand of orchids - *Chris Ecroyd*
  How to draw an orchid - *Max Gibbs*
  How to photograph an orchid - *Val Smith*
  How to dissect an orchid flower - *Bruce Irwin*
  How to study pollination in orchids - *Ian St George*
- 10.30 TEA.
- 1pm LUNCH
- 2pm **WALK THROUGH THE BLOCKS** and look for groups of orchids that should be shifted into the Reserve
- 6pm BARBECUE
- 7.30 to 10pm **SHORT PRESENTATIONS**.
  This is your chance to talk about what you want to - stand up, speak for no more than fifteen minutes (showing no more than ten slides) per topic, then sit down and someone else will take over. If you have several topics you want to talk about, fine, but not consecutively please.

Sunday 11 December

- A CHOICE - free activity, or tasks in the Reserve
- **A WALK IN THE BLACK FOREST**
  - a walk with Nancy Adye to see the non-orchid plants in the block
  - a look at the orchids in the Reserve

Those wishing to attend or to speak, should register their intention with Trevor Nicholls, 33 Hinekura Ave, Taupo, phone 07 378 4813, before 1 December. He will supply details of travel, cost, accomodation, supplies, etc by return.