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## Editorial

### If it is self-pollinating why does *Calochilus robertsonii* look like an insect?

*Calochilus robertsonii* is mostly insect-pollinated in Australia. You might infer that from its flowers - they look like insects, with their baleful eyes (dark thickenings on the column-wings) and hairy body.



*Calochilus robertsonii*  
Watercolour by Jessie Brownlee, reproduced  
courtesy of the Auckland Museum (wrongly  
labelled as *Calochilus campestris*).

Yet the species seems to be predominantly self-pollinating in New Zealand [1], and even in Australia self-pollination is a fall-back position.

Why then has *Calochilus robertsonii* retained its insect mimicry in New Zealand?

It would gain no advantage from getting rid of such structures of course, and it would be difficult to do so. I suppose a self-pollinator has only half the chance to change by mutation of a cross-pollinator where parenthood is shared.

Might the insect-look persist for other reasons? Sexual and nectar lures are not the only ways of achieving insect-pollination; mimicking enemies may provoke *attack* by insects for the same purpose [2]. Darwin reported that "Mr Price has frequently witnessed attacks made upon the bee orchis by a bee...." [4]. To my knowledge nobody has seen insects attacking the flowers of *C. robertsonii* though.

There are some distinct advantages in self-pollination (for instance structural stability, a full set of seed, no need for insects, and the chance for multiplication from a single plant). Could the insect mimicry have persisted in order to frighten insects off? Could the flower be a spider-mimic?

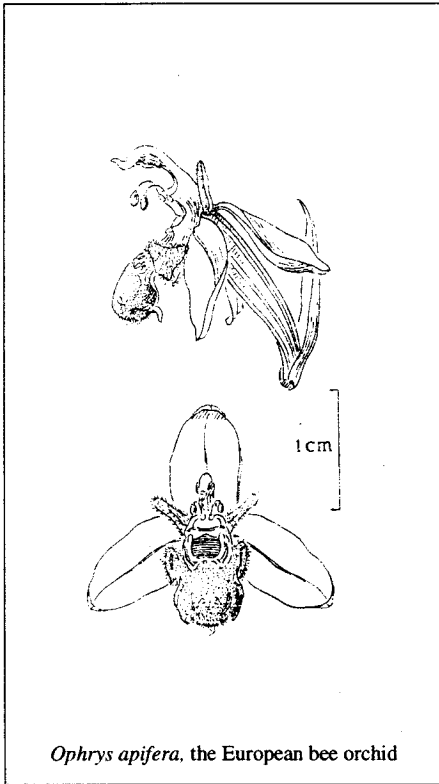
The answer to such conjecture has to be no. Even in a predominantly selfing species, occasional opportunistic insect-pollination would have advantages - and it may happen in New Zealand [4]

Seemingly *C. robertsonii* has the best of both worlds.

In a freshly opened flower the column is rather upright, the pollinia are

coherent, and the rostellum is broad - suggesting readiness for insect-pollination.

some protection from selfing. As the flower matures the column adapts to facilitate self-pollination - a "fall-forward" (rather than a fall-back) position.

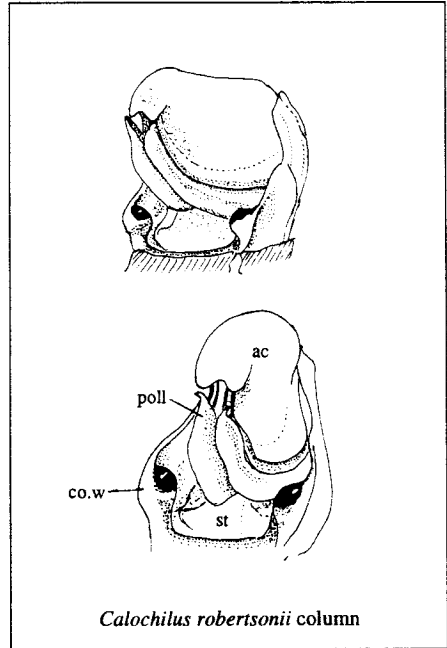


*Ophrys apifera*, the European bee orchid

In the ripe column the anther bends forward to place the pollinia directly over the upturned cup of the stigma, a stance that would facilitate self-pollination. The rostellum withers, and is almost hidden between the pollinia - no longer providing an effective barrier between pollinia and stigma. The pollinia crumble.

**Summary**

*C. robertsonii* retains its insect mimicry as a lure for occasional insect-pollination, even in New Zealand: to this end the young flower appears to have



**References**

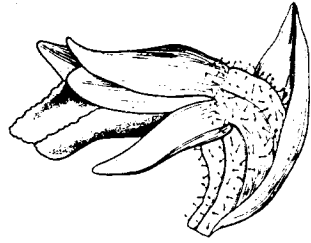
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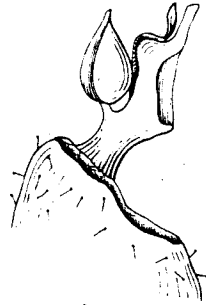
*Calochilus robertsonii*: monochrome photograph by HB Matthews, labelled Rotorua, Nov.13-1923.

### Close relations

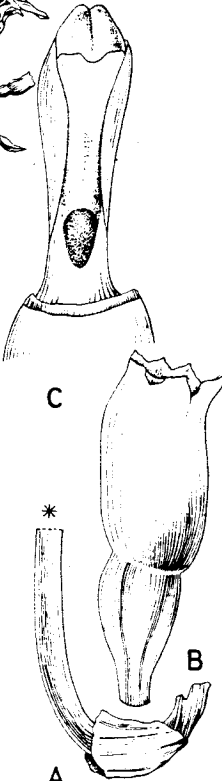
*Spiranthes sinensis*: H plant; I flower; J column side view with pollinia removed



I



J



C

B

A

← *Gastrodia orobanchoides*: A plant; B flower; C column ventral view

*Gastrodia orobanchoides* and *Spiranthes sinensis*; drawings by S.Hameed, from Nasir E and Ali SI. *Flora of Pakistan* No 164: *Orchidaceae*. J.Renz, Basel, 1984.

S.Hameed '84

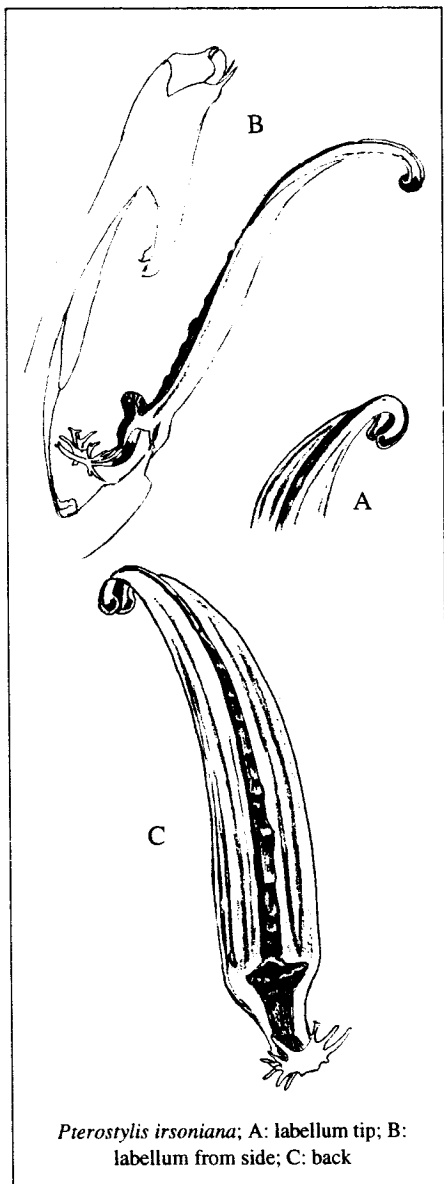
## Notes

\* New member Eric Scanlen (4 Sunny Park Ave, Papakura) wrote, "Photography of the orchids has been my main interest... and I am available in weekends to do photographic service for anyone who needs me in a good cause".

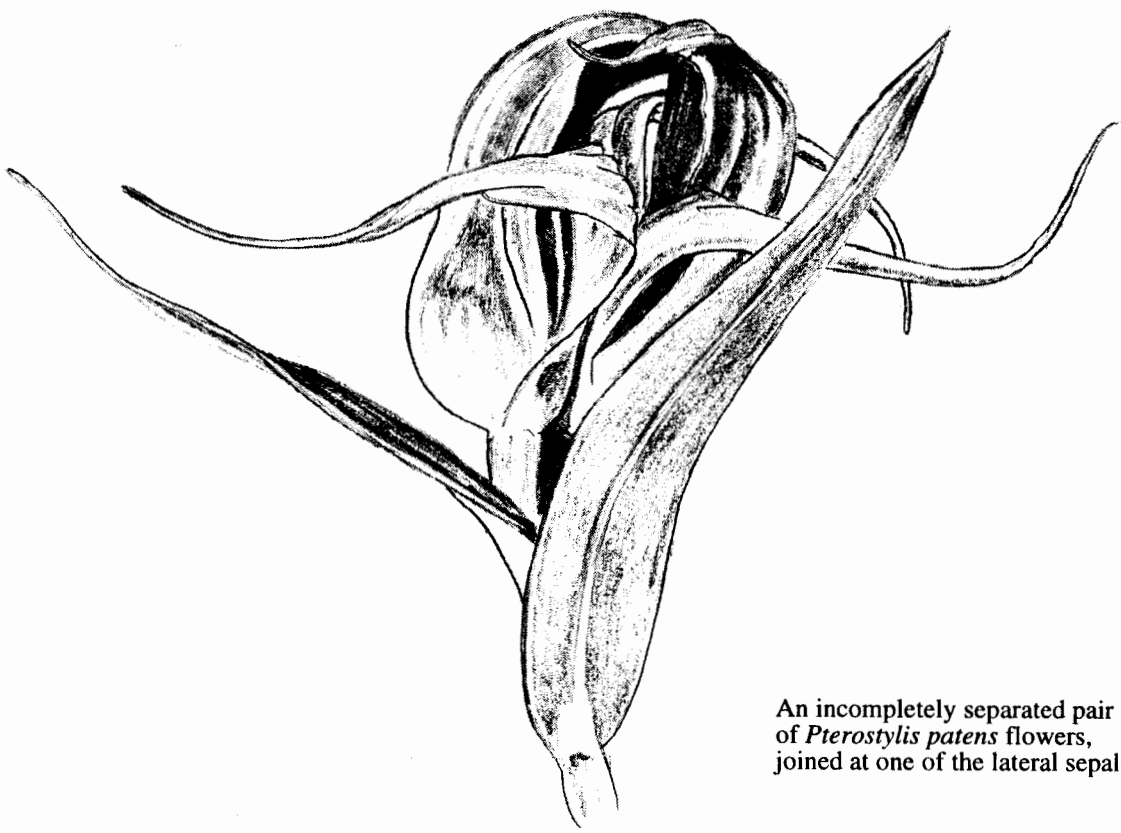
\* Dan Hatch wrote (4 May), "I am indebted to Mr Ewen Cameron for the following extension of range - *Yoania australis*, Te Matuku Bay, Waiheke Island. RE Beever, January 1994. Two plants only, in the classical environment, with nikau under a taraire canopy. The bare fact of the plant's discovery on Waiheke, is recorded in *Gulf News*, 25 February 1994, p50, and repeated in the *Auck.Bot.Soc. Newsletter* May 1994".

\* The South Australian Native Orchid *Journal* (1994; 18 (4): 39) reported, of the newly renamed *Pterostylis tasmanica* (ex *P. plumosa* - see Brian Molloy in this issue): "This is the name for the short flowered self pollinated version of *P. plumosa*.... Although Jones suggests it occurs in Tasmania, New Zealand and Victoria it almost certainly extends to South Australia where it occurs in swampy sand heath...."

\* I was delighted to see *Pterostylis irsoniana* for the first time - on Mt Taranaki. One of its distinguishing features is the large callus at the base of the labellum. In the specimens I examined, the whole midline ridge of the labellum was raised in a series of calli, the basal one merely being the biggest (see figure). The same day I saw incompletely separated flowers ("Siamese twins") of *P. patens* - joined at a third shared lateral sepal (see figure) - Ed.



*Pterostylis irsoniana*; A: labellum tip; B: labellum from side; C: back



An incompletely separated pair of *Pterostylis patens* flowers, joined at one of the lateral sepals

\* Val Smith wrote, "On an open ridge of the Whitecliffs Walkway in North Taranaki, blue and a few pinkish *Thelymitra* flowers were opening to the sun on at least two warm days in November. I believe them to be *T. pauciflora*, but with more flowers on the stems than is generally described. I spent some time waiting for lulls in the breeze to photograph them in natural light, both sunlight and the diffused light of a white golf umbrella. I can only guess what a lone trumper was thinking when he came over the brow, sighted the broily among the gorse bushes and called out, 'Is anyone there?'"

\* Dan Hatch drew attention to a paper by AM Pridgeon: Systematic leaf anatomy of *Caladeniinae*; *Botanical Journal of the Linnaean Society of London*, 1994; 114 (1): 45. An extract reads, "*Aporostylis bifolia* was originally described as *Caladenia bifolia* by JD Hooker (1853) on the basis of floral features, transferred to *Chiloglottis* by Schlechter (1926), because of its vegetative similarity to that genus, and then segregated by Rupp and Hatch (1946), because of its inconsistencies with both genera. Like many species of *Caladenia*, the leaves have glandular trichomes, stomata on both surfaces, and homogeneous mesophyll. However the trichomes of *Aporostylis* are unique among *Caladeniinae* in being multiseriate. Furthermore, the mean length:width ratio of its adaxial stomata (0.772) falls far outside the range of that of other taxa. Pending cladistic analysis, *Aporostylis* may well be a sister taxon to *Caladenia sensu stricto*, diverging early and isolated in New Zealand".

\* The Taupo Orchid Society Newsletter of May 1994 reported, "On 30 March Trevor and Doug met Brian Grinrod, Headteacher of Rangitaiki School together with 42 pupils and parents at

the (Iwitahi Orchid) Reserve. They spent the afternoon transplanting young native trees from outside the Reserve in pine forests and they planted them on the boundary line of the Reserve and forestry to form a shelter belt when forestry mills the adjacent forest. The whole school were so enthusiastic and worked so well, they got half the boundary line completed. One boy, Andrew, found a native orchid in the pines, and Doug helped him to transplant it in the Reserve. All the children showed great interest in looking for native orchids". The pupils later completed the boundary planting, and the Taupo Society hopes to keep the Rangitaiki schoolchildren involved with all the future progress of the Reserve.

\* I was sad to read of Eric Adye's death a few weeks ago; and regretted, when I read about what a fascinating and full life he had led, that I had not known him better. Our condolences to Nancy - Ed.

\* It was good to see Cath and Ken Wilson's smiling faces in the June issue of *Next* magazine, and to read about their work and their music - Ed.

\* It was also good to see Brian Molloy's face in Air New Zealand's in-flight magazine *Pacific Way* - the May issue. His work on orchids was well reviewed for a lay readership by Keith Lyons, and accompanied by colour photographs of such rarities as *Thelymitra ixioides*, *T. carnea*, *Earina aestivalis* and *Caladenia minor* - Ed.

\* Pat Enright wrote on a botanical trip to Maungakotukutuku Valley on 27 May, "The forest on the valley floor and on the lower slopes was mixed tawa/podocarp with an interesting understorey of ferns and shrubs where light and moisture permitted, but otherwise the forest was rather open.



"The recent high winds had brought down some large boughs and 'aerial gardens'.

Growing on one large branch were *Earina autumnalis*, *E. mucronata*, *Dendrobium cunninghamii* and *Drymoanthus adversus*. Another rather rotten branch yielded *Bulbophyllum pygmaeum*.

"A *Thelymitra* sp. was quite common on bare ground on the river banks. A spring trip to see this in flower and to see the *Pterostylis* sps. which are reported from here is a must."

\* Pat also sent short notes on a Wellington Botanical Society trip on 28 December 93 to 7 January 94 -

Castle Hill *Microtis unifolia*, *M. oligantha*.

Lake Lyndon area *Pterostylis* aff. *cycnocephala*.

Rakaia Gorge *P. areolata*.

Temple Basin skifield *Pterostylis venosa* growing at 1400m close under a rock overhang, very much dwarfed in stature to look superficially like *Chiloglottis*.

Arthur's Pass *Aporostylis bifolia*, *Caladenia lyallii*, *P. oliveri* (early Dec).

Beech forest, Craigieburn; Andrews Stream Wharfdale Track *Chiloglottis cornuta*, *Caladenia minor*."

\* Colin Ogle wrote (11 February), "Brian Molloy has just confirmed that two *Gastrodia* specimens I sent him last week were *G. cunninghamii* s.s. and *G. sesamoides* auct NZ.

He took pains to tell me that NZ '*G. sesamoides*' is probably an undescribed species, not the same as *G. sesamoides* in Australia (whence the species was named). What I found interesting about these two specimens was that they were growing only about 20 metres apart, the first time I've seen two *Gastrodia* species growing together.



*Gastrodia sesamoides*,  
watercolour by Lillian Gibbard

They were in Lismore Forest, an exotic forest of mainly radiata pine near Wanganui. *G. cunninghamii* (two orchid stems) was under *Sequoia sempervirens* and '*G. sesamoides*' (26 orchid stems in a patch  $<1\text{m}^2$ ) was under *Cupressus macrocarpa*".

Colin wrote again on 17 February, "*Gastrodia sesamoides* turned up again recently, in Owen Batley's garden west of Mataroa (north of Taihape). The owner had partly cleared an old shrubbery at the base of a large sweet chestnut tree, and spread a thick layer of sawdust over it preparatory to digging a vegetable garden. Several of us in the Wanganui Botanical group identified asparagus-like shoots emerging through the sawdust as being *Gastrodia* when we visited the garden on 1 February 1994 and it was identified as *G. sesamoides* auct NZ. Owen Batley's garden is at 700m, and flowering was later than at Lismore (50m) where we'd seen 26 stems of the species with only the terminal flowers still open on 30 January. I saw the same species in flower many years ago under pines at Opoutere Beach (Coromandel Peninsula) around New Year".

*The very good watercolour of G. sesamoides* auct NZ is in the Auckland Institute and Museum collection, painted by Lillian Gibbard (a daughter of flower painter Fanny Osborne of Great Barrier Island); it is reproduced here with permission - Ed.

\* Allan Ducker wrote (7 June), "Have been out and about again to my favorite haunt, Bream Tail Res. Found in flower *Acianthus sinclairii*, *Pterostylis alobula*, *P. trullifolia*, *P. rubricaulis*, *Corybas trilobus*.

"I was looking for signs of *C. trilobus* at Easter and found none; this time I saw it in flower but had to look really hard - only small leaves and flowers - most of the leaves showing had flowers, say

95%. Last year when there was lots of leaf there were not many flowers - when the flowers had elongated into seedheads the percentage would have been 5% seed to 95% leaf". - Dan Hatch wrote (*Auckland's orchids*, 1959), "*Corybas trilobus* begins to flower at this time (June) also, although the flowering plants are very tiny, and few in proportion to the numbers of barren plants which appear later, and so is easily overlooked". Your observations are accurate and the pattern is the same throughout the country; late vegetative spread of the colony produces many flowerless leaves. - Ed.



*Gastrodia cunninghamii*

\* Randal Springer of Wanganui wrote that Edwin B. Dickson's name for the 1866 Taranaki *Pterostylis* (June 94 NOG *Journal*) was *ochrolinea* (not *Ochroleuca* as we had thought); that the recipient's note read "*Ans<sup>d</sup>*" - for answered (not "*Arr<sup>d</sup>*" - for arrived); and that the man we referred to in note 2 was Spencer Medley, son-in-law of the Rev Richard Taylor of Putiki. Medley was a RN officer who served as an Aide-de-Camp to Governor Grey. The Miss King we referred to in note 4 was probably Martha King, New Zealand's first resident botanical artist, who moved to New Plymouth in 1847.

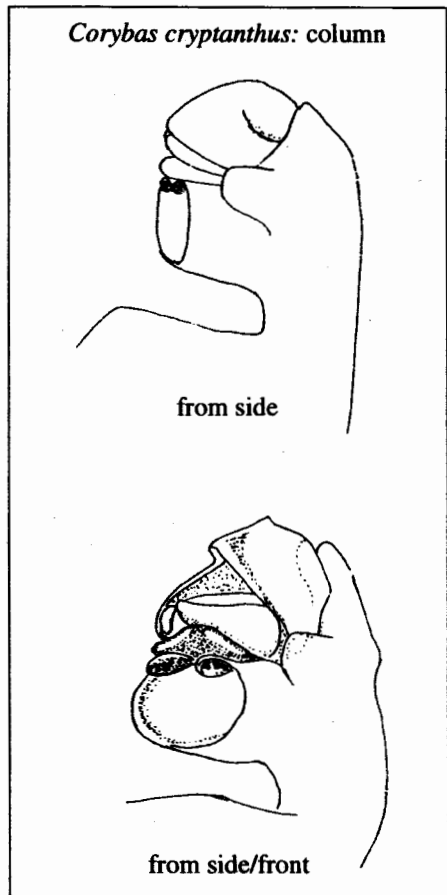
Mr Springer wrote about his work with the Wanganui Museum collection of herbaria, "one of the collections originated from early Auckland.... On four of the specimen pages the collector is named as E.B. Dickson."

The specimens were collected in Wellington January 1856, Auckland August 1856, Coromandel 1863, New Plymouth 1866, Taranaki 1869.

"The collector is not listed on many of the specimen pages but from the style of the presentation I now think we have a collection which must have had some connection with Dickson, even though his is not the only name given as a collector. There is no conclusive proof however, which is a great pity.... None of the specimens are orchids by the way - they are nearly all ferns."

\* On 10 July I found flowers of *Corybas cryptanthus* beside the ridge track above Days Bay, Wellington. This was a site I had marked when I found fruiting heads on 26 December last year. Five flowers were located, one of which was dissected. It showed an interesting column - upright, with a broad, solid rostellar shelf separating the coherent pollinia from the vertical stigma; there was a mass of sugar-rich tissue in front of the stigma, as in several insect-pollinated *Corybas* species: perhaps a

nectary. It suggests insect pollination as much as self-pollination. Doug McCrae noted (of a colony of *C. cryptanthus* in the Far North) "the abundant seed set suggests that the species is autogamous (self-pollinating). Fungus gnats (*Myceptophylla* sp.) are known to pollinate other species of *Corybas*. The high fungal infection of the litter in this area would undoubtedly attract these tiny insects". Insect pollination, even in the depths of the leaf-litter, is conceivable then; the column structure and the possibility of a nectary suggest it - *Ed.*



\* In the New Zealand Botanical Society Newsletter (June 1994) Graeme Jane reported on the Nelson Society's April field trip to Croisilles Harbour (western Marlborough Sounds), "...*Bulbophyllum pygmaeum* ...was soon found to be quite common on the faces of the (ultramafic) rocks within easy reach. Close examination revealed flowers on many plants". *B. pygmaeum* flowers open in December in Wellington - were these fruits? - Ed.

\* I am grateful to Maureen Young and Frank Hudson for guiding me to *Corybas rotundifolius* near Warkworth. Only one was in flower on 1 July, but more were in bud. Frank reported that many flowers are nipped off before setting fruit, presumably by mice - Ed.

\* Betty Seddon wrote (17 July), "Have just returned from Little Barrier Island where I was fortunate to be working for two weeks. Magic - as usual!

"While there I found the following orchids in flower: *Acianthus sinclairii*, *Pterostylis alobula*, *P. trullifolia*, *Corybas trilobus*; *Cyrtostylis reniformis* - still in bud, *Bulbophyllum pygmaeum* - leaves only, on kauri trees which were shedding bark! quite a lot on the trunks of big trees; Many *Thelymitra* leaves showing along track edges; also *Earina autumnalis*, *E. mucronata* and *Dendrobium cunninghamii* leaves - common.

"On Bruce Irwin's note in Journal 49 on *Pterostylis* 'epiphyticus', while working on Whale Island (off Whakatane) in 1986 I noticed plants of *Pterostylis alobula* growing profusely up the sloping trunk of an old pohutukawa tree. As there were still rabbits and rats present on the island (although in the process of being exterminated) this was the only place I saw them growing in any profusion. It was at least 5-6ft off the ground, and the trunk sloped quite steeply".

## Original papers

### **Reinstatement of *Corybas orbiculatus* (Colenso) L.B. Moore** by Brian Molloy, Manaaki Whenua - Landcare Research, Lincoln

The combination *Corybas orbiculatus* (Colenso) L.B. Moore was published in 1970 in Volume 2 of the *Flora of New Zealand* [1], and is based on *Corysanthes orbiculata* the name given to an orchid from the Mt Cook district by William Colenso when he described it more than 100 years ago [2]. The name *Corysanthes orbiculata* was typified by Lucy Moore, who chose a specimen from Colenso's herbarium that was collected from Black Birch Creek

Valley, Mt Cook in 1890 by Henry Suter (WELT 24287). Moore also cited *Corybas macranthus* var. *longipetalus* Hatch as a synonym of *Corybas orbiculatus*.

Moore's circumscription of *Corybas orbiculatus* includes entities currently referred to *Corybas rivularis* (A. Cunn.) Rchb.f. As pointed out by Clements & Hatch [3], the name *Corybas rivularis* had been mistakenly applied in the past to an unnamed species which they

described as *Corybas acuminatus* M.A. Clem. et Hatch. In correcting this mistake, Clements & Hatch restricted the epithet *rivularis* to the species originally described as *Acianthus rivularis* by Allan Cunningham [4] (later placed in *Corybas* by H. G. Reichenbach [5]), and treated *Corybas orbiculatus* as a synonym of *Corybas rivularis*.

In preparation for the forthcoming *Catalogue of New Zealand Orchidaceae* in collaboration with Mark Clements and David Jones of the Australian National Botanic Gardens, Canberra, I have examined type material of *Corybas* held in New Zealand herbaria. The type of *Corysanthes orbiculata* Colenso, on which the name *Corybas orbiculatus* (Colenso) L.B. Moore is based, clearly belongs to a distinct species readily distinguishable from other entities currently included in *Corybas rivularis*. Live material from the original locality matches Colenso's description and type. Moreover, the type of *Corysanthes orbiculata* is identical with the orchid currently known by the tag names *Corybas* "C" and *Corybas* "short tepals" [6, 7].

Accordingly, Colenso's species is fully vindicated, and the name *Corybas orbiculatus* (Colenso) L.B. Moore is hereby reinstated.

*Corybas orbiculatus* is easily distinguished from orchids of the *C. rivularis* complex, and from *Corybas macranthus* (Hook. f.) Rchb.f., by its short (less than 2 cm), thin petals and sepals and dark purplish-red labellum, narrowed and folded inwards in the fresh state, orbicular when flattened and pressed. Comparative illustrations have been published by Irwin [6, 8].

*Corybas orbiculatus* occurs locally in central, western, and southern North Island, in Nelson (F.G. Gibbs 1907, CHR 147024), Canterbury, Otago, and Southland, and on Stewart Island and the Chatham Islands. The species is relatively uniform throughout its range.

It commonly grows on well irrigated banks on forest margins, often in association with members of the *C. rivularis* complex, and is especially abundant locally along bush-clad roadsides in Wanganui and Taranaki where Bruce Irwin first became aware of it in 1947 (see p. 32, *New Zealand Native Orchid Group Journal* 48, 1993).

In cultivation at Lincoln *C. orbiculatus* flowers are predominantly self-pollinating and self-fertilised; this is probably facilitated by an erect column and friable, incoherent pollinia. I had previously thought that this species was predominantly insect-pollinated [7].

*Corybas orbiculatus* (as *Corybas* "short tepals") was formerly ranked as "Vulnerable" [9]. However, because the species is more widespread and abundant than at first thought, it is no longer considered threatened [10].

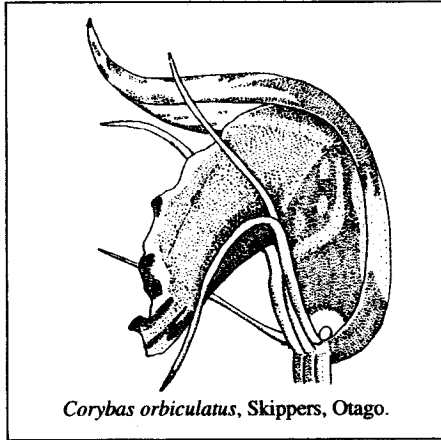
#### Acknowledgments

I thank Kevin Luff (Wanganui) for first drawing this species to my attention in 1983, and Jean Jenks (Nelson), Ian St George (Otago), Bruce Irwin (Taranaki/Wanganui) and Tom Pendrigh (Canterbury) for specimens and live plants, and for their company in the field. The loan of specimens from the Auckland Institute and Museum and from the Museum of New Zealand Te Papa Tongarewa is also acknowledged. My research on New Zealand orchids is funded by the Foundation for Research, Science and Technology under Contract C09226.

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### ***Pterostylis tasmanica* D.L. Jones -**

#### **a new name for the bearded greenhood indigenous to New Zealand**

by Brian Molloy, Manaaki Whenua - Landcare Research, Lincoln

In a recent paper in *Muelleria*, published by the National Herbarium of Victoria, Royal Botanic Gardens, Melbourne, David Jones of the Australian National Botanic Gardens, Canberra, described nine new species of Orchidaceae from south-eastern Australia, with one, *Pterostylis tasmanica* D.L. Jones, extending to New Zealand. [1]

*Pterostylis tasmanica* is a new name for the bearded greenhood orchid previously known in New Zealand as

*Pterostylis barbata* Lindl [2, 3]; or *Pterostylis plumosa* Cady [4, 5].

The application of the last two names, both in New Zealand and in Australia, has been confusing to say the least. However, recent and continuing research on the systematics of Australasian Orchidaceae has shown that *P. barbata* and a similar orchid, *Pterostylis turfosa* Lindl., both distinguishable from each other and from *P. plumosa*, are endemic to south-western Western Australia,

whereas *P. plumosa* is restricted to south-eastern Australia but was thought to extend also to New Zealand [6, 7].

*Pterostylis plumosa* has long been regarded as a variable species in growth habit, size and colour of leaves and flowers, labellum ornamentation, and pollination system [7 & pers. comm.]. Further studies of this species throughout its range, including material from New Zealand, has revealed a distinct entity formerly included with *P. plumosa* and newly described as *P. tasmanica* [1].

David Jones's paper includes a full description of *P. tasmanica* and illustrations of its flower in side view and a detached labellum, together with accompanying notes. According to its author *P. tasmanica* is readily distinguished from *P. plumosa* by its shorter stature (8-14 cm), smaller leaves (1-2.4 cm x 3-7 mm) arranged in a relatively tight rosette, and a smaller (1.8-2.5 cm long) self-pollinating flower with a more densely plumose labellum and a short apical point on the dorsal sepal, giving the flower a blunt appearance. *Pterostylis plumosa*, on the other hand, grows up to 25 cm tall, has leaves up to 4 cm x 10 mm arranged in a relatively loose rosette, and flowers up to 4.5 cm long with a longer (up to 4 mm) apical point (usually upturned) on the dorsal sepal [1].

New Zealand plants of the bearded greenhood match the description of *P. tasmanica* fairly closely, but can be taller (up to 18-(20) cm), with the apical knob of the labellum sometimes brown suffused with red or purple instead of the usual brown. However, there is no mistaking their blunt flowers held erect on flowering stems - a posture seemingly characteristic of self-pollinating greenhoods.

*Pterostylis tasmanica* is restricted to southern Victoria, Tasmania, and New Zealand, whereas *P. plumosa* is widespread in south-eastern Australia.

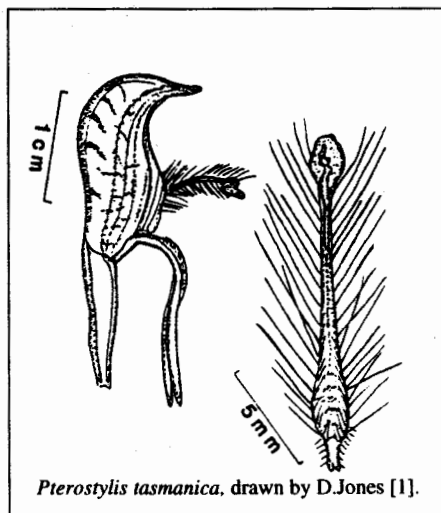
In Australia, *P. tasmanica* commonly grows in coastal or near-coastal woodland and heathland, usually in sandy loam soils, and is considered a widespread and well conserved species there. In New Zealand (North Island and northern South Island) *P. tasmanica* is also commonly found in coastal or near-coastal districts, sometimes further inland, and usually in scrub, including gorse (*Ulex europaeus*), or on disturbed forest and track margins in sandy or clayey soils.

In this country *P. tasmanica* (as *P. plumosa*) is classed as Rare though not Endangered or Vulnerable but at risk [8].

The epithet *tasmanica* refers to the distribution of the species, centred around Tasmania and the Tasmanian Basin [1]. Illustrations of *P. tasmanica* are included in the books and papers referenced below and marked with an asterisk.

#### Acknowledgment

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*Pterostylis tasmanica*, drawn by Bruce Irwin from a specimen collected from Wallaceville Hill, Hutt Valley, 5 November 1966



## Research projects and orchid badges

by Heather Crofsky, Papatoetoe

The growing number of people in the orchid world who are finding increasing fascination with orchid badges as an extension of their love for the flowers forces me to think of their possible value as fund raisers.

Orchid badges provide an opportunity to establish funding for a special project or research while helping to quench the continuing thirst of orchid badge collectors around the world in their quest for yet another badge.

A badge can be a valuable educational tool. Those of us who enjoy our native orchids without necessarily knowing their botanical names can have a small reminder in badge form if the orchid depicted is named. A badge can improve our geography and expand our knowledge. Badges are talking points, conversation starters, even fashion accessories.

Like most things made in small quantities they often become sought after which can add to their value very

quickly. The trick seems to be to keep the quality up, the numbers produced down, and the cost reasonable. Of course high costs in the production of a small number can be daunting, but there are ways to minimise this to the benefit of all.

The three new very limited editions released earlier this year supporting NZ native orchids will sell out within four months. By releasing badges to coincide with national and international shows and conferences the initial outlay is quickly recouped.

Occasions deserving of celebration and the striking of a badge could be annual shows (already practised in the USA and Australia but yet to be seen in New Zealand), a fifth, tenth, fifteenth etc anniversary or an extra special occasion when a new species is discovered. Funding for study, research or special projects from the sale of badges would surely be welcome.

### NZ native orchids on badges

A very limited number of badges will mark special events this year.

#### BEAT THE BADGE COLLECTORS AND BUY YOURS NOW!

**1. Native Orchid Reserve Iwitahi 1994:** depicting *Chiloglottis valida*.

Cost: NZ\$5 - add p&p for overseas orders.

Rush your cheque/money order to Taupo Orchid Society, POB 650, Taupo.

**2. Conservation of NZ native orchids (CONZNO)** depicting *Earina mucronata*.

Cost: NZ\$7 - add p&p for overseas orders.

**3. First NZ Native Orchid Group Conference 1994** depicting *Aporostylis bifolia*. Cost: NZ\$5 - add p&p for overseas orders.

Rush your cheque/money order to Heather Crofsky, 45 Milan Rd, Papatoetoe, Auckland.

## Orchid artists

**Claire Scott (c.1892-c.1978)**  
**Lydia Blumhardt (?-c.1968)**  
**Eleanor Blumhardt (?)**

In the collections of the Auckland Institute and Museum there are three albums and a number of loose sheets of watercolours of native plants. One album bears the inscription, "Painted by Miss Lydia Blumhardt Kamo c.1906-1915, presented by M.C.S. 1 June 1971." A card inside reads "Miss Claire Scott, 30 Beckenham Ave, Royal Oak presented three albums of watercolour sketches of N.Z. plants & 80 specimens of dried ferns." Another album has "Painted by Miss Claire Scott, Whangarei, c.1909-1915, presented by M.C.S. 1 June 1971." It contains watercolours and monochrome photographs of plants, some of the latter hand-coloured; thirteen watercolours and seven photographs are of native orchids. A third album contains watercolour sketches by Eleanor Blumhardt, several of them orchids. One of the best is labelled "*Bulbophyllum tuberculatum* 30.10.11", though it is actually *Drymoanthus adversus*; another is of "*Acianthus sinclairii*, *Pterostylis trullifolia*, Whangarei, June 1908".

Who were these women?

A card in one album informs us that the Blumhardts had a homestead at Three Mile Bush at Kamo; the father, boys and Eleanor came out from Germany to get established, the mother and the rest of the family following later. Later still they had a cottage at Arthur's Pass. A niece, Doreen Blumhardt, is a well-known potter in Wellington.

Claire Scott's niece, Betty Budd of Whangarei replied to my advertisement in the *NZ Herald* in 1985 -

"Lydia Blumhardt passed away about 16-18 years ago (i.e c. 1968). I only met her a couple of times as a child. My aunt Claire passed away six years ago... I don't know if they ever did anything like that for the museum."

Indeed they did. As a teenager Claire Scott lived for a time with the Blumhardt sisters, and the three young women must have painted together, for several of the illustrations are clearly of the same plant, painted by each of them from a slightly different angle. Later Claire Scott worked as a photograph colorist in Auckland. Their orchids are skilful and artistic sketches, with clean colour and line - not scientifically detailed, but accurate and pleasing.

Brooker, Cambie and Cooper's *New Zealand medicinal plants* has illustrations by Eleanor Blumhardt, but gives no clue as to who she was (in fact the introduction wrongly acknowledges Lydia Blumhardt, although plates of *Planchonella novo-zelandica* and *Dysoxylum spectabile* are clearly signed "EB").<sup>1</sup>

### References

1. Brooker S.G., Cambie R.C., Cooper R.C. *New Zealand medicinal plants*. Auckland, Heinemann, 1981.



*Corybas oblongus*: watercolour by Lydia Blumhardt, reproduced with permission from the Auckland Institute and Museum.



*Chiloglottis cornuta*: watercolour by Claire Scott, c. 1909-15; reproduced with permission from the Auckland Institute and Museum.



*Drymoanthus adversus*: watercolour by Eleanor Blumhardt, 1911; reproduced with permission from the Auckland Institute and Museum.

### Australian notes

\* Helen Richards reported (in ANOS Victorian Group *Bulletin* May 1994 p11) an extract from a report by researcher Alec Pridgeon to the Australian Orchid Foundation, "... the subterranean storage organs of *Diurideae* (as well as like organs in other *Orchidoideae*) are root tubers. They are not root-stem tubers or root-stem tuberoids. All have a basic root anatomy, often including a 1-2-layered velamen and exodermis. The basis for calling them root-stem tubers derives from the observation that droppers may arise from the coalescence of an adventitious bud with a root primordium of the parent axis. This is hardly a phenomenon confined to orchids or even monocots. Moreover, not all droppers and tubers in *Diurideae* form in this way. They may also arise endogenously from undifferentiated

cortical parenchymata at the stem base (as an adventitious root), from the previous dropper, or from the distal pole of the previous root tuber. There is morphologically no such entity as Dressler's 'root stem tuberoid', and the term should be removed from usage".

\* Coming ANOS Group shows: Warrigah Spring Show 10-11 September; Port Hackling Spring Show 11 September; Geelong 5-6 November.

\* The third Australasian Native Orchid Conference and Show in 1996 will be held at Flinders University in Adelaide, hosted by the Native Orchid Society of South Australia: 25-30 September, a good time of year for field trips - make a diary entry now.

## How can orchids and fungi live together?

by Heinrich Beyrle

[Reprinted from the *Native Orchid Society of South Australia Journal* of June 1993; 17(5): 43-44.]

It is well known that our native orchids live in a close association (symbiosis) with certain fungi. This association is termed mycorrhiza. The mycorrhizal fungi colonise the soil and the bark of trees but also penetrate the living tissue of orchids. The fungi are of great importance for young orchid seedlings (protocorms). Lacking leaves and roots the protocorms are dependent on their fungi for the uptake of carbohydrates, minerals and water. However leafy adult orchids still benefit from the association and are often heavily infected. The degree of dependency varies within the genera and species. Epiphytic orchids are in general regarded as less dependent than terrestrial orchids. In protocorms, the fungus stays restricted to the basal part, not penetrating the cell division zone (meristem) and as roots develop they become infected from the soil. In *Caladenia* and *Pterostylis* and some other genera native to Australia, where roots are sparse or absent the fungus colonises the thickened stem just below the soil surface (stem collar). As one examines for the first time an infected root under the microscope, one will be certainly astonished to see the masses of fungus present. The outer region of the root (epidermis) is only sparsely colonised, the inner root region (vascular system) is fungus-free and most of the fungus is crowded in the cortical tissue between. The distribution of the fungus seems to be well organised and it becomes obvious that the plant controls the growth of the fungus within its tissue.

The first scientific studies on orchid mycorrhiza were done by the French scientist Noel Bernard. In May 1899 he discovered, under a log in a forest, germinating orchid seeds. Bernard realised that the seedlings contain mycorrhizal fungi and depend on them for nutrition. In the following years until his early death in 1911, Bernard germinated the seeds of many orchid species and conducted numerous experiments. He discovered that the relationship is specific and only certain fungi are able to stimulate the growth of seedlings. For example the neotropical epiphytic orchid *Cattleya* will form a mycorrhiza with a fungus originating from *Cattleya* but when combined with a fungus from *Phalaenopsis* or *Odontoglossum*, either the fungus infects and kills the orchid or the fungus infects the orchid but becomes killed by reactions of the host plant cells and seedlings do not develop further. The orchids are capable of destroying the fungus. Further, Bernard showed that cuttings from orchid tubers, which do not usually contain mycorrhizal fungi have a strong fungicidal activity. Substances which diffuse out of the tubers can inhibit and stop the growth of an approaching fungus. Bernard concluded from his studies that the mycorrhizal fungi are potential parasites which are controlled by reactions of the host cells. As he writes about the "*maladie bien faisante*" he sees the association as a disease which turns out to be beneficial to the orchids. Indeed, studies from other researchers in later years revealed that some mycorrhizal fungi of orchids are pathogenic to certain plants (parasitic fungi). Examples are the tree-killing honey fungus *Armillaria mellea* (a symbiont of *Gastrodia elata*) and the crop-destroying *Rhizoctonia solanii* (a symbiont of the European orchid *Dactylorhiza purpurella* and sometimes isolated from native *Prasophyllum* and *Pterostylis* by Jack Warcup). However, most orchid fungi showed no pathogenicity to plants and live on dead, decaying plant material (saprophytic fungi) or live in symbiosis with roots of certain shrubs and trees (ectomycorrhizal fungi).

Nevertheless most fungi seem to be capable of producing an array of chemical substances (enzymes) which catalyse the conversion of organic molecules. These enzymes enable the fungi to break down and decompose complex organic material, degrade cell walls and even penetrate living cells of plants and animals, causing diseases. However, like animals, plants have highly effective mechanisms for disease resistance that have contributed to survival under the selection pressure of evolution. Plants are continuously exposed to fungi and other micro organisms but resistance to disease is the rule and susceptibility the exception. The mechanisms of resistance employed by plants are diverse. Plant physiologists differentiate in preinfectious resistance (passive defence) and postinfectious resistance (active defence). The first mechanism refers to compounds which are present in plants before the event of an infection. The latter refers to compounds which accumulate only during or after the course of infection. The molecules that are capable of preventing infection and diseases are not synthesised in the main metabolic pathways of a plant, necessary for growth and differentiation of shoots, leaves, roots and flowers and common to all plants (nucleic acids, proteins,

sugars, fatty acids). Antimicrobial compounds are synthesised in particular metabolic pathways and are therefore called secondary metabolites. These chemicals are of great diversity and different plant species produce different compounds. Secondary metabolites can be attractants for pollinators (scents, colours), but others are defence molecules and toxic to feeding predators (e.g. insects) and micro organisms. To give a few examples compounds which may be present in plant cells at the time a potential pathogenic fungus starts to attack and invade a plant tissue are lignin, phenols, terpenes and flavonoids. Many pathogens will successfully overcome these and other defence molecules and colonise the first plant cells. The plant may actively respond by the formation of papillae or cell wall appositions with the aim to encapsulate the invader. Additionally, major disturbance to the metabolism of the infected tissue may result in the immediate death of the infected cells. This localised cell death (hypersensitivity reaction) together with the synthesis of new antimicrobial substances (phytoalexins) in significant amounts in the neighbouring healthy tissue will in most cases prevent further invasion and growth of the pathogen. The result of such an encounter between plant and pathogen is then visible as dark pigmented spots on leaves, roots or other plant tissues. However, nutritional stress and environmental constraints often limit the metabolic activities of plants and favour the pathogen. As a result, the disease progresses further and the plant will be lost.

The similarity of the orchid mycorrhiza to host-pathogen interactions becomes obvious in symbiotic germination trials. Even a suitable (compatible) fungus which supports the growth of orchid seedlings at the first stage may later become parasitic and kill the protocorms. Break-away parasitism is a major problem in symbiotic in-vitro cultures and limits its application for raising orchid seedlings. However in soil (in nature and in potting mixtures), where the growth of the fungus is sparse compared to in-vitro cultures, break-away parasitism seems rare or absent. Two very different organisms seem to benefit from each other by living together. (At least the fungus does not seem to be harmed in the association). A fungus with the potential to kill and an orchid ready to defend itself against a fungal invader. Little is known what controls the process of infection and balances between orchid and fungus. Several systems seem to be possible:

- a) The aggressive nature of the fungus is balanced by defence mechanisms of the orchid. Phytoalexins are thought to be important in these context. In stress conditions, they are continually produced by the orchid and they can be gradually inactivated by the fungus. The oxidases, hydrolases and other enzymes of the fungus are inactivated by defence molecules of the orchid.
- b) The fungus alters its metabolism and plant-tissue destroying enzymes are not produced after the establishment of an infection. The orchid does not employ defence reactions as discussed above and other, unknown controlling mechanisms are employed.
- c) Some defence reactions operate at a low level (e.g. phytoalexins) additionally to unknown controlling mechanisms.

The possibility a) seems to be supported by the unstable nature of the orchid mycorrhiza. However, the high degree of specificity (only certain fungi are able to form a mycorrhiza with certain orchids) seem to favour possibilities b) and c) as a) should allow for a wider range of fungi.

The outcome of an infection is dependent on the orchid, the fungus and the nutrients available to the symbionts. Moderate nutrition will restrict the fungus and allow the establishment of a mycorrhiza. However, high levels of carbohydrates and nitrogenous compounds will result in a profusely growing fungus, parasitic invasion and death of the orchid. To investigate the balance between orchids and their fungi the production of key enzymes, polyphenols and phytoalexins have to be analysed during the course of an infection. The activities of the enzymes and amounts of defence molecules have to be defined and compared in different interactions, which are analysed microscopically. To obtain further evidence about the defence molecules involved, inhibitors of pathways of secondary metabolites can be applied and its effect on the symbiosis assessed. Investigations of this kind are currently carried out at the Waite Institute by Dr. S.E. Smith and myself in cooperation with Prof. R.L. Peterson, Canada. The research is supported by the Australian Research Council and the Alexander von Humboldt-Foundation, Germany.

\* *Cymbidium Mosaic Virus* (CMV) has recently been found in *Pterostylis* at the Australian National Gardens, and almost half the pots there had to be destroyed. ANOS Newcastle Group *Bulletin* reported (June 1994) that the plants look sick, and have deformed leaves with uneven green and brown coloration.

\* An editorial in *The Native Orchid Bulletin* (1994; 25 [10]: 94 - published by the Native Orchid Society of Queensland) celebrated the 50th anniversary of D-Day in its own special way, storming the taxonomic beaches. It began, "Blessed are the Allied airmen who wiped out the Berlin Herbarium during World War Two. The only pity is that the German airmen didn't return the compliment on British Herbariums and whatever other Herbariums in which busybody pests like David Jones and Mark Clements with nothing better to do with themselves than poke about, digging out totally useless information to anyone but themselves, resulting in the changing of names of orchids with which everybody else is completely

happy. This is all such a total waste of time and money. Why don't they devote their time to being out in the field doing what botanists are supposed to do.

"What does it matter if some other explorer found, described and named the same plant a hundred years before. I couldn't care less and I am sure the original discoverer is now beyond caring.

"The inconvenience to long suffering growers learning new names is as nothing when we consider the total havoc created in Sanders List of Orchid Hybrids. This, of course, doesn't matter a damn to David Jones and his ilk. The fact that the World's List of Orchid Hybrids is in the process of being made useless just doesn't matter to them.

"It does however, matter a hell of a lot to me and it's high time to a stop was put to this kind of nonsense. Henceforward I totally refuse to use these new names and just won't recognise them, unless someone can come up with an extremely good reason". *Someone already has. But you have to feel a little sympathy with the writer, don't you? - Ed.*

## Historical reprint

### Swartz's orchid classification of 1800

The Swedish botanist Olaf Swartz classified the 25 known orchid genera in a paper that appeared in *Kongl. vetenskaps akademis nya handlingar* in 1800. At one time or another several of these names have been used for NZ genera: *Ophrys* (for *Microtis*), *Serapius* (*Thelymitra*), *Neottia* (*Spiranthes*), *Thelymitra*, *Arethusa* (*Caladenia*),

*Epipactis* (*Microtis*), *Malaxis* (*Cryptostylis*), *Cymbidium* (*Earina*), and *Epidendrum* (*Earina*).

Swartz drew sixteen species as examples of the genera, among them *Thelymitra ixioides* (illustration L.).

Mo- nan- dræ.	Anthera subterminali, stylo brevissi- mo connata; Calcarea floris	Antico	.....	Orchis.
			Postico; <i>Calyce</i>	refupinato; galea unicalcarata .....
		Nullo; <i>Calyce</i>		ringente; galea bicalcarata .....
			foliolis lateral. exterior. horizontalibus concavis .....	Pterygodium.
			foliolis lateralibus exterior. horizontalibus calcaratis .....	Disperis.
			4-phylo, foliolis lateralibus erectis, basi ventricosis .....	Corycium.
	Anthera erecta, stylo parallela, lateri ejus postico adfixa.	<i>Calyce</i>	foliolis omnibus subpatentibus .....	Ophrys.
			foliolis omnibus conniventibus .....	Scrapias.
			foliolis lateralibus basi anticè productis .....	Neottia.
			refupinato; labello galeato .....	Cranichis.
Anthera operculari, margini postico apicis styli inferta, mobili,	persistente; <i>polline granu- loso; Calyce</i>	patente; labello foliol. <i>calyc.</i> conformi .....	Thelymitra.	
		7-phylo; foliolis 2 anter. elongatis labello suppositis ...	Diuris.	
	plerumque decidua; <i>polline glo- bulari;</i>	<i>Calyce</i>	subringente .....	Arethusa.
			subpatente .....	Epipactis.
			refupinato; labello ascendente .....	Malaxis.
			labello concavo .....	Cymbidium.
			labello plano .....	Oncidium.
			labello erecto, inferne stylo connexo .....	Epidendrum.
patente	<i>Calyce</i>	labello subcucullato; capsula ecarinata .....	Vanilla.	
		labello lamina faccata .....	Aërides.	
		labello basi calcarato .....	Limodorum.	
		labello a foliol. <i>calyc.</i> anter. basi productis incluso	Dendrobium.	
		labello foliol. <i>cal.</i> conformi; exterioribus basi coalitis	Stelis.	
		labello nullo .....	Lepantes.	

Diandrum

Cypripedium.



