



*The
New
Zealand
Native
Orchid
Journal
February 2015*

No. 135



Nematoceras papillosum from its type locality at Glenross.



Nematoceras macranthum at its type locality near Cape Turnagain.

The type locality *Jan St George*

*The micropapillose leaf of *Microtis papillosa* at the Kaipara Heads*

In 1884 William Colenso described an orchid he had received from his old Te Aute friend Charles Winkelmann, then living in Northland...

Microtis papillosa sp. nov.

Plant rather stout, 1 foot–1 foot 6 inches high, finely and thickly papillose. Leaf erect, fistulous, ribbed internally, much longer than scape. Spike 1 ½–2 inches, flowers not crowded, sub 30; pedicelled; pedicel short, about 1 line long, stoutish; bracts oblong, acuminate, acute, 1-nerved, longer than pedicel, adpressed to flower. Perianth, upper sepal orbicular, 3-nerved, concave, apiculate; lower pair, ovate, acute, recurved; lateral petals linear-ovate, very obtuse; labellum oblong, wavy and crisped, sub-fimbriate, bifid, sinus broad, truncate at base, apical lump at base of sinus, large, verrucose, continuous to the two lumps at base of labellum, which are again divided, so making four.

Hab. Kaipara Heads, West Coast, North Island; *Mr. C. P. Winkelmann*; in letter, October, 1884. Flowering in October. [1]

The type specimen has never been found, though the description (labellum bifid, sinus broad and truncate at base) and the Northland habitat strong-

ly suggest *M. arenaria* (see cover photo). Colenso was certainly familiar with *M. unifolia* and he thought this different.

A year before, in 1883, Colenso had described *Corysanthes papillosa* [see J116], “Leaf $\frac{3}{4}$ –1¼ inches diameter, membranous, finely and regularly papillose on upper surface”. [3]

Yet in neither *M. arenaria* nor any of the *Nematoceras macranthum* aggregate (of which *N. papillosa* is a member) are papillae (minute pimple-like processes) so obvious to the naked eye that one would name the plant for them. On the other hand the leaves of some orchids do show papillae under the microscope.

Colenso’s microscopy

Indeed, it was in 1884 that Colenso wrote to his old friend JD Hooker,

And now I come to my great want – a long-standing one, viz. a good Microscope.... I have long had two small compound ones, (one being an early present from a lady you well knew – Lady Franklin!) and one of these has done me great service, only; unfortunately, I cannot use its higher power, as it projects onto and touches the object before it is quite in focus! and, then, again, from its old fashion vertical construction I have great difficulty w. an opaque object, – as I cannot throw the light required in underneath. I have formerly used Dr. Spencer’s fine binocular, but that is kept in his consultation room, and now that he is the Mayor of this town, &c., &c., – neither are so readily accessible. [4]

Charles Peter Winkelmann was a teacher at Te Aute and member of the Hawke’s Bay Philosophical Institute. He wrote a paper in the *Transactions* and collected several plants described by Colenso. He had dispensing qualifications and was later a teacher and a native dispenser at Otorohanga, and later again in Northland. His admiration for Colenso was such that he named his son Walter Colenso Winkelmann. His brother Henry Winkelmann was a famous Auckland photographer. [2]

Dr. William Isaac Spencer was Napier's third Mayor. He had been an army surgeon, attached to the 18th Royal Irish Regiment, and took part in the second land war. On account of his "eminent qualities as a surgeon and physician", he was induced by the people of Napier to resign his commission, and to practise in town. He was a regular member of the Hawke's Bay Philosophical Institute and became its President, giving lessons on microscopy.

Papillae

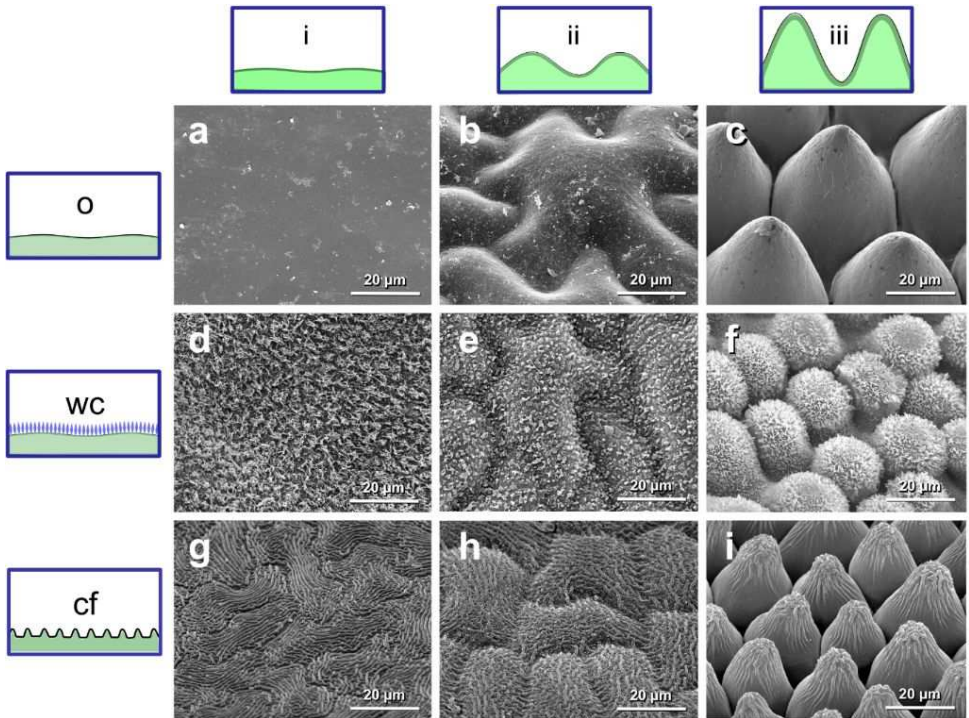
The epidermis is the outermost cell layer of the leaf, and of stems, roots, flowers, fruits, and seeds. Epidermal cells are tightly linked to each other and provide mechanical strength and protection to the plant. Their walls are covered with a cuticle which reduces water loss to the atmosphere, the cuticle in turn sometimes covered with wax in smooth sheets, granules, plates, tubes or filaments, acting as a moisture barrier to protect the plant from intense sunlight and wind. The wax layers give some plants a whitish or bluish colour. While wax crystals and cuticular folds reduce insect attachment, papillose epidermal cells have been shown to improve the grip of pollinators. Such papillae obviously increase surface area, but may also act as lenses, focussing light in dim habitats to enhance photosynthesis.

Colenso's new microscope duly arrived and he employed it—he used the word "papillose" (or "subpapillose") 85 times in his published papers over the next ten years, but never again as a plant name.

His microscope was recently purchased by Te Papa at an auction of objects from a Napier vendor. It was made by Ross, London, 1885.



Colenso's old microscope at MTG Hawke's Bay, — and his new one, now at Te Papa



Above are scanning electron micrographs of plant surfaces showing different types of structuring. Pictograms on the top show the shape of the epidermal cells: Tabular cells (i), convex cells (ii) and papillate cells (iii). Pictograms on the left illustrate the level of superimposed microstructuring: Films of wax or no further structuring (o), epicuticular wax crystals (wc) and cuticular folds (cf). Prüm B et al (2012). [5]

Another research group looked at orchids...

Epidermal cells from adaxial leaf surfaces of 42 species of *Paphiopedilum* and 6 species of *Phragmipedium* were surveyed with the SEM (scanning electron microscope). The surfaces of the cells are flat to papillose and often have various sculpturing patterns. To designate two orders of papilla size the terms 'macropapilla' and 'micropapilla' are proposed. Species exhibiting unornamented flat to macropapillose epidermal cells appear to be correlated with

high light environments, whereas those species exhibiting micropapillae and various degrees of sculpturing appear to be correlated with low light environments. Sculpturing features are often characteristic of a single species, but they may vary considerably between species. Epidermal characters are of some utility in identifying sterile plants which are otherwise indistinguishable. [6]

New Zealand orchids

We might surmise then that wild orchids with bluish leaves would tend to be alpine self-pollinators (the wax layer reflecting the blue light reduces pollinator grip but protects against harsh weather): indeed, that is so of *Pterostylis humilis* and *Waireia stenopetala*.

The flowers of *Gastrodia cunninghamii* might be said to be macropapillose, and the leaves of *Microtis papillosa* ("finely and thickly papil-

lose”) and *Corysanthes papillosa* (“finely and regularly papillose”) should be micropapillose.

Orchids that grow in low light often have large leaves or are dependent on mycorrhizal associations (instead of photosynthesis) for nutrition. We might wonder if those with micropapillose leaves would tend to be insect-pollinated, would need to photosynthesise and would grow in low light, so would also have big leaves.

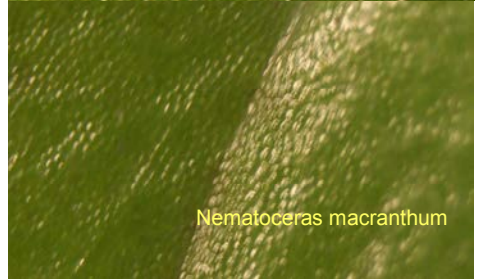
We might therefore look for micropapillae in *Nematoceras*, *Singularybas*, some species of *Pterostylis* (*Pp. areolata*, *australis*, *auriculata*, *venosa* for instance), *Ichthyostomum*.... But *Microtis* grows in full sun!

I photographed single leaves from a range of orchids. Many are micropapillose.

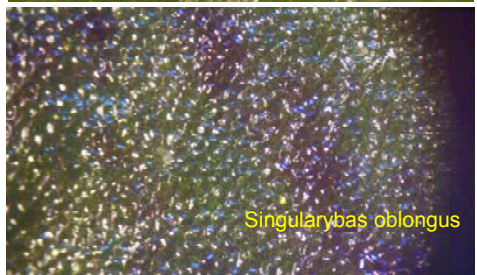
All the epidermal cells of the upper surfaces of leaves of *Nematoceras* appear to have convex bubblewrap surfaces, creating “fine and regular” micropapilosity—perhaps as lenses to concentrate light in its dim habitats: there were very few stomata. The lower surfaces appear similar, except that stomata are frequent. The *Nematoceras* leaf is therefore “hypostomatous” [7] with an upper surface adapted to use as much light as possible, and a lower surface adapted for transpiration.



Nematoceras trilobum



Nematoceras macranthum



Singularybas oblongus



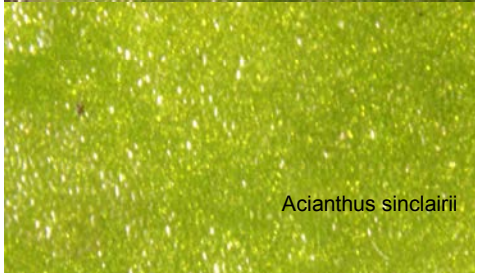
Nematoceras papillosum



Nematoceras longipetalum



Ichthyostomum pygmaeum



Acianthus sinclairii



Microtis arenaria (photo Mike Lusk)



Thelymitra "rough leaf" (kindly sent by Kevin Matthews) is very papillose; the papillae appear to be wax excrescences, apparently similar to those on the leaves of *Pterostylis australis* and *Microtis*. They rub off easily.



Microtis unifolia



Pterostylis australis



Nematoceras "eastern hills" and *N. iridescens* leaves (kindly photographed by Cheryl Dawson).



Pterostylis foliata

The "fine and thick" papillae of *Microtis* (both *M. arenaria* aka *M. papillosa* and *M. unifolia*) are different: the "papillae" are waxy excrescences. They appear to be similar on *Pterostylis australis* and *Thelymitra* "roughleaf".



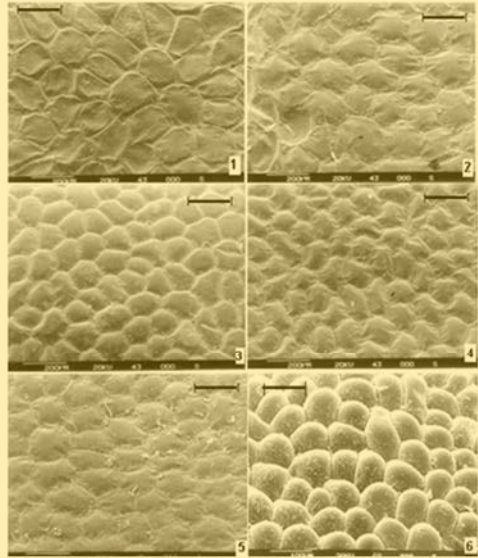
Drymoanthus adversus

These adaptations would provide some protection against the sun and would provide good grip for pollinators: indeed, these are insect-pollinated open-ground orchids.

These are at the limit of size (or the limit of my expertise) for macrophotography, and the translucency of the cells adds to the difficulty.

Figure A2.7. A comparison of the adaxial epidermis of six CA species

- 1 = *N. iridescens*,
2 = *N. macranthum*,
3 = *N. papa*,
4 = *N. rivulare*,
5 = *N. trilobum*,
6 = *Singularybas oblongus*;
Bar =
1-5 = 200 μ m,
6 = 100 μ m.



Scanning electron micrographs comparing the upper surfaces of the leaves of various members of the Corybas Alliance. Figure A 2.7 from Dr Roger Watkins' PhD thesis *The biogeography, ecology and endophyte mycorrhiza of the NZ Corybas alliance* [8]. Only *Singularybas* shows a truly domed, papillose upper surface.

Electron microscopy is really necessary for decent images, unless any reader can come up with a method for good light microscopic views.

Many of the NZ orchids appear to have micropapillose leaves. Colenso used the specific epithet “papillosa” only when he first had access to a good microscope and was able, perhaps for the first time, to see micropapillae on the leaves of the plants he was describing. Later, observing that many other plants also have micropapillose leaves, he realised “papillosa” was not a distinguishing epithet and stopped using it as such.

References

1. Colenso W 1885. Trans NZ I 18: 256–287.
2. St George IM 2009. Colenso’s collections. NZNOG, Wellington, p.345.
3. Colenso W 1883. Trans NZ I 16: 325–363.
4. Colenso W to JD Hooker 31 Dec 1884. In St George IM (2009). Colenso’s collections. NZNOG, Wellington, p.345.
5. Prüm B et al (2012). Impact of cell shape in hierarchically structured plant surfaces on the attachment of male Colorado potato beetles (*Leptinotarsa decemlineata*). Beilstein J. Nanotechnol. 2012, 3, 57–64. Figure 1.
6. Atwood JT, Williams NH (1979), Surface features of the adaxial epidermis in the conduplicate-leaved Cyripedioideae (Orchidaceae). Botanical Journal of the Linnean Society, 78: 141–156.
7. Rasmussen H 1987. Orchid stomata—structure, differentiation, function, and phylogeny. Ch. 4 pp. 105–138 in Arditti J (ed.). Orchid biology, reviews and perspectives IV. Cornell, Ithaca.
8. Watkins RLS 2012. The biogeography, ecology and endophyte mycorrhiza of the NZ Corybas alliance. PhD thesis, Massey University. Online at <http://muir.massey.ac.nz/handle/10179/4063>

Original papers

*An analytical review of the current status of *Pterostylis australis* agg. and other associated taxa. By Mark Moorhouse*

Pt 2 A follow on to Guest Editorial in Journal 132 pp4-6, and complimentary to J 133 pp 10-12

In our May 2013 Journal pp 7–14 our Editor took us back to one of the original sites where the first specimens of *Pt. australis* were collected and he observed there specimens of plants which did not seem too different from plants that have been seen in other South Island locations. Unfortunately none were in flower. The pressed specimens collected by Dr Lyall were used by Hooker to write his original description of the plant and in his article the Editor raises some valid questions as to why Dr Lucy Moore, who lumped many related taxa under *Pt. banksii*, including *Pt. patens*, was tempted to go further by shuffling the entire *Pt. australis* aggregate into *Pt. banksii* just as Hooker had done in his revised *Handbook of NZ Flora* of 1864 where he called it *Pt. banksii* var Beta. Dr Moore would have done so, but to her, it seemed expedient “to retain the concept of *Pt. australis* for the very abundant and often very large Fiordland plant which is matched in suitable habitats further north.”

Does this indicate that Moore felt all specimens collected by Lyall were in fact *Pt. banksii*, as Hooker was also inclining towards, but knew of these larger plants which required “further investigation,” or merely that she considered there was a great natural variation in known colonies? Was she alluding to *Pt. “Bluff?”*

Diverging momentarily, we could examine the Editor’s findings and address one of his questions. In Dea’s Cove he found “normal” *Pt. australis* plants well past flowering compared

to the time stated for the collection of the type specimens. He asks “Why did Lyall find it flowering in February?” A possible explanation is climate. In the 1700s the world was still locked in a “mini ice-age” which peaked when Mts Tambora and Aso, in Indonesia and Japan respectively, simultaneously pushed huge amounts of ash into the atmosphere and induced the year known as “1800 and froze to death”. The world has only recently fully recovered from the mini ice-age. Were the flowering seasons delayed in the southern regions due to less clement conditions when Lyall was there collecting?

“Why did Lyall collect large broad leaved plants?” another question posed by our Editor. I don’t think there was any intention to cause misconception, but rather to show a natural range of variation to the botanists at Kew. Could a more sizeable proportion of the population have demonstrated the broader leaves at the time? One hundred and sixty growing seasons is plenty of time to see a noticeable climate induced natural selection. Did the plant require broader leaves in the 18th–19th centuries when conditions were somewhat more inclement with most days cloudy and these became less important as sunshine levels rose? Extrapolating this concept, could this explain the acicular leaves so common in very high sunshine areas like Nelson where the plants of the aggregate grow in virtually full exposure to the sun? It’s food for thought.

Further analysis of Hooker's description

In his notes Hooker qualifies his basic Latin description [see J132] considerably in English as follows:

"Nearly as large as *P. banksii*, but leaves are shorter and broader, **not keeled**, reticulated [visible network of veins]. *Stem* sheathed by the leaves. *Perianth*: $\frac{3}{4}$ –1 inch (20–25 mm) long, erect at base, then suddenly curved downwards" (Lucy Moore interpreted this as erect then arcuate until tip is pointing downwards with no horizontal section, perhaps to accommodate her own observations of Northern plants. "Suddenly turning" and "arcuate" convey clearly angled and a continuous arc to me. Two different concepts poles apart!). "*Lateral sepals* with subulate erect tips. *Upper sepals* and *petals* with long acuminate points. *Lip* as in *P. banksii* but the appendix is shorter."

Hooker did **not** note down the obvious feature that the leaves varied greatly from lowest to highest and in fact both (especially the lectoparatype) Kew specimens do not show a great variance of widths or lengths but do show an expected range. Taken as an average specimen of the southern form, such as we would expect Lyall to have collected, the present lectotype gives the range of leaf size variance from 6.5–10cm long x 1.7–3.0 cm wide.

Hooker did, however note down that the specimens received from Lyall had leaves that were **not keeled**, a feature Dr Moore either overlooked or chose to ignore in *Flora of NZ* Vol 2 [1]. What is more, her given range of leaf sizes is c.4–15 cm long x 1.0–1.6 cm wide, meaning her maximum recorded leaf width did not even reach the minimum width of the narrowest leaf of the lectotype, whilst her maximum given leaf length is half as long again as any on the lectotype. This in itself is confusing. Hooker states his plants have "narrow linear-oblong" leaves, something that would better fit Dr Moore's range of leaves, whereas Dr Moore states the leaves to be "elliptic, occasionally broadly so", a descrip-

tion that would better fit Hooker's lectotype specimen. Is there any wonder that we are confused? Was Hooker describing the *Pt. banksii* specimens on the sheet before any were designated as *Pt. australis* so opted for a medial specimen to describe? Both Kew specimens designated *Pt. australis* are different, one favouring linear leaves, the other favouring elliptic leaves. Notably, Hooker's description of the leaves subsequently best fits the lectoparatype not the lectotype which perhaps was nominated recently by Dr Brian Molloy because it is further removed morphologically from *Pt. banksii*, rather than because it best fitted Hooker's description.

A further comment about morphology and colour

Under our currently accepted range of variation of *Pt. australis* we can find examples which fit well in leaf structure to Moore's concepts and fit loosely in perianth structure but vary widely in labellum colour. Within the taxa currently accepted under the *Pt. australis* aggregate we can find labellums that are 1. Red, like *Pt. banksii*, 2. Red tipped with the ridge red extended half along the labellum, 3. Black tipped flushed red with black extended half way along the labellum, 4. Black tipped with black ridge extending most of the way along the labellum, wide, the rest green, and 5. Labellums which are mostly black. Is this telling us something about where we should be looking to draw boundary lines of natural variation? Perhaps, but caution is required. A parallel case occurs in Tasmania. An article [16] published just recently by Janes, Steane and Vaillancourt regarding *Pt. melagramma*, *Pt. stenochila*, *Pt. williamsonii* & *Pt. tunstallii* (all Jones & Clements) shows these four Tasmanian representatives of the *Pt. longifolia* (Brown) complex are in fact genetically virtually identical as evidenced by several reliable forms of modern sampling methods, yet are morphologically quite easy to distinguish mainly by labellum colours. Their studies suggest the plants under scrutiny are

actually still in the process of recolonisation, after surviving ice age encroachment in four separate refugia, where they morphologically developed separately but now have begun the gradual process of reuniting, undoing the in-bred factors and returning to the morphology of the ancestral parent. Until now half-way-house plants were thought to be the result of hybridising but just as easily could be quite the opposite.

This then could offer a possible, in fact very feasible, explanation to our own *Pt. australo-banksii* complex and its current state and similar studies here may in the future confirm this and justify Dr Moore's stance regarding this group, but there are questions which still need asking regarding what we currently find included in the complex.

Is there some southern taxon that flowers late? The Editor's "Type Locality" article for *Pt. australis* seems to suggest this is no longer the case, but to remain unbiased the following may bear relevance.

Later flowering time has been somewhat confirmed by parties that frequent Stewart Island and Fiordland. Peter Tait of Stewart Is. confirms that in February local *Pt. australis* plants can be found flowering and photographs by Alasdair Nicoll [2 and illus. J132 p11 Fig 5] taken on Coal Island in Preservation Inlet at a similar time show plants that match well to the lectotype on the Kew sheet. Other plants, which we might consider more familiar as *Pt. australis* were published [3] by Gael Donaghy. These on the Dusky Track match Hooker's long sepals and the leaves of the Kew lectoparatype. Gael states "Most *Pterostylis banksii* were over, but *P. australis* still had quite a few good flowers in colonies". The one published is over mature with two spent flowers in background. It was mid January and the inland site did not benefit from the mild effect of sea air.

Sheila Natusch, a one time resident of Stewart Island wrote in her book *A bunch of wild orchids*, "With many of the orchids it is not easy

(to identify species), in fact it is a hairsplitting job and botanists do not always agree about the exact point where the hairs should be split. Therefore in sketching some of these strange little plants, I have not bothered about species. One cannot even be cocksure about the genera: these things can alter."

Sheila's watercolour (Fig.1) seems to have two different taxa shown in them. She had been a science/botany teacher in Dunedin before retiring to Stewart Is. What would you call them *Pt. australis*, *Pt. banksii* or *Pt. "Bluff"*?



Fig.1: Sheila Natusch's watercolour of two forms of *Pterostylis*. Perhaps *Pt. 'Bluff'* and *Pt. australis sensu* Moore from Stewart Island.

Some further questions to consider—

1. Moore lumped in with Hooker's *Pt. australis* many taxa from various points north of Lyall's collection sites. Can that be justified?

To ascertain this it is necessary first to revisit the description of *Pt. australis* sensu Moore drawing comparisons and points of differentiation to Hooker's in an attempt to identify criteria on which to base an opinion.

[See comparative chart of descriptions of *Pt. australis* as published Journal 132 p. 5.]

We have already established two features that differ from Hooker's description in plants found in more northerly type localities.

- a. Plants that have distinctly keeled leaves and/or acicular leaves. Compiler has not seen any that don't have keels in Nelson or Marlborough
- b. Plants that flower between Oct–Jan–(Feb)

To these we can add,

- c. Galea profile shortly +/- vertical from base, then evenly arcuate until dorsal tip is pointing downward
- d. Acuminate lateral sepals that do shortly overtop the galea when freshly open but tend to deflex backwards at maturity and are much shorter than those of Hooker's *Pt. australis sensu stricto*.
- e. Plants that have the leaf range: c.4–15 cm long x 1.0–1.6 cm wide. Having one or two elliptic leaves near the base, then generally linear-ellipsoid leaves of greater length above, the highest often overtopping the inflorescence. (Could a sample on the Kew sheet fit this at a pinch? [J. 132 page 8])

In the light of the Tasmanian studies perhaps the answer to the question is still yes, Moore was justified and all this is natural variation caused by various populations being isolated for considerable periods and subsequent re-mingling. If you are a splitter you may disagree.

2. Was Hatch a leading influence in Moore's decision to lump so many taxa together?

In 1948 Dan Hatch published a summary treatise of New Zealand *Pterostylis* as referred to in the Editors article [J 132 p.10], accompanied by a useful sketch of most species [Fig 3 same article]. Vegetatively the cited sketch of *Pt. australis* by Hatch's father in 1947, resembles remarkably well the lectotype on Hooker's Kew sheet and clearly had an influence on his decision to place this Ruapehu taxon as *Pt. australis* ss and have it sketched as a key example of the species. Hindsight is a great thing and looking back, using knowledge subsequently gained on the subject, it is fairly evident that it is not the taxon Hooker described as *Pt. australis* from Southern Fiordland. Three points in particular can be presented as evidence. The stigma is ovate and sketched with no linear component, but more importantly the labellum is unevenly constricted (causing twisting) both in written description and sketch, strongly suggesting that the Ruapehu taxon is more closely allied to *Pt. montana* and at best could represent a *Pt. australis x montana*. Thirdly the flower's galea appears to be disproportionately diminutive and the synsepalum tips too short. However Hatch also describes the galea as "rather narrow" a definite symptom of aging perianths in all species. Could this and the unevenly constricted distal end of the labellum simply be symptoms of slightly overmature flowers? [Refer J 133 p 10 & 11].

So was Moore misled or influenced by Hatch's concept of *Pt. australis*? I think we can confidently answer no to that, because even in her all-encompassing description in Flora II she rejected any consideration of the dorsal stance of Hatch's sketch which shows neither a smoothly arcuate dorsal nor a downturned tip, in fact the sketch is in sharp contrast to this, the description stating the distal end to be somewhere between horizontal and sub-erect; perhaps in fact, debatably, its more in keeping with *Pt. australis* Hooker in that respect.



Fig.2: A bunch of “plonkers” (hybrids). Natural variation in *Pt. banksii* ? *Pt. “Bluff”*? Or re-merging of ancient isolated genetic pools? Upper Motupiko, Nelson Lakes district. More typical *Pt. banksii* and *Pt. australis sensu* Moore—both grow nearby.

3. Has another epithet already been offered with description by our past respected botanists for a suitable taxon to “mop up” the more northerly taxa?

Our Editor wrote an article [7] on two of Colenso’s proposed species that that worthy had collected in the Ruahines. *Pt. subsimilis* & *Pt. speciosa*

It was brought to our attention there that both of these had been rejected by Cheeseman as natural variation in *Pt. banksii*, an opinion apparently upheld by Moore who placed them in footnotes under *Pt. banksii*. Ian St George spent some time researching these and was of the opinion that they more closely affiliated to *Pt. australis* and *Pt. areolata*, an opinion shared by this writer, the specimens of *Pt. speciosa* on the Kew sheet matching remarka-

bly well to both photo 4 on inside cover of NZNOG J.115 and similar plants commonly referred to as *Pt australis* in the Nelson Lakes district, some of which were caught on film during the field trips of the 2013 AGM.

Can we equate the taxa we are studying to Colenso’s *Pt. speciosa* or the smaller *Pt. subsimilis* thus soaking up the void caused by separating *Pt. australis sensu strictum* (Hooker) from Moore’s slant on it? Doing so would cover most of the currently accepted northern forms we call *Pt. australis* at present. The Kew specimen sheet of Colenso’s *Pt. speciosa* appears to have flowers with galeas that are smoothly arcuate, backward pointing lateral sepals and elliptic leaves. Pressing can distort flowers, (eg WELT specimen sheet 24279 of *Pt. speciosa*), but the Kew specimens appear

to be carefully pressed to retain those features. However the dorsal sepal is too long for most of the cited examples [4]. Is Colenso's taxon a candidate for the new epithet of northern forms of what we currently call *Pt. australis*? No. Lateral sepals are described as "largely spreading above and behind the dorsal, **tails long**". Specimens seem to verify this.

What about the similar *Pt. subsimilis*, is it similar to *Pt. australis*? The galea is "**erect, curved**". That might fit Moore's "smoothly arcuate", but it appears that is where any similarity stops.

4. What study regime needs establishing to further our understanding of *Pt australis* agg. ?

We should carry out genetic studies on all *Pt. australis* look-alikes, identifying and defining areas where hybridisation with *Pt. banksii*, *Pt. oliveri*, *Pt. areolata*, *Pt. auriculata*, *Pt. montana* and perhaps *Pt. silvicultrix* have taken place, if in fact it has, and identifying any populations that have remained pure or become genetically separated. A useful task that perhaps a botany student could tackle as a thesis.

Clearly there are sites where hybridisation has taken place. Even Hatch acknowledged this in 1947 [8]. Under the general description of the "Australis Group" he wrote,

"It (the Australis group) consists of 8 jordanons, all of which have been known to hybridise. In some isolated areas, particularly in Stewart Island for instance, the hybrid population far exceeds the numbers of true species. Another polymorphous area is the Waimakariri River basin." To this we could add Nelson Lakes district and Central-south West Coast. These areas are always (in our life times) going to be places where "half-way house" specimens ("plonkers" as one respected botanist calls them) are going to continue to confuse observers *ad infinitum*. Identifying these areas and mapping the extent of "hybrid popula-

tions" (or are they as suggested by Janes's study only morphotypes of one species in process of recombining?) could determine whether in fact we should continue as we are currently and consider this natural variation, lump all northern plants back into *Pt. banksii* and/or identify those populations which have become far enough separated genetically to start calling *spp. nov.*

Hatch's comments quoted above raise an interesting issue. Could the Kew lectoparatype specimen from Port William, in fact be a hybrid or a recombining pair of morphotypes? Either might explain the difference in leaf morphology to the lectotype. If it is a hybrid, could it be *Pt. "Bluff"*? If so did Hooker describe *Pt. "Bluff"* or is *Pt. "Bluff"* just closer to being representative of the ancestral taxon? As our editor wisely summed up in Feb 2010. "There is more work to be done on these yet."

Before dwelling on more questions consider the three features which botanists have used to separate N.Z. species of the Australis Group (*sensu* Hatch) and in fact build a phylogeny for the group.

1. The importance of synsepalum size, shape and position in linear-leafed NZ species of *Pterostylis*.
2. Twisting of the distal end of the labellum in NZ species of *Pterostylis*.
3. The importance of leaf morphology in larger NZ *Pterostylis*.

These features were analysed in an article published in Journal 133 p 10–12 where an attempt was made to establish that these so called stable markers are only mildly consistent and undergo changes with the maturation processes and whilst useful as markers must be taken as part of the whole "species recognition regime" and not used individually to define a species.

Bearing these processes in mind, some further questions...

5. Are there known and recognised populations of *Pt. australis* agg. and close relatives which at present seem to be already divergent enough to consider study with a view to separation?

There may be some taxa worthy of consideration, tagged and untagged. Some examples come to mind,

- a. *Pt.* “Bluff”, eg. which apparently has sufficient differences to warrant a recent tagname but as Bruce Irwin once said, “giving a plant a tag does not mean the tagger necessarily thought it was a new species, merely that it has notable differences which require further investigation.” Hooker may well have already separated one form of this for us.
- b. A semi dwarf *Pt. aff. australis* with crenulated leaves which can be found widespread in the South Island including the limestone karst of Takaka Hill, Nelson. For the present it will be tagged *Pt.* “Nortonii” but this epithet may be dissolved after analytical sampling studies have been carried out as may many *Pt. aff. australis* tagged taxa.
- c. *Pt.* “Goodgerii” in Bruce Irwin’s notes is similar though differences of labellum occur.
- d. Dickson’s *Pt. ochroleuca* also similar but its preference for swampy habitat puts it apart.

Following is a discussion about these four entities.

a. *Pt.* “Bluff”

As I am not placed with personal knowledge of this plant I can only conjecture using published material. This material has added to the reader’s confusion because it is clear two taxa have been tagged and published as *Pt.* “Bluff”.

These require delineating here first and will be referred to as *Pt.* “Bluff” Kepler (which is later established as belonging in *Pt.*

“Nortonii”) and *Pt.* “Bluff” Marsden to differentiate them in this article.

1. *Pt.* “Bluff” Kepler: Spawned, it seems by Kathleen Shepherd on her now obsolete website <http://www.westofsouthernalps.co.nz/Gallery> and rather ethereally connected to Phil Norton’s plant published on the back cover of J103 p40 by a brief reference to it in J114 p 20. As Kathleen coined the tag perhaps it would be good to see her photos of what she tagged published so the readers can judge for themselves if indeed they are the same as Kepler and/or Marsden.

Kepler displays the following features: Dorsal sepal very narrow, the distal end short like *Pt. australis*. The labellum in Phil Norton’s photo in J 103 p40 appears to be black but a further shot by Phil shows the labellum to have a black central ridge with a blackish red tip and the rest green. The labellum is very wide and only constricts in the last 2 mm to an emarginate tip. Petals are wide, distally subacute and clearly visible along their full length. Leaves few, crenulated, obovate and barely reach the galea. Distal ends of synsepalum are acicular, barely rolled and at maturity held at c.30 degrees above horizontal in a lateral direction (See b. *Pt.* “Nortonii” below for more about this taxon).

2. *Pt.* “Bluff” Marsden: spawned in an article by “The Column” in Journal 116 page 34, p.20 and the inside back cover.

In this article the plants display the following features. Dorsal sepal is wider than Kepler, long like *Pt. banksii*. Labellum is red and gradually tapers toward the distal end, petals narrower and protrude visibly only at the tips, leaves grass-like, overtopping the galea, not crenulated, distal ends of the synsepalum widely splayed and horizontal at maturity and very long, rolled, tips pointing rearward. The article writer lumps and rejects various referenced plants that had been previously published, rejecting Kepler amongst his “obvious contenders” because they “are too far from the average so are being left distinct for the mo-

ment...". He suggests DNA analysis would be helpful. I agree. Recent developments in fingerprinting techniques can be useful to detect genetic differences between plants that are considered closely related, or prove them to be the same, whichever the case may be.

In a photo published by Kelly Rennell of *Pt.* "Bluff" [5] plants appear to have flat leaves with midrib but no obvious keel, similar to *Pt. auriculata* and matching Hookers *Pt. australis* s.s.

The labellum appears to be dark, but clearly using this as distinction is contentious. It is quite widely reported from Southland and Stewart Island, but like all tags, concepts are suffering gradual morphing due to lack of publication of any formal description and both readers and writers are seeking variation range boundaries amongst what little has been written on it. Eg. in J 116 p31, photos which show clear alliance to *Pt. banksii* and *Pt. patens* are labelled *Pt.* "Bluff", whereas J. 127 p 3 has a colony of plants which in my view are, according to current status of *Pt. australis*, correctly labelled *Pt. australis* aka *P.* "Bluff". The Column's article in J116 concludes with a plea to send details and photos to the Editor, but makes no effort to provide any guiding botanical details that could help the reader make an intelligent decision about similar finds. In comparison J90 p32 bears many useful details of a similar (perhaps a northerly record that fits Hookers *Pt. australis* description) taxon from near Mt Hercules between Fox and Franz Josef.

The Column's article on *Pt.* "Bluff" Marsden alludes to the thought that this could be a *Pt. banksii* x *australis* hybrid but he rejected this a few lines later "because *Pt. australis* has relatively short tepals". This perhaps reflects Hatch's concept too as he was most familiar with similar short-tepal plants from Ruapehu [8a]. In the light of material already presented I beg to differ. It seems highly probable that in fact we have "hybrids" or re-merging taxa south of the West Coast glaciers area and there is a good reason for it.



Fig.3: *Pt.* "Nortonii" (was *Pt.* "Bluff" Kepler.) "Dorsal sepal very narrow, distal end short like *Pt. australis*... petals wide distally subacute & visible full length." Leaves crenulated.

About 14,000 years ago a mini-ice age caused the Haast glacier and many others to extend and isolate Fiordland from the West Coast further north. The Haast Glacier became massive stretching from Jacksons Bay to Lake Moeraki and pushing out into the sea [12]. Such a barrier also effectively isolated plant populations, the most remarkable being the creation of the hiatus in Beech forests, but clearly such an event effected all plants down to herb level. After the thaw the isolated populations once more began the long task of recolonising and in the case of *Pt. australis* where southern long-tepal and northern taxa finally met up it would be reasonable to expect that, because of isolation, they might after thousands of breeding cycles have developed morphological differences on at least varietal level and the gradual reintegration of the gene pool at meeting point could produce both new crosses further removed from the ancestral stock (depending on pollinator vectors) and genetically merging throw-backs as well as pure northern and southern taxa, thus leaving a population difficult to define. A great area to begin genetic studies similar to those carried out by Jasmine Janes *et al* in Tasmania.

b. *Pt.* “**Nortonii**” a form of *Pt.* aff. *australis* formerly tagged *Pt.* “Bluff” (Kepler above) and also as *Pt.* “karst”)

In the pages of our Journals have appeared a number of photos of an unnamed taxon of *Pterostylis*. It has a large flower of similar proportions to *Pt. australis* but often sits on a dwarfed plant that rarely exceeds 10cm in height. Over the years various opinions have been formed about it by knowledgeable botanists but little study has been done to date to prove or disprove their theories. The writer has dedicated this flowering season to addressing some of the voiced opinions with some interim findings as follows. It is touted as *Pt.* “Bluff” in the NZNOG’s current online *Colour Field Guide*, and is the Kepler referred to above. I offer this new epithet to remove it from *Pt.* “Bluff” Marsden which descriptive article precedes the *Colour Field Guide* .

Plant Height: Flowering scape height range (minus flower) (2.5) 4–10 (12) cm. Galea usually c. 25mm. The short stature of these plants has been observed widely and often explained away as just a *Pt. australis* “doing it hard”. On the back cover of Journal 103, photographed by Phil Norton, is a lovely healthy specimen of *Pt.* “Nortonii” growing in perfect conditions along the Kepler track. Its lush green leaves and associated damp moss belie that it is neither stressed, nor exposed to the elements, yet it has grown to a height of no more than 10 cm. Any doubt that this taxon does not frequently have a natural short stature is removed completely after examining the example of *Pt.* “Nortonii” from the Hokonui which was pot cultivated by Arnold Dench, a genius at growing NZ natives. Pat Enright collected it [6] and it has retained its dwarf form over many seasons.

Does soil and exposure cause dwarfism in related taxa? Arguments that similar plants found in the marble karst area of Takaka Hill in Nelson are short due to over-calcified soil and exposure to the elements only hold partially true at best. In exposed areas the plants

tend to have leaves that are shorter, tightly sheathing, carinate and held erect to shield the scape from damaging sun’s rays and subsequent rapid dehydration and to direct any water collected to the root. Yes, over-calcification of soil must of necessity create some leaf burn and stunting, however it is well worth noting that plants of this taxon growing on Adele Island, a granite outcrop, exhibit identical growth habit, and thriving healthy colonies of *Pt. oliverii* share identical conditions in the karst territory.



Fig. 4: *Pt.* “Nortonii”. This example suffering minor rabbit damage—from Wairau Valley, Marlborough. Features include short stature, at least 2 basal crenulated leaves, narrow dorsal, broad petals broad dark-tipped labellum with little distal curvature [cf back cover J 103]

This suggests that exposure to sunlight perhaps has far greater effect than soil. In shade the plants in the karst area generally do hold the leaves in a more “normal” stance [15], but plants remain short. A characteristic which seems consistent throughout *Pt.* “Nortonii” is the tendency to produce leaves with undulating or crenulated edges in flowering plants, in much the same way that *Pt. oliverii*, *Pt. mi-*

cromega, *Pt. venosa* and to a lesser degree other nonflowering rosettes of larger *Pt. spp.* do. This seems in sharp contrast to flowering examples of *Pt. areolata* and *Pt. banksii* for example where this is a rare observation.

A comparative chart illustrating some differences and similarities between *Pt.* “Nortonii” and *Pt. australis* *ss. sensu* Moore is presented on the next page.

Plants of similar leaf form, and not dissimilar flowers to *Pt.* “Nortonii” as it appears in true karst areas, also occur in the North Island. They are taller, habitat is wet and there are differences. Two as follows could be construed to have some association to *Pt. australis* and *Pt.* “Nortonii”, while other published opinions favour a *Pt. montana* association, or *spp. nov.*:

c. *Pt.* “Goodgerii”

A plant not dissimilar to examples of *Pt.* “Nortonii” growing in its most extreme conditions in karst country (Fig 4). However labellum differences clearly separate it [13].

d. *Pt.* “ochroleuca” Dickson

This not an intended treatise on this taxon, but it seems appropriate to comment here that plants of similar galea structure to *Pt.*

“ochroleuca” (labellum not twisted, profile of dorsal turns through 120 degrees, shortish laterals) as per specimen sheets and sketches [14] appear intermingled amongst *Pt.*

“Nortonii” (Fig 4). The distinctive wet habitat from which *Pt.* “ochroleuca” was reported no doubt helps to give it a pallid appearance that is common in wetland *Pt.* species like *Pt. paludosa* and *Pt. cernua* as explained in J 124 p 12, with illustrations p 16. (Is the McManus’s sp. from Pirongia Rd an example of *Pt.*

“ochroleuca” or Irwin’s *Pt.* “Goodgerii” perhaps? Labellum is not visible.) The wet habitat however seems to preclude it from association to either *Pt.* “Nortonii” or *Pt. australis*. Steve Reekie’s similar plant [back cover J 104] with broader leaves, growing in Queen’s Park, Invercargill is the exception that seems to raise doubts.

What form of division for *Pt. australis* agg. suggests itself in light of the evidence?

Having eliminated *Pt. speciosa* & *Pt. subsimilis* and known hybrid populations, and placed *Pt.* “Nortonii” and *Pt.* “Goodgerii” along with some North Island taxa to one side for further study, let’s return to recap on Moore’s description of *Pt. australis*. It purportedly demonstrates an evenly arcuate galea with a down-pointing dorsal tip, a matching feature of many plants which have been published in the journal and alluded to above [4, also Fig 5]. These have variously been described there as *Pt. areolata* (in Nth Is), *Pt. australis*, *Pt. patens* and *Pt.* species unknown. Their size seems to vary considerably, but one consistent feature is leaf morphology, ie. leaves broader and shorter than *Pt. banksii*, demonstrating an elliptical shape. If this sounds familiar, it should, as it matches Moore’s “lumped” description of *Pt. australis* which she wrote to incorporate both northern and southern forms. Another notable consistent feature is that the sepals are fairly short and nearly always “laid back” at maturity, the second option Moore offered in that description of *Pt. australis sensu* Moore. A further, but less constant feature is that commonly the lateral sepals (of those cited as [4]) are not rolled (as in *Pt. montana*) and here perhaps is a sticking point. Or is it? Occasionally we find unfurled examples of *Pt. patens* and to a lesser degree *Pt. banksii* too.

Curiously Jones and Clements [3, pp 20,23] seem to imply that *Pt. australis*, *Pt. graminea* and *Pt. banksii* have flat tepals as the norm, clearly a highly debatable issue and not one you would expect to use as a morphological identifying factor on which to base a clade of those species,

“the remaining spp in the *curta* group viz *P. banksii* & *P. australis*, cluster together in a partially ladderised monophyletic but poorly supported clade based on possession of a solitary homopleisious character. Within this assemblage 3 NZ spp, ***Pp. graminea*, *banksii* and *australis*** form a polytomy with 77%

Pterostylis australis

s.s. Hook. fil. Fl NZ 1853

Specimen Kew et al.

Distribution: Stewart Is, Fiordland and wet West Coast area of Sth Is. Maybe Mt Taranaki in Nth. Mainly lowland in the south.

This description based on Hooker & Moore as published.

Cauline plant

Plant 10 to 25 [to 30] cm tall

Non-fl plants form rosettes

Leaves:

Not keeled

4-5. 0-2 leaves overtop galea

Leaves varying in width and shape usually arching to some degree due to lack of keel.

Lowest 4-5 cm long elliptic to obovate

Middle 4-10 cm long elliptic-narrow

Top 6-15cm linear and +/- grasslike

Tips sub acute to acute.

Inflorescence:

2.5 – 3.5 [4.5] cm tall

General shape not much taller than wide.

Perianth:

+/- erect at base then smoothly arcuate until tip is downward pointing.

Lateral sepals diverge at narrow angle, long and acuminate usually greatly overtopping the galea. Can spread and point back with ageing flower.

Tip of dorsal shortly acuminate

Labellum as in *banksii*. Lanceolate-oblong, little arched, broad almost to middle then tapering to obtuse tip, margins there +/- deflexed and inclined to be pinched in.

Labellum appendage shortly curved, apex with brush-like tuft

Column about as tall as labellum

Stigma long-oval as broad as column

Sometimes overlapped by wings from above.

Pterostylis “nortonii”

Undescribed taxon

Distribution: South Island, North Island?

Sthnmost known records at Kepler track.

Wairau and W. Ranges of Nelson , also Arthurs Pass & Hokonuis. Shares distribution similar to *Pt. oliveri*, in the north, usually at elevation.

Cauline plant.

Scape 6 to 12 [to 20] cm tall

Non-fl plants rosettes. Leaves crenulated.

Leaves:

Keeled.

2-5. Usually no leaf overtops the galea.

Leaves do not vary greatly in width or shape, erect, linear, tapering, acuminate.

Lowest to 1 cm in length sheathing and bract-like, frequently drained by the disproportionately large flower.

Middle, sheathing, linear, acute to acuminate 3 –5–[8] cm, often crenulated

Highest overlaps galea, sheathing, linear, keeled, erect, long tapering tip acute to acuminate 5–8 –[10] cm long

Inflorescence:

2.5 – 3.5 cm tall

General shape taller than wide. Stance upright to semi-nutant, occ. hunchbacked in northern sites, but resembles *Pt australis ss* in many respects.

Perianth:

Nutant 30-45 degrees in northern range, but turns fairly abruptly through 90 degrees.

Lateral sepals diverge rapidly and at maturity are at 180 degrees to each other. Tips overtop the galea when fresh, taper evenly and are often acuminate. Dorsal tip shortly acuminate, often not rolled.

Labellum broad, lanceolate-oblong steadily broadening from the base then abruptly narrowing to an obtuse tip. Prominent keel at broad tip, a little deflexure and not pinched in. Appendage shortly curved, apex with semi-circular tuft of brushlike hairs. **Column** taller than labellum and +/- equal to wings.

Stigma long, linear narrower than column reaching almost to the base of the column and well clear of wings.

bootstrap support. The position of this group is supported by absence of a rosette in flowering plants (a reversal of character 4) and **free points of lateral sepals being flat, not linear terete** (character 20 [3])....” (Clearly not fresh sample plants!)

Looking under character 20 in the table quoted, four options are given for lateral sepals (0) short involute, (1) long involute, (2) long flat, (3) long, thick and channelled. Their quoted characteristics (above in bold) and reference (20.3) don't match nor do either match the plants in real life which are all normally long and involute. It calls to question what their sample stock was doesn't it (was it similar to this group in [4] perhaps?). *Pt. graminea* with flat distal ends to the synsepalum!? Please show us one.

All of the plants [4 & Fig 5] bear a number of likenesses to *Pt. australis* and some differences that favour strongly *Pt. areolata*, so does it seem reasonable to investigate variation in this species further or carry through with the suggested separating of *Pt. australis sensu* Hooker (aka *Pt* “Bluff” Marsden) from *Pt. australis sensu* Moore? initially lumping all of those with dark labellums only in *Pt. australis sensu* Moore. There's always the need to approach this from all angles. The dark coloured labellum may not be induced by an identifiable gene, which colour it shares with *Pt. graminea* & *Pt. areolata* but could it perhaps be a key to tying many of these unnamed *Pt. australis* agg. taxa together because they share a pollinator that likes the aroma of dark labellums?

By incorporating this concept (ie. lumping dark labellum taxa) and extracting from the general current *Pt. australis* aggregate even one taxon worthy of a higher classification, much of the remainder may prove to be natural variations of *Pt. banksii* under a slightly broader concept which then would include most of the current *Pt. australis* agg. bearing red labellums with distally medium-short dorsals and keeled leaves slightly wider than, but similar to *Pt. banksii*—those plants that don't really sit comfortably under either epithet using the current state of understanding.

As stated at the outset, an across the board study of the whole *Pt. australis* agg. would answer many of the questions that confront us now. This is a layman's opinion based mostly on personal observation.



Fig.5: A very large flowered example of the group [4] photographed by Cheryl Dawson in the Ruahine. Dorsal has Moore's smoothly arcuate profile, short distal end points downwards, broad labellum is dark, dorsal is narrow and petals wide bearing some likenesses to *Pt. "Nortonii"* and *Pt. australis sensu* Moore but favouring *Pt. areolata* in others. It appears to be related to other taxa previously published.



Fig.6: *Pt. "Nortonii"* in marble rocks on Takaka Hill, Nelson. 50mm lens cap for scale. Leaves held more erect due to exposure, lower ones crenulated. Paler colour is sun and soil induced.

The writer's intention was to invigorate our thinking patterns, stimulate debate and provide food for thought. If this article draws comment and correction then I have succeeded.

Conclusions

There is evidence to show that,

- The current status of *Pt. australis* should be reviewed by someone qualified to do so.
- There is a southern form *Pt.* "Bluff" Marsden which may take precedence to the epithet *Pt. australis*, Hooker.
- There is logic in retaining a large percentage of what we currently know as *Pt. australis* using Moore's description, but under what epithet? Some taxa we currently call *Pt. australis* could be natural variation in *Pt. banksii*. Eg Many areas have colonies of *Pt. banksii* which have atypically shorter distil end to dorsal, but little else to make them different.
- Variations in morphology within certain populations require study to ascertain if they are hybrids. There is a need to study whether morphotypes of the same species are in the process of regaining lost genes by back-crossing or currently diverging from main-stream plants through use of new pollinators. Geology, soil and climate which induce observable differences need further study. Pollinators causing crosses need identifying.
- There are *Pt. australis* agg. which are advanced in separation morphologically from *Pt. australis s.s.*
- There is a waiting challenge for our botany students to carry out widespread genetic sampling in New Zealand to demonstrate or disprove most of the above points.

References

1. Flora of New Zealand Vol 2, pp142-146
2. NZNOG Journal 125 p. 15 image 17
3. NZNOG Journal 113, p 16 & 21 pers com Gael Donaghy

4. NZNOG Journals 86, p 32 (as *Pt. australis*), J. 92 p. 10 (debating if *Pt. australis* or *Pt. areolata*), J 99 p. 23 (as *Pt. areolata*), J 100 p. 25 (as *Pt. areolata*), J 110 p. 43 (debated as *Pt. areolata*), J 115 inside front cover (as *Pt. subsimilis*) J 116 p 120 inset (as *Pt.* "droopsnoot") and perhaps also J 129 pp 11, 12 (as *Pt. patens*) Also recently placed on NZNOG forum by Cheryl Dawson a large form (as *Pt. sp.*). This is in no way suggesting that all are the same taxon but all appear to have matching leaf and arcuate dorsal with downpointing tip. One observable point which does tie virtually all together is the dark labellum. Some variation is quite evident, but do we not expect this naturally?
5. NZNOG Journal 90 p.32
6. NZNOG Journal 98 pp10-11 Notes on effect of cultivation of various *Pt. spp.*
7. In NZNOG Journal 115, pp.2 & 4-9
8. Transactions Vol 77 p. 238 ED Hatch on New Zealand *Pterostylis* species
- 8a. Transactions Vol 77 p239 & plate 21
9. NZNOG Journal 116 p. 33
10. NZNOG Journal 127 p 3. is a case in point.
12. Source DOC information boards at Lake Paringa, Sth Westland describing Recent glaciation of the area.
13. NZNOG Journal 123 p. 28 Irwin & Sylvester on *Pt.* 'Goodgerii'
14. NZNOG J 50 p. 9, 10. Article Hatch & St George. Sketch, letter and description by Edwin B Dickson *Pt. sp nov* Hautoki Stream, New Plymouth. "... leaves.. pale...".
15. NZNOG J88 p15 image 6 A healthy *Pt. australis* plant growing under short beech forest, well shaded in ideal conditions at Hawkes lookout, Takaka Hill. I believe image 5 may represent an atypical hybrid between *Pt.* "Nortonii", *Pt. banksii* or *Pt. irwinii* (image 4) which are all present in close proximity.
16. Open Access–Ecology & Evolution 2012; 2 (11): pp 2631-2644. Article: What does Population Structure Analysis reveal about the *Pterostylis longifolia* complex (Orchidaceae)? Jasmine K Janes, Dorothy A Steane & Rene E Vaillancourt. An analytical study of the four Tasmanian representatives of *Pt. longifolia* family showing that DNA and other similar studies suggest they are actually genetically the same plant still in the process of recolonisation after surviving ice age encroachment in four separate refugia where they became morphologically separated but now are in the process of reuniting and returning to the morphology of the ancestral parent.

Notes *etc*

Recreational hunters have joined forces with the Department of Conservation to save one of the last populations of a rare and endangered orchid threatened by rodents on the Coromandel Peninsula. About 30 members of the Thames Valley branch of the New Zealand Deerstalkers' Association are maintaining the trap line and controlling weeds. The first year of trapping produced 154 rats, six stoats and 20 mice; and this year 68 rats, one stoat and 40 mice were removed. In the past the orchid population had peaked in response to intensive predator control.

<http://www.deerstalkers.org.nz/press-releases/2014/hunters-protect-rare-orchid/>



▲ *Diploidium (Linguella) puberulum* at Kaueranga valley site (NZDA photo).

Pat Enright sent these shots of *Nematoceras trilobum* s.s. (aka *N. "trotters"*) from Sulphur Wells in the Wairarapa on 15 September... ▼



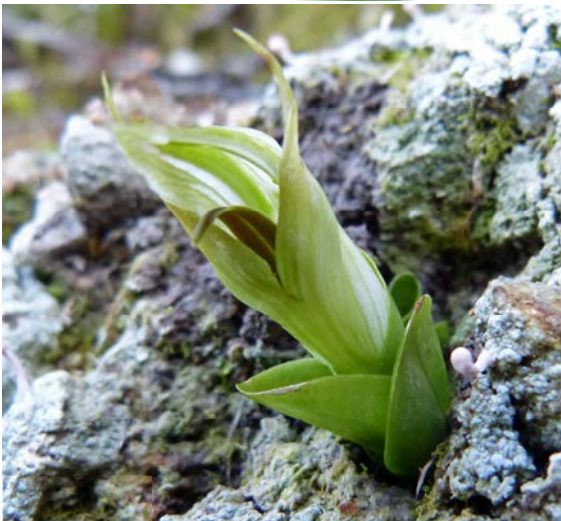
Pat Enright emailed (25 September), “These were taken in the Ratapihipihi Reserve (just outside the reseve fence actually) in boggy ground covered pretty much in *Selaginella kraussiana*. It was common in the area but flowers were few and far between.”

Mark Moorhouse responded, “... whilst it has some similar features of “Eastern Hills”, the narrow dorsal seems to preclude it. If I were to excuse that obvious difference it would still be placed in extreme left-field in that group due to general appearance, the extremely fimbriated bib, the almost translucent nature of this and the protruding tip of the dorsal. I think it probably better fits one of Eric's tagged groups. It could be transitional, ie halfway between two taxa. You do strike them occasionally. It's what confused my initial studies of *N. trilobum* agg. If you looked long enough you could find what seemed to be a continuous graduation of forms among almost all the taxa in the group. I believe this may be partially due to certain pollinators being less fussy in their choice of flowers to visit. Closest I've seen to these were in South Westland, Cascade area and near Lake Hauroko in Southland.”



Murray Dawson pointed out that our website doesn't have *Nematoceras iridescens* recorded from Canterbury and sent these photographs from these websites, commenting, "...there appear to be two forms of it at Travis Wetlands (near Brighton, Christchurch), and the notes at <http://naturewatch.org.nz/observations/372688> and <http://naturewatch.org.nz/observations/372689> have discussion on this."

There appear to be a coloured and an albino form of the same taxon, but even the coloured form lacks the "iridescent" colours of the dorsal sepal usually seen in N. iridescens in the North Island—Ed.



Cheryl Dawson sent these shots of the short alpine *Pterostylis* from alt 830m in the Tararua (14 October 2014).

From NZNOG@yahoo.com

Join by emailing nznog-subscribe@yahoo.com



C Cheryl Dawson sought identification of these on 15 September and Mark Moorhouse responded as below...



... definitely *N. "triwhite"*. The two with very fimbriated bibs and dark colouring on the dorsal I would place in *N. hypogaeum* despite the flowers being well clear of the litter. As for the other one which is almost circular front on, the narrow dorsal almost certainly precludes it from being a pure *N. Eastern Hills*. Perhaps it's the product of an unusual cross....



Pat Enright sent these shots of an almost black *Nematoceras macranthum* in dry habitat at Palliser Bay, southern Wairarapa, 19 October.



Alasdair Nicholl photographed this “white” pterostylis among normal *P. banksii* plants at Waitawheta, comparing it with that found by Sue & Jake McManus on West Piringia road [J124:12].

Such small-leaved colourless “ghost plants” sometimes appear in colonies of normal individuals. They are probably mutations that lack sufficient green chlorophyll to get nourishment from photosynthesis. They would in that case have to rely on mycorrhizal associations, leaving them stunted—Ed.



Kathy Warburton sent these shots of a red-dorsal-sepal *Nematoceras* aff. *trilobum* from an Otago swamp: isn't this remarkably like Mark Clements' photos of *N. sulcatum* from Mcquarie Is.? (p.29).





Kathy Warburton: this green dorsal sepal *N. aff. trilobum* (see p.29)▲...
... and two colour forms of *N. iridescens* ▼ (see also page 24)





These photographs are by Australian orchidologist Dr Mark Clements and are *Nematoceras sulcatum* from Mcquarie Island, its type location. The plants, like Kathy Warburton's (pp. 27, 28), show red and green dorsal sepals in the same site. It makes me wonder if the southern pale *N. aff. iridescens* isn't the other Mcquarie *Nematoceras*, *N. dieneum* (right).





A photographic essay on NZ's rarest orchid *Anzybas carsei*, by Catherine Beard



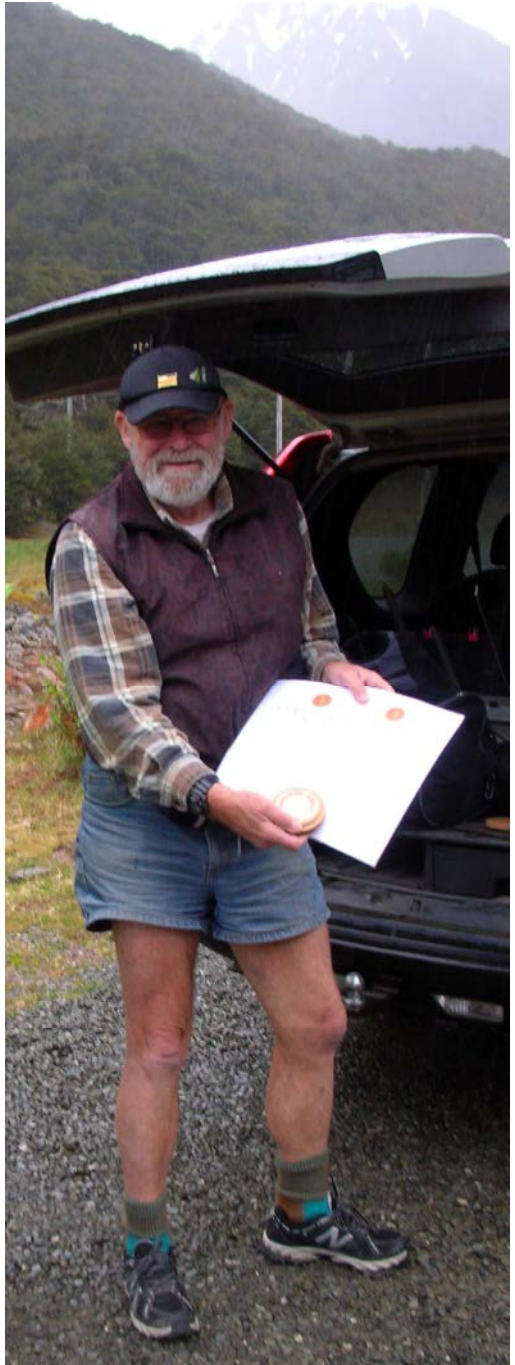
The Hatch Medal 2014

David McConachie wrote,

This year Gordon Sylvester was “recognised ... by the Executive of the Group, for his outstanding contribution to orchidology in New Zealand resulting from his many years of work creating and maintaining the Group’s Mapping Scheme, an immense catalogue of orchid observations over many years and over the whole country, which is regularly utilised by researchers studying New Zealand Orchids.” This has been, and still is, a labour of love for Gordon. One of the latest innovations for the group is the Yahoo NZNOG group and for Gordon “[t]he Yahoo group is successful. Even a little too successful, as I have some difficulty in keeping up with the sightings at times.”

Gordon also received a “Certificate of Appreciation” this year in recognition of “... his role in the formation of the NZ Native Orchid Group in 1982, and his ongoing support of it – [a]s frequent writer and photographer of material in the Journal, as an organiser of many successful field trips, and as a member of the Executive of the Group.”

Gordon Sylvester received the Hatch Medal sheltered by a car boot, in pouring rain, in the DoC carpark at his beloved Arthur’s Pass. What could be more apt? ▶



Does this look familiar? ▶

It's unlikely you have seen this one, the rare Tasmanian alpine greenhood *Pterostylis dubia*, photographed by "Malcolm" on Mt Wellington, 26 November 2011. Google *Pterostylis dubia* images.

Tasmania has a lot of orchids closely related to ours.—Ed.



Alasdair Nicholl's photos of *Pterostylis emarginata* from Waitawheta valley, mid-november. This is the plant that has been included in *P. banksii* (which can also have an emarginated labellum tip) but which is much smaller and does have consistent differences.



This was advertised recently on eBay. The vendor tells us that at NZ Post's request this trial/essay was produced some time in the 80s or 90s – possibly by Wyatt & Wilson of Christchurch – in order to show the quality of their work in the hope of obtaining a contract to supply self adhesive stamps. This essay shows the Slender Forest Orchid and at 40x31.5mm it is virtually commemorative size and without denomination. A small supply of this attractive item has just been discovered. *It's a lousy painting. Thank goodness they didn't make a stamp—Ed.*



Audrey Eagle's watercolour of *Pterostylis humilis*, showing the prominent heart-shaped stigma and upright floral stance to facilitate self-pollination.

Carlos Lehnebach updates NZNOG members on his orchid research...

This year I wasn't able to fit in a trip up north to the AGM but I am hoping that through this note I can let the Group know what I have been up to. I would like to start with a big thanks to all the members of the Group for supporting my research and helping me with information on odd looking members of the *Nematoceras trilobum* aggregate, taking me to sites to collect samples and sharing their photos or their knowledge on distribution and flowering periods.

My 3-years' Marsden project has now finished but I still have quite a bit of work to complete. I have gathered enough genetic and morphological evidence to recognise several forms of the *trilobum* aggregate as species (so far I am quite confident *N.* "trisep" (Hunua Ranges), *N.* "triwhite", *N.* "eastern hills" and *N.* "roundleaf" deserve to be recognised at the species level) but for other entities still further research is needed before I can comment on their taxonomic status. I am hoping to get some *Nematoceras* species described by the end of the year. This summer I am hoping to use AFLP, a DNA fingerprinting technique of higher resolution than DNA sequencing, to uncover the boundaries among forms such as *N.* "Trotters," *N.* "Rimutaka" and *N.* "darkie". (By the way, a thesis revising the genetic affinities with the *Corybas* alliance has now been completed and there is no support to split *Corybas* into *Nematoceras* and other genera so if I want to be current I should be using *Corybas* and not *Nematoceras*).

Besides my Spider orchids project I have been involved in several other orchid studies. Last summer I supervised two students from Victoria University of Wellington, Jasmine Gibbins and Bart Cox, who were awarded a Summer Research Scholarship to study native orchids. Jasmine looked at the genetic differences among the different species of *Gastrodia* and two undescribed entities; *Gastrodia* "long column" and *Gastrodia* "long column black".

Her work also included morphological measurements of herbarium specimens for each of these species and undescribed entities. Jeremy Rolfe, DoC Wellington, was also involved in this project. He was particularly interested in *Gastrodia* "long column black", a rather uncommon entity that might need to be included in the list of threatened plants of NZ. We were fortunate to get funding from DoC and the NZNOG to cover the expenses related to Jasmine's summer scholarship and DNA analyses, so big thanks to you all.

The second project I supervised was on the epiphytic species *Drymoanthus adversus* and *D. flavus*. These two species have a contrasting pattern of abundance and conservation status and I was interested to find out whether abundance and rarity was related to habitat preferences/availability. Bart Cox spent several weeks in the forest of a protected QEII covenant in the Wellington area and measured several variables to answer questions such as: do these orchids have preference for a host species or host size? Do they grow along other epiphytic plants or lichens, liverwort and moss? We have written an article with our findings and this has now been published in the *Bulletin* of the Wellington Botanical Society. Bart has also taken results of this study overseas and presented them at the Society for Conservation Biology conference in Fiji. This study was partially funded by a donation from the Capital City Orchid Society.

Jonathan (Jonno) Frericks, also from Victoria University of Wellington, has successfully completed his MSc and thesis project. Jonno's research focused on the identification of fungal partners of a range of NZ terrestrial orchids and the implementation of symbiotic seed germination techniques to propagate threatened orchids. Jonno travelled to Perth and visited Kings Park and Botanic Gardens where he gained the skills necessary to conduct these studies and learnt several tech-

niques over there. His trip was funded by the Australian Orchid Foundation and several other grants from the Wellington Botanical Society, Otari Wilton's Bush Trust and San Diego County Orchid Society in the US supported his research expenses.

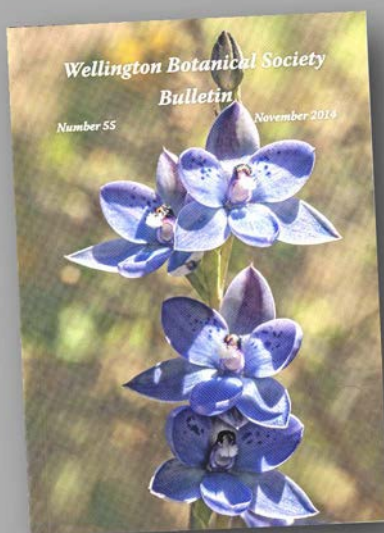
A success story of his project is the germination of seeds of *Spiranthes novae-zelandiae* on agar plates using a fungal species isolated from roots of adult *Spiranthes* plants. He also managed to germinate seeds of *Thelymitra longifolia* and *Microtis unifolia* in situ using seed packages made of very fine mesh, these seeds took over 6 months to germinate and, despite these orchids being rather abundant or weedy species, their germination success was surprisingly low. He also noticed the seed viability decreases very fast. Using DNA methods Jonno identified the diversity of fungi living inside roots of several terrestrial

orchids. The fungal diversity was impressive and over 40 species of fungi were detected from five common orchid species; some of these are well known orchid fungal partners. Jonno will write a note for the *NZNOJ* with a summary of his findings and some photos of his baby *Spiranthes* plants. We can't wait for them to flower!

To conclude this rather long note, I will give you the "heads up" about an exhibition in the making at Te Papa that will showcase the discovery of new species and behaviours. My research on spider orchids and their fungus gnat pollinators will be included in this exhibition. There will be some videos, dead orchid specimens and fungus gnats on vials (sad) and some great images (Pam Shearer's great shot of a fungus gnat with pollinia on *N. acuminatum* is one of them!). Exhibition will open in midDecember.

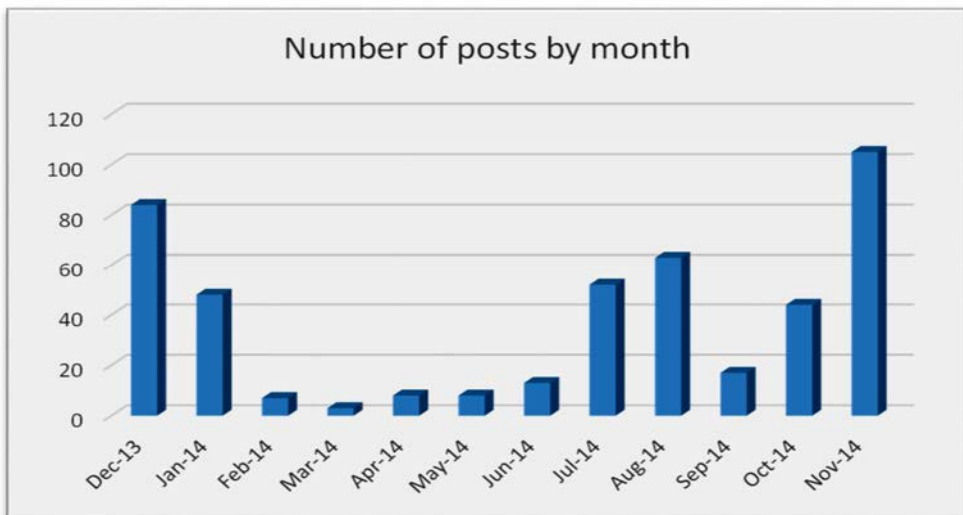
The Wellington Bot Soc *Bulletin* for November 2014 has two papers on native orchids,

- ◆ Jeremy Rolfe and Pat Enright's "Thelymitra novelty from Te Marua" (p50)—which examines the unusual *Thelymitra* aff. *nervosa* found there, and
- ◆ Bart Cox and Carlos Lehnebach's "Habitat preferences of two NZ perching orchids with contrasting abundance and conservation status" (p70)—which discusses *Drymoanthus adversus* and *D. flavus* habitats.



Look at this website, admire Pam Shearer's extraordinary photograph, then come to Wellington to see the exhibition showing Carlos Lehnebach's work on *Nematoceras* ... <http://www.tepapa.govt.nz/WhatsOn/exhibitions/Pages/DeCLASSIFIEDNaturesSecretsExposed.aspx>

Mark Moorhouse was the one who suggested an online chat group and the Group was started on 25 November 2013. On 25 November 2014 NZNOG@YahooGroups had 30 members and 12 months of activity as shown below (the number of posts roughly proportional to the number of orchids flowering in each month?) Post a message to nznog@yahoogroups.com. Subscribe: nznog-subscribe@yahoogroups.com. Unsubscribe: nznog-unsubscribe@yahoogroups.com. Thanks Mark: it is a very good idea!



Gordon Sylvester photographed this insect visiting *Pterostylis cernua* in late November.



C Cheryl Dawson sent these photographs from the Sunrise Track, Te Ruahine, in late November. Clockwise from top left,

Nematoceras “triwhite”, *Pterostylis graminea*, *P. humilis*, *P. subsimilis*, *P. irsoniana*.

“What a great day; snowed most of the day on the Sunrise Track and up at the hut quite a lot of orchids about, a lot in bud; no wonder the season seems late when the weather is so cold.”



Pat Enright in the
Waingawa,
Wairarapa, 7 Dec 14.



Pterostylis montana



“B” *Prasophyllum* “A”



Pterostylis graminea
with curled dorsal



A tiny late-flowering
Singulariylbas

Warm congratulations to Brian Molloy, 2014 recipient of the Allan Mere.

The mere was presented by Lucy Moore to commemorate HHB Allan, first Director of Botany Division, DSIR and is awarded each year to a person who has made outstanding contributions to botany in New Zealand.

Brian has certainly done that.

Photograph from the NZ Botanical Society Bulletin.



Mark Moorhouse “revisited the enormous colony of *Nematoceras macranthum* on Mt Robert on 14 December (that we saw at 2013 AGM) ...we discovered once again a section of it is pink-flowered and also a possible clue to its origin. Attached shot of colony. Note the *N. trilobum* seedheads intermingled. A single chance cross, now vegetatively reproducing might have given us this unique coloured colony which abuts the main normal colony. Now we just have to wait a year to catch the *trilobum* to see what that is!”





Kevin Matthews emailed, “This is a *Thelymitra longifolia* aggregate which at first thought I announced as *T.* “roughleaf.” Possibly a back cross with *T.* “rough leaf”. Anyhow it’s a beauty and quite unusual. I think the best find and flower during the field trip. Also attached a Tohanga *T.* “roughleaf” for comparison.

Kathy Warburton photographed *Pterostylis banksii* and *Thelymitra pauciflora* at Taieri Mouth in early December.



Cheryl Dawson photographed this "ghost" pterostylis in early December.

Pat Enright photographed this wide-leaved thelymitra on a dull cold day in the Rimutaka in early December.

That is a very deeply cleft column if we are to call this T. longifolia—Ed.



Iwitahi Annual Orchid Weekend 5-7 December 2014

By Brian Otto

The season has been colder than previous years and expectations were that there would be fewer orchids in full flower. This was only partly true as we saw orchid colonies in flower that we had not seen in previous years.

Caladenia lyallii in significant numbers inside the reserve, the green *Stegostyla atradenia* that we had not seen in flower previously in at least two areas, new and quite large colonies of *Adenochilus gracilis* and the *Pterostylis* orchids had moved away from the marked colony areas but were in abundance in new areas adjacent.

Bill Liddy shifted *Calochilus robertsonii* from the old Iwitahi camp site in June 2012 and one of the transplants flowered in an area where there are other known plants in leaf at this time.

What was so gratifying was the number of members (21) who attended and the extra eyes found orchid colonies we might otherwise have missed particularly while clearing away undergrowth and spending more time in an area.

Dennis Chuah, Alasdair Nicoll and members extended the walking track further around the reserve with easy walking that ensures passing greater numbers of orchid species from damp mossy areas with *Chiloglottis cornuta* and *Adenochilus gracilis* and *Stegostyla lyallii* to the shady areas with *Chiloglottis valida* in colonies covering up to six metres and to the drier open banks with more light where *Thelymitra longifolia* and *T. nervosa* are abundant. *T. carnea*, *T. pauciflora* are dotted in amongst them as well.

Karen Nicoll has marked out each colony with a blue tipped spike to draw attention to them on the track.



Thelymitra variations in colour (four plants of a light orange colour with the anther cap and column and spotted petals of *T. nervosa* were found growing out of a fallen *Pinus nigra* log.) see photo.



Guest speakers Jessica Schnell supported by her senior associate from Massey University have set up a native seed bank and are looking to have seed collected and fertility checks made for as many native orchid species as possible. The value of the NZNOG is the knowledge base of its members and their ability to collect seed and have it tested and banked for the future. The collection needs to include a clear description of the orchid species, its location (preferably a photo of the orchid, as well as an identifying site map) and because the seed is so fine a careful paper capsule created to send the seed to Massey.

Funding for this project is in place until 2017 (three collection opportunities.)

The second speaker Carlos Lehnebach is the current botany curator at Te Papa. Carlos spoke in depth about the four groups of *Gastrodia* orchids and showed no significant chromosome difference between *G. "long column"* and *G. "long column black"*.

The dependence of *Gastrodia* on nutriment supporting fungi is made complex by the fact that multiple fungi participate in the nutritional requirement and each contribution may be finite and essential for the success of early plant development.

Iwitahi is unique for orchid numbers and species with easy walking access and minimal walking distance. We keep finding new species each year which add to the 31 recorded species.

It is a gem in our native orchid library.



New Zealand Indigenous Flora Seed Bank (NZIFS)

Protecting New Zealand's indigenous plant biodiversity

by Jessica Schnell

The New Zealand Indigenous Flora Seed Bank is a project to conserve New Zealand's plant biodiversity by collecting seed of indigenous flora and placing it in storage at low temperature (-18°C) and moisture. About one-third of New Zealand plant species are at risk or threatened; a seed bank is an effective *ex situ* method of conservation in support of *in situ* conservation as seed of many species remain viable for decades in seed bank storage. Although seed banking has long been recognised as a method of plant conservation that is used world-wide, New Zealand through this project is only beginning to bank seed of its indigenous flora.

The project is managed by the New Zealand Seed Bank Group comprising Massey University, AgResearch Ltd, the Department of Conservation, Landcare Research Ltd and the New Zealand Plant Conservation Network (NZPCN). Each organisation contributes skills and/or facilities to support the collection, study and conservation of indigenous seed. The New Zealand Indigenous Flora Seed Bank has received funding support from the Strategic Innovation Fund (Massey University), the New Zealand Lottery Grants Board and the George Mason Charitable Trust for staff and equipment to progress the project.

The process of seed collecting and banking is managed through a series of protocols. Having obtained appropriate collecting permissions, trained personnel collect seed and herbarium samples in the field, with limits on the

quantity that can be collected from any site. Collections are sent to Massey University (Palmerston North) for initial processing and assessment to determine seed quality. Seed is dried to a moisture level in equilibrium with a relative humidity of 15% and then placed in storage at -18°C at the Margot Forde Germplasm Centre (AgResearch Ltd). A duplicate accession is held by one of the four main botanic gardens (Auckland, Wellington, Christchurch, and Dunedin).

The herbarium specimens are catalogued and stored in the Dame Ella Campbell Herbarium (Massey University, Palmerston North) with duplicates sent to the Allan Herbarium, Landcare Research Ltd (Christchurch). The herbarium specimens provide the link between the seed in store and the plant in the field from which the seed was collected. The specimens are used to ensure that the seed collected is correctly identified to species and to facilitate any subsequent research.

Seed can only be removed from the bank for a limited range of purposes, such as reintroduction of species where populations have been lost in the wild, or for research projects that will help with the conservation of the species. Seed may also be used for multiplication to replenish seed in the seed bank. All withdrawals from the seed bank must be approved by the New Zealand Seed Bank Group.

Species that will be collected in this project include both threatened and non-threatened species. Threatened species clearly have an

immediate conservation need, but the threats that any species may face in the future is unknown banking seed of all species is a good insurance policy. While the aim is to collect seed of all New Zealand's flowering indigenous flora four species groups have been identified as immediate priorities, the Myrtaceae, the alpine flora and in particular the forget-me-nots, the Fabaceae and fourthly podocarps and trees of the forest.

Orchid Council of New Zealand Iwitihi weekend

Jessica Schnell, the seed bank coordinator, attended the Orchid Council of New Zealand weekend at Iwitihi Reserve in December to learn more about New Zealand native orchids

and any challenges to banking native orchid seed. The weekend was also a chance to meet some of the people involved in the work of the Council.

Anyone interested in becoming an active collector for the New Zealand Indigenous Flora Seed Bank will need to undertake collector training. The next collector training is planned for March 2015 most likely in Taranaki. For further information on the training please contact Mrs Jessica Schnell on (06) 356 9099 extension 83236 or J.L.Schnell@massey.ac.nz. Any other enquiries on the project can be directed to the project leader, Mr Craig McGill on (06) 356 9099 extension 84803 or C.R.Mcgill@massey.ac.nz.



Anzybas carsei
Photograph: Catherine Beard

The NZ orchids the editor's list

There has been a reactionary trend away from the revised generic names of recent years, back towards broader concepts, as Pterostylis, Caladenia, Bulbophyllum, Dendrobium, Corybas, Chiloglottis. We have not followed the trend at this stage.

Acianthus R.Br. Prodr. Fl. Nov. Holland.: 321 (1810).

Acianthus sinclairii Hook.f. Fl. Nov.-Zel. 1: 245 (1853).

Acianthus fornicatus var. *sinclairii* (Hook.f.) Hatch. Trans. & Proc. Roy. Soc. New Zealand 75: 369 (1945).

Adelopetalum Fitzg. J. Bot. 29: 152 (1891).

Adelopetalum tuberculatum (Colenso) D.L.Jones, M.A.Clem. & Molloy. Orchadian 13(11): 498 (2002).

Bulbophyllum tuberculatum Colenso. Trans. & Proc. New Zealand Inst. 16: 336 (1884).

Bulbophyllum exiguum as meant by Buchanan. Trans. & Proc. New Zealand Inst. 16: 397 (1884), is not that of F.Muell. (1861).

Adenochilus Hook.f. Fl. Nov.-Zel. 1: 246, t.56 (1853)

Adenochilus gracilis Hook.f. Fl. Nov.-Zel. 1: 246, t.56 (1853).

Anzybas D.L.Jones & M.A.Clem. Orchadian 13(10): 442 (2002).

Anzybas carsei (Cheeseman) D.L.Jones & M.A.Clem. Orchadian 13(10): 443 (2002).

Corysanthes carsei Cheeseman. Trans. & Proc. New Zealand Inst. 44: 162 (1912).

Corybas carsei (Cheeseman) Hatch. Trans. & Proc. Roy. Soc. New Zealand 75: 367 (1945).

Corybas unguiculatus as meant by L.B.Moore. Fl. New Zealand Vol. 2: 116 (1970) is not *Corysanthes unguiculatus* of R.Br. (1810).

Anzybas rotundifolius (Cheeseman) D.L.Jones & M.A.Clem. Orchadian 13(10): 443 (2002).

Nematoceras rotundifolia Hook.f. Fl. Nov.-Zel. 1: 251 (1853).

Corysanthes rotundifolia (Hook.f.) Hook.f. Handb. N. Zeal. Fl. 266 (1864).

Corybas rotundifolius (Hook.f.) Rchb.f. Beitr. Syst. Pflanzenk. 67 (1871).

Corysanthes matthewsii Cheeseman. Trans. & Proc. New Zealand Inst. 31: 351 (1899).

Corybas matthewsii (Cheeseman) Schltr. Repert. Spec. Nov. Regni Veg. 19: 23 (1923).

Corybas unguiculatus as meant by Hatch. Trans. & Proc. Roy. Soc. New Zealand 75: 367 (1945), is not *Corysanthes unguiculatus* of R.Br. (1810).

A late pale form may be distinct.

Aporostylis Rupp & Hatch. Proc. Linn. Soc. New South Wales 70: 60 (1946)

Aporostylis bifolia (Hook.f.) Rupp & Hatch. Proc. Linn. Soc. New South Wales 70: 60 (1946).

Caladenia bifolia Hook.f. Fl. Nov.-Zel. 1: 247 (1853).

Chiloglottis traversii F.Muell. Veg. Chath. Is. 51 (1864).

Caladenia macrophylla Colenso. Trans. & Proc. New Zealand Inst. 27: 396 (1895).

Chiloglottis bifolia (Hook.f.) Schltr. Engl. Bot. Jahrb. 45: 383 (1911).

Calochilus R.Br. Prodr. Fl. Nov. Holland.: 320 (1810)

Calochilus herbaceus Lindl. Gen. & Spec. Orch. Plant.: 45 (1840).

Calochilus campestris as meant by Hatch. Trans. & Proc. Roy. Soc. New Zealand 77: 248 (1949), is not that of R.Br. (1810).

Calochilus paludosus R.Br. Prodr. Fl. Nov. Holland.: 320 (1810).

Calochilus robertsonii Benth. Fl. Austral. 6: 315 (1873).

Calochilus campestris as meant by Fitzg. Austral. Orchids 1(4): t.6 (1878), is not that of R.Br. (1810).

Calochilus campestre as meant by Cheeseman. Man. New Zealand Fl. 686 (1906), is not that of R.Br. (1810).

Corunastylis Fitzg. Austral. Orchids 2(3): t.1 (1888).

Corunastylis nuda (Hook.f.) D.L.Jones & M.A.Clem. Orchadian 13(10): 461 (2002).

Prasopphyllum nudum Hook.f. Fl. Nov.-Zel. 1: 242 (1853).

Prasopphyllum tunicatum Hook.f. Fl. Nov.-Zel. 1: 242 (1853).

Prasopphyllum variegatum Colenso. Trans. & Proc. New Zealand Inst. 20: 208 (1888).

Genoplesium nudum (Hook.f.) D.L.Jones & M.A.Clem. Lindleyana 4(3): 144 (1989).

Corunastylis pumila (Hook.f.) D.L.Jones & M.A.Clem. Orchadian 13(10): 461 (2002).

Prasopphyllum pumilum Hook.f. Fl. Nov.-Zel. 1: 242 (1853).

Genoplesium pumilum (Hook.f.) D.L.Jones & M.A.Clem. Lindleyana 4(3): 144 (1989).

Corybas Salisb. Parad. Lond. t.83 (1805).

Corybas cheesemanii (Hook.f. ex Kirk) Kuntze. Revis. Gen. Pl. 2: 657 (1891).

Corysanthes cheesemanii Hook.f. ex Kirk. Trans. & Proc. New Zealand Inst. 3: 180 (1871).

Corybas aconitiflorus as meant by Hatch. Trans. & Proc. Roy. Soc. New Zealand 75: 367 (1945), is not that of Salisb. (1807).

Cryptostylis R.Br. Prodr. Fl. Nov. Holland.: 317 (1810)

Cryptostylis subulata (Labill.) Rchb.f. Beitr. Syst. Pflanzenk. 15 (1871).

Malaxis subulata Labill. Nov. Holl. Pl. 2: 62, t.212 (1806).

Cyrtostylis R.Br. Prodr. Fl. Nov. Holland.: 322 (1810).

Cyrtostylis oblonga Hook.f. Fl. Nov.-Zel. 1: 246 (1853).

Acianthus reniformis var. *oblonga* (Hook.f.) Rupp & Hatch. Proc. Linn. Soc. New South Wales 70: 59 (1946).

Cyrtostylis rotundifolia Hook.f. Fl. Nov.-Zel. 1: 246 (1853).

Cyrtostylis macrophylla Hook.f. Fl. Nov.-Zel. 1: 246 (1853).

Caladenia reniformis (R.Br.) Rchb.f. Beitr. Syst. Pflanzenk. 67 (1871).

Cyrtostylis oblonga (Hook.f.) var. *rotundifolia* (Hook.f.)

Cheeseman. Man. New Zealand Fl. 685 (1906).

Acianthus reniformis (R.Br.) Schltr. Engl. Bot. Jahrb. 34: 39 (1906).

Acianthus reniformis var. *reniformis* (Hook.f.) Rupp & Hatch. Proc. Linn. Soc. New South Wales 70: 59 (1946).

Cyrtostylis reniformis as used by many authors until now is not that of R.Br. Prodr. Fl. Nov. Holland.: 322 (1810).

Danhatchia Garay & Christenson. Orchadian 11(10): 469, f.471 (1995)

Danhatchia australis (Hatch) Garay & Christenson. Orchadian 11(10): 470 (1995).

Yoania australis Hatch. Trans. Roy. Soc. New Zealand, Bot. 2: 185 (1963).

Diplodium D.L.Jones, Molloy & M.A.Clem. Austral. Orchid Res. 4: 70 (2002).

Diplodium alobulum (Hatch) D.L.Jones, Molloy & M.A.Clem. Austral. Orchid Res. 4: 70 (2002).
Pterostylis trullifolia as meant by Cheeseman. Man. New Zealand Fl. (1906), is not that of Hook.f.

Diplodium trullifolia Hook.f. var. *alobula* Hatch. Trans. Roy. Soc. NZ 77: 244, t.30, f.3E–H (1949).
Pterostylis alobula (Hatch) L.B.Moore. New Zealand J. Bot. 6: 486, f.3 (1969).

Diplodium alveatum (Garnet) D.L.Jones & M.A.Clem. Austral. Orchid Res. 4: 70 (2002).
Pterostylis alveata Garnet. Victoria Naturalist 59: 91 (1939).

Diplodium brumale (L.B.Moore) D.L.Jones, Molloy & M.A.Clem. Austral. Orchid Res. 4: 70 (2002).
Pterostylis trullifolia Hook.f. var. *rubella* Hatch. Trans. & Proc. Roy. Soc. New Zealand 77: 244 (1949).
Pterostylis brumalis L.B.Moore. New Zealand J. Bot. 6: 485, f.3 (1969).

Diplodium trullifolium (Hook.f.) D.L.Jones, Molloy & M.A.Clem. Austral. Orchid Res. 4: 72 (2002).
Pterostylis trullifolia Hook.f. Fl. Nov.–Zel. 1: 249 (1853).
Pterostylis rubella Colenso. Trans. & Proc. New Zealand Inst. 18: 271 (1886).
Pterostylis trullifolia Hook.f. var. *gracilis* Cheeseman. Trans. & Proc. New Zealand Inst. 47: 271 (1915).

Drymoanthus Nicholls. Victorian Naturalist 59: 173 (1943)

Drymoanthus adversus (Hook.f.) Dockrill. Australasian Sarcanthinae: 32, t.3 (1967).
Sarcochilus adversus Hook.f. Fl. Nov.–Zel. 1: 241 (1853).
Sarcochilus breviscapa Colenso. Trans. & Proc. New Zealand Inst. 14: 332 (1882).

Drymoanthus flavus St George & Molloy. New Zealand J. Bot. 32: 416, f.1 (1994).

Earina Lindl. Bot. Reg. sub t.1699 (1834)

Earina aestivalis Cheeseman. Trans. & Proc. New Zealand Inst. 51: 93 (1919).

Earina autumnalis (G.Forst.) Hook.f. Fl. Nov.–Zel. 1: 239 (1853).
Epidendrum autumnale G.Forst. Prodr. 60 (1786).
Earina suaveolens Lindl. Bot. Reg. 29 (1843).
Earina alba Colenso. Trans. & Proc. New Zealand Inst. 18: 267 (1886).

Earina mucronata Lindl. Bot. Reg. 20 sub t.1699 (1834).
Earina quadrilobata Colenso. Trans. & Proc. New Zealand Inst. 15: 325 (1883).

Gastrodia R.Br. Prodr. Fl. Nov. Holland.: 330 (1810)

Gastrodia cunninghamii Hook.f. Fl. Nov.–Zel. 1: 251 (1853).
Gastrodia leucopetala Colenso. Trans. & Proc. New Zealand Inst. 18: 268 (1886).

Gastrodia minor Petrie. Trans. & Proc. New Zealand Inst. 25: 273, t.20, f.5–7 (1893).

Gastrodia “long column” agg.: there are a number of late flowering *Gastrodia*, one black, with a long column.

Gastrodia aff. sesamoides. *Gastrodia* sesamoides as meant by Cheeseman. Man. New Zealand Fl. 697 (1906), is not that of R.Br. (1810).
Gastrodia “city” appears to be a variant.

Hymenochilus D.L.Jones, M.A.Clem. & Molloy. Austral. Orchid Res. 4: 72 (2002).

Hymenochilus tanypodus (D.L.Jones, Molloy & M.A.Clem.) D.L.Jones, M.A.Clem. & Molloy. Austral. Orchid Res. 4: 74 (2002).
Pterostylis tanypoda D.L.Jones, Molloy & M.A.Clem. Orchadian 12(6): 273 (1997).
Pterostylis cynocephala as meant by L.B.Moore. Fl. New Zealand Vol. 2: 135 (1970) and others (1970–1997), is not that of Fitzg. (1876).

Hymenochilus tristis (Colenso) D.L.Jones, M.A.Clem. & Molloy. Austral. Orchid Res. 4: 74 (2002).

Pterostylis tristis Colenso. Trans. & Proc. New Zealand Inst. 18: 271 (1886).

Pterostylis mutica as meant by Cheeseman. Trans. & Proc. New Zealand Inst. 15: 300 (1883), is not that of R.Br. (1810).

Ichthyostomum D.L.Jones, M.A.Clem. & Molloy. Orchadian 13(11): 499 (2002).

Ichthyostomum pygmaeum (Sm.) D.L.Jones, M.A.Clem. & Molloy. Orchadian 13(11): 499 (2002).
Dendrobium pygmaeum Sm. in Rees. Cycl. (Rees) 11: n.27 (1808).
Bulbophyllum pygmaeum (Sm.) Lindl. Gen. Sp. Orchid. Pl. 58 (1830).
Bulbophyllum ichthyostomum Colenso. Trans. & Proc. New Zealand Inst. 26: 319 (1894).

Linguella D.L.Jones, M.A.Clem. & Molloy. Austral. Orchid Res. 4: 74 (2002).

Linguella puberula (Hook.f.) D.L.Jones, M.A.Clem. & Molloy. Austral. Orchid Res. 4: 75 (2002).
Pterostylis puberula Hook.f. Fl. Nov.–Zel. 1: 249 (1853).
Pterostylis nana as meant by Hatch. Trans. & Proc. Roy. Soc. New Zealand 77: 237 (1949), is not that of R.Br. (1810).
Pterostylis aff. nana.
This is likely to be included in *Diplodium*.

Microtis R.Br. Prodr. Fl. Nov. Holland.: 320 (1810).

Microtis arenaria Lindl. Gen. Sp. Orchid. Pl. t.306 (1840).
Microtis biloba Nicholls. Victoria Naturalist 66: 93, f.O–L (1949).
Microtis papillosa Colenso. Trans. & Proc. New Zealand Inst. 18: 269 (1886). The type has not been found but Colenso’s notched labellum suggests *M. arenaria* (which in turn has been included in *M. unifolia* by others).

Microtis oligantha L.B.Moore. New Zealand J. Bot. 6: 473, f.1 (1969).
Microtis magnadenia as meant by Hatch. Trans. Roy. Soc. New Zealand, Bot. 2: 185–189 (1963), is not that of R.S.Rogers (1930).

Microtis parviflora R.Br. Prodr. Fl. Nov. Holland.: 321 (1810).
Microtis javanica Rchb.f. Bonplandia 5: 36 (1857).
Microtis benthamiana Rchb.f. Beitr. Syst. Pflanzenk. 24 (1871).
Microtis longifolia Col. Trans. & Proc. New Zealand Inst. 17: 247 (1885).

Microtis porrifolia (Sw.) R.Br. ex Spreng. var. *parviflora* (R.Br.) Rodway. Tasman. Fl. 159 (1903).
Microtis aemula Schltr. Bot. Jahrb. Syst. 39: 37 (1906).
Microtis bipulvinaris Nicholls. Victoria Naturalist 66: 92–94, f.A–F (1949).
Microtis holmesii Nicholls. Victoria Naturalist 66: 93, f.G–I (1949).

Microtis unifolia (G.Forst.) Rchb.f. Beitr. Syst. Pflanzenk. 62 (1871).
Ophrys unifolia G.Forst. Fl. Ins. Austr. 59 (1786).
Epipactis porrifolia Sw. Kongl. Vetensk. Acad. Nya Handl. 21: 233 (1800).

Microtis porrifolia (Sw.) R.Br. ex Spreng. Syst. Veg. (ed. 16) [Sprengel] 3: 713 (1826).
Microtis banksii A.Cunn. Bot. Mag. 62: sub 1.3377 (1835).
Microtis frutetorum Schldl. Linnaea 20: 568 (1847).
Microtis viridis F.Muell. Fragm. (Mueller) 5: 97 (1866).
Microtis longifolia Colenso. Trans. & Proc. New Zealand Inst. 17: 247 (1885). This is an autumn flowering form and may be distinct.
Microtis pulchella as meant by Lindl. Gen. Sp. Orchid. Pl. 395 (1840), is not that of R.Br. (1810).

Microtis aff. unifolia: a summer flowering form allied to *M. unifolia* and *M. parviflora*.

Molloybas D.L.Jones & M.A.Clem. Orchadian 13(10): 448 (2002).

Molloybas cryptanthus (Hatch) D.L.Jones & M.A.Clem. Orchadian 13(10): 448 (2002).
Corybas cryptanthus Hatch. Trans. Roy. Soc. New Zealand 83: 577 (1956).
Corybas saprophyticus as meant by Hatch. Trans. & Proc. Roy. Soc. New Zealand 79: 366, t.71 (1952), is not that of Schltr. (1923).

Myrmecchila D.L.Jones & M.A.Clem. Orchadian 15(1): 36–37 (2005).

Myrmecchila formicifera (Fitzg.) D.L.Jones & M.A.Clem. Orchadian 15(1): 37 (2005).

Chiloglottis formicifera Fitzg. Austral. Orchids 1(3): (1877).

Myrmecchila trapeziformis (Fitzg.) D.L.Jones & M.A.Clem. Orchadian 15(1): 37 (2005).

Chiloglottis trapeziformis Fitzg. Austral. Orchids 1(3): (1877).

Nematoceras Hook.f. Fl. N. Zel. 1: 249, t.57 (1853).

Nematoceras acuminatum (M.A.Clem. & Hatch) Molloy,

D.L.Jones & M.A.Clem. Orchadian 13(10): 449 (2002).

Corybas acuminatus M.A.Clem. & Hatch. New Zealand J. Bot. 23: 491, f.2 (1985).

Corysanthes acuminata (M.A.Clem. & Hatch) Szlach. Richardiana 3(2): 97 (2003).

Corybas rivularis as meant by Cheeseman. Man. New Zealand Fl. 697 (1906), and others (1906–1985), is not *Acianthus rivularis* of A.Cunn. (1837).

Nematoceras hypogaeum (Colenso) Molloy, D.L.Jones &

M.A.Clem. Orchadian 13(10): 449 (2002).

Corysanthes hypogaea Colenso. Trans. & Proc. New Zealand Inst. 16: 336 (1884).

Nematoceras iridescens (Irwin & Molloy) Molloy, D.L.Jones &

M.A.Clem. Orchadian 13(10): 449 (2002).

Corybas iridescens Irwin & Molloy. New Zealand J. Bot. 34: 1, f.1 (1996).

Corysanthes iridescens (Irwin & Molloy) Szlach. Richardiana 3(2): 98 (2003).

Nematoceras longipetalum (Hatch) Molloy, D.L.Jones &

M.A.Clem. Orchadian 13(10): 449 (2002).

Corybas macranthus (Hook.f.) Rchb.f. var. longipetalus Hatch.

Trans. & Proc. Roy. Soc. New Zealand 76: 580, t.60(1) (1947).

Corybas longipetalus (Hatch) Hatch. NZNOG Journal 47: 6 (1993), is not that of Schltr. (1923).

Corybas orbiculatus (Colenso) L.B.Moore. Fl. New Zealand Vol. 2: 118 (1970), is not *Corysanthes orbiculata* of Colenso (1891).

Nematoceras macranthum Hook.f. Fl. Nov.-Zel. 1: 250 (1853).

Corysanthes macrantha (Hook.f.) Hook.f. Handb. N. Zeal. Fl. 266 (1864).

Corybas macranthus (Hook.f.) Rchb.f. Beitr. Syst. Pflanzenk. 67 (1871).

There are several entities in this aggregate. Probable hybrids with insect-pollinated members of the *N. trilobum* aggregate have been reported.

Nematoceras orbiculatum (Colenso) Molloy, D.L.Jones &

M.A.Clem. Orchadian 13(10): 449 (2002).

Corysanthes orbiculata Colenso. Trans. & Proc. New Zealand Inst. 23: 389 (1891).

Corybas orbiculatus as meant by L.B.Moore. Fl. New Zealand Vol. 2: 118 (1970) and others (1970–1996), is not *Corysanthes orbiculata* of Colenso (1891) (see Molloy & Irwin. New Zealand J. Bot. 34 (1): 5 [1996]).

Nematoceras papa (Molloy & Irwin) Molloy, D.L.Jones &

M.A.Clem. Orchadian 13(10): 449 (2002).

Corybas papa Molloy & Irwin. New Zealand J. Bot. 34(1): 5, f.1 (1996).

Corysanthes papa (Molloy & Irwin) Szlach. Richardiana 3(2): 98 (2003).

Nematoceras papillosum (Colenso) Molloy, D.L.Jones &

M.A.Clem. Orchadian 13(10): 449 (2002).

Corysanthes papillosa Colenso. Trans. & Proc. New Zealand Inst. 16: 337 (1884).

This is a form of *Nematoceras macranthum*, and though its status remains speculative, the form with a pale lower labellum, long leafstem and very short flowerstem has been identified with this name.

Nematoceras rivulare (A.Cunn.) Hook.f. Fl. Nov.-Zel. 1: 251

(1853).

Acianthus rivularis A.Cunn. Companion Bot. Mag. 2: 376 (1837).

Corysanthes rivularis (A.Cunn.) Hook.f. Handb. N. Zeal. Fl. 266 (1864).

Corybas rivularis (A.Cunn.) Rchb.f. Beitr. Syst. Pflanzenk. 67 (1871).

Nematoceras panduratum (Cheeseman) Molloy, D.L.Jones &

M.A.Clem. Orchadian 13(10): 449 (2002).

Corysanthes rotundifolia var. *pandurata* Cheeseman. Man. New Zealand Fl. 366 (1925), is not *Nematoceras rotundifolia* of Hook.f.

Corysanthes rotundifolia as meant by Cheeseman. Man. New Zealand Fl. 695 (1906), is not *Nematoceras rotundifolia* of Hook.f. (1853).

Corybas orbiculatus as meant by L.B.Moore. Fl. New Zealand Vol. 2: 118 (1970) and others (1970–1996), is not *Corysanthes orbiculata* of Colenso (1891).

The *Nematoceras rivulare* complex includes unnamed taxa with the tag names N. “Kaimai”, N. “rest area”, N. “Kaitarakihī”, N. “whiskers” (aka N. “viridis”), N. “Mangahuia”, N. “sphagnum”, N. “Pollock” and N. “Motutangi” among others.

Nematoceras trilobum Hook.f. Fl. Nov.-Zel. 1: 250 (1853).

Corysanthes triloba (Hook.f.) Hook.f. Handb. N. Zeal. Fl. 265

(1864).

Corybas trilobus (Hook.f.) Rchb.f. Beitr. Syst. Pflanzenk. 67

(1871).

About 25 taxa in the *Nematoceras trilobum* complex are of speculative taxonomic status; they include the late-flowering N.

“Trotters” (almost certainly *N. trilobum* sens. strict.), the tiny May

to July flowering forms with the tag name N. “pygmy”; N.

“Rimutaka” (NZNOG Journal 58: 8–9 [1996]), N. “round leaf”, N.

“craigielea”, N. “darkie”, N. “trispet”, N. “trirwhite”, and many

others. The N. *trilobum* complex has tetraploids in the South Island and Chatham I., and predominantly diploids in the North Island, but further chromosome counts are needed (see Dawson, Molloy &

Beuzenberg. New Zealand J. Bot. 45(4): 644 [2007]).

Nematoceras aff. sulcatum: plants similar to *N. sulcatum* from Macquarie Is have been found at a number of S. Is. Sites and on the Chathams.

Orthoceras R.Br. Prodr. Fl. Nov. Holland.: 316 (1810)

Orthoceras novae-zeelandiae (A.Rich.) M.A.Clem., D.L.Jones &

Molloy. Austral. Orchid Res., 1: 100 (1989).

Diuris novae-zeelandiae A.Rich. Essai Fl. Nov. Zel. 163 t.25, f.1 (1832).

Orthoceras solandri Lindl. Gen. Sp. Orchid. Pl. 512 (1840).

Orthoceras rubrum Colenso. Trans. & Proc. New Zealand Inst. 18: 273 (1886).

Orthoceras caput-serpentis Colenso. Trans. & Proc. New Zealand

Inst. 22: 490 (1890).

Orthoceras strictum R.Br. forma *viride* Hatch. Trans. Roy. Soc.

N.Z. Bot. 2: 195 (1963).

Orthoceras strictum R.Br. Prodr. Fl. Nov. Holland.: 317 (1810).

Petalochilus R.S.Rogers. J. Bot. 62: 65 (1924).

Petalochilus alatus (R.Br.) D.L.Jones & M.A.Clem. Orchadian 13

(9): 406 (2001).

Caladenia alata R.Br. Prodr. Fl. Nov. Holland.: 324 (1810).

Caladenia minor Hook.f. var. *exigua* Cheeseman. Man. New

Zealand Fl. 688 (1906).

Caladenia exigua Cheeseman. Trans. & Proc. New Zealand Inst.

45: 96 (1913).

Caladenia carnea R.Br. var. *alata* (R.Br.) Domin. Bibliotheca

Botanica Heft 85: 549 (1915).

Caladenia carnea R.Br. var. *exigua* (Cheeseman) Rupp. Proc. Linn.

Soc. New South Wales 69: 75 (1944).

Caladenia holmesii Rupp. Victoria Naturalist 70: 179 (1954).

Caladenia catenata (Sm.) Druce var. *exigua* (Cheeseman)

W.M.Curtis. Stud. Fl. Tasman., 4A: 133 (1979).

Petalochilus bartlettii (Hatch) D.L.Jones & M.A.Clem. Orchadian

13(9): 406 (2001).

Caladenia carnea R.Br. var. *bartlettii* Hatch. Trans. & Proc. Roy.

Soc. New Zealand 77: 402 (1949).

Caladenia bartlettii (Hatch) D.L.Jones, Molloy & M.A.Clem.

Orchadian 12(5): 227 (1997).

Petalochilus calyciformis R.S.Rogers. J. Bot. 62: 66 (1924).

Moore (1970) treated this as an aberrant floral (peloric) mutation of other species.

- Petalochilus chlorostylus** (D.L.Jones, Molloy & M.A.Clem.) D.L.Jones & M.A.Clem. *Orchadian* 13(9): 406 (2001).
Caladenia catenata as meant by Cooper. Field guide to the NZ native orchids 17 (1984), is not that of Druce (1917).
Caladenia chlorostyla D.L.Jones, Molloy & M.A.Clem. *Orchadian* 12(5): 223 fl (1997).
Arethusa catenata and *Caladenia alba* are names used for Australian plants once confused with NZ taxa.
- Petalochilus aff. chlorostylus** is a similar taxon to *Petalochilus chlorostylus*, with red hairs and later flowering. There is also a larger late flowering plant with (usually) 2-3 fls.
- Petalochilus minor** (Hook.f.) D.L.Jones & M.A.Clem. *Orchadian* 13(9): 410 (2001).
Caladenia minor Hook.f. *Fl. Nov.-Zel.* 1: 247, t.56b (1853).
Caladenia carnea var. *pygmaea* (R.S.Rogers) Rupp. *Proc. Linn. Soc. New South Wales* 69: 74 (1944).
Caladenia carnea R.Br. var. *minor* (Hook.f.) Hatch. *Trans. & Proc. Roy. Soc. New Zealand* 77: 401 (1949).
Caladenia catenata var. *minor* (Hook.f.) W.M.Curtis. *Stud. Fl. Tasman.* 4A: 106 (1979).
The identity of *Petalochilus minor* is not clear, but it may be a taxon within *P. aff. chlorostylus*.
- Petalochilus nothofageti** (D.L.Jones, Molloy & M.A.Clem.) Jones & M.A.Clem. *Orchadian* 13(9): 410 (2001).
Caladenia nothofageti D.L.Jones, Molloy & M.A.Clem. *Orchadian* 12(5): 226, f.1 (1997).
- Petalochilus saccatus** R.S.Rogers. *J. Bot.* 62: 66, t.571, 4-7 (1924).
Caladenia saccata (R.S.Rogers) Hopper & A.P.Br. *Austral. Syst. Bot.* 17: 171-240 (2004).
Moore (1970) treated this as an aberrant floral (peloric) mutation of other species.
- Petalochilus variegatus** (Colenso) D.L.Jones & M.A.Clem. *Orchadian* 13(9): 410 (2001).
Caladenia variegata Colenso. *Trans. & Proc. New Zealand Inst.* 17: 248 (1885). Some flowers have a clear two rows of calli on the labellum, others have extra calli scattered to either side of the two rows.
- Petalochilus aff. fuscatus**: a small pink flowered entity which appears similar to the variable Australian species *Petalochilus fuscatus*. See Scanlen. *NZNOG Journal* 72: 22 [1999]. It appears to be identical with HB Matthews's *Caladenia "nitida-rosea"* (see Scanlen E. Matthews & son on orchids. *NZNOG Historical Series* 2006; 14: 12).
- Petalochilus aff. pusillus**: a tiny pink flowered entity with broad oval sepals and petals, an incurved dorsal sepal and a triangular labellum midlobe; grows near Wellington, Taranaki and in Northland (W.M.Curtis. *Stud. Fl. Tasman.*, 4A: 133 [1980]).
- Plumatichilos** Szlach. *Polish Bot. J.* 46(1): 23 (2001).
- Plumatichilos tasmanicum** (D.L.Jones) Szlach. *Polish Bot. J.* 46(1): 23 (2001).
Pterostylis tasmanica D.L.Jones. *Muelleria* 8(2): 177 (1994).
Pterostylis squamata as meant by Hook.f. *Fl. Nov.-Zel.* 1: 249 (1853), is not that of R.Br. (1810).
Pterostylis barbata as meant by Cheeseman. *Man. New Zealand Fl.* 683 (1906), is not that of Lindl. (1840).
Pterostylis plumosa as meant by Cooper. Field guide to NZ native orchids 51 (1981), is not that of Cady (1969).
Jones suggests there is a second unnamed NZ entity.
- Prasophyllum R.Br. Prodr. Fl. Nov. Holland.: 317 (1810)**
- Prasophyllum colensoi** Hook.f. *Fl. Nov.-Zel.* 1: 241 (1853).
Prasophyllum pauciflorum Colenso. *Trans. & Proc. New Zealand Inst.* 18: 273 (1886).
Prasophyllum rogersii as meant by Hatch. *Trans. & Proc. Roy. Soc. New Zealand* 76: 290 (1946), is not that of R.S.Rogers & Rees (1921).
Probably a number of taxa, including Irwin's P. "A" and P. "B" (*NZNOG Journal* 79: 9-10 [2001]).
- Prasophyllum hectorii** (Buchanan) Molloy, D.L.Jones & M.A.Clem. *Orchadian* 15: 41 (2005).
Gastrodia hectori Buchanan. *Trans. & Proc. New Zealand Inst.* 19: 214 (1886).
Prasophyllum patens as meant by Cheeseman. *Man. New Zealand Fl.* (1906), is not that of R.Br. (1810).
Prasophyllum tutoni as meant by Hatch. *Trans. & Proc. Roy. Soc. New Zealand* 76: 291 (1946), is not that of Rupp (1928).
- Pterostylis R.Br. Prodr. Fl. Nov. Holland.: 326 (1810).**
- Pterostylis agathicola** D.L.Jones, Molloy & M.A.Clem. *Orchadian* 12(6): 266 (1997).
Pterostylis graminea (Hook.f.) var. *rubricaulis* H.B.Matthews ex Cheeseman. *Man. New Zealand Fl.* 351 (1925).
Pterostylis montana (Hatch) var. *rubricaulis* (Cheeseman) Hatch. *Trans. & Proc. Roy. Soc. New Zealand* 77: 240, plate 23 (1949).
- Pterostylis areolata** Petrie. *Trans. & Proc. New Zealand Inst.* 50: 210 (1918).
- Pterostylis aureolata** Colenso. *Trans. & Proc. New Zealand Inst.* 22: 489 (1890).
- Pterostylis australis** Hook.f. *Fl. Nov.-Zel.* 1: 248 (1853).
- Pterostylis banksii** A.Cunn. *Companion Bot. Mag.* 2: 376 (1837).
- Pterostylis cardiostigma** D.Cooper. *New Zealand J. Bot.* 21: 97, f.1,2 (1983).
- Pterostylis cernua** D.L.Jones, Molloy & M.A.Clem. *Orchadian* 12(6): 267, f.2 (1997).
- Pterostylis emarginata** Colenso. *Trans. & Proc. New Zealand Inst.* 15: 328 (1883).
Pterostylis aff. banksii: a smaller taxon than true *P. banksii*, common around Wellington, and apparently found elsewhere (see *NZNOG Journal* 80: 14, 19 [2001]).
- Pterostylis foliata** Hook.f. *Fl. Nov.-Zel.* 1: 249 (1853).
Pterostylis verecunae R.S.Rogers. *Trans. & Proc. Roy. Soc. South Australia* 38: 360-361, f.18(2) (1914).
Pterostylis gracilis Nicholls. *Victoria Naturalist* 43: 324-326 (1927).
- Pterostylis graminea** Hook.f. *Fl. Nov.-Zel.* 1: 248 (1853).
There are several taxa in the *P. graminea* complex, including tagname *P. "sphagnum"*.
- Pterostylis humilis** R.S.Rogers. *Trans. & Proc. Roy. Soc. South Australia* 46: 151 (1922).
- Pterostylis irsoniana** Hatch. *Trans. & Proc. Roy. Soc. New Zealand* 78: 104, t.18 (1950).
- Pterostylis irwinii** D.L.Jones, Molloy & M.A.Clem. *Orchadian* 12(6): 269 (1997).
- Pterostylis micromega** Hook.f. *Fl. Nov.-Zel.* 1: 248 (1853).
Pterostylis polyphylla Colenso. *Trans. & Proc. New Zealand Inst.* 22: 489 (1890).
Pterostylis furcata Lindl. var. *micromega* Hatch. *Trans. Roy. Soc. New Zealand* 80: 326 (1953).
- Pterostylis montana** Hatch. *Trans. & Proc. Roy. Soc. New Zealand* 77: 239, t.22 (1949).
- Pterostylis aff. montana** agg.: includes as many as 14 undescribed taxa, including the distinctive P. "Blyth" = "*P. pulchragalea*" ms name of HB Matthews.
- Pterostylis nutans** R.Br. *Prodr. Fl. Nov. Holland.:* 327 (1810).
Pterostylis matthewsii Cheeseman. *Trans. & Proc. New Zealand Inst.* 47: 46 (1915).
- Pterostylis oliveri** Petrie. *Trans. & Proc. New Zealand Inst.* 26: 270 (1894).
- Pterostylis paludosa** D.L.Jones, Molloy & M.A.Clem. *Orchadian* 12(6): 271 (1997).
Pterostylis furcata Lindl. var. *linearis* Hatch. *Trans. & Proc. Roy. Soc. NZ* 77: 243, plate 29, 2 (1949).
- Pterostylis patens** Colenso. *Trans. & Proc. New Zealand Inst.* 18: 270 (1886).
Pterostylis banksii Hook.f. var. *patens* (Colenso) Hatch. *Trans. & Proc. Roy. Soc. New Zealand* 75: 370 (1945).
- Pterostylis porrecta** D.L.Jones, Molloy & M.A.Clem. *Orchadian* 12(6): 272 (1997).
- Pterostylis siliculitrix** (F.Muell.) Molloy, D.L.Jones & M.A.Clem. *Austral. Orchid Res.* 4: 66 (2002).
Pterostylis banksii var. *siliculitrix* F.Muell. *Veg. Chath. Is.* 51 (1864).
- Pterostylis speciosa** Colenso. *Trans. & Proc. New Zealand Inst.* 22: 488 (1890).
Dubious. Was identified as *P. banksii* by Cheeseman.

Pterostylis subsimilis Colenso. Trans. & Proc. New Zealand Inst. 28: 611 (1896).

Was identified as *P. banksii* by Cheeseman but appears distinct.

Pterostylis venosa Colenso. Trans. & Proc. New Zealand Inst. 28: 610 (1896).

Pterostylis trifolia Colenso. Trans. & Proc. New Zealand Inst. 31: 281 (1899). May be distinct.

Pterostylis confertifolia Allan. Trans. & Proc. New Zealand Inst. 56: 32 (1926).

Simpliglottis Szlach. *Polish Bot. J.* 46(1): 13 (2001). **Chiloglottis alliance**

Simpliglottis cornuta (Hook.f.) Szlach. *Polish Bot. J.* 46(1): 13 (2001).

Chiloglottis cornuta Hook.f. Bot. Antarct. Voy., Vol. 1, Fl. Antarct.: 69 (1844).

Caladenia cornuta (Hook.f.) Rchb.f. Beitr. Syst. Pflanzenk. 67 (1871).

The NZ form of *Simpliglottis cornuta* may differ from the Australian, and may be an aggregate.

Simpliglottis valida (D.L.Jones) Szlach. *Polish Bot. J.* 46(1): 14 (2001).

Chiloglottis valida D.L.Jones. Austral. Orchid Res. 2: 43–44, t. 54, plate p.92 (1991).

Chiloglottis gunnii as meant by Molloy. Native orchids of NZ: 9 (1983), is not that of Lindl. (1840).

Singularibas Molloy, D.L.Jones & M.A.Clem. *Orchadian* 13 (10): 449 (2002).

Singularibas oblongus (Hook.f.) Molloy, D.L.Jones & M.A.Clem. *Orchadian* 13(10): 449 (2002).

Nematoceras oblonga Hook.f. Fl. Nov.-Zel. 1: 250, t.57B (1853).
Corysanthes oblonga (Hook.f.) Hook.f. Handb. N. Zeal. Fl. 266 (1864).

Corybas oblongus (Hook.f.) Rchb.f. Beitr. Syst. Pflanzenk. 67 (1871).

There are two or three taxa included in this complex. One appears to be identical with HB Matthews's *Corysanthes "aestivalis"* (see Scanlen E. Matthews & son on orchids. NZNOG Historical Series 2006; 14: 12). A white flowered form (Nelson lakes and subantarctic islands) is more clearly separate.

Spiranthes Rich. *De Orchid. Eur.* 20, 28, 36 (1817)

Spiranthes novae-zelandiae Hook.f. Fl. Nov.-Zel. 1: 243 (1853).

Spiranthes australis as meant by Hook.f. Handb. N. Zeal. Fl. 272 (1864), is not that of Lindl. (1824).

Spiranthes sinensis as meant by Rupp & Hatch. Proc. Linn. Soc. New South Wales 70: 58 (1946), is not that of Ames (1908).

Spiranthes lancea as meant by Hatch. Trans. Roy. Soc. New Zealand 82: 614 (1954), is not that of Backer, Bakh.f. & Steenis (1950).

Spiranthes alticola D.Jones has been applied to Kew specimens from New Zealand (wrongly we think).

The names *Neottia sinensis* and *Spiranthes sinensis* var. *australis* (R.Br.) H.Hara & Kitam. Acta Phytotox. Geobot. 36 (1–3): 93 (1985) have been used for *Spiranthes australis* in Australia.

Spiranthes "Motutangi": tagname for endangered large Far North taxon, its flowers similar to *S. australis*.

Stegostylia D.L.Jones & M.A.Clem. *Orchadian* 13(9): 411 (2001).

Stegostylia atradenia (D.L.Jones, Molloy & M.A.Clem.) D.L.Jones & M.A.Clem. *Orchadian* 13(9): 414 (2001).

Caladenia iridescens as meant by Hatch. NZNOG Newsletter 16: 1 (1985), is not that of R.S.Rogers (1920).

Caladenia carnea R.Br. var. *minor* forma calliniger Hatch. Trans. Roy. Soc. New Zealand, Bot. 2: 187 (1963).

Caladenia atradenia D.L.Jones, Molloy & M.A.Clem. *Orchadian* 12(5): 221 (1997).

Stegostylia lyallii (Hook.f.) D.L.Jones & M.A.Clem. *Orchadian* 13 (9): 413 (2001).

Caladenia lyallii Hook.f. Fl. Nov.-Zel. 1: 247 (1853).

There seem to be a number of taxa currently included in the *S. lyallii* agg., including a small form from Nelson Lakes, tagnamed *S. minor*.

Stegostylia aff. alpina: plants structurally closer to *S. alpina* than to *S. lyallii* are in NZ (see St George. NZNOG Journal 63: 4 [1997]).

Sullivania F.Muell. *J. Proc. Roy. Soc. New South Wales* 15: 229 (1882).

Sullivania minor (R.Br.) D.L.Jones & M.A.Clem. *Orchadian* 15: 36 (2005).

Caleana minor R.Br. Prodr. Fl. Nov. Holland.: 329 (1810).

Caleya minor (R.Br.) Sweet. Hort. Brit. (Sweet) 385 (1827).

Caleya sullivanii F.Muell. Australas. Chem. Druggist 4: 44 (1882).

Caleana nublingii Nicholls. Victoria Naturalist 48: 15 (1931).

Paracaleana sullivanii (F.Muell.) Blaxell. Contr. New South Wales Natl. Herb. 4:281 (1972).

Paracaleana minor (R.Br.) Blaxell. Contr. New South Wales Natl. Herb. 4: 281 (1972).

Taeniophyllum Blume, *Bijdr. Fl. Ned. Ind.*: 355 (1825)

Taeniophyllum norfolkianum D.L.Jones, B.Gray & M.A.Clem. in Jones et al., 15: 157 (2006)

NZ plants show some differences from the Norfolk Is sp.

Thelymitra J.R.Forst. & G.Forst. *Char. Gen. Pl.* 97 t.49 (1776)

Thelymitra aemula Cheeseman. Trans. & Proc. New Zealand Inst. 51: 94 (1919).

Thelymitra brevifolia Jeanes. *Muelleria* 19: 19–79 (2004).

Thelymitra carnea R.Br. Prodr. Fl. Nov. Holland.: 314 (1810).

Thelymitra imberbis Hook.f. Fl. Nov.-Zel. 1: 244 (1853). A colour form only.

Thelymitra carnea R.Br. var. *imberbis* (Hook.f.) Rupp & Hatch.

Proc. Linn. Soc. New South Wales 70: 59 (1946).

Thelymitra colensoi Hook.f. Handb. N. Zeal. Fl. 271 (1864)

Thelymitra intermedia Berggr. Minneskr. Fisiog. Salsk. Lund 8: 21 f (1878).

Thelymitra longifolia J.R.Forst. & G.Forst. var. *stenopetala* Hatch.

Trans. & Proc. Roy. Soc. New Zealand 79: 396, plate 80 F–H (1952).

Thelymitra longifolia J.R.Forst. & G.Forst. var. *intermedia* Hatch.

Trans. & Proc. Roy. Soc. New Zealand 79: 396, plate 80 J (1952).

Thelymitra concinna Colenso. Trans. & Proc. New Zealand Inst. 20: 207 (1888). See T. Hatchii.

Thelymitra cyanea (Lindl.) Benth. Fl. Austr. 6: 323 (1873).

Macdonaldia cyanea Lindl. Bot. Reg. 25 (1840).

Thelymitra uniflora Hook.f. Bot. Antarct. Voy., Vol. 1, Fl. Antarct.: 70 (1844).

Thelymitra venosa as meant by Cheeseman. Man. New Zealand Fl. 671 (1906), is not that of R.Br. (1810).

Thelymitra venosa R.Br. var. *typica* Hatch. Trans. & Proc. Roy. Soc. New Zealand 79: 390, plate 77 A–C (1952).

Thelymitra venosa R.Br. var. *cedricsmithii* Hatch. Trans. & Proc. Roy. Soc. New Zealand 79: 390, plate 77 D–E (1952).

Thelymitra venosa R.Br. var. *cyanea* Hatch. Trans. & Proc. Roy. Soc. New Zealand 79: 391, plate 77 F–H (1952).

Thelymitra X dentata: a sterile hybrid of *T. longifolia* X *T. pulchella*.

Thelymitra dentata L.B.Moore. New Zealand J. Bot. 6: 478, f.2 (1969).

Thelymitra formosa Colenso. Trans. & Proc. New Zealand Inst. 16: 338 (1884).

Thelymitra circumsepta as meant by Hatch. NZNOG Journal 65: 8 (1997), is not that of Fitzg. (1878).

Thelymitra hatchii L.B.Moore. New Zealand J. Bot. 6: 477, f.2 (1969).

Thelymitra pachyphylla as meant by Hatch. Trans. & Proc. Roy. Soc. New Zealand 79: 394, plate 79 D–H (1952), is not that of Cheeseman (1906).

Thelymitra concinna appears to be the pink-ciliated form of *T. hatchii*, and if so has precedence.

Thelymitra aff. ixioides.

Thelymitra ixioides as meant by Hook.f. Handb. N. Zeal. Fl. 669 (1864), is not that of Swartz. (Kongl. Vetensk. Acad. Nya Handl. 21: 253, t.3, fL [1800]).

Thelymitra *ixioides* var. *typica* (Hook.f.) Rupp & Hatch. Proc. Linn. Soc. New South Wales 70: 59 (1945).

Thelymitra longifolia J.R.Forst. & G.Forst. Char. Gen. Pl. 98 t.49 (1776).

Serapias regularis Banks & Sol. ex G.Forst. Prodr. 59 (1776).

Thelymitra forsteri Sw. Kongl. Vetensk. Acad. Nya Handl. 21: 228 (1800).

Thelymitra nemoralis Colenso. Trans. & Proc. New Zealand Inst. 17: 249 (1885).

Thelymitra alba Colenso. Trans. & Proc. New Zealand Inst. 18: 272 (1886).

Thelymitra cornuta Colenso. Trans. & Proc. New Zealand Inst. 20: 206 (1888).

Thelymitra longifolia J.R.Forst. & G.Forst. var. *alba* (Colenso) Cheeseman. Man. New Zealand Fl. 339 (1925).

Thelymitra longifolia J.R.Forst. & G.Forst. var. *forsteri* Hatch. Trans. & Proc. Roy. Soc. New Zealand 79: 396, plate 80 B-E (1952).

Thelymitra aristata as meant by Hatch. Trans. & Proc. Roy. Soc. New Zealand 79: 395, plate 79 M-N, plate 80 A (1952), is not that of Lindl. (1840), and has been tagnamed T. "tholinigra" by Scanlen.

Thelymitra aff. longifolia **agg.**: some undescribed taxa that appear to be insect-pollinated.

Thelymitra malvina M.A.Clem., D.L.Jones & Molloy. Austral. Orchid Res. 1: 141 (1989).

Thelymitra matthewsii Cheeseman. Trans. & Proc. New Zealand Inst. 43: 177 (1911).

Thelymitra nervosa Colenso. Trans. & Proc. New Zealand Inst. 20: 207 (1888).

Thelymitra decora Cheeseman. Man. New Zealand Fl. 1151 (1906). Spotted and unspotted forms together.

Thelymitra pauciflora R.Br. Prodr. 314 (1810).

Thelymitra pauciflora sens. strict. is in NZ according to Jeanes (Muelleria 19: 19-79 [2004]); however, there are also a number of forms in this aggregate.

Thelymitra pulchella Hook.f. Fl. Nov.-Zel. 1: 244 (1853).

Thelymitra fimbriata Colenso. Trans. & Proc. New Zealand Inst. 22: 490 (1890).

Thelymitra pachyphylla Cheeseman. Man. New Zealand Fl. 1151 (1906).

Thelymitra caesia Petrie. Trans. & Proc. New Zealand Inst. 51: 107 (1919).

T. pulchella is a very variable species, yet all of these appear to have features that are relatively stable in some populations.

Thelymitra purpureofusca Colenso. Trans. & Proc. New Zealand Inst. 17: 249 (1885).

Thelymitra "Whakapapa": undescribed taxon from Ruapehu, appears to be distinct.

Thelymitra sanscilia Irwin ex Hatch. Trans. & Proc. Roy. Soc. New Zealand 79: 397, plate 81 B-E (1952).

Thelymitra tholiformis Molloy & Hatch. New Zealand J. Bot. 28: 111, f.6 (1990).

Thelymitra intermedia as meant by L.B.Moore. Fl. New Zealand Vol. 2: 129 (1970), is not that of Berggr. (1878).

Thelymitra "Ahipara": an unnamed taxon from the Far North.

Thelymitra "Comet": a large, late-flowering Thelymitra from the Kaweka range. Appears to be sterile, so probably a hybrid.

Thelymitra "darkie": undescribed taxon from the Far North (see McCrae. NZNOG Journal 24: 11; 77: 22 [1987]).

Thelymitra "rough leaf": undescribed taxon from the Far North (see McCrae. NZNOG Journal 24: 11; 77: 22 [1987]).

Thelymitra "sansfimbria": plain blue flowers from Far North (see Scanlen. NZNOJ 98: 36 & 102: 39, 45).

Thelymitra "sky": undescribed taxon from the Far North (see Scanlen. NZNOG 70: 30-35, f.6 [1998]).

Thelymitra "tholinigra": (see Scanlen. NZNOJ 85: 10, 15).

Thelymitra "Whakapapa": undescribed taxon from Ruapehu.

Townsonia Cheeseman. Man. New Zealand Fl. 692 (1906).

Townsonia deflexa Cheeseman. Man. New Zealand Fl. 692 (1906).

Townsonia viridis as meant by Schltr. Repert. Spec. Nov. Regni Veg. 9: 250 (1911), is not Acianthus viridis of Hook.f. (1860).

Acianthus viridis as meant by L.B.Moore. Fl. New Zealand Vol. 2: 107 (1970), is not that of Hook.f. (1860).

Waireia D.L.Jones, M.A.Clem. & Molloy. *Orchadian* 12(6): 282 (1997)

Waireia stenopetala (Hook.f.) D.L.Jones, M.A.Clem. & Molloy. *Orchadian* 12(6): 282 (1997).

Thelymitra stenopetala (Hook.f.) Bot. Antarct. Voy., Vol. 1, Fl. Antarct.: 69 (1844).

Lyperanthus antarcticus Hook.f. Bot. Antarct. Voy., Vol. 1, Fl. Antarct.: 544 (1847).

Winika M.A.Clem., D.L.Jones & Molloy. *Orchadian* 12(5): 214 (1997).

Winika cunninghamii (Lindl.) M.A.Clem., D.L.Jones & Molloy. *Orchadian* 12(5): 214 (1997).

Dendrobium biflorum as meant by A.Rich. Essai Fl. Nov. Zel. 221 (1832), is not that of Sw. (1800).

Dendrobium cunninghamii Lindl. Bot. Reg. 21 sub. t.1756 (1835).

Dendrobium lessonii Colenso. Trans. & Proc. New Zealand Inst. 15: 326 (1883).

The New Zealand Native Orchid Journal

The New Zealand Native Orchid Group's main aim is informing people about native orchids, so others are welcome to copy material published here, provided they acknowledge the source and author s.

The **Journal** is published quarterly from February, and deadline for copy is the first of the preceding month. We like copy to be typed or sent on disk or by email.

Chair: David McConachie, 42 Titiro Moana Rd.,

Korokoro, Lower Hutt, pleione@orcon.net.nz.

Secretary: Pam Shearer, 7 Ring Terrace, St Marys Bay, Auckland. pam@insidetrack.co.nz.

Treasurer: Judith Tyler, 4 Byrd St, Levin, bandj.tyler@xtra.co.nz: subs. NZ\$42 + post.

Books and publications: Brian Tyler, 4 Byrd St, Levin, bandj.tyler@xtra.co.nz.

Webmaster: Michael Pratt, www.nativeorchids.co.nz, Michael@nativeorchids.co.nz.

The site posts journals 6 months after publication.

Journal editor: Ian St George, 32 Hawkestone St, Thorndon, Wellington 6011 istge@yahoo.co.nz.

WE MAY NOT SHARE AUTHORS' OPINIONS .

Contents *No. 135*

February 2015 ISSN 1177-4401

Cover Mike Lusk

Microtis arenaria, Henderson's Beach, Northland, 6 October.

The type locality Ian St George

3 The micropapillose leaf of *Microtis papillosa* at the Kaipara Heads.

Original papers

9 An analytical review of the current status of *Pterostylis australis* agg. and other associated taxa. By Mark Moorhouse.

Notes, questions, comments & NZNOG@yahoogroups.com

22 NZDA helping save "Diplodium puberulum".

Pat Enright's *Nematoceras trilobum* s.s., and...

23 ... a curious *Nematoceras* aff. *trilobum*.

24 Murray Dawson with *Nematoceras iridescens* from Travis Wetlands.

Cheryl Dawson photographs short alpine *Pterostylis* from the Tararua...

25 ... and *Nematoceras* "triwhite" and *N. hypogaeum*.

26 Pat Enright's black *N. macranthum* from Palliser Bay.

Alasdair Nicholl's ghost greenhood at Waitawheta.

27 Kathy Warburton's Little Red Dorsal Hood from an Otago swamp...

28 ... and another *Nematoceras* aff. *trilobum* from that swamp,
as well as two colour forms of *N. iridescens*.

29 MacQuarie nematoceras photos by Mark Clements.

30 Catherine Beard photographs *Anzybas carsei*.

31 Gordon Sylvester receives the Hatch Medal for 2014.

32 *Pterostylis dubia* (Tasmania). *Pterostylis emarginata* (Waitawheta).

33 Planned *Adenochilus* stamp. Audrey Eagle's *Pterostylis humilis*.

34 Carlos Lehnebach updates members on his orchid research.

35 Orchid papers in Wellington Bot Soc *Bulletin*. Te Papa exhibition.

36 Second Colenso Conference 17–19 November 2016, Wellington.

37 NZNOG@yahoogroups activity. Insect on *Pterostylis cernua*.

38 Pat Enright in the Waingawa valley

39 Allan Mere presented to Brian Molloy. Pink *Nematoceras macranthum*.

40 Kevin Matthews: a new *Thelymitra*?

41 Photographs by Kathy Warburton, Cheryl Dawson, Pat Enright.

42 Iwitahi Annual Native Orchid Weekend 2014. Brian Otto.

44 NZ Indigenous Flora Seedbank. Jessica Schnell.

51 Instructions for contributors.

The New Zealand orchids

46 The editor's annual list.

