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**Fig.3:** the specimen enlarged from the type sheet.

# Editorial: Ian St George

## How *does* that Australian orchid seed get here?

Kevin Matthews raised an interesting point when he emailed early in the New Year, “I thought you would be interested in this record of the Australian Lesser Wanderer and my thoughts on Australian orchid seed arriving to our shores.

“I was down at Kaimaumau Village on 1Jan08 and saw what I believed to be a painted lady butterfly scoot past in a strong easterly wind. About half an hour later I saw a similar one about 100 metres further afield (it could have been the same one) and managed to capture it on camera after much running and patience: it finally settled for all of three seconds, giving me the chance to confirm it as a Lesser Wanderer (**Fig. 1: inside front cover**).

“The transtasman passage time for the infrequent visits of butterflies from Australia in the right weather conditions has been calculated at 54-60 hours [1]. It’s my opinion that these butterflies must stay at a comfortable altitude to arrive on our shores in such good condition.

“We know that Aussie bush fire smoke that’s propelled skyward arrives here at low altitude but I wonder how feasible it is to assume orchid seed could arrive in a viable state if it were somehow propelled high enough to make the transtasman crossing? I have my doubts on this one. I think it’s far more feasible for orchid seed to arrive here attached to an insect such as the Lesser Wanderer or birds making this relatively quick transtasman crossing.

“While chasing this elusive Lesser Wanderer to capture it on camera, I saw it visit flowers fleetingly, fly in amongst foliage, land on foliage and land on the ground. Given this behaviour I theorise that if these butterflies were to come from a site

in Australia with a high number of freshly seeding orchids there would be a reasonable chance of seed getting caught up on/in these hairy bodied insects for transfer to our shores; with perhaps the odd one establishing itself.”

What a fascinating thought! This raises a number of issues...

1. Can orchid seed really cross the Tasman on the wind? or
2. Can orchid seed cross the Tasman on insects or birds?
3. If (1), can orchid seed survive high altitudes? Or might the wind bring it over at low altitude? How might it get into the air in the first place?

HMR Rupp concluded in 1932 that “It is conceivable, perhaps, that minute seeds of orchids have been conveyed by wind across the Tasman Sea, and that only those forms which have found suitable provision for their necessities in the new home have survived” [2].

The issues were reviewed in 2000: “Orchid seeds are very small, extremely light and produced in great numbers. Most range in length from *c.* 0.05 to 6.0 mm, with the difference between the longest and shortest known seeds in the family being 120-fold. The “widest” seed at 0.9 mm is 90-fold wider than the “thinnest” one, which measures 0.01 mm (because orchid seeds are tubular or balloon-like, “wide” and “thin” actually refer to diameter). Known seed weights extend from 0.31 lg to 24 lg (a 78-fold difference). Recorded numbers of seeds per fruit are as high as 4000000 and as low as 20±50 (80000±200000-fold difference). Testae are usually transparent, with outer cell walls that may be smooth or reticulated. Ultrasonic treatments enhance germination,

which suggests that the testae can be restrictive. Embryos are even smaller: their volume is substantially smaller than that of the testa. As a result, orchid seeds have large internal air spaces that render them balloon-like. They can float in the air for long periods, a property that facilitates long-distance dispersal. The difficult-to-wet outer surfaces of the testa and large internal air spaces enable the seeds to float on water for prolonged periods. This facilitates distribution through tree effluates and/or small run-off rivulets that may follow rains. Due to their size and characteristics orchid seeds may also be transported in and on land animals and birds (in fur, feathers or hair, mud on feet, and perhaps also following ingestion) ” [3].

But what actual studies have been done? Korean researchers wrote, “These dust-like seeds are windborne and, thus, would seem to have the potential for long distance dispersal (a common perception); this perception has led to a prediction of near random spatial genetic structure within orchid populations. Mathematical models (e.g., a simple ballistic model) for wind dispersed seeds and wind tunnel experiments, in contrast, indicate that most seeds of orchids should fall close to the maternal plant (<6 m), supporting a prediction of significant fine scale genetic structure within populations. In reality we do not know much about seed dispersion in orchids” [4]. They studied the genetic structure of colonies of *Cephalanthera longibracteata*, and their results supported the prediction that the majority of seed dispersal occurs over distances of less than 10 m.

Using a simple ballistic mathematical model and wind tunnel experiments, Murren and Ellison showed that mean expected seed dispersal distances for the neotropical epiphytic orchid *Brassavola nodosa* were less than 6m under conditions approximating those found in its natural habitat [5].

Carlyle Luer considered *Platanthera*

*holochila*, an orchid of mountaintop bogs on the older Hawaiian Islands, to be indistinguishable from *Platanthera hyperborea* var. *viridiflora* from the Aleutian Islands and the southern coast of Alaska far to the north. He wrote, "Seeds should not find transportation to the [Hawaiian] islands wanting, since the Pacific golden plover migrates annually between the cold bogs of Alaska and these high cool bogs of Hawaii. As evidence, a sun-dew (*Drosera anglica*), also common in the Alaskan bogs, probably also spanned the great distance in mud on the feet of birds"[6].

There is simply not a lot of science in all of this, but what science there is suggests long distance wind dispersal should be uncommon, so Kevin Matthews may well be right.

## References

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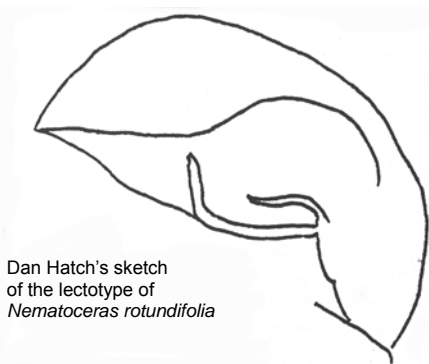
# The type locality

## 3. Puehutai and *Nematoceras rotundifolia*

By Ian St George

In J38 (1991) Dan Hatch wrote that *Corybas* (*Anzybas*) *rotundifolius* appeared actually to be what was then known as *C. aff. unguiculatus*, and not (as had been supposed) a synonym for *Corybas rivularis* agg. or *Corybas oblongus*.

The lectotype had been determined by Mark Clements as Colenso's specimen #740 at Kew – a collection of 12 orbicular-apiculate leaves, one with an unopened flower. Clements thought the specimen was likely to be *Corybas* (*Anzybas*) *carsei* or *C. aff. unguiculatus*, and sent a photograph to Hatch, who determined its identity from the photograph. He sketched the outline of the flower (**below**).



Dan Hatch's sketch of the lectotype of *Nematoceras rotundifolia*

Colenso's note in his July 1846 letter to WJ Hooker says, "740. Orchis, – sides of clayey hills, Puehutai, R. Manawatu; - only 1 in fl. – I can get more – leaf struck me as being new". He had by 1846 collected a number of specimens of "Acianthus" – members of the *Nematoceras trilobum* and *N. rivulare* aggregates – so he knew this leaf was not of one of those.

### Hooker's description

JD Hooker described it thus: "caule elongato, folio rotundato cordato apiculato, scapo ex axilla folii orto brevi, bractea ovario aequilonga" (stem long, leaf round, heart-shaped, pointed, scape from armpit of leaf straight, short, bract as long as ovary) "I regret not having expanded flowers of this curious little plant; those I have in bud resemble *N. oblonga* in size and form of the pieces of the perianth. **Stem** slender, 1-2 inches long. **Leaf** orbicular, cordate, acuminate or apiculate, ½ inch broad. The flower rises from between the lobes of the base of the leaf in my specimens, but this may not be a constant character." (Hooker wrote "those" and "specimens", which suggests he had examined more than the one bud from #740, perhaps of other taxa). "Hab. Northern Island. Clay banks."

He expressed his uncertainty about the plant, for he then wrote "I have leaves of this or a very similar plant from Lord Auckland's Group", and later listed its localities as Manawata Harbour (*sic*) etc, Nelson, Lord Auckland's group and Campbell's Island. "Perhaps a variety of *C. oblonga*".

### Where and when did Colenso collect it?

Colenso wrote to WJ Hooker that he collected the plant on 2 April 1846. The entry in his Journal for 2 April tells us he had spent the preceding night in Otawao; it goes on, "Started at 7, travelled to Puehutai, another small village about 1½ miles from Otawao.... Resuming our journey, 3 hours travelling brought us to Te Hautotara, another small village, and the last, upon the upper part of the River Manawatu".

Otawao was on the west bank of the Manawatu river, south of Dannevirke, south of the Otawhao-Manawatu confluence, between Kumeroa and Dannevirke. Puehutai was on the

river, just downstream from the loop opposite Oringi – i.e. a few miles south of Dannevirke; above Puehutai the river was shallow and no longer navigable. Hautotara was south of Dannevirke at the Mangatera-Manawatu confluence.

Colenso had spent 2 April 1846 walking upriver on the south bank, crossed to Puehutai (his journal entry for another visit on 29 Sep 1846 says “Crossing the River Manawatu on a native’s shoulders... arrived at Puehutai”), should have recrossed a little upstream, to take a short cut and thus avoid backtracking around the loop to the north of Puehutai (the walk to Hautotara took 3 hours in April, and 2 ½ hours in September – almost impossible if he had backtracked). The river and the flats were again to his left, his direct path to Hautotara skirting the foothills of the Puketoi ranges to his right (see map). If indeed this was when Colenso found the orchid, my bet it was on the clay foothills to his right.

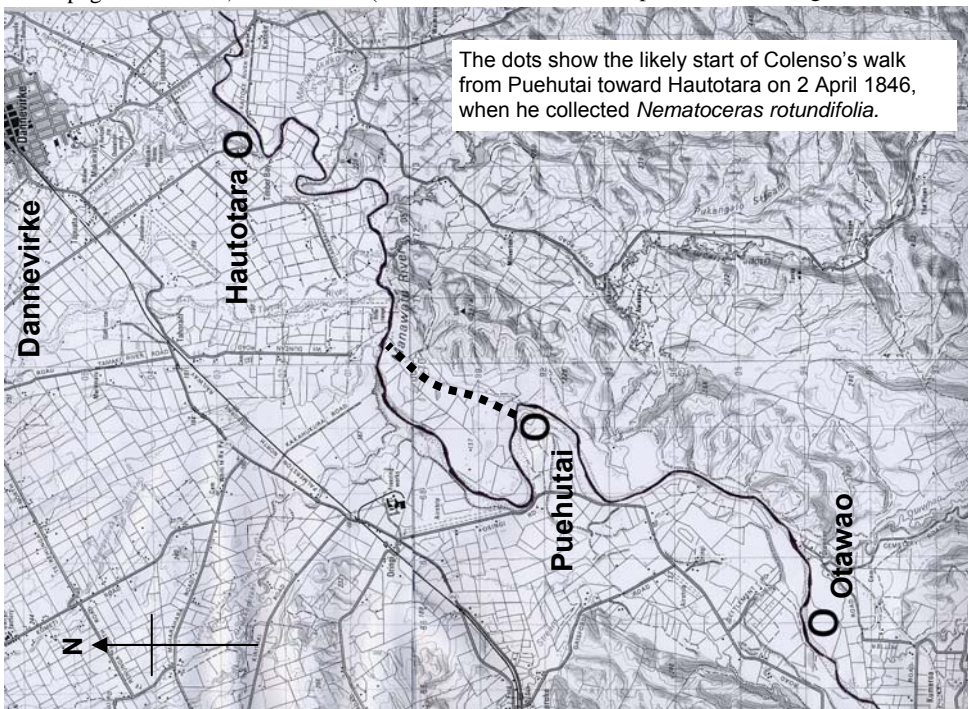
Other plants collected nearby and listed on the same page in his letter, were no. 744 (“banks R.

Manawatu”), 745 (“near Puehutai”), 746 (“Banks River Manawatu”), suggesting a consistent sequence.

### Wrong, wrong, wrong

Time and place and habitat are all out of joint. The latitude and the flowering time are wrong for *Anzybas rotundifolius*, which until its recent discovery on the Chathams, and apart from this Puehutai discovery, has been found only north of Warkworth, flowering June to August, and never on clay hills. Hatch wrote, “specimens in herbaria suggest that it once extended much further south” but I know of no other specimens from south of Warkworth. These were cold years (the Ruamahanga river in the Wairarapa had frozen over the winter before, according to entries in Colenso’s journal, and he wrote from Hawkes Bay in August 1846, “It is very cold here – water freezes in our Chamber, and milk in the pantry!”), and April just seems too early and the Manawatu too far south.

Could the plant be something else?



Hooker's description could fit several species, but of all the candidates, only *Corybas cheesemanii* flowers in April (or, most unlikely, a vagrant Australian *Anzybas unguiculatus* which flowers early and grows as far south as Tasmania). Hatch's drawing could be a bud of *Anzybas rotundifolius*, and though it also bears a resemblance to *Corybas cheesemanii*, the leaves are wrong.

**Fig. 2** (IFC) shows the restored solitary flower bud (January 1989) of the holotype of Hooker's *Nematoceras rotundifolia* (and it is unequivocally an *Anzybas*) collected by Colenso (740) from "Northern Island. Clay banks. Manawatu." ( courtesy of Brian Molloy). **Fig. 3** shows the specimen enlarged from the type sheet, which is itself shown in **Fig.4** (p.9). Why did Hooker suggest he had examined more than one flower?

### What is at the type locality today?

Today the river is marked by a row of willows, and the hills rise above rich sheep land, but their raw faces are clayey, a layer of yellow clay on top of soft mudstone, full of

fossil shells.

The river is low after the drought, barely above my knees as I cross. Barkers, dotterils, black swan, paradise duck panic at my approach. An angler is landing a 2lb rainbow at the corner of the river. He asks what I am looking for, and I tell him an orchid. He scratches his head, "Gee, an orchid. I don't think so. I don't think you'll find orchids here. Look around: there are no native plants at all."

He is right: an odd totara and cabbage tree survives, but every piece of land is farmed.

Colenso replied to an enquiry from Cheeseman in a letter dated 25Dec82: "... were I there, or at ... 'Puehutai,' I doubt if I could find a single plant in its old haunts. Sheep & Cattle, - Clover, Grasses, Weeds, and Fires, have effectually done their work of extermination."

Puehutai must have been on the raised old river terrace above the flood level, in the middle of the omega-shaped river bend.

I didn't see an orchid all day. Colenso's *Nematoceras rotundifolius* must remain a puzzle.



▲ The Oringi loop of the Manawatu river, photographed from the hills to the west. Puehutai should have been on the elevated river terrace in the centre of the loop.

▼ (left) Clay banks of grey sedimentary mudstone, full of fossil shells—not volcanic papa.

▼ (right) Colenso's path from Puehutai toward Te Hautotara ran along these now bare hills; if these were the "clay hills" where he found the orchid, it is not there now.







Fig. 4: The Type sheet for *Anzybas rotundifolia* carries several specimens, and only #740 has been designated the lectotype. Note the 11 leaves (and a seedpod?), as well as the single flower in the separate envelope at upper right. The other specimens appear to be members of the *Nematoceras macranthum* or *N. rivulare* complexes, long thought to be the true inheritors of the specific epithet "*rotundifolia*".



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# Notes etc

We reported in the last issue that Pat Enright found, in the Waiohine valley, Tararua SFP, the **pink-ciliated *Thelymitra* aff. *hatchii*** previously reported by Margaret Menzies from a Taranaki site now destroyed, and by your editor from Mt Holdsworth, Tararua SFP. We sent specimens to Brian Molloy, who emailed, “Last Friday I had a look at the pollen of the flowers you sent, the one with a pinky-red brush of hairs, a character not unusual in *T. hatchii*. As I expected from the rest of the floral characters, the pollen consisted of two types, monads or single grains, and tetrads, grains in fours, or breaking up into threes or twos. There were also many sterile grains consistent with an amphidiploid, in this case *T. hatchii* (*T. formosa* X *T. longifolia*). Conclusion: your specimen is *T. hatchii*, a variable taxon like *T. pulchella*, another amphidiploid.”

The little ***Pterostylis* of the *P. graminea* agg.** (Fig. 5 opp.) was growing at Boundary Creek reserve, north of Tutira, Hawke’s Bay, on 2 December. A late flowering form, photographed by Ed.

Mark Moorhouse emailed, “Attached is what appears to be ***Caladenia bartlettii*** from the North side of the Nile Valley, near Charleston, which we believe to be a new record for the species in ER 48.02. (Fig.6).

Jeremy Rolfe emailed (23Dec07), “I thought you might be interested in my contribution on ***Thelymitra hatchii* variation in the Tararua Range, as well as *T. pulchella* and *T. xdentata***: *Thelymitra hatchii* (yellow cilia) on Kaitoke Ridge Track (Fig.7), *T. hatchii* (white cilia) on Dobson Loop Track, southern Tararua Forest Park (Fig.8). At Kaitoke Ridge (Sat 22 Dec), *T. longifolia*, *T. pulchella* numerous; *T. hatchii* less common. Puffer / Dobson Loop Track (Sun 23 Dec), *T. longifolia*, *T. pulchella* numerous, *T. xdentata*

reasonably common, occasional *T. hatchii*, two specimens seen of *T. cyanea*. *T. pulchella* occurred in two distinct colour forms - white with blue stripes (Fig.9, p.27), mauve with blue stripes (Fig.10). All specimens of *T. xdentata* were white with blue stripes.”



Jeremy emailed again in early January, with “pictures of a ***Prasophyllum colensoi*** (above) that I photographed yesterday in a wetland near the Waingawa River in the Tararua foothills. Pat Enright and I believe it matches species “B” in the NZ field guide. I agree—Ed.

Kevin Matthews reports **another new site for *Pterostylis puberula*** on the Rangaunu Harbour west of Ohia. The colony has at least 30 plants with 7 bearing mature seed pods. He will follow the colony with interest next flowering season.

**K**evin emailed with the **cover picture of *Thelymitra cyanea*** (five flowers open at once!) on 14 January. ER5.

**T**axonomic exaggeration and its effects on orchid conservation! Yohan Pillon and Mark W. Chase of New Caledonia and Kew wrote (in a research note in *Conservation Biology* 21 (1): 263–265), "Orchids are the largest family of flowering plants, encompassing several times as many species as birds or mammals. Because of their diversity, charisma, and threats from overcollection and habitat loss, they are a key group in conservation. Nevertheless, preservation of this group is plagued by taxonomic problems, particularly in Europe, where new taxa are actively being described. We used a checklist of orchids to compare the taxonomic treatment of this family between Europe and neighboring areas to search for geographical patterns. Numbers of invalid, infraspecific, and hybrid names are significantly higher in Europe than in surrounding areas. Recognition of numerous and poorly circumscribed orchid taxa is a serious obstacle to their conservation because rare, poorly defined species may be prioritized for conservation over taxonomically "good" species. This phenomenon may be the result of the popularity of orchids in Europe. We believe that more taxonomic effort should be made in other areas of the world (e.g., the tropics) and on less charismatic groups." *Hmmm. I don't know about that – Ed.*

**M**ike Lusk emailed (22Jan08), "I was on the track to Sunrise Hut in the Ruahines on 20 Jan in light drizzle on the lookout for orchids, notwithstanding the lateness of the season and the weather. As expected nearly everything was well past but I did spot a few *Thelymitras* which were in full bud. I was unsure of its identity so sent a photo (**Fig.11**) to Eric, who was also unsure, suggesting I send it on to you for comment and consideration of publication. Our group was based at an old school, now 'Camp Wakarara'

run buy a trust and very well set up for hire. It is about 30min from Waipawa, and within 10min of several tracks in the Ruahine Forest Park. A friend and I have found many orchids in the Park, several of them apparently not reported from the region. I think this may be because there hasn't been much searching since Colenso's time. Eric tells me that the Group might be interested in visiting this area, and if it did Camp Wakarara would make a good base."

*Its hard to tell without a clear picture of the postanther lobe, but all the signs point to *T. hatchii*. The field trip to Colenso's Ruahine haunts is an excellent suggestion. If you are interested see the spruik on p.21—Ed.*

**R**otorua Bot Soc members (leader Chris Ecroyd, finder Sarah Beadel) found 70 plants of ***Calochilus robertsonii* at Lake Rotokawa** on 3 November—many in "spectacular flower" (*NZ Bot Soc Newsletter* Dec 2007).

**N**elson Bot Soc members found ***Nematoceras* "whiskers"** at Sawcut Gorge on 20 October 2007 (*ibid.*).

**W**hoops. On p.12 of J107 the description of ***Pterostylis oliveri* is mistakenly ascribed to John Buchanan**, when in fact it was described by Donald Petrie. The error is entirely that of the editor, and is not Val Smith's—Ed

**K**endyll Levy (Mark Moorhouse's daughter) emailed, "During the winter of last year [2007] my husband Lloyd and I made a trip into the Cascade valley some 65 km or so south of Haast. When we returned my Dad made the usual request - a description of the orchids found. It being the wrong time of year a few dried *Thelymitra* seed pods were pretty much all we found. Dad then commented on the fact that very little had been recorded in this ER (71.01) the most probable cause being the distance off the main road, rather than a lack of orchids. I convinced

my husband that we needed to go there again during flowering season and so early this summer we returned. As is typical of the South Island's West Coast, *Earina autumnalis* and *Winika* hang from every second tree even in the most exposed places -eg. a single tree in the middle of a massive paddock. Cascade is a place of extremes. It has ice capped mountains as a backdrop. The river passes through a mineral belt where grows *Thelymitra cyanea* in pink and blue and *T. pulchella*. The herb fields there were also home to *Aporostylus bifolia*, *Singularibus oblongus* and a *Prasophyllum* sp. The river then passes through dense beech forest, very swampy anywhere not sloping and down through wide grassy river flats. The edge of the swamp turned up a round leaf *Nematoceras* which I theorise to be *N. macranthum* but this will require further investigation during another flowering season - my husband willing of course. We came ill prepared or I should say ill vehicled and whilst we gained permission to cross the privately owned land in search of orchids, we didn't get to drive very far as our car couldn't get through the first ford which is only about 1 kilometer past the gate and we had to walk the rest of the way. On our return to Jacksons Bay we stopped at the Lake Ellery Walkway and found two different *Pterostylis* in seed, one with the distinctive stripes of *P. irsoniana*. The other with the broad leaf of *P. australis* and more of the round leaved *Nematoceras*. A quick look under the ngaio trees at Jacksons Bay on our return home turned up nothing.

**A Lesson on Dendrobium:** Gordon Sylvester wrote. "Journal 107 raised the question of another species described by William Colenso, which was collected from the South Wellington Coast: and several times commented on by William without convincing anyone.

"Variations have been noted in the colourings of *Winika* ranging from white and apple green to an overall light red

mauve on the flower. These have always been dismissed as local variations within the species. The article concentrates on the number of ridges on the base of the labellum, raising the question of a possible new "old" species.

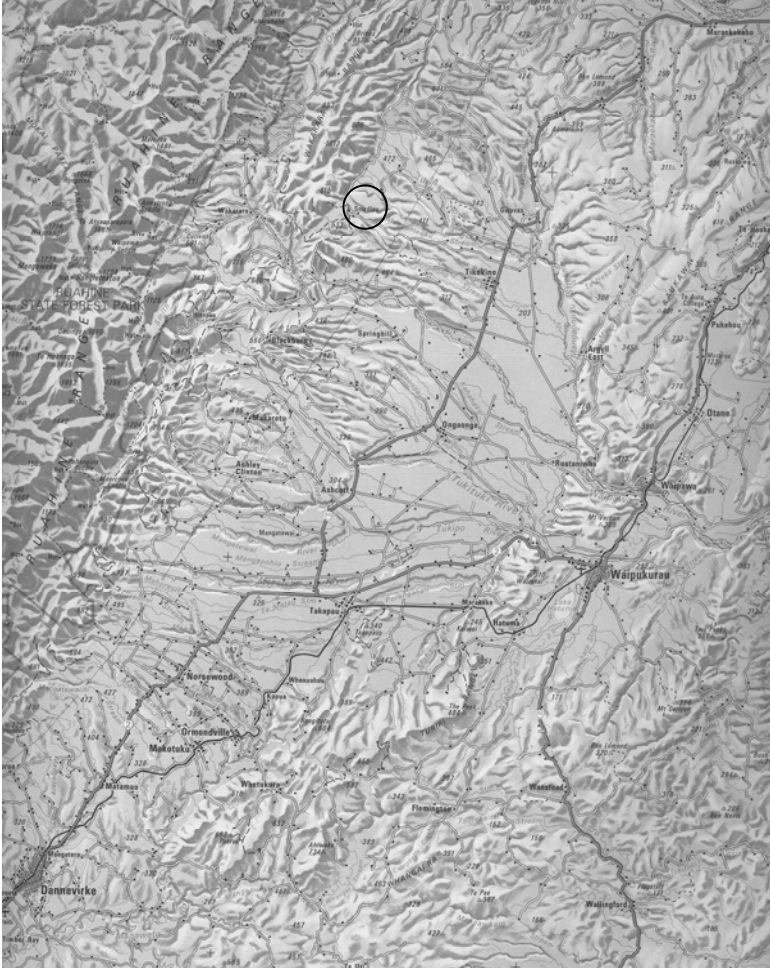
"I decided to go and have a look at my nearest *Winikia cunninghamii* repository behind Dillmanstown on 16 Feb 2008 hopefully to see if any of the dozens of plants living a rupestral lifestyle on the tailings would still be in flower. Walking into the site, I was amazed at the density of flowering of *Earina autumnalis* and the heavily scented atmosphere. There were large quantities of bumble bees working these concentrated sites of flowers.

"On the tailing field the several dozen *W. cunninghamii* showed a good quantity of fat seed pods from the December/January flowering, but more importantly about a dozen flowers were still open and several buds were still evident. This particular site has two variations of flower colouring. A white and apple green, with a dark wine red face to the column and a white and apple green with the bluey red margin to the labellum and back of the column.

"Five flowers were collected and examined; all were on plants spread over 30 to 40 metres on the top of the pile of tailings. These five broke down to one flower with five keels, one flower with five prominent and one indistinct mid column, and three flowers with four keels. The flower with the indistinct ridge also had a fold in the labellum

"Thomas Cheeseman had already expressed his doubts about this being a separate species: maybe the chromosome tool needs to be employed yet again. However I will be a lot more observant next season.

"Tailings: - a collection of large boulders removed during gold mining operations and stacked on worked over ground; in this particular place these piles are about 15m high."



Come to  
Colenso  
country  
5-7 Dec

In the country on the chart at left Colenso and his cobbbers collected orchids which he went on to call *Bulbophyllum ichthyostomum*, *Caladenia macrophylla*, *C. variegata*, *Corysanthes hypogaea*, *C. papillosa*, *Dendrobium lessonii*, *Earina alba*, *E. quadrilobata*, *Gastrodia leucopetala*, *Microtis longifolia*, *Pterostylis emarginata*, *P. patens*, *P. subsimilis*, *P. trifolia*, *P. tristis*, *P. venosa*, *Sarcochilus breviscapa*, *Thelymitra cornuta*, *T. nemoralis*, *T. purpureofusca*, *T. formosa*.

Few regions can have been the subject of such intense early scrutiny, nor the identity of the orchids the subject of such intense debate.

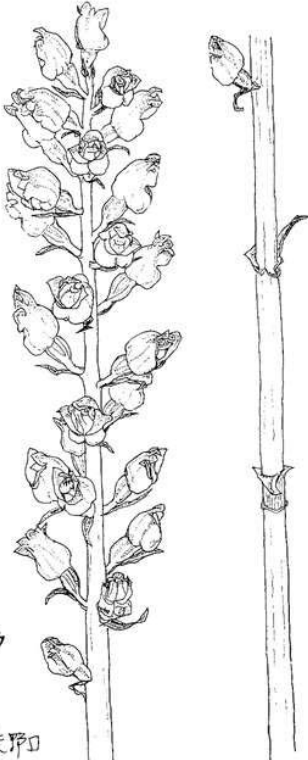
Camp Wakarara (circled on the map above) is easily capable of accommodating 20. There is a large dining area with fully appointed kitchen attached, showers and toilets and various bunkrooms close by. There is also a substantial BBQ setup (woodburning), and plenty of outdoor tables (<http://www.campwakarara.org.nz/>). Full catering is available and cheap. There are 2 easy low-level walks, one to Middle Stream and the other Yeomans Track, and several which, while easy in tramping terms, do require gaining height, Mike Lusk tells us.

**Email Ian St George if you are interested: [istge@rnzcgp.org.nz](mailto:istge@rnzcgp.org.nz).**

# Close relations:

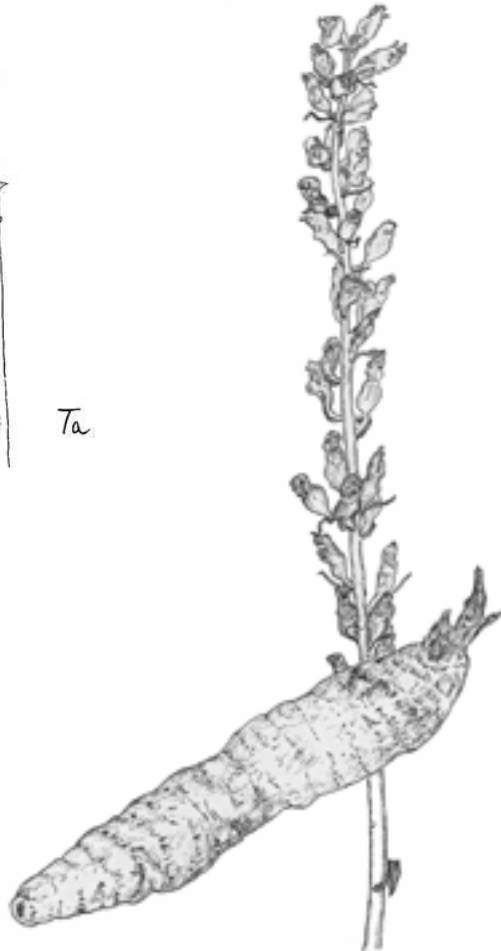
## *Gastrodia elata* Blume

The extracted tuber is an important oriental medicine, and the orchid features in the art of China (left), Japan (below) and Korea (below left)



オニヤガラ  
ラン科  
97.65  
稲城市矢野口

Ta



# Original papers

## Chromosomes of New Zealand native orchids – part 1 of 2

By Murray Dawson, Landcare Research, Lincoln

In the December 2007 issue of the *New Zealand Journal of Botany*, Ernst Beuzenberg and I published our chromosome counts for most of the New Zealand native orchids [1]. These counts were made in collaboration with our co-author Dr Brian Molloy's long-term taxonomic study, and are the latest addition to the *Contributions to a chromosome atlas of the New Zealand flora* series initiated in 1958 by Ernst and the late Dr John Hair.

The orchid manuscript was well received by the reviewers, and Professor Rod Peakall (The Australian National University, Canberra) had this to say:

This is an exceptionally important study being the first to document in such comprehensive detail the chromosome numbers of the NZ orchid flora. In addition, the paper includes detailed comparisons with other relevant orchid chromosome counts for related Australian and Asian orchids. Another valuable feature provided by the document is the extensive review of the current (sometimes confusing) state of taxonomic changes. One final important feature of this study is that it highlights future groups, both in NZ and Australia, where it appears chromosome counts will be particularly useful for assisting the resolution of outstanding taxonomic questions. In all, this contribution will not only be of great interest to Australasian orchid researchers, but to orchid researchers worldwide.

Over two articles, I will summarise some of the major findings. This first part provides introductory notes and our chromosome

results, and the second part will examine the wider taxonomic implications of our findings.

### Background and acknowledgements

Chromosomes are key indicators of biological diversity and provide an important means of investigating relationships between plant groups. Changes in chromosomes, either structural or numerical, can produce different plant forms, and cause reproductive isolation leading to speciation. Numerical changes include the addition of whole sets of chromosomes (polyploidy) or loss or gain of individual chromosomes (aneuploidy).

We began counting chromosomes of native orchids from about 1984, when I was a young technical trainee and Ernst Beuzenberg was teaching me his chromosome techniques at the former DSIR. However, with Ernst retiring in 1986 and Brian Molloy in 1995, and the lack of major funding for plant chromosome studies at Landcare Research from 1999, full publication of this project was stalled for many years.

Several of our chromosome counts have been cited over the years in various taxonomic revisions (many co-authored by Brian Molloy) and by members of the NZNOG (e.g., [2, 3, 4]). Unfortunately, many of these citations are brief and rather informal. The full documentation process involves making detailed measurements, drawings, and photomicrographs of the chromosomes from microscope slides; confirming plant identifications and nomenclature (names used); checking locality information; and depositing voucher specimens in the Allan Herbarium at Lincoln. Because this process



had not been completed I had to omit our unpublished orchid counts from an otherwise comprehensive index of chromosome numbers of the New Zealand flora [5].

Fortunately, in 2004 we obtained a TFBIS (Terrestrial and Freshwater Biodiversity Information System) contract to publish this outstanding work. Without this support, it would have been impossible to complete the project. Our sincere thanks go to the TFBIS Programme and our application supporters, Ian St George and Peter de Lange.

Orchid experts Mark Clements and David Jones (Centre for Plant Biodiversity Research, Canberra) have also supported us over the years. Many contributors from both sides of the Tasman have provided plant material, and we also thank the private landholders and the Department of Conservation for permission to collect live plants for our chromosome counts.

#### Previous chromosome counts

Prior to our 2007 paper [1], relatively few chromosome numbers of the Australasian orchids had been published. Chromosomes of 35 Australian species were counted by Peakall and James [6], but even including our counts of Australian material, there are still less than 15% of the genera and only about 6% of the described taxa from that country counted.

For New Zealand, the first chromosome count of an orchid was made in 1942 by John Hair [7], who counted *Thelymitra longifolia*. Forty years later, Jones et al. [8] counted *Winika cunninghamii* (then as *Dendrobium cunninghamii*). More recently, Brian Murray and Peter de Lange have also published several orchid chromosome numbers [9, 10, 11]. Chromosomes of New Zealand orchids previously counted by others are:

*Anzybas carsei* ( $2n = 36$ ) [9]  
*Cryptostylis subulata* ( $2n = c. 60$ ) [11]  
*Microtis parviflora* ( $2n = 44$ ) P. J. de Lange in [1]  
*Mymechila trapeziformis* ( $2n = c. 40$ ) [10]  
*Pterostylis cernua* ( $2n = 44$ ) [10]  
*Simpliglottis valida* ( $2n = 40$ ) [11]  
*Thelymitra longifolia* ( $2n = 26$ ) [7]

*Winika cunninghamii* ( $2n = 38$ ) [8]

#### Our chromosome counts

We counted the chromosomes of many orchid species and genera from Australasia for the first time. For New Zealand, we made 190 counts of 80 species and about 25 undescribed taxa, tag-name entities, and hybrids.

The following list shows the range and diversity of chromosome numbers that we obtained for New Zealand (for more details and our counts of Australian material, please refer to our 2007 paper [1]):

*Acianthus sinclairii* ( $2n = 40$ )  
*Adelopetalum tuberculatum* ( $2n = 38$ )  
*Adenochilus gracilis* ( $2n = 38$ )  
*Anzybas carsei* & *A. rotundifolius* ( $2n = 36$ )  
*Aporostylis bifolia* ( $2n = 40$ )  
*Calochilus* aff. *herbaceus* ( $2n = 22$ ); *C. paludosus* & *C. robertsonii* ( $2n = 24$ )  
*Corunastylis nuda* & *C. pumila* ( $2n = 44$ )  
*Corybas cheesemanii* ( $2n = 54+2$ )  
*Cryptostylis subulata* ( $2n = 64$ )  
*Cyrtostylis oblonga* ( $2n = 44(+2)$ ); *C. rotundifolia* ( $2n = 44+2$ )  
*Danhatchia australis* ( $2n = 22$ )  
*Diplodium alobulum*, *D. brumalis*, *D. trullifolium* ( $2n = 50$ )  
*Drymoanthus adversus* ( $2n = 76$ ); *D. flavus* ( $2n = 38$ )  
*Earina aestivalis* ( $2n = 40, 41$ ); *E. autumnalis* ( $2n = 40$ ); *E. mucronata* ( $2n = 40(+0-2)$ )  
*Gastrodia cunninghamii* & *G. minor* ( $2n = 40$ ); *G. aff. sesamoides* & *G. "long column"* ( $2n = 38-40$ )  
*Hymenochilus tanypodus* ( $2n = 54$ ); *H. tristis* ( $2n = 52$ )  
*Ichthyostomum pygmaeum* ( $2n = 38$ )  
*Linguella puberula* ( $2n = (48), 50$ )  
*Microtis oligantha* & *M. parviflora* ( $2n = 44$ ); *M. unifolia* ( $2n = 88$ )  
*Molloybas cryptanthus* ( $2n = 34$ )  
*Nematoceras acuminatum*, *N. iridescens*, *N. macranthum*, *N. orbiculatum*, *N. papa* ( $2n = 36$ ); *N. aff. trilobum* ( $2n = 36$  &  $2n = 72$ )  
*Orthoceras novae-zeelandiae* ( $2n = 42, 44$ )  
*Petalochilus* aff. *carneus* ( $2n = 40$ ); *P. chlorostylus* ( $2n = 39, 40, 41$ ); *P. minor* ( $2n = 39, 40$ )

*Plumatichilos tasmanicum* ( $2n = 50-54$ )  
*Prasophyllum colensoi* & *P. hectorii* ( $2n = 42$ )  
*Pterostylis agathicola*, *P. areolata*, *P. aff. areolata*, *P. auriculata*, *P. australis*, *P. banksii*, *P. cardiostigma*, *P. graminea* agg., *P. humilis*, *P. irsoniana*, *P. micromega*, *P. montana* sens. str., *P. paludosa*, *P. patens*, *P. porrecta*, *P. venosa* ( $2n = 44$ ); *P. aff. montana* agg. ( $2n = (43), 44$ ); *P. foliata* & *P. silvicultrix* ( $2n = 44-46$ ); *P. oliveri* ( $2n = 46$ )  
*Simpliglottis cornuta* & *S. valida* ( $2n = 40$ )  
*Singularlybas oblongus* ( $2n = 34$ )  
*Spiranthes novae-zelandiae* & *S. "Motutangi"* ( $2n = 30$ )  
*Stegostyla lyallii* ( $2n = 47, 48$ )  
*Thelymitra longifolia*, *T. aff. longifolia* agg., *T. malvina*, *T. aff. pauciflora*, *T. sanscilia* ( $2n = 26$ )  
*Thelymitra* aff. *ixioides* ( $2n = 28$ )  
*Thelymitra aemula*, *T. cyanea*, *T. formosa* ( $2n = 40$ )  
*Thelymitra* × *dentata* (*T. longifolia* × *T. pulchella*) ( $2n = (45), 46$ ). Natural hybrid  
*Thelymitra longifolia* × *T. pulchella* ( $2n = 45, 46$ ). Artificial hybrid  
(*Thelymitra longifolia* × *T. pulchella*) × *T. pulchella* ( $2n = 52$ ). Artificial hybrid  
*Thelymitra nervosa* ( $2n = 54$ )  
*Thelymitra* "Ahipara" & *T. "darkie"* ( $2n = 60$ )  
*Thelymitra carnea* ( $2n = 62$ )  
*Thelymitra hatchii* & *T. pulchella* ( $2n = 66$ )  
*Thelymitra tholiformis* ( $2n = 65$ , c. 66)  
*Thelymitra* "rough leaf" ( $2n = 84$ )  
*Thelymitra* aff. "rough leaf" ( $2n = c. 84$ )  
*Townsonia deflexa* ( $2n = 28$ )  
*Waireia stenopetala* ( $2n = 40$ )  
*Winika cunninghamii* ( $2n = 40$ )

The term "2n" is used to indicate that vegetative (non-sexual) tissue was counted. For the orchids this includes root tips, root-stem tubers, and pseudobulbs.

Including our contribution and those from previous workers, about 75% of the species representing all the native orchid genera in New Zealand now have chromosome counts.

## Polyploids

Polyploid plants have more than two of the

basic (haploid) sets of chromosomes in the nucleus of the cells. The prefixes tri, tetra, penta, octa, etc. are used to denote the level of ploidy. We found tetraploidy (plants with four times the haploid number) in three genera of New Zealand orchids.

*Drymoanthus flavus* is diploid ( $2n = 38$ ) but *D. adversus* is tetraploid ( $2n = 76$ ); similarly, *Microtis oligantha* and *M. parviflora* are diploid species ( $2n = 44$ ) whereas *M. unifolia* is tetraploid ( $2n = 88$ ).

*Nematoceras* is interesting. All New Zealand species are diploid except for within the *N. trilobum* aggregate where both diploid ( $2n = 36$ ) and tetraploid ( $2n = 72$ ) taxa occur. We found predominantly diploids in the North Island, and only tetraploids in the South Island and Chatham Island. Further chromosome counts are needed to see if this pattern holds up, and to help resolve the 25 or so taxa said to occur in this species complex.

## Allopolyploids and chromosome evolution in *Thelymitra*

Including all Australasian material, there is a remarkably wide range of chromosome counts in *Thelymitra*,  $2n = 26, 28, 32, 36, 40, 45, 46, 52, 54, 56, 57, 58, 60, 62, 65, 66, 70, 84$ , and 93.

These numbers do not form a simple polyploid series, and in 1998 we explained some of them by natural hybridism, allopolyploidy, and speciation [12]. In our most recent paper [1] we presented additional chromosome counts and interpretation on how these numbers are related.

Allopolyploidy was confirmed only in *Thelymitra*. Allopolyploids (also known as amphidiploids) are polyploids with chromosomes derived from different species. For example, if two progenitor species, represented by *T. longifolia* ( $2n = 26$ ) and *T. aff. ixioides* ( $2n = 28$ ), hybridised naturally, they would produce  $F_1$  hybrids with the intermediate chromosome number of  $2n = 27$ . These plants could represent a transition phase as they may not be fertile, because the chromosome complement is unbalanced and the chromosomes cannot pair evenly at

meiosis (the sexual cell division cycle). This chromosome set of  $2n = 27$  would need to double to pair evenly and hence produce fully fertile and reproductively isolated derivatives, in this case represented by the allopolyploid *T. nervosa* (previously known as *T. decora*) with  $2n = 54$ . And so on for other examples:

*T. carnea*,  $2n = 62$ , an Australian and New Zealand allopolyploid possibly between *T. pauciflora* ( $2n = 26$ ) and *T. flexuosa* ( $2n = 36$ );

*T. rubra*,  $2n = 62$ , an Australian allopolyploid with similar origins to *T. carnea*;

*T. tholiformis*,  $2n = 65$  & c. 66, a New Zealand allopolyploid between *T. aemula* ( $2n = 40$ ) and *T. aff. pauciflora* ( $2n = 26$ );

*T. hatchii*,  $2n = 66$ , a New Zealand allopolyploid between *T. longifolia* ( $2n = 26$ ) and *T. formosa* ( $2n = 40$ );

*T. pulchella*,  $2n = 66$ , a New Zealand allopolyploid between *T. longifolia* ( $2n = 26$ ) and *T. cyanea* ( $2n = 40$ ).

We obtained other interesting numbers for some of the undescribed entities. Two similar taxa from Northland, *Thelymitra* “Ahipara” and *T.* “darkie”, both share  $2n = 60$ .

A higher chromosome number of  $2n = 84$  was found in both *Thelymitra* “rough leaf” from North Auckland and a similar undescribed *Thelymitra* from Shag Point, Otago. This same number was also found in some Tasmanian *Thelymitra*, including *T. viridis*. Closer comparisons are needed between some of these undescribed New Zealand entities and Australian taxa.

$2n = 26$  and  $2n = 28$  are the lowest chromosome numbers found in *Thelymitra* and are considered functional diploid species. If the “original” number is  $2n = 28$ , then it is likely that the lower number,  $2n = 26$ , is derived from the loss of one chromosome pair through aneuploidy.

There are a few species with chromosome counts ( $2n = 36$ ,  $2n = 40$ ) that are intermediate between the low diploids ( $2n = 26$  &  $2n = 28$ ) and the high allopolyploids (starting from  $2n =$

52). These are fertile species likely to have hybrid origins between the diploids and allopolyploids.

Naturally occurring  $F_1$  hybrids with the odd number of  $2n = 45$  were found for *Thelymitra*  $\times$  *dentata* of New Zealand and *T. \times* *irregularis* of Australia. These numbers are intermediate with their suspected parent species, but the chromosome complements are unbalanced and as a consequence the plants are sterile.

### Aneuploids

As previously mentioned, aneuploidy is a variation in chromosome number involving the loss (or gain) of one or two chromosomes. Aneuploidy appears to be extensive for the Australasian orchids, and occurs at several levels:

Within the same species or apparently even within the cells of the same plant: *Earina mucronata*,  $2n = 40, 41, 42$ ; *Petalochilus chlorostylus*,  $2n = 39, 40, 41$ ; *Pterostylis* aff. *montana* agg.,  $2n = 43, 44$ ; *Stegostyla lyallii*,  $2n = 47, 48$ .

Between species in the same genus. I have already mentioned the example of an aneuploid reduction within *Thelymitra* of  $2n = 28$  to  $2n = 26$ , but there is also aneuploidy within the related genus *Calochilus* from  $2n = 24$  to  $2n = 22$ . Other examples are:

*Adelopetalum*, from  $2n = 38$  to  $2n = 36$ ;

*Hymenochilus*, from  $2n = 54$  to  $2n = 52$  (to  $2n = 48?$ ); *Prasophyllum*, from  $2n = 44$  to  $2n = 42$ .

Between subgenera: *Pterostylis* subg.

*Pterostylis*, with  $2n = 42$ , derived  $2n = 44$  found in the other two subgenera.

Between related genera: *Calochilus*,  $2n = 24$ , possibly derived from  $2n = 26$  in *Thelymitra*; *Molloybas* and *Singularybas*,  $2n = 34$ , from  $2n = 36$  found elsewhere in the *Corybas* alliance (*Anzybas* and *Nematoceras*).

As I will explain in Part 2, chromosome characters have proven remarkably informative for the Australasian orchids, not only at the species level, but in some cases up to the subtribal level.

However, it must be stressed that chromosome information on its own should be treated cautiously at higher taxonomic levels and that orchid classification is certainly not straightforward. We have not solved all of the problems and orchidologists will still have to make their own decisions based on our additional chromosome evidence. I should also mention that the plant names used in the original paper [1] and in these two articles follow Dr Brian Molloy's taxonomic concepts.

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**Chair:** David McConachie, 42 Titiro Moana Rd, Korokoro, Lower Hutt, pleione@orcon.net.nz.

**Editor:** Ian St George, 22 Orchard St, Wadestown, Wellington 6012  
ian.stgeorge@rnzcg.org.nz.

**Secretary:** Gary Pennial, 637 Otaraoa Rd, RD 43, Waitara, Taranaki  
gary.p@clear.net.nz.

**Treasurer:** Judith Tyler, 4 Byrd St, Levin, bandj.tyler@xtra.co.nz: subscription NZ\$40 + post overseas.

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

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

**Editorial Board:** Mark Clements, David Jones, Brian Molloy, Eric Scanlen.

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# Eponymous orchids: Val Smith

Andrew Sinclair (c. 1796–1861)

## *Acianthus sinclairii*

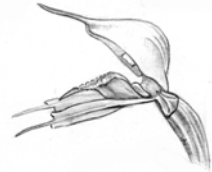
Andrew Sinclair, the son of a middle-class family, was born at Paisley, Scotland. He studied medicine at Glasgow, Paris and Edinburgh, and in 1822 joined the Royal Navy as an assistant surgeon. Botany was a component of medical studies at that time, and while he was abroad, Dr Sinclair pursued this interest, sending plant specimens to the British Museum from South Africa, the Mediterranean and Central America.

He made a brief return to England for health reasons, and then went to Australia. In 1841 he took the opportunity to visit the Bay of Islands while Ross's Antarctic expedition was there, and accompanied JD Hooker and William Colenso on some of their botanical expeditions.

Two years later he sailed to Australia again, this time as Surgeon-Superintendent on a convict ship bound for Tasmania. The voyage marked the end of his term of service; he took his discharge at Sydney and offered to accompany Governor Fitzroy to New Zealand and serve in a medical or exploratory capacity. He was pressed into accepting the position of Colonial Secretary and held that office for twelve years. Although he had no special aptitude for the job, he was reputed to be honest, fair and hardworking. He devoted his leisure to botany, collecting specimens from all parts of the North Island and sending them to Kew Gardens where they provided Hooker with much of the material for his work on New Zealand flora.

His focus in retirement was scientific exploration. He made a visit to Scotland and Europe, and had discussions on scientific matters with Darwin, Huxley and Hooker. In 1858 he was back in New Zealand, collecting further material for Hooker. His journals show that he collected in most districts, ever hopeful of new finds. He was elected fellow of the Linnaean Society in 1959. In 1861 he joined Julius von Haast on a Southern Alps exploratory trip, and was drowned while crossing the Rangitata River. His lonely grave is on the river flat near the Mesopotamia homestead.

Dr Andrew Sinclair was described as a pleasant, widely knowledgeable companion, genial, entertaining and instructive, who made a major contribution to New Zealand botany. Plants named in his honour include an alpine buttercup (*Ranunculus*) and daisy (*Celmisia*), a tiny orchid (*Acianthus*), the large-leafed puka (*Meryta*) and a shade-loving herb (*Jovellana*). *Haastia sinclairii*, another plant of the South Island alpine regions, commemorates the friendship of Julius von Haast and Dr Andrew Sinclair.



Detail from Bruce Irwin's drawings of NZ orchids, NZNOG, Wellington, 2007

# Elementary: ED Hatch

## 17. Miscellaneous terrestrials 6.

Drawings by Bruce Irwin

### *Gastrodia*

(the pot-bellied flower).

Non-green saprophytes with the leaves reduced to scale bracts. Sepals and petals united to form a lobed tube, partly split down one side. There are 2 forms in NZ –

**A:** self pollinated, with a short column.

**B:** insect pollinated, with a long column.

### Group A

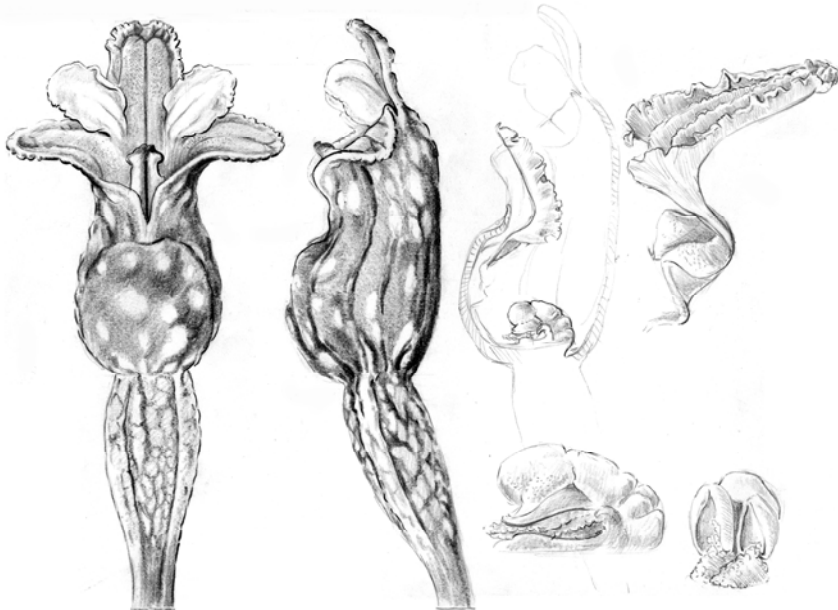
#### 17: *Gastrodia cunninghamii* ▼

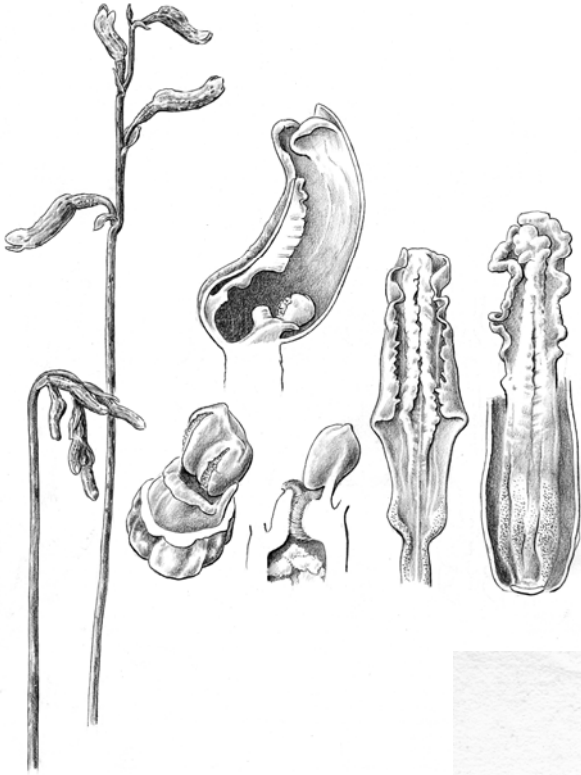
(for Richard Cunningham)

Mature plants are tall and robust, with up to 40, ± tuberculate, greyish-green-to-black flowers. The column is very short. The mycorrhizal fungus involved is *Armillaria mellea*.

**Distribution** – endemic – North, South, Stewart and Chatham Is.

**Flowers** – November-February – self pollinated (the ridges on the back of the column expand like springs and force the pollinia down on to the stigma).





◀18: *Gastrodia minor*

(smaller than *G. cunninghamii*)

A very slender, few-flowered plant with narrow brown flowers.

**Distribution** – endemic – North Id., from the Waitakere and Hunua Ranges southwards. South Id., Stewart Id.

**Flowers** – November-January – self pollinated (see under *G. cunninghamii*. Lives in a mycorrhizal association with manuka).

**Group B:**

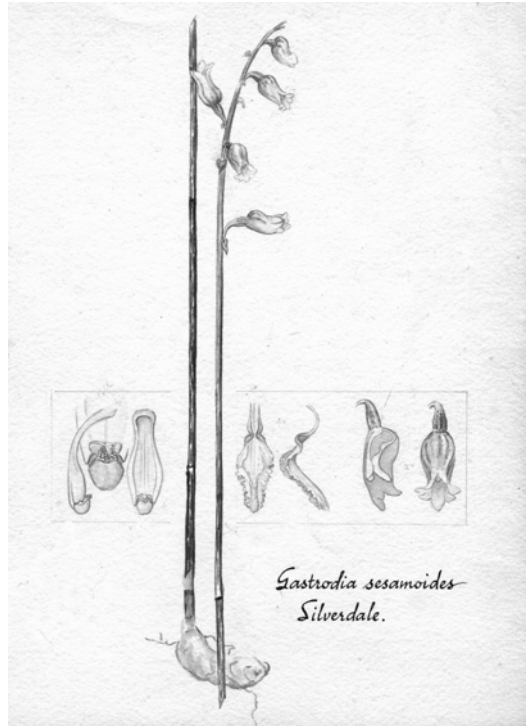
19: *Gastrodia* aff “sesamoides”▶

Up to 90cm tall with as many as 20 flowers, varying in colour from white to dark mustard-yellow. The column is almost as long as the labellum.

**Distribution** – endemic – North, South Is.

**Flowers** – October-December – insect pollinated. (The mycorrhizal partner here is the bracket-fungus *Fomes mastoporus*. The orchid grows with a variety of legumes and pines).

There are in NZ several other tag-named plants in the long-column group.



# Australian notes: David McConachie

## Wild orchids in South Australia in 2007, a summary, including new discoveries and rediscoveries!

By R. Bates (reprinted from *NOSSA Journal* 2008; 32 (1): 3-4).

Despite 2006's severe rainfall deficit during the orchid growing season rain in April 2007 brought up wild orchids early in many areas. The longer season meant that plants had extra growing time to reach normal size and at first it looked like a bumper year. Then winterearly spring rains failed and for more than 50% of the states' orchid districts there was a dismal season or no flowering season.

Some coastal districts fared better. Lower Eyre Peninsula, parts of southern Flinders, Southern Lofties, Kangaroo Island and lower South-East all had reasonable flowering despite well below average rainfalls simply because of timing. Rain was light but most weeks there was some. Orchids don't need heavy rain, just regular showers.

Not surprisingly all new discoveries and rediscoveries were in the Southern Lofty, Kangaroo Island and lower Southeast districts. Rediscoveries included *Thelymitra cyanapicata* in SL which was thought to be extinct. Over a hundred were found near the type location at Kuitpo in October. The spiral leaf sun-orchid *T. matthewsii* as reported in the Journal, having not been seen in flower in SA for thirty years was found as a viable population at one of its previously known Kangaroo Island locations in September.

Another rediscovery was the large bird orchid *Simpliglottis valida* which was last seen as a wild population over 80 years ago on Fleurieu Peninsula but turned up in October in the South-East at Caroline Forest.

An undescribed leek orchid simply known as *Prasophyllum* 'Bushfires' was located in good numbers in the burned section of Mount Bold Reserve (SL) the first the author has seen in flower since Ash Wednesday 1983. On the

same burn over a thousand of the nationally threatened *Diuris brevifolia* were seen. This is the first time such a large population has been seen since 1984. The species was also located on the Cox Scrub burn by Thelma and Phil Bridle and a count showed nearly a hundred flowers there. In addition a hundred plants in flower were located at Knott Hill during a survey in November. Never have so many been seen in one season before.

Species new to science included a *Diuris* aff *behrii* 'sandhills' found near Glencoe (SE) by Bryan Haywood. I am looking forward to seeing this one next year.

A new *Petalochilus* aff *mentiensi* was located in good numbers in coastal dunes south of Nora Creina and an undescribed *Linguella* found in good numbers in July in the same area now has a type collection and can be named.

A possible new midge orchid *Conunastylis* aff *rufa* was found by Cathy and Mal Houston in Onkaparinga NP after fire. This was sent to DL Jones.

A new *Prasophyllum* species was located in Bagdad NFR in the SE in late September and closer to home a new form of *Prasophyllum pruinosum* was located by Jenny Skinner and Joe Quarmby on Sheoak Road Belair. I look forward to seeing that one in 2008.

June Njieleke located many interesting orchids in 2007 including a large colony of duck orchids *Paracaleana disjuncta* on the burned area in Cox's Scrub. This species seems to be located in flower about once every ten years in SA. June also found such unusual species as *Calochilus pruinosus* (SE) and *Corysanthes dentatus* (Sandy Creek) which most enthusiasts never see in their life time.



Well done June, I was also looking for *Paracaleana* on the Cox's Scrub burn but did not see them.

Several new taxa were verified in 2007 including the painted *Petalochilus* in Bagdad NFR and *Linguella* 'tall mallee nana' near Karte also found by June (SE). A new species of *Thelymitra*, known as *T.* 'long slender arms' suspected at Lobethal was seen in good numbers this year and a Type collection made in late October. This species was first seen on a NOSSA excursion in 2005.

We were also fortunate that a dozen new species were named in 2007 by DL Jones. We only have ninety more to be described officially!

## Colenso to Balfour

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# South Australian Native Orchids

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# The Column: Eric Scanlen

## 1. *Caladenia*: new taxa

New *Caladenia* taxa keep arriving, courtesy of dedicated observers such as

- Tricia Aspin, with *C.* “kauri mauve” (Fig. 13, 14) from Awhitu [J103:13,15] and her perfumed, late flowering, multi-flowering, *C. chlorostyla* from Matakawau [J99:22,23; 103:12];
- Mike Lusk also with the very late, multi-flowering *C. chlorostyla* from the Kawekas [J104:28,31] and an unusual *C. aff. chlorostyla* (*C. minor*?) from the Aorangis;
- Kevin Matthews, with perfumed *Caladenia* “2 leaf”, Fig. 16, Kaitaia [J102:1; 103: 8, 35, 39];
- Gary Little has *C.* “pink wonder” (Fig. 17 and J107 as *C.* “speckles”) right by his back deck at Diggers Valley;
- Mark Moorhouse had something similar to Gary’s J107 taxon (Figs. 12, 18) from Arapawa Islands in the Marlborough Sounds which the Column had likened to *C. aff. variegata* and
- Gael Donaghy with *C.* “Pupu” [J75:36 Fig. 1] from Nelson.

Tricia Aspin’s most interesting *C.* “kauri mauve” [J103:13,15] was in flower in a new site on 15 Nov 2007. The Column, overawed at this new orchid, messed up all the photographs on his steam-age film camera. Meanwhile, Tricia hunted around in Kevin Dodd’s kauri rickers and found 40 specimens. Only four had open flowers and a few had twin buds. Last year’s site, on a spur nearby, now showed only 3 or 4 specimens. The large (for *Caladenia*), 13-19mm wide flowers in the new site, had bright green column backs and pale pink tepals. They looked strangely familiar; but out of place in kauri. The variable bumpy margins to the midlobe — under a X20 lens — made it look very much like *C. aff. variegata*; “aff.” because there were none of

Colenso’s stray calli outside the two rows on the disc. [See J96:23,24]. The Column had to return to Kevin Dodd’s on 17 Nov. 07 for sharper pix, this time with the lens stopped down, for Figs. A & B. A close relationship becomes clear between it and southerly, non-kauri zone, single flowered, *C. aff. variegata* with its disjunct distribution from Northwest Nelson to the Kawekas. Thank you Mike Lusk, J104:31, for the latter. But at Dodd’s, Awhitu, Tricia could find no plants further than 8m from kauri boles. Who ever heard of *C. aff. variegata* dependant upon kauri? and so far north? This has to be a new taxon, *C.* “kauri mauve” as Tricia tagged it. Incidentally, this same area of kauri, also had triple flowered *C. chlorostyla* and *Chiloglottis cornuta* “khaki calli” with single leaved juveniles as at Diggers Valley and Kaitaia in Journal 107. A true GLOS (great little orchid spot).

Tricia’s late, scented, four flowered *C. chlorostyla*, had two flowers stemming from one floral bract [J99:23 as *C. minor*] and could have been a doubling mutation. It showed for three years but 2007 was a poor season with the population at Kemp Rd. Reserve, Matakawau, down from 200+ on 29 Nov 05 to only eight plants above ground on 17 Nov 07. Amongst the eight were triplets, twins and singles but no quads. The colony at Kevin Dodd’s, 5.5kms distant, also had numbers of triplets, twins and singles but no quads either, in 2007. The triplets, being so late and common on the Awhitu Peninsula but rare elsewhere, makes this worth following up, Tricia? Why not compare notes with Mike Lusk and his similar specimens from the Kawekas. These could be the same scented, late flowering taxon.

Kevin Matthews’ scented *C.* “2leaf” [cover J102], is a more colourful form of *C. minor*, alias *C. aff. chlorostyla*, (more about that below) and it also flowers either in two pairs, each pair from a solitary floral bract or with three pedicels, the top pair of flowers from

9



10





**“The column” captions, pp. 28, 35 & 36.**

- Fig. 12** The Fig. 17 flower, looking similar to Gary Little's twin flowered *Caladenia* “pink wonder” [J107] from far north Diggers Valley.
- Fig. 13** *Caladenia* “kauri mauve” from K. Dodd's Awhitu kauri grove, showing bumpy midlobe margin and two discrete rows of disc calli typical of *C. aff. variegata*. How did it sneak as far north as Awhitu and why is it only amongst kauri?
- Fig. 14** *Caladenia* “kauri mauve” showing green plus a reddish midrib on the dorsal sepal back, typical of *C. aff. variegata*.
- Fig. 15** *Caladenia minor*, as depicted in the Column's *C. minor* imbroglia J72:27 Fig. 2 taken at Albany Scenic Reserve on 18 Nov 1993 with Doug McCrae who identified it as his *C. “green column”*. Probably *C. minor* designate, by comparison with Fig. G. In 1997, the Column felt sure it was *C. chlorostyla* which is in fact more greenish.
- Fig. 16** Scented *Caladenia* “2leaf”, 7 Nov 2006 from Kaitaia showing 3 pedicels but 4 flowers/ buds, the top twins from twinned floral bracts. Buds show the unusual green stem and red sepal midribs on this variation on *C. minor*.
- Fig. 17** *Caladenia* “pink wonder” later flowering specimen with three small marginal calli and red amongst the green column back, rather like *C. “nitida rosea”* which was always difficult to separate from *C. aff. variegata* in a species key. Is this a transition between the two? It varies somewhat from Gary's J107 specimen from the same colony.
- Fig. 18** Unusual form of *Caladenia aff. variegata* from Arapawa Id, Marlborough Sounds. Note the atypical curled tepal tips and large rostellum behind the pink anthers.
- Fig. 19** Black thrips on *Thelymitra aff. longifolia* “stunted” at Lake Ohia, 1 Nov 2007. The tawny wing roots are the only non-black part on this widespread species. Photo K. Matthews
- Fig. 20** Black thrips carrying pollen grains. Column of *Thelymitra pulchella* at Lake Ohia, 1 Nov 2007. Photo K Matthews
- Fig. 22** *Thelymitra nervosa* (was *T. “bee”*) at Hatfields Beach, 30 Oct 1999 where the huge(?) native bee hunting for absent nectar and loose pollen, ignores the thrips which may have given its life, pollinating the stigma
- Fig. 22** Probably *Caladenia minor* designate (*C. aff. chlorostyla*). Actually the best specimen matching WH Fitch's drawing (see J106:42) taken from Sir J.D. Hooker's *C. minor* type sheet of 19 specimens, originally published as lectotype in 1989 [2] by Dr Mark Clements.
- Fig. 23** *Thelymitra pulchella* with two thrips loaded with pollen, several grains at a time. Lake Ohia, 7 Dec 07, Photo K. Matthews
- Fig. 24** *Thelymitra cyanea* pollen distribution mostly onto the labellum from that outstretched anther. 7 Feb.1997 from Horopito.
- Fig. 25** *Thelymitra nervosa* from Shag point, 30 Nov 07. Post anther lobe with black thrips, 0.8mm long. Note the bar-like wings. Hair like wing ribs are not visible in this gross enlargement.
- Fig. 26** Black thrips on *Thelymitra cyanea* at Kaitaia on 21 Jan 08 showing pollen clusters on its wing roots and odd grains behind its head. Photo. K. Matthews, Photoshop smoothing, Grant Scanlen.
- Page 32** *Thrips tabaci*, [1] a 2mm long, serious New Zealand pest showing basic thrips equipment including the spar-like wings and hair-like wing ribs to provide lift. Wings tuck neatly down the bug's back when at rest (black and white illustration p.32)

one floral bract (**Fig. 16**). Look at the colour here and in J103:39 Fig 30; green stem but red sepal ribs up the ovary, the red continuing up the sepal midribs with a full width red blob at sepal base. *C. minor* on the other hand, has either; green stems and ovaries; or red stems and ovaries with green between the sepal ridges. *C. "2leaf"* can have both the leaves and bracts in opposed pairs which proclaim this form also as a viable, doubled mutation, at least in part. There was at least one quad plant in 2005 and two spaced well apart in 2006. Single leaved, three flowered plants with similar flowers, occurred in the vicinity in 2006, along with *C. minor* itself. Could it be that the three flowered, single leaved taxon is the new one? but with a number of hybrids including a doubling mutation? Kevin reported several single leaved triplets in a bad 2007 season with only two *C. "2leaf"*, each with only two flowers. Some further observations of these will be of value Kevin if you can tear yourself away from the farm and clearing the dratted wiwi.

Gary Little's "*Caladenia*" pink wonder", (**Fig. 17**) at arm's length from his back deck in Diggers Valley, had a few more in this semi shaded, mossy colony like Fig. D and a greener form, showing up to three marginal calli to the base of the midlobe. So the Column's J107 tentative tag of *C. "speckles"* (Allan Ducker's single flowered taxon, J96:18) no longer fitted. In addition, its variable marginal calli to the midlobe and with the J107 specimen being distinctly similar to Mark Moorhouse's Arapawa Island ones, (**Figs. 12, 18**) it seems to align with *C. aff. variegata* — in the far north? would you believe? Fig. D is actually closer to *C. "nitida rosea"* J100 back cover, with those three marginal calli (which are however too short) and red parts on the green column back. Perhaps this colony is a transition between *C. "nitida rosea"* and *C. aff. variegata*? These taxa were always difficult to separate in a species key. Mark's specimen, from 15 Feb 06 seemed a little isolated at the time, awaiting similar specimens elsewhere, before any unveiling so now is the time. Mark's colony was in the

known zone for *C. aff. variegata* on Arapawa Id, wedged between North & South Islands. However, the Arapawa specimen's prominent rostellum, visible behind the pink anther caps, is atypical as are the curled in tepal tips rather than flat and minutely acuminate as are commonly seen around central North Island. Others at Arapawa were more typical. Have we a new taxon here or just a variation within *C. aff. variegata*?

Mike Lusk's *C. aff. variegata* from Hau-rangi SF [J104:31 Fig.17] also varied in detail from typical specimens which of course is normally not a problem. In fact, the variation in this taxon tends to support the hypothesis that *C. aff. variegata*, without the stray disc calli, is the original form so had ages of time to diverge a little in character from north to south, whilst *C. variegata* which varies less (apart from its number of stray calli) could be the more recent peloric mutation yet it is the accepted species of William Colenso's.

Gael Donaghy's specimen from the Pupu Springs, alone had Hooker's described *C. minor* characters of pink colour, a fringed midlobe and obtuse sepals. Who, amongst the several Nelson orchidologists is following up this tantaliser from June 2000?

*Caladenia minor* may well be the taxon that the Column first depicted as such (**Fig. 15** herein) in the *C. minor* *Imbroglia* of J72:22 Dec 99. He thought at the time it was *C. chlorostyla*. Doug McCrae identified the Fig. G specimen at Albany Scenic Reserve on 18 Nov 1993, as his "new one" *Caladenia* "green column". Jones et al described the greenish form and Latinised Doug's tag as *C. chlorostyla* in 1997 [1]. In 2001/2 Bruce Irwin perspicaciously portrayed the Fig. G taxon as *C. aff. chlorostyla* [J79:6; 83:17], different from *C. chlorostyla*. Debate has waxed unabated throughout the nine subsequent years as to the true identity of *C. minor*. The lectotype annotation [J106:38, 42, Fig. 13] on Sir J.D. Hooker's depicted *C. minor* specimen sheet, has never been published (pers comm. Dr. Brian Molloy), so Dr. Mark Clements' 1989 designation [2] still stands. **Fig. 21** is likely to be the present lectotype, from Mark Clements'

designation on another of Hooker's *C. minor* specimen sheets. At the Column's request, Ewen Cameron, Curator at AK Herbarium, borrowed the type sheet from Lindley's Herbarium at Kew and the Column photographed it on 21 Jan. 05. Fig. H was the best specimen of all 19 on sheet H2004/02298 but this flower had been carefully tucked into an envelope of broken parts, attached to the sheet. Fig. H is hopefully the lectotype and depicts a dark back to the dorsal sepal and the fringe of marginal calli to the midlobe as drawn by WH Fitch and included with Hooker's 1853 description [3] where he lumped a number of species into one. So the debate cannot have quite finished but the evidence is now pointing more at *C. aff. chlorostyla* being the presently designated lectotype of *Caladenia minor*.

#### Acknowledgements.

The Column is indebted to; Brian Molloy for timely comment which seriously changed the course of this write-up; Kevin Matthews for photos of his scented *Caladenia* "2leaf" and his patience in email debate on this taxon; Tricia Aspin for bringing her unusual Awhitu *Caladenia* to the Column's attention and for her well founded reserve in the tagging thereto; Ewen Cameron for somehow borrowing the *C. minor* type sheet despite the Kew policy of never letting type material out of the Lindley-Kew Herbarium; Ian St George for his excellent historic series which has been invaluable; Kevin Dodd's for permission to orchid hunt his kauri GLOS; Mike Lusk, Mark Moorhouse and Gary Little for their valuable contributions and last but not least, Bruce Irwin for his unflagging and instructive debate on the *C. minor* issue for the last nine years.

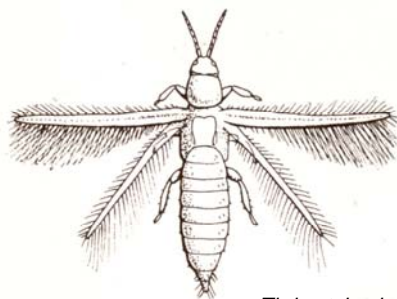
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## 2. Thrips as *Thelymitra* pollinators

Kevin Matthews sent the Column pix on 1 Nov 2007 from Lake Ohia, of *Thelymitra* aff. *longifolia* "stunted" (Fig. 19) and *T. pulchella* (Fig. 20) with those dratted little black bugs. In Fig. Q, one is carrying grains of pollen stuck to its side. We couldn't identify the minuscule bugs then but John Early, entomologist at Auckland Museum and Institute said they looked like thrips from the photos. Kevin caught more on film, (Fig. 23) on 7 Dec 07 also on *T. pulchella* at Lake Ohia. Coincidentally, on 30 Nov 07, Ian St George sent the Column a flower bud from Shag Point, Palmerston, of *T. nervosa* Col., the spotless blue *T. decora*. Some will argue about these identifications of the Column's. More about that another time. Out from Ian's column crawled a black thrips, Fig. 25, only just alive, after a day or three in the mail. Note that "thrips" is both singular and plural like "species". The thrips' trip stripped off any pollen it may have been carrying. It had its portraits made, but getting detail on a 0.80mm bug body with a 35mm camera and no microscope, wasn't ever going to be easy. Incidentally, the Column identified Ian's mystery bud as *Thelymitra* "bee" because of its similarity with the Hatfields Beach colony espied on 30 Oct 1999 [J74:13,14,18]. That put another cat amongst the pigeons: it seems that the elusive *T. "bee"* = spotless *T. nervosa*! *T. "bee"* has also been videoed by Allan Ducker at Motutangi in the far north and twice at Horopito. The Column has several photos of *T. "bee"* with a native bee clambering all over its column and under the fimbria in a lost cause for pollen and nectar. Allan has video footage of the bee kicking the stuffing out of the fimbria trying to fill its leg pockets with it which is why it is all askew in Fig. 21. The bee may well have cross pollinated the several plants of that colony which however, never showed again at Hatfields Beach. Stuck there on the stigma, through-

out this mini-drama, was a dead thrips, trapped in the sticky stigma. The thrips was an embarrassing distraction in the Column's 3-D shows but now becomes more interesting. Lying against it is a blob of presumably the orchid's own pollinium, possibly dislodged by the bee in a case of self-pollination-by-insect but it seems the thrips got there first so any pollen it was carrying would already have fertilised some ovules. Kevin also sent a pic of *T. cyanea* from Uncle Hackney Matthews' Kaitaia place **Fig. 26**, on 20 Jan 08. It has been heavily enlarged, then expertly smoothed on Photo-shop by Grant Scanlen. Thus the tail bristles don't show but two blobs of pollen do, not to be confused with tawny wing roots on these thrips. Kevin's *T. sansscilia* from Peria also had thrips in the column as did *T. "sky"* and *T. pauciflora* from Cable Bay. Indubitably, these black thrips are unwittingly delivering pollen grains from flower to flower, so must at times be cross pollinating *Thelymitra* with friable pollen. Why not? Some of Kevin's photos show damage wrought by the thrips, principally around the column. Most self respecting photographers wouldn't think of taking these wrecks; would you? Thus *Thrips* involvement in *Thelymitra* pollination may have continually gone unrecorded. The Column did photograph a *T. longifolia* at Comet Track on 5 Dec. 1999 whilst Bruce Irwin and Bill Liddy were changing a flat tyre. [J74 Fig. 18]. The plea on p20 for anyone to identify the tiny dead fly on the stigma, went unanswered. Who wants anything to do with a thrips?



*Thrips tabaci*

What exactly are thrips? Reference [1] has about 3,000 species world-wide of these tiny insects and mentions *Thrips tabaci* (below, left), a serious 2mm long pest in New Zealand. Too big to be our 0.8mm black orchid pollinator but illustrating the essential equipment of the family. Narrow, spar-like wings with hair-like wing-ribs but lacking any fabric covering. Getting lift from them, is an example of nature's own nano-technology but apparently adult thrips fly well and often. When not flying, the wings are tucked neatly down the insect's back. [2] mentions clouds of them flying in the US of A, irritating people's skin but it also has them as important pollinators of fruit trees. [3] has the New Zealand endemic, *Thrips obscuratus* and unidentified other species, pollinating some 13 native tree species which author Scott Norton explains, have evolved panicles of small, unscented (to people) flowers yet attracting small pollinators. He wrote of thrips arriving at stigmas of dioecious trees, already having male tree pollen of the same species clinging to them. That's impressive symbiosis at work! Norton didn't venture into orchid pollination but if trees have adapted to thrips' pollination, why wouldn't orchids, in a country with such a paucity of pollinating insects? [4] has a picture of exotic (for Australia) *T. obscuratus*, the light brown New Zealand endemic but clearly not our black *Thelymitra* thrips. The text of indecipherable entomological jargon detailed its essential characters. Female thrips often breed without male assistance so male thrips are a rare commodity. Don't you girls get any ideas now! *Homo sapiens* guys can be handy at times.

Kevin also noted that flowers of an early (22 Sept 07), strongly perfumed *Thelymitra* aff. *longifolia*, still emitted perfume when closed. But why? Orchids normally exude perfume selectively, for example, only at times of day when pollinators are about, in order to conserve scarce resources. *Earina autumnalis*, for instance, loses its all-pervading perfume at night so must surely have evolved for daylight pollinators? Why



then would an orchid emit perfume when closed? Tiny thrips come and go unhindered in open or closed flowers. It could well be that they pollinate closed flowers. So these orchids could have evolved mostly closed, for thrips pollination, couldn't they? And we all thought it was to protect the column details from the elements in self-pollinating orchids, didn't we? One has to wonder then, why do they open at all? Speculatively, thrips pollination, with only a few grains of pollen at a time, would be unlikely to fill a seed capsule so the fall-back self-pollination may kick in to fill the gap with undoubtedly second rate seeds but better than nothing.

These black thrips, possibly *Dichromothrips* sp according to Laurence Mound, CSIRO (pers. comm. to Kevin) at 0.8mm long, are too small to carry pollinia (adherent pollen masses in insect-pollinated orchids) so why wouldn't orchids, pollinated by thrips, evolve mealy pollen? Thrips can easily carry several grains of pollen at a time. Scott Norton's Scanning Electron Microscope [3] showed two grains of tawa pollen on one crocodile-like *Thrips obscuratus*' leg and ten grains of five finger pollen adhering to the armadillo-like abdomen of another. Kevin's photos show the *Thelymitra* thrips, carrying pollen in small clusters on their thoraxes and sides. It seems likely that at least some of these *Thelymitra* species have adapted to friable pollen not only for self-pollination but also for preferential cross-pollination by thrips. Cross-pollinators always outstrip asexual or self-fertilised species in the struggle for supremacy so it does seem likely, doesn't it?

Charles Darwin would have been pleased at the prospect of undetected, almost invisible insects, cross-pollinating the so-called self-pollinating species. Ian St George, in J52:2 quotes from Darwin's 1862 first edition on orchid fertilisation as printed below" Notice that feminine "Nature" features a capital initial;

"It is hardly an exaggeration to say that Nature tells us in the most emphatic manner that she abhors perpetual self-fertilisation." and; "I believe that orchids which do not now

inter-cross, either did formerly inter-cross, or that they will do at some future period, under different conditions, unless indeed they become extinct from the evil effects of long continued close interbreeding." Perhaps no one suggested cross-fertilisation by thrips to Charles?

Why does *T. longifolia* leave its pollen behind the stigma? T.F. Cheeseman studied the fertilisation of *Thelymitra longifolia* from 1876-1879, [4] on up to 103 flowers and his detailed report is recorded in the NZNOG's Historic Series No. 4, p18-23. He noted that the flower was arranged firstly for insect-pollination then soon reverted to fall-back self-pollination as the top of the pollinia drooped over the front of the stigma. Cheeseman did observe a thrip-like insect "sometimes abundant on the pollen on which it probably feeds; but it is much too small to be of any service in removing the pollen from flower to flower,..." He may have missed a vital point but remained thoughtful about the thrip-like insect's role in nature. He pondered, if it were responsible for breaking down the pollen masses for distribution on the flower's own stigma. He also missed a point about thrips being unhindered by closed flowers and remarked on some species of *Thelymitra* "remaining closed for a large part of the day thus absolutely preventing the access of insects."

It seems then, that the widespread, thus successful, *T. longifolia*, leaves the self-fertilisation option to last, as purely a fall-back system if a large insect-pollinator fails to take all the pollinia (native bees have been reported at the column, e.g. J53:10,11), then thrips may take pollen a few grains at a time, but, as a last resort, self-pollination fills those seed capsules. Even if cross-pollination is only occasional, it would be better for the survival of the species than the obligate self-pollination that has often been assumed.

Then again, why does *T. cyanea* have such a long, overhanging anther which lets the friable pollen flop out onto the labellum as in Fig. 24? One would expect any self-respecting self-pollinator, to drop its pollen onto the broad

stigma, inside the base of the column. Perhaps an extended anther is a successful adaptation for thrips or flies etc, to blunder into the scattered mealy pollen whilst feeding and carry it off to the next flower? Inevitably some to most self pollination is still going to occur as well, going by regularly full seed capsules on this and other friable pollen *Thelymitra* species. Australia also has *T. cyanea*, thrips and flies galore but no *Thrips obscuratus* [5]. Of the Column's five Aussie references, only one, [6] mentions pollination of *T. cyanea*, not selfing but "by small native bees." NZ texts too are coy about pollination of *Thelymitra cyanea* but Ian St George listed it as self pollinating in J52:6. From the evidence the Column believes both are right. Fig. W shows a typical splatter of *T. cyanea*'s white pollen, some on its wide stigma but most has dropped straight onto the labellum, probably for bug feed and incidental transport to the next flower thus some insect pollination is catered for with selfing as merely a back-up.

There is more, don't go away. Three of our amphidiploid hybrid *Thelymitra*, *T. decora* (spotted), *T. pulchella* and *T. hatchii* have *T. longifolia* as one parent, according to Molloy and Dawson [7]. The other parents are also so-called self pollinators, being *T. aff. ixioides*, *T. cyanea* and *T. formosa* in the same order. How would hybridisation happen in self pollinating orchids? Wind pollination? Not likely, not with the adherent little clusters of pollen dropped behind the column as in *T. longifolia* or on the labellum as in *T. cyanea*; this isn't dusty pollen like pine trees. One species of thrips, unconcerned which species of *Thelymitra* they visit, could well be doing the job, over and over going by the wide variety of forms particularly in *T. pulchella*, thus reflecting the many variations in both parents.

Do thrips pollinate other orchid genera? Kevin has captured another, more active, thrips species in *Spiranthes* at Sweetwater and at Motutangi and observed them taking flight. Then there were those straw coloured flies [J59:13; J75:18,19] on *Earina mucronata* which the Column captured unbeknown, at Mangatangi Dam in the Hunuas on 19 Oct

1986 and on top of Mt Messenger on 19 Sept 1993 which also have to be thrips. Of the last, a dozen or so on one flower were biting the feet of a white footed mayfly which dared to feed on their pollen. They were so well camouflaged that the Column didn't spot them until three years later, when he put the x20 magnifier on the film to see what the little black dots were; they were thrips eyes! No one was able to elucidate what they were or what they were doing in the intervening 22 years. Please keep your eyes and x20 lenses alert in the coming season for thrips pollinating native orchids and do tell the Editor all about any of your finds. A sequel article will cover any and all reports of thrips in orchid flowers, especially if your camera gear and photographer are capable of depicting these minuscule insects.

A Google search for "Thrips, Orchids, Pollinators" turned up 12,900 references, the first few indicating that other people have investigated this subject world wide and thrips do pollinate orchids. Why have we been so slow to cotton on in New Zealand?

The Column acknowledges all the generously given assistance from those mentioned specifically in the text. This subject needed voicing and could not have been put together without them.

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