THE PTEROSTYLIS RUFA COMPLEX - BENTHAMS MISTAKE

This is the text of a talk given Bill Kosky to the Australian Native Orchid Society (Victorian Group) on 10 May 2019

This talk is about somewhat similar, smaller, members of the *Pterostylis rufa* complex, *P. rufa*, *P. squamata, P. aciculiformis, P. ferruginea,* and *P. pusilla*. *P. praetermissa,* and other similar species from north of Sydney, are not considered here. The talk also provides insight into the rich history of Australia's plants, and botanists, found in Australia's Herbariam collections.

Roughly the distribution of *P. rufa* is from north of Sydney to around Nowra; *P. squamata* (so called) from Nowra into the eastern half of Victoria and Tasmania; *P. aciculiformis* in a band across the central latitudes of Victoria into NSW and SA, with a disjunct population in East Gippsland; *P. ferruginea* Victoria west from the Grampians into SA; and *P. pusilla* in a band from central Victoria west into SA, unlike the others extending part way into the dryer northern parts of Victoria and SA.

Taxonomy. The hierarchy of taxonomy can be likened to Wikipedia. That is the last valid ranking of a species takes precedence over an earlier one. Any new species named requires a type specimen (or in earlier times a specimen collection) to be nominated, and that type stands as the primary reference for that species.

Bracts are modified leaves. Those that grow on and more or less embrace an orchids stem are referred to as **stem bracts** or **sterile bracts**. (In the past also as **scales** or **empty scales,** and in recent times, as **stem leaves)**. Those that embrace the **pedicle** or flower stem, as **fertile** or **flower bracts**.

Window/s is used here to describe the transparent frosted sections of the sepals and petals.

George Bentham (1800-1884) was an English Botanist working in England with specimens sent by Baron von Mueller.

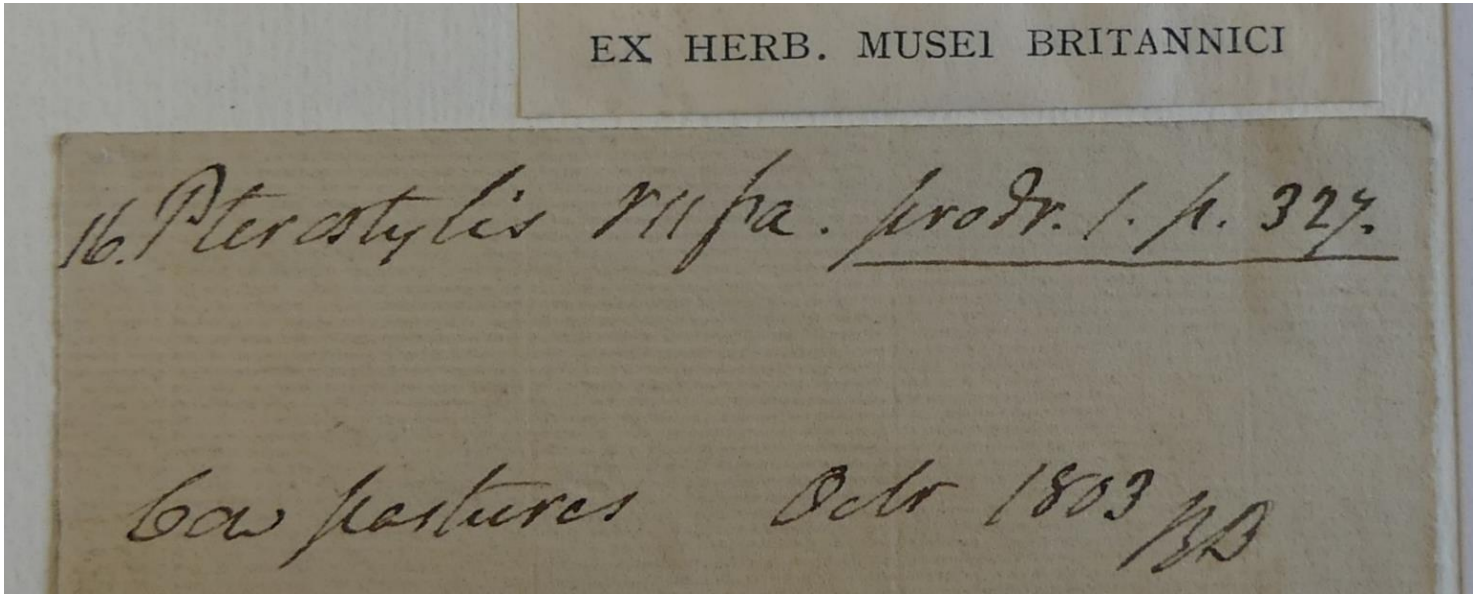
Sources

This talk is informed by specimens examined at the Melbourne, Sydney and Canberra Herbaria and an extensive photo collection. When comparing photos of different orchid species, it is helpful to use photos taken with the same camera settings, including lighting. To achieve this, many photos were sourced from ANOS members Mischa and Colin Rowan's http://www.retiredaussies.com/ web site which is perhaps the best Australian terrestrial orchid photo resource. Certainly, better than any government orchid web site, all operated at no cost to the public purse. Well done Mischa and Colin. Bush Gems is another good source of photos, also of flowering and distribution data.

Bentham's Mistake

In 1810 Robert Brown (in *Prodromus Florae Novae Holldiae* et Insulae Van-Diemen) described *Pterostylis squamata* and *P. rufa in* successive paragraphs, the short Latin descriptions identical except that *P. squamata* is described as having *bracteis scapi sub-imbricatis*, ie: bracts that overlap, hence the name squamata which means a scaled reptile; and *P. rufa* as having *bracteis scapi remotis*, ie: well-spaced bracts.
<u>The distinction between the two could not be more simple, or obvious.</u>

Robert Brown made type collections without naming specific plants as the holotype. His *Pterostylis rufa* type collection consists of (by my count) some 76 plant specimens from Port Jackson (Sydney) cow pastures circa October 1803 on multiple sheets held at 11 different Herbaria. I have examined all these. None have overlapping stem bracts. Below the note on Browns *P. rufa* specimen NSW652172:

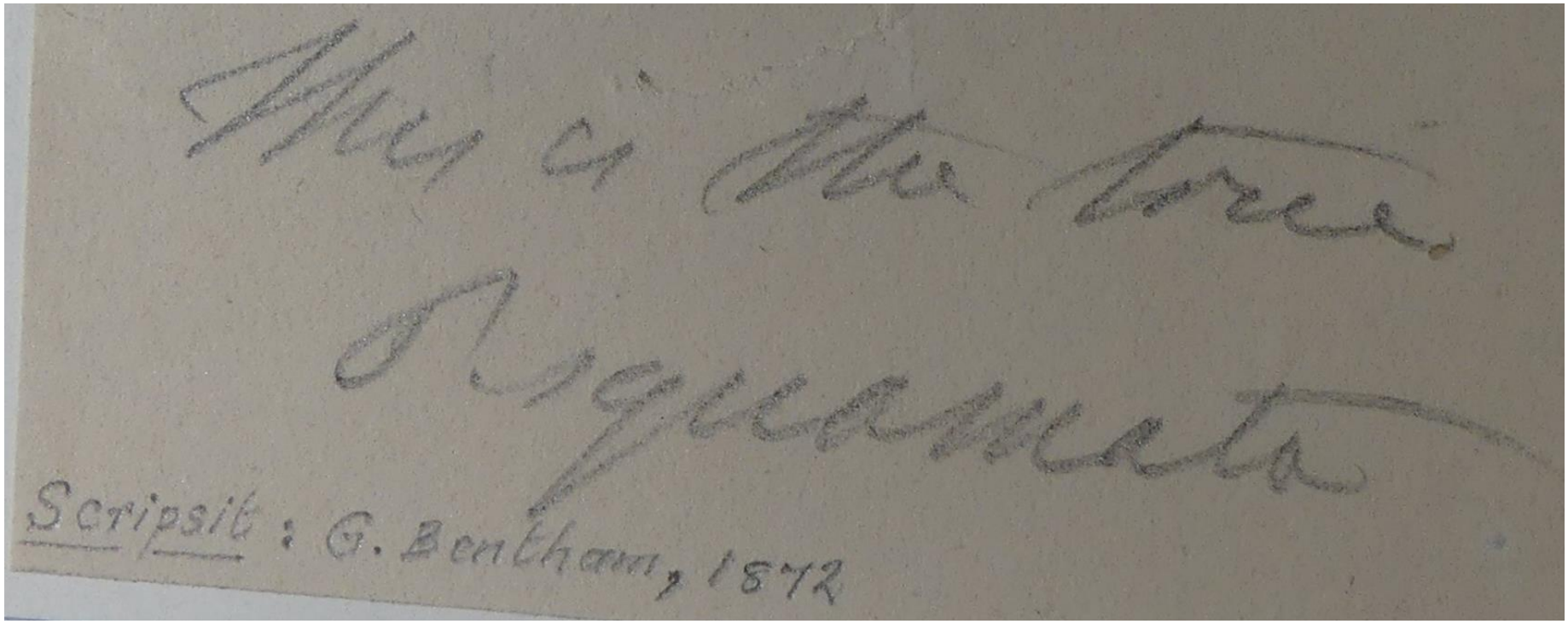


Robert Brown's handwriting?

By contrast Brown's *Pterostylis squamata* type collection is one specimen sheet containing 2 plants, and a detached flower, from '*Table Mountain'* (aka Mt Wellington), Tasmania, of which plant 'a' was in 1987 designated by Mark Clements as the isolectotype. It is 5.5 cm tall and has 6 broad leafy stem bracts, the ends of which overlap and resemble the overlapping scales on reptiles or fish.

In 1873 the English Botanist George Bentham lumped into *Pterostylis rufa* all the then known species of the broader Rufa Group or Rustyhoods with the grudging exception of a few principal forms that had been described as species, *P. squamata* being one such exception, which he distinguished from *P. rufa* by 'its *scarious empty scales more numerous'*.

Then he makes his mistake. In describing *P. squamata* he refers to a specimen with '*fewer empty scales'* from Tasmania collected by **C. Stuart**. That specimen is still held at the Melbourne Herbarium. It contains one plant 25 cm tall with 6 narrow well-spaced (remote) stem bracts. The specimen sheet containing the plant with remote stem bracts still has Bentham's 147 year old hand written note, viz: '*This is the true P squamata*'



Since then plants with well-spaced (remote) stem bracts have been included in *P. squamata* ignoring the fact that they lack the one characteristic that distinguishes them from *P. rufa*, namely overlapping stem bracts.

Recent Taxonomy of *Pterostylis squamata* and *P. rufa*

In 1986 J. A. P. Blackmore & S. C. Clemasha placed *Pterostylis squamata* in *P. rufa* (as a synonym) referencing plants from NSW, Victoria (including Greensborough), and Tasmania. They relied on poor quality black and white photos of the *P. rufa,* and *P. squamata,* types sent from England. The photo of the *P. squamata* type with only a short part of the stem showing. They noted but did not address the distinction Brown made in relation to the spacing of the stem bracts.

Mark Clements (in Australian Orchid Research Vol 1, 1989) reinstated *P. squamata* as a species citing Brown's description and type, but qualified that by adding*: 'An extremely rare and distinctive species that appears confined to the southern part of Tasmania…'*. He nominated plant 'a' on Robert Brown's British Museum's type specimen BM000062855 as the Isolectotype.

One assumes the distinctive feature he refers to is the scarious overlapping stem bracts on both plants on this specimen sheet. It is significant that in 1988 Clements determined a Tasmanian specimen of 2 plants with scarious overlapping stem bracts, and a very good match for Brown's type, to be *Pterostylis squamata* (**Archers specimen**).

In my opinion Clements reinstatement of *Pterostylis squamata* as an extremely distinctive rare species from southern Tasmania, with, by inference from all of the above, scarious overlapping stem bracts, is the correct interruption of *P. squamata* as described by Robert Brown. That being the case those plants currently considered to be *P. squamata* but lacking scarious overlapping stem bracts are, in a strict sense, *P. rufa*, by virtue of Blackmore & Clemasha's placing them as a synonym of *P. rufa.* That is until someone describes them as something else.

This interpretation has been overlooked or ignored by Australian Herbaria and orchidologists resulting in the perpetration of Bentham's mistake 147 years after it was made.

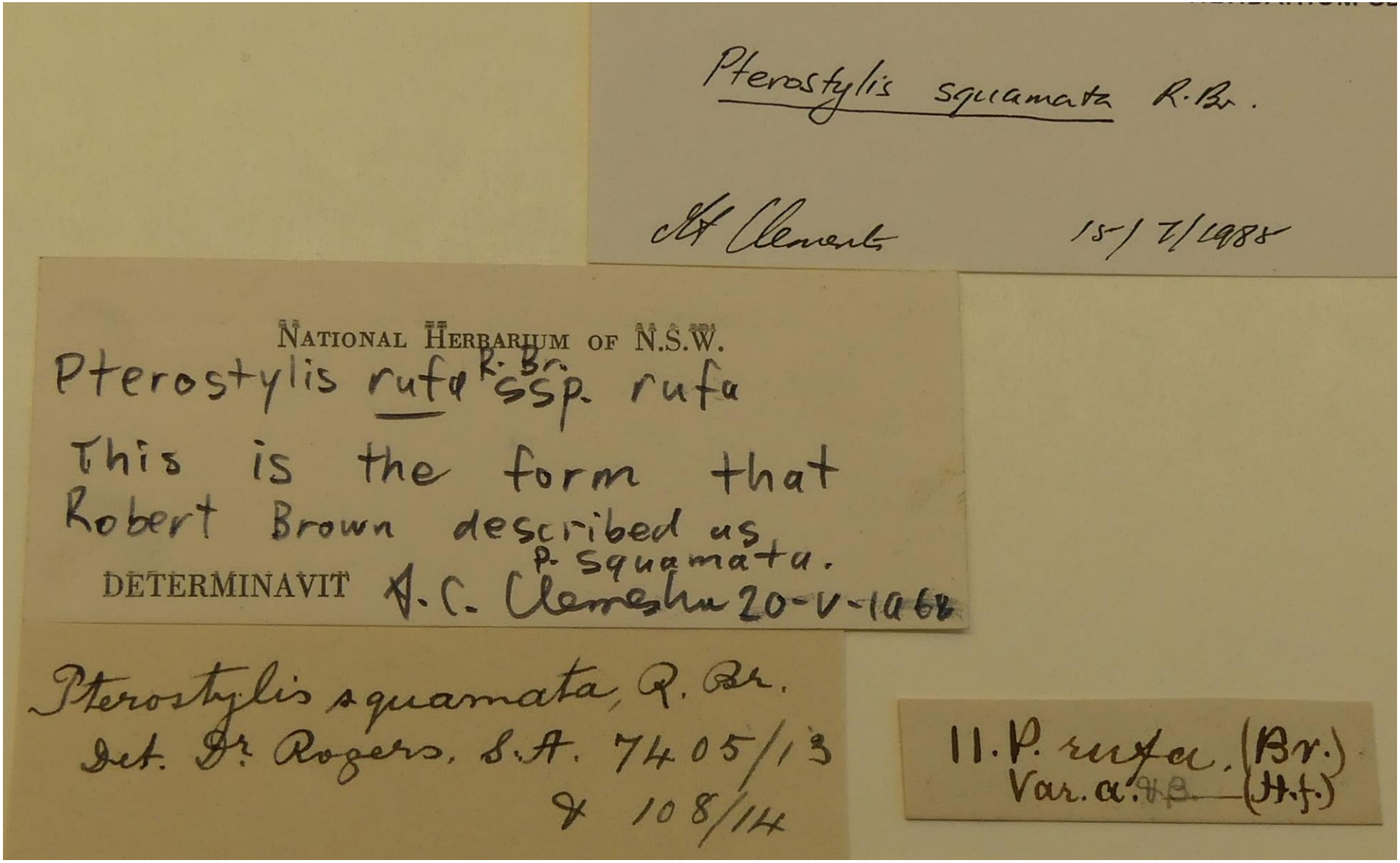
Above, left: Brown's *P. squamata* collection. BM000062855, Mt Wellington Tas. Both ~6 cm tall. 'a' Isolectotype. Tas. Leafy 'scales overlapping'

Archers' specimens. Tas. 14.5 & 8 cm tall. Left leafy 'scales overlapping'. Right scales broken off. (NSW 652172)

One of Brown's collection of *P. rufa.* Sydney. 12 cm tall 'scales remote' (NSW 124685)

Stuart's specimen. Bentham's 'true squamata' 24 cm tall 'scales remote' (MEL 27297)

The handwritten determinations on Archer's specimen a piece of potted history confirming that Dr Rodges, Mark Clements and is that S.C. Clemasha, determinations that it is a good match for Brown's *P. squamata.*



To recap, based on the taxonomy I have described:

1 Tasmanian plants with scarious overlapping stem bracts are *Pterostylis squamata sensu stricto,* by virtue of Brown's description distinguishing them from *P. rufa*, and Clements reinstatement of such plants (as Brown's *P. squamata*) to species level.

2 Mainland and Tasmanian plants with well-spaced stem bracts are *P. rufa*, by virtue of Blackmore & Clemasha's paper including them in *Pterostylis rufa*, unless and until described as something different.

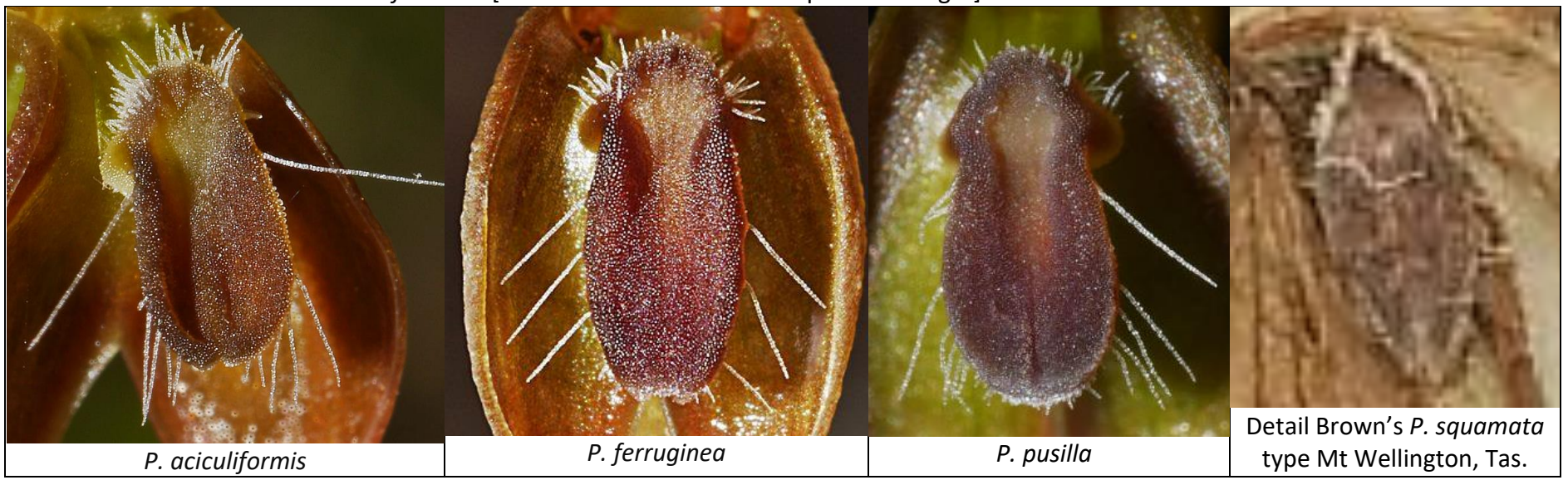
Should Mainland and Tasmanian plants with well-spaced stem bracts, currently considered to be *Pterostylis squamata,* be left in *P. rufa*, or is there sufficient justification for describing them as a new species?

To allow examination of that question and to avoid confusion, I will continue to identify plants in the wider Sydney region (say Newcastle to Nowra) matching Brown *Pterostylis rufa* type collection as *P. rufa; and,* somewhat similar plants in Victoria, southern NSW and Tasmania with well-spaced stem bracts considered by most authorities to be *Pterostylis squamata as* ***Pterostylis 'bentham'.***

Unlike most other members of the wider Pterostylis Rufa Group and, Genus such as *Caladenia*, where the labella of individual species, are usually species specific, the labella of the species of the small rufa group species I have nominated are all but identical.

The characteristics by which they are distinguished are a combination of colour, size, the shape of the lateral sepals, the length and form of the of the narrow, extended tips of the sepal ends (**free points**), and other similar, and all reasonably variable, characteristics. Therein lies the difficulty in distinguishing these species.

P. rufa [All these M or C Rowan except bottom right] *P. 'bentham'* unusual colour form



P. aciculiformis *P. ferruginea* *P. pusilla* Detail Brown's *P. squamata* type Mt Wellington, Tas.

All have almost identical shaped labella and side bristles. Whilst bristle arrangement across the top of the base varies on all, all are more or less reasonably dense, save that on *P. pusilla* they usually sparse. Brown's *P. squamata* type specimen may look different, but it is much the same if one allows for desiccation and shrinkage in a 200 year old specimen.

P. rufa

P. 'bentham'

P. aciculiformis, Grampians

P. aciculiformis, Enfield

P. feruginea, Tallageria

What is the difference?

P. feruginea, Tallageria

P. pusilla, Talbot

P. rufa & *P. ''bentham'* with short rudimentary free points. *P. aciculiformis, P. feruginea* & *P. pusilla* with longer free points. [All these Rowan]

P. squamata sensu stricto is much the same as *P. rufa* and *P. 'bentham'* but is distinguished by its broad leafy overlapping stem bracts.

P. aciculiformis and ***P. ferruginea*** are distinguished from *P. rufa, P. 'bentham'* and *P. squamata sensu stricto* by their longer free points which, along with the upper margins of the lateral sepals, are rolled in and may have solid round tips. However, distinguishing between (a) *P. rufa* and *P.'bentham'* and between (b) *P. aciculiformis* and *P. ferruginea* is difficult.

P. pusilla is readily distinguished from all of the others by the well rolled-in upper margins of the lateral sepals, the lateral sepals narrower than the galea, its smaller flowers, thin flower stem, and usually a sparse cover of bristles across the top of the labellum and the free point ends solid round formations. Colour a darker emerald green with olive to tan highlights on labellum and free points, often some olive striping.

Pterostylis rufa **and** ***P. 'bentham'*** **compared**

As noted, the main morphological features of *P. rufa* and *P. 'bentham'* are very similar. The essential differences as I see them is that *P. rufa* flowers, taken as a whole, have fewer, darker and smaller tepal windows its flowers an overall rusty red tinge whilst most *P. 'bentham'* have a rusty orange tinge. However, with both, there is variation in window form/incidence; and some plants of both are mostly green, or green with brown/olive striping and infusions.

Pterostylis rufa is said to have longer pedicles and flowers that nod compared to *P. squamata's* and its flowers described as semi-erect (see NSW FloraOnline and VicFlora) but as the bud matures into a flower then finishes, the length of the pedicles lengthens, and the posture of the bud/flower alters from erect to nodding.

In long good seasons some *P. 'bentham'* will continue to grow on and add buds. Some grow to 50+ cm tall with up to 15 flowers. I have no evidence of that growing on occurring with *P. rufa.*

See also Endnote Table comparing *Pterostylis rufa*, *P. 'bentham'* and *P. ferruginea*

Pterostylis pusilla

All *P. pusilla*			
			
[Rowan]	Broken Bucket	Wyperfeld West	Red Bluff Track

P. pusilla is usually a short rather spindly plant with smaller flowers, shorter thicker free points, and a small rosette. Its lateral sepals concave with the outer margins noticeably well, but very loosely, rolled in. Unflattened this characteristic gives them a long narrow, lanceolate, appearance and a width narrower than the galea. It usually has a less hairy labellum, sometimes with hairs and bristles almost absent from the top of the base. Its colour a darker shade of green with orange or reddish/brown highlights, *P. pusilla* typically growing to 8 to 12 cm tall, but in a good season some may grow to a rather spindly ~25+ cm.

Distribution: Bush Gems has it as spread widely but sporadically across north central Victoria from Wangaratta into South Australia. It extends further into low rainfall regions than the other *P. rufa* complex species considered here.

Pterostylis aciculiformis* and *P. ferruginea (The name aciculiformis a reference to this species needle like sepal free points)

Part Lectotype *P. aciculiformis*, Clysdale Vic. 20.5 cm tall. Sepal free points: Lateral ~5.5 mm. Dorsal ~ 3mm (Both at same scale)

Part Holotype *P. ferruginea* Yellow Gum Woodland Padthaway, SA. 23.5cm tall. Sepal free points: Lateral ~3 mm. Dorsal ~2 mm

Note there is no difference in the size of the flowers and plants, the difference is the length of the free points.

Above & leftt: *P aciculiformis*. Enfield. Rowan
The Enfield plants are extremely variable.

Above, right: P. ferruginea, Wolsely, S.A. (~30km west of Kaniva) June Niejalke

The above match the type specimens, but there are many that don't, such as a different plant from Enfield a better match for the *Pterostylis ferruginea* type.(left, Rowan). Contrast that withRussell Stanley's *P. aciculiformis* from Glenalbyn (right)

Questions:
Are *Pterostylis aciculiformis* and *P. ferruginea* separate species?
If so how does one distinguish them? OR

Are they all *P. aciculiformis?* That is, is *P. aciculiformis* an extremely variable species? OR

Are they all part of a broader *P. rufa* species complex?

Judge for yourself.

Glenalbyn as *P. aciculiformis* (near Inglewood). Russell Stanley

Until recently I took the view that *Pterostylis aciculiformis* and *P. ferruginea* were different species distinguishable in a number of significant ways. Such as:

	P. aciculiformis	***P. ferruginea***
Colour	Most often two main colours, viz: Lateral sepals a reddish brown to orange, rest of flower/plant mostly green with galea free points reddish brown and occasionally other parts with reddish brown hues. Some all a brighter mid green.	Lateral sepals and petals and galea free point a coppery reddish brown, rest of flower/plant usually green often with coppery hues. Some all emerald green. Rosettes often drying to a coppery colour.
Glossiness	Grainy semi-gloss	Glossy shiny
Bracts	Typical of complex – most hugging stem and pedicle, some looser and leafier.	Leafy, often only partly and loosely hugging stem and pedicle. Usually not dried out at anthesis.
Free points	Lateral sepals; free points longer thinner, needle like, usually > 4 mm. Galea free point a distinctly longer needle point usually > 3 mm often, but not always, upturned.	Lateral sepals; free points shorter thicker, less tightly rolled usually <3mm. Galea free point rudimentary typically around 2mm.
Petal Flanges	Usually narrower, particularly the bulge near the base, but varies to broader.	Usually broader, particularly the bulge near the base, but varies to narrower.
Habitat	Variable	Yellow Gum (*Eucalyptus leucoxylon*) stands

However, I found so many exceptions to this assessment to render it unsound.

Pterostylis aciculiformis as generally understood grows in a variety of habitats, whilst all occurrences of *P. ferruginea* I know of are in stands of Yellow Gum (*Eucalyptus leucoxylon*), and are usually fairly robust plants. Yellow Gum stands in semi-arid places like the Little Desert grow in soil over water-retaining clay depressions. These places are rich in species including orchids.

In several places in the Little Desert what I have taken to be *Pterostylis aciculiformis* grow in sandy mallee habitat in the vicinity of stands of Yellow Gum containing what I have taken to be *P. ferruginea.* The *P. aciculiformis* puny plants in comparison. But apart from size I have trouble separating them morphologically.

Further not all plants considered to be *Pterostylis ferruginea* growing in Yellow Gum stands have short free points, and not all taken to be *P. aciculiformis* growing in other habitats have the relatively longer free points and thus true to the type specimens of both, as the following photos show, as does perusal of photos of both in Bush Gems and Misha and Colin's http://www.retiredaussies.com/ .

Brisbane Ranges with coppery tones and short(*P. ferruginea* like?) free points; presumably *P. aciculiformis*?

Nearby Barrabool with longer needle like free points fairy typical of *P. aciculiformis*

Brisbane Ranges similar plant with short free points. Green colour form.

P. ferruginea copper tonings colour form with short free points Kaniva South

Longer Free Points

Both *P. ferruginea* Kaniva South
The rosettes of *P. ferruginea* often drying to a coppery colour still apparent on dried specimens

P. ferruginea Kaniva South Green colour form

Part specimen (CANB632424.1) as *P. ferruginea* Banghan CP, SA. One plant 31cm tall. Needle-like sepal free points: Lateral ~5 mm, Dorsal ~2.3 mm. Closer to the *P. aciculiformis* type specimen.

PHOTOS

Oligochaetochilus aculeatus (only in MS) in Native Orchids of South Australia 2007 but not later editions.

Bates 2007 P. aff. aciculiformis Adelaide Hills, SA

Rowan SE Sth. Aust.

Rowan Grampians

A furphy?

All "The Yellow Gum", Urimbirra Co-op, Miram South, Little Desert

Narrow lateral sepals with longer needle like free points, but unusual thicker leafier stem. = *P. pusilla*?

Above: Shorter thicker lateral sepal free points, rudimentary dorsal free points, distinct copper colouring = *P. ferruginea* ? **Below:** *P. cheraphila*

Above and below: Much the same as plant on left above but with 2 biseta like forward pointing bristles places it as a *P. ferruginea X P. cheraphila* hybrid

Pterostylis praetermissa, Mt Kaputar, NSW. Gary Backhouse.

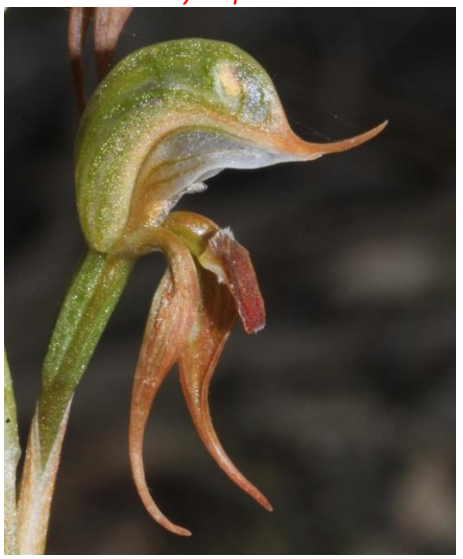
1 *Pterostylis praetermissa*

2 *Pterostylis praetermissa*

Pterostylis aciculiformis Glenalbyn, Russell Stanley

3 *Pterostylis aciculiformis*

4 *Pterostylis praetermissa*



5 *Pterostylis aciculiformis*

6 *Pterostylis praetermissa,*

7 *Pterostylis aciculiformis*

Pterostylis praetermissa is distinguished from *P. rufa* by its longer needle like free points, rather like *P. aciculiformis.* By comparison, the labella on some of the *P. praetermissa,* appears to be relatively longer/narrower, the apex more rounded, than *P. aciculiformis.* There is considerable variation in the size of the flowers; the height of its flowers; and other characteristics in specimens determined as *P. praetermissa* held at the NSW and Qld Herbaria. There is some conjecture that there is more than none species involved. I should stress that I have not read the description of *P. praetermissa* sighted the holotype nor conducted a proper comparison of it with *P. aciculiformis,* I am not asserting *P. praetermissa* and *P. aciculformis* are the same species, simply noting their similarities.

Comparison of similar sized specimens of Pterostylis aciculiformis* and *P. praetermissa

Part Lectotype *P. aciculiformis*, Clysdale Vic. 20.5 cm tall. Sepal free points: Lateral ~5.5 mm. Dorsal ~ 3mm (Both at same scale)

Part Isotype *P. praetermissa AQ643826*
20 cm tall. Sepal free points: Lateral ~4 mm. Dorsal ~2 mm

Endnote Table

COMPARISION : Determined specimens of *Pterostylis rufa, P. squamata* (so called) and *P. ferruginea*

	No	Height	Longest	Sterile	Flowers	Galea	Ovary #2	Pedicle #2	Labellum	Lat Sep F/P
P rufa P. squamata	Plant	<cm>	Leaf	Bracts #1	+ Buds	No FP	<-mm->		Length	length #3
Specimens - Brown's P rufa type collection										
Number counted	53	53	43	37	52	43	43	43	19	43
Average		**13.12**	**1.88**	**2.68**	**3.06**	**9.51**	**6.73**	**6.85**	**3.58**	**1.99**
Highest		**21.50**	**3.00**	**5.00**	**9.00**	**12.00**	**10.00**	**12.00**	**4.00**	**3.00**
Lowest		**8.00**	**1.00**	**2.00**	**1.00**	**9.00**	**5.00**	**5.00**	**3.50**	**1.00**
Specimens - MEL as P squamata (so called)										
Number counted	43	43	28	42	37	74	74	74	46	65
Average		**16.40**	**1.79**	**3.19**	**4.84**	**8.90**	**5.97**	**5.34**	**3.66**	**1.92**
Highest		**32.00**	**3.00**	**6.00**	**7.00**	**11.00**	**8.00**	**13.00**	**4.00**	**3.50**
Lowest		**6.00**	**1.00**	**2.00**	**1.00**	**7.00**	**4.00**	**1.00**	**3.00**	**1.00**
Difference in average		**-3.27**	**0.09**	**-0.51**	**-1.78**	**0.61**	**0.77**	**1.51**	**-0.08**	**0.07**
P Rufa + larger - smaller		**-24.9%**	**4.9%**	**-19.2%**	**-58.2%**	**6.4%**	**11.4%**	**22.1%**	**-2.2%**	**3.5%**
COMPARISON *P. squamata* (so called) as above & *P. ferruginea*										
Specimens - P. ferruginea **CANB & MEL**										
Number counted	30	30	21	30	31	50	50	50	29	43
Average		**16.55**	**2.06**	**2.53**	**4.40**	**9.17**	**6.70**	**7.45**	**3.75**	**3.07**
Highest		**30.00**	**4.50**	**5.00**	**11.00**	**11.00**	**10.00**	**13.00**	**4.00**	**4.50**
Lowest		**7.00**	**1.00**	**1.00**	**2.00**	**6.00**	**4.00**	**2.00**	**2.00**	**2.00**
Difference in average		**-0.15**	**-0.27**	**0.66**	**0.44**	**-0.27**	**-0.73**	**-2.11**	**-0.09**	**-1.15**
P squamata + larger - smaller		**-0.9%**	**-15.1%**	**20.6%**	**9.1%**	**-3.0%**	**-12.3%**	**-39.6%**	**-2.6%**	**-59.9%**

#1 Not always clear if lowest bract present. All plants had well-spaced sterile bracts save one MEL with 4 close but not touching.

#2 **One needs to allow for the fact that pedicles and ovaries lengthen as a flower matures**. My source data clearly shows that typically the lowest flower has the longest pedicle, and ovary, the top the shortest.

#3 I only measure the narrowest fully rolled-in (filiform) parts as free points. The lateral sepals of dried specimens tend to roll in exaggerating length of free points. Also, tips can break off. Where obvious adjustments are made, or not counted.

P rufa, P. squamata

In this sample the height, number of flowers, galea, and lateral sepal free points, are much the same as is their range. The main differences are that *P. squamata* (so called) as a population grows taller with more flowers and sterile bracts and marginally shorter pedicles and ovaries. However the ranges of the flower and bract numbers, and pedicle length are similar.

P. squamata, P. ferruginea

In this sample, height, the length of the labellum and the galea without its free point, are much the same. The stand-out difference is that the lateral sepal free points of *P. ferruginea* are on average 60% longer. *P. ferruginea* has longer pedicles and marginally (a) a longer leaf; (b) fewer sterile bracts; and (c) fewer flowers; however the ranges of these are similar.