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Volume 4, 2002

A review of *Pterostylis* (Orchidaceae) (including Supplement, 2002)

David L Jones & Mark A Clements

The Australian Orchid Foundation

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by

David L. Jones & Mark A. Clements

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FRONT COVER PHOTO: ***Diplodium revolutum*** from Kangarooby, New South Wales. (C2)
REAR COVER PHOTO (top): ***Diplodium coccinum*** from Bowral, New South Wales. (C4)
REAR COVER PHOTO (bottom): ***Diplodium hamiltonii*** from Wagin, Western Australia. (C5)

David L. Jones

David Lloyd Jones was born at Mont Albert in Victoria in 1944. Early days at Balwyn were spent in nearby Beckett Park and exploring the wonderful collection of native plants in the iconic Maranoa Gardens. School holidays were enjoyed with an elderly garden-loving aunt at The Basin in the Dandenong Ranges where first involvements with native orchids and bushfires were experienced. Knowledge gained at Burnley Horticultural College, where David met Barbara, the sunny lady who was to share his passion for plants and life, was expanded and diversified by a degree in agricultural science at the University of Melbourne which was supported by a cadetship gained from the Department of Agriculture.

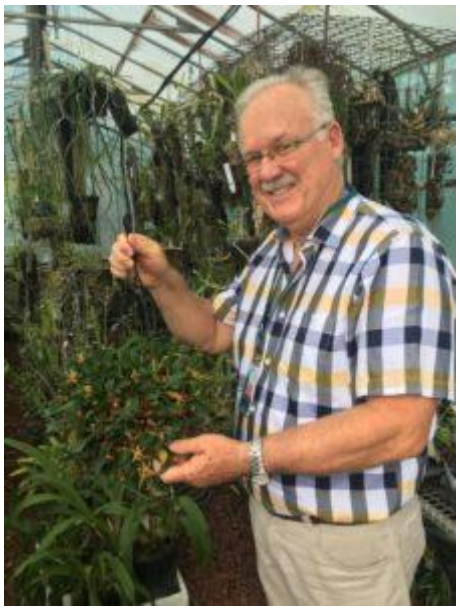
After graduating from university in 1968, his research work at the Scoresby Horticultural Research Station in Victoria involved the introduction of fruit cultivars from overseas, introduction and establishment of miscellaneous fruit crops, including blueberries, Chinese gooseberries and feijoas, grafting and nutrition of ornamental plants and the identification and testing of alternative materials for nursery potting mixes with the late David Nicholls. In 1978 the family moved to Queensland opening Eugenia Park Nursery in the Currumbin Valley, growing hardy coastal plants and bringing many rainforest species into cultivation. This was followed by a stint as a horticultural research officer at the Australian National Botanic Gardens in Canberra and then as research scientist in the Orchid Research Group at the Centre for Plant Biodiversity Research established within CSIRO.

A challenge in his teens by a nurseryman that “native orchids are impossible to grow” stimulated him to pioneer cultivation techniques for native terrestrial orchids that are the basis of those in use today. A plentiful supply of displaced plants from Melbourne’s encroaching urban sprawl fuelled the early growing experiments and stimulated his natural botanical curiosity. Corresponding with like-minded enthusiasts in other areas revealed different morphological interpretations between species in different parts of the country. This led to a very successful research program involving a network of licensed collaborators forwarding fresh specimens and for the first time allowing direct comparison between taxa from different areas and habitats. A rewarding simple process that revealed large gaps in our knowledge of native orchids and also resulted in the recognition of numerous new species. Following his first new species, *Pterostylis aestiva* in 1972, David has described more than 370 species of native orchids that have come to his attention from his network of contacts or travels in the bush. He also prepares detailed botanical drawings of native orchids and writes prolifically, sharing his knowledge of plants through books and other publications.

In 1991, David was awarded the Victorian College of Agriculture & Horticulture medal in recognition of his outstanding contribution to the Australian ornamental horticultural industry. In 2001 he was presented with the Australian Orchid Foundation’s prestigious ‘Award of Honour’ in recognition of his enormous contribution to the study of orchids in Australia and internationally. David served as a member of The Australian Orchid Foundation, Research Committee from its inception in 1977 to 2009; and as its Chairman from 1981 to 2002. In 2004 his contribution to orchid taxonomic research, while at the Centre for Plant Biodiversity Research was recognised when he was a finalist in the Australian Museum’s esteemed Eureka Prize for Biodiversity Research.

David's contribution to orchid research and education through his many publications has been considerable. In 1988, he published *Native Orchids of Australia*: a comprehensive coverage of Australia's then known orchid flora. In 2006, he followed with the expanded *A Complete Guide to Native Orchids of Australia including the Territories* with colour photos of each species. And in 2021, David produced a third and comprehensive edition: *A Complete Guide to Native Orchids of Australia.*

Dr Mark A. Clements



Mark Clements is an Australian botanist born in 1949. His career spans four decades and in that time, he has discovered about 250 new species of Australian orchids and curated tens of thousands of specimens representing more than 1600 species of Australian native orchids. These specimens are housed in the Australian National Herbarium.

Mark grew up in Largs Bay in South Australia, on the Le Fevre Peninsula about 16 km northwest of Adelaide city centre. Mark's father was an analytical chemist who had extensive general knowledge, particularly in natural history. He was also a keen grower of native orchids. With this background, Mark developed his own interest in natural history, and orchids in particular, from 10 years old. Mark attended Urrbrae Agricultural High School in Adelaide. During his high school years, he completed a preliminary course in Wool Classing at the Adelaide Institute of Technology. On leaving school he undertook and completed the course and was awarded a Certificate in Wool Classing.

Between 1968 and 1974, Mark continued his training and development as a professional wool classer. Over this period, he worked with various shearing contractors, totalling 84 shearing sheds throughout South Australia, western New South Wales, Victoria and at the edge of the Nullarbor in Western Australia. On weekends, on mainly mostly remote sheep stations and properties, Mark spent much of his spare time studying birds, plants, the geology and searching for indigenous Australian artifacts. These interests led him to volunteer to undertake work at the South Australian Museum, Anthropology Department during the periods when wool classing work was not available. During this time he helped curate some of their natural history collections.

It was in this Museum environment that Mark's desire to expand his interest in natural history studies, and orchids in particular, became clear. His interest in orchids had also grown significantly during this period, firstly through association with a group of field naturalists and orchid growers with like interests, in particular Ray Nash, and secondarily through study of W.H. Nichols' book on Australian Native Orchids, co-incidentally co-edited by David Jones (see below). To pursue his interest in orchids and natural history, Mark decided to move to Canberra. Following a meeting with John Wrigley, who was the curator of the Australian National Botanic Gardens (ANBG), Mark was offered a job as a gardener. By this time, Mark had developed an interest in the symbiotic relationship between mycorrhiza and the germination of orchids, having observed the development of orchid protocorms following germination from seed in pots of terrestrial orchids he was growing at home.

After a couple of years working as a gardener, an opportunity to work with the research team at the Gardens became available. He also commenced study for a science degree at Canberra University. Mark took up the position in the research laboratory at the ANBG and immediately commenced work on trying to isolate mycorrhizal fungi from wild orchids, and then germinating seeds of those species in vitro. Fortuitously the first trials worked and in 1977 he achieved the successful germination of the threatened terrestrial orchid *Diuris fragrantissima* (or *D. punctata* var. *albo-violacea* as it was then called). Many other native orchids were successfully germinated during this

early phase. Soon after, wanting to learn more about the nature of the relationship between orchids and their mycorrhizal partners, at the invitation of Professor Denis Carr at the Australian National University, Mark started a collaboration looking at this aspect of orchid biology. He found that some cells harboured fungal growth while others didn't. Mark also found that most species studied had a preferred fungal partner.

In 1981, Mark attended the 10th World Orchid Conference in Durban, South Africa. He gave a presentation on his work entitled "Propagation and re-introduction of endangered orchids of Australia". While at the conference, Mark met Dr Phillip Cribb, Curator of Orchids at the Royal Botanic Gardens, Kew, England. Dr Cribb thought that Mark's methods might be able to solve some of the problems that scientists were facing with threatened orchids in the United Kingdom. Mark was invited (seconded) to the Royal Botanic Gardens, Kew as the Sainsbury Orchid Fellow to work on the propagation and re-introduction of five endangered United Kingdom orchids. After first completing an honours degree at the Australian National University, Mark started work at RBG, Kew in 1983. One of the first things he realised was that the laboratory protocols being used for the germination and propagation of orchids were not adequate. He changed the protocols and turned his attention to England's infamous lady slipper orchid *Cypridpedium calceolus.*

Cypridpedium calceolus had been harvested from the wild for flower markets since Victorian times until only a single plant remained in Yorkshire. Possibly hundreds of years old, this plant had held the title of last survivor for at least 30 years and was protected by security guards during its growing and flowering season. Despite concerted efforts, no-one had been able to propagate it. Mark used his knowledge of orchid biology and, in 1984, was able to finally initiate germination of the lady slipper beginning the process that would save the species from possible extinction. Mark also successfully germinated other European orchid species such as *Orchis militaris, Anacamptis morio* and *A. laxiflora* and instituted the protocols for their establishment and maintenance in cultivation with the aim of re-establishment in the wild.

During this visit to Kew, at the request of Dr. Cribb, Mark studied most of the original collections of Australian orchid species, and historical sketches of 'Lindley's herbarium collection', and visited the British Museum of Natural History which contained original specimens collected by Robert Brown and drawings by Ferdinand Bauer during Matthew Flinders circumnavigation expedition of Australia. Using this data, Mark was able to solve many taxonomic issues with Australian orchids.

Throughout his career, Mark contributed to many revisions of the classification of Australian orchids. He wrote the Checklist of Australian Orchids and then re-wrote another volume called the Catalogue of Australian Orchidaceae. On the basis of his studies at the RBG, Kew, he commenced research on *Dendrobium*. As a significant part of this research, he visited herbaria and museums in Europe to locate, study and photograph many of the type collections of Australian orchids and many *Dendrobium* species. It was during this period that his collaborative research partnership on Australian orchids with David Jones commenced. Together David and Mark have authored numerous papers, CDs, and reformed the interpretation of the biodiversity and extent of Australian orchids – and identified many new orchid species.

After returning to Australia, Mark began his PhD studies on the embryology of orchids. His thesis was entitled 'Reproductive Biology in relation to phylogeny of the Orchidaceae, especially the tribe Diurideae.' Mark was also a pioneer of molecular systematics of Australian orchids. He not only prepared classic samples for the Australian National Herbarium collection but had the foresight to store orchid specimens in silica gel, making them suitable for molecular analysis.

Aside from undertaking field work in Europe whilst at the RBG, Kew, to study European orchids, on returning to Australia, Mark participated in a series of expeditions to study species related to Australian orchids, in particular *Dendrobium* and *Pterostylis*, in Borneo, New Guinea, New Caledonia, Vanuatu and New Zealand. One of Mark's many career highlights was undertaking research on the translocation of three threatened species, including the Eastern Australian Underground orchid, *Rhizanthella slateri,* for the New South Wales government Bulahdelah Bypass, Pacific Highway project. This was one of a string of projects in which Mark's expertise on Australian orchids was sought on the conservation of threatened orchid species.

Mark has worked collaboratively with many scientists throughout his career, both overseas and in Australia. Since 2010, Mark worked in a strong partnership with Dr Katharina Nargar, at the Australian Tropical Herbarium in Cairns, as well as others in her team including Dr Lars Nauheimer and Dr Lalita Simpson. Together they have collaborated on major projects on the phylogenetics and systematics of Australian orchids, and others at a broader world-wide scale, specifically those in tribes Diurideae and Pteorstylidinae and Dendrobieae (*Dendrobium* and *Bulbophyllum*).

In 2016, in recognition of his lifetime of achievements and enormous contributions to the Orchidaceae family, Mark was awarded the prestigious Westonbirt Orchid Medal from the Royal Horticulture Society in the United Kingdom. The Westonbirt Orchid Medal is awarded annually to individuals for "scientific, literary or any other outstanding personal achievement in connection with orchids".

Throughout his career, Mark has authored many scientific publications, and written and contributed to several books. He is a member the IUCN Orchids Specialist Group and served as a member of The Australian Orchid Foundation, Research Committee for over 30 years (1985 – 2020). He has helped to develop a collection of hardy orchids for the horticultural industry, and has been successful in his work to re-introduce endangered orchids into areas of Australia and the UK. He has also been a lifelong mentor, inspiring many early career scientists, sharing his interest and passion with citizen scientists and demonstrating the value of herbarium collections.

Mark has progressed our understanding and knowledge of the Orchidaceae immeasurably, not just in Australia but in many countries in the world, including the UK. In early 2021, Mark retired from his position as Research Scientist at the Australian National Herbarium but continues his involvement in orchid research as an CSIRO Honorary Scientist.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***Paper by David L. Jones. Mark A. Clements & Brian P. J. Molloy**

Photo: D.L. Jones

Pterostylis* X *ingens was originally described by H.M.R. Rupp as *Pterostylis acuminata* var. *ingens* in 1928, the Type locality being Healesville, Victoria. It was then recognised by David L. Jones to be a natural hybrid between *Pterostylis nutans* and *Pterostylis falcata* and was subsequently reclassified in *The Orchadian* back in 1976. This marked the beginning of his scientific research into the Pterostylidinae.

DPB

1. A Reassessment of *Pterostylis* R.Br. (Orchidaceae)

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ABSTRACT

The historical background, classification, distribution, floral morphology, biology and ecology of *Pterostylis* are reviewed using morphological and molecular characters. A critical assessment of morphological characters, supplemented with data from studies into reproductive and pollination biology was undertaken, with many morphological features illustrated using line drawings and scanning electron micrographs. A total evidence phylogenetic analysis of morphological and ITS sequence data using *Achlydosa glandulosa, Spiranthes australis* and *Chloraea virescens* as outgroups, supports the monophyly of *Pterostylis,* as currently interpreted, while recognising 16 groups or isolated species in two major lineages within this taxon, *viz* (i) *'mutica', 'rufa', 'barbata', 'longifolia', 'vittata', 'curta', 'parviflora', 'nana', 'alata'* and *'ophioglossa'* groups and (ii) *P. recurva, P. daintreana, P. sargentii, P. bicornis, P. allantoidea* and *P. pedoglossa.* All 16 groups or isolated species are readily distinguished morphologically and on the basis of these results require recognition at some higher level. Relationships amongst the groups only partially reflect attempts at classification of the genus.

INTRODUCTION

Pterostylis is a complex aggregation of orchids which, as a group, are readily recognised by distinctive floral features. The most noticeable feature, immediately obvious from an external view of the flower, is the adherence of the inflated dorsal sepal to the petals to form a hooded galea that encloses the column. Another useful character for ready identification is the unification of the lateral sepals to form a single structure termed a synsepalum. Additionally all species in the group have an actively motile labellum, a character found in very few orchid groups.

A common vegetative feature in *Pterostylis* is for the leaves to be aggregated into a rosette, with the majority of species producing a rosette at some stage in their life cycle. The placement of the rosette relative to the flowering scape and the arrangement of the leaves within the rosette are variable and provide a useful means of grouping species vegetatively. Briefly, the rosette can encircle the base of the scape, be produced on one or more growths arising laterally from the base of the scape or be absent from a flowering plant and appear solely as a non-flowering or sterile plant (a transitional stage sometimes wrongly interpreted as juvenile plants).

No monographic treatment of *Pterostylis* has been published, although, as discussed below, there have been five attempts at classification of the group. The main purpose of this work is to provide a monograph of the taxon bringing together in one volume extensive field observations, experiences garnered from cultivation and the results of studies of herbarium collections and live plants.

This paper brings together data on the morphology of *Pterostylis* and aspects of its biology, particularly pollination ecology and breeding systems, along with the classification of *Pterostylis* in an historical context. Together these data provide the basis for the phylogenetic analysis of the group using morphological data, in part 2. Further analyses using molecular data and combined molecular and morphological data are also included in part 2, and the detailed molecular study, including investigation of internal relationships of groups, will be presented elsewhere in a more appropriate journal. In a second paper, a new classification of the group is proposed based on the results of these analyses (Jones & Clements, this volume), and a synopsis of the subtribe Pterostylidinae is presented in a third paper (Jones, Clements & Molloy, this volume).

PART 1: MORPHOLOGY, BIOLOGY AND HISTORICAL CLASSIFICATION

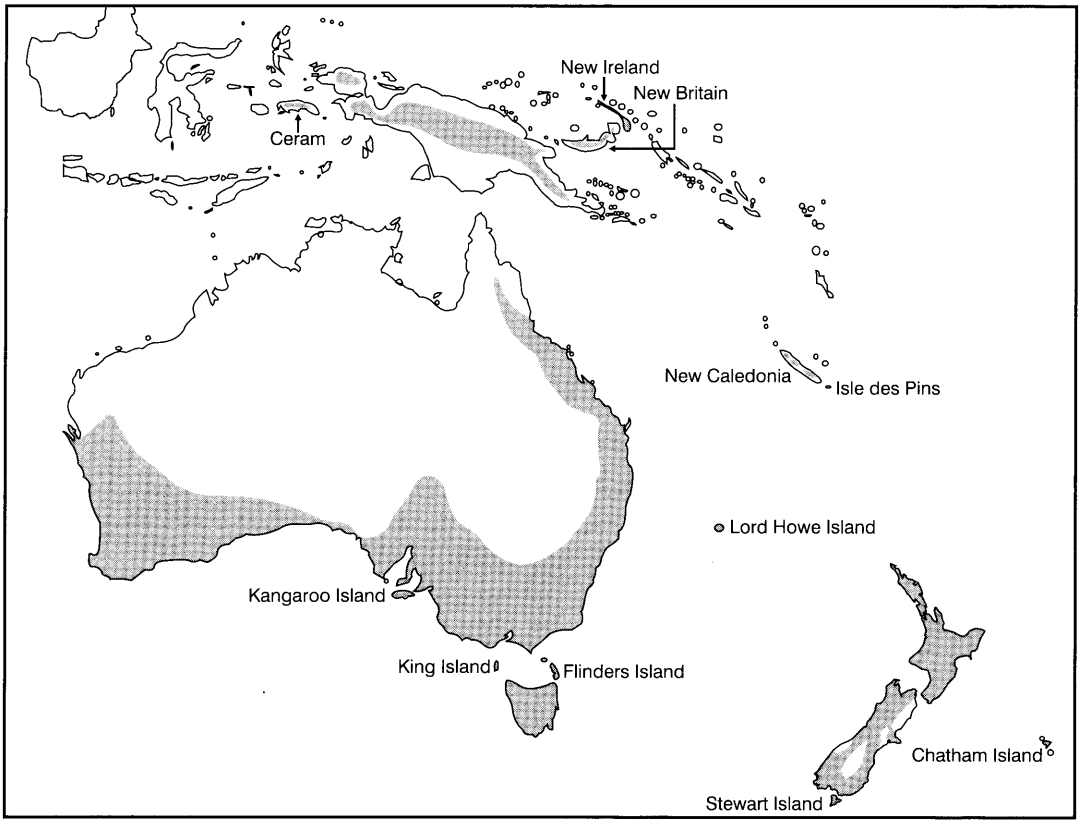
When Robert Brown described *Pterostylis* in 1810 only 19 species were known. Since then the number of species recognised has increased significantly, including some species and assemblages that do not fit the original concept of the genus as enunciated by Brown.

Number of Species

Pterostylis, as currently recognised, comprises approximately 180 named species, with another 50 species or more yet to be formally recognised. Following publication of this higher-level treatment, it is our intention to described these new species.

Distribution

Pterostylis is distributed mainly in Australia (including Lord Howe Island), but also occurs in New Zealand (including Stewart Island, Poor Knights Island and Chatham Island), New Caledonia (including Isle des Pins), New Guinea, New Britain, New Ireland and Malaku (Ceram) in Indonesia (Map 1). The genus has a broad latitudinal distribution, extending from about 1° South in the Arfak Mountains of Irian Jaya to about 47° South on Stewart Island. Species grow in a wide range of mesic and semi-mesic to semi-arid habitats and are distributed from near sea level to subalpine and alpine regions up to about 3660 m. altitude in subequatorial Papua New Guinea (Royen 1979), and from coastal districts to far inland areas.



Map 1. Distribution of *Pterostylis* sens. lat.

Diversity

The genus is most diverse in Australia where there is a strong development in southern temperate regions, including south-western and especially south-eastern areas of the continent, including Tasmania and some Bass Strait islands. A number of species occur in subtropical eastern Australia and a few species are found on the ranges and tablelands of tropical Queensland, extending north to about the Windsor Tableland. Islands off the east coast, including Moreton, Stradbroke and Fraser Island, contain species of *Pterostylis* and three Australian species extend to Lord Howe Island (Green 1994). The genus is also well developed in New Zealand, including Stewart Island, Poor Knights Island and the Chatham and Auckland Island groups, with about 30 species (Moore 1969, Moore & Edgar 1970, Johns & Molloy 1983, Jones, Molloy & Clements 1997, St George *et al.* 1996, St George 1999). Five species occur in New Caledonia (Hallé 1977, Begaud *et al.* 1995, Jones & Clements 1998, Clements & Jones 1999), including the Isle des Pins. Diversity in Melanesia is not particularly rich, but four species are described from the islands of New Guinea, New Britain and New Ireland (Royen 1979) and Malaku (Ceram) in Indonesia (Smith 1928).

Habitat

Pterostylis species are basically tuberous geophytes (rarely facultative epiphytes) which occupy an extensive range of diverse habitats, especially in temperate regions. These include

coastal scrub, heathland, heathy forest, wet sclerophyll forest, rainforest, rainforest margins, dry sclerophyll forest, woodland, mallee communities over both sand and limestone, granite outcrops, shrubland, grassland, montane forests and alpine and subalpine moorland. Within these various plant communities *Pterostylis* species can be found growing in or on the margins of swamps, peaty bogs, sphagnum mounds, hummocks, slopes and ridges, gullies, embankments and beside streams. Some species may be found growing on rotting logs and the living fibrous trunks of tree ferns, or on moss-covered trunks and large branches of rainforest trees in New Guinea (Royen 1979). A few species have extremely narrow habitat requirements. For example *P. tenuissima* is restricted to alkaline boggy soils in near-coastal swamps dominated by *Leptospermum lanigerum* (Nicholls 1969, Jones 1988, Bates & Weber 1990, Backhouse & Jeanes 1995). Another, *P. cheraphila*, is exceptional in growing in heavy textured clays and silty clays beside a stream where whole colonies may be covered during floods (Jones & Clements 1993). In fern gullies *Pterostylis pedunculata* often forms colonies in the fibrous trunks of tree ferns and occasionally also grows as a facultative epiphyte in moss pads on tree trunks. Some abundant species such as *P. aspera, P. curta*, *P. nutans* and *P. pedunculata* are known to colonise commercial pine plantations.

By contrast, in tropical regions species of *Pterostylis* are restricted to tablelands and mountains where the extremes of heat and dryness are greatly reduced during the day, and with markedly cooler nights than in the lowlands.

Distinctive groups of *Pterostylis* occur in drier inland and semi-arid regions of Australia where rainfall is low and irregular. Here they are nearly always found in well-drained sites and are often associated with rocks, occurring in such situations as stony slopes, rock outcrops, domes, ironstone breakaways, jump-ups, gorges and escarpments. In these situations the plants commonly grow in rock crevices or on rock sheets and platforms where run-off is concentrated (Jones 1988, French 1995). Often the vegetation on these sites is sparse and low, but usually the orchid plants gain some additional shelter from shrubs and grass tussocks. Many species of inland regions also grow in sandy soils, particularly those supporting native pines (*Callitris* spp.) and Broombush (*Melaleuca uncinata*), and in terra rossa soils over sheet limestone, usually under spinifex (*Triodia* spp.) or in mallee (*Eucalyptus* spp.) communities.

Ecology

Pterostylis species are restricted to regions with a seasonal climate and the plants exhibit distinct periods of active growth, flowering, seed production and dormancy. Dormant periods coincide with climatic extremes of heat or long dry spells and the plants persist as individual small, fleshy, naked tubers. These tubers can survive periods of two or three months and sprout when conditions become favourable. Dormant periods are less regular, shorter and less pronounced in species from the tropics and subtropics. In these regions plants can cease growth and become quiescent while still retaining their leaves, and growth and flowering can be stimulated sporadically by prevailing conditions, such as heavy rain following dry periods. In tropical species such brief periods of dormancy result in new tubers often sprouting while still attached, via the stolonoid root, to the parent tuber.

Periods of erratic rainfall and long periods of low rainfall which can extend into droughts are frequent in the areas where many Australian groups of *Pterostylis* grow. These orchids are well adapted to survive such conditions, having rosettes of overlapping leaves pressed tightly to the ground. This feature is absent in all other groups and it is suggested that the leaves exert downward force on the soil surface to assist with gathering of moisture, including dew, to be channelled directly to the centre of the rosette and eventually to the tuber, and probably also to minimise water loss from abaxial stomata. In rocky situations the plants are frequently found where they gain some protection from the rocks against the excesses of sun, wind and frost or benefit from increased run off during light rain and intermittent showers. They also have the ability to shut down the production of flowers during extremes of heat or dryness and channel energy into the production of a new tuber ready for the following season. The tubers of some species, especially those growing in sandy soil, can lose water during the dormant period. This loss can be substantial, sometimes to such an extent that the tubers become soft and pliable (pers. obs. D.L.Jones), becoming turgid again with the onset of substantial rain. Once suitable conditions return the plants are able to flower and produce seed. Seedlings grow fast in favourable seasons and can reach flowering size two or three years from germination. Flowering in *Pterostylis* is distributed over most months with a concentration in spring, summer and autumn. No species is known to be fire dependent, indeed flowering is generally suppressed by hot summer fires until suitable microhabitats return.

CLASSIFICATION

Historical Background

The first recording of a *Pterostylis* was probably made by Joseph Banks on the Endeavour voyage of 1768-1771 when he visited Botany Bay between 28 April and 5 May 1770. Illustrated works of natural history drawings commissioned

by Banks (Banks & Solander 1905, Diment *et al.* 1984) include an unusual drawing of a composite of two species, three flowers of *P. revoluta* R.Br in frontal and side views together with a basal rosette, apparently of *P. acuminata* R.Br, displaying an atypical root system. Both of these species would have been in flower at the time of Banks' visit but herbarium specimens apparently did not survive the voyage. In an unpublished manuscript entitled *Plants of Novae Hollandiae* Daniel Solander, who accompanied Banks on the voyage, proposed the name *Arethusa tetrapetala* for *P. revoluta* but this name was never published (Diment *et al.* 1984). The first collection of a *Pterostylis* substantiated by a herbarium specimen was made in Australia by Jacques Labillardière in 1792 from Bruny Island in south-eastern Tasmania. In 1806 he described the species, placing it in the genus *Disperis*, as *D. alata* (Labillardière 1806). Additionally two species of *Pterostylis* were collected by John White, R.N., Chief Surgeon of the colony of New South Wales 1788-1794. Both collections are in the J.E.Smith Herbarium, which is housed in the premises of the Linnaean Society in London (Clements & Cribb 1985). These collections more than likely predate the collection by Labillardière but as both specimens are undated the record remains conjectural. There is also a collection of *P. obtusa* in the J.E.Smith Herbarium attributed to Banks with the date of 1798 which is debatable since Banks did not visit Australia in that year.

Robert Brown and George Caley were the first European collectors to recognise the distinctiveness of this group of terrestrial orchids. Caley, an active collector in New South Wales from 1800-1810, amassed some 208 specimens of this genus, in 16 species (Webb & Lister 1991a). The majority of these collections were from various localities around Sydney, but he also collected specimens from Tasmania. Caley recorded species of *Pterostylis* as "Druid's Caps", this tag name apparently arising from the strongly cucullate galea of the flowers which reminded him of the hoods worn by Druids. For each species recognised he applied a further tag name honouring botanical colleagues, patrons or some notable aspect of the taxon; for example specimens of *P. reflexa* collected by Caley have a tag recording the taxon as "Druids Cap patersoni". Caley prepared detailed descriptions of the various species he encountered and also noted habitat details, morphological variation and diagnostic differences from similar taxa. These descriptions and the accompanying details were never published.

Brown also collected species of this genus from around Sydney and in Tasmania. In 1810 he formally described the genus *Pterostylis* in his *Prodromus Florae Novae Hollandiae* (Brown 1810, Stearn 1960). Nineteen species of *Pterostylis* were described in that publication, fourteen of which were collected from locality "J" [Port Jackson], New South Wales and five from locality "D" [Tasmania]. Port Jackson, as detailed in the Prodromus, is "the neighbourhood of the colony of Port Jackson, including the banks of the river named Hunter's River or Coal River" [thus Sydney to Newcastle]. Brown and Caley may have collected together on occasions (Webb & Lister 1991b), and several of the sheets in Brown's herbarium attribute the collection to Caley. Also in the same year, Swartz (1810) described *Diplodium* to account for Labillardière's *Disperis alata* which he correctly judged to be misplaced in *Disperis*. Swartz in describing *Diplodium* also renamed the species *D. australe* in accordance with the "Kew rule" of botanical nomenclature that was widely followed at that time. *Diplodium* was subsequently submerged as a synonym of *Pterostylis* by Bentham and Hooker (1880), which is how it has appeared in all treatments of the genus since. *Diplodium* has also been cited as a synonym of *Eriochilus* in the botanical literature (Pfeiffer, 1874) based on a paper by Swartz, published posthumously and edited by Wikström (Swartz, 1829). However, there has clearly been a mix-up with the designation of footnotes to particular species on pages 50 and 51 in this publication and the reference to and presumed relationship between *Diplodium* and *Eriochilus* is completely erroneous.

From its early start, the number of species recognised in *Pterostylis* grew steadily. Alan Cunningham (1832) was the first to record the genus from New Zealand when he described *P. banksii*. John Lindley (1840a) described four species from Western Australia based on the collections of James Drummond and later in the same year named four Tasmanian species using Ronald Gunn's collections (Lindley 1840b). Endlicher (1846) described *P. turfosa* from specimens collected at Albany, Western Australia by Preiss and *P. mitchellii* was described by Lindley from specimens collected in Queensland by the explorer Thomas Mitchell (Lindley 1848). In a significant contribution to the genus in New Zealand, Hooker (1853) described six species, including *P. foliata* which is common to both New Zealand and Australia. Bentham (1873) recognised 24 species of *Pterostylis* in Australia, including two new species. In a major treatment of Australian Orchidaceae, Robert FitzGerald (1875-1893), presented a series of illustrated lithographs which included seven new species of *Pterostylis*. Shortly after he also described *P. clavigera* (FitzGerald 1885). About this time in New Zealand, the Reverend W. Colenso published a series of papers that included four new species of *Pterostylis* (Colenso 1886, 1890, 1896). F.M.Bailey (1891), described *P. depauperata* from specimens collected near Cairns in north-eastern Queensland and W. Petrie (1894) described the spectacular New Zealand

species *P. oliveri*. In 1899 *Pterostylis* was first recorded from New Guinea (Rolfe 1899).

Several botanists have been active in naming species of *Pterostylis* in the 20th Century. C.R.P. Andrews was the first, describing the Western Australian species *P. sargentii* (Andrews 1905), followed by Schlechter (1906) with *P. bureaviana* and *P. neocaledonica*, both from New Caledonia. Between 1915 and 1940, R.S. Rogers described six species (Rogers 1915, 1918, 1922, 1923, 1927, 1940); Ridley (1916) described *P. novoguineensis* from New Guinea; J.J. Smith (1917) described *P. papuana* var. *arfakensis* based on a collection made by L.S.Gibbs in the Arfak Mountains of north-western New Guinea; Petrie (1918) established the New Zealand species *P. areolata*; J.J. Smith named *P. papuana* var. *seranica* from the Indonesian island of Ceram (Smith 1928); Rupp described three species plus one variety between 1929 and 1943 (Rupp 1929, 1941, 1943a); Nicholls four species between 1933 and 1950 (Nicholls 1933, 1937, 1950) and Hatch described two New Zealand species and one variety (Hatch 1949, 1950). Other authors who described new species during this period include Coleman (1929), Kraenzlin (1929), Messmer (1933), Garnet (1939) and Williams (1946). In the 1950's Hunt described two species from Queensland (Hunt 1952, 1957), followed by a succession of species from various authors: Upton (1967); Blackmore (1968); Blackmore & Clemesha (1968); Cady (1969b); Moore (1968); George (1971); Clemesha & Gray (1972); Jones (1972); Clemesha (1974). Numerous species have been named in the last two decades (Cooper 1983, George 1984, Clements *et al.* 1985, Jones 1985, Clements 1986, Jones & Clements 1987, Clements 1989, Mohr 1990, Jones 1993a, Jones & Clements 1993, Jones 1994a, Jones 1997a, Jones 1997b, Jones & Clements 1997, Jones, Molloy & Clements 1997, Jones & Clements 1998).

There has been no modern detailed study of the genus throughout its range, although there have been numerous regional flora treatments which have included accounts of *Pterostylis* (Cheeseman 1925, Rupp 1943b, Burbidge & Gray 1970, Moore & Edgar 1970, Willis 1970, Hallé 1977, Curtis 1979, Royen 1979, Schlechter 1982, Weber & Bates 1986, Metcalfe 1987, Stanley & Ross 1989, Jones 1993b, Jones 1994b). A proliferation of popular accounts on Orchidaceae have included illustrations of many species (Cady 1969a, Nicholls 1969, Cady & Rotherham 1970, Cooper 1981, Johns & Molloy 1983, Woolcock & Woolcock 1984, Jones 1988, Bates & Weber 1990, Backhouse & Jeanes 1995, Begaud *et al.* 1995, St George *et al.* 1996, Bishop 1996, Hoffman & Brown 1992, 1998, St George 1999, Jones *et al.* 1999). A recent review of the genus in Tasmania documented the taxa of that region of Australia (Jones 1998).

Historical Infrageneric Classification

When describing *Pterostylis*, Brown (1810) subdivided the genus into three informal groups, plus a fourth of dubious status. G. Don (1830) formalised the first three of Brown's informal groups, naming them as sections (Table 1.1). Ten years later Lindley (1840b) described an additional nine species and reorganised the genus into six informal sections based on the number of flowers per inflorescence and vegetative morphology. Lindley's sections have never been formally named. In 1871 the German botanist H.G. Reichenbach, proposed an entirely different classification system based on the presence or absence of leaves on the peduncle and their structure. Three sections were described each containing two subdivisions; (i) appendix penicillate versus (ii) callus not penicillate (Reichenbach 1871). Reichenbach's system of classification resulted in an unwieldy conglomeration of species with little apparent close relationship amongst them. Consequently his system has mostly been ignored or overlooked since its publication. Bentham (1873) produced a more realistic classification of the genus based on differences in floral morphology including recognising, for the first time, the significance of the position of the lateral sepals. He divided the genus into two sections placing most species into the first of two series within one section. Pfitzer (1889) adopted Bentham's system in his treatment of the family. Rupp (1933) in essence also adopted Bentham's system, with modification, once more dividing the genus into two sections and placing most species within the first, section *Laminatae*. Within section *Laminatae* he allocated species to two subsections with respectively two and three divisions in each. Rupp's system is both complicated and contradictory, e.g. *P. pyramidalis* is placed in two different divisions of section *Laminatae*. Consequently Bentham's system for the classification of *Pterostylis* has remained the most commonly used in regional and flora treatments and accounts of the genus.

Newly described *Pterostylis* species have rarely been assigned to infrageneric taxa, although the above systems of classification are available. Over the years a number of informal groups with names such as the '*rufous*' or '*rufa*', '*parviflora*', '*plumosa*' and "bearded greenhood" groups have arisen from common usage, mainly by orchid enthusiasts and horticulturalists (Blackmore 1965, 1966, Cady 1969a, Blackmore & Clemesha 1968, Jones 1988, French 1995).

Summary of Historical Infrageneric Classification Systems

1. G.Don:

1.1 ***Pterostylis*** sect. ***Nudicaules*** G.Don in Loudon's, *Hortus Britannicus* 369 (1830). Type species: *non designatus*.

1.2 ***Pterostylis*** sect. ***Squamatae*** G.Don in Loudon's, *Hortus Britannicus* 369 (1830). Type species: *non designatus*.

1.3 ***Pterostylis*** sect. ***Foliosae*** G.Don in Loudon's, *Hortus Britannicus* 369 (1830). Type species: *non designatus*.

2. H.G.Reichenbach:

2.1 ***Pterostylis*** sect. ***Acuminatae*** Rchb.f., *Beitr. Syst. Pflanz.* 68 (1871). Type species: *non designatus*. There are two informal groupings:-
I. Appendix penicillate.
II. Appendix callose, not penicillate.

2.2 ***Pterostylis*** sect. ***Cucullatae*** Rchb.f., *Beitr. Syst. Pflanz.* 68-69 (1871). Type species: *non designatus*. There are two informal groupings:-
I. Appendix penicillate [labellum appendage].
II. Appendix callose, not penicillate.

2.3 ***Pterostylis*** sect. ***Alatae*** Rchb.f., Beitr. Syst. Pflanz. 69-70 (1871). Type species: *non designatus*. There are two informal groupings:-
I. Appendix penicillate.
II. Appendix callose, not penicillate.

3. Bentham:

3.1 ***Pterostylis*** sect. ***Antennaea*** Benth., *Flora Australiensis* 6: 353-354 (1873). Type species: *non designatus*.

3.2 ***Pterostylis*** sect. ***Antennaea*** Benth. ser. ***Grandiflorae*** Benth., *Flora Australiensis* 6: 353-354 (1873). Type species: *non designatus*.

3.3 ***Pterostylis*** sect. ***Antennaea*** Benth. ser. ***Parviflorae*** Benth., *Flora Australiensis* 6: 353, 360 (1873). Type species: *non designatus*.

3.4 ***Pterostylis*** sect. ***Catochilus*** Benth., *Flora Australiensis* 6: 354, 361 (1873). Type species: *Pterostylis barbata* Lindl., *fide* Pfitzer (1889: 102).

4. Rupp:

4.1 ***Pterostylis*** sect. ***Laminatae*** Rupp, *Proc. Linn. Soc. New South Wales* 58: 423 (1933). Type species: *non designatus*.

4.2 ***Pterostylis*** sect. ***Filiformae*** Rupp, *Proc. Linn. Soc. New South Wales* 58: 423 (1933). Type species: *non designatus*.

Table 1.1. A comparison of the infrageneric classifications of *Pterostylis*

Brown 1810	Don 1830	Lindley 1840	Reichenbach 1871	Bentham 1873	Rupp 1933
I Appendix [*concinna, ophioglossa, curta, acuminata, pedunculata, cucullata, nana, nutans*]	§ Nudicaules [*cucullata, nutans, acuminata, curta, ophioglossa concinna*]	§ 1 [*reflexa, grandiflora, banksii, scabra, praecox, pyramidalis, barbata, squamata*]	§ Acuminatae I Appendix penicillata II Appendix non penicillata	§ Antennaea Series 1: Grandiflorae [all other spp.] Series 2. Parviflorae [*daintreana, parviflora, aphylla*]	§ Laminatae Sub§ A Div. I Subdiv. i , 1. [*ophioglossa, concinna*]; 2a [*acuminata, baptistii, curta, nutans, vereenae, depauperata*]; 2b [*nana, pyramidalis, pedoglossa, pedunculata*] Subdiv. ii, 1. [*mutica, cycnocephala*]; 2 [*rufa, pusilla, mitchellii, squamata, woollsii*] Div. II, i [*furcillata*]; ii [*cucullata, falcata, alpina, furcata, gracilis*] Sub§ B Div. III, i [*constricta*; ii [*toveyana*]; iii.1 [*truncata, alata, robusta, rogersii, revoluta, reflexa, coccina, truncata*]; iii.2 [*obtusa, decurva, recurva, pyramidalis*] Div. II [*parviflora*] Div. III, i [*sargentii*]; ii [*daintreana, longifolia, vittata*]
II Appendix [*obtusa, reflexa, revoluta, grandiflora, parviflora*]	§ Foliosae [*grandiflora reflexa, obtusa*]	§ 2 [*longifolia, vittata, parviflora*]	§ Cucullatae I Appendix II Appendix non penicillata	§ Catochilus [*barbata, turfosa, mutica, rufa, longifolia, vittata*]	§ Filiformae [*barbata, turfosa*]
III Appendix [*longifolia, squamata, rufa, gibbosa, mutica*]	§ Squamatae [*longifolia, gibbosa*]	§ 3 [*obtusa, revoluta, scabrida, furcata, cucullata, dubia*]	§ Alatae I Appendix II Appendix non penicillata		
IV Dubiae tribus [*dubia*]		§ 4 [*mutica, gibbosa, rufa*]			
		§ 5 [*curta, nutans, concinna, acuminata, pedunculata, nana, ophioglossa*]			
		§ 6 [*aphylla*]			

Legend: § = section; species in [ ] are those assigned to each section or group.

HISTORICAL GENERIC CLASSIFICATION

Pterostylis was initially treated as part of the tribe Arethuseae Lindl. (Lindley 1840b, Endlicher 1842), but later transferred to Neottieae (Bentham 1873); and still later to Diurideae Endl. (Bentham & Hooker 1883). Soon after, Pfitzer (1887) first placed *Pterostylis* in its own subtribe, along with *Caleana* R.Br. and *Drakaea* Lindl., in the Pterostylidinae Pfitz. (as "*Pterostylideae*"), within the tribe Neottieae. Schlechter (1926a) created a monotypic subtribe by the removal of *Caleana* and *Drakaea*, placing them in a newly created subtribe the Drakaeinae, a position followed by most authors when classifying the family (e.g., Mansfeld 1937, 1938, Dressler & Dodson 1960, Dressler 1981, 1993). The taxon has also been elevated to tribal rank as the Pterostylideae (Pfitz.) P. Royen (Royen 1979), and as part of the subfamily Neottioideae based on a phylogenetic analysis of the family using morphological data (Burns-Balogh & Funk 1986a,b). Dressler (1974, 1979, 1981, 1993) in his popular accounts of the family, placed *Pterostylis* within the tribe Diurideae based primarily on the possession of so called "root-stem tuberoids", a position he adopted following the work of Lavarack (1971, 1976).

By contrast, *Diplodium* was included by Swartz (1829), along with most other orchids, within the *Monandria*, as intermediate between *Diuris* and *Arethusa,* where it resided until reduced to a synonym of *Pterostylis* in the Diurideae (Bentham & Hooker 1883). Since that time the monophyly of *Pterostylis* has apparently rarely been questioned. However, the phylogenetic affinities of the genus have proven problematic to determine. A study on the patterns of embryological development of representative species throughout the tribe Diurideae provided strong evidence that the tribe was polyphyletic when both the Pterostylidinae and Chloraeinae were included (Clements 1995, 1996). Futhermore these results suggest that the Pterostylidinae and Chloraeinae are more closely related to the Spiranthinae and Goodyerinae (tribe Cranichideae), than to any other taxon within the subfamily Orchidoideae, and provide an independent data set that refutes Dressler's concept of subfamily Spiranthoideae (Dressler, 1979, 1981, 1993). Subsequent phylogenetic studies inferred from analyses of *rbc*L plastid sequences in subfamilies Orchidoideae and Spiranthoideae by Kores *et al.* (1997; Cameron et al., 1999; Chase et al., 2001), *mat*K plastid DNA sequence data (Kores et al., 2000), and the combined *mat*K and *trn*L-F plastid DNA sequence data (Kores et al., 2001), arrived at similar conclusions. All modern studies indicate that *Pterostylis* should be placed in its own monotypic subtribe, the Pterostylidinae.

During the late stages of preparation of this paper a Polish botanist D.L. Szlachetko working from the study of herbarium specimens stored in various institutions mainly from throughout Europe, and the literature (but in particularly that previously published by the authors, e.g. Clements 1989; Jones 1994a, 1998), proposed an entirely new classification of *Pterostylis* (Szlachetko, 2001). He proposed that the genus be divided into *Pterostylis* and two new genera *Plumatichilos* to account for the '*barbata*' group species and *Oligochaetochilus* for all species with deflexed lateral sepals and exposed labellum. He further divided *Oligochaetochilus* into three subgenera: subgenus *Oligochaetochilus* based on *P. rufa*, for species with "Lip oblong to ovate in general outline, thick and fleshy, variously adorned on margins by long or short, fine or coarse setae"; subgenus *Galbrichilos* based on *P. cycnocephala* for species with "Lip completely glabrous, truncate or shallowly notched at apex with simple thickened at base"; and subgenus *Apicuchilos* based on *P. vittata* for species with "lip apex notched, with horn-like appendage at base, ciliate or papillate on surface". The status of all described genera within Pterostylidinae will be examined in our analyses.

NATURAL GROUPS

Twelve apparently "natural" groups, some of which have previously been given formal infrageneric status, have been recognised within *Pterostylis* and these have been used as a basis for research into the phylogeny of the genus (**Figs 1.1, 1.2**). A summation of significant morphological details of these groups is provided here to facilitate interpretation of the section of this paper that deals with cladistics.

1. *'curta'* (rosetted) group: Sterile and fertile plants monomorphic; rosette leaves encircling the base of the scape; inflorescence 1(-2)-flowered; galea with a single opening; synsepalum erect; free points usually exceeding the galea; labellum entire (unlobed); basal appendage penicillate; column wings lacking barrier trichomes.

2. *'alata'* (cauline) group: All of the above characters except that the sterile and fertile plants are dimorphic; sterile plants consist of a rosette of petiolate leaves and fertile plants consist of a flowering scape with sheathing or spreading cauline leaves.

3. *'nana'* group: Sterile and fertile plants monomorphic (one species, *P. dilatata*, is dimorphic); rosette leaves encircling the base of the scape; remarkably uniform, small, "pillar-

box" type flowers with a single high sinus opening; small, dark green, ligule-like lobule at the upper conjunction of the synsepalum; labellum entire (unlobed); basal appendage penicillate; column wings lacking barrier trichomes.

4. *'parviflora'* group: Sterile and flowering plants dimorphic; rosette leaves either on separate growths (sterile plants) or on lateral growths attached to the base of the scape; inflorescence multi-flowered; galea with a single opening; synsepalum erect; free points incurved, short, usually not or hardly exceeding the galea; labellum entire (unlobed); basal appendage mostly trilobed; column wings lacking barrier trichomes.

5. *P. recurva:* Sterile and fertile plants dimorphic; inflorescence multi-flowered; flower with a single apical opening; veins on dorsal sepal ridged; synsepalum obliquely erect; free points sharply reflexed in front of the galea; labellum three-lobed; basal appendage penicillate; column wings with barrier trichomes.

6. *P. daintreana:* Sterile and fertile plants dimorphic; rosette leaves either on separate growths (sterile plants) or on lateral growths attached to the base of the scape; inflorescence multi-flowered; galea with a single opening; synsepalum obliquely deflexed; labellum three-lobed; basal appendage absent; column wings with barrier trichomes.

7. *P. sargentii:* Sterile and fertile plants dimorphic; inflorescence multi-flowered; galea with a single opening; synsepalum deflexed; labellum three-lobed; basal appendage absent; column wings with barrier trichomes.

8. *'mutica'* group: Sterile and fertile plants monomorphic; inflorescence multi-flowered; galea with a single opening; synsepalum deflexed, deeply pouched; labellum entire (unlobed), membranous; basal appendage entire, rostrate; column wings with barrier trichomes and a terminal border of beaded siliceous cells.

9. *'longifolia'* group: Sterile and fertile plants dimorphic; sterile rosettes perched; inflorescence multi-flowered; galea with a single opening; synsepalum deflexed, flat to convex, the anterior surface with bubble-like micropapillae; labellum three-lobed; basal appendage absent; column wings with barrier trichomes.

10. *'vittata'* group: Sterile and fertile plants dimorphic; inflorescence multi-flowered; galea with a single opening; synsepalum deflexed, flat to convex, with a sunken pit below the labellum, the anterior surface with bubble-like micropapillae; labellum three-lobed; basal appendage caudate; column wings with barrier trichomes.

11. *'rufa'* group: Sterile and fertile plants monomorphic; inflorescence multi-flowered; galea with a single opening; synsepalum deflexed; labellum entire (unlobed); labellum margins and base with white, moniliform setae; basal appendage absent; column wings with barrier trichomes and a terminal border of beaded siliceous cells.

12. *'barbata'* group: Sterile and fertile plants monomorphic; inflorescence 1(-2)-flowered; galea with two openings; synsepalum deflexed, with a thickened central pad; labellum entire (unlobed), filiform, with coarse, wrinkled, moniliform setae and an apical counterweight; basal appendage extending as a flattish rostrate structure; column wings with barrier trichomes.

MORPHOLOGY

Although the general morphology of the genus has been outlined by previous workers, no detailed morphological study has been undertaken previously.

Vegetative Morphology

Root system - Species of *Pterostylis* are tuberous geophytes with fleshy subterranean tubers (not tuberoids). The parent tuber, which produces the growth for one season, lasts about 10-12 months before dying. A replacement tuber is produced in close proximity to the parent tuber, arising early in the development of the new shoot and maturing later in the growing season. Extra tubers, termed daughter tubers, are produced in those species which form colonies.

In *Pterostylis* two different types of root system can be discerned. Simple absorbing roots are short and very filamentous whereas the tuber-forming roots are much more robust (**Fig. 1.1, 1.2**). Two types of tuber-forming roots occur which relate to whether the taxon forms clonal colonies or not. In colony-forming species, each plant produces one to four long stolonoid roots, each of which grows horizontally through the substrate and forms a daughter tuber at the end. Non-colony-forming species form a single replacement tuber annually on the end of a short dropper that grows vertically in the substrate close to the parent tuber (**Fig. 1.1, 1.2**).

Root-tuber shape - Most species of *Pterostylis* have globose root tubers, however, taxa allied to *P. biseta*, have oblate tubers and taxa allied to *P.*

spathulata have ellipsoid to lacriform tubers. These are all treated as variations within a single character state.

Leaves - Leaves in *Pterostylis* are either attached to a floral scape (cauline) or a rosette, and although of basically similar structure they can be of very different size and shape (**Figs 1.1, 1.2**).

Rosette leaves are attached either via a distinct petiole or the lamina grades imperceptibly to the base (treated here as being sessile). This latter condition is commonly found in species occurring in semi-arid areas, such as members of the *'rufa'* group and *'mutica'* group, and the tapered base probably helps to channel moisture from dew or rainfall to the root system via the centre of the rosette (**Fig. 1.2**). Rosette leaves are either held prostrate close to the ground surface (*'alata'*, *'rufa'*, *'mutica'* groups), semi-erect (*P. cucullata* and its relatives), erect (*'barbata'* group), or perched above ground on a short common stalk (*'longifolia'* group).

The leaves of members of the *'rufa'* group and the *'mutica'* group bend downwards soon after collection. This feature is absent in all other groups and it is suggested that the leaves exert downward force on the soil surface to assist with gathering dew and rainfall and probably also to minimise water loss from abaxial stomata.

Cauline leaves in *Pterostylis* are sessile. Most commonly cauline leaves are well-developed with a short sheathing base and large lamina which spreads away from the scape, but in some species the cauline leaves are reduced to strongly sheathing, bract-like structures which are held close to the scape.

Leaf margins are entire, crisped or undulate. In species from drier habitats the margins are frequently ornamented with transparent bead-like siliceous cells.

Venation - Both the rosette and cauline leaves have a prominent midrib with acrodromus venation and anastomosing veins without included veinlets.

Rosette placement - All species of *Pterostylis* produce rosettes in which the leaves are arranged in a loose to tight spiral with the smallest leaves in the centre. The disposition of the rosette on or relative to a flowering plant is variable (**Figs. 1.1, 1.2**).

In the *'curta'* group the base of the flowering scape is subtended by a stem-encircling basal rosette which is fully developed before the flower scape emerges. Sterile plants consist of a similar rosette of leaves which does not produce an inflorescence. In a subgroup of the *'curta'* group, as exemplified by *P. cucullata* and *P. falcata*, the rosette and the scape develop simultaneously and the leaves form in a spiral on the basal third of the scape. Sterile plants consist of a rosette of leaves similar in shape to that on flowering plants but which does not produce an inflorescence. In the *'alata'* group, sterile and fertile plants exhibit complete dimorphism with the rosette developing as a growth completely separate from the flowering scape (which has cauline leaves but completely lacks a rosette).

Dimorphism is also exhibited in the *'parviflora'* group and *P. daintreana*, however in these species the flowering plants also develop one or more rosettes on lateral growths which emerge from the base of the scape. A sterile plant consists of a rosette similar in shape and size to that which develops from the base of the scape.

Floral Morphology

Inflorescence - Scapes are either consistently single-flowered (occasional plants can produce two flowers) or multi-flowered (two or more flowers). Multi-flowered species can be reduced to a single flower in dry seasons or in the first flowering of a seedling.

Floral attitude - The majority of multi-flowered *Pterostylis* species have outward-facing flowers, but in the *'parviflora'* group the flowers face inwards towards the scape (for significance of the floral attitude see "Variations in pollination systems", group 4: *'parviflora'* group).

Floral scent - The majority of *Pterostylis* have no scent noticeable to humans, but flowers of the *'parviflora'* group have a distinctive semen-like scent which is especially evident in humid conditions or changes in barometric pressure such as immediately prior to a thunderstorm or in squally weather.

Galea - The flowers of all species of *Pterostylis* are dominated by a hood-like galea which is formed by the adherence of the dorsal sepal and the petals. It encloses the column and plays an important role in the pollination process. Unification of the dorsal sepal and petals is achieved in most species by the margins of the dorsal sepal fitting into a groove which runs the length of the petal beside the central ridge. In the *'barbata'* group the petals are greatly reduced in width and the organs adhere firmly together without the involvement of a groove. In *P. recurva* the tips of the petals are hooked and curve away from the distal part of the dorsal sepal.

Galea opening - The opening into the galea is of significance since it influences the mode by which a pollinating vector enters and exits the flower (**Fig. 1.3**). The majority of *Pterostylis* species have a single opening to the galea through which the vector both enters and departs, but the flowers of the *'barbata'* group have two openings, the vector entering through the lower

opening and egressing through the upper. In *P. recurva* the galea opening is apical.

Dorsal sepal - The dorsal sepal is erect or leans forward and in most species is strongly curved distally. It is either transparent or translucent white and is adorned with green, reddish or brown stripes which coalesce towards the apex. The surface is either smooth, or in some groups, especially those growing in semi-arid climates, adorned with either bead-like or acicular siliceous cells. The majority of species have immersed veins and a flat surface to the dorsal sepal but in *P. recurva* the veins are prominently raised or ridged. The dorsal sepal apex can be suberect (*P. anatona*), horizontal (*P. banksii*), decurved (*P. foliata*) or even inflexed (*P. patens*) and the tip acute to acuminate or with a filiform-terete extension of varying length.

Synsepalum - The lateral sepals in all *Pterostylis* are partially conjoined proximally along the inner margin to form a synsepalum (**Fig. 1.4**), which has free sepaline points (see below). This structure is either erect and held close to the galea (**Fig. 1.5**), or deflexed away from it at varying angles (**Fig. 1.6**). In species with an erect synsepalum this structure either firmly embraces the anterior petal margins (e.g. *P. foliata*, *P. nana*), or is much looser leaving a prominent lateral gap (e.g. *P. curta*, *P. pedunculata*). In *P. recurva* (**Fig. 1.6k**) the synsepalum is held obliquely erect rather than being fully erect and in *P. porrecta* it is projected forwards just above the horizontal.

The synsepalum is particularly important in species where it is deflexed since it subtends the labellum and plays a role in pollination (see "Pollination mechanisms"). Commonly the synsepalum is deflexed at more than a right angle and may even recurve (*P. longifolia*), whereas that of *P. daintreana* is obliquely decurved at much less than a right angle. The anterior surface of the synsepalum can be flat, concave or convex, but in species of the *'mutica'* group it is deeply pouched, and in *P. daintreana* the margins are strongly inrolled. Members of the *'vittata'* group have a sunken pit beneath the labellum which accommodates this organ when in the "set position" (see "Pollination mechanisms and the role of the labellum"). In most species the conjoined parts are firmly fused, but in members of the *'mutica'* group, the sepals are weakly united and the two sepals can be readily separated along the midline.

The synsepalum is mostly unadorned but in the *'vittata'* and *'longifolia'* groups, numerous, tiny, whitish, bladder-like micropapillae are scattered over the ventral surface. When magnified these micropapillae can be seen to be structurally different in each group (**Plate 12 a-d**). In some species such as *P. cucullata*, pointed siliceous cells adorn the distal parts of the dorsal surface of the synsepalum and members of the *'rufa'* group frequently have irregular transparent acicular cells on the upper margins of the synsepalum. In the *'barbata'* group the basal part of the synsepalum is developed into a distinctive thickened pad which is dotted with lenticel-like structures (**Fig. 1.4q**).

Sepaline free points - The apices of the lateral sepals, which extend from the distal margins of the synsepalum, are termed the free points. These structures range in length and vary greatly in shape (**Fig. 1.4**). In species which have an erect synsepalum the shapes range from triangular-tapered to filiform-terete, with some of the latter type ending in narrowly clavoid tips. Mostly these free points are erect and extend well above the galea or are recurved in varying degrees behind the galea. In the *'parviflora'* group (**Figs. 1.4f, 1.5f**) the free points are quite short and curve forwards flanking distal parts of the petals or incurve just above the galea. *P. recurva* is unique in that its free points reflex sharply away from the synsepalum and galea at an acute angle (**Fig. 1.6k**).

Those species which have a deflexed synsepalum mostly have short deltate free points with the tips either flat, cymbiform or involute. Some species in the *'rufa'* group have filiform-terete tips, including the remarkable *P. woollsii* in which these extensions become filamentous and can be up to 15 cm long. Those of the *'barbata'* group are very distinctive being linear-oblong, thick and channelled.

Sepaline sinus - The region at which free points separate from the conjoined parts of the synsepalum is termed the sinus. When viewed from the front this sinus can be U- or V- shaped or nearly flat with a shallow central notch. When viewed in profile the sinus region can be flat, mounded, bulging or extended like a platform. In the *'nana'* group the point of conjuncture of the two sepals (the central part of the sinus) is very dark green in contrast with the surrounding tissue; inside this point is a small dark green lobule which is folded inwards (**Fig. 1.4e**). The significance of this lobule is unknown but it is thought that the contrasted dark green spot acts as a target for the pollinating vector when it enters the flower. In *P. allantoidea* two broadly rounded lobules fold internally in this region (**Fig. 1.4j**).

Petals - The petals of *Pterostylis* are highly modified in various ways (**Fig. 1.7**). All are asymmetrical and range from straight to falcate. Basally they are attached to the ovary by a short, barely discernible stalk, but in the petals of *P. recurva* the basal stalk is proportionately long and well developed (**Fig. 1.7k**). In some members of the *'longifolia'* and *'rufa'* groups, the basal stalk has a fleshy anterior flange which serves to block off a gap in the base of the galea when the

labellum is in the closed position (see labellum below).

The petals of most *Pterostylis* have a dorsal ridge which is flanked by a groove into which slot the margins of the dorsal sepal to form the galea. This ridge is either relatively smooth or adorned with siliceous cells or trichomes. In members of the *'rufa'* group the dorsal ridge is adorned to varying degrees with transparent uniseriate trichomes. Similar uniseriate trichomes are strongly developed in *P. daintreana* (**Fig. 1.7l**), whereas in *P. sargentii* the dorsal ridge has a mass of thick, white, multiseriate trichomes which combine with the triggered labellum to trap the pollinating vector inside the galea (**Fig. 1.7m**).

In some groups the petals are differentiated into well-developed dorsal and ventral laminae (*'curta'* and *'alata'* groups), in others the dorsal lamina is vestigial (*'mutica'* group) and in the *'barbata'* group both regions are greatly reduced. The ventral lamina in some species, such as *P. grandiflora* and *P. nana*, is widely flared and forms a verandah-like structure over the sinus. The anterior margins of the petals are usually entire but can be erose, minutely ciliate or with bead-like siliceous cells. Some groups also have a deltate dorsal flange towards the base of the petal which overlaps with the dorsal sepal and assists with the galea adherence.

The petal apex is commonly acute to acuminate and projects below the dorsal sepal. *P. bicornis* is unique in having a prominent terete extension projecting from the tip of each petal (**Plate 12e**). In *P. recurva* the petal tips are hooked strongly outwards and flank the apical extension of the dorsal sepal (**Figs. 1.6k, 1.7k**).

Labellum lamina - In *Pterostylis* the labellum lamina is either simple and entire (**Plate 1a**) or three-lobed (**Plate 1b**). Those species with an entire labellum have either a thin, almost membranous lamina (*'mutica'* group; **Plate 1e**), or a moderately thick lamina (*'parviflora'*, *'alata'* and *'curta'* groups) with a prominent central abaxial fold that appears on the adaxial surface as a medial rounded ridge (**Plate 1a**). By contrast all other groups have a narrow central abaxial groove and an inconspicuous corresponding mound or ridge on the upper surface.

The labellum surface is either smooth or covered with highly reflective, transparent, siliceous, bead-like or acicular cells (**Plate 1**). In the *'rufa'* group, the labellum margins and base are also ornamented with white moniliform setae arising from a swollen basal cell (**Plates 11b,d,e,f**). In the *'barbata'* group the labellum has a 'bottle-brush' arrangement of spreading coarse, yellow, wrinkled setae arising from a decurrent basal cell (**Plate 10f**). On the proximal part of the lamina, these yellow setae are interspersed with narrow white setae (**Plate 10d**). In this same group the proximal part of the ventral surface of the labellum is transversely wrinkled, a condition unique in the genus.

Labellum apex - The labellum apex of most species is entire but can also be narrowly notched (*'mutica'*, *'longifolia'* and *'vittata'* groups), broadly notched or forked (*P. concinna* and allied species), swollen (*P. bicornis*, **Plate 12f**) or with an unusual knob-like apical counterweight (*'barbata'* group) which is structurally distinct from the rest of the lamina (**Plate 10e**).

Labellum basal appendage – This is a variable character that is not homologous between groups within *Pterostylis* (**Plates 2,3**). The role of the appendage seems, to some extent at least, to coincide with that of the labellum, its exposure and the role it plays in the pollination process. The basal appendage is well developed in those groups that have an erect synsepalum, ie. *'curta'*, *'alata'*, *'parviflora'* groups and also *P. recurva* (**Fig. 1.9k**). This suggests that the stimulation of the basal appendage in these species triggers the labellum. By contrast the basal appendage is poorly developed or absent in most of the groups that have a deflexed synsepalum (**Fig. 1.9**), ie. *'rufa'*, *'longifolia'* and *'vittata'* groups, since the labellum lamina itself acts as the contact for triggering.

In groups that have an erect synsepalum, including *P. recurva*, the basal appendage projects backwards as a continuous extension from the base of the labellum lamina. It has a strongly incurved basal stalk and the apex is either tripartite (*'parviflora'* group; **[Plates 2d,f]** and *P. recurva*) or penicillate (*'curta'* group; **Plates 2a,b,c**). Of those groups with a deflexed synsepalum, the *'mutica'* group has the most prominent basal appendage. It is set at right angles to the labellum lamina and has a dark-coloured, entire apex with a centrally sited, protruding beak-like structure (**Plates 3a,b**). This dark appendage probably acts as a target for pollination vectors since the labellum lamina is indistinguishable within the pouched lateral sepals in which it nestles. In the *'vittata'* group a narrow caudate structure, projecting forward from the base of the labellum mound, could be interpreted as a basal appendage, whereas members of the *'longifolia'* group lack any such structure (comparison photo **Plate 10c**). No comparative basal appendage is present in the *'barbata'* group, although there is a short beak-like basal extension of the lamina (**Plate 3e**).

Column - The base of the column is recurved from the apex of the ovary in all species of *Pterostylis*. In most species it then gently incurves towards the apex but in the *'vittata'* group, sharply so, and in *P. recurva* it is slightly recurved from this point. An anterior view of the distal parts of a *Pterostylis* column showing the

anther, pollinia, column wings and stigma *in situ* is presented in **Plate 11a**.

Column wings - In all species of *Pterostylis* the distal margins of the column extend as large, paired, hatchet-shaped, wing-like structures. These project forwards from the column apex and curve inwards distally towards each other with the anterior margins nearly meeting, the whole arrangement forming a tunnel-like structure. Each wing has a broad central area supported by a substantial vein and a lower lobe which is generally partially twisted off line. The wings are mostly translucent and play a major role in the pollination process.

In most groups of *Pterostylis* an apical lobule occurs on the dorsal or upper margin of the column wings (**Plate 4**). This lobule, which is either about as wide as long (e.g. *'rufa'* group) or much longer than wide (e.g. *'barbata'* group), is absent from the *'mutica'* group (**Plate 5f**). In *P. recurva* and the *'barbata'* group, the lobule is adorned with a few tiny acicular, siliceous cells (? micropapillae; **Plate 8d,f**). In the *'rufa'* group and the *'mutica'* group the dorsal margin of the column wing is covered with layers of bead-like siliceous cells (**Plate 5f,8b**). These are not present in any other group.

Barrier trichomes - In the groups of *Pterostylis* with a deflexed synsepalum (ie *'longifolia'*, *'mutica'*, *'rufa'* and *'barbata'* groups) and also in *P. recurva*, a cluster of specialised trichomes occurs on the upper anterior margins of the column wings (**Plates 8,9**). We refer to these structures as "barrier trichomes". Their function is presumably to prevent anterior egress by the pollinator from the tunnel formed by the column and its wings and so ensure that it exits via the apical opening in the column wings, thus causing it to pass over the viscidium. Barrier trichomes are absent from all species which have an erect synsepalum with the exception of *P. recurva*. The structure of the barrier trichomes is variable and seems to be unique in each group – uniseriate, clavate (*'mutica'* group, **Plate 8b**); uniseriate, linear, apically lobed (*P. daintreana*, **Plate 9e**); multiseriate, thickened, apically lobed (*P. recurva*, **Plate 9c**); multiseriate, irregularly thickened (*P. sargentii, 'rufa'* group, **Plate 9a,b**); multiseriate, clavate (*'vittata'* group, **Plate 9d**); multiseriate, obclavate (*'barbata'* group, **Plate 8c**); and, multiseriate, irregularly lobed (*'longifolia'* group, **Plate 9f**).

Stigma - In *Pterostylis* the stigma is situated medially on the anterior surface of the column in all groups except members of the *'parviflora'* group, where it occurs towards the base. The stigma of *P. recurva* extends the full length of the anterior surface of the column. The stigmatic lobes are fully united in all groups except the *'parviflora'* group where they are poorly fused and nearly separate (**Plate 7e,f**). Stigma shapes are variable (**Fig. 1.13a-r, Plates 6,7**) - deltate (*'parviflora'* group); scutiform (*'rufa'* group); elliptic (*'curta'* group); oblong (*P. recurva, 'longifolia'* group); broadly ovate-elliptic (*P. daintreana*) and broadly obtrullate (*'vittata'* group). Texture ranges from thick and fleshy (*'parviflora'* group) to membranous (*'vittata'* group). In the *'curta'* group the lateral margins of the stigma do not protrude from the column margins, whereas in the *'vittata'* group they protrude conspicuously past the margins and in *P. recurva*, recurve behind the margins.

Rostellum - In *Pterostylis* the rostellum is highly modified and consists of a viscidium situated just beneath the anther and well separated from the stigma. The rostellum is connected to the stigma by a long narrow medial groove on the anterior surface of the column, mostly hidden beneath the column wings (**Plates 4d, 11a**).

Pollinia - Species of *Pterostylis* have four mealy, yellow, pollinia, each situated in a valve of the anther. The shape of a pollinium is variable (**Fig. 1.13**) – linear in most species but they can be short and thick (clavate) in the *'mutica'* group and long and slender (filiform) in the *'parviflora'* group.

Pollen - The pollen grains of *Pterostylis* are arranged in tetrads and linked by viscin threads. The surface of each grain is sculptured but a detailed study of this feature was not carried out.

Capsules - The capsules of *Pterostylis* are mostly oblong-elliptic to elliptic in shape at maturity with three longitudinal ridges. Some species, such as *P. sargentii* and *P. recurva*, are adorned with transparent beaded siliceous cells. The floral segments wither quickly after pollination and remain attached to the apex of the capsule as dry remnants.

Seeds - The seeds of *Pterostylis* lack endosperm and at maturity are roughly ellipsoid in shape with the outer integument forming a thin papery tunic around the embryo, extending as a wing-like structure which aids dispersal by air currents. The cells of the seed coat have prominent ridged anticlinal walls. A recent study (Molvray & Kores 1995), which included *P. banksii* as the sole representative of the genus, found that this species has a goodyeroid type seed.

Embryo type - *Pterostylis* has an embryological development pattern of the Spiranthinae type (Clements 1999). This in itself is variable and several variations can be recognised within the genus – elongate, protruding suspensor (*'curta'*, *'alata'* groups, **Plate 13a**); small elliptic (*'mutica'* group); obovate (*'rufa'* group); rostrate

micropyle (*'longifolia'* *'sanguinea'* groups); and, rostrate hypostase (*'barbata'* group).

BIOLOGY

Insect pollination

Pterostylis species are mostly entomogamous, and although records are scanty, these orchids seem to be exclusively pollinated by tiny microdipterans of the families Mycetophilidae and Culicidae (Cheeseman 1873, Darwin 1882, Sargent 1934, Hyett 1960, Jones 1981, Stoutamire & Bates 1990, Bartareau & Jackes 1994). These insects approach the flower flying into the wind as if following a perfume trail (Jones 1981), although in all groups except the *'parviflora'* group, no scent is noticeable to humans. Activity of the microdipterans dramatically increases following decreases in barometric pressure, as occurs during squally weather, with the insects appearing to become excited with the approach of a squall, almost as if a floral scent was being released (D.L.Jones pers. obs.). In multi-flowered species the insects frequently crawl from flower to flower on the raceme, sometimes running.

Pollination in the group of species that have deflexed synsepala and a fully exposed labellum, seems to be exclusively by male microdipterans and observations suggest that the syndrome of pseudocopulation may be involved. Typically when approaching a flower the male gnats fly into the wind as if following a scent trail and aim directly for the labellum, with their genitalia becoming exserted when in close proximity to that structure (M.A.Clements, pers. obs.). Further studies are needed to elucidate these relationships.

Self pollination

Autogamy is also developed to a limited extent in the genus, usually involving taxa with incoherent, easily fragmented pollinia, with pieces of pollinia dropping directly onto a protruding or basally-sited stigma (D.L.Jones, pers. obs). This process has been noted in *P. alveata, P. cardiostigma, P. foliata, P. montana, P. tanypoda, P. tasmanica, P. tristis, P. venosa* and some members of the *'parviflora'* group such as *P. aphylla* and *P. uliginosa.*

Pollination mechanisms and the role of the labellum

All species of Pterostylidineae have an actively motile labellum (Cheeseman 1873, Darwin 1882, Northen 1972, Jones 1981, 1988, Bernhardt 1995). The labellum lamina is basally attached to the apex of a sensitive strap which extends either from the base of the column or from the apex of the column foot (**Figs. 1.10, 1.11**). This strap, which is thickened medially, is capable of active movement via an inversion system. In the set position (ie. ready for activation) the strap is convex and when the labellum is triggered, it rapidly becomes inverted, resulting in the labellum lamina moving in an arc to close against the column. A triggered labellum remains in the closed position for 5 to about 30 minutes, depending on the prevailing temperature, before returning to the set position. Initially after resetting, the labellum is not sensitive to touch, this sensitivity increasing over a period of about 10 minutes.

Labellum presentation

A major divergence in the pollination mechanism employed by groups within the Pterostylidinae occurs with the presentation of the labellum. Two scenarios are recognisable (**Fig. 1.3**); the labellum is either exposed totally as a target for the pollinating vector or enclosed within the flower to some extent (wholly or partially). In the group which has the labellum fully exposed, the labellum is triggered by the impact of a flying microdipteran in the act of landing. In the second group the labellum is triggered by the touch of a crawling microdipteran, but only after it passes a point of balance or contacts the basal appendage of the labellum. In both cases the connecting strap inverts and actively moves the labellum (with the insect) from the set position to the closed or triggered position, thus trapping the insect between the column, the closed labellum and the enclosing floral organs.

Vector response

Two options are available to a trapped insect once the labellum closes; it can either wait in the flower for the labellum to reset and then leave the flower or else it can exit immediately via the tunnel formed at the top of the column by the pair of translucent column wings. Observations of insect behaviour are few and difficult to make but they suggest that the labellum movement and resulting entrapment disorient and alarm the insect, which then attempts to quickly leave the flower. To exit the flower the trapped insect travels upwards along the column passing over the stigma and viscidium and through the tunnel formed by the column wings, emerging from the flower via the galea opening. This route enables the possibility of firstly pollen deposition and then pollen removal, preventing self pollination within the one flower.

Variation in pollination systems

The basic procedures of the pollination mechanism described above are employed by all entogamous species of Pterostylidinae, but some groups have significant modifications which are worthy of comment.

Groups 1-3: (*'curta'*, *'alata'* and *'nana'* groups). The flowers have an erect synsepalum

and a single anterior opening to the galea. Some species, such as *P. curta* and *P. pedunculata*, also have a gap (termed lateral gap) between the margins of the synsepalum and the petals (**Figs. 1.5a, b**). The labellum, which is unlobed and has a penicillate basal appendage, is either completely enclosed within the flower or the distal parts protrude through the sinus opening. An insect enters the flower by crawling, either through the main galea opening (sometimes along the protruding parts of the labellum) or via the lateral gap. The labellum is not triggered until the insect is well past the midway point or contacts the basal appendage. Upon triggering, the labellum travels about 30° and when closed its distal parts rest against the column wings forming a narrow tube between it, the column and the margins of the galea. The gap between the anterior margins of the column wings is usually closed by the triggered labellum. It is noteworthy that in these groups the labellum does not act as a primary target for the pollinator, in fact many of these species have the labellum completely hidden from exterior view.

Group 4: (*'parviflora'* group and *P. bicornis*). This group has a similar mechanism to the previous group except that the flowers release a strong semen-like scent, which becomes very obvious in humid weather. Inflorescences are multi-flowered with the flowers facing inwards towards the scape and the pollinating vectors frequently crawl from flower to flower (D.L.Jones, pers. obs.). Observations made on *P. bicornis* showed that the gnats either flew from plant to plant or crawled across the ground from one plant to another. The extra weight of a pollinium, which was deposited on the dorsal part of the insect's thorax, seemed to impede flying and pollen-bearing gnats were all observed to crawl. Activity of the insects greatly increased as a storm approached (D.L.Jones, pers. obs.).

Group 5: (*P. recurva*). The synsepalum and sloping galea form an apical opening to the flower. In the "set" position the strongly siliceous labellum, which does not act as a target, lies against the internal fused part of the synsepalum and is triggered by contact with an insect, which presumably crawls inside. The labellum has two broad lateral lobes, a penicillate basal appendage and a narrow apical lobe which in the triggered position fits into the junction of the anterior margins of the column wings. "Barrier trichomes" on the upper parts of the anterior margins of the column wings, prevent unproductive escape from this area.

Group 6: (*P. daintreana*). This species has obliquely deflexed lateral sepals and a partially protruding, strongly three-lobed labellum which does not act as a target. When triggered the labellum travels about 40°. Its large basal lobes block off the base of the galea and the tip of the lamina rests against the anterior junction of the column wings. Anterior egress from the column wings is prevented by barrier trichomes.

Group 7: (*P. sargentii*). The highly modified labellum of this species acts as a target. It has spreading lateral lobes, each with a large erect basal appendage. When triggered the labellum travels about 130° to close off the base of the galea. A dense proliferation of large trichomes on the dorsal margins of the petals prevents the pollinating insect from escaping into the back of the flower. Long, prominently protruding barrier trichomes on the anterior margins of the column wings close the gap between the labellum apex and the column wings.

Group 8: (*'mutica'* group). The synsepalum is strongly cupped to form a pouch in which the labellum lamina rests when in the set position. The labellum lamina, which is thin-textured, pale-coloured and inconspicuous, is not insectiform and the close-in role of insect attraction is undertaken by a prominent, raised, dark-coloured basal appendage. The labellum is triggered on contact with this appendage and travels about 120° to seal off the base of the galea. When triggered the labellum appendage tucks into the base of the column and the tip of the lamina rests against the basal lobes of the column wings. Anterior egress between the column wings is prevented by barrier trichomes.

Groups 9, 10, 11: (*'longifolia'*, *'vittata'* and *'rufa'* groups). The highly modified labellum is presented as a target to the vector and is triggered by the actual momentum of the landing insect. The visual appearance of the labellum lamina, which could be interpreted as being insectiform, is enhanced by densely clustered highly reflective siliceous cells, and white moniliform setae (*'rufa'* group only). When triggered the labellum travels in an arc of about 150° to close off the base of the galea, its apex ending in close proximity to the apices of the basal lobes of the column wings. Triggering of the labellum occurs very rapidly and the insect is deposited against the base of the column in an apparently disoriented manner (D.L.Jones, pers. obs.). Anterior egress between the column wings is prevented by barrier trichomes.

Group 12: (*'barbata'* group). This group exhibits divergent modifications to the basic pollination system. The galea has two openings and the labellum protrudes from the lower galea opening like a fishing rod and remains nearly fully exposed in the triggered position. The labellum is not triggered until the vector passes over the basal beak-like swelling of the labellum, which is held just inside the galea. When

triggered the labellum moves about 45° to block off the basal opening thus trapping the insect inside the flower. The insect however, is not trapped in a tunnel between the labellum and column as it is in all other groups of the Pterostylidineae. Egress from the flower via any route, other than the column wing tunnel which leads to the upper galea opening, is prevented by the combination of a narrow galea and extraordinarily long basal lobes on the column wings which project obliquely forwards and contact the front of the galea just below the upper galea opening. Further guidance to the insect is provided by very long filiform apical lobes on the column wings which are so arranged as to ensure the pollinating insect reaches the upper galea opening after emerging from the column-wing tunnel. Anterior egress from the column wings is prevented by barrier trichomes.

Post-pollination development

Pedicel elongation – Limited elongation of the pedicel following pollination occurs in the *'parviflora'* group and *'mutica'* group but is absent in others.

Peduncle elongation - Elongation of the peduncle following pollination occurs only in *P. uliginosa* (*'parviflora'* group) and in *P. humilis* (*'curta'* group).

Seed development and seed dispersal

In *Pterostylis*, seeds are released from a dehiscent capsule three to six weeks after pollination. The capsule opens by slits and the seed is dispersed over several days by the wind, although the majority of seeds are deposited in close proximity to the parent plant (D.L.Jones, pers. obs.).

Pterostylis uliginosa, a member of the *'parviflora'* group, is unique within the group with its scape thickening and elongating prior to seed release, although *Pterostylis humilis* from New Zealand may have a similar adaptation. Elongation of the scape prior to seed dehiscence allows wider dispersal of the seeds.

Mycorrhiza

The mycorrhizal endophytes present in the underground organs of various species of *Pterostylis* have been identified (Warcup 1971, 1973, 1981a,b, 1990, Clements & Ellyard 1979, Clements 1980, 1981, 1982a,b, 1983, 1988), and germination studies using some of these fungi have provided a substantive data set for understanding the processes involved during this critical life cycle stage which occurs throughout the Orchidaceae (Clements 1982a, 1988, Rasmussen 1995). Isolated fungi found to be symbiotic with various species of *Pterostylis* all belong to the Ceratobasidiaceae: Tullasnellales (Warcup 1981); most have been identified as *Ceratobasidium cornigerum* (Bourd.) Rogers. Typically these fungi are found in cortical cells of the stem collar situated at or near ground level in all species, but fungi may also be present, to a lesser extent, in absorbing roots. Mycorrhizal fungi function in this situation as an absorbing organ with a network of hyphae radiating out into the substrate surrounding the collar or roots. In this situation the fungi act as an extended root system for the orchid. They may also serve to protect the plant tissue from infection by other fungi.

Germination

Depending on the time of dispersal, seeds can lie dormant over the summer dry period or germinate soon after landing in a suitable moist microhabitat, becoming infected by an appropriate mycorrhizal fungus (Clements 1982a, Batty *et al.* 2000). In the wild all orchids, including *Pterostylis*, are dependent on infection by an appropriate mycorrhizal fungus to stimulate germination of the embryo and facilitate the establishment of the seedling. *Pterostylis* seeds do not carry the fungus, rather they are infected upon becoming embedded in a substrate where the appropriate mycorrhizal fungus exists. These fungi form an ectotrophic mycorrhizal association invading the hypostasis at the micropylar end of the embryo and form pelotons (coiled balls of fungal hyphae) in these cells. Parts of these pelotons are digested by the orchid thus enabling the transferral of nutrients from the fungus to the orchid. The fungus is thus the primary source of nutrients for the developing protocorm until establishment and development of a root tuber.

Protocorms

Studies by Clements (1995; 1999; unpublished) on seedlings germinated *in vitro* have shown that two types of protocorm are present in *Pterostylis*. The majority of species have a simple obovoid protocorm-seedling type on which the growth arises centrally from the upper surface (Plate 13e). In protocorms of the *'rufa'* and *'barbata'* groups and *P. recurva*, a positively geotrophic growth extends downwards before curving upwards and producing a shoot at the apex. This is known as the obovoid-deorsum protocorm-seedling type (**Plate 13e, f**).

Annual growth

Dormant root tubers contain little or none of the appropriate mycorrhizal fungus and the collar and roots of each plant must be reinfected each year during the early stages of growth. Infection is facilitated through the rhizoids that develop on the epidermis of the underground shoots or roots, but particularly around the stem collar.

Vegetative reproduction

All species of *Pterostylis* reproduce from seed and some groups within the genus also reproduce locally by vegetative methods. In those species with an erect synsepalum, some groups produce

supplementary daughter tubers on the end of long stolonoid roots. Reproduction rates can be impressive with robust plants of some species producing up to five daughter tubers each season. By this means these species grow in clonal colonies which can be dense and extensive and expand in area and density annually.

Pterostylis recurva, members of the '*parviflora*' group and those species with a deflexed synsepalum do not produce stolonoid roots or daughter tubers. Occasionally one of these species can produce extra daughter tubers on droppers close to the parent tuber and as a result form localised clonal tufts consisting of few to several crowded individuals. This mode of vegetative reproduction is limited, only occurring on relatively large or robust plants in congenial seasons and does not contribute significantly to spatial expansion.

SUMMARY

Pterostylis, as commonly interpreted, is a heterogeneous assemblage that exhibits considerable morphological and biological variation. Within the genus a number of readily recognisable natural groups can be discerned as well as some very distinctive taxa which appear to be well isolated from the main group of species. The significance of this variation will be explored in Part 2 of this paper via a cladistic analysis of the morphology, a molecular study (the details of which is to be published elsewhere), and a combined analysis.

PART 2: MORPHOLOGICAL AND MOLECULAR ANALYSES[1]

The subtribe Pterostylidinae, as currently interpreted, consists of the solitary genus *Pterostylis* (Dressler 1993). *Pterostylis* is defined (Schlechter, 1926; Jones, in press) by the possession of :-

1) Dorsal sepal and petals forming an oblong galea, connate at the base with the lateral sepals;
2) Labellum actively motile on an irritable claw, with a retrorse basal appendage although this is absent in many taxa;
3) Column slender, two-winged at apex, incurved at foot; stigma decurrent; column wings apical, retrorse; and
4) Rostellum extended between the wings.
5) Lateral sepals connate to form a synsepalum.

Despite the overall unification of the genus provided by these characters, *Pterostylis* is highly variable and several natural groups can be readily discerned (see Part 1). The existence of these natural groups, which are separated by prominent characters and character states, gave rise to the question of monophyly and the phylogeny within the genus. These features were studied, initially using morphological characters, and later supplemented with molecular studies.

MATERIALS AND METHODS

Morphological, Biological and Molecular Data

Data for these analyses were compiled primarily from our own field observations and detailed morphological, developmental, and biological research of living plants and from published sources. We also studied available herbarium specimens from the following herbaria: AD, AK, AMES, B, BM, BRI, CANB, CHR, E, FI, G, HO, K, L, LAE, MEL, MOU, NOU, NSW, PERTH, W, Z.

Morphological analysis

Morphological data obtained from representative taxa of all the major taxonomic lines within the Pterostylidinae, were used for a cladistic analysis. Characters and character states used in these analyses are given in Table 1.2. Many morphological characters and character states are self explanatory but others are discussed in detail in part 1 of this paper.

Table 1.2. Morphological character list used in cladistic analyses of the Pterostylidinae where all multistate characters were coded as non-additive characters.

1. *Dimorphic growth habit*: absent (0); present (1).
2. *Leaves dimorphic in flowering plant*: absent (0); present (1).
3. *Reproduction vegetative*: absent (0); present (1).
4. *Rosette in flowering plant*: absent (0); present (1).
5. *Rosette type*: basal (0); lateral (1).
6. *Rosette leaf attachment type*: petiolate (0); sessile/subsessile (1).
7. *Rosette leaves exerting pressure on ground surface*: absent (0); present (1)
8. *Rosette leaf attitude*: obliquely erect (0); spreading horizontally (1)
9. *Flower number*: solitary (0); multiple (1)
10. *Flower attitude*: facing inwards (0); facing outwards (1)
11. *Flowers with semen scent*: absent (0); present (1)
12. *Galea opening*: one (0); two (1)
13. *Attitude of lateral sepals*: erect (0); deflexed (1)
14. *Erect lateral sepals with prominent lateral gap*: absent (0); present (1)

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[1] Contribution for molecular data sets from Ish K. Sharma* and Anne M. Mackenzie**

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15. *Lateral sepal union*: scarcely joined (0); firmly joined (1); free (2)
16. *Lateral sepals with thickened pad*: absent (0); present (1)
17. *Venation on lateral sepals*: free (0); anastomosing (1)
18. *Papillae on interior surface of lateral sepals*: absent (0); present (1)
19. *Deflexed lateral sepal – with sunken central pit*: absent (0); present (1)
20. *Free point of lateral sepals*: short flat (0); short involute (1); long involute (2); long flat (3); long, thick and channelled (4)
21. *Free points of erect lateral sepals*: parallel and high above galea (0); incurved and as long as galea (1); recurved (2)
22. *Sepals ridged*: absent (0); present (1)
23. *Dorsal sepal apex filiform*: absent (0); present (1)
24. *Dorsal sepal venation*: free (0); anastomosing (1)
25. *Basal flange on petal*: absent (0); present (1)
26. *Trichomes on petal ridge*: absent (0); smooth (1); moniliform (2)
27. *Anterior margins of petals*: entire (0); erose flat (1); erose spreading (2); minutely ciliate (3); beaded cells (4)
28. *Petal venation*: free (0); anastomosing (1)
29. *Petal apex*: entire (0); extended and thickened (1); hooked (2)
30. *Labellum lamina with acicular cells*: absent (0); present (1)
31. *Labellum lobing*: absent (0); three-lobed (1)
32. *Labellum with inflated lateral lobes*: absent (0); present (1)
33. *Labellum apex emergent through sinus*: absent (0); present (1)
34. *Labellum with transverse basal wrinkles*: absent (0); present (1)
35. *Labellum with central abaxial fold*: absent (0); present (1)
36. *Labellum with apical counter weight*: absent (0); present (1)
37. *Labellum apex swollen and knob-like*: absent (0); present (1)
38. *Labellum entire, apex notched*: absent (0); present (1)
39. *Labellum lobed, apex notched*: absent (0); present (1)
40. *Labellum setae*: absent (0); of one type (1); of two types (2)
41. *Labellum setae surface*: irregularly swollen (0); transversely wrinkled (1)
42. *Labellum setae colour*: yellow (0); white (1)
43. *Labellum setae basal cell type*: elongate (0); rounded (1)
44. *Labellum lamina basal appendage*: absent (0); penicillate (1); rostrate (2)
45. *Labellum lobed, base fleshy*: entire (0); caudiculate (1)
46. *Labellum appendage acting as target*: absent (0); present (1)
47. *Labellum lamina thickness*: membranous (0); thin (1); thick and fleshy (2)
48. *Labellum lamina exposed as a target*: absent (0); partially (1); wholly (2)
49. *Labellum blocks off entrance to galea*: absent (0); present (1)
50. *Petals with barrier trichomes*: absent (0); present (1)
51. *Angle of labellum travel*: 20° (0); 45° (1); >90° (2)
52. *Apical lobule of column wings*: absent (0); as wide as long (1); much longer than wide (2)
53. *Column posture*: gently recurved (0); sharply bent inwards (1); slightly recurved (2); straight (3)
54. *Barrier trichomes*: absent (0); moniliform (1); bifurcate (2)
55. *Siliceous cells on upper column wings*: absent (0); present (1)
56. *Stigma lobes*: nearly free (0); fully united (1)
57. *Stigma substance*: thick and fleshy (0); thin and membranous (1)
58. *Stigma curvature*: incurved (0); flat (1); outcurved (2)
59. *Stigma margins*: level with column (0); protruding (1); recurved (2)
60. *Stigma dimensions*: longer than wide (0); as wide as long (1)
61. *Pollinia length: width ratio*: <2:1 (0); 4:1 to 6:1 (1); >10:1 (2)
62. *Pedicel elongating in fruit*: absent (0); present (1)
63. *Petal obliquely falcate and asymmetrical*: absent (0); present (1)
64. *Column with terminal wings forming a tunnel*: absent (0); present (1)
65. *Labellum actively mobile*: absent (0); present (1)
66. *Dorsal sepal and petals forming a galea*: absent (0); present (1)
67. *Root-tubers*: clustered, thin-fleshy (0); solitary globose (1); fasciculate, elongate or palmate (2).
68. *Pollinia attached to viscidium*: absent (0); present (1)
69. *Embryo developmental pattern*: spiranthoid: Achlydosinae (0); spiranthoid: Spiranthinae (1).
70. *Spiranthoid embryo type*: small, suborbicular, included (0); large elliptic (1); small elliptic (2); huge protruding (3); elongate (4); obovate (5); elongate, protruding suspensor (6); rostrate hypostase (7); rostrate micropyle (8)
71. *Protocorm-seedling type*: (0) obovoid; (1) obovoid-deorsum.

Choice of Taxa

Forty five species representative of all major natural groups within *Pterostylis*, plus *Achlydosa glandulosa* (Schltr.) M.A.Clem. & D.L.Jones (Achlydosinae: Cranichideae), *Spiranthes australis* (R.Br.) Lindl. (Spiranthinae: Cranichideae) and *Chloraea virescens* Lindl. (Chloraeninae: Cranichideae) as outgroups, were used in this study. Collections were made during field trips throughout Australia, New Zealand, Papua New Guinea and New Caledonia, or as in the case of *Chloraea*, from cultivated material of known provenance. The choice of outgroups was based on morphological and reproductive biology studies (Clements 1995, 1996), assessment of the literature (Schlechter 1926, Dressler 1981, 1993) and from independent molecular studies on the Diurideae (Clements *et al.*, 2002).

There is considerable variation in vegetative and floral morphology between members of the tribe Cranichideae (outgroups) and within *Pterostylis* itself. Numerous characters and character states relating to *Pterostylis* have been detailed in Part 1 of this paper. Variations of characters and character states present in the outgroup taxa to that of *Pterostylis* are detailed here.

Tuber shape - In *Achlydosa* the perennating organ is a cluster of thin but fleshy roots (Jones & Clements 2002); *Chloraea* has fasciculate fleshy roots (Correa 1969), whereas in *Spiranthes* they can be fasciculate, elongate or palmate (Garay 1982, Jones 1988).

Rosette placement - In both *Chloraea* and *Spiranthes* the leaves form a rosette and are synanthous or proteranthous (Garay 1982), the replacement rosette emerging adjacent to the old rosette.

Floral attitude - All three outgroup species and the majority of multi-flowered *Pterostylis* species have outward-facing flowers, but in the *'parviflora'* group the flowers face inwards towards the scape.

Floral scent - *Chloraea virescens* has a sweet scent and the other outgroups are unscented.

Embryo type - This is variable – huge protruding (*Chloraea*); large elliptic (*Spiranthes*); small suborbicular, included (*Megastylis glandulosa*).

Molecular and combined morphology-molecular analyses

Phylogenetic analyses using firstly molecular sequence data based on the internal transcribed spacers, ITS1 and ITS2, non-coding regions flanked by the 18S and 26S nrDNA coding regions and "containing" the highly conserved 5.8S coding region, and secondly a combined morphology-molecular data matrix, were carried out for comparison and further resolution of taxa. Fresh leaf samples from plants of known provenance were used where possible or rarely material was sampled from herbarium specimens or from floral dissection cards (Appendix 1). All collections were vouchered, the majority being deposited at the Australian National Herbarium (CANB) or at the Landcare Research Herbarium, Lincoln (CHR). The methods used for DNA extraction and sequencing are outlined in Clements *et al.* (2002). All sequences were initially aligned with Clustal W (Thompson *et al.* 1994) in BioEdit and adjusted by eye. Gaps were coded as missing values and unambiguous indels of four or more base pairs were coded for all sequences, totalling an addition of 17 characters for the ITS matrix.

Parsimony analyses were conducted using PAUP* version 4.0b4a (Swofford 1998). All characters were unordered and weighted equally in the morphological and combined morphological and molecular analyses of all 854 characters. In the morphological data set unknowns or uncertainties were coded as questionmarks and treated as missing in the analyses, and inapplicable characters coded with hyphens (-). The most parsimonious trees were generated using a heuristic search algorithm with TBR branch swapping and the "MulTrees" option generating a consensus tree. Starting trees were constructed using 100 replicates of random addition sequence. Successive weighting (Farris 1969) was applied through recalculation of the rescaled consistency indices and re-analysis for the most parsimonious trees using heuristic search algorithm with TBR branch swapping (as described above) until a stable position was attained. To determine the relative support for the resultant clades, bootstrap analyses (Felsenstein 1985) were conducted for both unweighted and weighted trees, using 1,000 bootstrap replicates with TBR branch swapping and all minimal length trees saved.

RESULTS

Morphological Analysis

Cladistic analysis of 45 coded taxa, using 72 morphological characters and character states, all unordered and of equal weight (Table 1.3), 68 of which are potentially parsimony-informative, produced 321 most-parsimonious trees with Fitch length of 180 steps; consistency index (CI) = 0.5556; a CI excluding uninformative characters = 0.5429; retention index (RI) = 0.8587; and, rescaled consistency index (RC) = 0.4770. Successive weighting of these trees resulted in eight most-parsimonious trees of weighted Fitch length 87.84189 with CI = 0.7754; CI excluding uninformative characters = 0.7618; RI = 0.9340; and, RC = 0.7242. One randomly selected successively weighted tree is presented (Tree 1.1).

These results show that *Pterostylis,* as currently circumscribed, is monophyletic and well isolated from the outgroup taxa, *Achlydosa glandulosa, Spiranthes australis* and *Chloraea virescens*. Six of the twelve study groups form isolated and well-supported monophyletic clades within *Pterostylis*. *Pterostylis daintreana*, *P. recurva* and *P. sargentii* remain well isolated, while the *'curta'* group is paraphyletic with the *'nana'* and *'alata'* groups embedded therein.

Sister to the remainder of the ingroup is the *'barbata'* group, Clade A, which by previous authors has been treated as a distinct section within *Pterostylis*. The position of the *'barbata'* group is well supported with high bootstrap value (100%) and by the possession of 14 character states, including seven autapomorphs, *viz.* galea opening two (#12); lateral sepals with a thickened central pad (# 16); anterior margins of petals vestigial (#27); labellum with transverse basal wrinkles (# 34); labellum with apical counter weight (# 36); labellum with coarse yellow setae (# 40); and labellum seta with a corrugated surface (# 41). Species in the *'barbata'* group form a well-supported clade isolated from the remainder of *Pterostylis* by five synapomorphies. The remaining representatives of *Pterostylis* form a dichotomy divided into two major clades, B and C.

Clade B comprises those taxa with a deflexed synsepalum and an exposed labellum, *viz.* the *'longifolia', 'vittata', 'mutica'* and *'rufa'* groups as well as *P. daintreana* and *P. sargentii*. Within this clade *P. sargentii, P. daintreana* and the *'longifolia'* and *'vittata'* groups which have cauline leaves and a multi-flowered inflorescence cluster together and are isolated from the *'mutica'* and *'rufa'* groups which have a multi-flowered inflorescence and leaves arranged in a basal rosette. All terminal groups within clade B have high bootstrap values (86-100%) and are well supported with three to ten synapomorphies. Species representative of these groups are non colony-forming and reproduce exclusively from seed.

Clade C comprises those taxa with an erect synsepalum and enclosed or partially enclosed labellum, *viz. P. recurva, 'parviflora', 'nana', 'alata'* and *'curta'* groups. Components of clade C form a ladderised arrangement with *P. recurva* and the *'parviflora'* groups being well isolated from a weakly supported and poorly resolved assemblage of species from the *'nana', 'alata'* and *'curta'* groups. Reproduction in clade C is a mixture with *P. recurva* and members of the *'parviflora'* groups reproducing solely from seed, whereas the remainder reproduce vegetatively to form clonal colonies as well as by seed. The *'nana', 'alata'* and *'curta'* groups cluster together into a single clade but the arrangement of taxa within that clade renders the *'curta'* group paraphyletic. The character state and bootstrap support for this grouping is also weak (>50%). Topological arrangement of these groups correlates to varying degrees with some earlier attempts at the classification of *Pterostylis* (Don 1830, Bentham 1873, Pfitzer 1887, Rupp 1933) that were purely based on morphology. Species listed in sections *Foliosae* and *Nudicaules* of Don (1830) occur in clade C, while those listed for section *Squamatae* are found in clade B. Bentham's concept of section *Antennaea* containing the series *Grandiflorae* and *Parviflorae*, with the exception of *P. daintreana*, correlates with species in clade C. Series *Grandiflorae* is however paraphyletic with the inclusion of *P. recurva* in the present tree. Bentham's section *Catochilus*, which included *P. barbata, P. turfosa, P. mutica, P. rufa, P. longifolia* and *P. vittata*, correlates to those taxa in clade B, with the exception of the first two. The isolation of the *'barbata'* group from the remaining taxa in clade B renders Bentham's section *Catochilus* paraphyletic. There is also a broad level of congruence between the results

Table 1.3. Data matrix of characters used in these analyses.

Achlydosa glandulosa	0001000011	0-1-2010--	-0010-0100	0--00000-0	---0--21-0	-03--10011	0010010000	0
Chloraea virescens	0001010011	0-1-2010--	-0010-0100	10-00000-0	---0--01-0	-11--10101	1000002113	0
Spiranthes australis	0001010011	0-1-2000--	-0000-0000	10-00000-0	---0--00-0	-13--10101	1000012111	0
laxa	1010-0010-	00001000-2	0011000101	0-101000-0	---1-01100	1200010100	1011111016	0
grandiflora	1010-0010-	00001000-2	0011000101	0-101000-0	---1-01100	1200010100	1011111016	0
decurva	1010-0010-	00001000-2	0011000101	0-101000-0	---1-01100	1200010100	1011111016	0
concinna	011100010-	00001000-2	0001000101	0-001001-0	---1-01100	1200010100	1011111016	0
ophioglossa	011100010-	00001000-2	0001000101	0-101001-0	---1-01100	1200010100	1011111016	0
taurus	011100010-	00001000-2	0001000101	0-101001-0	---1-01100	1200010100	1011111016	0
collina	011100010-	00001000-2	0001000101	0-101001-0	---1-01100	1200010100	1011111016	0
pedoglossa	011100010-	00001000-2	0011000100	0-001000-0	---1-01000	1200010100	1011111016	0
pyramidalis	001100010-	00001000-2	0001000101	0-001000-0	---1-01000	1200010100	1011111016	0
nana	011100010-	00001000-2	0001000101	0-001000-0	---1-01000	1200010100	1011111016	0
dilatata	1010-0010-	00001000-2	0001000101	0-001000-0	---1-01000	1200010100	1011111016	0
allantoidea	011100010-	00001000-2	0011000101	0-101000-0	---1-02100	1200010100	1011111016	0
bicornis	1101100110	10001010-0	1001000111	0-101010-0	---1-01100	1200000211	2111111015	0
parviflora	1101100110	10001010-0	1001000101	0-001000-0	---1-01000	1200000211	2111111015	0
nigricans	1101100110	10001010-0	1001000101	0-001000-0	---1-01000	1200000211	2111111015	0
aphylla	1101100110	10001010-0	1001000101	0-001000-0	---1-01000	1200000211	2111111015	0
australis	0010-1000-	00011000-3	0001000101	0-101000-0	---1-01100	1200010100	1011111011	0
banksii	0010-1000-	00011000-3	0001000101	0-101000-0	---1-01100	1200010100	1011111011	0
graminea	0010-1000-	00011000-3	0001000101	0-101000-0	---1-01100	1200010100	1011111011	0
cucullata	001101000-	00011000-2	0001000101	0-101000-0	---1-01100	1200010100	1011111011	0
furcata	001101000-	00011000-2	0001000101	0-101000-0	---1-01100	1200010100	1011111011	0
bureaviana	001101000-	00011000-2	0001000101	0-101000-0	---1-01100	1200010100	1011111011	0
curta	011100010-	00011000-2	0001000101	0-101000-0	---1-01100	1200010100	1011111011	0
baptistii	011100010-	00011000-2	0001000101	0-101000-0	---1-01100	1200010100	1011111011	0
pedunculata	011100010-	00011000-2	0001000101	0-001000-0	---1-01000	1200010100	1011111011	0
foliata	001101000-	00011000-2	0001000101	0-101000-0	---1-01100	1200010100	1011111011	0
papuana	011100000-	00011000-2	0001000101	0-101000-0	---1-01100	1200010100	1011111011	0
biseta	0101011111	001-101002	-011110101	0--0000-01	01100-2210	2001110110	1011111012	1
rufa	0101011111	001-101002	-011110101	0--0000-01	01100-2210	2001110110	1011111012	1
spathulata	0101011111	001-101002	-011110101	0--0000-01	01100-2210	2001110110	1011111012	1
bicolor	0101010111	001-000001	-000004000	0--0000-10	---2-10010	2000110100	0111111012	1
cycnocephala	0101010111	001-000001	-000004000	0--0000-10	---2-10010	2000110100	0111111012	1
mutica	0101010111	001-000001	-000004000	0--0000-10	---2-10010	2000110100	0111111012	1
concava	1000-00111	001-101111	-101110001	10-0000-10	---01-2010	2112011011	1011111018	0
sanguinea	1000-00111	001-101111	-101110001	10-0000-10	---01-2010	2112011011	1011111018	0
vittata	1000-00111	001-101111	-101110001	10-0000-10	---01-2010	2112011011	1011111018	0
sargentii	1000-00111	001-101002	-101022001	11-0000-10	---0-?1211	2101010100	1011111014	0
daintreana	1101100111	001-100002	-000010001	11-0000-10	---0-?1110	2001010211	1111111014	1
longifolia	1000-00111	001-101101	-001113001	10-0000-10	---00-2010	2101010100	1111111014	0
smaragdyna	1000-00111	001-101101	-001113001	10-0000-10	---00-2010	2101010100	1111111014	0
tunstallii	1000-00111	001-101101	-001113001	10-0000-10	---00-2010	2101010100	1111111014	0
recurva	1000-00111	00111000-2	2110000021	1000100-10	---1-01000	0122010120	1011111014	1
barbata	000101000-	011-110104	-001001000	0--101---2	1000--?210	1222010120	1011111017	1
plumosa	000101000-	011-110104	-001001000	0--101---2	1000--?210	1222010120	1011111017	1
turfosa	000101000-	011-110104	-001001000	0--101---2	1000--?210	1222010120	1011111017	1

generated in this study and the system proposed by Rupp (1933). Rupp's section *Laminatae* correlates to the combined clades B and C, while section *Filiforme* is equivalent to the *'barbata'* group in our studies (Clade A). However, both subsections of section *Laminatae* are a mixture of groups from both clades B and C. By contrast, there is virtually no correlation with the results generated here to that proposed earlier either by Lindley (1840) or Reichenbach (1871).

At a narrower level these analyses show various degrees of support for the integrity of each of the twelve groups identified by morphological characters in the first part of this paper. All groups in clades A and B maintain their integrity but in clade C the *'curta'* (rosetted) group is shown to be paraphyletic with both the *'alata'* and *'nana'* groups embedded within it. Species which have a notched labellum apex (character 38(1)), *viz. P. concinna, P. collina, P. taurus* and *P. ophioglossa,* form one clade and align with the *'alata'* and ' *nana'* groups rather than with the clade containing *P. curta* – this assemblage of species hereafter referred to as the *'ophioglossa'* group. Similarly, *P. allantoidea,* which we interpreted as belonging to the *'curta'* group, is embedded between species representing the *'alata'* and *'nana'* groups. The remaining species in the *'curta'* group, *viz. P. pedunculata, P. baptistii, P. curta, P. foliata, P. cucullata, P. graminea, P. banksii* and *P. australis,* cluster together in a partially ladderised, monophyletic, but poorly supported clade based on possession of a solitary homopleisious character. Within this assemblage, three New Zealand species, *P. graminea, P. banksii* and *P. australis,* form a polytomy with 77% bootstrap support. The position of this group of species is supported by absence of a rosette in flowering plants (a reversal of character 4), and free points of lateral sepals being flat, not linear-terete (character 20(3)). Species representative of the *'alata'* group form a polytomy in a monophyletic clade, with poor (55%) bootstrap support, deeply embedded within a clade containing representatives of both the *'curta'* and *'nana'* groups. Characters supporting the *'alata'* clade include, dimorphic growth habit (character 1(1); flowering plant dimorphic (character 2(0)); and rosette absent in flowering plant (character 4 (0)), all of which are either reversals or parallelisms. By comparison, representatives of the *'nana'* group form a ladderised assemblage for which there is only very weak support. The position of *P. dilatata* within the *'nana'* groups is supported by the dimorphic growth habit (character 1(0)), rendering that character paraphyletic as it has also been important in defining members of the *'alata'* group. This character is absent in *P. clavigera, P. pyramidalis, P. pedoglossa* and *P. allantoidea* which have flowering plants with a basal rosette and monomorphic growth habit. The strikingly dissimilar *'parviflora'* group, which has a multi-flowered inflorescence, is a monophyletic, strongly supported group (100% bootstrap support), sister to the *'curta'*, *'alata'* and *'nana'* groups. This group of species are isolated by 11 synapomorphies including three that are unique to the group, *viz.* flowers with a semen-like scent (character 11); triangular free points of the lateral sepals (character 21); and dilated stigma lobes (character 56). Their position allied to the *'curta'*, *'alata'* and *'nana'* groups is supported by seven synapomorphies, most notably labellum enclosed within the galea (character 10), and lateral sepals erect (character 13). Adjacent to the *P. parviflora* group is the *P. recurva* clade containing a solitary species that is isolated from the remaining groups in clade C by a combined total of 20 synapomorphies, including three autapomorphies. Significant characters are the recurved free points of the lateral sepals (character 21(2)) and uncinate petal apex (character 29(2)). *Pterostylis recurva* is included within clade B by three synapomorphies, *viz.* labellum with a central abaxial ridge (character 35); penicillate basal labellum appendage (character 42); and, position of the labellum blocking off the entrance to the galea (character 49).

Clade B comprises six groups in a step-wise arrangement. The *'mutica'*, *'rufa'*, *'vittata'* and *'longifolia'* groups have high levels of support, the other two groups each being represented by a single species (*P. daintreana* and *P. sargentii*). Within this clade *P. daintreana* is isolated by the possession of six character states, including basal rosettes arising on lateral growths (character 5); labellum exposed as a target (character 48); stigma concave (character 58 (2)); and, stigma as wide as long (character 60). Isolation of *P. daintreana* from the *'parviflora'* group renders Bentham's section *Antennaea* series *Parviflorae* paraphyletic (Bentham 1873). Likewise Rupp's section *Laminatae* subsection B, Division III is paraphyletic with this species included. Conversely, there is strong support (100% each) for the monophyly of both the *'mutica'* and *'rufa'* groups within this part of clade B, but no support for their combined alignment, despite the similarity in general appearance of species in these two groups. *P. sargentii* sits isolated from, but sister to, the *'longifolia'* and *'vittata'* groups, supported by the possession of seven synapomorphies. There is poor bootstrap support for the combined alignment of these three groups contrary to the strong support for the *'longifolia'* and *'vittata'* groups in isolation.

Clade A identifies 14 morphological characters and shows there is strong (100%) bootstrap support for the recognition of the *'barbata'* group as a monophyletic taxon.

Molecular Analysis

Phylogenetic analyses of the Pterostylidinae were also undertaken using molecular sequence data with the same set of species representatives as for the morphological study and the outgroup. Whilst this only represents a subsample of taxa within the Pterostylidinae it does provide sufficient data to construct a phylogenetic overview of the group. Detailed studies, including use of another part of the genome, are also being undertaken to more fully enunciate relationships of taxa within the Pterostylidinae and these will be published elsewhere at a later date. The alignment of 753 nucleotide sites, including 17 scored indels, contained 195 potentially informative sites. These analyses produced 126 equally parsimonious trees; tree length = 588; consistency index (CI) = 0.6888; consistency index excluding uninformative characters = 0.6013; retention index (RI) = 0.8375; and rescaled consistency index (RC) = 0.5768. Successive weighting (SW) produced 24 equally parsimonious trees; tree length = 339.22370; consistency index (CI) = 0.8618; consistency index excluding uninformative characters = 0.7770; retention index (RI) = 0.9211; and rescaled consistency index (RC) = 0.7938. One randomly selected SW tree is presented, showing nucleotide substitution values along the branches (Tree 1.2). The results show, as currently interpreted, the Pterostylidinae is monophyletic on a well-supported clade sister to the subtribes Achlydosinae (represented by *Achlydosa glandulosa*), Chloraeinae (represented by *Chloraea virescens*) and Spiranthinae (represented by *Spiranthes australis*). The position of the Pterostylidinae adjacent to these taxa is congruent with the results obtained in the overall assessment of the Diurideae and Cranichideae in the subfamily Orchidoideae (Clements *et al.*, 2002).

Within the Pterostylidinae there is a basic dichotomy aligning *'mutica'*, *'rufa'*, *P. recurva*, *'barbata'*, *'longifolia'*, *P. daintreana*, *P. sargentii*, and the *'vittata'* groups into one major clade, and the *'curta'*, *P. bicornis*, *'parviflora'*, *P. allantoidea*, *'nana'*, *P. pedoglossa*, *'alata'* and *'ophioglossa'* groups into a second major clade. The integrity of the informal morphological groups has been maintained in all cases within the first major clade. This major clade also includes *P. recurva* which, in the morphological analyses, aligned with the *'parviflora'*, *'curta'* and *'nana'* groups. The position of the *'barbata'* group has also changed from being isolated in the morphological analyses to becoming deeply embedded within the first major clade. Alignments between the *'rufa'* and *'mutica'* groups, with their similar habit and morphology, have changed so that they are now sister to one another on an isolated branch within this major clade. Conversely however, two other groups with similar habit and morphology, the *'vittata'* and *'longifolia'* groups, no longer occupy sister positions to one another, now being separated by *P. daintreana* and *P. sargentii*. Support for the monophyly of five of these taxa is also very high. In the second major clade the integrity of the several groups including the *'curta'*, *'parviflora'* and *'ophioglossa'* groups has been maintained. *Pterostylis pedoglossa* is however isolated from the *'nana'* group, rendering that grouping paraphyletic. Although still intact, the *'ophioglossa'* group is embedded within a paraphyletic *'alata'* group. The position of *P. allantoidea* as sister to the *'nana'* group (minus *P. pedoglossa*), and that of *P. bicornis* with the *'parviflora'* group remain the same. However, the position of the *'parviflora'* group is now intermediate between the *'curta'* and *'alata'*-*'nana'* alignment, rendering the traditional interpretation of the colony-forming *Pterostylis* species paraphyletic. Bootstrap support for branches within this major clade are very high; 85% for the *'parviflora'* group; 99% for the reduced *'nana'* group, and 93% for the *'curta'* groups, although support is weak for the overall monophyly of the major clade.

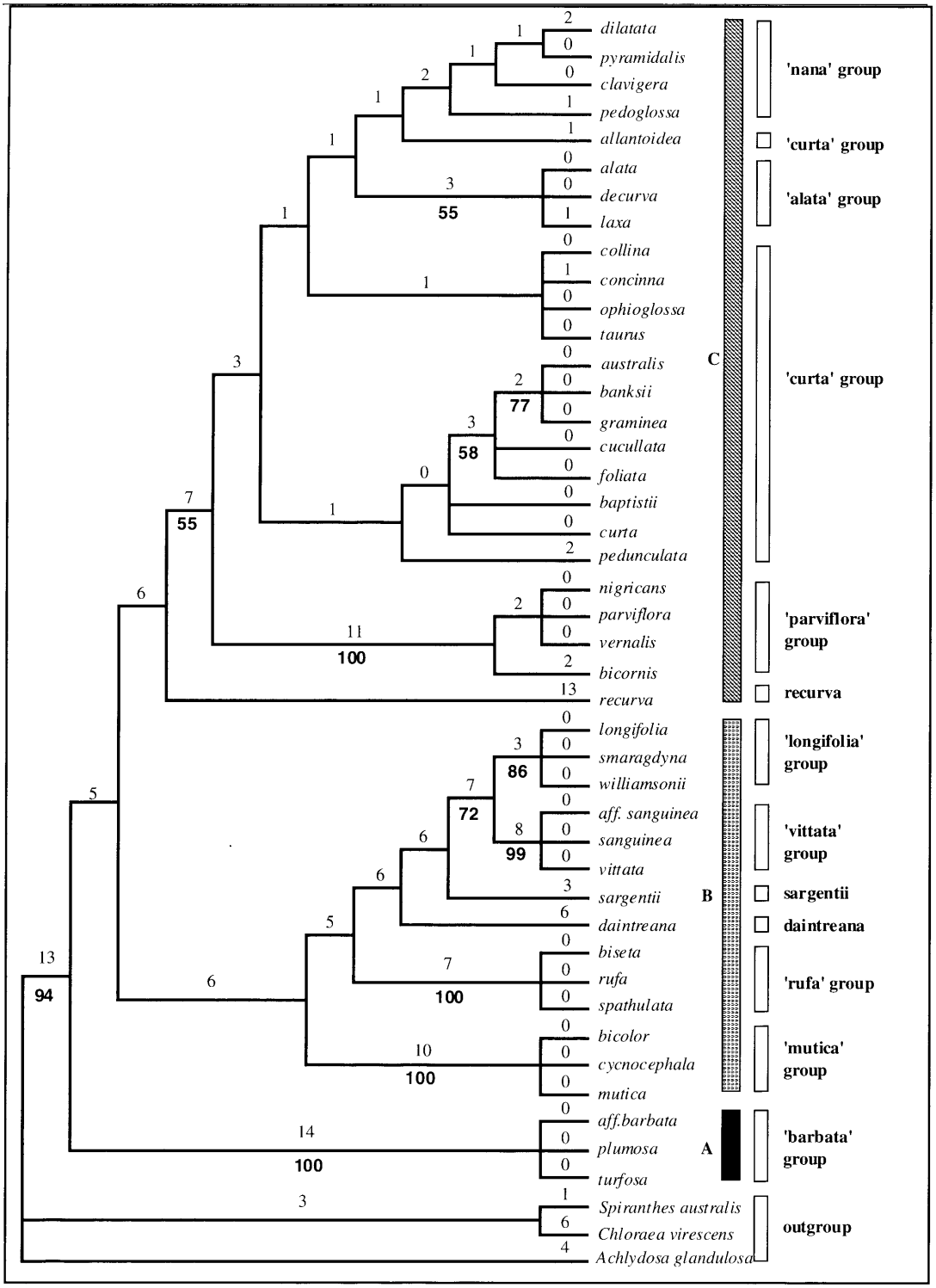
Combined Analysis

A combined morphological-molecular or total evidence analysis of the same 45 species, representative of every taxonomic group plus three outgroup species, within the alignment of 825 nucleotide and morphological sites of which 263 are parsimony informative characters, produced 324 equally parsimonious trees with a tree length of 788; consistency index (CI) = 0.6409; consistency index excluding uninformative characters = 0.5673; and retention index (RI) = 0.8327 and rescaled consistency index (RC) = 0.5337. Successive weighting was applied and produced eight equally parsimonious trees with tree length of 425.40774; consistency index (CI) = 0.8348; consistency index excluding uninformative characters = 0.7588; retention index (RI) = 0.9157 and rescaled consistency index (RC) = 0.7644. Overall topologies of all eight combined trees maintained the integrity of the major clades shown in the molecular tree (Tree 1.2), and most of the component groupings. They differed only in respect to: (a) the segregation of the '*alata*' group into a monophyletic clade separate from the '*ophioglossa*' group, where previously the latter had been embedded within the '*alata*' group; (b) the repositioning of *P. daintreana* from an intermediate position between the '*longifolia*' and '*vittata*' groups to sister to those groups; and (c) the alignment of *P. recurva* with the '*barbata*' group. One of these trees is presented here (Tree 1.3), showing the characters and character states, both morphological and molecular, supporting the phylogenetic arrangement of taxa.

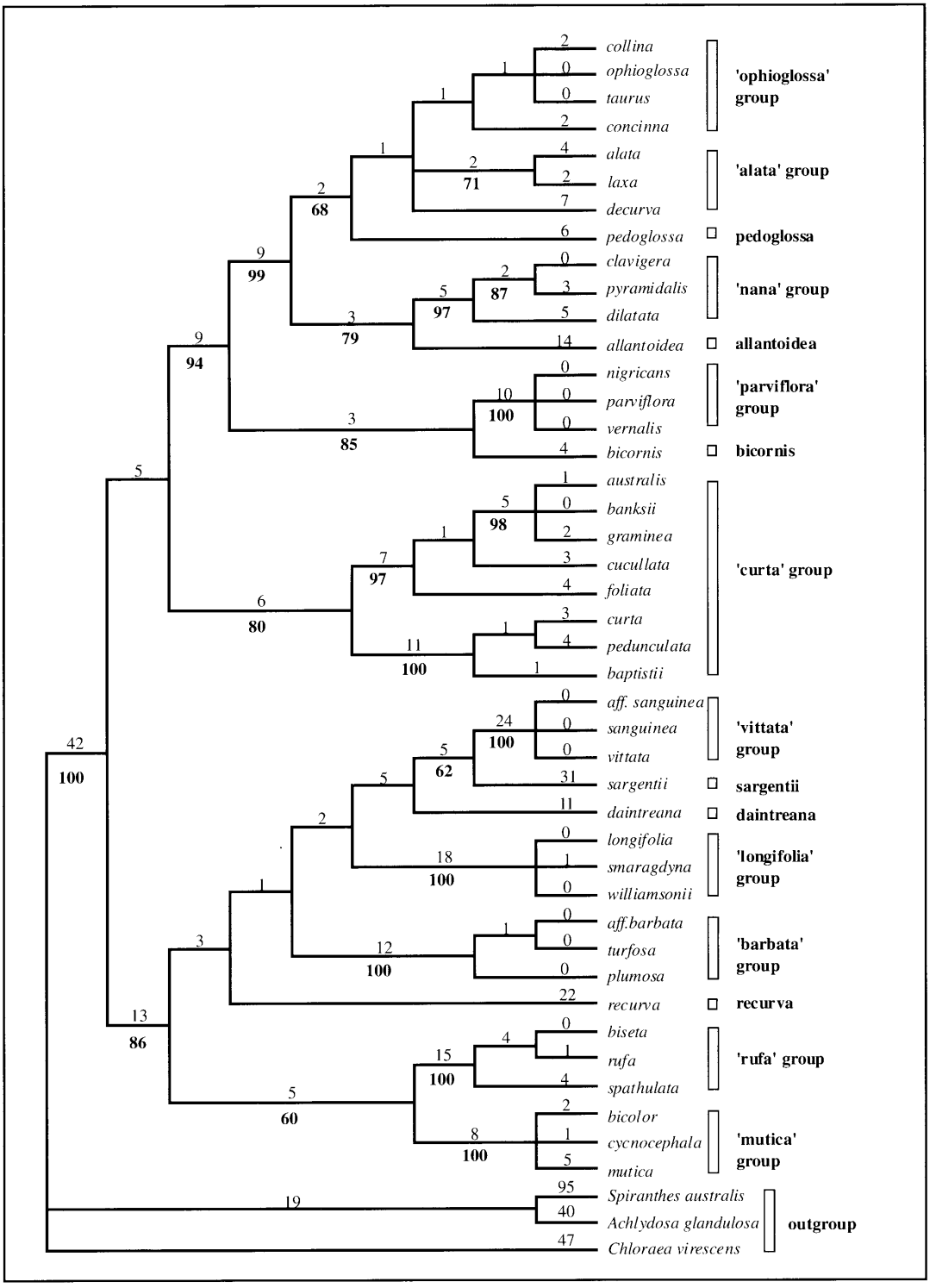
Study of Tree 1.3 shows a high level of support for the monophyly of the ingroup, the Pterostylidinae, as distinct from all three outgroup taxa. Within the ingroup there are two major clades, one containing the '*mutica*', '*rufa*', '*barbata*', '*longifolia*' and '*vittata*' groups, as well as *P. recurva, P. daintreana* and *P. sargentii*. The second major clade contains all remaining taxa, including *P. curta* the conserved type of the genus and part of the '*curta*' group. These combined morphological-molecular results provide a clear picture of the relationships between all elements of the subtribe.

First major clade- Within the first major clade, eight identified lineages are well defined with both molecular and morphological data. All five groups within the clade have 100% bootstrap support for their monophyletic integrity. They consist of non colony-forming taxa (reproducing solely from seed) and, apart from species in the '*barbata*' group, typically have multi-flowered inflorescences. Clustered together are the '*mutica*' and '*rufa*' groups both of which have a basal rosette and central inflorescence. At this level of analysis, representatives of the '*mutica*' group cluster together in a polytomy, providing no insight into their phylogenetic arrangement. Although both the '*rufa*' and '*mutica*' groups are vegetatively similar, they are nevertheless readily distinguished by unique floral morphological characters. There is some phylogenetic structure within the '*rufa*' group indicating a division into minor clades based on molecular data, this representing an apparent east-west disjunction of species within the group.

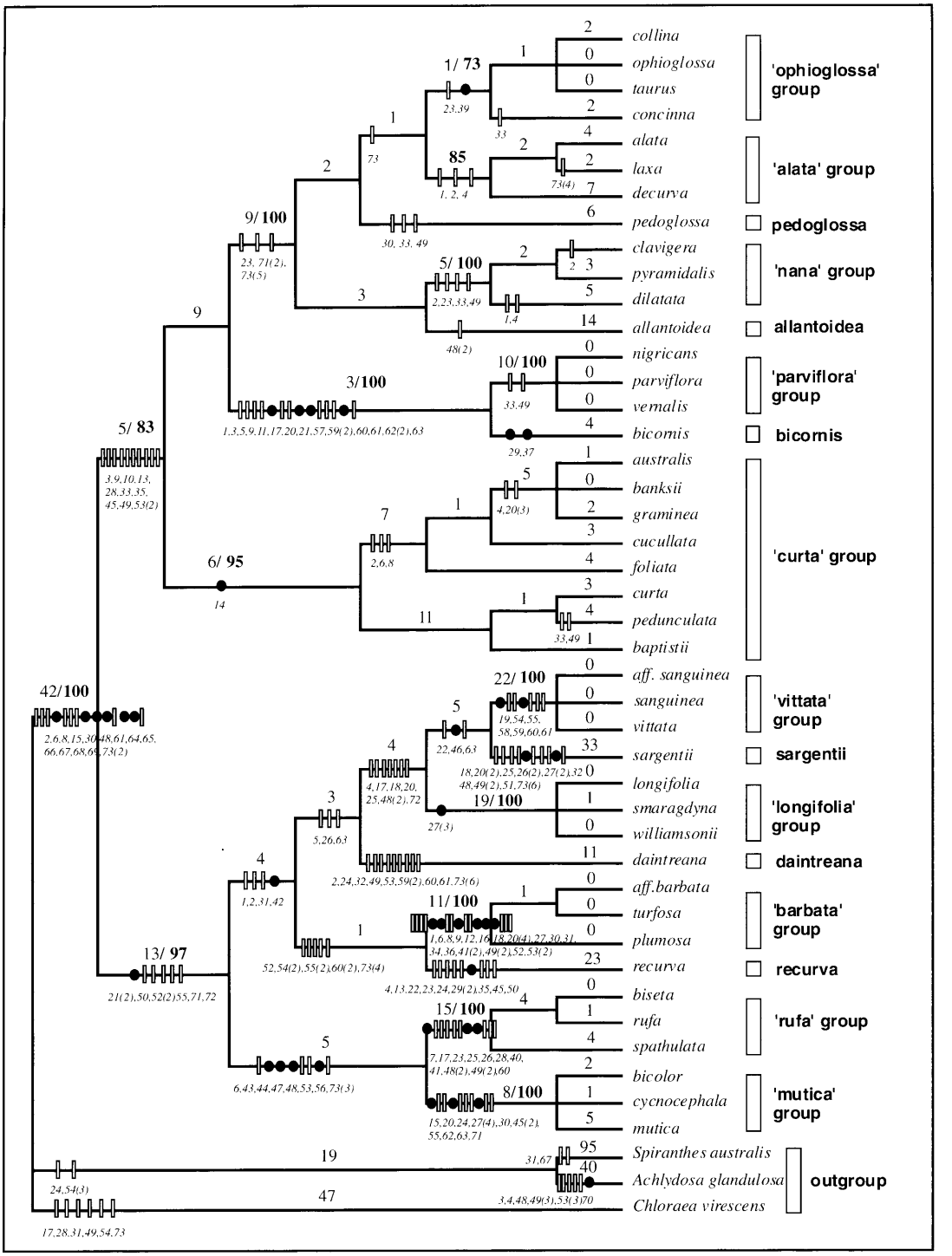
Adjacent to the '*mutica*' and '*rufa*' groups is a clade containing *P. recurva* from south-western Australia with its unique jug-like flowers, and the '*barbata*' group, characterised by a filiform, plumose labellum and galea with two openings. Floristically members of this clade are the most distinctive within the subtribe, as exemplified by the large number of molecular and morphological changes supporting each. Although they group together, the high level of divergence between *P. recurva* and the '*barbata*' group supports their recognition as separate taxa.



Tree 1.1. One of the six successive weighted most-parsimonious trees for the morphological data of weighted Fitch length 90.01649 with CI = 0.7882; CI excluding uninformative characters = 0.7731; RI = 0.9389; and RC = 0.7400, showing the presumed relationships amongst the 12 morphological groups within *Pterostylis* and the outgroup taxa. Numbers above the bars represent character state changes and numbers below in bold are bootstrap support values above 50%. Major clades A, B and C are identified with bars.



Tree 1.2. A randomly selected successive weighted (SW) tree from 24 equally parsimonious trees based on the alignment of 753 nucleotide sites, including 17 scored indels, contained 195 potentially informative sites with a weighted Fitch length = 339.22370; consistency index (CI) = 0.8618; and retention index (RI) = 0.9211, showing phylogenetic relationships between the various groups within *Pterostylis* and the outgroups. Nucleotide substitution values are shown above branches and bootstrap support values above 50% are shown in bold below. The *'ophioglossa'* group, *P. bicornis, P. allantoidea* and *P. pedoglossa* are identified as separate taxa within the tree.



Tree 1.3. One randomly selected equally parsimonious successive weighted (SW) tree from eight trees generated from the combined morphological-molecular analyses based on the alignment of 825 nucleotide and morphological sites of which 263 are parsimony informative characters; tree length of 425.40774; consistency index (CI) = 0.8348; and retention index (RI) = 0.9157, showing the phylogenetic relationships between the 16 taxonomic groups identified within *Pterostylis* and the outgroups. Morphological characters and states are identified along branches either as dots for synapomorphies or bars for parallelisms. Figures above the branches signify nucleotide substitution numbers, those separated by a forward stroke in bold are bootstrap support values for the combined morphological-molecular data.

The remaining taxa in the clade form a ladderised group containing *P. daintreana*, the '*longifolia*' group, *P. sargentii* and the '*vittata*' group. All species within these taxa have cauline leaves and a multi-flowered inflorescence. As in the preceding example, there is considerable support, both at a morphological and molecular level, for the recognition of these four as separate taxa. Conversely there is far less support (three homopleisious morphological character states and weak bootstrap support) for the recognition of these four taxa as a single unit, which is how, in part, they have been previously treated (Bentham 1872, Rupp 1942). Even with the exclusion of *P. daintreana* there is still only poor bootstrap support for the recognition of the remaining three taxa as a single entity. In fact the brace of morphological and molecular characters found in *P. sargentii*, clearly isolate it from either of the '*vittata*' or '*longifolia*' groups and renders them paraphyletic if placed together, which is the way they have traditionally been treated. These morphological and molecular differences are almost certainly indicative of a long period of genetic isolation. This is also borne out by their distribution, the '*longifolia*' group being confined to eastern Australia, whereas *P. sargentii* is from south-western Australia which is also the site of greatest divergence of the '*vittata*' group. Species belonging to the '*longifolia*' group are characterised by green flowers, white, bubble-like micropapillae on the anterior surface of the synsepalum and a three-lobed labellum lacking a basal appendage but with an enlarged basal mound. The '*vittata*' group is characterised by green to red-brown flowers, bubble-like micropapillae on the anterior surface of the synsepalum (different structurally to those of the '*longifolia*' group), a synsepalum of similar length and width with a recessed pit to accommodate the labellum in the set position, and a fleshy, siliceous labellum with a characteristic caudate appendage. Within both the '*longifolia*' and '*vittata*' groups there is very little differentiation at the molecular level, even though the various taxa are readily distinguished morphologically (Jones *et al.* 1999).

Pterostylis sargentii from south-western Australia is a unique species characterised by large petaline trichomes, lacerate petal margins and a distinctly trilobed labellum with inflated lateral lobes.

Pterostylis daintreana has a three-lobed labellum which lacks a basal appendage, the basal parts of the lateral lobes of the labellum extend as free lobes and the column lacks a column foot. Vegetatively this species is unusual in having rosettes produced on lateral growths from the base of flowering scapes, a condition homopleisious in the '*parviflora*' group.

Second major clade - The second major clade produced from these combined analyses is comprised of the remaining elements of the subtribe. Species cluster into eight groups, although there are generally fewer characters and character states and nucleotide changes supporting them. Despite this, bootstrap levels of support for the monophyly of five of these groups is very good (73-100%). The other three are single entry species, *P. bicornis, P. allantoidea* and *P. pedoglossa*, isolated from the main body of four of the five identified groups.

Sister to the main body of species within this major clade is the '*curta*' group, representatives of which are widespread in eastern Australia and New Zealand, extending to New Caledonia, New Guinea and Ceram. Clustered within this group are species with a scape-encircling basal rosette, or those with leaves extending up the flowering stem. They also have a solitary flower with erect, tapered lateral sepals and an entire labellum. Bootstrap support for the group is high (95%), despite the lack of apparent supporting morphological characters. As presented, the '*curta*' group represents a much-reduced interpretation of the species alignments for this taxon, irrespective of rank. The large number of molecular changes isolating this alliance is heavily influenced by the presence of several unique indels in these groups. Within this clade there is an assemblage of species into three loose groups. *Pterostylis baptistii, P. pedunculata* and *P. curta* form one alliance, supported by the presence of a ground-hugging rosette. Remaining species in the '*curta*' groups generally have leaves extending up the flowering stem (e.g. *P. cucullata* and *P. foliata*). The narrow leaves of the New Zealand endemic taxa *P. australis*, *P. banksii* and *P. graminea* are strikingly distinct and this group forms a separate, well supported clade embedded in the '*curta*' group. Despite unique morphological characters, its position within the '*curta*' clade means that it is difficult to recognise this group as anything other than part of the '*curta*' lineage.

Sister to the '*curta*' group is an alliance of species containing both multi-flowered and all other solitary-flowered species. The multi-flowered species are represented by *P. bicornis* and the '*parviflora*' group, all from eastern Australia. Their position renders the solitary-flowered species throughout this major clade paraphyletic. *Pterostylis bicornis* and members of the '*parviflora*' group produce lateral rosettes from the base of the scape in flowering plants, a condition absent from all other groups within this clade. There is considerable support, both at a morphological and molecular level, for the monophyly of *P. bicornis* and the '*parviflora*' clade. Within this clade however, there is also strong (100%) bootstrap support for the recognition of the '*parviflora*' group as a taxon

separate from *P. bicornis*. *Pterostylis bicornis*, a relatively recently described species, has two morphological apomorphies unique in the subtribe (apical labellum knob and horn-like petal extension). Its position, external to but sister of the *'parviflora'* group, suggests the two should be treated as separate taxa. At this level there are no characters to differentiate species representative of the *'parviflora'* group although they are all readily recognisable as distinct species (Jones 1999).

All remaining taxa, which includes the *'nana'*, *'alata'* and *'ophioglossa'* groups, are found in southern and eastern Australia with outliers in New Zealand and New Caledonia. They cluster into a single clade for which there is strong molecular, but only weak morphological support, with three homopleisious characters. All species in these groups have a solitary flower, although in the *'alata'* group and *P. dilatata*, dimorphic growth habit is characteristic. In one clade, *P. allantoidea* and the *'nana'* group cluster together in a poorly supported alignment, compared to the high bootstrap support (100%) for the recognition of the *'nana'* group as a separate taxon. *Pterostylis allantoidea* is confined to south-western Australia as are the bulk of species in the *'nana'* group. Sister to *P. allantoidea* and the *'nana'* clade is an alliance of species representing the *'alata'* and *'ophioglossa'* groups and *P. pedoglossa*, for which there is only minimal support as a unit. However, internal to this clade are the *'alata'* and *'ophioglossa'* groups, with relatively high support for each, although based only on a few morphological characters and/or nucleotide changes. These two groups represent a large proportion of species that had previously been treated by us as part of the *'curta'* group. All species in the *'ophioglossa'* group have a bifid labellum apex and the inflorescence arises from the centre of a basal rosette. By comparison, the *'alata'* group is characterised by dimorphic growth habit and an entire labellum. These characteristics, plus the relatively high values supporting each branch, as opposed to the lack of support for their amalgamation, suggests they should be treated as separate taxa.

Pterostylis pedoglossa aligns with the *'ophioglossa'* group and the *'alata'* group, although there is no support for their amalgamation. Initially we considered *P. pedoglossa* to be part of the *'nana'* group but its inclusion there renders that group paraphyletic and these results suggest it be recognised as a separate taxon.

DISCUSSION

Overall these results, total evidence, confirm the monophyly of the subtribe Pterostylidinae isolated from Chloraeinae, Achlydosinae and Spiranthinae. Our results strongly correlate with those obtained in broader based phylogeny studies of the Orchidaceae or tribe Diurideae from *rbc*L nucleotide sequences analyses (Kores *et al.*, 1997; Cameron *et al.*, 1999; Chase *et al.*, 2001), *mat*K plastid DNA sequence data (Kores *et al.*, 2000), the combined *mat*K and *trn*L-F plastid DNA sequence data (Kores *et al.*, 2001) and ITS nrDNA sequence data (Clements *et al.*, 2002). Whilst the monophyly of Pterostylidinae is not in dispute, nevertheless these current results show that there is a high level of support for 16 monophyletic taxa within the subtribe. Although this is only an overview study of Pterostylidinae, extensive sampling has been undertaken to include unusual or disparate taxa and obvious natural groups. The results, which will form the basis of a detailed molecular paper, (Clements *et al.*, in prep.) show that the addition of further species to the sample matrix has virtually no impact on the phylogenetic patterns reported here.

Phylogenetic results obtained in this study, based on total evidence analyses, only partially correspond to those identified in previous attempts at the classification of *Pterostylis*, where less information was available (Brown 1810, Don 1830, Lindley 1840b, Reichenbach 1871, Bentham 1873, Pfitzer 1887, Rupp 1933 and Szlachetko 2001). Most notable are: (i) the separation of the *'alata'*, *'nana'* and *'ophioglossa'* groups, *P. allantoidea* and *P. pedoglossa* from the body of the *'curta'* group; (ii) recognition of *P. bicornis* and the *'parviflora'* group as separate entities distinct from the main body of the *'curta'* group; (iii) recognition of the distinctiveness of the *'longifolia'* and *'vittata'* groups; (iv) the alignment and separation of *P. sargentii* and *P. daintreana* from the *'longifolia'* and *'vittata'* groups; and, (v) the alignment of the *'barbata'* group with *P. recurva* and their juxtaposed position to all the taxa with deflexed lateral sepals and an exposed labellum. In addition, examination of the results obtained in these studies reaffirms the significance of the decurved or recurved position of the lateral sepals (synsepalum) in the classification of groups within *Pterostylis*, first introduced by Bentham (1873). Our results show a major basic dichotomy within the subtribe that groups together species on the basis of synsepalum attitude. The solitary exception is *P. recurva*, which in both the molecular and combined morphology-molecular results, aligns with taxa having a deflexed synsepalum. This grouping occurs despite the synsepalum of *P. recurva* being suberect and acting in combination with the galea to virtually enclose the labellum. In this species however, the free points of the lateral sepals recurve away from the synsepalum suggesting the "erectness" of the synsepalum may represent an independent secondary partial change in *P. recurva*,

rather than a reversal. If this is the correct interpretation of the situation, the results suggest that this basic division in the subtribe occurred only once and then during the very early stages of evolution of taxa. Comparison with outgroup taxa, which all have flowers with lateral sepals in the recurved position, points to this being the derived condition within the subtribe Pterostylidinae.

The results also single out *P. recurva* as the only species outside of the erect synsepalum group to also have a penicillate basal labellum appendage. With *P. recurva* grouped with the '*barbata*' group and deeply embedded within that major clade, the most plausible explanation for the origin of its penicillate labellum appendage is that this organ has evolved twice within the subtribe. The available data (Trees 2 and 3), shows species in the ingroup share many features with species in the outgroup, suggesting that the alternative explanation of the penicillate labellum appendage being lost or modified in all other species in this major clade, is the least plausible of the two options. These results question the undue emphasis placed on this character in earlier classifications of the subtribe, eg. Bentham (1873) and Rupp (1933). *Pterostylis recurva* also has the distinctive character of column wings being adorned with barrier trichomes, again sharing this feature with the group of species that have a decurved synsepalum.

Comparing our results with those in the recent treatment of *Pterostylis* by Szlachetko (2001), not all of his conclusions are supported and demonstrate the danger of relying entirely on a small number of morphological features when defining taxa. Our results confirm that the morphologically distinct "*barbata*" group, that Szlachetko named as *Plumatichilos,* is a well-supported monophyletic taxon and its recognition at that rank is justified. Conversely, his other proposed genus *Oligochaetochilus* is not a monophyletic taxon with *Plumatichilos* embedded deep within it. Furthermore, within *Oligochaetochilus* of the three proposed subgenera only subgenus *Oligochaetochilus* with the designated type of *P. rufa* is monophyletic. Subgenus *Glabrichilos* is paraphyletic with *P. daintreana* included within it and subgenus *Apicuchilos* is polyphyletic with representatives of three separate groups, the "*vittata*", "*longifolia*" and *P. sargentii* included within that concept.

These results also highlight the importance of studying live material for both vegetative and floral characters in preparing a phylogenetic treatment of a major group of this type. Use of molecular data greatly assisted in this research as it helped to clarify the phylogenetic positions of several otherwise troublesome groups. Overall the results provide a very robust phylogenetic reconstruction of the subtribe and present a solid means for the classification of the taxa. Most taxa exhibit a high degree of divergence from their sister taxa, especially in the multi-flowered species. Further molecular research is being undertaken, based on a far greater range of species, to elucidate relationships within these major monophyletic groups. Additionally, these results provide a basis for future studies in areas such as biogeography, pollination biology and fungal relationships within the subtribe.

Taxonomic Rank

With such strong support for the majority of these easily recogniseable groups, the potentially contentious issue of rank arises. Examination of the results of some recent revisionary treatments of Orchidaceae provides interesting and varied examples of interpretation. Two studies of the subtribe Spiranthinae, both based on different morphological character sets, arrived at different conclusions and resulted in conflicting taxonomic treatments. Garay (1982), using a traditional morphological study, recognised 44 genera, with his generic concepts based primarily on floral morphology, including flower resupination, presence or absence of a floral tube, position of the stigmata and rostellum shape. Balogh (1982), with a broader generic concept and using a cladistic approach, with characters based primarily on the pollinia, accepted only 14 genera. The contrast between these two authors of the generic interpretation of taxa in the same subtribe could not be more marked.

Even a single author can reach different conclusions depending on the methods used. For example Linder's (1981) treatment of the Diseae, based purely on morphology, arrived at a different set of conclusions as to the treatment of the genera *Disa* and *Hershelia* compared with a later study (Linder & Kurzweil 1999). In yet another study of the Diseae, Linder & Kurzweil (1994) utilised 31 morphological characters, mostly floral, for a cladistic analysis to determine the phylogeny and classification of that group of orchids. In their results most genera in the Diseae were supported by one to a few characters, the results being used in subsequent major treatments of the tribe and its subtribes (Linder & Kurzweil 1999).

The advent of molecular sequence analysis has the potential to provide a more objective basis of interpreting species phylogenies from sequence data, but there can still be conflict and the difficulty has been discussed at length (Slowinski & Page 1999). Interpretation of the taxonomic rank within the Orchidaceae has also presented difficulties and in order to standardise the interpretation of results we have followed a benchmark set of criteria used by other authors such as Albert & Chase (1992), Cox *et al.* (1997) and Bateman *et al.* (1997a,b, 2001). There is a strong tendency to recognise distinct taxa at generic rank if (a) there is molecular support for the

monophyly of the group, and (b) if the unit is supported by some morphological characters.

In two recent assessments of the Orchideae, Bateman *et al.* (1997b, Fig. 3; 2001, Fig. C.5a, b) reported the polyphyletic nature of the genus *Orchis* and recognised the various elements as three separate genera, *Orchis*, *Anacamptis* and *Neotinea*. It should be noted that there were few, if any, morphological characters to support these separations. In the same two publications, Bateman in Bateman *et al.* (1997b, 2001) maintained both *Barlia* and *Comperia* as distinct from *Himantoglossum,* despite the whole group being monophyletic. A similar situation occurs in the treatment of the Cypripedioideae whereby Albert & Chase (1992), erected a new monotypic genus *Mexipedium* to accommodate *Phragmipedium xerophyticum* Soto Arenas, Salazar & Hágsater, because it presented a mixed suite of characters of *Paphiopedilum* and *Phragmipedium*, as an alternative to merging these two genera. In the most recent treatment of the Cypripedioideae, Cox in Pridgeon, *et al.* (1999), maintained the generic status of *Mexipedium* because of incongruencies in morphological features, despite it being in a monophyletic clade within *Phragmipedium* - see Figures B.2 and B.3, Pridgeon *et al.* (1999).

Consistent with concepts of many other researchers, in our treatment of the Pterostylidinae, we have recognised most monophyletic groups as genera when there is significant morphological support for the recognition of that group. Therefore these results provide data to support the following: (i) the recognition of the original concept of *Diplodium* and its reinstatement as distinct from *Pterostylis*; (ii) recognising *Pterostylis* in a reduced form; (iii) recognition of *Plumatichilos* as a valid genus for the "*barbata*" group of species; (iv) recognition of *Oligochaetochilus* in the narrow sense as a validly published genus for the "*rufa*" group; and (v) the recognition of other new genera requiring description within the Pterostylidinae.

The inclusion of sequence data in a phylogeny can have unexpected consequences such as highlighting taxa, which based on morphology, were not considered to be of problematical placement. For example the placement of the *Pterostylis ophioglossa* group with the *Diplodium* clade was unexpected since both groups have distinct vegetative and floral characters by which they are readily discernible. The alliance perhaps makes some sense from a biological viewpoint, as natural hybrids are known to occur between some species in these groups. To combine both of these disparate groups together in the one genus, however, would result in a clumsy arrangement of broadly circumscribed taxa, and we feel it is more logical to treat them as two narrowly circumscribed, easily distinguishable groups that we recognise at generic level. The alignment of *P. pedoglossa* was similarly surprising as morphologically we thought its relationships lay with the *'nana'* group or perhaps the *'curta'* group. Its separation from both these groups on long branches indicates substantial periods of genetic isolation. This, together with its alignment with the *P. ophioglossa* group, from which it is readily distinguished morphologically, has led us to recognise it at generic rank. The alternative of placing these morphologically disparate taxa into a single, broadly circumscribed genus was considered phylogenetically less informative.

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Appendix 1. Collection details of the species used for these analyses

Species	Provenance	Collector No.	GenBank No.
Achlydosa glandulosa (Schltr.) M.A.Clem. & D.L.Jones	New Caledonia; Mt Do	Clements 7806	AF348042
Chloraea virescens (Willd.) Lindl.	Chile; S of Punta Arenas	Wallace 001/85	AF348004
Pterostylis alata (Labill.) Rchb.f.	Tas*; Flinders Island	Whinray ORG 1497	AY134620
Pterostylis allantoidea R.S.Rogers	Wey; Raventhorpe	Jones 12330	AY134621
Pterostylis australis Hook.f.	New Zealand; Craigieburn	Molloy 041/98	AY134622
Pterostylis banksii A. Cunn.	New Zealand; Northland	Parr (Molloy 87/99)	AY134623
Pterostylis baptistii Fitzg.	Ncc; Green Point	Jones 15781	AY134624
Pterostylis aff. barbata	Wda; S of New Norcia	French 1586	AY134625
Pterostylis bicolor M.A.Clem. & D.L.Jones	Nst; Adelong	Cunningham (ORG 1735)	AY134626
Pterostylis bicornis D.L.Jones & M.A. Clem.	Nnt; Glassy Mt, Woodenbong	Benwell (ORG 2629)	AY134627
Pterostylis biseta Blackmore & Clemesha	Sfr; Banycrooling Gorge	Jones *s.n.*	AY134628
Pterostylis clavigera Fitzg.	Ncs; Conimbla NP	Clements 9706	AY134629
Pterostylis collina (Rupp) M.A.Clem. & D.L.Jones	Nnt; Copeland	Tunstall *s.n.*	AY134630
Pterostylis concinna R. Br.	Tas; Goats Bluff, S. Arm Rd	Wapstra (ORG 748)	AY134631
Pterostylis cucullata R. Br.	Tas; King Island	Jones 15940	AY134632
Pterostylis curta R. Br.	Can; Tidbinbilla	Clements 9734	AF348054
Pterostylis cycnocephala Fitzg.	Can; Tharwa	Clements 9768	AY134633
Pterostylis daintreana Benth.	Qdd; Girraween NP	Crane 1824	AF348055
Pterostylis decurva R.S. Rogers	Can; Brindabella Range	Clements 9739	AY134634
Pterostylis dilatata A.S. George	Wda; Fox's Lair, Narrogin	French 1427	AY134635
Pterostylis foliata Hook.f.	New Zealand; Port Hills, Christchurch	Molloy 006/98	AY134636
Pterostylis graminea Hook.f.	New Zealand; Riccarton Bush	Molloy 001/98	AY134637
Pterostylis laxa Blackmore	Can; Tidbinbilla NR	Clements 9855	AY134638
Pterostylis longifolia R. Br.	Ncc; Green Point	Jones 15783	AY134639
Pterostylis mutica R. Br.	Sep; N. of Cowell	Jones 14100	AY134640
Pterostylis nigricans D.L.Jones & M.A.Clem.	Qwb; Fraser Island	Crane 2100	AY134641
Pterostylis ophioglossa R. Br.	Qmo; Beachmere	Crane 1540	AY134642
Pterostylis parviflora R. Br.	Vgi; Tooradin	Jones 16376	AY134643
Pterostylis pedoglossa Fitzg.	Ncc; Bundeena-Jibbon	Brinsley (ORG 2244)	AY134644
Pterostylis pedunculata R. Br.	Can; Tidbinbilla NR	Clements 9733	AY134645
Pterostylis plumosa Cady	Ncs; Parks-Wellington Rd	Jones 14329	AY134646
Pterostylis pyramidalis Lindl.	Wda; Preston Beach area	French 1283	AY134647
Pterostylis recurva Benth.	Wav; Murdoch Uni., Perth	French 1266	AY134648
Pterostylis rufa R. Br.	Qdd; Kogan	Crane 2214	AF348056
Pterostylis sanguinea D.L.Jones & M.A.Clem.	Sls; Stirling East	Clements 8273	AY134649
Pterostylis aff. sanguinea	Wda; Murdoch Univ., Perth	French 1263	AY134650
Pterostylis sargentii C.R.P. Andrews	Wav; Wubin	Jones 12093	AY134651
Pterostylis smaragdyna D.L.Jones & M.A.Clem.	Sls; Upper Sturt	Clements 8276	AY134652
Pterostylis spathulata M.A.Clem.	Wir; Moora	Jones 2073	AY134653
Pterostylis taurus M.A.Clem. & D.L.Jones	Qkn; Eungella Range	Jones 11637	AY134654
Pterostylis turfosa Endl.	Wey; Doubtful Island	Heberle (ORG 1614)	AY134655
Pterostylis vernalis D.L.Jones MS	Nsc; Flat Rock Crk, Nowra	Clements 9724	AY134656
Pterostylis vittata Lindl.	Wda; E of Dardanup	French 1308	AY134657
Pterostylis williamsonii D.L.Jones	Tas; South Arm Rd	Wapstra (ORG 754)	AY134658
Spiranthes australis (R.Br.) Lindl.	Sls; S. Mt Lofty Ranges	Molloy 076/99	AY134659

***Abbreviations for Australian Botanical Districts**:

Can = Australian Capital Territory; Ncc = New South Wales, Central Coast, Ncs = Central-west Slopes, Nnt = Northern Tablelands, Nsc = South Coast, Nst = Southern Tablelands; Qdd = Queensland, Darling Downs, Qkn = Kennedy north, Qmo = Moreton, Qwb = Wide Bay; Sep = South Australia, Eyre Peninsula, Sfr = Flinders Range, Sls = Lofty south; Tas = Tasmania; Vgi = Victoria, Gippsland; Wav = Western Australia, Avon, Wda = Darling, Wey = Eyre, Wir = Irwin.

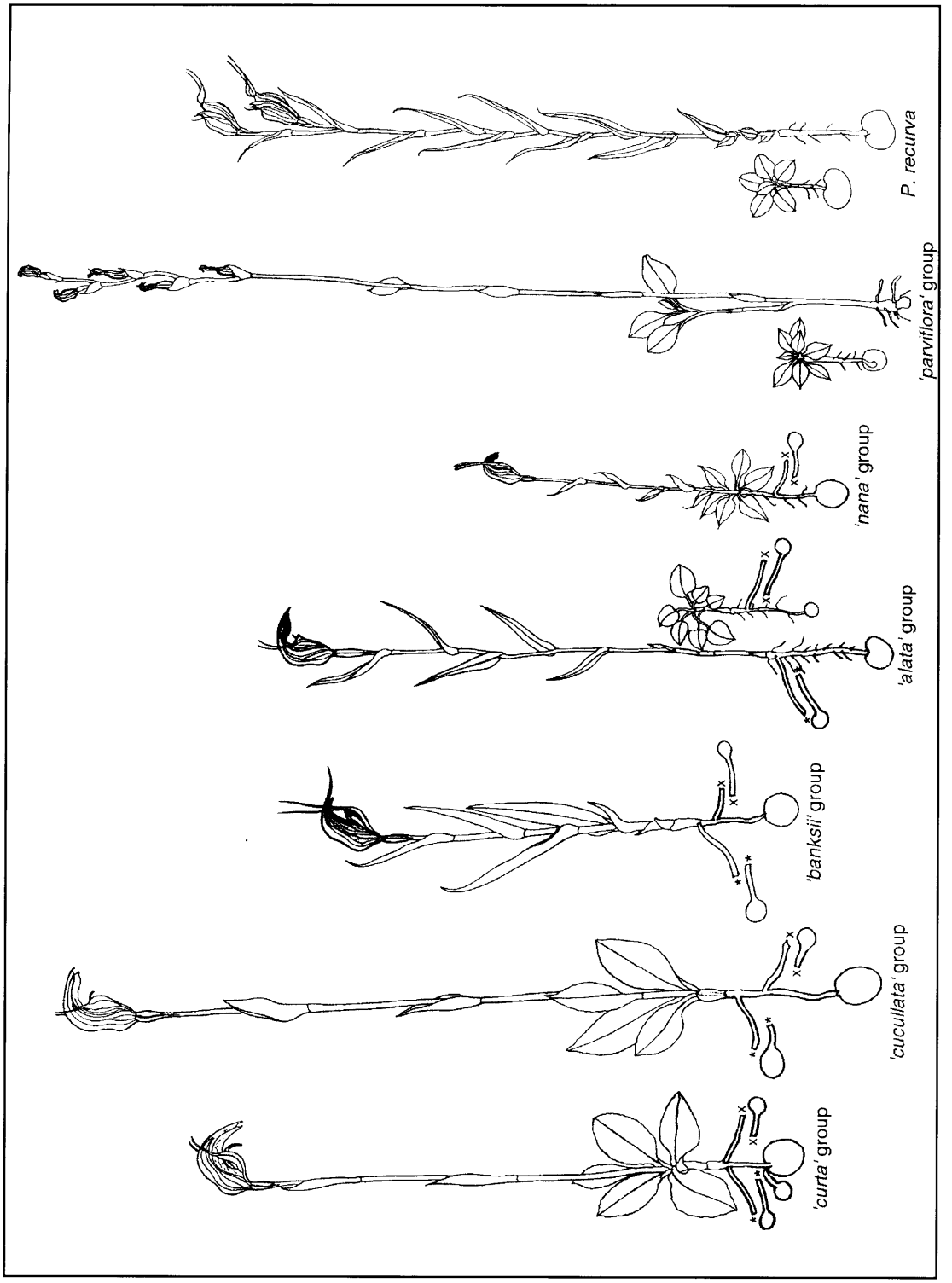

Fig. 1.1. Flowering plants of *Pterostylis* species with an erect synsepalum showing tuberous system, leaf arrangement, including rosette habit and cauline leaves, and generalised flower arrangement.

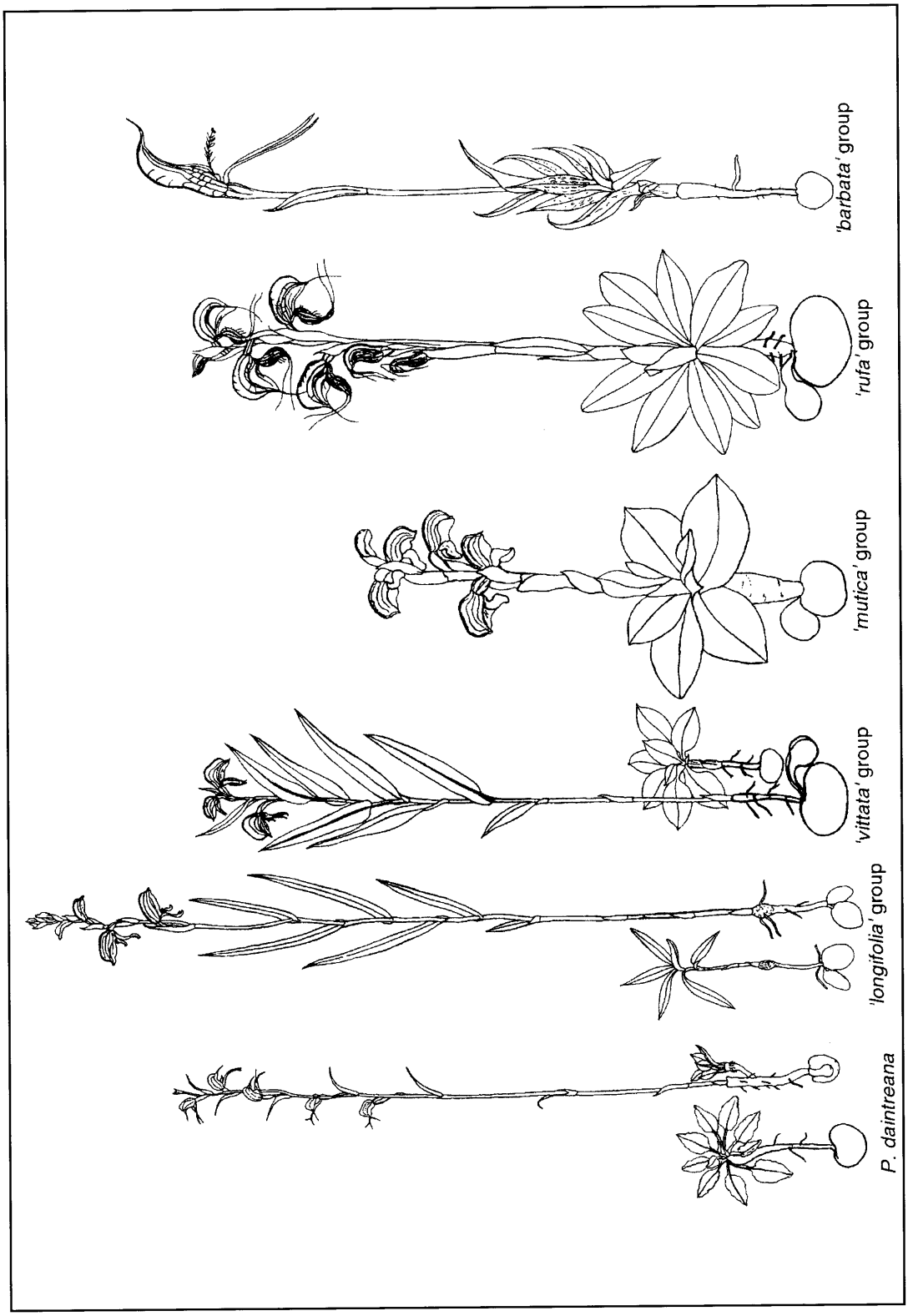

Fig. 1.2. Flowering plants of *Pterostylis* species with a deflexed synsepalum showing tuberous system, leaf arrangement, including rosette habit and cauline leaves, and generalised flower arrangement.

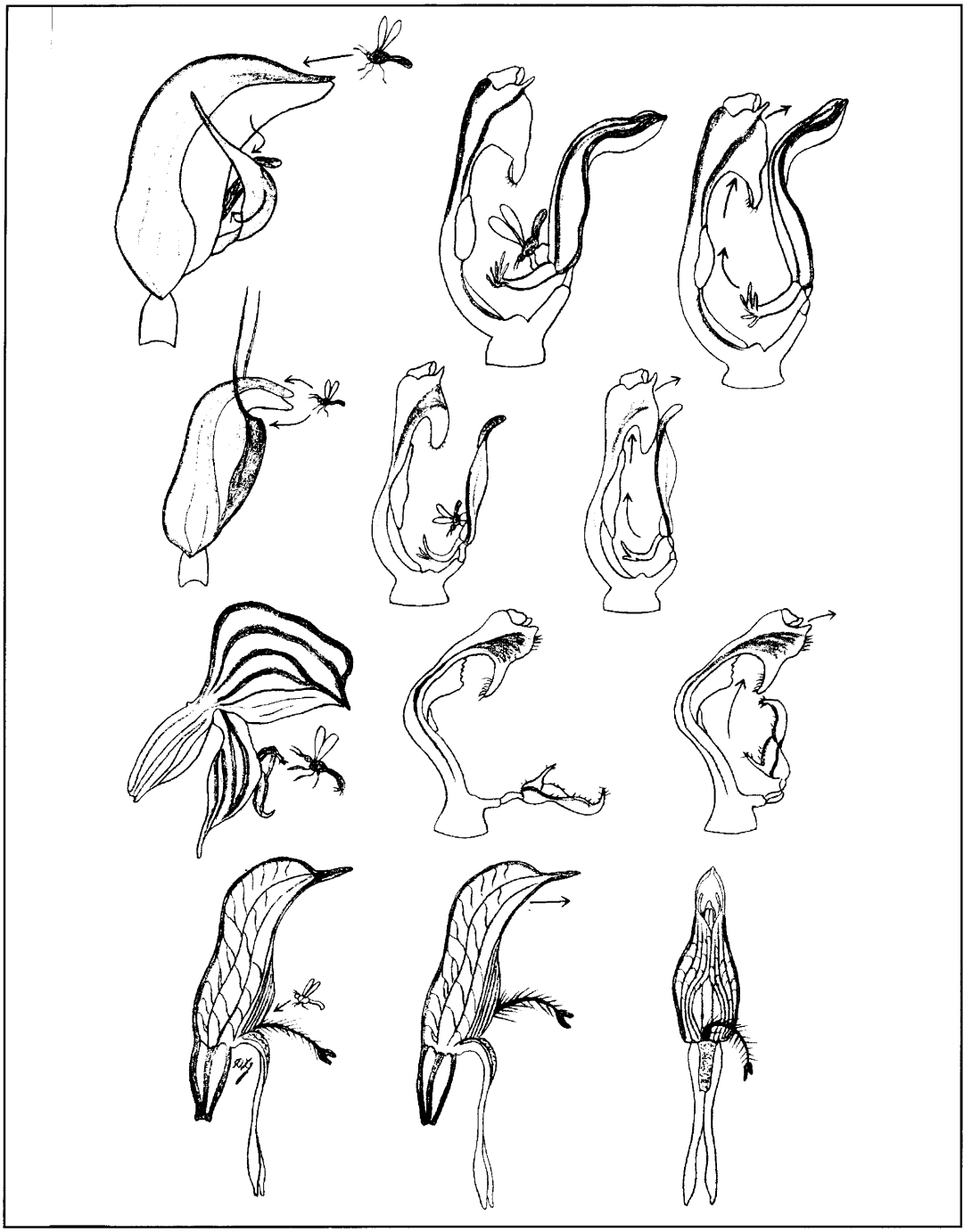

Fig. 1.3. Schematic drawings of *Pterostylis* pollination systems. Top; *P. curta,* showing gnat landing on top of flower and entering either via the main opening or the lateral gap; centre, showing gnat in the triggering position on the labellum appendage; RHS, showing movement of the gnat over the stigma and through the column wing tunnel. Second row down; *P. nana* showing entry of the gnat either after landing on the top of the flower or on the dark green target spot on the top of the synsepalum; centre, showing gnat in the triggering position on the labellum appendage; RHS, showing movement of the gnat over the stigma and through the column wing tunnel. Third row down; *P. vittata* showing gnat landing on labellum; centre, column with labellum in the set position; RHS, column with labellum in the closed position. Bottom; *P. plumosa* showing gnat entering flower via lower opening and, centre, exiting via upper opening; RHS, front view of flower showing lower and upper galea openings.

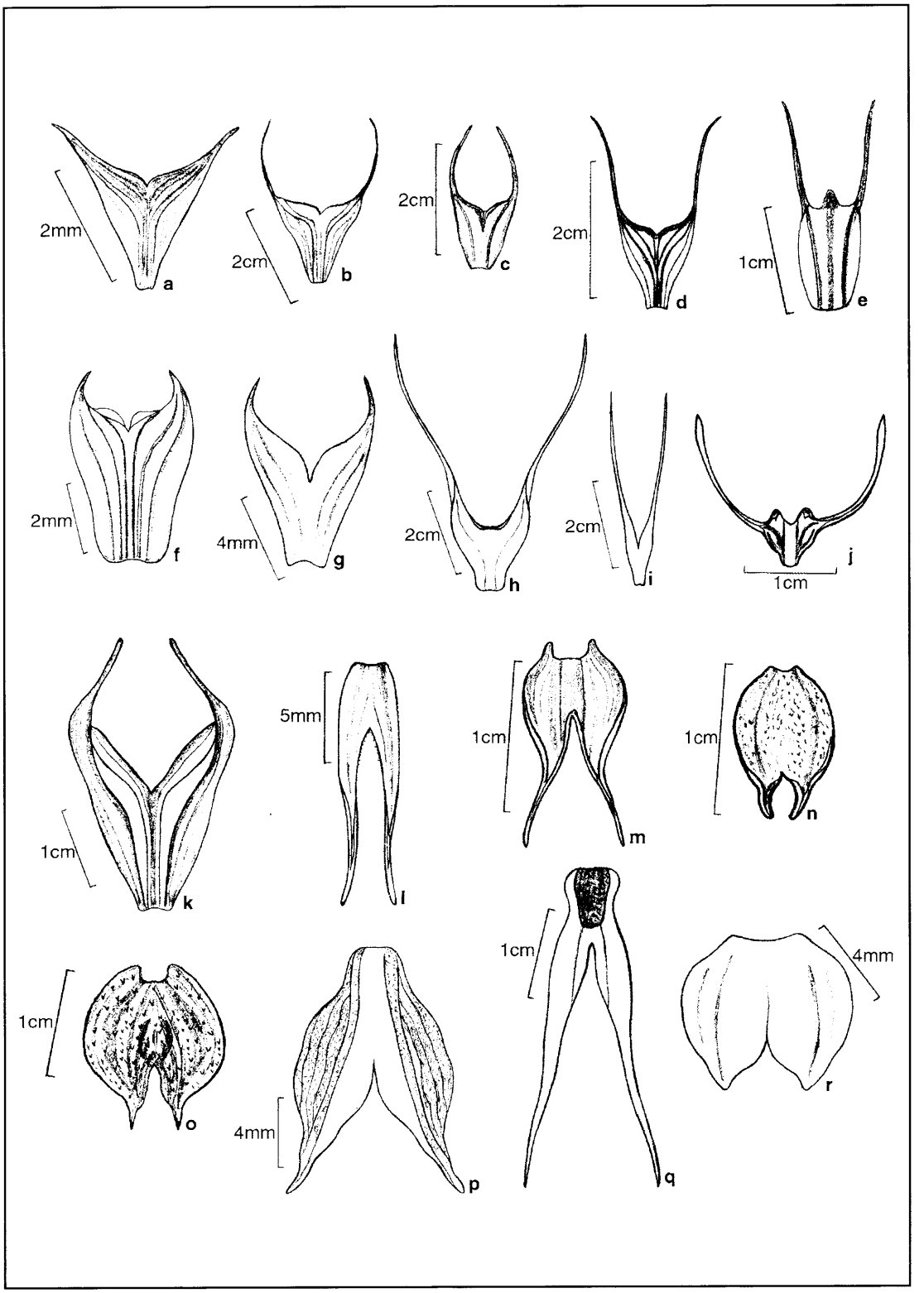

Fig. 1.4. *Pterostylis* synsepala. **a**. *P. curta*; **b**. *P. alpina*; **c**. *P. foliata*; **d**. *P. alata*; **e**. *P. nana*; **f**. *P. parviflora*; **g**. *P. bicornis*; **h**. *P. ophioglossa*; **i**. *P. pedoglossa*; **j**. *P. allantoidea*; **k**. *P. recurva*; **l**. *P. daintreana*; **m**. *P. sargentii*; **n**. *P. longifolia*; **o**. *P. vittata*; **p**. *P. rufa*; **q**. *P. barbata*; **r**. *P. mutica*.

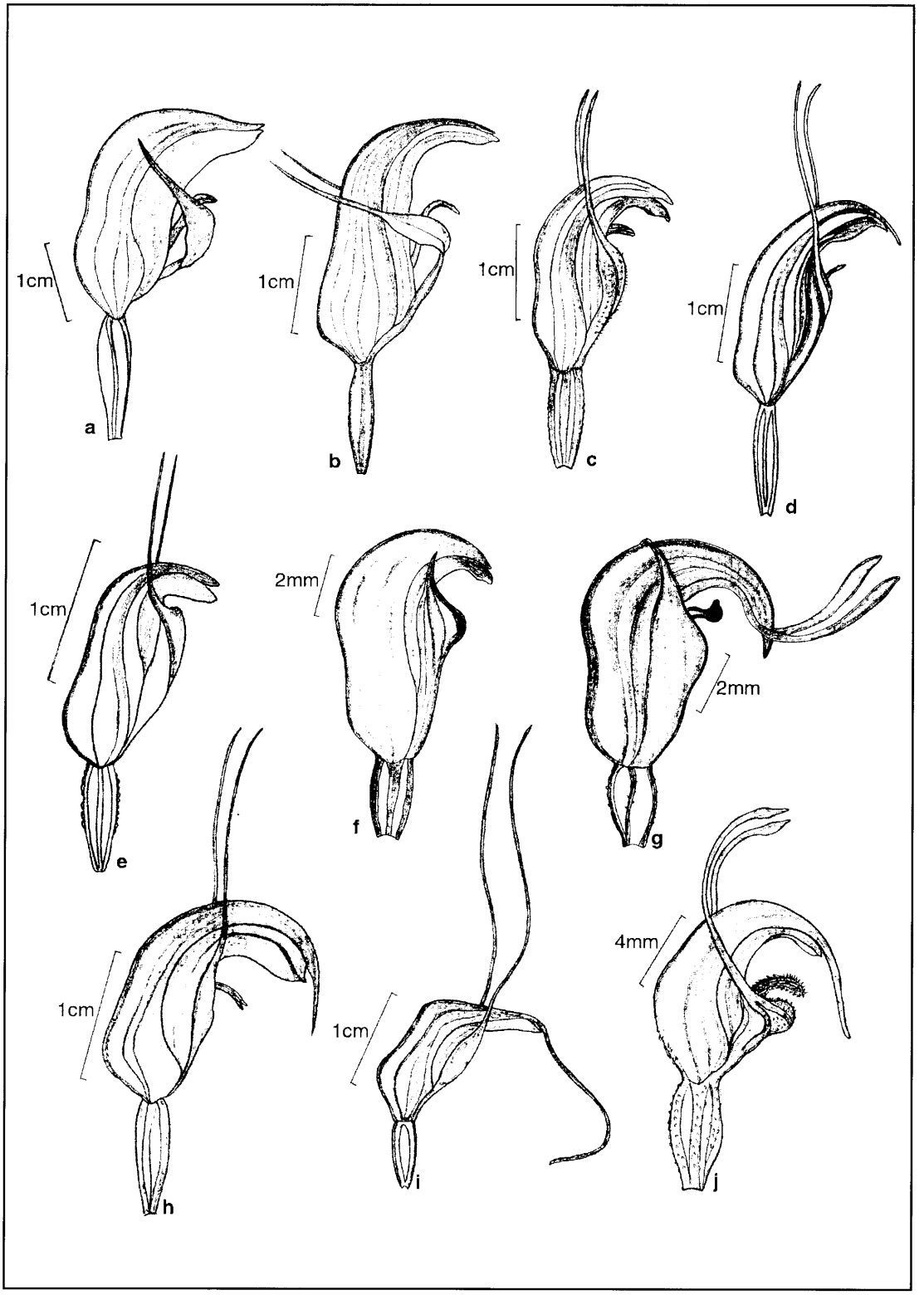

Fig. 1.5. Side view of *Pterostylis* flowers with erect lateral sepals. **a**. *P. curta*; **b**. *P. alpina*; **c**. *P. foliata*; **d**. *P. alata*; **e**. *P. nana*; **f**. *P. parviflora*; **g**. *P. bicornis*; **h**. *P. ophioglossa*; **i**. *P. pedoglossa*; **j**. *P. allantoidea*.

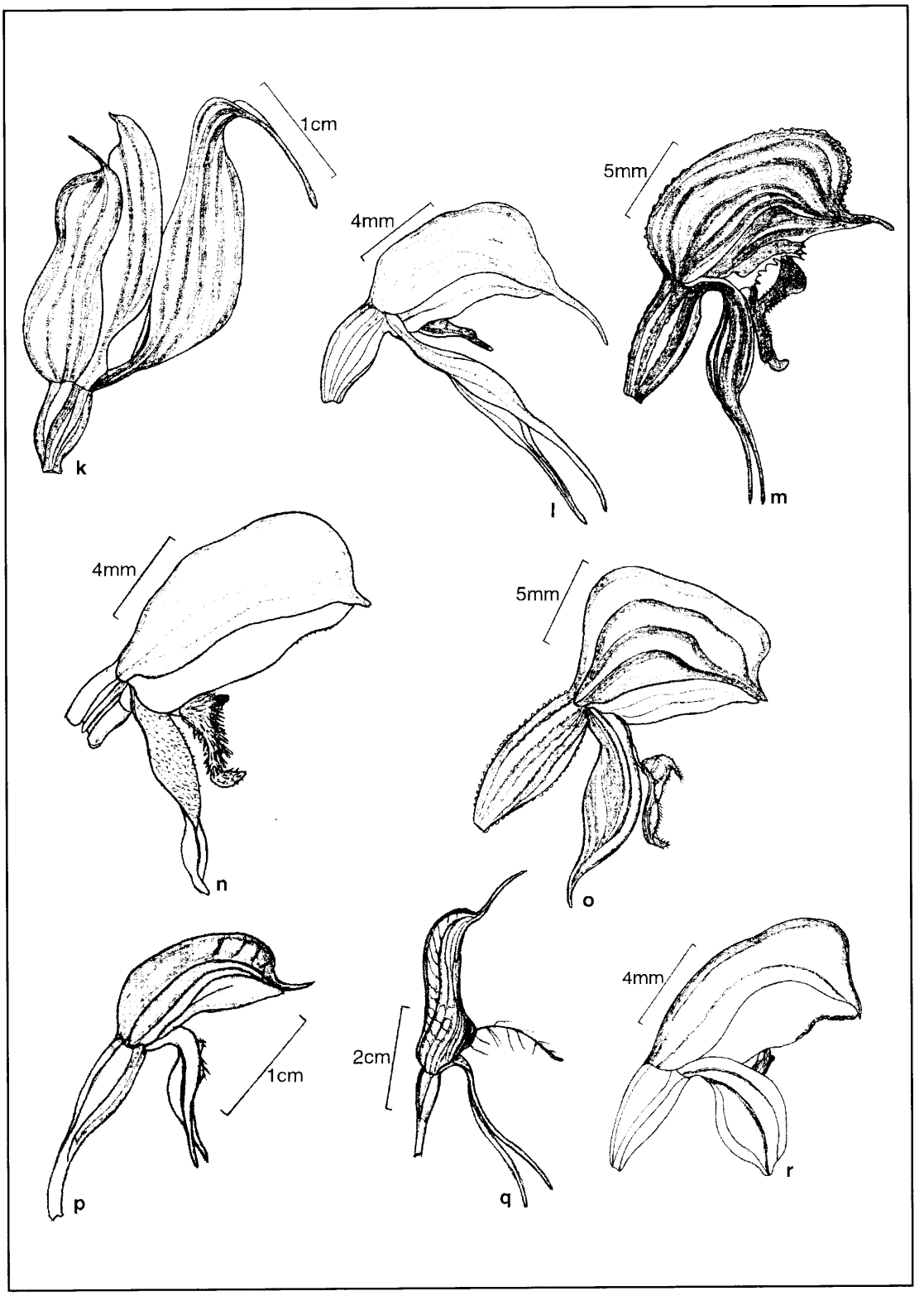

Fig. 1.6. Side view of *Pterostylis* flowers with deflexed lateral sepals. **k**. *P. recurva*; **l**. *P. daintreana*; **m**. *P. sargentii*; **n**. *P. longifolia*; **o**. *P. vittata*; **p**. *P. rufa*; **q**. *P. barbata*; **r**. *P. mutica*.

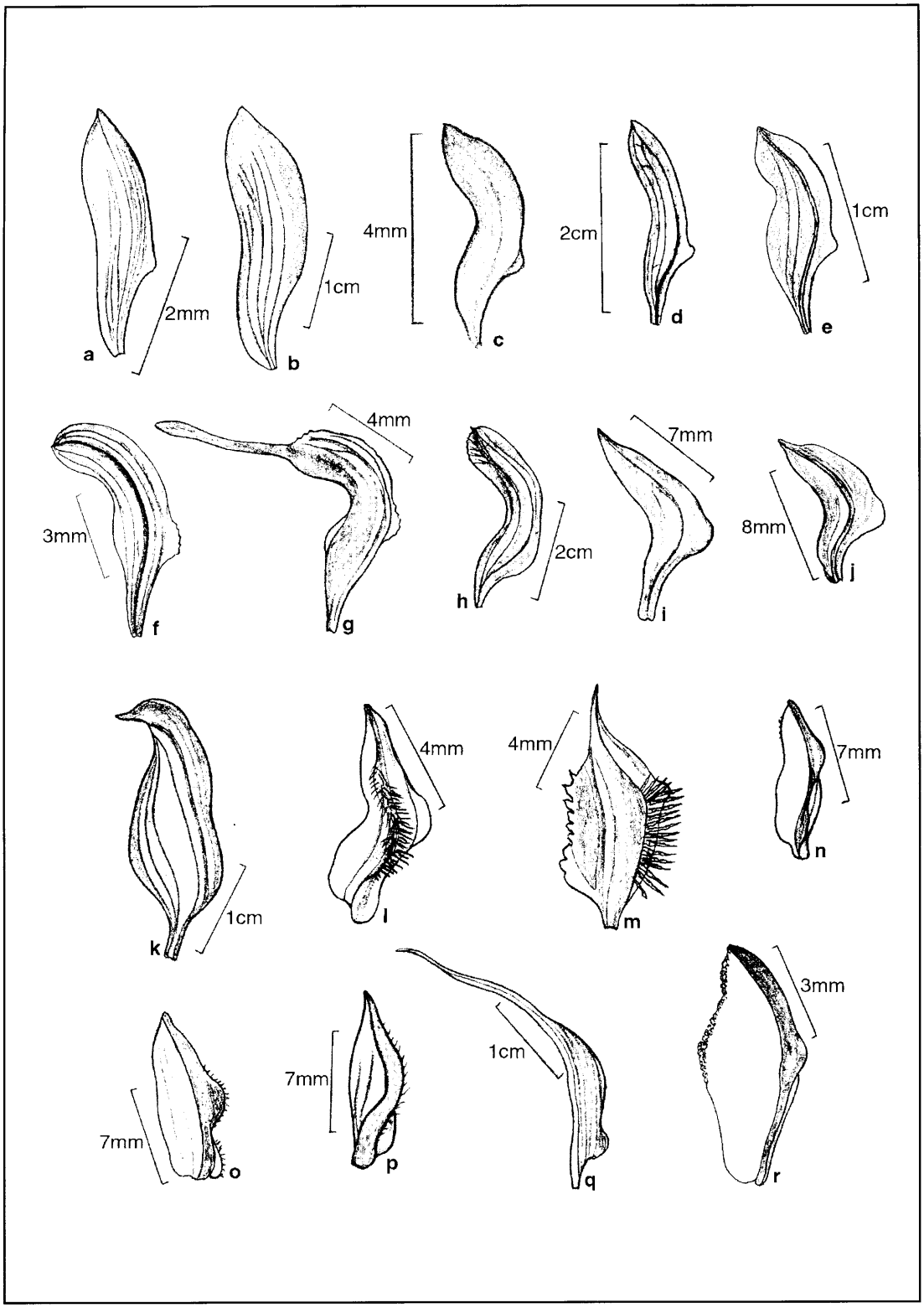

Fig. 1.7. *Pterostylis* petals. **a**. *P. curta*; **b**. *P. alpina*; **c**. *P. foliata*; **d**. *P. alata*; **e**. *P. nana*; **f**. *P. parviflora*; **g**. *P. bicornis*; **h**. *P. ophioglossa*; **i**. *P. pedoglossa*; **j**. *P. allantoidea*; **k**. *P. recurva*; **l**. *P. daintreana*; **m**. *P. sargentii*; **n**. *P. longifolia*; **o**. *P. vittata*; **p**. *P. rufa*; **q**. *P. barbata*; **r**. *P. mutica*.

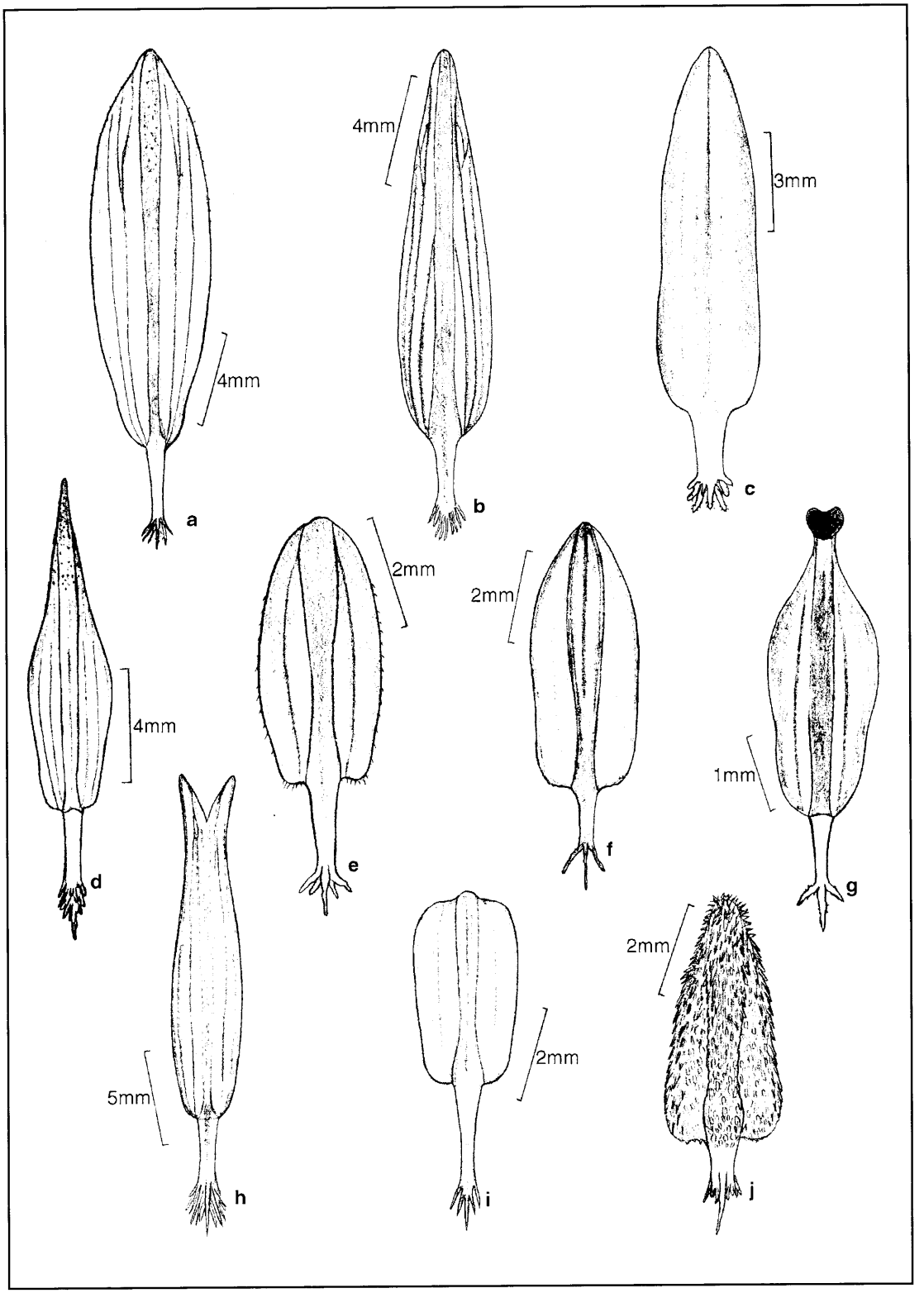

Fig. 1.8. *Pterostylis* labella, from species with erect lateral sepals. **a**. *P. curta*; **b**. *P. alpina*; **c**. *P. foliata*; **d**. *P. alata*; **e**. *P. nana*; **f**. *P. parviflora*; **g**. *P. bicornis*; **h**. *P. ophioglossa*; **i**. *P. pedoglossa*; **j**. *P. allantoidea*.

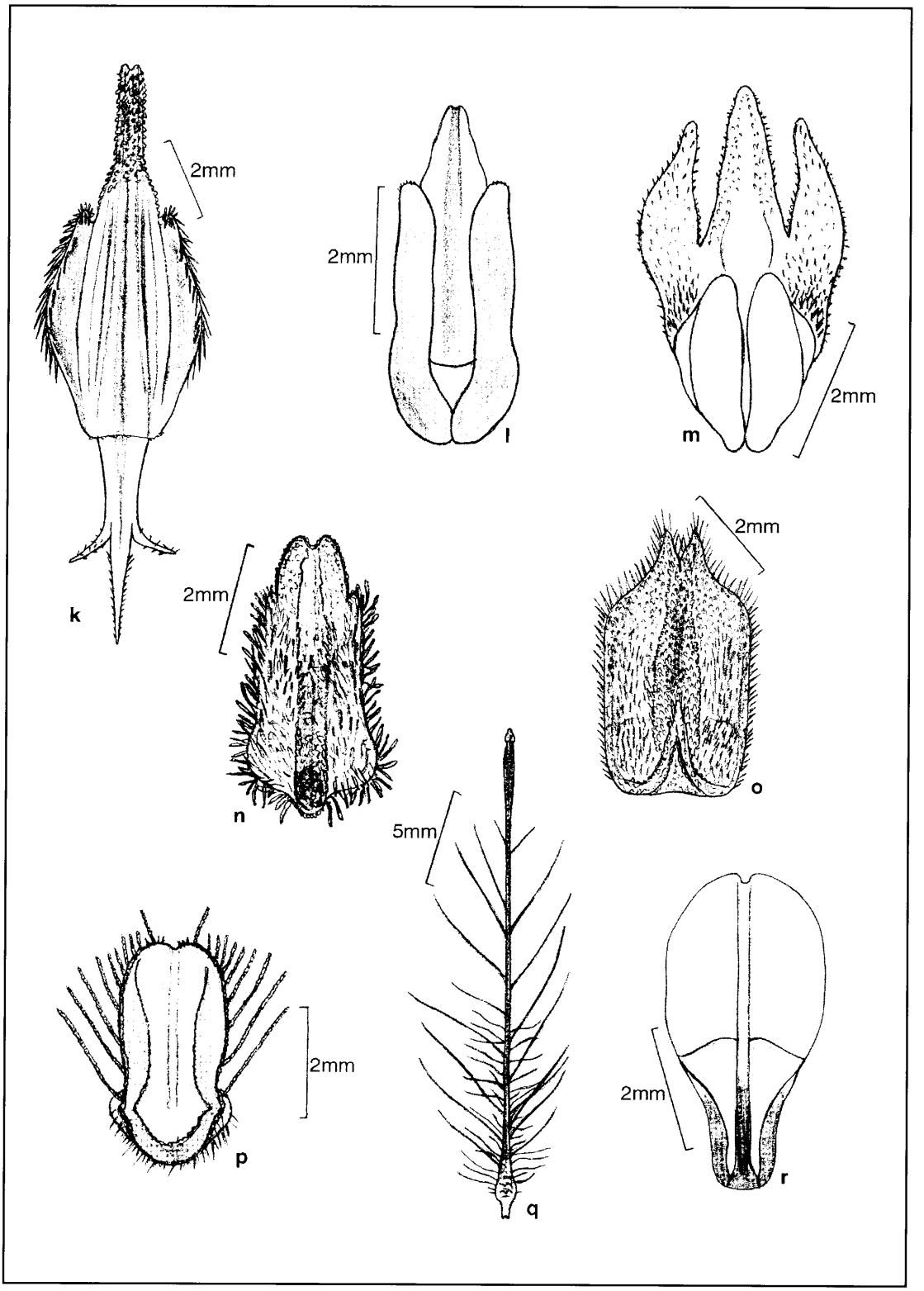

Fig. 1.9. *Pterostylis* labella, from species with deflexed lateral sepals. **k**. *P. recurva*; **l**. *P. daintreana*; **m**. *P. sargentii*; **n**. *P. longifolia*; **o**. *P. vittata*; **p**. *P. rufa*; **q**. *P. barbata*; **r**. *P. mutica*.

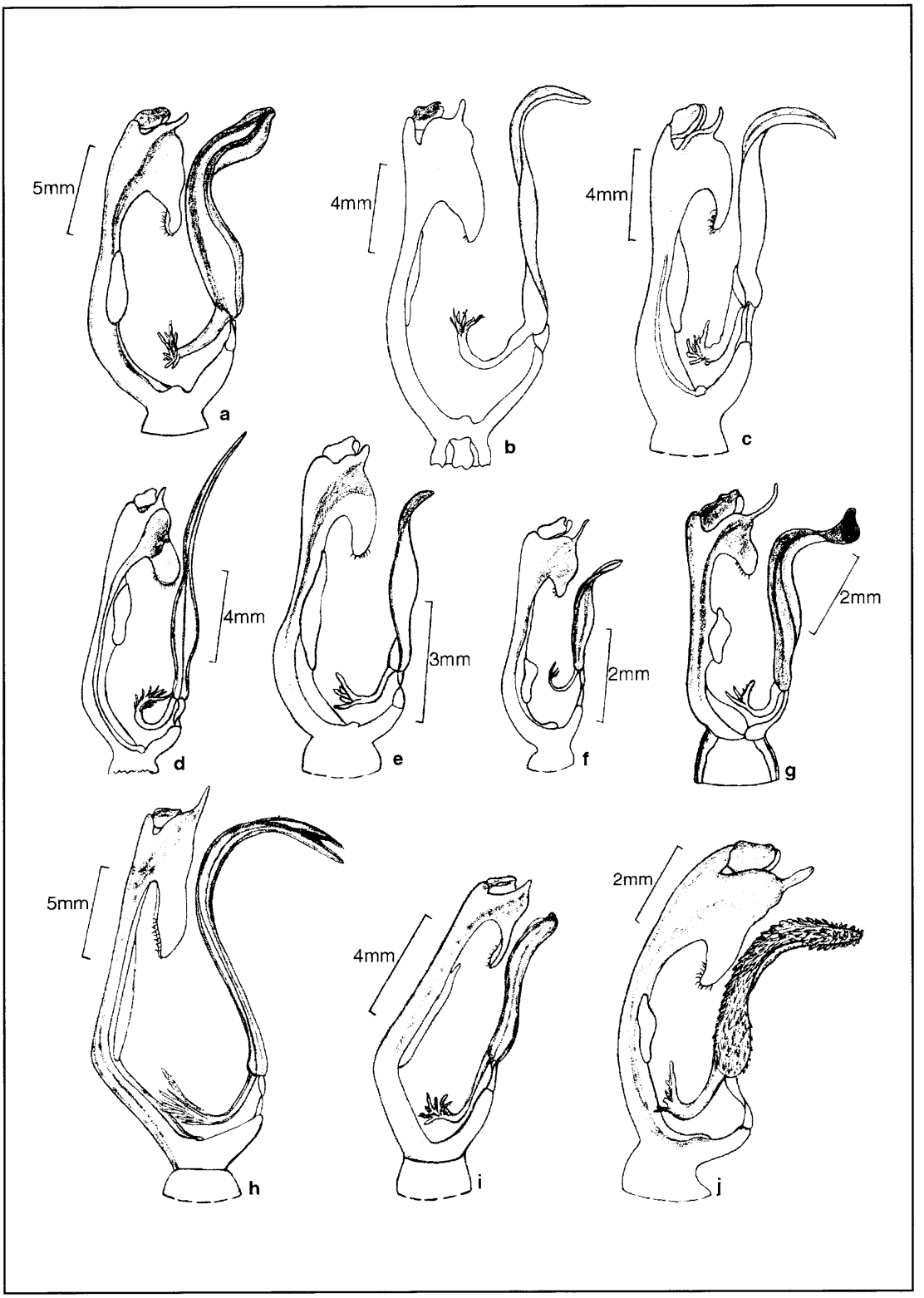

Fig. 1.10. Side view of *Pterostylis* columns and labella, from species with erect lateral sepals. **a**. *P. curta*; **b**. *P. alpina*; **c**. *P. foliata*; **d**. *P. alata*; **e**. *P. nana*; **f**. *P. parviflora*; **g**. *P. bicornis*; **h**. *P. ophioglossa*; **i**. *P. pedoglossa*; **j**. *P. allantoidea*.

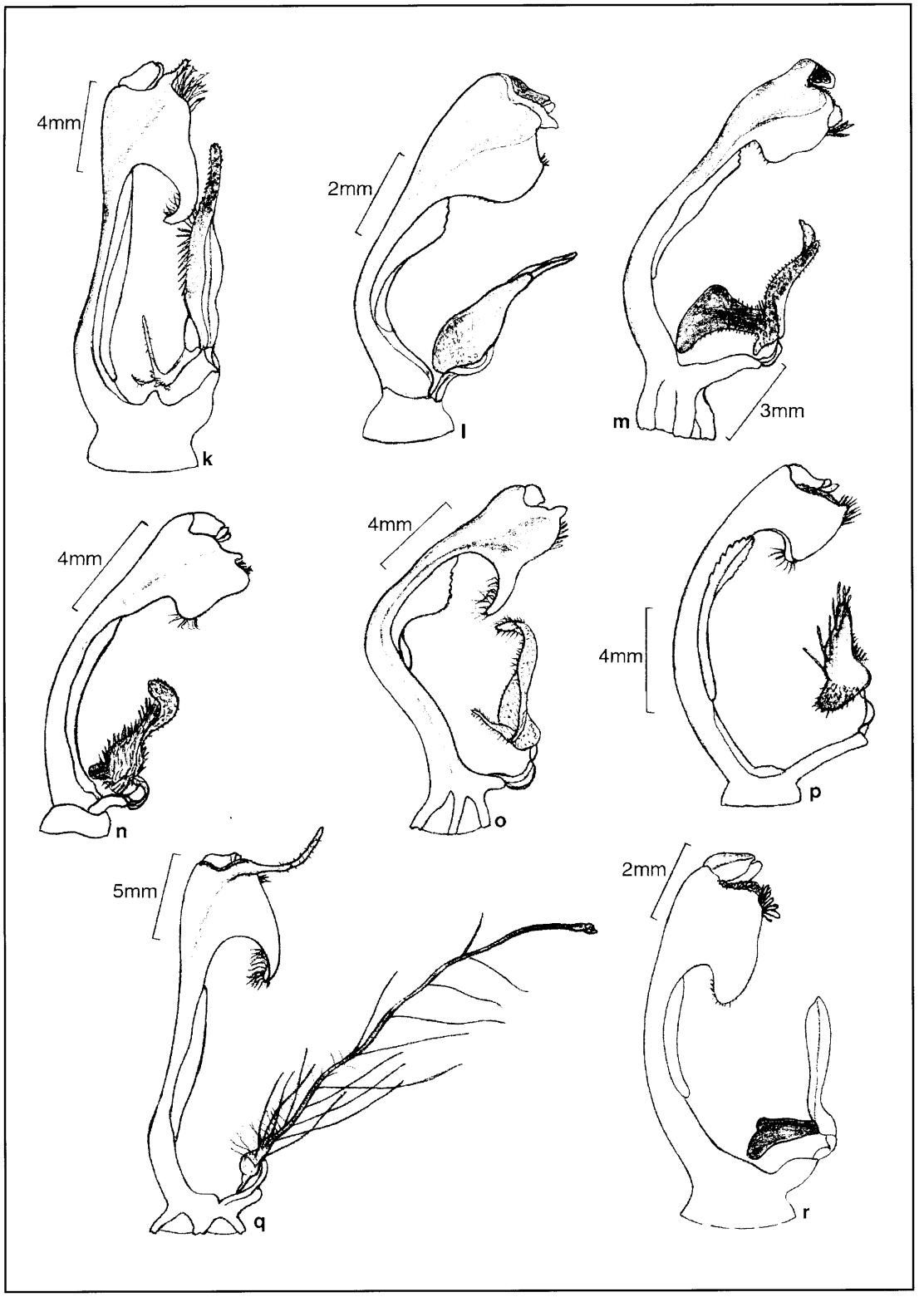

Fig. 1.11. Side view of *Pterostylis* columns and labella, from species with deflexed lateral sepals. **k**. *P. recurva*; **l**. *P. daintreana*; **m**. *P. sargentii*; **n**. *P. longifolia*; **o**. *P. vittata*; **p**. *P. rufa*; **q**. *P. barbata*; **r**. *P. mutica*.

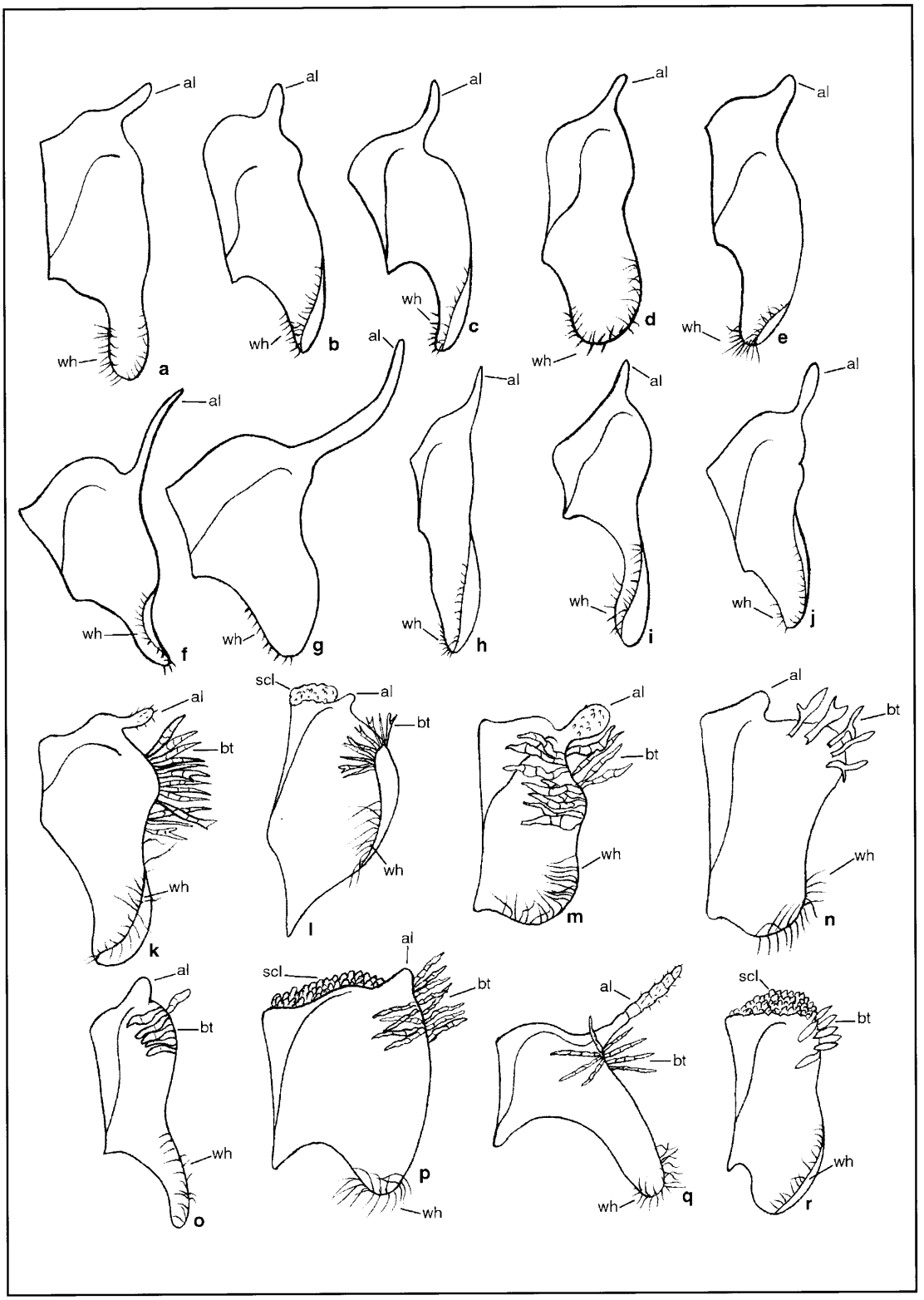

Fig. 1.12. *Pterostylis* column wing, interior view (al=apical lobule; bt=barrier trichomes; scl=siliceous cells; wh=wing hairs). **a**. *P. curta*; **b**. *P. alpina*; **c**. *P. foliata*; **d**. *P. alata*; **e**. *P. nana*; **f**. *P. parviflora*; **g**. *P. bicornis*; **h**. *P. ophioglossa*; **i**. *P. pedoglossa*; **j**. *P. allantoidea*; **k**. *P. recurva*; **l**. *P. daintreana*; **m**. *P. sargentii*; **n**. *P. longifolia*; **o**. *P. vittata*; **p**. *P. rufa*; **q**. *P. barbata*; **r**. *P. mutica*.

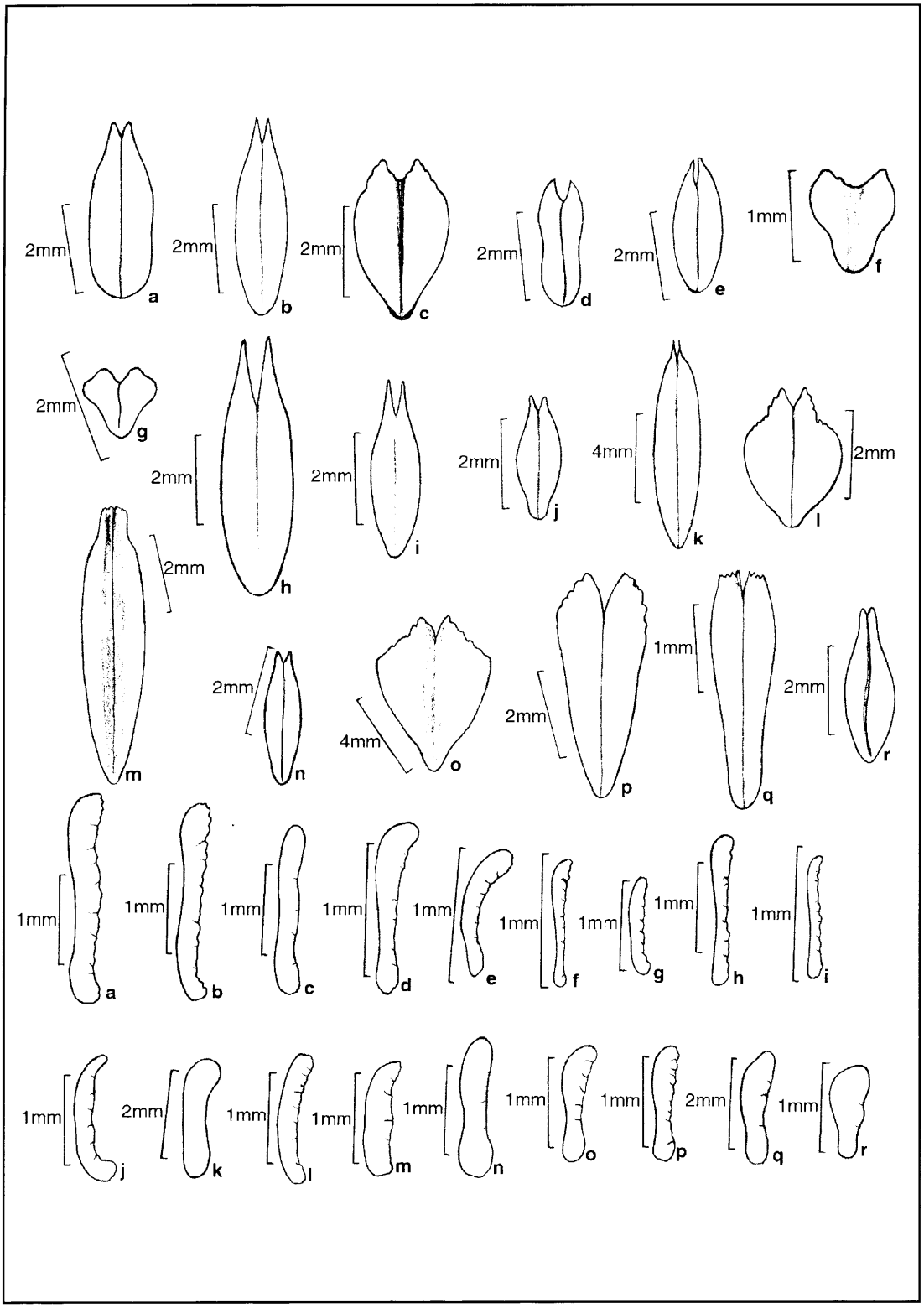

Fig. 1.13. *Pterostylis* stigmas and pollinia. **a**. *P. curta*; **b**. *P. alpina*; **c**. *P. foliata*; **d**. *P. alata*; **e**. *P. nana*; **f**. *P. parviflora*; **g**. *P. bicornis*; **h**. *P. ophioglossa*; **i**. *P. pedoglossa*; **j**. *P. allantoidea*; **k**. *P. recurva*; **l**. *P. daintreana*; **m**. *P. sargentii*; **n**. *P. longifolia*; **o**. *P. vittata*; **p**. *P. rufa*; **q**. *P. barbata*; **r**. *P. mutica*.

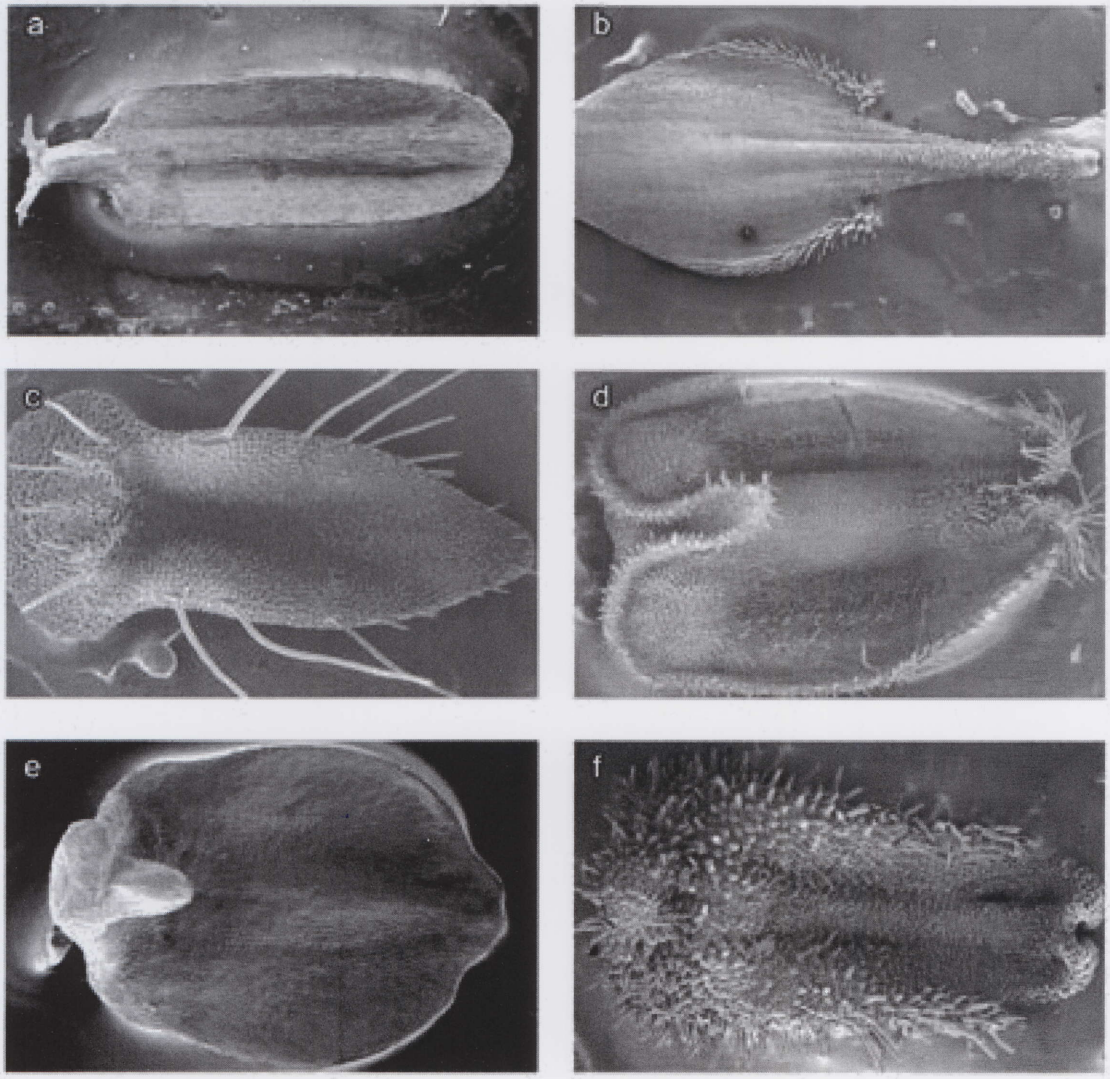

Plate 1. Abaxial views of *Pterostylis* labella. **a.** *P.* sp. aff. *parviflora*, Kurnell, NSW; **b.** *P. recurva*, near Walpole, WA; **c.** *P. basaltica*, Woorndoo, Vic.; **d**. *P. sanguinea*, Belair, SA; **e**. *P. cycnocephala*, Ardlethan, NSW; **f**. *P.* sp. aff. *longifolia*, Point Lookout, NSW.

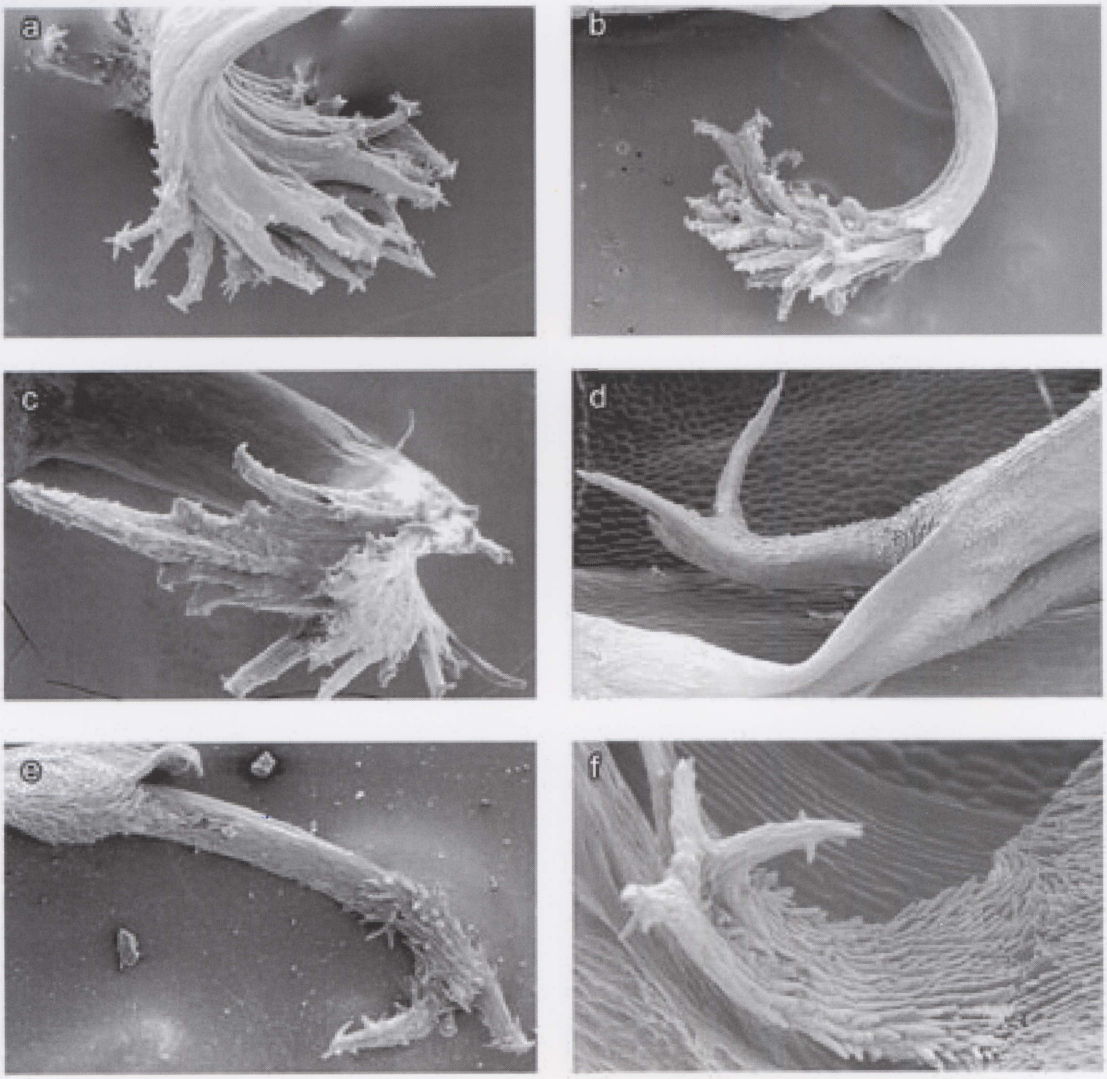

Plate 2. Labellum basal appendages. **a.** *P. bureauviana*, New Caledonia; **b.** *P. angusta*, Bunbury, WA; **c**. *P. decurva*, Brindabella Range, ACT; **d**. *P.* sp. aff. *parviflora*, Black Mountain, ACT; **e**. *P.* sp. aff. *nana*, Margaret River, WA; **f**. *P. bicornis*, Mt Maroon, Qld.

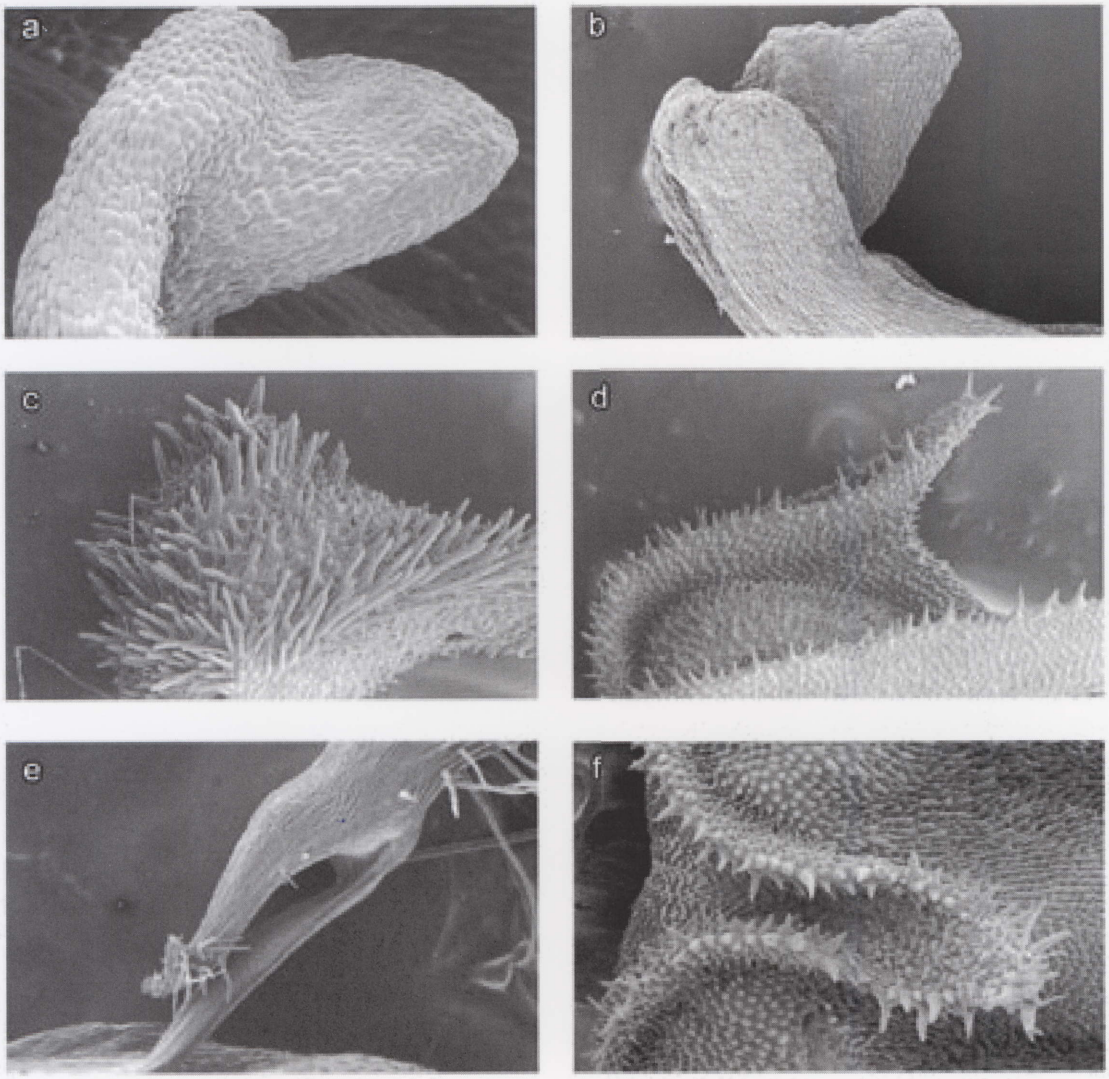

Plate 3. Labellum basal appendages continued. **a.** *P. cycnocephala*, side view, Ardlethan, NSW; **b.** *P.* sp. aff. *cycnocephala*, side view, Monarto, SA; **c**. *P.* sp. aff. *longifolia*, side view, Point Lookout, NSW; **d**. *P. vittata*, side view, Perth, WA; **e**. *P. barbata*, side view, Darling scarp, WA; **f**. *P. sanguinea*, from above, Belair, SA.

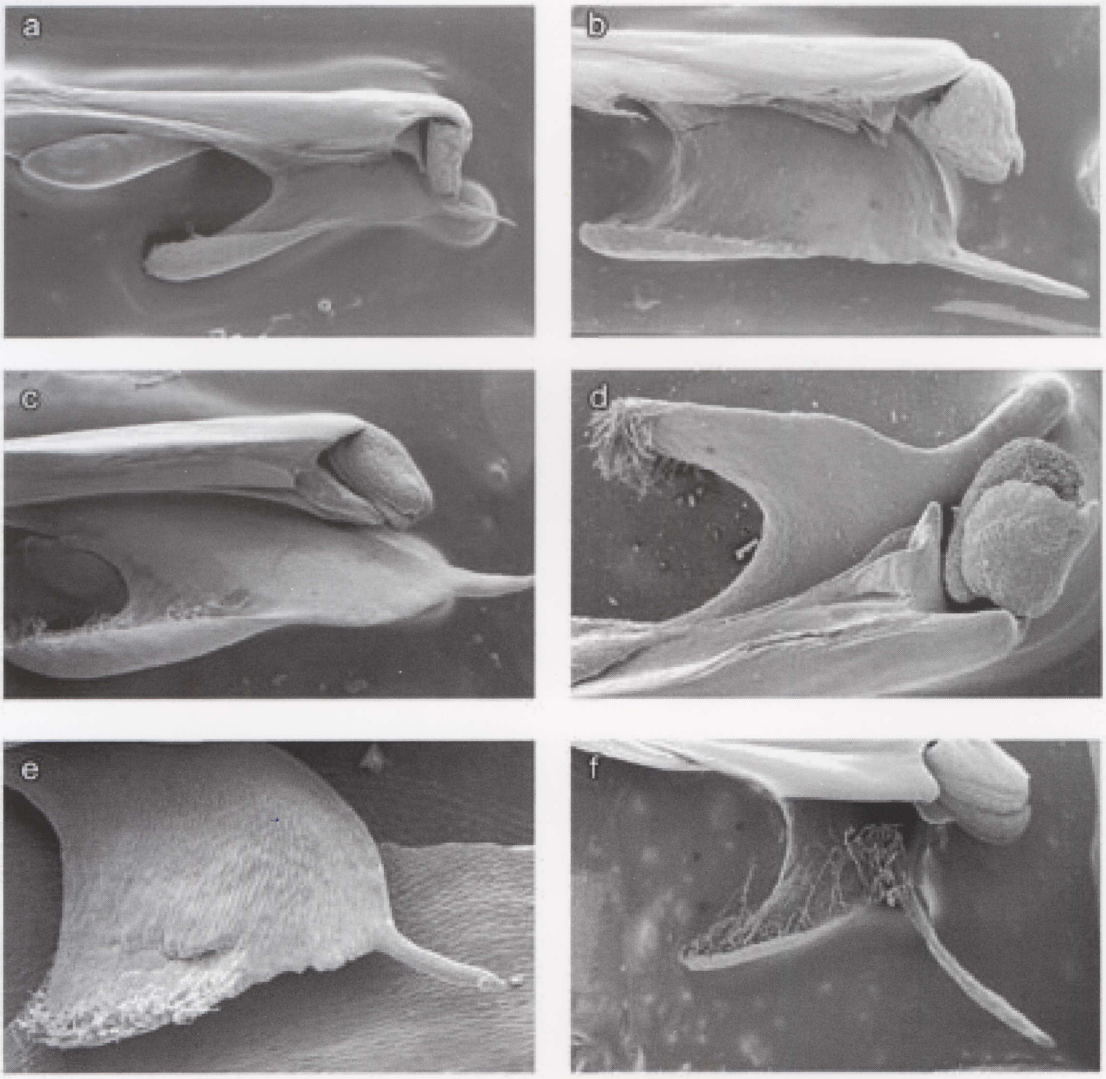

Plate 4. Internal view of a column wing. **a.** *P. angusta*, Bunbury, WA; **b.** *P. bureauviana*, New Caledonia; **c**. *P. coccina*, Point Lookout, NSW; **d**. *P.* sp. aff. *nana*, Margaret River, WA; **e**. *P.* sp. aff. *parviflora*, Kurnell, NSW; **f**. *P.* sp. aff. *plumosa*, Monarto, SA.

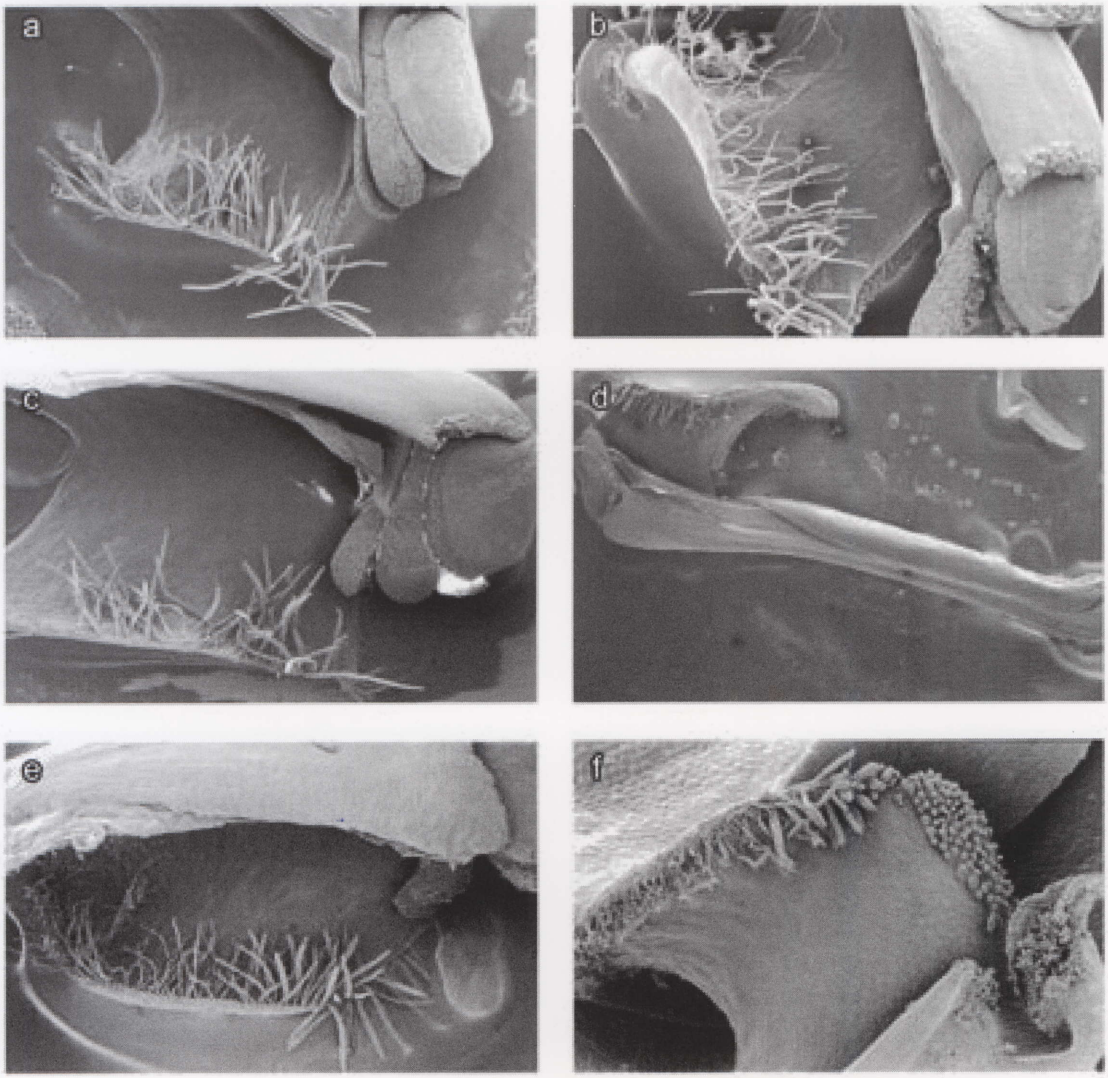

Plate 5. Internal view of a column wing continued. **a.** *P. basaltica*, Woorndoo, Vic; **b.** *P. pusilla*, Flinders Ranges, SA; **c**. *P. biseta*, Monarto, SA.; **d**. *P. recurva*, near Walpole, WA; **e**. *P. sargentii*, Mullewa, WA; **f**. *P. pratensis*, Liawenee, Tas.

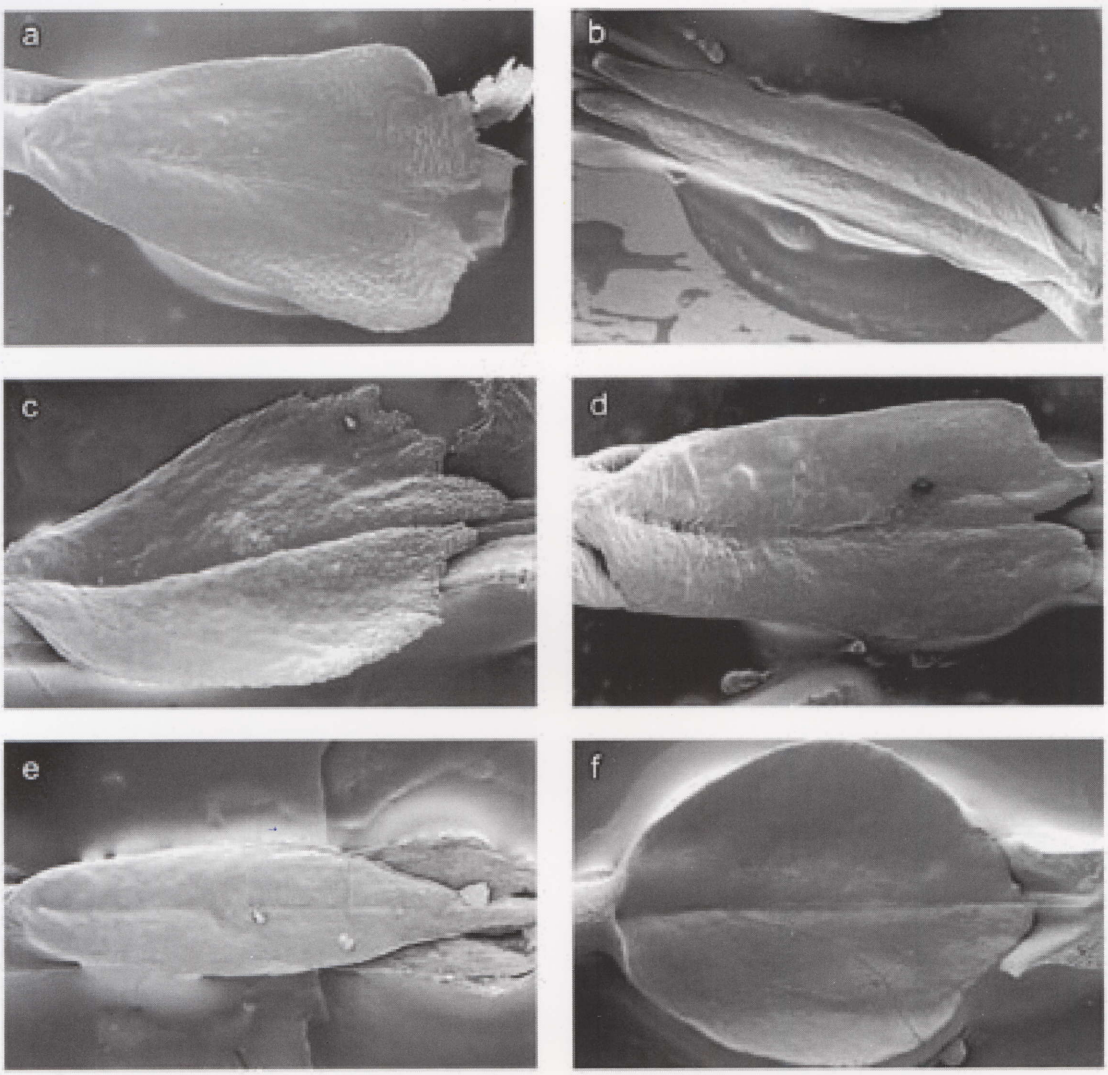

Plate 6. Anterior view of stigma. **a.** *P. pusilla*, Flinders Ranges, SA; **b.** *P. biseta*, Monarto, SA; **c**. *P. daintreana*, Helensburgh, NSW; **d**. *P. smaragdyna*, Adelaide Hills, SA.; **e**. *P. sargentii*, Mullewa, WA; **f**. *P. vittata*, Perth, WA.

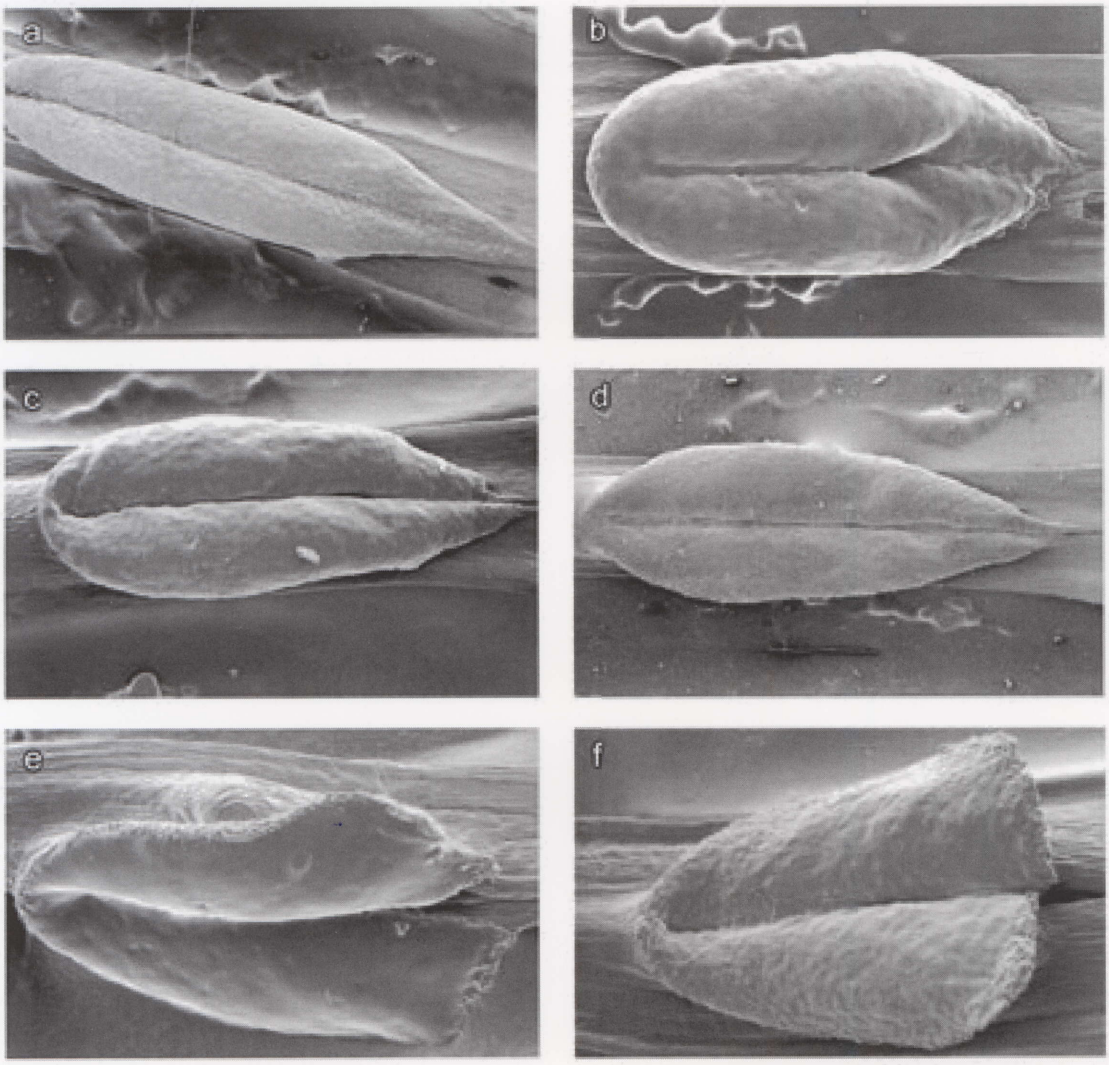

Plate 7. Anterior view of stigma continued. **a.** *P. ophioglossa*, Nelson Bay, NSW; **b.** *P. concinna*, Broulee, NSW; **c**. *P.* sp. aff. *nana*, Moora, WA; **d**. *P.* sp. aff. *nana*, Margaret River, WA; **e**. *P.* sp. aff. *parviflora*, Blue Mountains, NSW; **f**. *P.* sp. aff. *parviflora*, Brindabella Range, ACT.

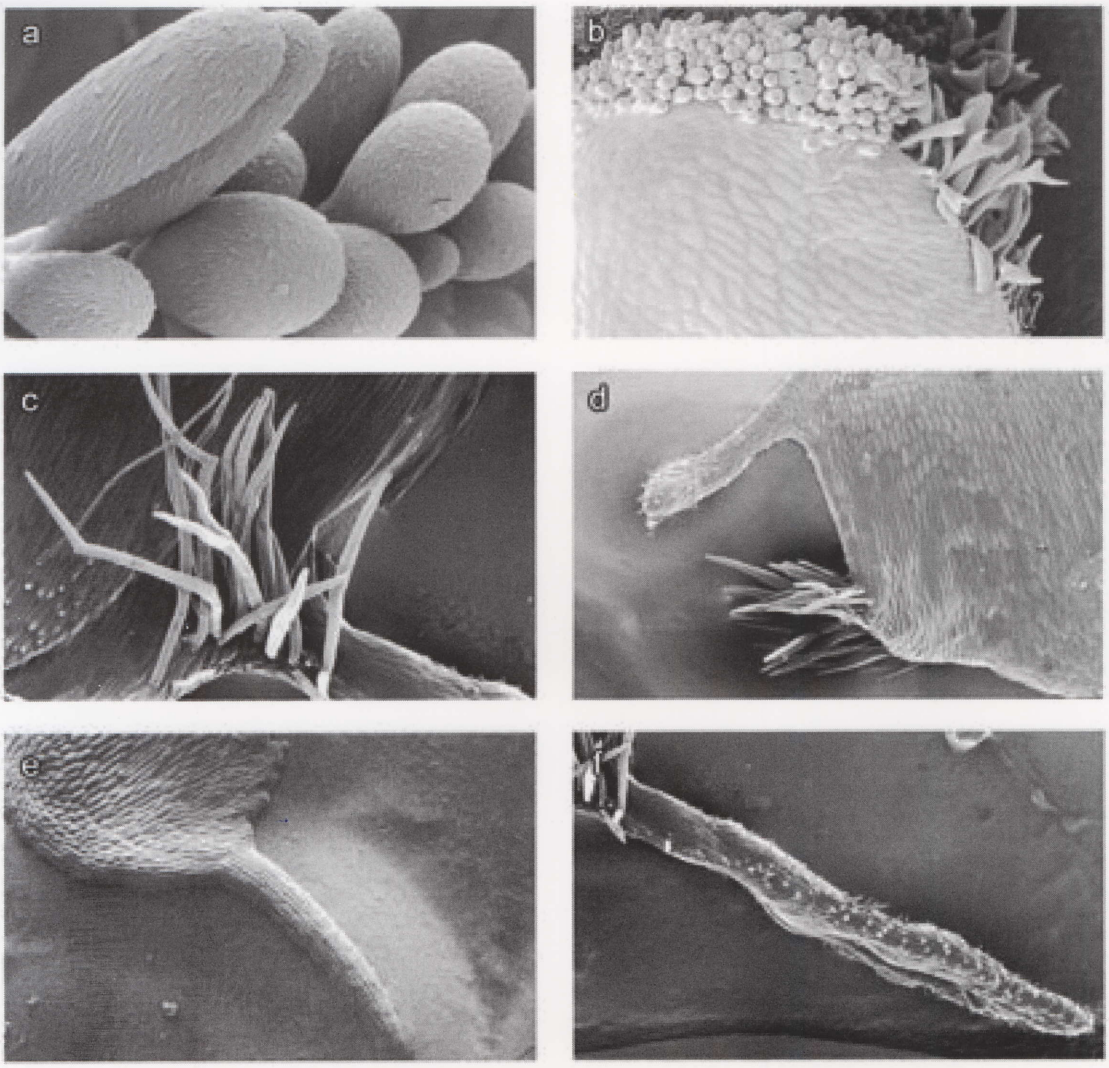

Plate 8. Column wing structures. **a.** Barrier trichomes, *P. pratensis*, Liawenee, Tas; **b.** Beaded siliceous cells and barrier trichomes, *P. cycnocephala*, Ardlethan, NSW; **c**. Barrier trichomes, *P*. sp. aff. *turfosa*, near Margaret River, WA; **d**. Apical lobule and barrier trichomes, *P. recurva*, near Walpole, WA; **e**. Apical lobule, *P. bicornis*, Mt Maroon, Qld; **f**. Apical lobule, *P*. sp. aff. *turfosa*, near Margaret River, WA.

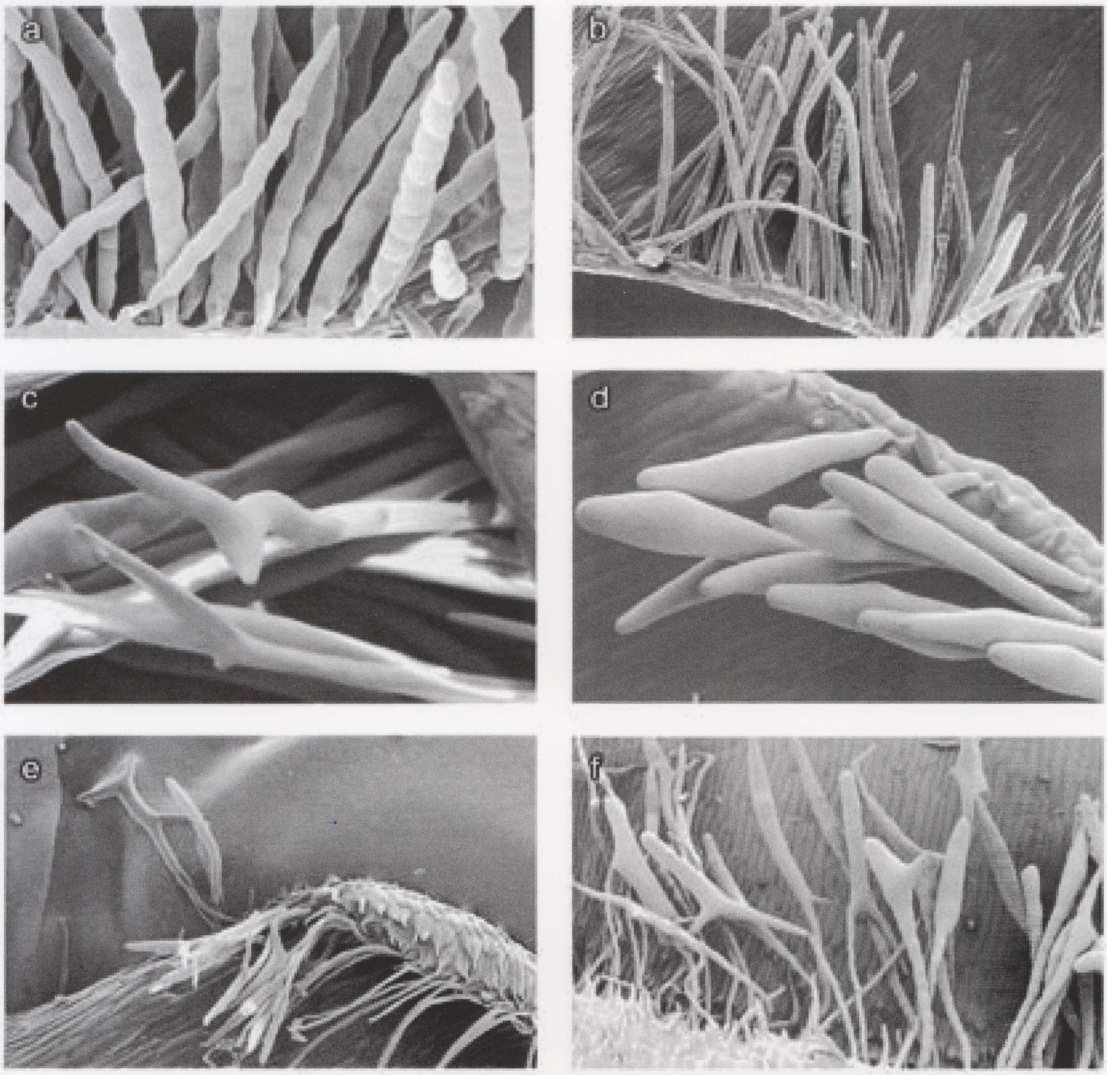

Plate 9. Barrier trichomes of column wings. **a**. *P. sargentii*, Mullewa, WA; **b.** *P. basaltica*, Woorndoo, Vic; **c**. *P. recurva*, Serpentine, WA; **d**. *P. vittata*, Perth, WA; **e**. *P. daintreana*, Helensburgh, NSW; **f**. *P. smaragdyna*, Adelaide Hills, SA.

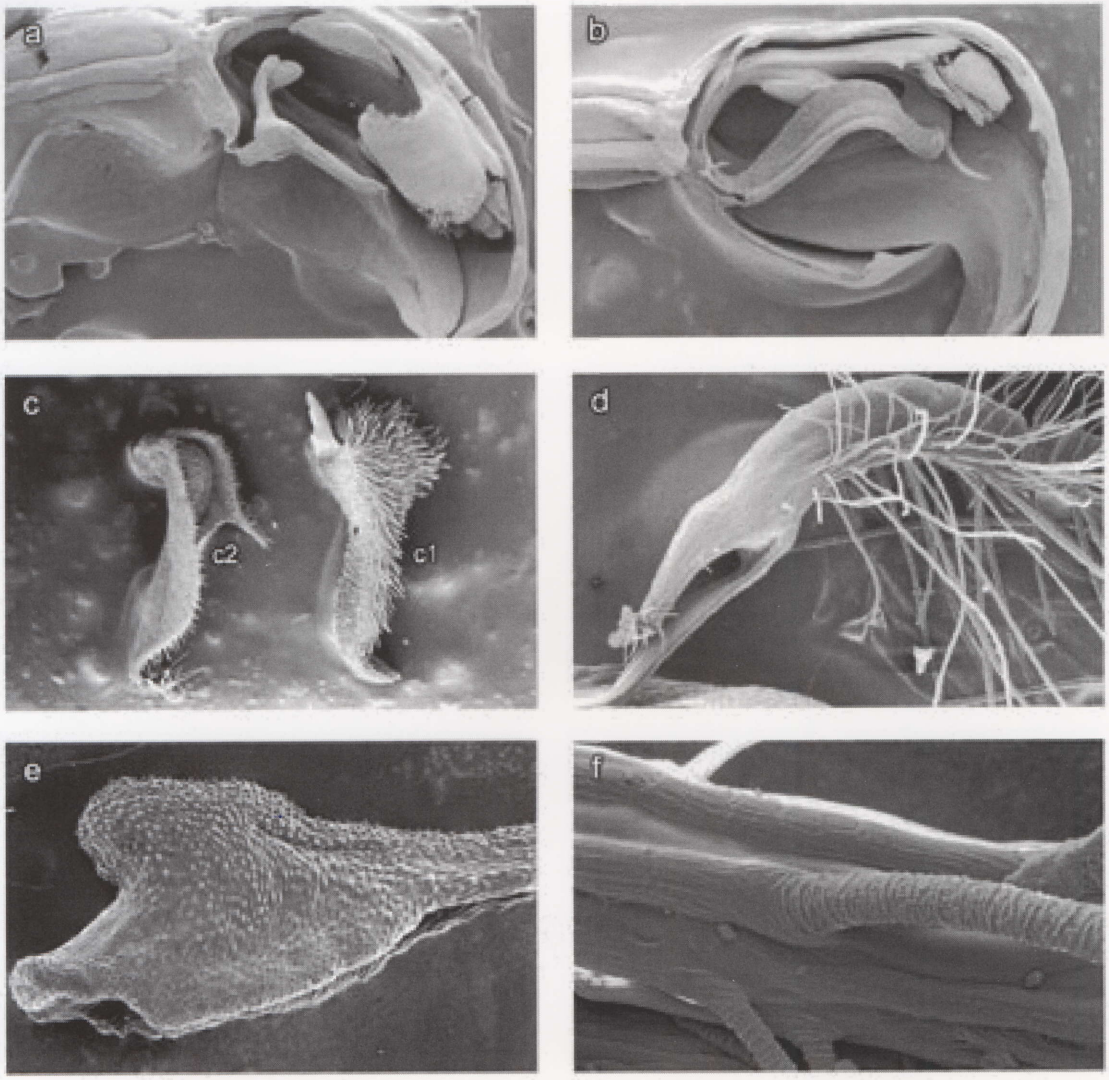

Plate 10. Miscellaneous floral structures. **a.** Lateral view of flower, one petal and half of dorsal sepal removed, *P. cycnocephala*, Ardlethan, NSW; **b.** Lateral view of flower, one petal and half of dorsal sepal removed, *P. bicornis*, Mt Maroon, Qld; **c**. Side views of labella; **c1**, *P.* sp. aff. *longifolia*, Point Lookout, NSW; **c2**, *P. vittata*, Perth WA; **d**. Proximal part of labellum showing basal beak, hinge and trichomes, *P.* sp. aff. *turfosa*, near Margaret River, WA; **e**. Labellum apical knob, *P.* sp. aff. *turfosa*, near Margaret River, WA; **f**. Proximal part of labellum trichome and attachment to lamina, *P. plumosa*, Conimbla, NSW.

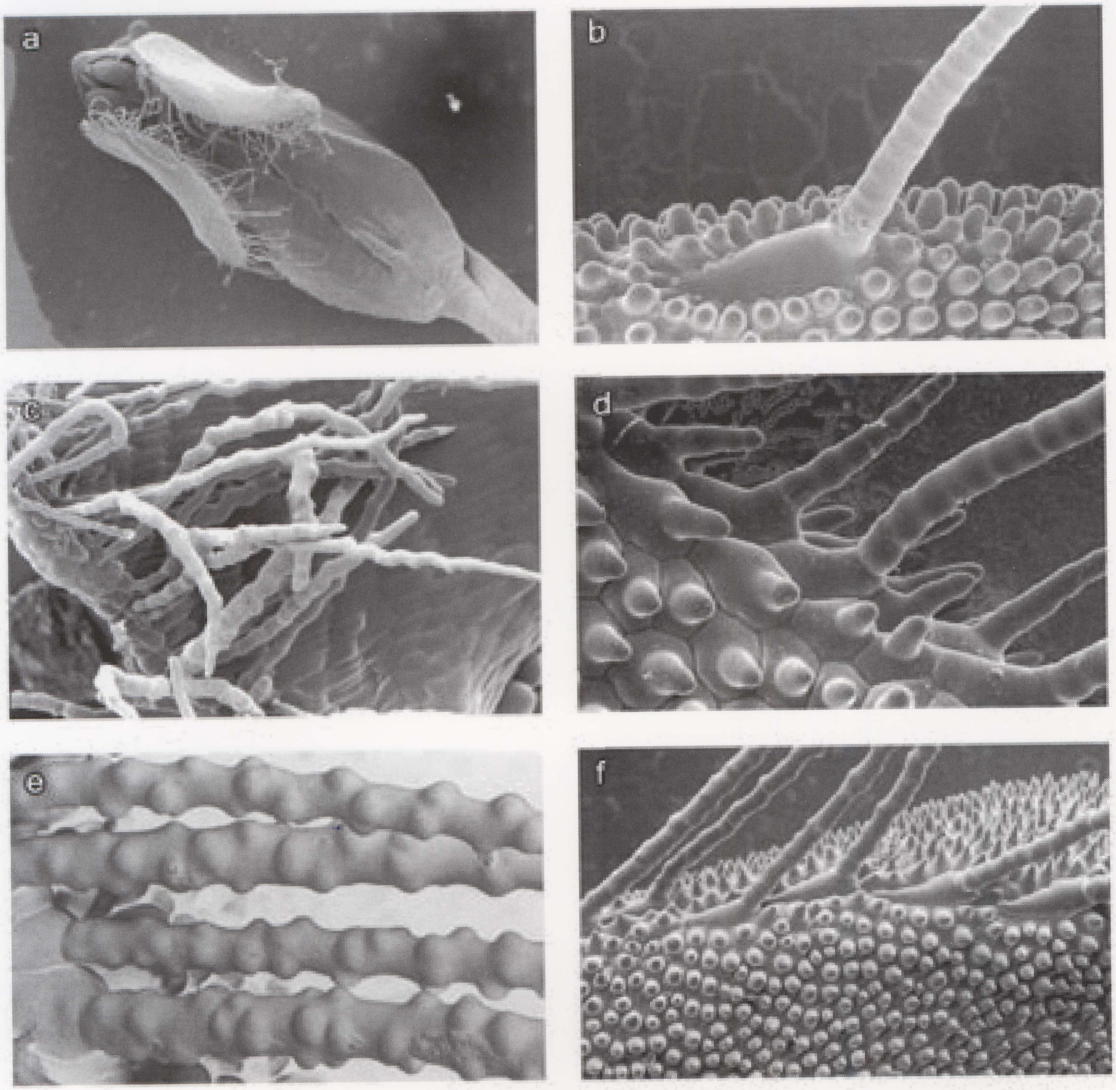

Plate 11. Miscellaneous floral structures – all of the '*rufa*' group. **a.** Anterior view of distal half of column showing stigma, anther and column wings, *P. insectifera*, Brookton, WA; **b.** Proximal part of labellum trichome and attachment to lamina, *P. basaltica*, Woorndoo, Vic; **c**. Barrier trichomes, *P. pusilla*, Flinders Ranges, SA; **d.** Labellum marginal trichomes, *P.* sp. aff. *biseta*, West Wyalong, NSW; **e.** Labellum basal setae, *P. setifera*, Bethungra, NSW; **f.** Labellum marginal trichomes, *P. picta*, Peak Charles, WA.

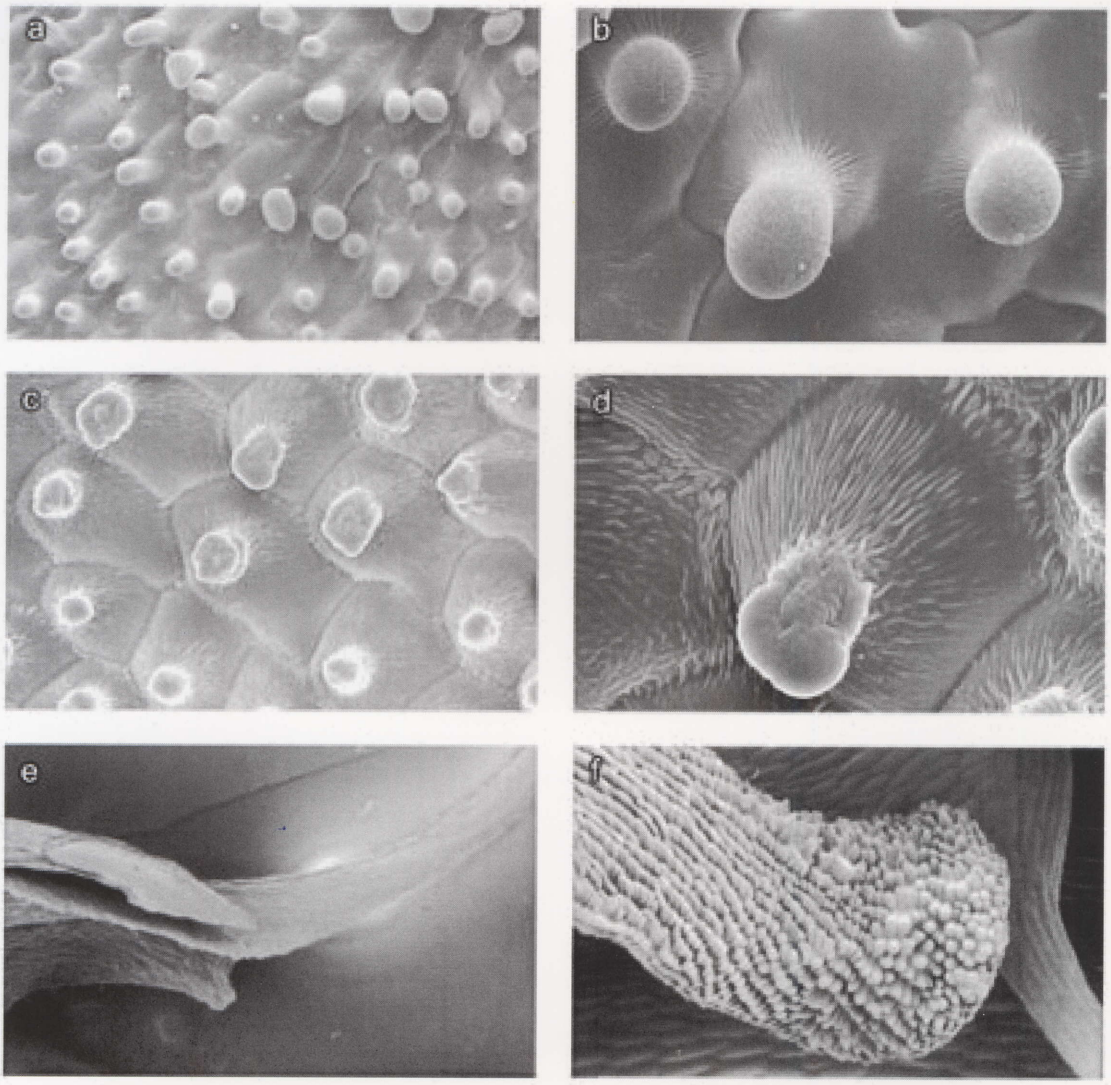

Plate 12. Miscellaneous floral structures. **a., b.** Micropapillae on the anterior surface of the synsepalum, *P. longifolia*, Bundana, NSW; **c., d.** Micropapillae on the anterior surface of the synsepalum, *P. vittata*, Perth, WA; **e.** Horn-like structure on petal apex, *P. bicornis*, Mt Maroon, Qld; **f.** Labellum apical knob, *P. bicornis*, Mt Maroon, Qld.

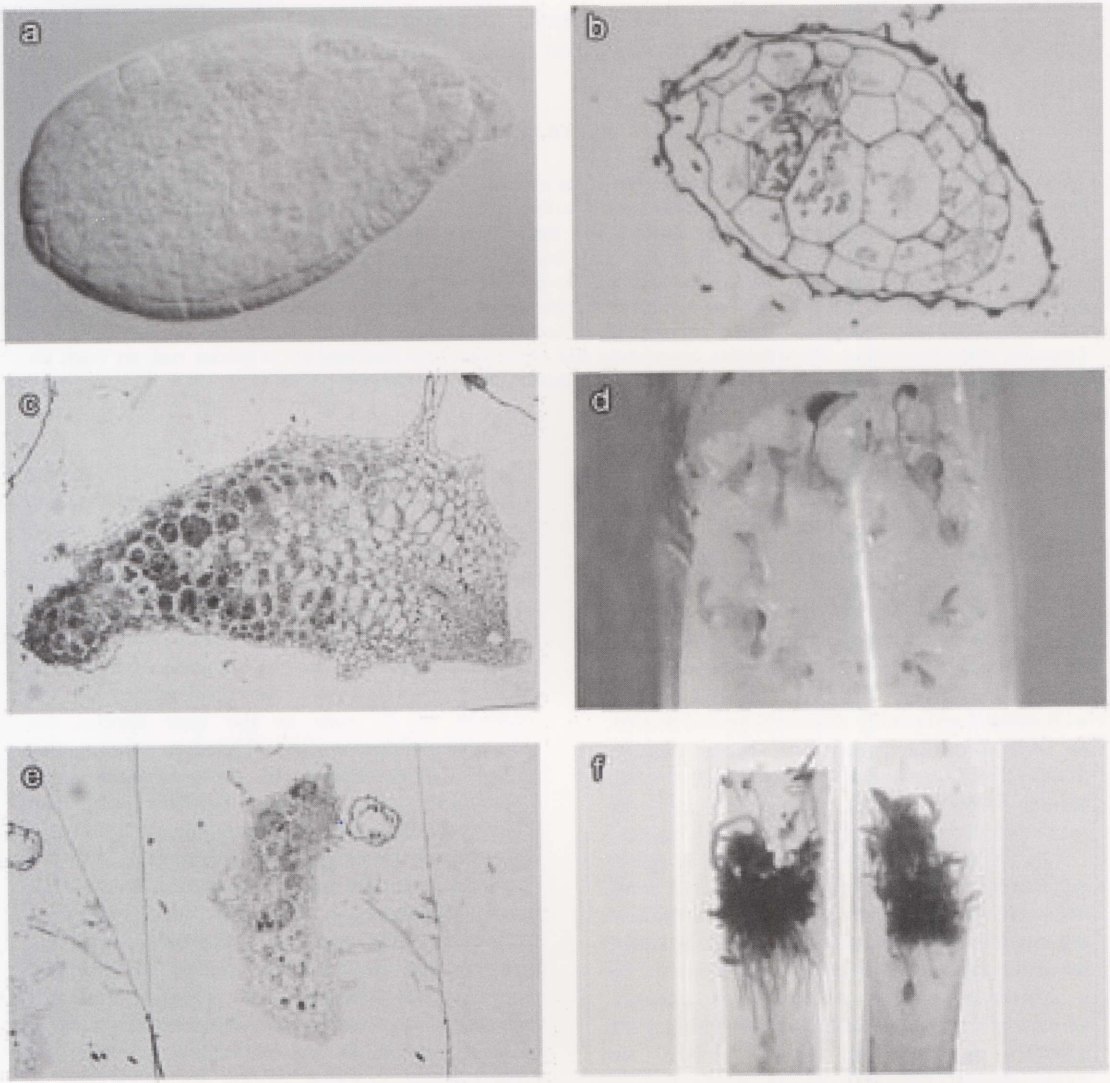

Plate 13. Seed and protocorm structures. **a**. Light micrograph of a mature embryo of *P. cucullata* isolated from the outer integuments, c. x 40; **b.** Median longitudinal section through a seed of *P. cucullata* with the basal cortical cells infected with mycorrhizal fungal hyphae, prior to germination, c. x 30; **c.** Median longitudinal section through a protocorm of *P. cucullata* with many cortical and subcortical cells infected with mycorrhizal fungal hyphae in the basal half, central cortical containing starch grains, and the first vascular cells visible near the meristematic end of the structure, c. x 10; **d.** Germinating seedlings of *P. cucullata* showing the obovoid protocorm-seedling type, c. x 2; **e.** Median longitudinal section through a partially developed obovoid-deorsum type protocorm of *P. rufa* with cortical and subcortical cells infected with mycorrhizal fungal hyphae in the upper (basal) half, c. x 10; **f.** Germinating seedlings of *P. rufa* showing the obovoid-deorsum protocorm-seedling type, c. x 1.

2. A New Classification of *Pterostylis* R.Br. (Orchidaceae)

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ABSTRACT

Pterostylis is redefined in a strict sense based on the results of morphological studies and analysis of nuclear DNA sequence data, *Diplodium* is reinstated from synonymy, the recently described genera *Oligochaetochilus* sense str. and *Plumatichilos* are accepted and twelve new genera are erected together with the necessary nomenclatural transfers. The new genera are:- *Bunochilus*, *Crangonorchis*, *Eremorchis*, *Hymenochilus*, *Linguella*, *Petrorchis*, *Pharochilum*, *Ranorchis*, *Speculantha*, *Stamnorchis*, *Taurantha* and *Urochilus*. Detailed drawings are provided for the type species of each genus, and a separate drawing shows a longitudinal section of a flower either of the type species or of a species representative of each genus. Sections historically identified within *Pterostylis sens. lat.* are lectotypified and new infrageneric taxa are described within *Bunochilus*, *Linguella*, *Oligochaetochilus*, *Plumatichilos*, *Speculantha* and *Pterostylis*. New combinations at species rank are made for *Pterostylis banksii* A.Cunn. var. *silvicultrix* F.Muell. and *P. papuana* Rolfe var. *arfakensis* J.J.Sm.

INTRODUCTION

In the traditional sense the subtribe Pterostylidinae is comprised of the single genus *Pterostylis* R.Br., which has evolved principally in Australia and is represented also in some adjacent countries. In the previous paper (paper 1, this Volume), *Pterostylis* has been shown to be a variable assemblage consisting of a number of well defined and readily discerned natural groups, as well as three remarkably distinct species (Table 2.1). These three species and most of the natural (monophyletic) groups, which are supported both by morphological characters and DNA-ITS sequence data, could either be given infrageneric status or recognised at higher rank. We have chosen the latter course because the taxa are not only readily identifiable morphologically, but in the majority of cases, are well supported by a substantial number of base pair changes. Infrageneric taxa are also recognised within some genera, these being based solely on morphological characters.

While this paper was in preparation two new genera, *Oligochaetochilus* and *Plumatichilos*, were segregated from *Pterostylis* (Szlachetko 2001). This action cut directly across our work (see also Jones *et al.* 2001) and caused considerable adjustments to this manuscript. As has been shown in the previous paper (paper 1, this volume), the basis of these proposed new genera varies, with *Oligochaetochilus* containing one natural (monophyletic) and two non-monophyletic groups whereas *Plumatichilos* is a natural (monophyletic) group. The name *Oligochaetochilus* is derived from a compound of three Greek words ending in "*chilus*" rendering the gender masculine. In choosing this name Szlachetko failed to assign the appropriate gender endings to the species he transferred to the genus. Szlachetko also failed to transfer the species to *Plumatichilos* with the appropriate gender endings. The skeletal nature of the paper and multitude of errors throughout the text, would suggest a lack of knowledge of delimitations within this complex group of orchids. Nevertheless because of the rule of priority of publication of botanical names and the selection of *P. rufa* as the type species for *Oligochaetochilus*, we are obliged to take up this name to recognise this natural group at generic rank, although we do so in a much narrower sense than that proposed by its originator. Similarly, *Plumatichilos* is recognised at generic rank.

In this paper *Pterostylis* is re-defined in the strict sense, *Diplodium* is reinstated from synonymy, *Oligochaetochilus* sense str. and *Plumatichilos* are accepted and twelve other groups are formally recognised at generic rank (Table 2.1) and infrageneric taxa are erected wherever necessary to cater for significant morphological variation. A nomenclatural synopsis of the Pterostylidinae is presented in an accompanying paper together with an index of the name changes involved.

The molecular and combined data sets (paper 1, Trees 1.2 & 1.3) show that members of the *Pterostylis ophioglossa* group, together with *P. pedoglossa* and *P. depauperata,* align with *Diplodium*, rather than the "*curta*" group as might have been expected on morphological grounds. The morphological characters of the flowers and features of their growth habit, particularly rosette placement in these taxa, differ from those exhibited by taxa of *Diplodium sens. strict*. These two groups of taxa do not fit comfortably within *Diplodium* and we feel, despite poor bootstrap support, that the differences between the groups should be emphasised and have

chosen to treat them at generic rank *viz.*, *Crangonorchis* and *Taurantha*. We expect that further studies including other regions of the genome will be useful in providing additional information on relationships within this group.

TAXONOMIC TREATMENT

Subtribe: PTEROSTYLIDINAE Pfitzer, *Entwurf Anordn. Orch.* 97 (Jan.-April 1887) (as "Pterostylideae"). Type: *Pterostylis* R.Br.

Pterostylideae (Pfitzer) P.Royen, *Alpine Fl. New Guinea* 2: 88-89 (1979).

1. *Pterostylis*

Pterostylis R.Br., *Prod.* 326 (1810) (nom. cons.). Type species: *Pterostylis curta* R.Br. (type cons.). **Figs. 2.1, 2.2.**

Notes

Pterostylis was conserved against *Diplodium* Sw. at the 3rd International Botanical Congress held in Brussels in 1910 (de Wildeman 1910). The proposed *Nomina conservanda* (Article 20) of *Pterostylis* was deemed necessary because: (a) both names were thought to apply to the same genus; (b) uncertainty existed about the date of publication of *Diplodium*.

Pterostylis curta R.Br. was chosen as the type species for *Pterostylis* in "*Standard-species of nominica conservanda*" prepared by M.L.Green and distributed softbound on 30 June 1926. This followed the proposed incorporation of the Berlin and American Codes in the 1920's and acceptance of the type species concept (Nicholson 1991). The list of chosen types was circulated in "*Proposals by British Botanists*" (1929: 98-109) and adopted as part of the Code at the Cambridge Congress 1930. It appeared as an Appendix under "*Species lectotypicae nominum genericorum-conservanadorum-Phanerogamarum*" in the "International Rules of Botanical Nomenclature" (Briquet 1935).

Etymology

The generic name *Pterostylis* is derived from the Greek *pteron*, wing and *stylos*, pillar, pole – but in Orchidaceae applied generally to the column. The name refers to the prominent apical wings on the column.

Recognition

Pterostylis sens. str. is recognised by the following combination of characters:- sterile and fertile plants monomorphic; clonal colonies formed by the production of daughter tubers on the end of stolonoid roots; leaves arranged in a basal or spiral, scape-encircling rosette; flower solitary (rarely two); synsepalum erect, embracing the galea; free points of lateral sepals long, narrowly tapered or filiform; labellum unlobed, partially exposed or fully enclosed within the galea when in the set position; basal appendage extending porrectly from the labellum base, incurved, apex penicillate; and, barrier trichomes (defined in the previous paper) absent.

Distribution

A genus of c. 40 species distributed in Australia, New Zealand, Lord Howe Island, New Caledonia, New Guinea, New Britain, New Ireland and Ceram. Map 2.

Notes

Reproduction is from seed and local clonal colonies are formed by the production of daughter tubers on stolonoid roots. Natural intergeneric hybrids are unknown.

Infrageneric taxa

A genus of three subgenera, two new:-

1a. *Pterostylis* subg. *Pterostylis*. Characterised by petiolate leaves in a compact, basal, scape-encircling rosette and scape with reduced, sheathing, bract-like leaves; rarely with a few basal leaves, the remainder in a loose spiral up the scape.

Pterostylis sect. *Nudicaules* G.Don in Loudon's *Hortus Brittanicus* 369 (1830). Lectotype species: *Pterostylis curta* R.Br., here designated.

Pterostylis sect. *Acuminatae* Rchb.f., *Beitr. Syst. Pflanz.* 68 (1871). Lectotype species: *Pterostylis acuminata* R.Br., here designated.

Pterostylis sect. *Laminatae* Rupp, *Proc. Linn. Soc. New South Wales* 58: 423 (1933). Lectotype species: *Pterostylis curta* R.Br., here designated.

1b. *Pterostylis* subg. *Cucullatae* (Rchb.f) D.L.Jones et M.A.Clem., **comb. et stat. nov**.

Basionym: *Pterostylis* sect. *Cucullatae* Rchb.f., *Beitr. Syst. Pflanz.* 68-69 (1871). Lectotype species: *Pterostylis cucullata* R.Br., here designated.

Characterised by subsessile to sessile leaves, arranged in a loose spiral up the scape.

New Combination:

Pterostylis arfakensis (J.J.Sm.) D.L.Jones et M.A.Clem., **comb. et stat. nov**.

Basionym: *Pterostylis papuana* Rolfe var. *arfakensis* J.J.Sm., in L.S.Gibbs, *Fl. Arfak mts.* 107-108 (1917). Types: Indonesia. West Irian; Arfak Mtns, Angi Lakes, terrestrial under edge of forest patch by lake, 7000', Dec., *L.S.Gibbs 5713 & 5890* (syn BM!). Dist.: Indonesia. West Irian. Notes: The type sheet consists of two specimens, apparently

from the same locality, and two labels with different collecting numbers. Lectotypification is not possible since collecting numbers cannot be matched with individual specimens. *Pterostylis arfakensis* can be readily distinguished from *P. papuana* by its much smaller (galea c. 2 cm long) pink flowers (galea c. 4 cm long and predominately brown in *P. papuana*); strongly falcate, sharply tapered petals (shallowly falcate and broadly tapered in *P. papuana*); and, broadly ovate-lanceolate labellum with an acuminate apex (oblong-lanceolate and subobtuse in *P. papuana*).

1c. *Pterostylis* subg. *Graminifoliae* D.L.Jones et M.A.Clem., **subgen. nov.**; ceteris subgeneribus generis *Pterostylis* R.Br. foliis angustis gramineis subsessilibus plus minusve distiche dispositis, distinguenda. Type species: *Pterostylis banksii* A.Cunn.

Characterised by subsessile to sessile, narrow, grass-like leaves arranged more or less distichously on the scape.

New Combination:

Pterostylis silvicultrix (F.Muell.) Molloy, D.L.Jones et M.A.Clem., **comb. et stat. nov**.

Basionym: *Pterostylis banksii* A.Cunn. var. *silvicultrix* F. Muell., *Veg. Chatham Is.* 51 (1864). Type: Chatham Island, in woods only, *H.Travers s.n.* (holo MEL!; iso W!). Dist: New Zealand (ChI).

2. *Bunochilus*

Bunochilus D.L.Jones et M.A.Clem., **gen. nov.:** affinis ad *Pterostylem* R.Br., sed plantis dimorphis sterilibus et fertilibus; racemo multifloro; sepalis lateralibus deflexis; synsepalo in pagina anticis micropapillis albis bulliformibus; sepalis lateralibus apicibus liberis triangularibus; labello trilobatis, in suus loco positus plene exposito; lamina labelli sine appendice basali sed umbone basali dilatato, suus apice nodulo obtuso producto; et alis columna trichomibus anticis impedientibus, distinguenda. Type species: *Pterostylis longifolia* R.Br. **Figs. 2.3, 2.4.**

Oligochaetochilus D.L.Szlachetko, subgen. *Apicuchilos* D.L.Szlachetko, *Polish Bot.J.* 46(1): 23 (2001), (*pro parte*). Type species: *Pterostylis vittata* Lindl.

Etymology

The name *Bunochilus*, which is derived from the Greek *bounos*, mound, knob and *cheilos*, lip, refers to the mounded knob-like swelling at the base of the labellum.

Recognition

Bunochilus is recognised by the following combination of characters:- sterile and fertile plants dimorphic (sterile plants consisting solely of a perched rosette of petiolate leaves; fertile plants consisting of a flowering scape with sessile, spreading cauline leaves); clonal colonies absent (reproduction is solely from seed); raceme multiflowered; lateral sepals deflexed; synsepalum flat to convex, with white bubble-like micropapillae on the anterior surface; free points of lateral sepals short, triangular; labellum fully exposed in the set position; labellum lamina three-lobed; basal appendage absent; labellum base enlarged, the apex extending as a blunt knob; barrier trichomes unbranched, thickened, multiseriate.

Distribution

A genus of c. 15 species distributed in eastern Australia. Map 3.

Notes

Reproduction is solely from seed. Natural intergeneric hybrids are unknown.

Infrageneric Taxa

A genus of two sections, one newly described:-

2a. *Bunochilus* sect. *Bunochilus*. Characterised by petals lacking basal flanges; labellum pale with a dark central stripe or wholly brown to black.

Pterostylis sect. *Squamatae* G.Don in Loudon's, *Hortus Brittanicus* 369 (1830). Type species: *Pterostylis longifolia* R.Br., lectotype here designated.

New Combinations:

Bunochilus longifolius (R.Br.) D.L.Jones et M.A.Clem., **comb. nov.**

Basionym: *Pterostylis longifolia* R.Br. *Prod.* 327 (1810).

Bunochilus melagrammus (D.L.Jones) D.L.Jones et M.A.Clem., **comb. nov.**

Basionym: *Pterostylis melagramma* D.L.Jones, *Austral. Orch. Res.* 3: 145-146, fig. 7.6 (1998).

Bunochilus tunstallii (D.L.Jones et M.A.Clem.) D.L.Jones et M.A.Clem., **comb. nov.**

Basionym: *Pterostylis tunstallii* D.L.Jones et M.A.Clem., *Austral. Orch. Res.* 1: 128 (1989).

Bunochilus williamsonii (D.L.Jones) D.L.Jones et M.A.Clem., **comb. nov.**

Basionym: *Pterostylis williamsonii* D.L.Jones, *Austral. Orch. Res.* 3: 157-158, fig. 7.16 (1998).

2b. *Bunochilus* sect. *Smaragdyna* D.L.Jones et M.A.Clem. **sect. nov.**; ceteris sectionibus generis *Bunochiluse* D.L.Jones et M.A.Clem. alis basalis petalorum galea inferiore obstructa, et labello uniformiter smaragdino vel bubalino, distinguenda. Type species: *Pterostylis smaragdyna* D.L.Jones et M.A.Clem.

Characterised by petals with basal flanges blocking the base of the galea; labellum uniformly emerald green or buff brown.

New Combinations:

Bunochilus chlorogrammus (D.L.Jones et M.A.Clem.) D.L.Jones et M.A.Clem., **comb. nov.**

Basionym: *Pterostylis chlorogramma* D.L.Jones et M.A.Clem., *Muelleria* 8(1): 78-79, fig.1,j-m (1993).

Bunochilus smaragdynus (D.L.Jones et M.A.Clem.) D.L.Jones et M.A.Clem., **comb. nov.**

Basionym: *Pterostylis smaragdyna* D.L.Jones et M.A.Clem., *Muelleria* 8(1): 82-83, fig.1, f-i (1993).

Bunochilus stenochilus (D.L.Jones) D.L.Jones et M.A.Clem., **comb. nov.**

Basionym: *Pterostylis stenochila* D.L.Jones, *Austral. Orch. Res.* 3: 153-154, fig.7.12 (1998).

3. *Crangonorchis*

Crangonorchis D.L.Jones et M.A.Clem., **gen. nov**. affinis ad *Pterostylem* R.Br., sed sepalo dorsali extensione apicali longa, elongato-tereti; ad *Diplodium* Sw. similis, sed rosula foliorum base scapi circumdans, differt. Type species: *Pterostylis pedoglossa* Fitzg. **Figs. 2.5, 2.6.**

Etymology

The generic name *Crangonorchis*, which is based on the common name of prawn greenhood, is derived from the Greek, *krangon*, shrimp and *Orchis* another genus of Orchidaceae (but which is often generally used when referring to an orchid).

Recognition

Crangonorchis is recognised by the following combination of characters:- sterile and fertile plants monomorphic; clonal colonies formed by the production of daughter tubers on the end of stolonoid roots; leaves arranged in a basal scape-encircling rosette; synsepalum erect, embracing the galea, without lateral gaps; free points of lateral sepals long, filiform; apex of dorsal sepal with a long filiform extension; labellum lamina unlobed, enclosed within the flower; basal appendage extending porrectly from the labellum base, incurved, apex penicillate; and, barrier trichomes absent.

Distribution

A genus of 2 species occurring in eastern Australia. Map 4.

Notes

Reproduction is from seed and by the production of daughter tubers to form local clonal colonies. Natural intergeneric hybrids are unknown. The erection of this genus will be controversial because morphologically it appears to have affinities with *Pterostylis*, but the results of the ITS study place its relationships with *Diplodium* where it does not sit comfortably from a morphological viewpoint, although the distinctions appear to be relatively minor. The option to expand the circumscription of *Diplodium* to include *Crangonorchis* was rejected in favour of the erection of a new genus.

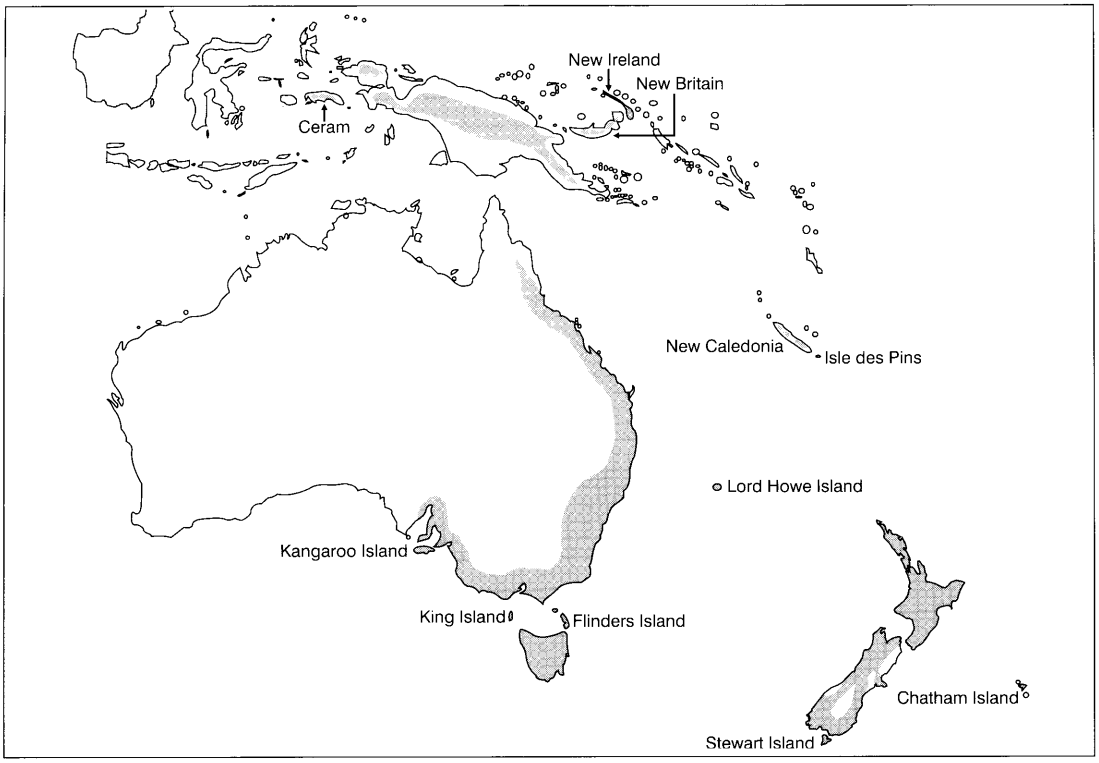
New Combinations:

Crangonorchis depauperata (F.M.Bailey) D.L.Jones et M.A.Clem., **comb. nov.**

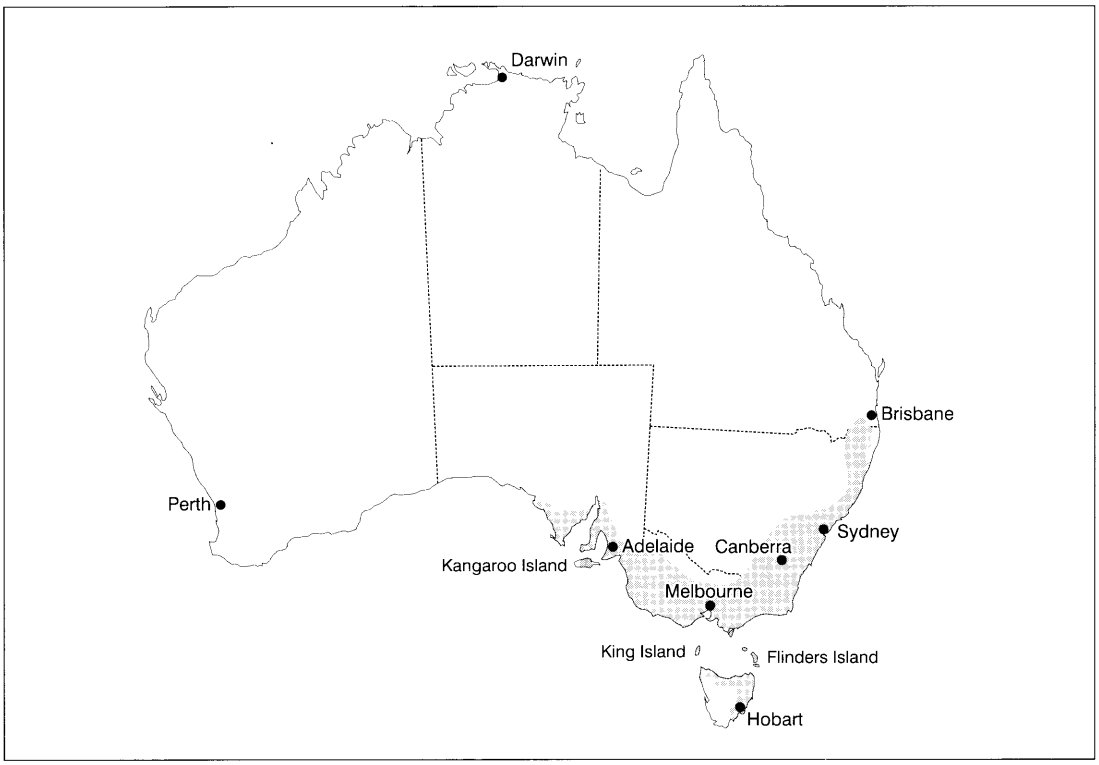
Basionym: *Pterostylis depauperata* F.M.Bailey, *Bot. Bull. Dept. Agric. Queensland* 4: 18 (1891).

Crangonorchis pedoglossa (Fitzg.) D.L.Jones et M.A.Clem., **comb. nov.**

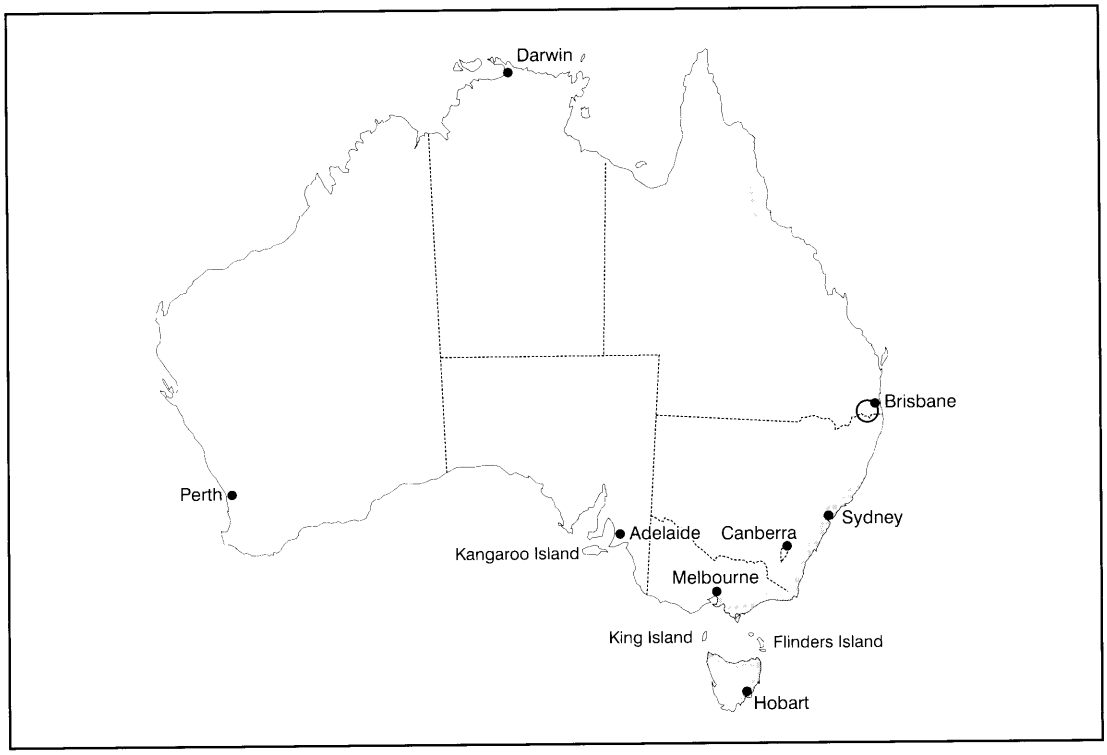
Basionym: *Pterostylis pedoglossa* Fitzg., *Austral. orch.* 1(3): [t. 5] (1877).



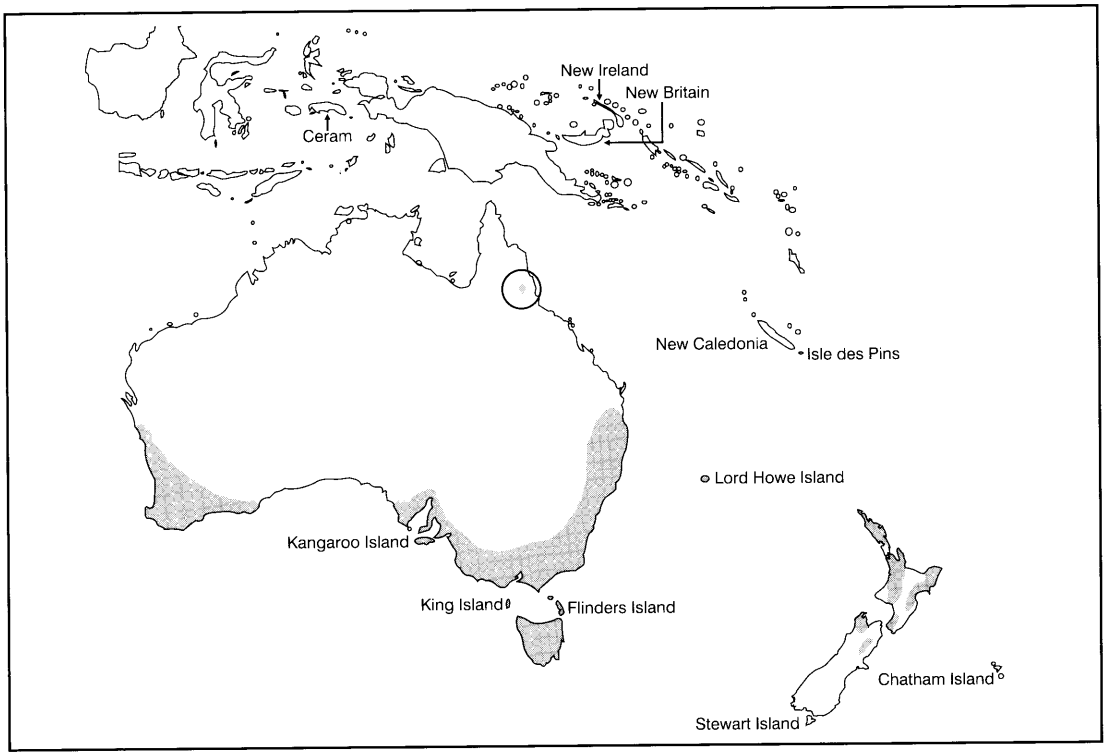
Map 2. Distribution of *Pterostylis sens. str.*



Map 3. Distribution of *Bunochilus*



Map 4. Distribution of *Crangonorchis*



Map 5. Distribution of *Diplodium*

4. *Diplodium*

Diplodium Sw., *Ges. Naturf. Freunde Berlin Mag. Neuesten Entdeck. Gesammten Naturk* 4: 84 (July 1810). Type species: *Diplodium australe* Sw. (*Disperis alata* Labill., = *Pterostylis alata* (Labill.) Rchb.f.). **Fig. 2.7; also Fig. 2.8,** *Diplodium aestivum.*

Pterostylis sect. *Foliosae* G.Don in Loudon's, *Hortus Brittanicus* 369 (1830). Lectotype species: *Pterostylis grandiflora* R.Br., here designated.

Pterostylis sect. *Alatae* Rchb.f., Beitr. Syst. Planz. 68-70 (1871). Lectotype species: *Pterostylis alata* (Labill.) Rchb.f., here designated.

Pterostylis sect. *Antennaea* Benth., *Flora Australiensis* 6: 353-354 (1873). Lectotype species: *Pterostylis grandiflora* R.Br., here designated.

Pterostylis sect. *Antennaea* Benth. Ser. *Grandiflorae* Benth., *Flora Australiensis* 6: 353-354 (1873). Lectotype species: *Pterostylis grandiflora* R.Br., here designated.

Etymology
The generic name *Diplodium* is derived from the Greek *diplous*, double, referring to the lateral sepals being united to about the middle to form a segment twice as wide as the other segments.

Recognition
Diplodium is recognised by the following combination of characters:- sterile and fertile plants dimorphic (sterile plants consisting solely of a rosette of petiolate leaves; fertile plants consisting of a flowering scape with either sessile, spreading cauline leaves or reduced, bract-like sheathing leaves); clonal colonies formed by the production of daughter tubers on the end of stolonoid roots; flower solitary (rarely two); synsepalum erect, embracing the galea; free points of lateral sepals long, filiform; dorsal sepal often with a filiform apical extension; labellum unlobed, partially exposed within the galea when in the set position, rarely enclosed within the flower; basal appendage extending porrectly from the labellum base, incurved, apex penicillate; and, barrier trichomes absent.

Distribution
A genus of c. 60 species distributed in Australia and New Zealand. Map 5.

Notes
Reproduction is from seed and by the production of daughter tubers on stolonoid roots to form local clonal colonies. Natural intergeneric hybrids are unknown.

Cytology
Pterostylis alobula, P. alveata, P. brumalis, P. obtusa, P. trullifolia, all 2n=50 (pers. comm. B. Molloy).

New Combinations:
Diplodium abruptum (D.L.Jones) D.L.Jones et M.A.Clem., **comb. nov.**
Basionym: *Pterostylis abrupta* D.L.Jones, *Orchadian* 8(6): 122-3, fig. (1985).

Diplodium aestivum (D.L.Jones) D.L.Jones et M.A.Clem., **comb. nov.**
Basionym: *Pterostylis aestiva* D.L.Jones, *Muelleria* 2(3): 151-4, fig.50 (1972).

Diplodium alatum (Labill.) D.L.Jones et M.A.Clem., **comb. nov.**
Basionym: *Disperis alata* Labill., Nov. Holl. pl. 2: 59-60, t. 210 (1806).

Diplodium alobulum (Hatch) D.L.Jones, Molloy et M.A.Clem., **comb. et stat. nov.**
Basionym: *Pterostylis trullifolia Hook.*f. var. *alobula* Hatch, *Trans & Proc. Roy. Soc. New Zealand* 77: 244, t.30, fig.3E-H (1949).

Diplodium alveatum (Garnet) D.L.Jones et M.A.Clem., **comb. nov.**
Basionym: *Pterostylis alveata* Garnet, *Victorian Naturalist* 59: 91-4, fig. (1939).

Diplodium angustum (A.S.George) D.L.Jones et M.A.Clem., **comb. nov.**
Basionym: *Pterostylis angusta* A.S.George, *Nuytsia* 1(2): 164 (1971).

Diplodium aquilonium (D.L.Jones et B.Gray) D.L.Jones et M.A. Clem., **comb. nov.**
Basionym: *Pterostylis aquilonia* D.L.Jones et B.Gray, *Orchadian* 12(6): 246-47, fig. (1997).

Diplodium asperum (D.L. Jones et M.A. Clem.) D.L.Jones et M.A.Clem., **comb. nov.**
Basionym: *Pterostylis aspera* D.L.Jones et M.A.Clem., *Austral. Orch. Res.* 1: 120 (1989).

Diplodium atrans (D.L.Jones) D.L.Jones et M.A.Clem., **comb. nov.**
Basionym: *Pterostylis atrans* D.L.Jones, *Muelleria* 8(2): 185-186, fig.3, a-d (1994).

Diplodium brumalis (L.B.Moore) D.L.Jones, Molloy et M.A.Clem., **comb. nov.**
Basionym: *Pterostylis brumalis* L.B.Moore, *New Zealand J. Bot.* 6: 485 (1969).

Diplodium bryophilum (D.L.Jones) D.L.Jones et M.A.Clem., **comb. nov.**
Basionym: *Pterostylis bryophila* D.L.Jones, *Orchadian* 12(4): 180-84, fig. (1997).

Diplodium coccinum (Fitzg.) D.L.Jones et M.A.Clem., **comb. nov.**

Basionym: *Pterostylis coccina* Fitzg., *Austral. orch.* 1(4): [t. 3] (1878).

Diplodium decurvum (R.S.Rogers) D.L.Jones et M.A.Clem., **comb. nov.**

Basionym: *Pterostylis decurva* R.S.Rogers, *Trans. & Proc. Roy. Soc. South Australia* 47: 339-40, t. 27 (1923).

Diplodium dolichochilum (D.L.Jones et M.A.Clem.) D.L.Jones et M.A.Clem., **comb. nov.**

Basionym: *Pterostylis dolichochila* D.L.Jones et M.A.Clem. in Jessop & Toelken, *Fl. S. Austral.* Part IV: 2117-2118, fig.982B (1986).

Diplodium elegans (D.L.Jones) D.L.Jones et M.A.Clem., **comb. nov.**

Basionym: *Pterostylis elegans* D.L.Jones, *Orchadian* 12(6): 247-48, fig. (1997).

Diplodium erythroconchum (M.A.Clem. et D.L.Jones) D.L.Jones et M.A.Clem., **comb. nov.**

Basionym: *Pterostylis erythroconcha* M.A.Clem. et D.L.Jones in Jessop & Toelken, *Fl. S. Austral.* Part IV: 2118, fig.983 (1986).

Diplodium fischii (Nicholls) D.L.Jones et M.A.Clem., **comb. nov.**

Basionym: *Pterostylis fischii* Nicholls, *Victorian Naturalist* 67: 45, fig.A-J (1950).

Diplodium grandiflorum (R.Br.) D.L.Jones et M.A.Clem., **comb. nov.**

Basionym: *Pterostylis grandiflora* R.Br., *Prod.* 327 (1810).

Diplodium hamiltonii (Nicholls) D.L.Jones et M.A.Clem., **comb. nov.**

Basionym: *Pterostylis hamiltonii* Nicholls, *Victorian Naturalist* 50: 89-91, fig.D-G (1933

Diplodium hians (D.L.Jones) D.L.Jones et M.A.Clem., **comb. nov.**

Basionym: *Pterostylis hians* D.L.Jones, *Orchadian* 12(4): 185-87, fig. (1997).

Diplodium laxum (Blackmore) D.L.Jones et M.A.Clem., **comb. nov.**

Basionym: *Pterostylis laxa* Blackmore, *Orchadian* 3: 2 (1968).

Diplodium longicurvum (Rupp) D.L.Jones et M.A.Clem., **comb. nov.**

Basionym: *Pterostylis longicurva* Rupp, *Contr. New South Wales Natl. Herb.* 1: 125 (1941).

Diplodium longipetalum (Rupp) D.L.Jones et M.A.Clem., **comb. nov**.

Basionym: *Pterostylis longipetala* Rupp, *Proc. Linn. Soc. New South Wales* 68: 9 (1943).

Diplodium metcalfei (D.L.Jones) D.L.Jones et M.A.Clem., **comb. nov.**

Basionym: *Pterostylis metcalfei* D.L.Jones, *Orchadian* 12(6): 248-50, fig. (1997).

Diplodium obtusum (R.Br.) D.L.Jones et M.A.Clem., **comb. nov.**

Basionym: *Pterostylis obtusa* R.Br., *Prod.* 327 (1810).

Diplodium pulchellum (Messmer) D.L.Jones et M.A.Clem., **comb. nov.**

Basionym: *Pterostylis pulchella* Messmer, *Proc. Linn. Soc. New South Wales* 58: 429 (1933).

Diplodium reflexum (R.Br.) D.L.Jones et M.A.Clem., **comb. nov.**

Basionym: *Pterostylis reflexa* R.Br., *Prod.* 327 (1810).

Diplodium revolutum (R.Br.) D.L.Jones et M.A.Clem., **comb. nov.**

Basionym: *Pterostylis revoluta* R.Br., *Prod.* 327 (1810).

Diplodium robustum (R.S.Rogers) D.L.Jones et M.A.Clem., **comb. nov.**

Basionym: *Pterostylis robusta* R.S.Rogers, *Trans. & Proc. Roy. Soc. South Australia* 51: 296 (1927).

Diplodium rogersii (E.Coleman) D.L.Jones et M.A.Clem., **comb. nov.**

Basionym: *Pterostylis rogersii* E.Coleman, *Victorian Naturalist* 46: 100 (1929).

Diplodium russellii (T.E.Hunt) D.L.Jones et M.A.Clem., **comb. nov.**

Basionym: *Pterostylis russellii* T.E.Hunt, *Orchid J.*, 1(1): 42, fig.1 (1952).

Diplodium scabrum (Lindl.) D.L.Jones et M.A.Clem., **comb. nov.**

Basionym: *Pterostylis scabra* Lindl. in Edwards's, Bot. Reg. 1-23: *Swan Riv. Append.* liii (1840).

Diplodium scoliosum (D.L.Jones) D.L.Jones et M.A.Clem., **comb. nov.**

Basionym: *Pterostylis scoliosa* D.L.Jones, *Orchadian* 12(6): 250-51, fig. (1997).

Diplodium striatum (Fitzg.) D.L.Jones et M.A.Clem., **comb. nov.**

Basionym: *Pterostylis striata* Fitzg., *Austral. orch.* 1(3): [t. 5] (1877).

Diplodium tenuissimum (Nicholls) D.L.Jones et M.A.Clem., **comb. nov.**

Basionym: *Pterostylis tenuissima* Nicholls, *Victorian Naturalist* 67: 46-8, fig. K-P (1950).

Diplodium torquatum (D.L.Jones) D.L.Jones et M.A.Clem., **comb. nov.**

Basionym: *Pterostylis torquata* D.L.Jones, *Orchadian* 12(6): 251-58, fig. (1997).

Diplodium trullifolium (Hook.f.) D.L.Jones, Molloy et M.A.Clem., **comb. nov.**

Basionym: *Pterostylis trullifolia* Hook.f., *Fl. nov.-zel.* 1: 249 (1953).

Diplodium truncatum (Fitzg.) D.L.Jones et M.A.Clem., **comb. nov.**

Basionym: *Pterostylis truncata* Fitzg., *Austral. orch.* 1(4): [t. 3] (1878).

5. *Eremorchis*

Eremorchis D.L.Jones et M.A.Clem., **gen. nov.**, affinis *Pterostylo* R.Br. sed margine distali synsepali duobus lobulis obsito; labello deltato, carni-tumido, cellula retrorsis siliceis ornatis; et polliniis curvatis, differt. Type species: *Pterostylis allantoidea* R.S.Rogers. **Fig. 2.9, 2.10.**

Etymology
The generic name *Eremorchis*, derived from the Greek *eremos*, solitary, lonely and *Orchis*, another genus of Orchidaceae (but which is often used generally when referring to an orchid), refers to its geographical and morphological isolation.

Recognition
Eremorchis is recognised by the floral scape elongating during anthesis; two internal lobules on the distal margin of the synsepalum; thickened, fleshy, deltate labellum adorned with retrorse siliceous cells; and, curved pollinia.

Distribution
A monotypic genus endemic in south-west Western Australia. Map 6.

Notes
Reproduction is from seed and local clonal colonies are formed by the production of tubers on the end of stolonoid roots. Natural intergeneric hybrids are unknown.

New Combination:
Eremorchis allantoidea (R.S.Rogers) D.L.Jones et M.A.Clem., **comb. nov**.

Basionym: *Pterostylis allantoidea* R.S. Rogers, *Trans. & Proc. Roy. Soc. South Australia* 64: 139 (1940).

6. *Hymenochilus*

Hymenochilus D.L.Jones et M.A.Clem., **gen. nov.**, *Pterostylidi* R.Br. affinis, sed foliis sessilibus ad subsessilibus; racemo multifloro; sepalibus lateralibus deflexis, membranaceis, sine acumenibus filiformibus liberis, ad basin saccum concavum labello subtendentum formantibus; labello membranaceo, in statu intento omnino exposito, appendice basali fusco, aucto, rostriformi; et columnae alis trichomatibus barrier ornatis, differt. Type species: *Pterostylis mutica* R.Br. **Figs. 2.11, 2.12.**

Oligochaetochilus D.L.Szlachetko, subgen. *Glabrichilos* D.L.Szlachetko, *Polish J. Bot.* 46(1): 23 (2001), (*pro parte*). Type species: *Pterostylis cycnocephala* Fitzg.

Etymology
The name *Hymenochilus*, which is derived from the Greek *hymen*, membrane and *cheilos*, lip, refers to the very thin-textured, membranous labellum of these orchids.

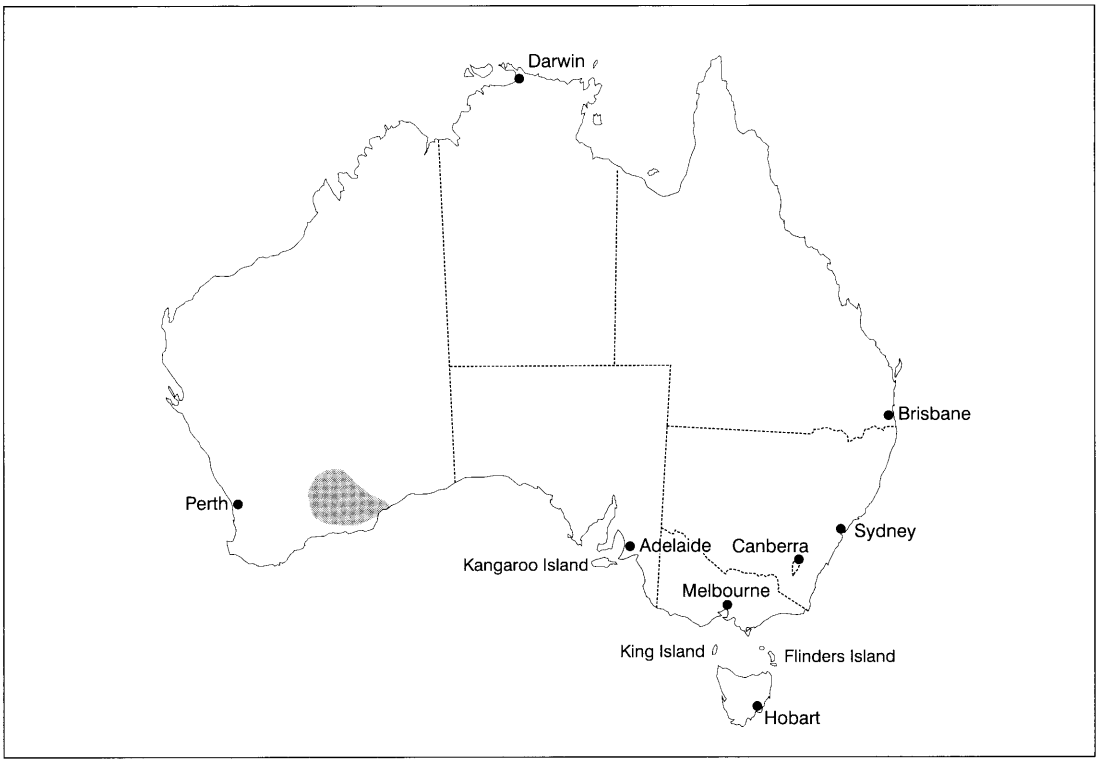
Recognition
Hymenochilus is recognised by the following combination of characters:- sterile and fertile plants monomorphic; clonal colonies absent; leaves sessile, in a scape-encircling basal rosette; raceme multiflowered; lateral sepals short, deflexed, forming a concave pouch subtending the labellum; labellum fully exposed in the set position; labellum lamina unlobed, membranous; basal appendage at right angles to the lamina, apex rostrate, enlarged; barrier trichomes unbranched, smooth, clavate.

Distribution
A genus of c. 12 species distributed in southern Australia and New Zealand. Map 7.

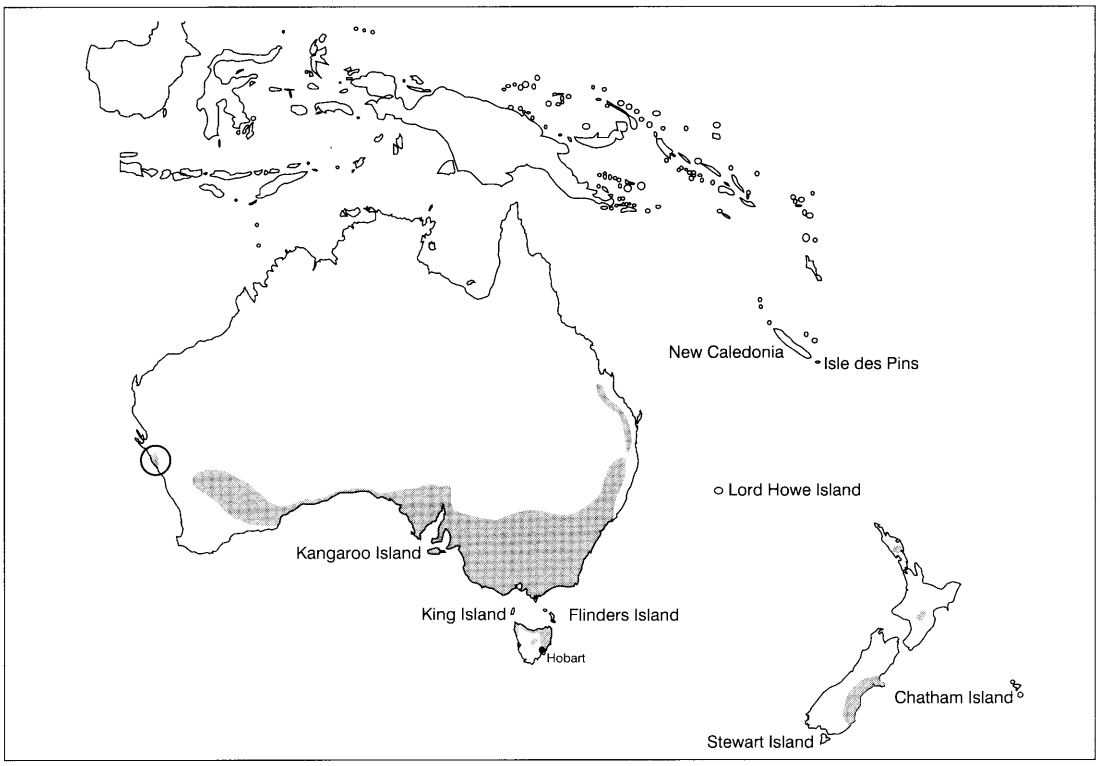
Notes
Reproduction is solely from seed. Natural intergeneric hybrids are unknown.

Cytology
Pterostylis tanypoda, *P. tristis*, 2n=52,54 (pers. comm. B. Molloy).

Infrageneric taxa
No infrageneric taxa are recognised.



Map 6. Distribution of *Eremorchis*



Map 7. Distribution of *Hymenochilus*

New Combinations:

Hymenochilus bicolor (M.A.Clem. et D.L.Jones) D.L.Jones et M.A.Clem., **comb. nov.**

Basionym: *Pterostylis bicolor* M.A.Clem. et D.L.Jones, *Proc. Roy. Soc. Queensland* 98: 126-8, fig.3 (1987).

Hymenochilus cycnocephalus (Fitzg.) D.L.Jones et M.A.Clem., **comb. nov.**

Basionym: *Pterostylis cycnocephala* Fitzg., *Austral. orch.* 1(2): [t.7] (1876).

Hymenochilus muticus (R.Br.) D.L.Jones et M.A.Clem., **comb. nov.**

Basionym: *Pterostylis mutica* R.Br., *Prod.* 328 (1810).

Hymenochilus pratensis (D.L.Jones) D.L.Jones et M.A.Clem., **comb. nov.**

Basionym: *Pterostylis pratensis* D.L.Jones, *Austral. Orch. Res.* 3: 149-150, fig.7.8 (1998).

Hymenochilus rubenachii (D.L.Jones) D.L.Jones et M.A.Clem., **comb. nov.**

Basionym: *Pterostylis rubenachii* D.L.Jones, *Austral. Orch. Res.* 3: 150-151, fig.7.9 (1998).

Hymenochilus tanypodus (D.L.Jones, Molloy et M.A.Clem.) D.L.Jones, M.A.Clem. et Molloy, **comb. nov.**

Basionym: *Pterostylis tanypoda* D.L.Jones, Molloy et M.A.Clem., *Orchadian* 12(6): 273-274, fig.6 (1997).

Hymenochilus tristis (Colenso) D.L.Jones, M.A.Clem. et Molloy, **comb. nov.**

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

Hymenochilus wapstrarum (D.L.Jones) D.L.Jones et M.A.Clem., **comb. nov.**

Basionym: *Pterostylis wapstrarum* [as *wapstreorum*] D.L.Jones, *Austral. Orch. Res.* 3: 156-157, fig.7.15 (1998).

Hymenochilus ziegeleri (D.L.Jones) D.L.Jones et M.A.Clem., **comb. nov.**

Basionym: *Pterostylis ziegeleri* D.L.Jones, *Austral. Orch. Res.* 3: 158-159, fig.7.17 (1998).

7. *Linguella*

Linguella D.L.Jones et M.A.Clem., **gen. nov.**, affinis ad *Pterostylem* R.Br. sed lobulo ligulato atrovirenti ad conjunctionem superam synsepali; labello brevi intra floram includenti admodum; et trichomibus acicularibus retrorsis in marginibus labelli, distinguenda. Type species: *Pterostylis nana* R.Br. **Figs. 2.13, 2.14.**

Etymology

The generic name *Linguella* is derived from the Latin *lingua*, tongue and the diminutive suffix -*ella*, in reference to the tiny, dark green, ligulate appendage found on the anterior side of the dorsal conjunction of the synsepalum of most species.

Recognition

Linguella is recognised by the following combination of characters:- sterile and fertile plants monomorphic, rarely dimorphic (*Pterostylis dilatata* A.S.George); clonal colonies formed by the production of daughter tubers on the end of stolonoid roots; leaves arranged in a basal or spiral, scape-encircling rosette, rarely on a separate rosette (*P. dilatata*); flower solitary (rarely two); synsepalum erect, embracing the galea; upper conjunction of synsepalum usually with a small, dark green, ligule-like lobe; free points of lateral sepals short to long, filiform; labellum lamina unlobed, fully enclosed within the flower; basal appendage extending porrectly from the labellum base, incurved, apex penicillate; and, barrier trichomes absent.

Distribution

A genus of c. 30 species distributed mainly in southern Australia with one species in New Zealand. Map 8.

Notes

Reproduction is from seed and by the production of daughter tubers to form local clonal colonies. Natural intergeneric hybrids are unknown.

Infrageneric taxa

A genus of two subgenera, one newly erected:-

7a. *Linguella* subg. *Linguella*. Characterised by monomorphic sterile and fertile plants. A subgenus of two sections, one new:-

Linguella* subg. *Linguella* section *Linguella. Characterised by the majority of leaves encircling the base of the scape in a rosette.

New Combinations:
Linguella clavigera (Fitzg.) D.L.Jones et M.A.Clem., **comb. nov.**

Basionym: *Pterostylis clavigera* Fitzg., *J. Bot.* 23: 138 (1885).

Linguella nana (R.Br.) D.L.Jones et M.A.Clem., **comb. nov.**

Basionym: *Pterostylis nana* R.Br., *Prod.* 327 (1810).

Linguella puberula (Hook.f.) D.L.Jones, M.A.Clem. et Molloy, ***comb. nov.***

Basionym: *Pterostylis puberula* Hook.f., *Fl. nov.-zel.* 1: 249 (1853).

7b. *Linguella* subg. *Linguella* section *Pyramidalis* D.L.Jones et M.A.Clem., **sect. nov**.; ceteris sectionibus subgeneris *Linguellae* D.L.Jones et M.A.Clem. sepalo dorsali extensione longa filiformi; et apice labelli integro, distinguenda.
Type species: *Pterostylis pyramidalis* Lindl. Characterised by the leaves arranged in a spiral up the scape.

New Combination:
Linguella pyramidalis (Lindl.) D.L.Jones et M.A.Clem., ***comb. nov.***

Basionym: *Pterostylis pyramidalis* Lindl. in Edwards's, Bot. Reg. 1-23: *Swan Riv. Append.* liii (1840).

7c. *Linguella* subg. *Dilatatae* D.L.Jones et M.A.Clem., **subgen. nov**.; ceteris subgeneribus generis *Linguellae* D.L.Jones et M.A.Clem. plantis dimorphis sterilibus fertilibusque, distinguenda. Type species: *Pterostylis dilatata* A.S.George. Characterised by dimorphic sterile and fertile plants (flowering plants lack a rosette; rosette occurs as a separate plant).

New Combination:
Linguella dilatata (A.S.George) D.L.Jones et M.A.Clem., **comb. nov.**

Basionym: *Pterostylis dilatata* A.S.George, *Nuytsia* 5(1): 61, fig. (1984).

8. *Oligochaetochilus*

Oligochaetochilus D.L.Szlachetko, *Polish Bot. J.* 46(1): 23 (2001). Type species: *Oligochaetochilus rufus* (R.Br.) D.L.Szlachetko. **Figs. 2.15, 2.16**.

Etymology
The name *Oligochaetochilus* is derived from the Greek words *oligos*, few, *chaetos*, bristle, -*cheilos*, lip.

Recognition
Recognised by the following combination of characters:- sterile and fertile plants monomorphic; clonal colonies absent; leaves sessile, in a scape-encircling basal rosette; raceme multiflowered; lateral sepals deflexed; synsepalum flat to concave, with siliceous trichomes on the dorsal surface; labellum fully exposed in the set position; labellum lamina unlobed, with an enlarged basal area; basal appendage absent; labellum margins with white moniliform setae; barrier trichomes unbranched, multiseriate, linear or clavate.

Distribution
A genus of c. 60 species distributed in subtropical and southern Australia. Map 9.

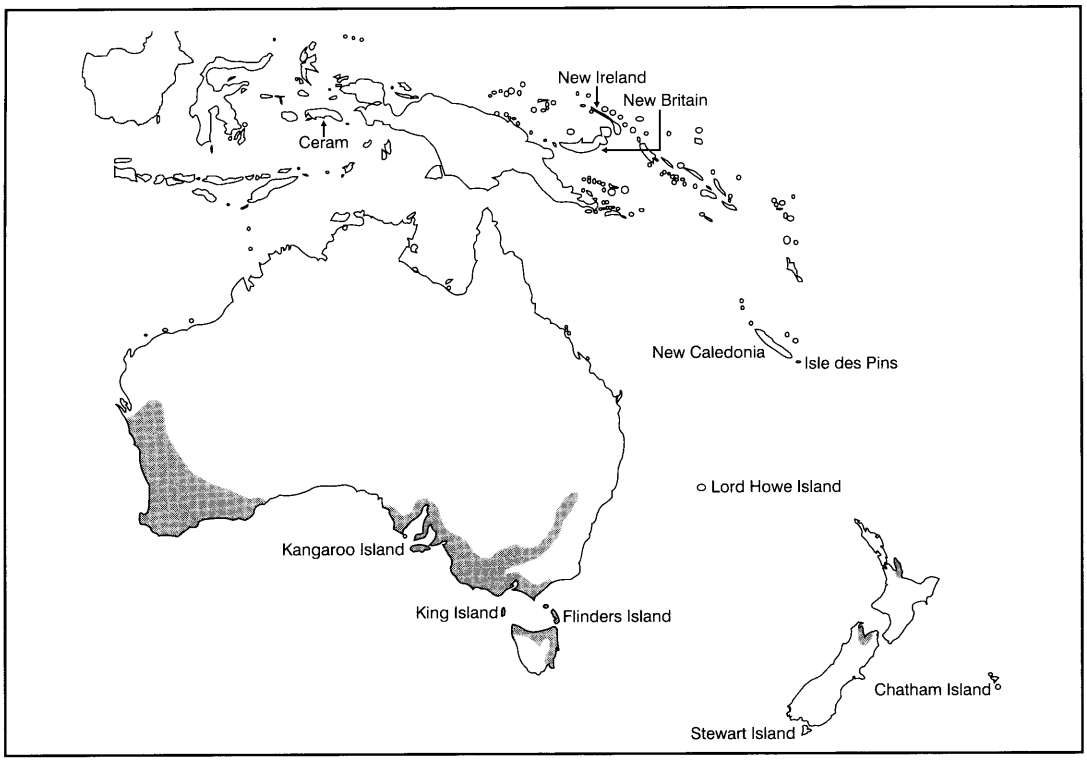
Notes
Reproduction is solely from seed. Natural intergeneric hybrids are unknown.

Infrageneric taxa
A very complex group which exhibits extensive radiation into specific ecological niches with remarkable morphological diversification. The genus is here divided into 12 sections, 11 newly erected, but further study is needed to solve some relationships:-

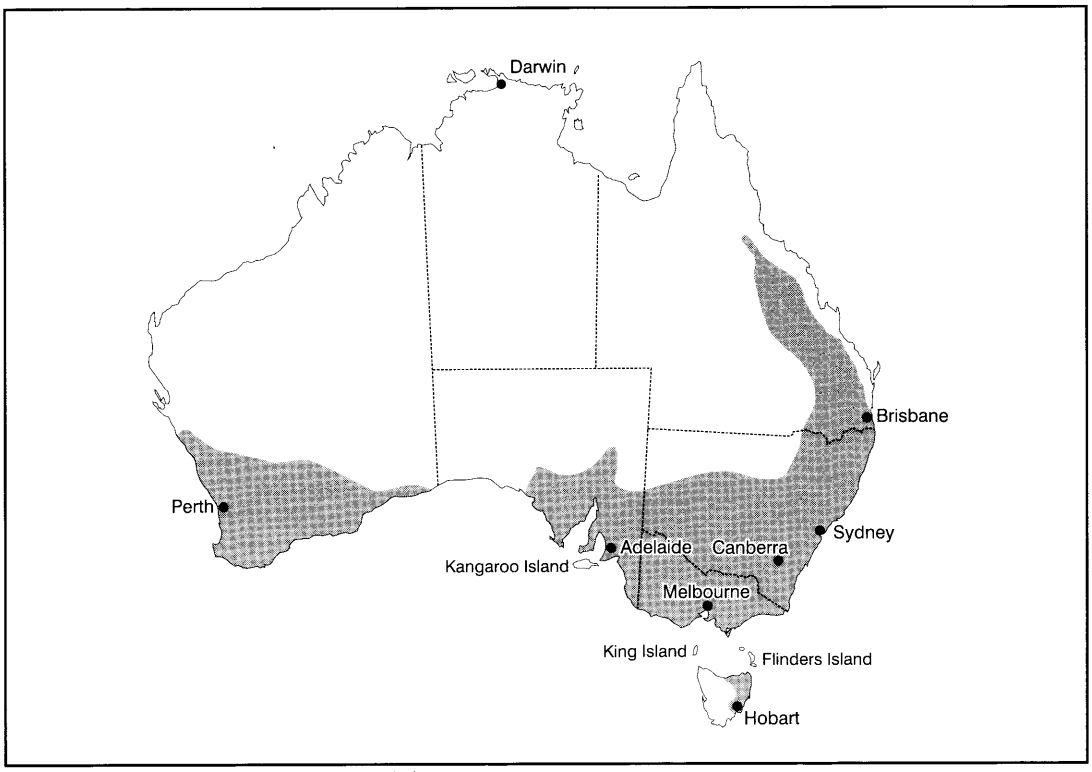
8a. *Oligochaetochilus* sect. *Oligochaetochilus*
Lateral sepals with short, involute free points; labellum more or less oblong with a basal lobe of similar width to the lamina.

8b. *Oligochaetochilus* sect. *Biseta* D.L.Jones et M.A.Clem., **sect. nov**.; ab sect. *Oligochaetochilus* sepalis lateralibus apicibus liberis filamentosis; lamina labellorum membranaceo, marginalibus setis brevis et superficiale sinuato-dentatis; basi laminae labelli paribus setarum longarum prominentium, differt. Type species: *Pterostylis biseta* Blackmore et Clemesha.

Characterised by lateral sepals with filamentous free points; labellum lamina thin-textured, with short marginal setae; labellum margins regularly indented or scalloped; base of labellum lamina with one pair of long, projecting setae; basal lobe of labellum short.



Map 8. Distribution of *Linguella*



Map 9. Distribution of *Oligochaetochilus*

New Combinations:

Oligochaetochilus cheraphilus (D.L.Jones et M.A.Clem.) D.L.Jones et M.A. Clem., **comb. nov.**

Basionym: *Pterostylis cheraphila* D.L.Jones et M.A.Clem., *Muelleria* 8(1): 76-78, fig.2e-h (1993).

Oligochaetochilus petrosus (D.L.Jones et M.A.Clem.) D.L.Jones et M.A.Clem., **comb. nov.**

Basionym: *Pterostylis petrosa* D.L.Jones et M.A.Clem., *Muelleria* 8(1): 79-81, fig.3 (1993).

Oligochaetochilus planulatus (D.L.Jones et M.A.Clem.) D.L.Jones et M.A.Clem., **comb. nov.**

Basionym: *Pterostylis planulata* D.L.Jones et M.A.Clem., *Muelleria* 8(1): 81-82, fig.2i-l (1993).

8c. *Oligochaetochilus* sect. *Boormania* D.L.Jones et M.A.Clem., **sect. nov.**; ab sect. *Oligochaetochilus* synsepalo latiore quam longiore; labello parvo; lobo basali quam lamina minorissime; et labello setis numerosis longis patentibus, differt. Type species: *Pterostylis boormanii* Rupp.

Characterised by synsepalum broader than long; labellum small with the basal lobe much smaller than the lamina; labellum with numerous long spreading setae.

8d. *Oligochaetochilus* sect. *Chaetophora* D.L.Jones et M.A.Clem., **sect. nov.**; ab sect. *Oligochaetochilus* synsepalo glabro; lamina labelli ovata, setis numerosis longis; et lobo basali dilatato, setis numerosis, differt. Type species: *Pterostylis chaetophora* M.A.Clem. et D.L.Jones.

Characterised by synsepalum glabrous; labellum lamina ovate with numerous long setae; basal lobe enlarged, with numerous setae.

8e. *Oligochaetochilus* sect. *Gibbosa* D.L.Jones et M.A.Clem., **sect. nov.**; ab sect. *Oligochaetochilus* sepalis lateralibus glabris apicibus liberis divergentibus brevis; sepalo dorsalo subulato; lamina labelli obovata setis marginalibus paucis, differt. Type species: *Pterostylis gibbosa* R.Br.

Characterised by lateral sepals glabrous; free points of lateral sepals short, divergent; dorsal sepal shortly pointed; labellum lamina obovate, with few marginal setae.

8f. *Oligochaetochilus* sect. *Hamata* D.L.Jones et M.A.Clem., **sect. nov.**; ab sect. *Oligochaetochilus* sepalis lateralibus apicibus liberis hamatis cernuis; marginibus petalorum basalibus ampliatis; et labello crasso plus minusve ovato prope basin constricto, differt. Type species: *Pterostylis hamata* Blackmore et Clemesha.

Characterised by free points of lateral sepals hooked forward; petals with enlarged basal flange; labellum thick, more or less ovate, constricted near base.

8g. *Oligochaetochilus* sect. *Insectifera* D.L.Jones et M.A.Clem., **sect. nov.**; ab sect. *Oligochaetochilus* floribus arrectis versum; marginibus synsepali postice labello incurvatis; sepalis lateralibus apicibus liberis hamatis cernuis; et labello setis numerosis patentibus, differt. Type species: *Pterostylis insectifera* M.A.Clem.

Characterised by flowers facing upwards; synsepalum margins incurved behind labellum; free points of lateral sepals hooked forward; labellum thick, the margins with numerous spreading setae.

8h. *Oligochaetochilus* sect. *Lingua* D.L.Jones et M.A.Clem., **sect. nov.**; ab sect. *Oligochaetochilus* sepalis lateralibus apicibus liberis longiusculis; labello exili marginibus superficiale sinuato-dentatis; setis marginibus brevis; et lobo basali quam lamina angustiore, differt. Type species: *Pterostylis lingua* M.A.Clem.

Characterised by free points of lateral sepals moderately long; labellum thin, the margins scalloped or regularly indented; marginal setae short; basal lobe narrower than lamina.

8i. *Oligochaetochilus* sect. *Setifera* D.L.Jones et M.A.Clem., **sect. nov.**; ab sect. *Oligochaetochilus* floribus arrectis versum; sepalis lateralibus apicibus liberis hamatis cernuis; labello exposito marginibus setis numerosis diffusis, differt. Type species: *Pterostylis setifera* M.A.Clem., Matthias et D.L.Jones.

Characterised by flowers facing upwards; free points of lateral sepals hooked forwards; labellum exposed as a target, thick, the margins with numerous spreading setae.

8j. *Oligochaetochilus* sect. *Spathulata* D.L.Jones et M.A.Clem., **sect. nov.**; ab sect. *Oligochaetochilus* sepalis lateralibus apicibus liberis hamatis cernuis; marginibus petalorum sine basalibus ampliatis; lamina labellorum spathulata; lobo basali labellorum diminuto multo, differt. Type species: *Pterostylis spathulata* M.A.Clem.

Characterised by free points of lateral sepals hooked forwards; petals without enlarged basal flange; labellum lamina spathulate, the basal lobe greatly reduced.

8k. *Oligochaetochilus* sect. *Excelsa* D.L.Jones et M.A.Clem., **sect. nov.**; ab sect. *Oligochaetochilus* labello crasso anguste ovato-lanceolato; lobo basali atque lato aut latiore quam lamina; et marginibus labellorum setis numerosis longis diffusis, differt. Type species: *Pterostylis excelsa* M.A.Clem.

Characterised by thick, narrowly ovate-lanceolate labellum, the basal lobe as wide or wider than lamina, and the margins with numerous long spreading setae.

New Combinations:

Oligochaetochilus basalticus (D.L.Jones et M.A.Clem.) D.L.Jones et M.A.Clem., **comb. nov.**

Basionym: *Pterostylis basaltica* D.L.Jones et M.A.Clem., *Muelleria* 8(1): 75-76, fig.2a-d (1993).

Oligochaetochilus validus (Nicholls) D.L.Jones et M.A.Clem., **comb. et stat. nov.**

Basionym: *Pterostylis squamata* R.Br. var. *valida* Nicholls, *Victorian Naturalist* 58: 115, fig.A-E (1941).

Oligochaetochilus saxicola (D.L.Jones et M.A.Clem.) D.L.Jones et M.A.Clem., **comb. nov.**

Basionym: *Pterostylis saxicola* D.L.Jones et M.A.Clem., Orchadian 12(3): 132-134 (1997).

8l. *Oligochaetochilus* sect. *Longicaudis* D.L.Jones et M.A.Clem., **sect. nov.**; ab sect. *Oligochaetochilus* sepalis lateralibus apicibus liberis longis filamentosis; lamina labellorum membranaceo, setis marginalibus brevis, marginibus integris et setis paribus longis exstantibus; et lobo basali elongato, differt. Type species: *Pterostylis woollsii* Fitzg.

Characterised by lateral sepals with long filamentous free points; labellum lamina thin-textured, with short marginal setae, entire margins; base of labellum lamina with one pair of long, projecting setae; basal lobe of labellum elongated.

9. *Petrorchis*

Petrorchis D.L.Jones et M.A.Clem., **gen. nov.**; affinis ad Pterostylem R.Br., sed plantis dimorphis sterilibus et fertilibus; rosulis in auctibus lateralibus basis scapis florentibus generatis; petalis apicibus teretibus extensis; et labello nodo apici turgido, distinguenda. Type species: *Pterostylis bicornis* D.L.Jones et M.A.Clem. **Figs. 2.17, 2.18.**

Etymology

The generic name *Petrorchis*, which is derived from the Greek *petros*, rock and *Orchis*, another genus of Orchidaceae (but which is often used generally when referring to an orchid), refers to the prediliction of this species for growing on rock ledges.

Recognition

Petrorchis is recognised by the following combination of characters:- sterile and fertile plants dimorphic (sterile plants consisting solely of a rosette of spreading petiolate leaves; fertile plants a flowering scape with sessile, bract-like cauline leaves and leafy rosettes on lateral growths from the base of the scape); flowers facing inwards towards the scape; petals with extended terete, horn-like tips; labellum lamina unlobed but with a swollen apical knob; trilobed basal appendage present; and, barrier trichomes absent.

Distribution

A monotypic genus endemic in eastern Australia. Map 10.

Notes

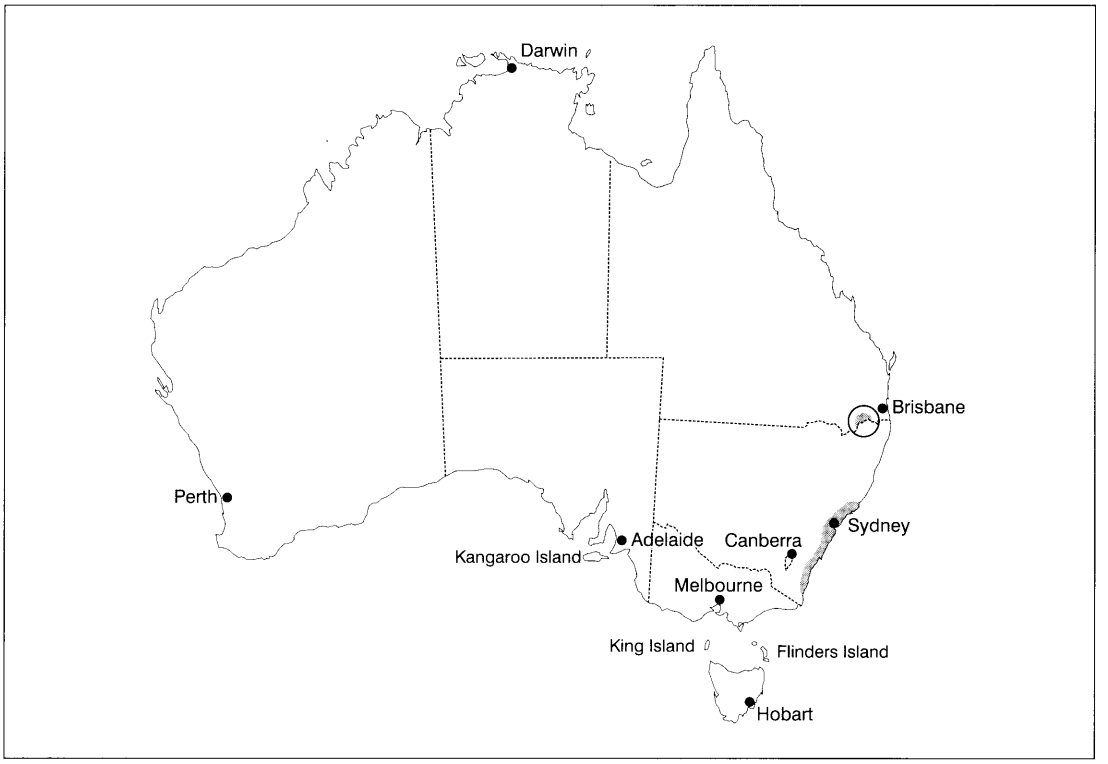
Reproduction is from seed and there are indications that clonal colonies may be formed. Natural intergeneric hybrids are known.

New Combination:

Petrorchis bicornis (D.L.Jones et M.A.Clem.) D.L.Jones et M.A.Clem., **comb. nov.**

Basionym: *Pterostylis bicornis* D.L.Jones et M.A.Clem., *Proc. Roy. Soc. Queensland* 98: 124-6, fig.4 (1987).

Map 10. Distribution of *Petrorchis*



Map 11. Distribution of *Pharochilum*

10. *Pharochilum*

Pharochilum D.L.Jones et M.A.Clem., **gen. nov.**, *Pterostylidi* R.Br. affinis, sed plantis sterilibus et fertilibus dimorphis; rosula a baso scapi florentis lateraliter orienti; racemo multifloro; sepalibus lateralibus decurvis, marginibus incurvis; labello 3-lobato, lobis lateralibus ad basin productis et liberis; et columnae alis trichomatibus barrier ornatis, differt. Type species: *Pterostylis daintreana* Benth. **Figs. 2.19, 2.20.**

Oligochaetochilus D.L.Szlachetko, subgen. *Glabrichilos* D.L.Szlachetko, *Polish Bot. J.* 46(1): 23 (2001), (*pro parte*). Type species: *Pterostylis cycnocephala* Fitzg.

Etymology
The generic name *Pharochilum*, which is derived from the Greek *pharos*, cloak or mantle and *cheilos*, lip, refers to the large labellum lateral lobes which appear to cloak the mid-lobe.

Recognition
Pharochilum is recognised by the following combination of characters:- sterile and fertile plants dimorphic (sterile plants consisting solely of a rosette of spreading petiolate leaves; fertile plants consisting of a flowering scape with sessile, bract-like cauline leaves and leafy rosettes on lateral growths from the base of the scape); clonal colonies absent; raceme multiflowered; lateral sepals obliquely deflexed; labellum nearly fully exposed in the set position; labellum lamina three-lobed; basal appendage absent; basal parts of labellum lateral lobes extending as swollen free lobes; column foot absent; and, barrier trichomes unbranched or bifurcate.

Distribution
A monotypic genus endemic in eastern Australia. Map 11.

Notes
Reproduction is solely from seed. Natural intergeneric hybrids are unknown.

New Combination:
Pharochilum daintreanum (Benth.) D.L.Jones et M.A.Clem, ***comb. nov.***

Basionym: *Pterostylis daintreana* Benth., *Fl. Austral.* 6: 360 (1873).

11. *Plumatichilos*

Plumatichilos D.L.Szlachetko, *Polish Bot. J.* 46(1): 22 (2001). Type species: *Plumatichilos barbatum* (Lindl.) D.L.Szlachetko. **Figs. 2.21, 2.22.**

Distribution
A genus of c. 15 species distributed in temperate Australia and New Zealand. Map 12.

Etymology
The name *Plumatichilos* is derived from the Latin *plumati*, feathered and *cheilos*, lip.

Recognition
Plumatichilos is recognised by the following combination of characters:- sterile and fertile plants monomorphic; clonal colonies absent; leaves sessile, ascending to erect, often with whitish or yellowish interveinal areas; flower with two galea openings; lateral sepals deflexed; synsepalum with a thickened basal pad; petals filiform; labellum fully exposed in both the set and triggered position; labellum lamina filiform, bearing long moniliform yellow hairs; labellum lamina with an apical counterweight and basal beak-like structure; column foot absent; and, barrier trichomes unbranched, filiform.

Cytology
Plumatichilos tasmanica, 2n=52 (pers. comm. B.Molloy).

Notes
Reproduction is solely from seed. Natural intergeneric hybrids are unknown.

Infrageneric taxa
A genus of two sections, one new:-

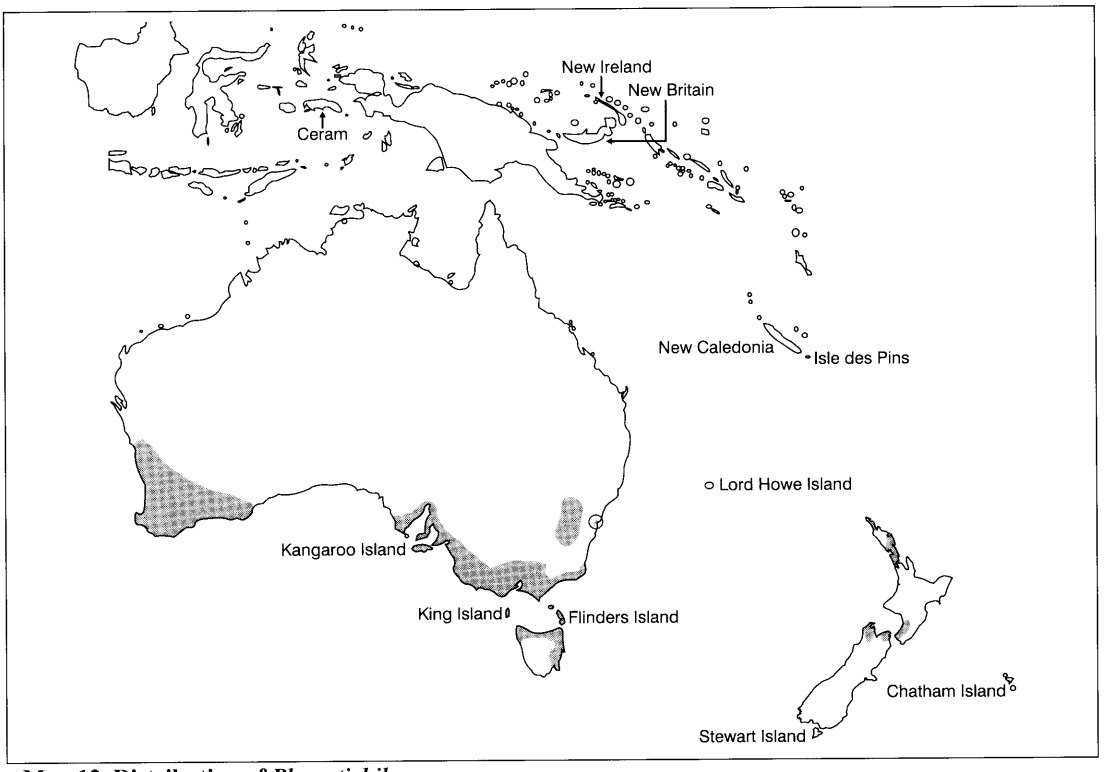
11a. *Plumatichilos* sect. *Plumatichilos*.
Characterised by blackish petals; labellum hairs sparse, pale yellow.

Pterostylis sect. *Catochilus* Benth., *Flora Australiensis* 6: 354, 361 (1873). Lectotype species: *Pterostylis barbata* Lindl., here designated.

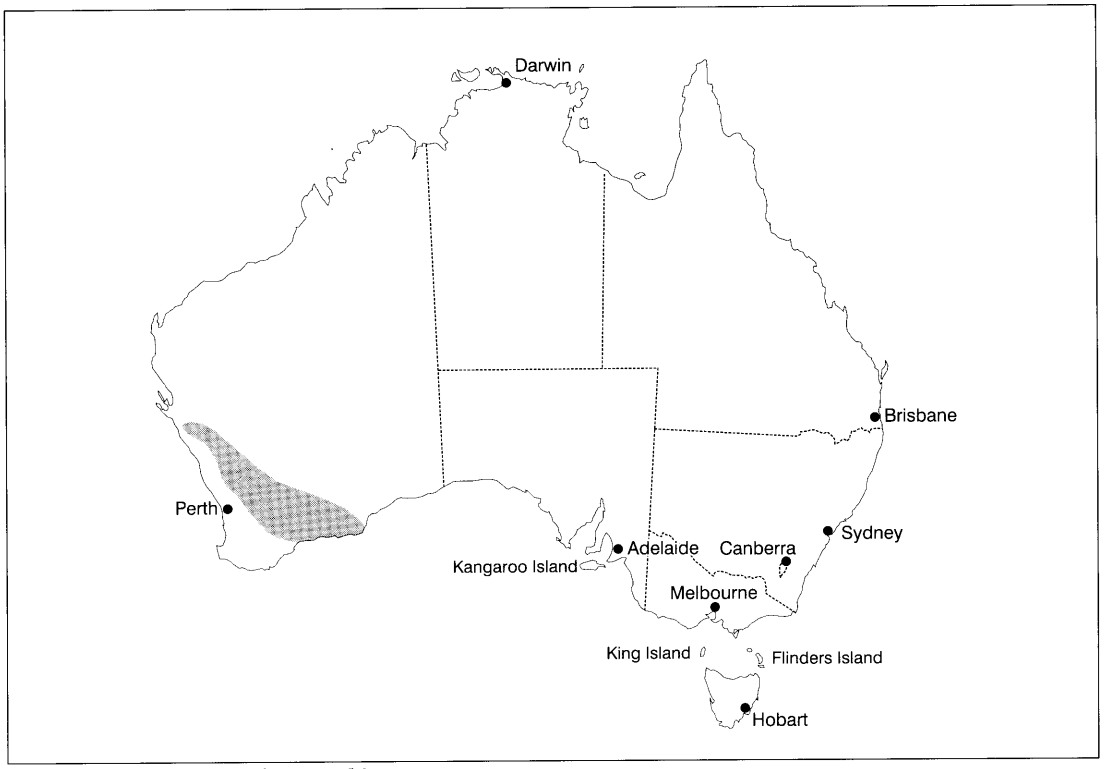
Pterostylis sect. *Filiformae* Rupp, Proc. Linn. Soc. New South Wales 58: 423 (1933). Lectotype species: *Pterostylis barbata* Lindl., here designated.

11b. *Plumatichilos* sect. *Plumosa* D.L.Jones et M.A.Clem., **sect. nov.**; ceteris sectionibus generis *Plumatichilos*. petalis virentibus; et pilis labelli densis, aureis, distinguenda. Type species: *Plumatichilos plumosum* (Cady) D.L.Szlachetko.

Characterised by green petals; labellum hairs dense, golden yellow.



Map 12. Distribution of *Plumatichilos*



Map 13. Distribution of *Ranorchis*

12. *Ranorchis*

Ranorchis D.L.Jones et M.A. Clem., **gen. nov.**: affinis ad *Pterostylem* R.Br., sed plantis dimorphis sterilibus et fertilibus; racemo multifloro; sepalis lateralibus deflexis; petalis trichomibus rigentibus marginibus internalis galeae claudens, margine antico lacerato et lobo dentato extenso; labello trilobo, in suus loco positus plene exposito; lobis lateralibus distale liberis, quaque appendice basali magna, erecta, concava; et alis columna trichomibus anticis impedientibus, distinguenda. Type species: *Pterostylis sargentii* C.R.P.Andrews. **Figs. 2.23, 2.24.**

Oligochaetochilus D.L.Szlachetko, subgen. *Apicuchilos* D.L.Szlachetko, *Polish Bot. J.* 46(1): 23 (2001), (*pro parte*). Type species: *Pterostylis vittata* Lindl.

Etymology
The generic name *Ranorchis,* which is adapted from this orchid's common name of "Frog Greenhood", is derived from a combination of the Latin *rana*, frog and *Orchis*, another genus of Orchidaceae (but which is often generally used when referring to an orchid).

Recognition
Ranorchis is recognised by the following combination of characters:- sterile and fertile plants dimorphic (sterile plants consisting solely of a rosette of spreading petiolate leaves; fertile plants consisting of a flowering scape with sessile, spreading cauline leaves); clonal colonies absent; raceme multiflowered; lateral sepals deflexed; petals specialised (anterior margin lacerate, a mass of stiff barrier trichomes blocking off the internal margins of the galea, and an extended toothed lobe on the proximal anterior margin); labellum fully exposed in the set position; labellum lamina three-lobed; basal appendage absent; lateral lobes free distally, each with a large, erect, hollow basal appendage; and, barrier trichomes unbranched, thickened, moniliform.

Distribution
A monotypic genus endemic in south-west Western Australia. Map 13.

Notes
Reproduction is solely from seed. Natural intergeneric hybrids are unknown.

New Combination:
Ranorchis sargentii (C.R.P.Andrews) D.L.Jones et M.A.Clem., **comb. nov.**

Basionym: *Pterostylis sargentii* C.R.P. Andrews, *J. Western Australia Nat. Hist.* Soc. 2(2): 57 (1905).

13. *Speculantha*

Speculantha D.L.Jones et M.A.Clem., **gen. nov.**: affinis ad *Pterostylem* R.Br., sed plantis dimorphis sterilibus et fertilibus; rosulis in auctibus lateralibus basis scapis florentibus generatis; racemo multifloro; floribus introrsis scapo spectantibus; florentibus chloridolentibus; labello intus flore amplexa aut apice exsertulissimo; pedicelis fructificantibus distincte elongatis, distinguenda. Type species: *Pterostylis parviflora* R.Br. **Figs. 2.25, 2.26.**

Etymology
The name *Speculantha* is derived from a combination of the Latin *speculum*, mirror, and the Greek *anthos*, flower, and refers to the flowers facing inwards towards the scape.

Recognition
Speculantha is recognised by the following combination of characters:- sterile and fertile plants dimorphic (sterile plants consisting solely of a rosette of spreading petiolate leaves; fertile plants a flowering scape with sessile, bract-like cauline leaves and leafy rosettes on lateral growths from the base of the scape); clonal colonies absent; scape multiflowered; flowers facing inwards towards the scape; flowers semen-scented; labellum fully enclosed in the flower or the tip just visible; labellum lamina unlobed; basal appendage present, apex trilobed or penicillate; pedicels elongating noticeably in fruit; and, barrier trichomes absent.

Distribution
A genus of c. 15 species distributed in eastern Australia. Map 14.

Notes
Reproduction is solely from seed. Natural intergeneric hybrids are unknown.

Infrageneric taxa
A genus of two sections, one new:-

13a. *Speculantha* sect. *Speculantha*.
Characterised by scape not elongating in fruit.

New Combinations:
Speculantha aphylla (Lindl.) D.L.Jones et M.A.Clem., **comb. nov.**

Basionym: *Pterostylis aphylla* Lindl., *Gen. sp. orchid. pl.* 392 (1840).

Speculantha atriola (D.L.Jones) D.L.Jones et M.A.Clem., **comb. nov.**

Basionym: *Pterostylis atriola* D.L.Jones, *Austral. Orch. Res.* 3: 140-141, fig.7.3 (1998).

Speculantha nigricans (D.L.Jones et M.A.Clem.) D.L. Jones et M.A.Clem., **comb. nov.**

Basionym: *Pterostylis nigricans* D.L.Jones et M.A.Clem., *Austrobaileya* 2(5): 550-1, fig.2E,F&G (1988).

Speculantha parviflora (R.Br.) D.L.Jones et M.A.Clem., **comb. nov.**

Basionym: *Pterostylis parviflora* R.Br., *Prod.* 327 (1810).

13b. *Speculantha* sect. *Elongatae* D.L.Jones et M.A.Clem., **sect. nov.**; sectione *Speculantha* scapo fructifero producto, differt. Type species: *Pterostylis uliginosa* D.L.Jones.

Characterised by scape elongating greatly in fruit.

New Combination:

Speculantha uliginosa (D.L.Jones) D.L.Jones et M.A.Clem., **comb. nov.**

Basionym: *Pterostylis uliginosa* D.L.Jones, *Austral. Orch. Res.* 3: 155-156, fig.7.14 (1998).

14. *Stamnorchis*

Stamnorchis D.L.Jones et M.A.Clem., **gen. nov.**: affinis ad *Pterostylem* R.Br., sed plantis dimorphis sterilibus et fertilibus; racemo multifloro; sepalo dorsali quam sepalis et petalis lateralibus multo breviore; venis principalibus floralibus porcatis manifeste formantibus; synsepalo oblique erecto apicibus liberis recurvissimis; petalis cauliculatis marginibus anticis expansissimis et apicibus uncinatis; et alis columna trichomibus anticis impedientibus, distinguenda. Type species: *Pterostylis recurva* Benth. **Figs. 2.27, 2.28.**

Etymology

Arising from of its common name of Jug Orchid, the generic name *Stamnorchis* is derived from a combination of the Greek *stamnos*, earthen jar or bottle and *Orchis*, another genus of Orchidaceae (but which is often generally used when referring to an orchid).

Recognition

Stamnorchis is recognised by the following combination of characters:- sterile and fertile plants dimorphic (sterile plants consisting solely of a rosette of spreading petiolate leaves; fertile plants a flowering scape with sessile, spreading cauline leaves); clonal colonies absent; raceme multiflowered; dorsal sepal much shorter than the lateral sepals and petals; main floral veins forming strongly raised ridges; synsepalum obliquely erect, not embracing the galea; free points strongly recurved, terete; petals stalked, with a greatly expanded anterior margin and an uncinate apex; labellum lamina three-lobed, the lateral lobes mostly fused; basal appendage present, apex trilobate; and, barrier trichomes thickened, entire or lobed.

Distribution

A monotypic genus distributed in south-west Western Australia. Map 15.

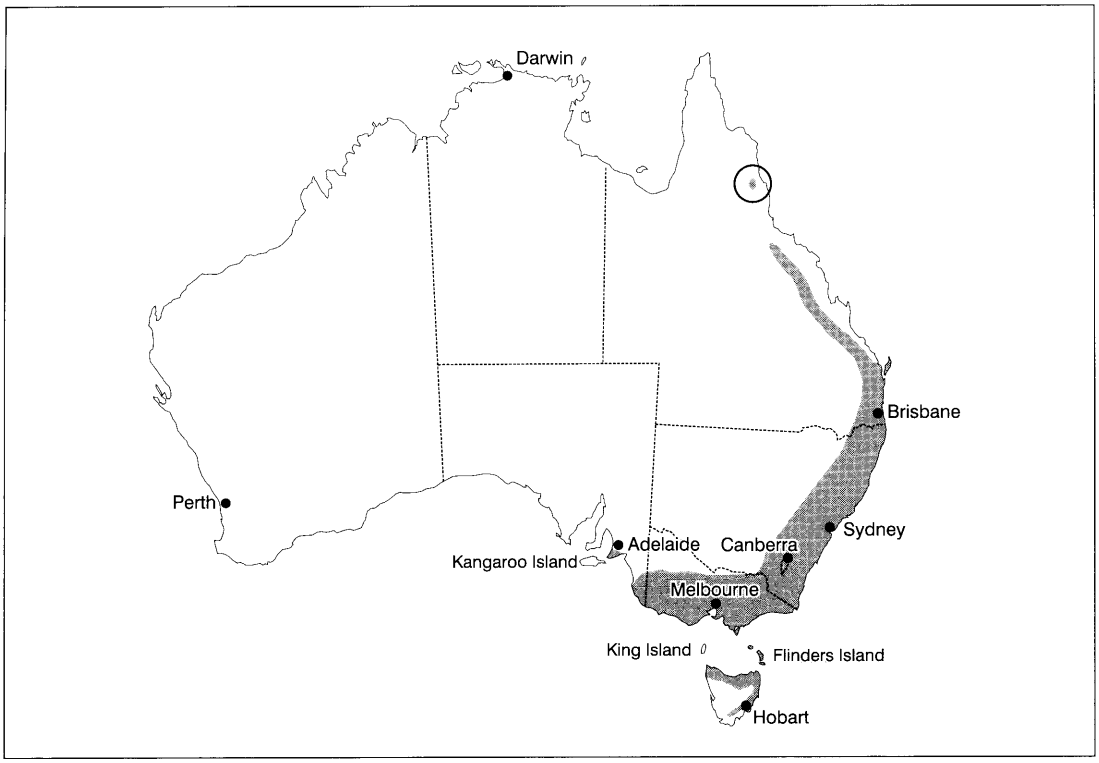
Notes

Reproduction is solely from seed. Natural intergeneric hybrids are unknown.

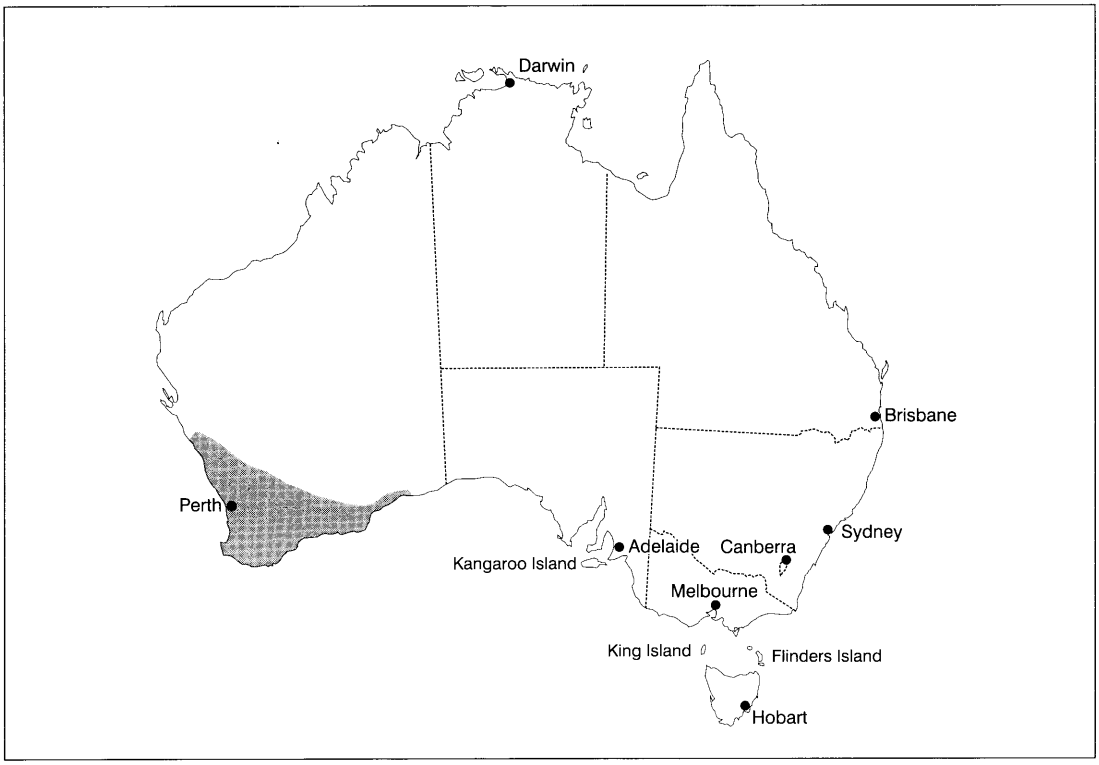
New Combination:

Stamnorchis recurva (Benth.) D.L.Jones et M.A.Clem., **comb. nov.**

Basionym: *Pterostylis recurva* Benth., *Fl. Austral.* 6: 360 (1873).



Map 14. Distribution of *Speculantha*



Map 15. Distribution of *Stamnorchis*

15. *Taurantha*

Taurantha D.L.Jones et M.A. Clem., **gen. nov.**: affinis ad *Diplodio* Sw. et *Pterostylo* R.Br., sed sinu synsepali et apici labelli duo incisuro profunde, differt; et idem, *Diplodio* Sw., rosula basali scapo circumdante, et sepalo dorsali acuto, differt. Type species: *Pterostylis ophioglossa* R.Br. **Figs. 2.29, 2.30.**

Etymology
The generic name *Taurantha,* is derived from a combination of the Latin *taurus*, bull and *Orchis*, another genus of Orchidaceae (but which is often generally used when referring to an orchid); the floral shape is reminiscent of a bulls head.

Recognition
Taurantha is recognised by the following combination of characters:- sterile and fertile plants monomorphic; clonal colonies formed by the production of daughter tubers on the end of stolonoid roots; leaves arranged in a basal, scape-encircling rosette; flower solitary (rarely two); synsepalum erect, embracing the galea; free points of lateral sepals long, filiform; labellum apex exserted from the sinus or extending above the sinus, the apex broadly or deeply notched; basal appendage extending porrectly from the labellum base, incurved, apex penicillate; and, barrier trichomes absent.

Distribution
A genus of c. 7 species distributed in eastern Australia and New Caledonia. Map 16.

Notes
Reproduction is from seed and by the production of daughter tubers to form local clonal colonies. Occasional natural intergeneric hybrids occur with some *Diplodium* species, these hybrids persisting as local clonal colonies via vegetative reproduction. Although morphologically distinct, *Taurantha* aligns itself with *Diplodium* (for further discussion see notes under that genus).

New Combinations:
Taurantha collina (Rupp) D.L.Jones et M.A.Clem., **comb. et stat. nov.**

Basionym: *Pterostylis ophioglossa* R.Br. var. *collina* Rupp, *Proc. Linn. Soc. New South Wales* 54: 552 (1929).

Taurantha concinna (R.Br.) D.L.Jones et M.A. Clem., **comb. nov.**

Basionym: *Pterostylis concinna* R.Br., *Prod.* 326 (1810).

Taurantha ophioglossa (R.Br.) D.L.Jones et M.A.Clem., **comb. nov.**

Basionym: *Pterostylis ophioglossa* R.Br., *Prod.* 326 (1810).

Taurantha splendens (D.L.Jones et M.A.Clem.) D.L.Jones et M.A.Clem., **comb. nov**.

Basionym: *Pterostylis splendens* D.L.Jones et M.A.Clem., *Orchadian* 12(7): 322-325, fig. (1998).

Taurantha taurus (M.A.Clem. et D.L. Jones) D.L.Jones et M.A.Clem., **comb. nov.**

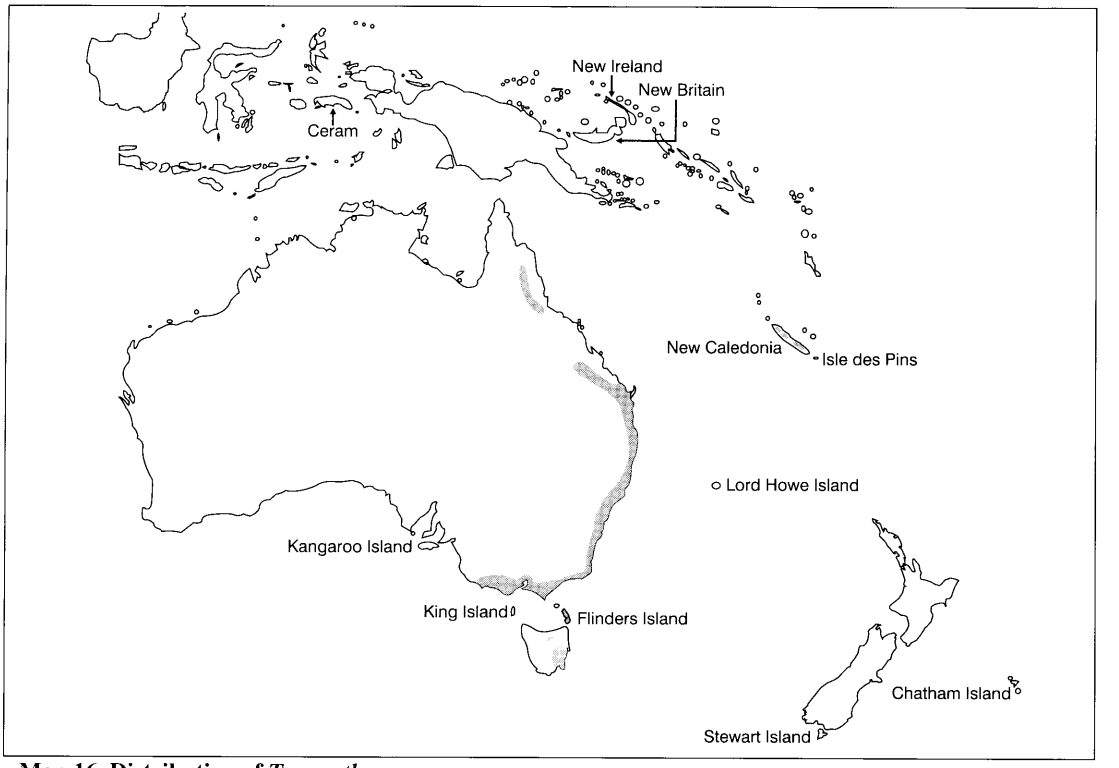
Basionym: *Pterostylis taurus* M.A.Clem. et D.L.Jones, *Austral. Orch. Res.* 1: 127 (1998).

Taurantha tenuicauda (Kraenzl.) D.L. Jones et M.A. Clem., **comb. nov.**

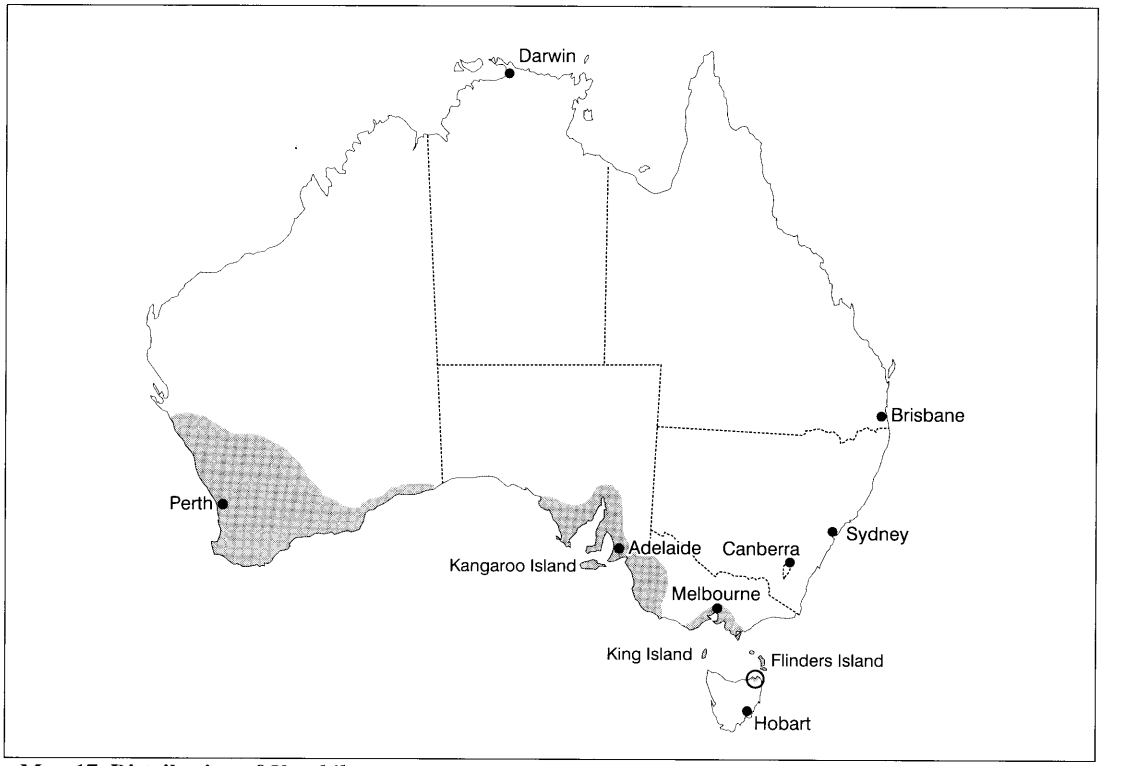
Basionym: *Pterostylis tenuicauda* Kraenzl., *Neu-Caledon. orchid.* 63 (1909).

Natural hybrids:
Taurantha* X *conoglossa (Upton) D.L.Jones et M.A.Clem., **comb. nov.**

Basionym: *Pterostylis* X *conoglossa* Upton, *Orchadian* 2: 114 (1967).



Map 16. Distribution of *Taurantha*



Map 17. Distribution of *Urochilus*

16. *Urochilus*

Urochilus D.L.Jones et M.A.Clem., **gen. nov**.: affinis ad *Pterostylem* R.Br., sed plantis dimorphis sterilibus et fertilibus; racemo multifloro; sepalis lateralibus deflexis; synsepalo in pagina anticis micropapillis albis bulliformibus et labello lacuna infossa inferna; sepalis lateralibus apicibus liberis triangularibus; labello trilobatis, in suus loco positus plene exposito; lamina labelli umbone basali dilatato et appendice caudata ad umbonem proxime connata et distale libera; et alis columna trichomibus anticis impedientibus, distinguenda. Type species: *Pterostylis vittata* Lindl. **Figs. 2.31, 2.32.**

Oligochaetochilus D.L.Szlachetko, subgen. *Apicuchilos* D.L.Szlachetko, *Polish Bot. J.* 46(1): 23 (2001), (*pro parte*). Type species: *Pterostylis vittata* Lindl.

Etymology
The name *Urochilus*, which is derived from the Greek *oura*, tail and *cheilos*, lip, refers to the small tail-like growth at the base of the labellum.

Recognition
Urochilus is recognised by the following combination of characters:- sterile and fertile plants dimorphic (sterile plants consisting of a rosette of petiolate leaves; fertile plants consisting of a flowering scape with sessile, spreading cauline leaves); clonal colonies absent; raceme multiflowered; lateral sepals deflexed; synsepalum flat to concave, with white bubble-like micropapillae on the anterior surface and a sunken pit beneath the labellum; free points of lateral sepals short, triangular; labellum fully exposed in the set position; labellum lamina obscurely three-lobed, with an enlarged basal mound; basal appendage caudate, proximally fused to the mound, distally free; and, barrier trichomes short, thickened, clavate.

Distribution
A genus of c. 6 species distributed in southern Australia. Map 17.

Notes
Reproduction is solely from seed. Natural intergeneric hybrids are unknown.

Infrageneric taxa
No infrageneric taxa are recognised.

New Combinations:
Urochilus concavus (D.L.Jones et M.A.Clem.) D.L.Jones et M.A.Clem., **comb. nov.**
Basionym: *Pterostylis concava* D.L.Jones et M.A.Clem., *Austral. Orch. Res.* 1: 121, fig.4,E-H (1989).

Urochilus sanguineus (D.L.Jones et M.A.Clem.) D.L.Jones et M.A.Clem., **comb. nov.**
Basionym: *Pterostylis sanguinea* D.L.Jones et M.A.Clem., *Austral. Orch. Res.* 1: 126-7, fig.4A-D (1989).

Urochilus vittatus (Lindl.) D.L.Jones et M.A.Clem., **comb. nov.**
Basionym: *Pterostylis vittata* Lindl. in Edwards's, Bot. Reg. 1-23: *Swan Riv. Append.* liii (1840).

17. X *Taurodium*

A hybrid genus between species of *Diplodium* and *Taurantha*.

X *Taurodium* X ***furcillatum*** (Rupp) D.L.Jones et M.A.Clem., **comb. nov.**
Basionym: *Pterostylis* X *furcillata* Rupp, *Proc. Linn. Soc. New South Wales* 55: 415 (1930).

X *Taurodium* X ***toveyanum*** (Ewart et Sharman) D.L.Jones et M.A.Clem., **comb. nov.**
Basionym: *Pterostylis* X *toveyana* Ewart et Sharman, *Proc. Roy. Soc. Victoria* (new ser.) 28(2): 235 (1916).

Artificial key to the genera of Pterostylidineae

1	Galea with two openings; labellum lamina filiform, with a swollen apical knob; labellum margins with coarse moniliform yellow setae	***Plumatichilos***
1.	Galea with a single opening; labellum lamina never filiform; labellum margins entire, with clear siliceous trichomes or with white setae, never with coarse moniliform yellow setae	**2**
2	Lateral sepals erect or obliquely erect in front of the galea (rarely projecting forwards as in *P. porrecta*); labellum wholly or partially enclosed within the galea; labellum lamina with a linear, decurved penicillate basal appendage	**3**
2.	Lateral sepals obliquely deflexed to fully deflexed below the galea; labellum fully exposed or rarely the basal part hidden by the petals; labellum lamina without a basal appendage or, if present, the appendage never penicillate	**13**
3	Free points of lateral sepals sharply recurved in front of the synsepalum; dorsal sepal with ridged veins; petals with hooked apices	***Stamnorchis***
3.	Free points of lateral sepals erect or recurved behind the galea; dorsal sepal smooth; petals without hooked apices	**4**
4	Rosette 1-3 per plant, arising on a lateral growth from the base of the scape; free points of lateral sepals not, or hardly exceeding the galea. Flowers multiple (regularly 2 or more)	**5**
4.	Rosette solitary, scape-encircling or forming a separate sterile plant; free points of lateral sepals extending well past the galea. Flower solitary (rarely 2)	**6**
5	Petal apex with a terete horn-like extension; labellum apex swollen and knob-like	***Petrorchis***
5.	Petal apex entire, lacking any horn-like extension; labellum apex flat, not swollen and knob-like	***Speculantha***
6	Rosette not attached to the flowering plant but forming a separate sterile plant	**7**
6.	Rosette leaves encircling the scape, either in a tight basal rosette or loose spiral	**8**
7	Synsepalum with a ligulate flap on the upper surface	***Linguella***
7.	Upper surface of synsepalum entire, without a ligulate flap	***Diplodium***
8	Synsepalum with a ligulate flap on the upper surface	***Linguella***
8.	Upper surface of synsepalum entire, without a ligulate flap	**9**
9	Labellum thick and sausage-like	***Eremorchis***
9.	Labellum thin	**10**
10	Dorsal sepal with a long filiform extension	**11**
10.	Dorsal sepal entire	**12**
11	Rosette encircling the base of the scape	***Crangonorchis***
11.	Rosette on a separate growth	***Diplodium***
12	Labellum apex entire	***Pterostylis***
12.	Labellum apex narrowly or broadly emarginate	***Taurantha***
13	Lateral sepals fully deflexed; rosette solitary, scape-encircling or forming a separate sterile plant	**14**
13.	Lateral sepals obliquely deflexed; rosette 1-3 per plant, arising on a lateral growth from the base of the scape	***Pharochilum***
14	Leaves forming a rosette encircling the base of the scape; leaves on scape reduced to sheathing bracts	**15**
14.	Rosette a separate sterile plant, never attached to the flowering plant; leaves on scape large and spreading	**17**

15 Petals with deeply serrate anterior margins; labellum strongly 3-lobed, each lateral lobe with a large, erect, hollow, basal appendage ***Ranorchis***

15. Petals with entire or minutely denticulate anterior; margins; labellum obscurely 3-lobed, the lateral lobes without any basal appendage **16**

16 Basal part of lateral sepals scarcely united, forming a pouch about as long as wide; labellum lamina unlobed, membranous, lacking marginal setae; basal appendage present ***Hymenochilus***

16. Basal part of lateral sepals firmly fused, flat or concave, if pouched then longer than wide; labellum lamina lobed, coriaceous, the margins with prominent white moniliform setae; basal appendage absent ***Oligochaetochilus***

17 Rosette leaves about as wide as long; lateral sepals as broad as long, with a shallow concavity beneath the labellum; labellum with a basal tail-like structure ***Urochilus***

17. Rosette leaves much longer than wide; lateral sepals longer than wide, without a concavity beneath the labellum; labellum with a basal mound but no tail-like structure ***Bunochilus***

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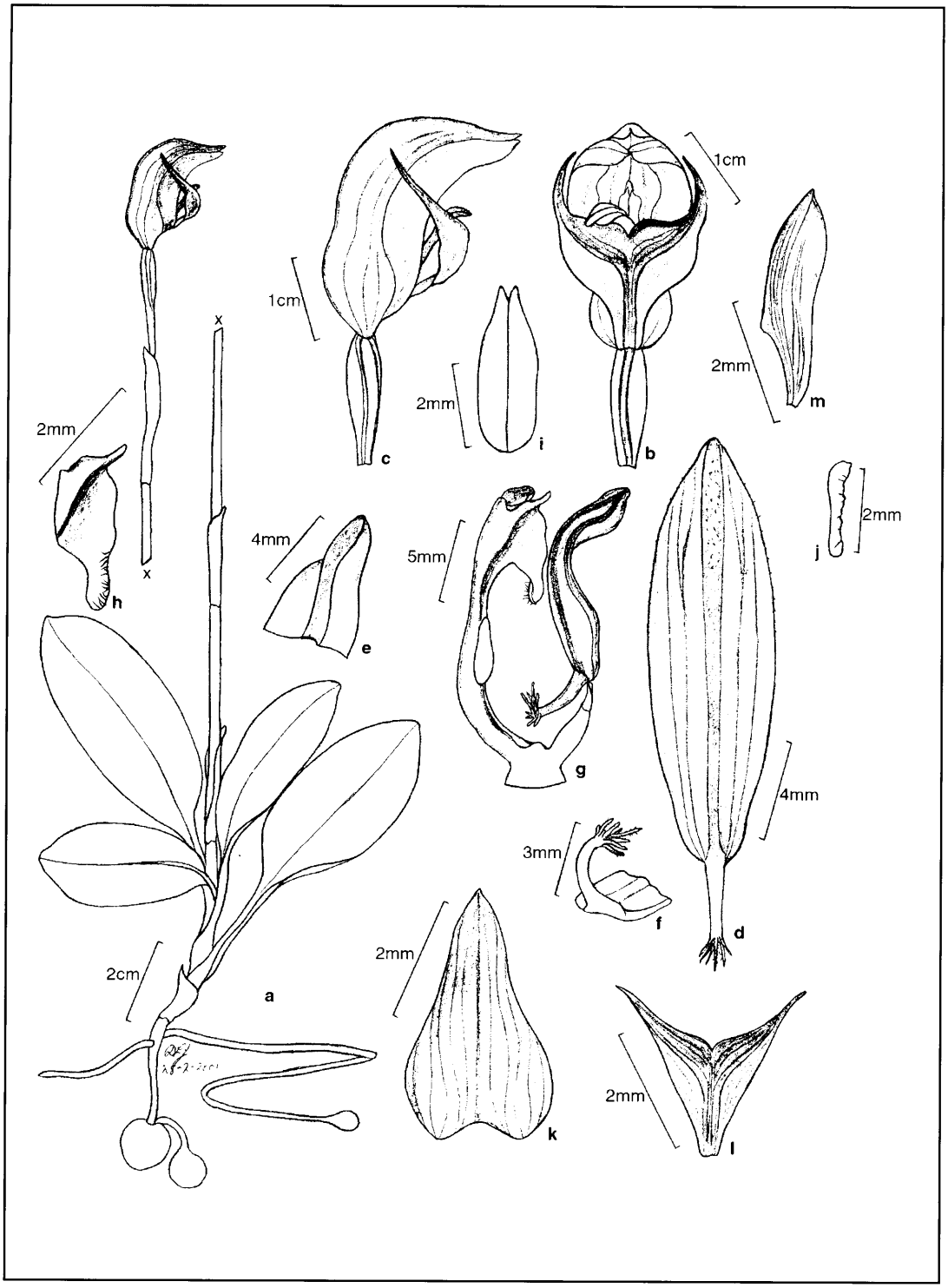

Fig. 2.1 ***Pterostylis curta***, Warrandyte, Vic, *J.Roberts*.
a. flowering plant; **b**. flower from front; **c**. flower from side; **d**. labellum from above, flattened out; **e**. labellum apex; **f**. labellum basal appendage; **g**. column and labellum from side; **h.** column wing, interior view; **i.** stigma; **j.** pollinium; **k**. dorsal sepal; **l**. synsepalum; **m**. petal.

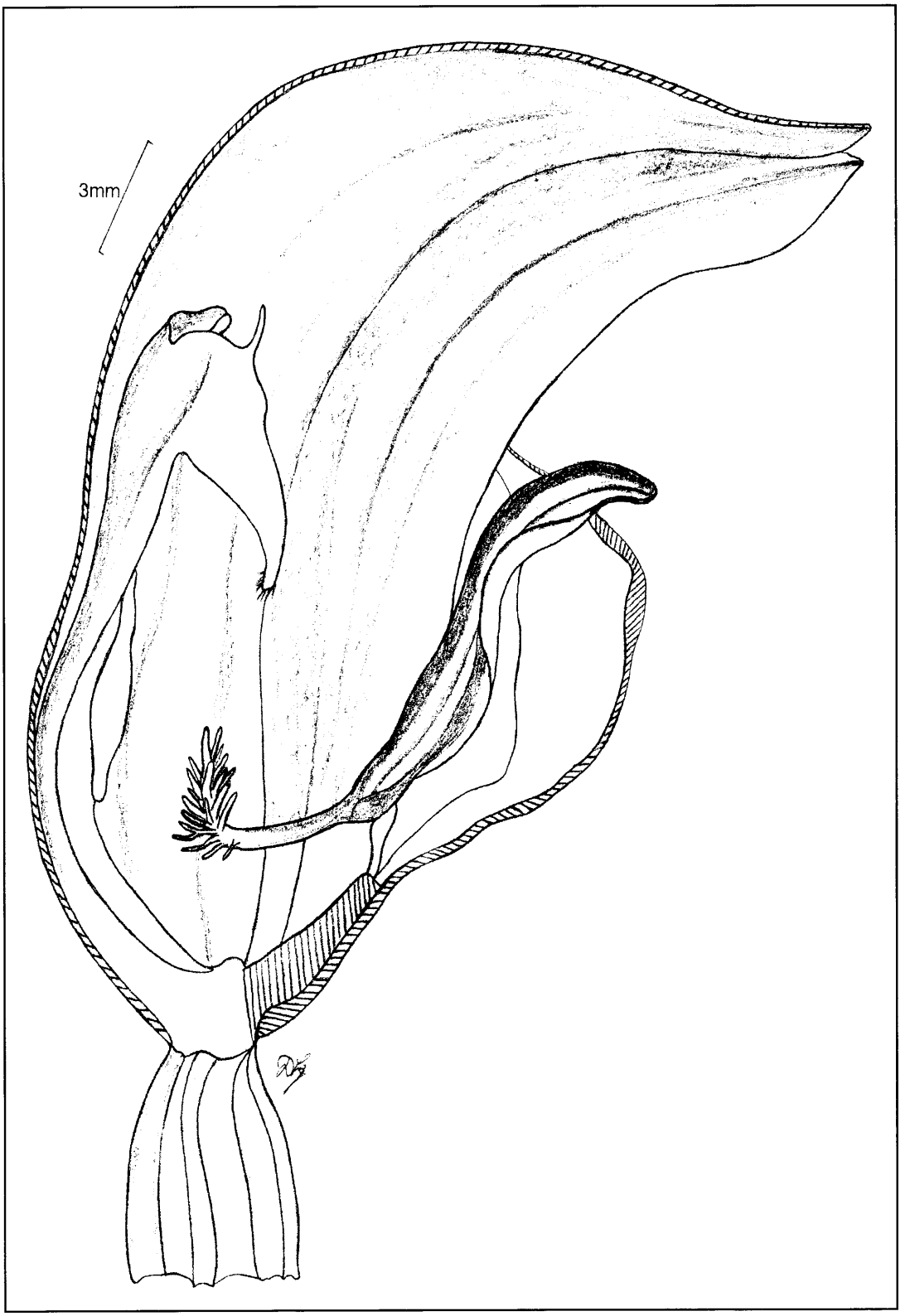

Fig. 2.2 Longitudinal section of flower of ***Pterostylis curta*** (labellum in set position).

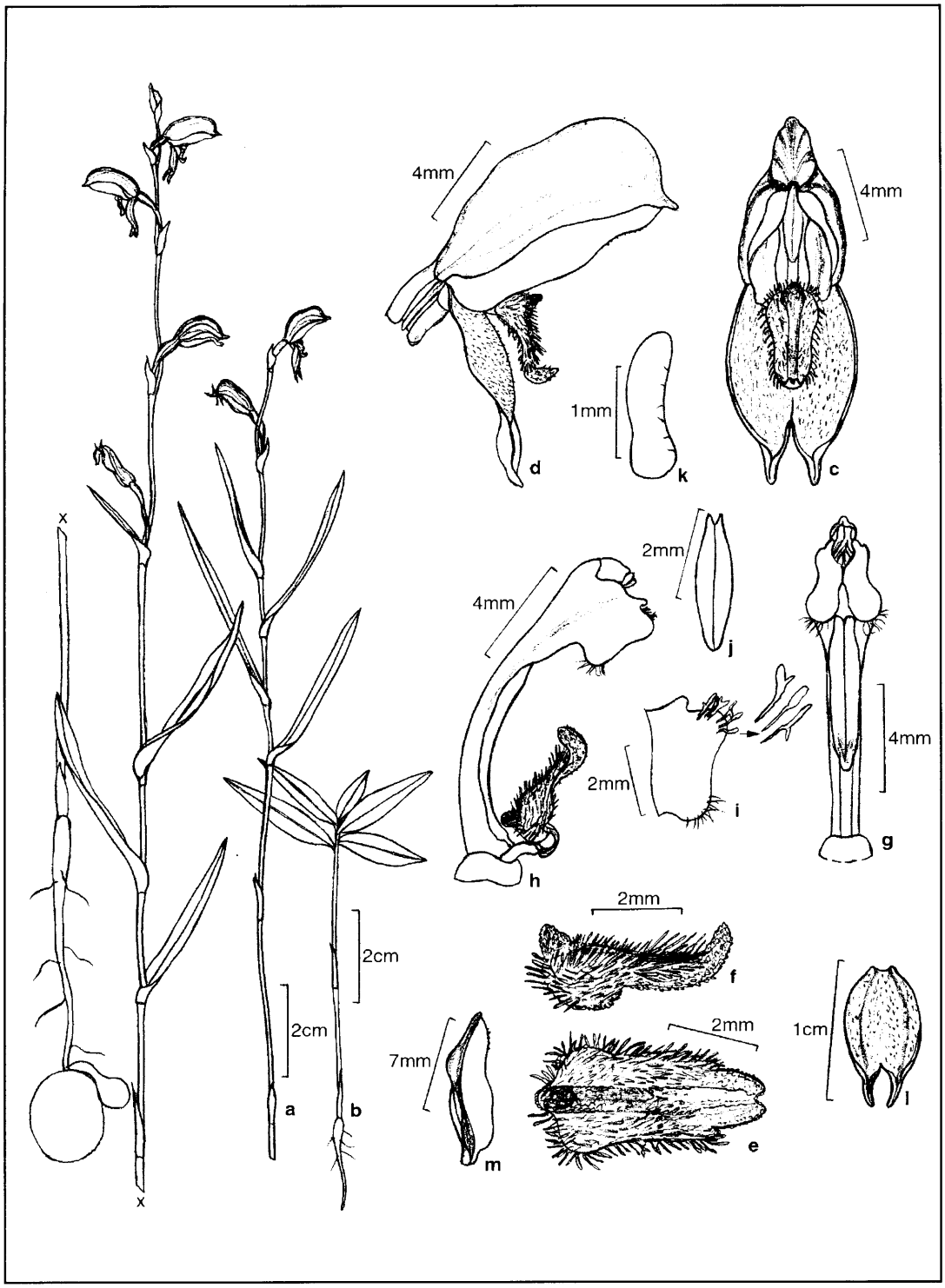

Fig. 2.3 ***Bunochilus longifolius***, Bundana, NSW, *R.Angus*.
a. flowering plants; **b**. sterile plant (rosette); **c**. flower from front; **d.** flower from side; **e**. labellum from above, flattened out; **f.** labellum from side; **g.** column from front; **h.** column and labellum from side; **i.** column wing, interior view with enlarged barrier trichomes; **j**. stigma; **k.** pollinium; **l.** synsepalum; **m**. petal.

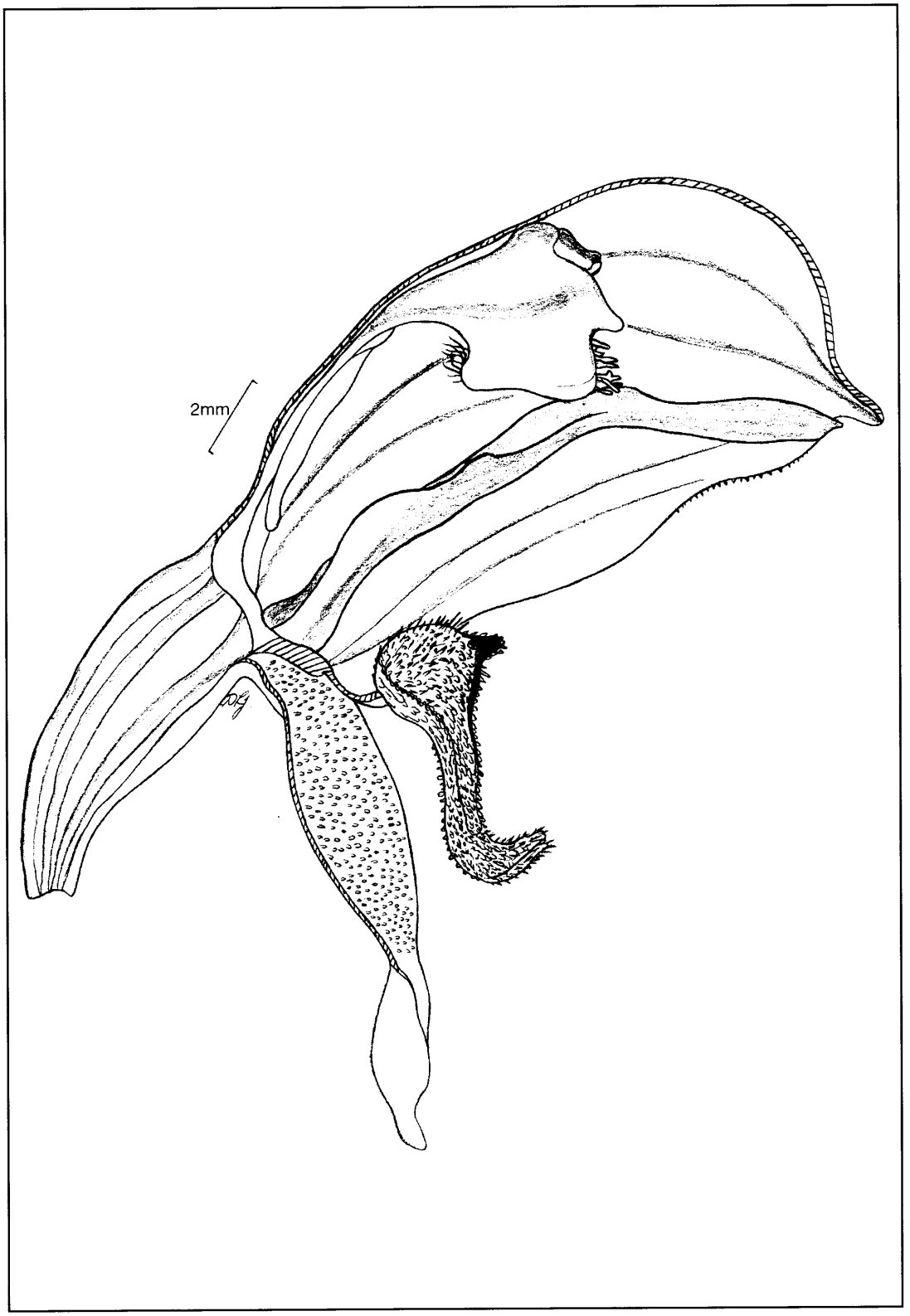

Fig. 2.4 Longitudinal section of flower of ***Bunochilus longifolius*** (labellum in set position).

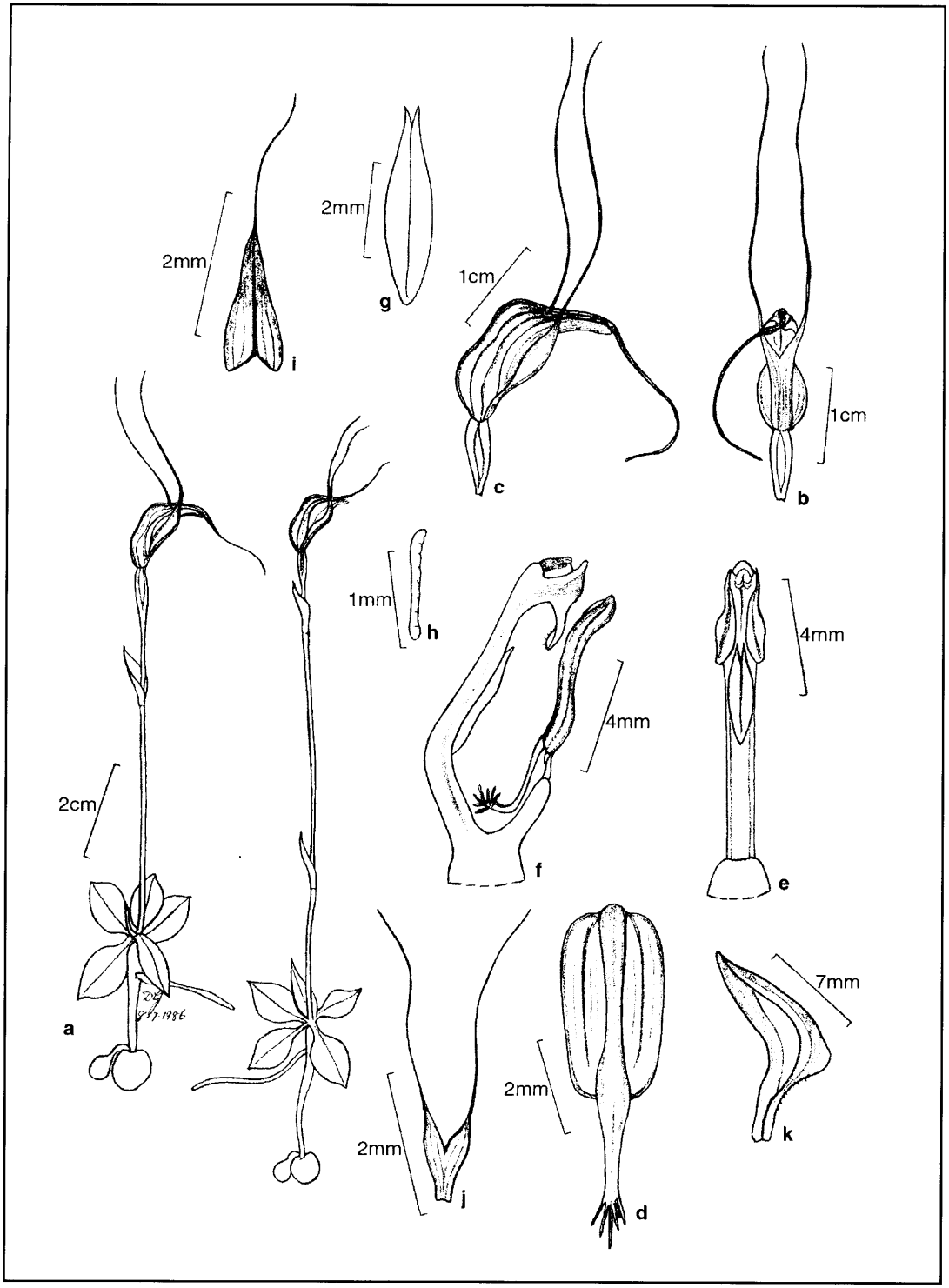

Fig. 2.5 ***Crangonorchis pedoglossa***, Nowra, NSW, *R.Tunstall* & Wilsons Promontory, Vic, *M.Clements* & *H.Richards*.

a. flowering plants; **b**. flower from front; **c**. flower from side; **d.** labellum from above, flattened out; **e.** column from front; **f**. column and labellum from side; **g**. stigma; **h**. pollinium; **i**. dorsal sepal; **j**. synsepalum; **k**. petal.

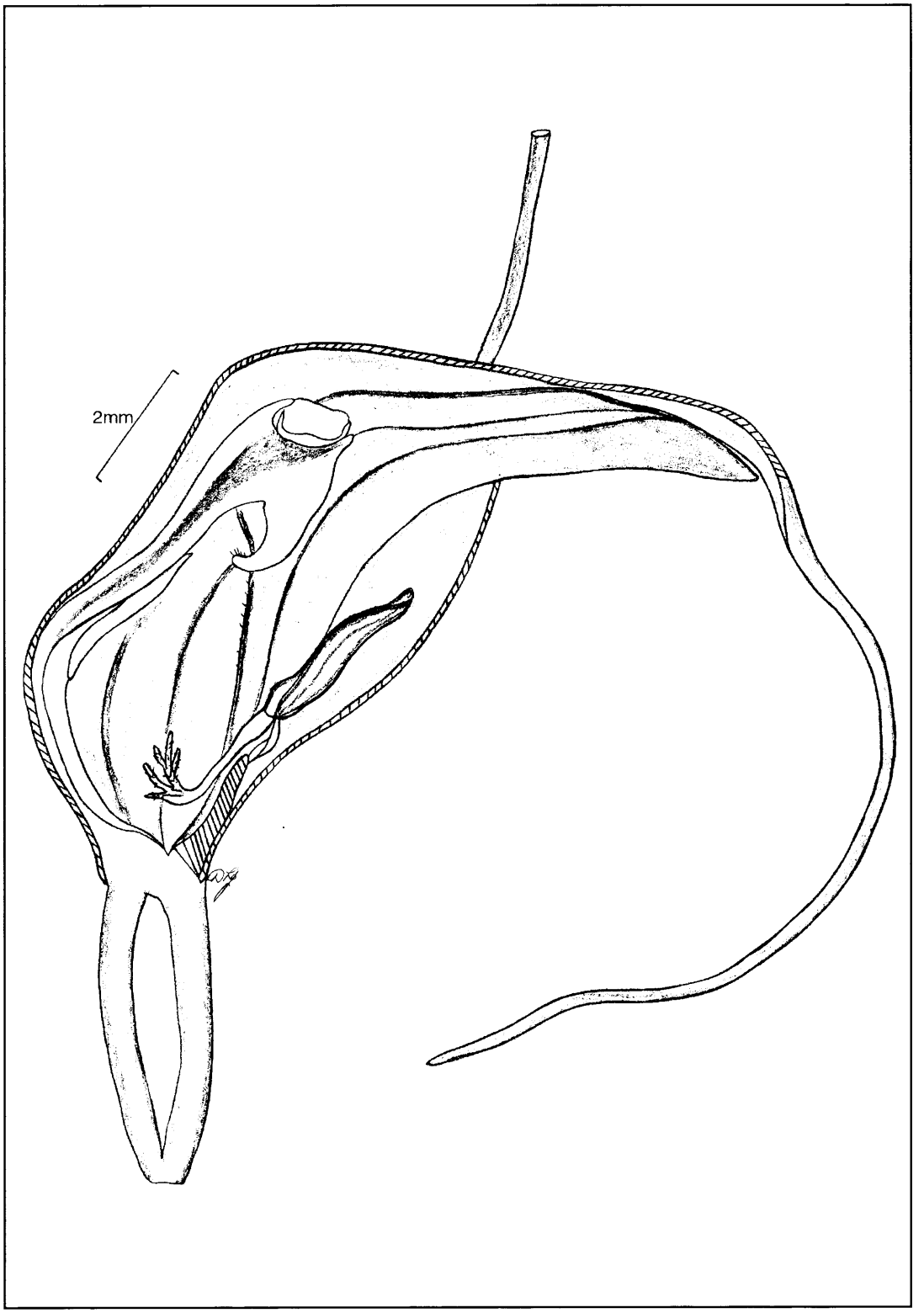

Fig. 2.6 Longitudinal section of flower of ***Crangonorchis pedoglossa*** (labellum in set position).

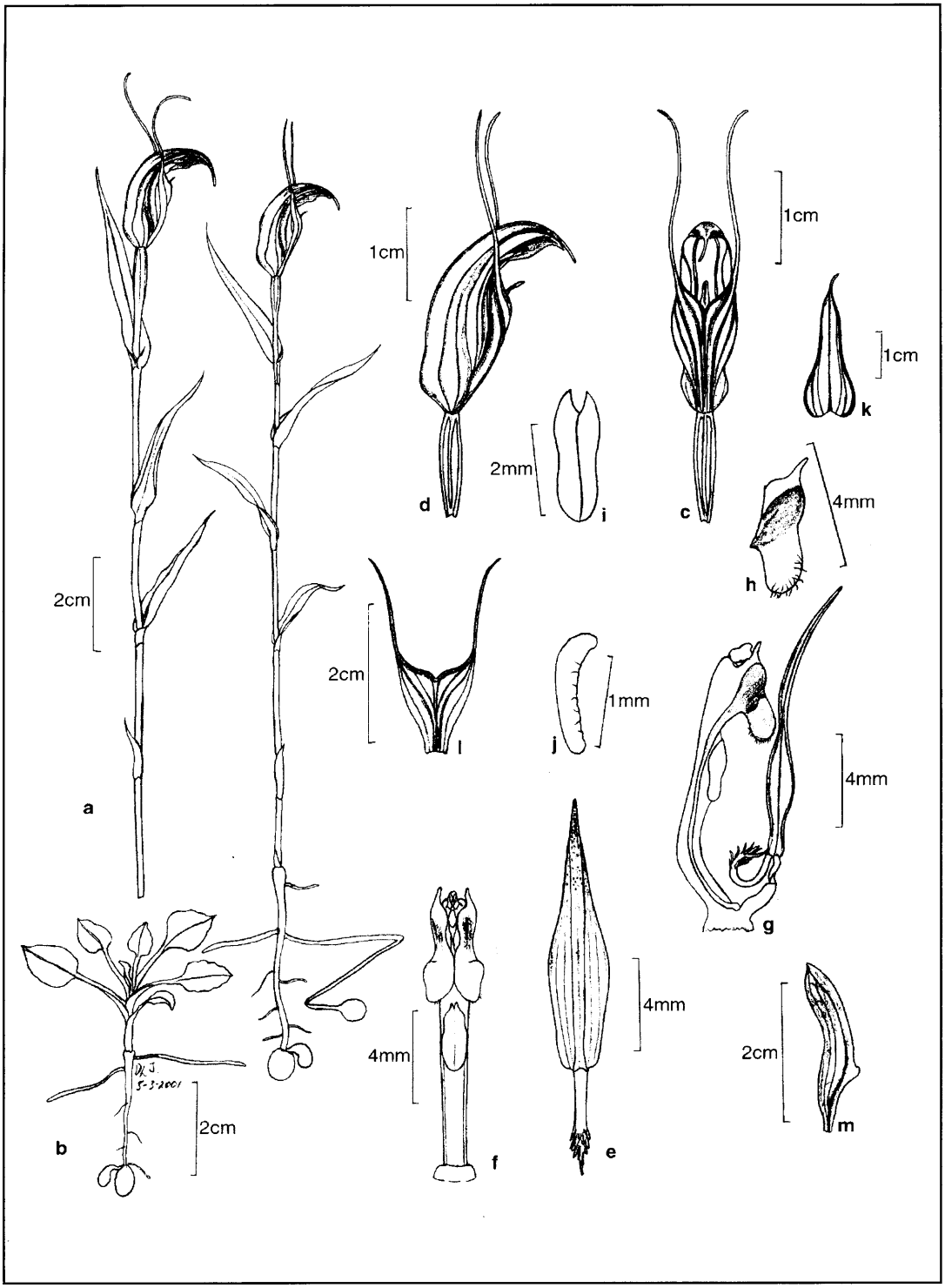

Fig. 2.7 ***Diplodium alatum***, Sandy Bay, Tas., *P.Palmer*.
a. flowering plants; **b**. sterile plant (rosette); **c**. flower from front; **d**. flower from side; **e**. labellum from above, flattened out; **f**. column from front; **g**. column and labellum from side; **h**. column wing, interior view; **i**. stigma; **j**. pollinium; **k**. dorsal sepal; **l**. synsepalum; **m**. petal.

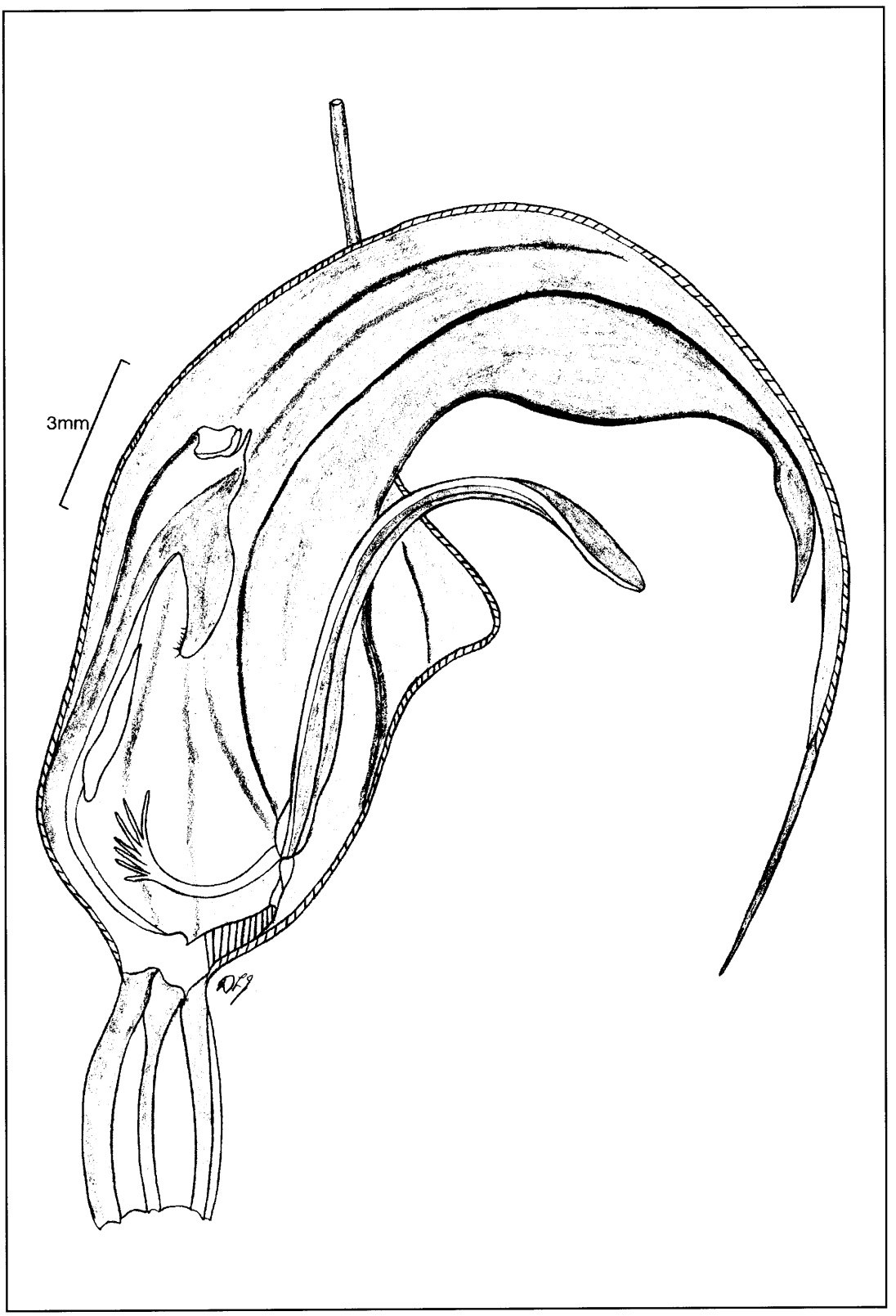

Fig. 2.8 Longitudinal section of flower of ***Diplodium aestivum*** (labellum in set position).

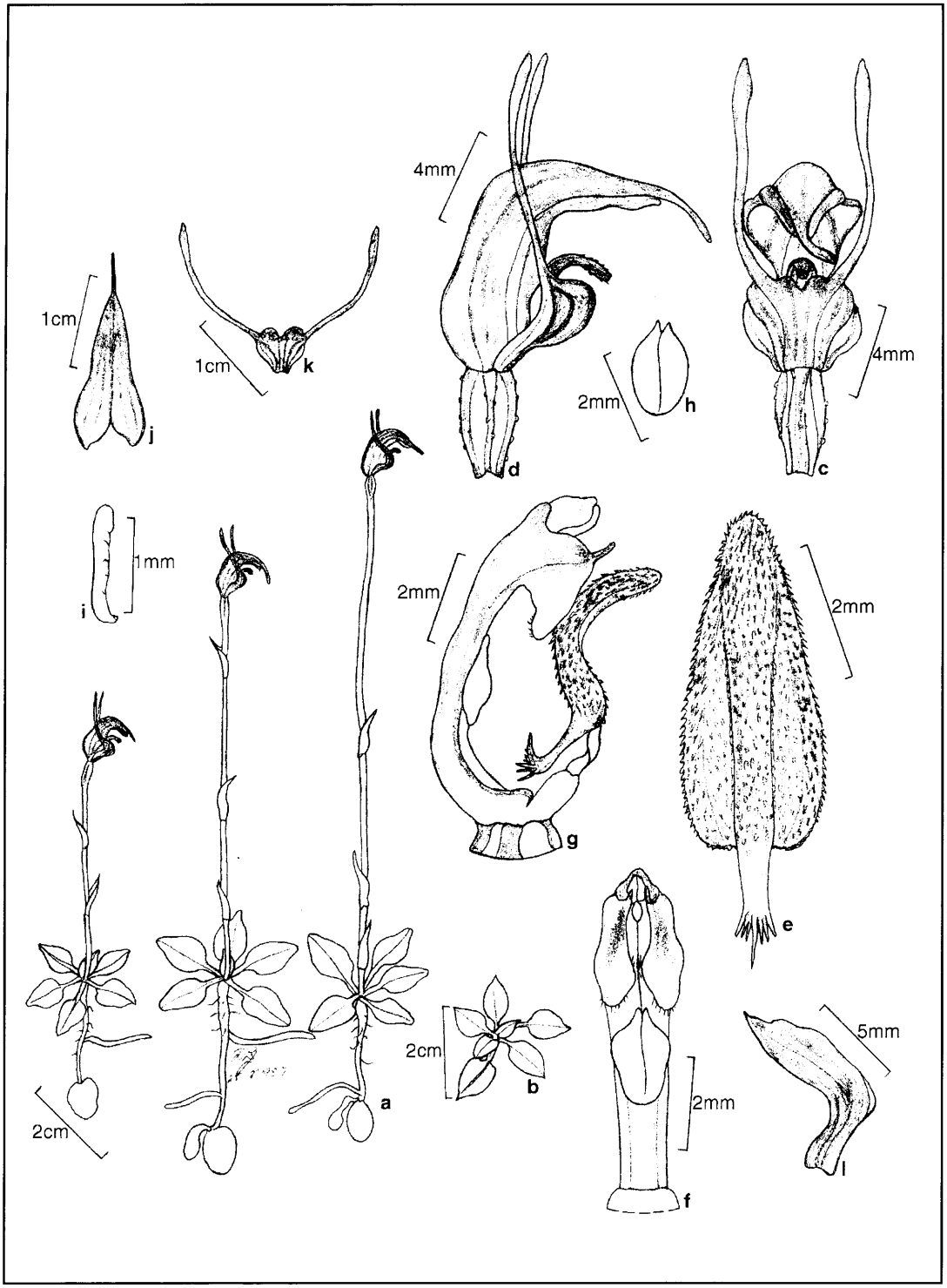

Fig. 2.9 ***Eremorchis allantoidea***, Ravensthorpe, WA, *R.Tunstall.*
a. flowering plants; **b**. sterile plant (rosette); **c**. flower from front; **d**. flower from side; **e**. labellum from above, flattened out; **f**. column from front; **g**. column and labellum from side; **h**. stigma; **i**. pollinium; **j**. dorsal sepal; **k**. synsepalum; **l**. petal.

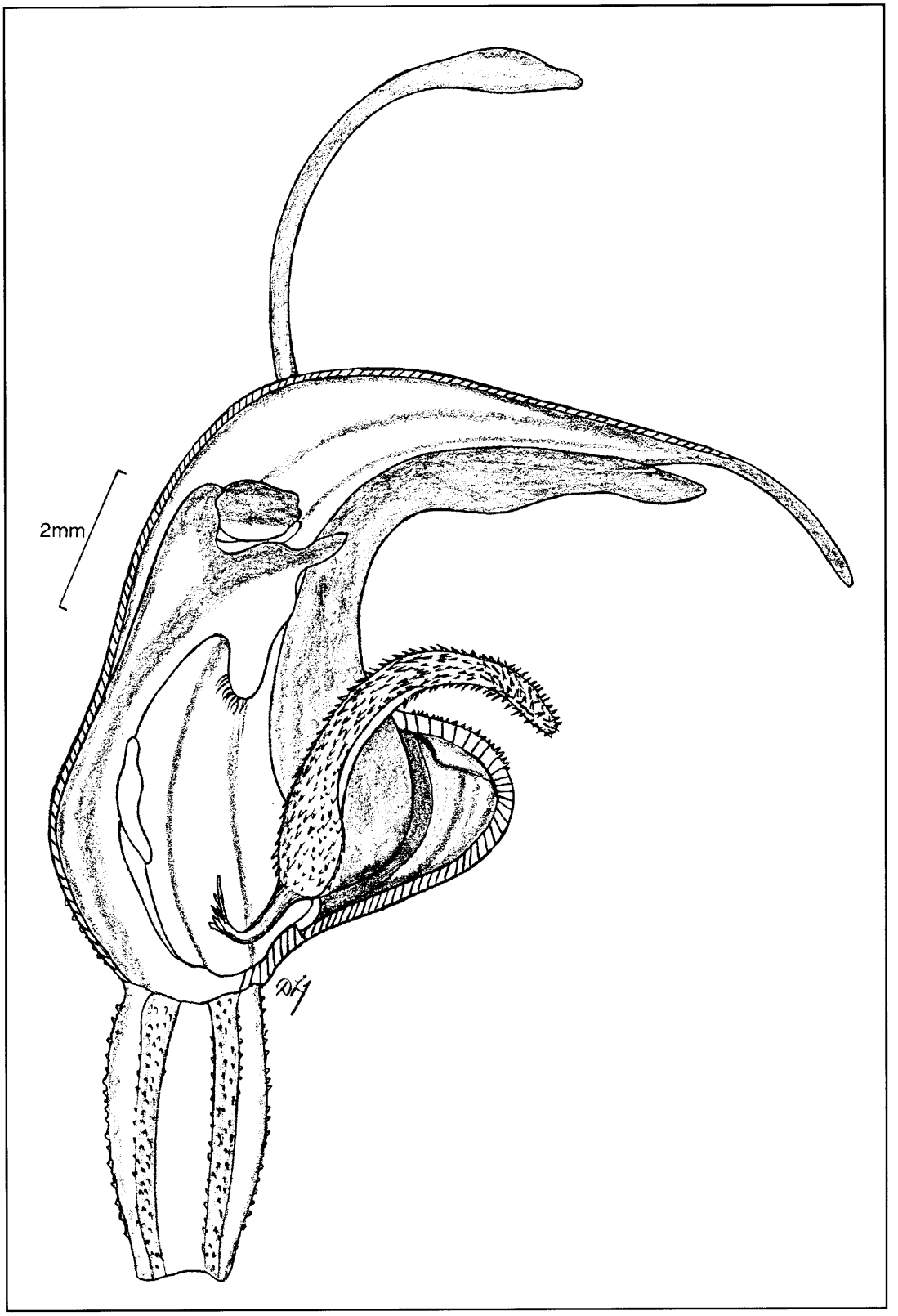

Fig. 2.10 Longitudinal section of flower of ***Eremorchis allantoidea*** (labellum in set position).

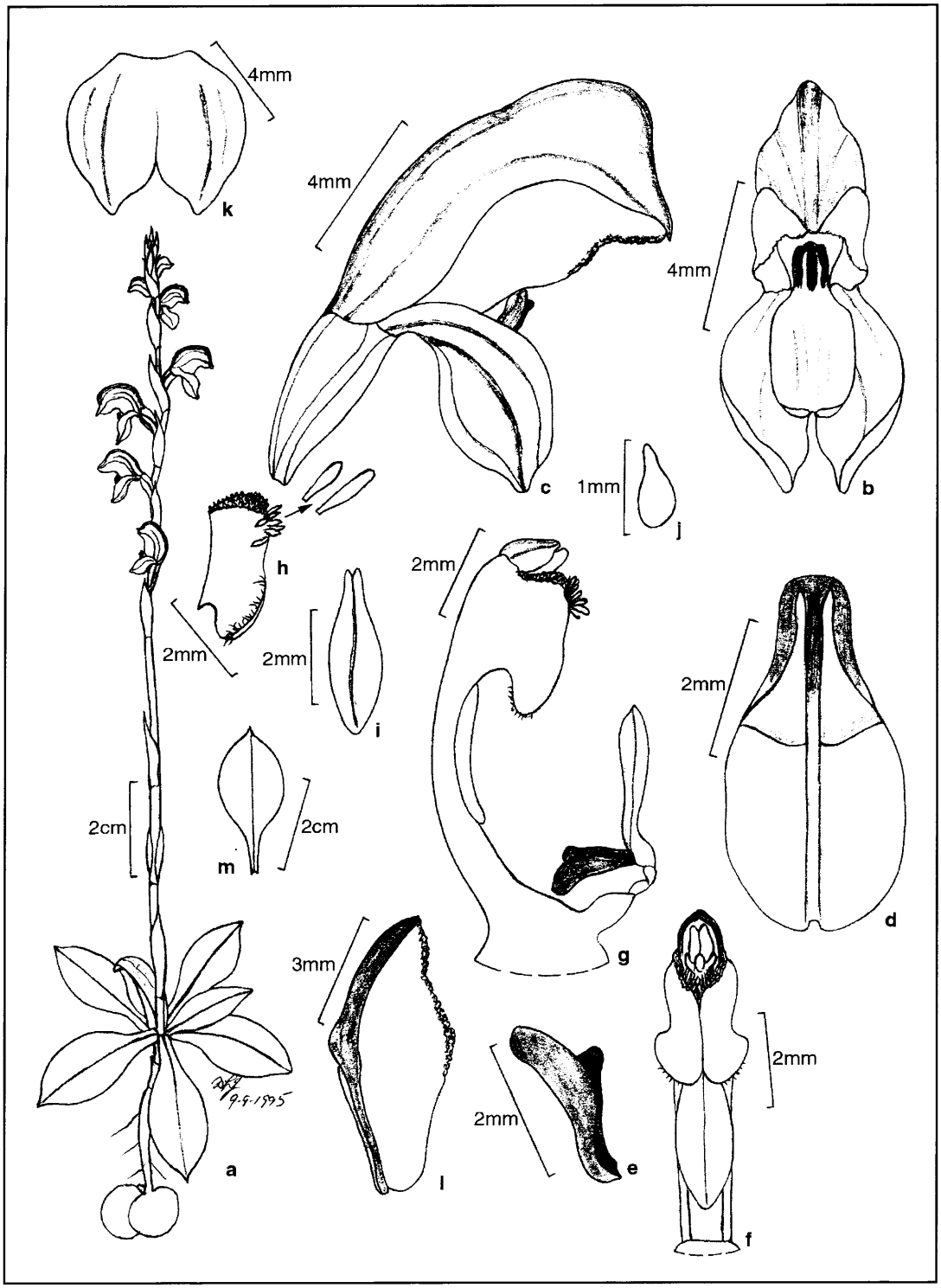

Fig. 2.11 ***Hymenochilus muticus***, Hervey Range, NSW, *D.Jones*.
a. flowering plant; **b**. flower from front; **c**. flower from side; **d**. labellum from above, flattened out; **e**. labellum basal appendage; **f**. column from front; **g**. column and labellum from side; **h**. column wing, interior view with enlarged barrier trichomes; **i**. stigma; **j**. pollinium; **k**. synsepalum; **l**. petal; **m**. rosette leaf.

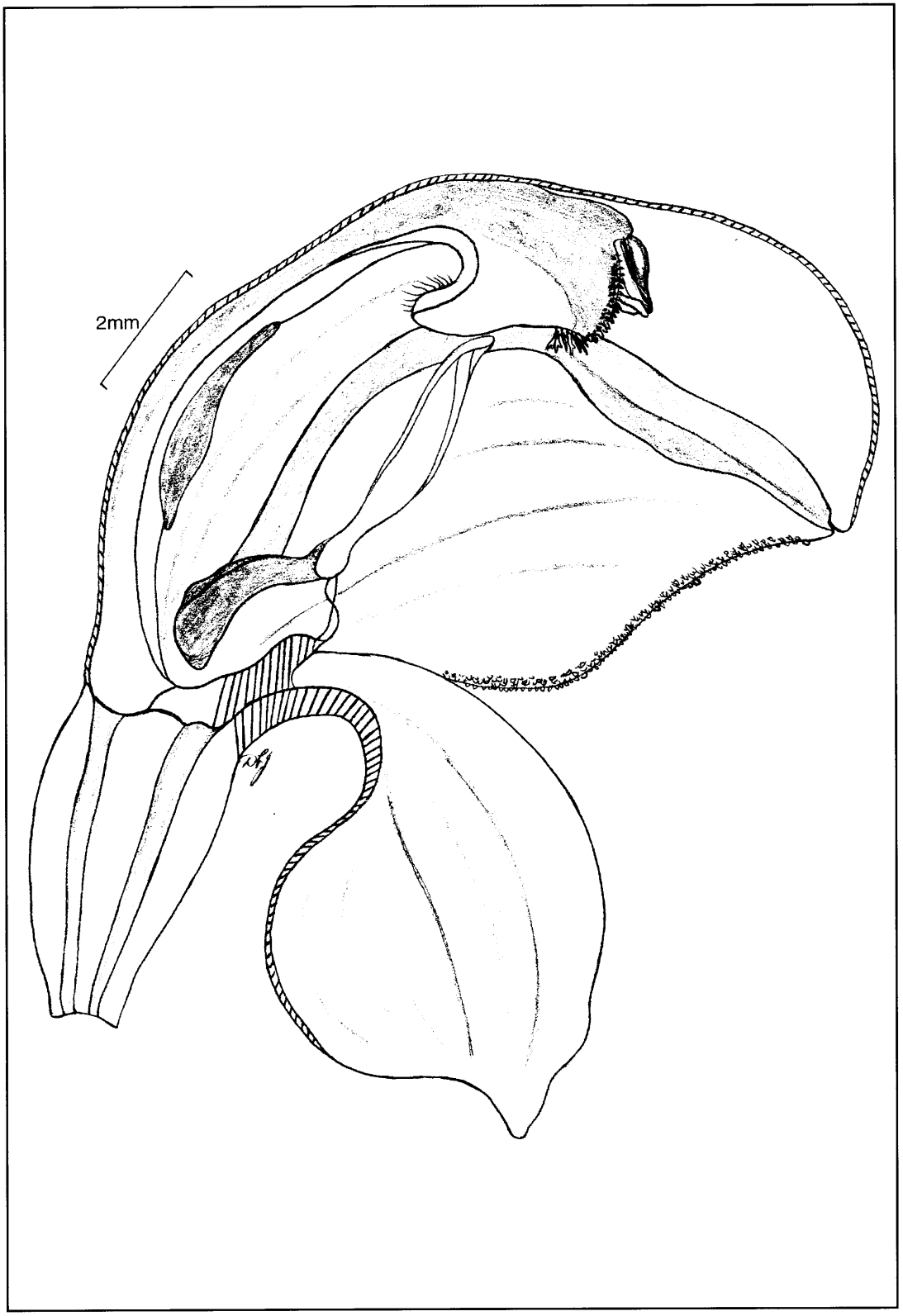

Fig. 2.12 Longitudinal section of flower of ***Hymenochilus muticus*** (labellum in closed position).

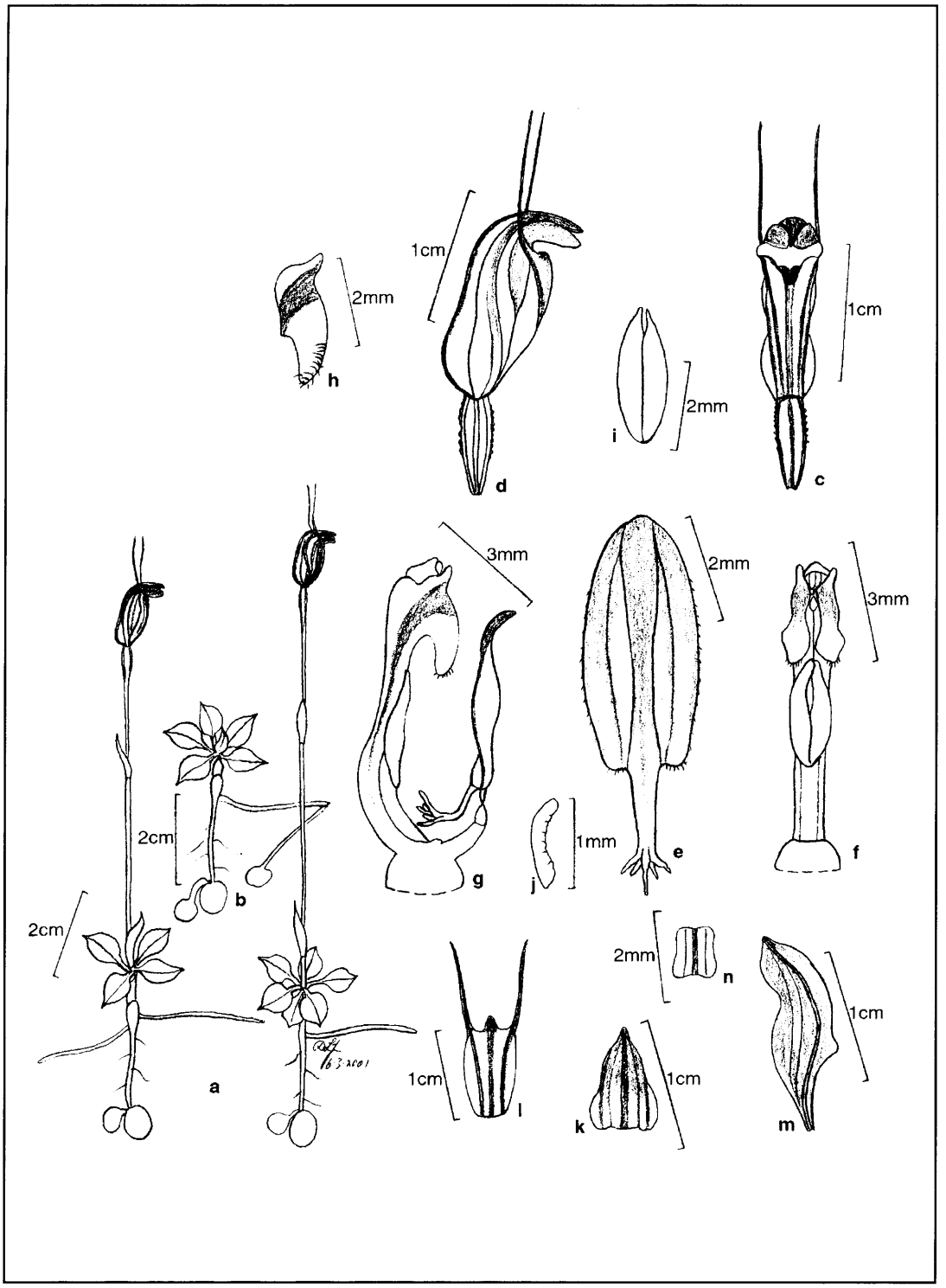

Fig. 2.13 ***Linguella nana***, Sherwood, Tas., *H.Ronken*.
a. flowering plants; **b**. sterile plant (rosette); **c**. flower from front; **d**. flower from side; **e**. labellum from above, flattened out; **f**. column from front; **g**. column and labellum from side; **h**. column wing, interior view; **i**. stigma; **j**. pollinium; **k**. dorsal sepal; **l**. synsepalum; **m**. petal; **n**. labellum hinge.

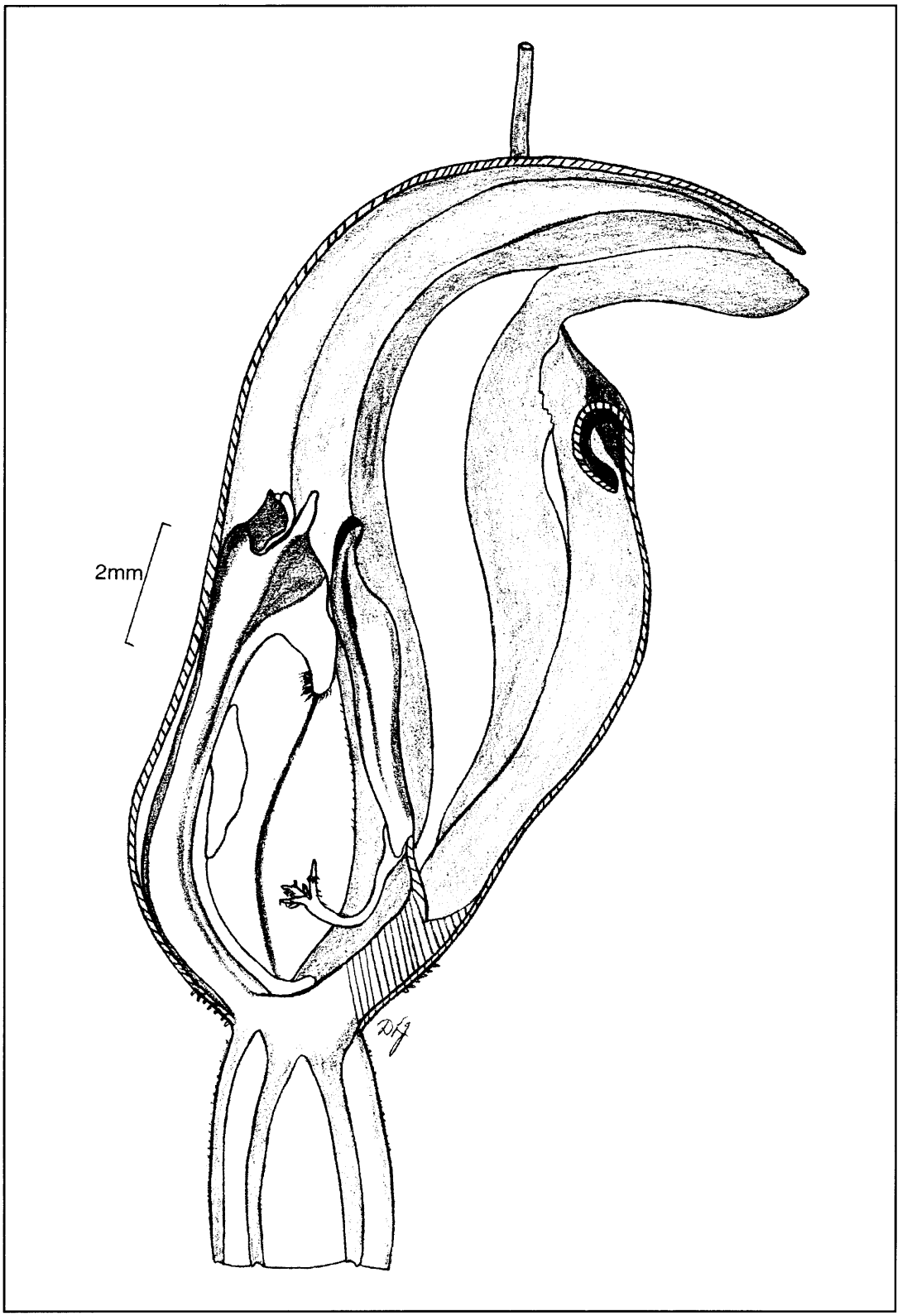

Fig. 2.14 Longitudinal section of flower of ***Linguella nana*** (labellum in closed position).

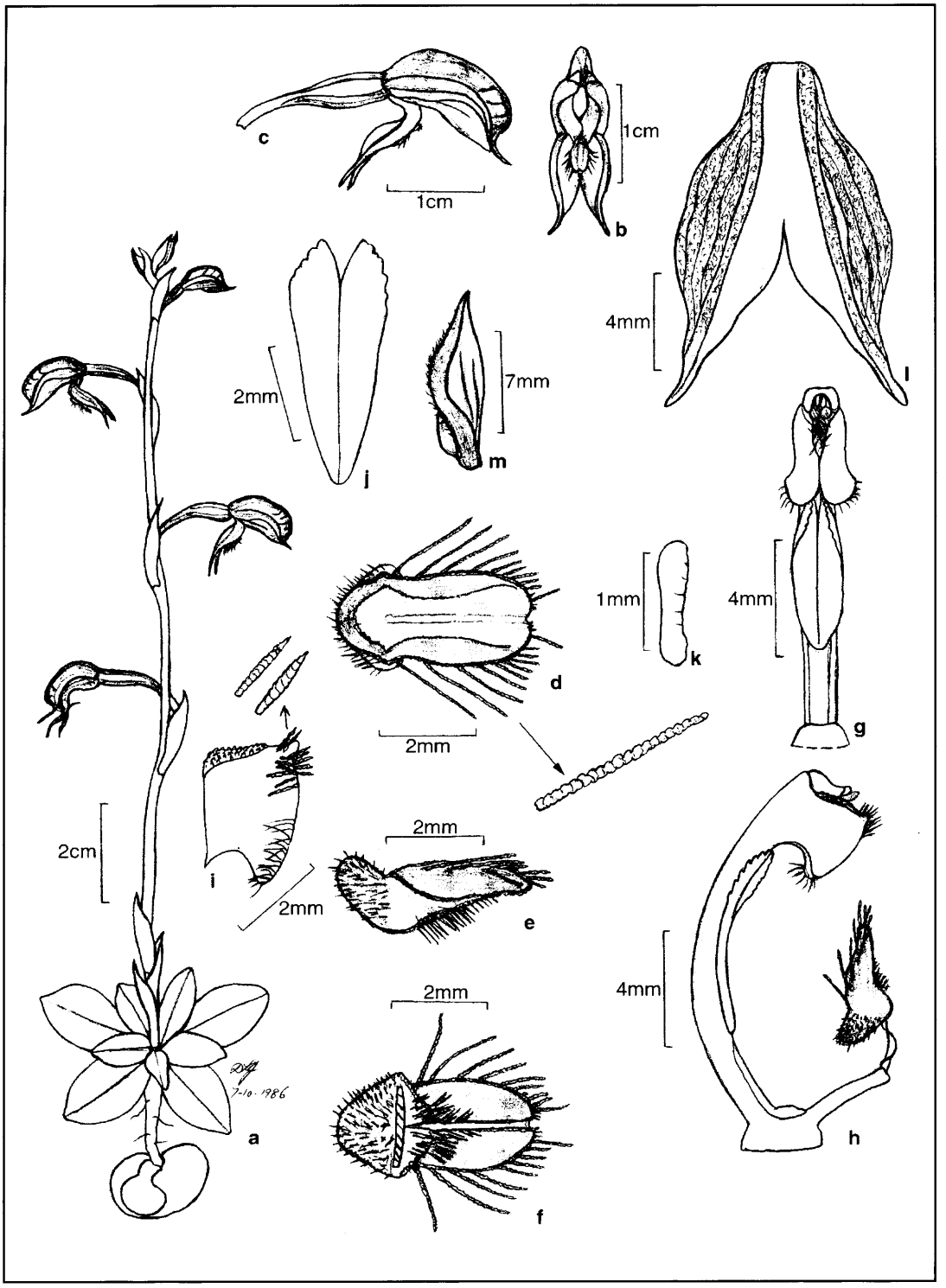

Fig. 2.15 ***Oligochaetochilus rufus***, Neath, NSW, *J.Roberts*.
a. flowering plant; **b**. flower from front; **c**. flower from side; **d**. labellum from above, flattened out, with enlarged marginal seta; **e**. labellum from side; **f**. labellum from below; **g**. column from front; **h**. column and labellum from side; **i**. column wing, interior view with enlarged barrier trichomes; **j**. stigma; **k**. pollinium; **l**. synsepalum; **m**. petal.

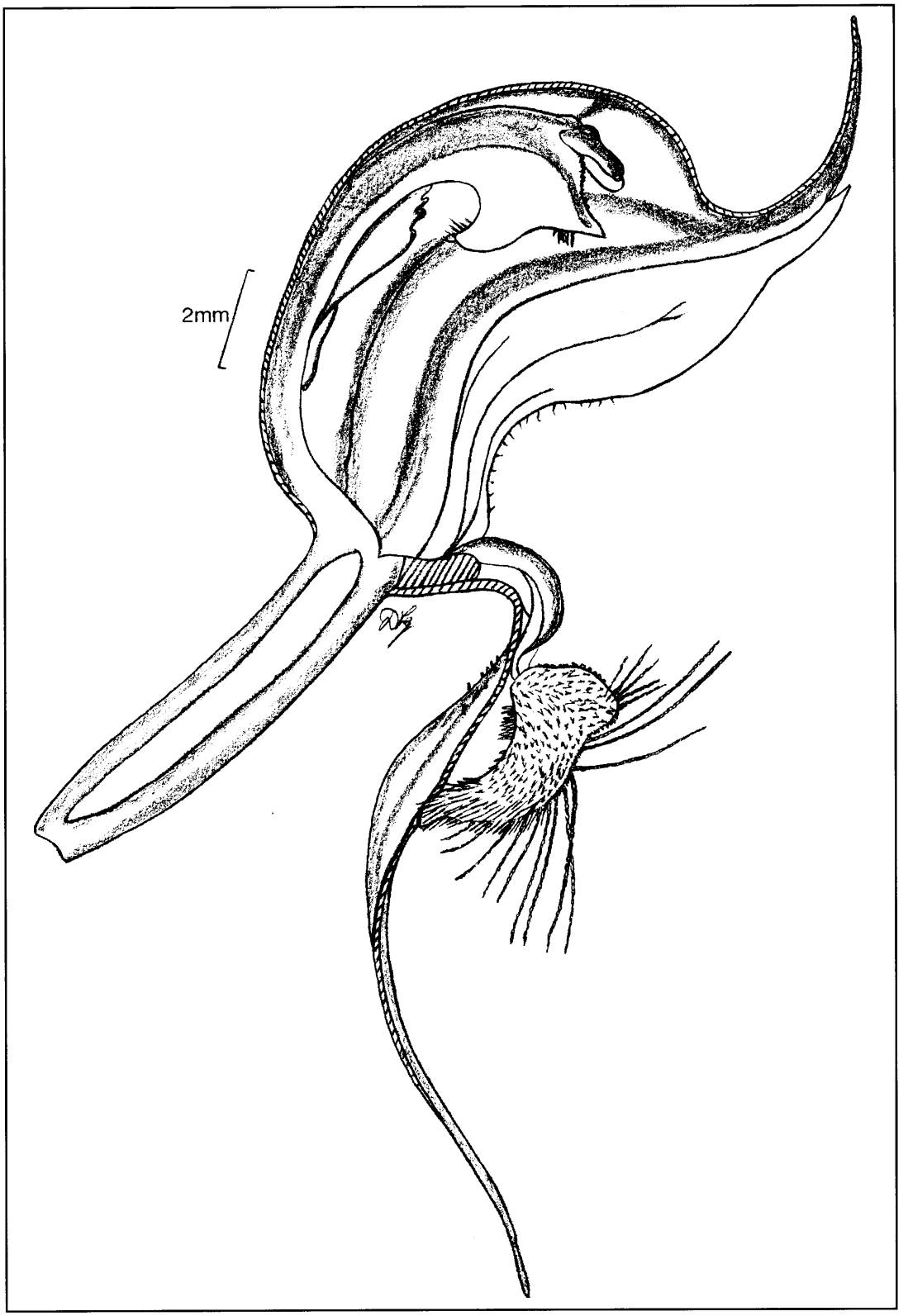

Fig. 2.16 Longitudinal section of flower of ***Oligochaetochilus setifer*** (labellum in set position).

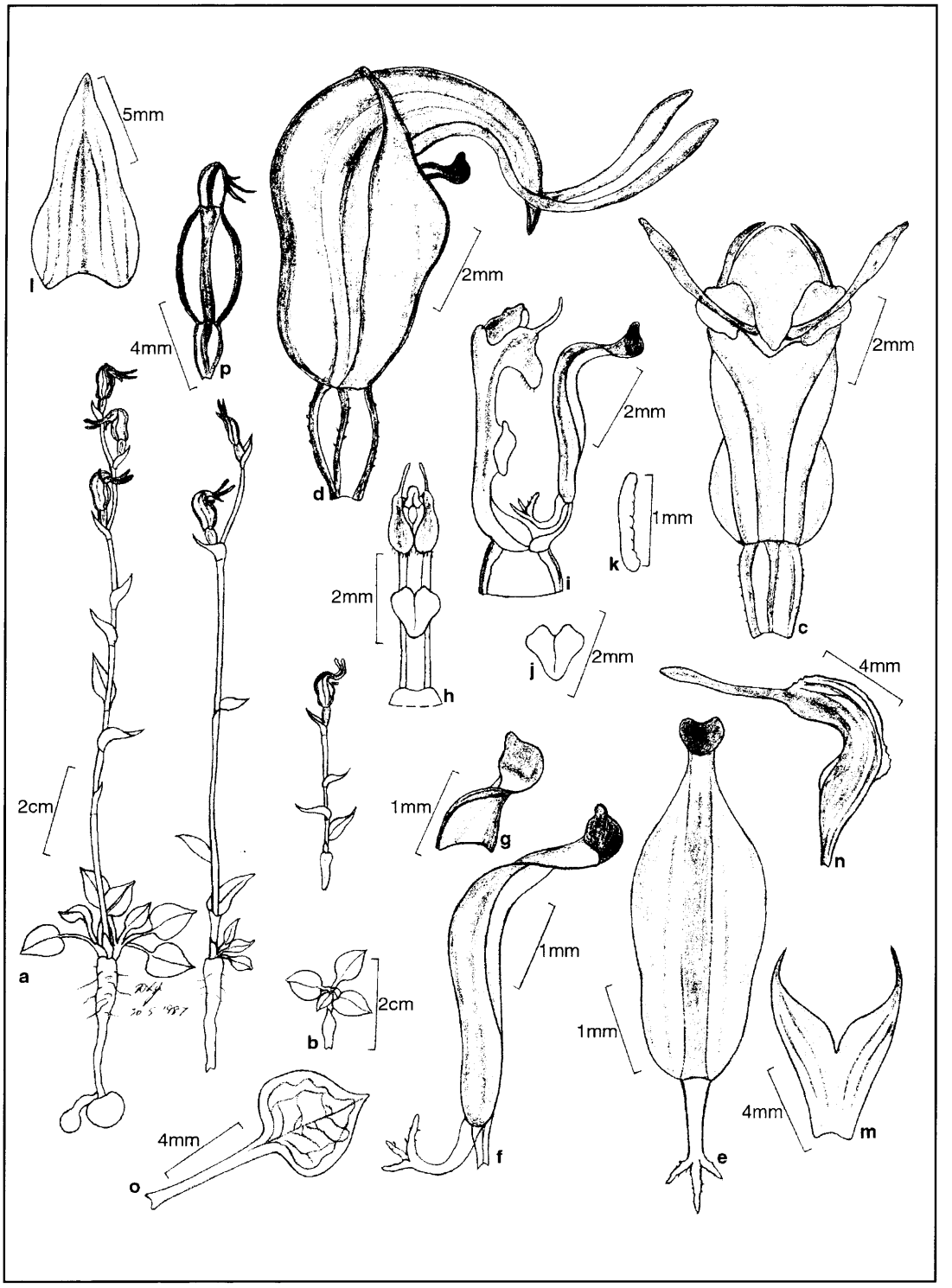

Fig. 2.17 ***Petrorchis bicornis***, Mt Maroon, Qld, *D.Jones & T.Jones*.
a. flowering plants with lateral rosettes; **b**. sterile plant (rosette); **c**. flower from front; **d**. flower from side; **e**. labellum from above, flattened out; **f**. labellum from side; **g**. labellum apex; **h**. column from front; **i**. column and labellum from side; **j**. stigma; **k**. pollinium; **l**. dorsal sepal; **m**. synsepalum; **n**. petal; **o**. rosette leaf.

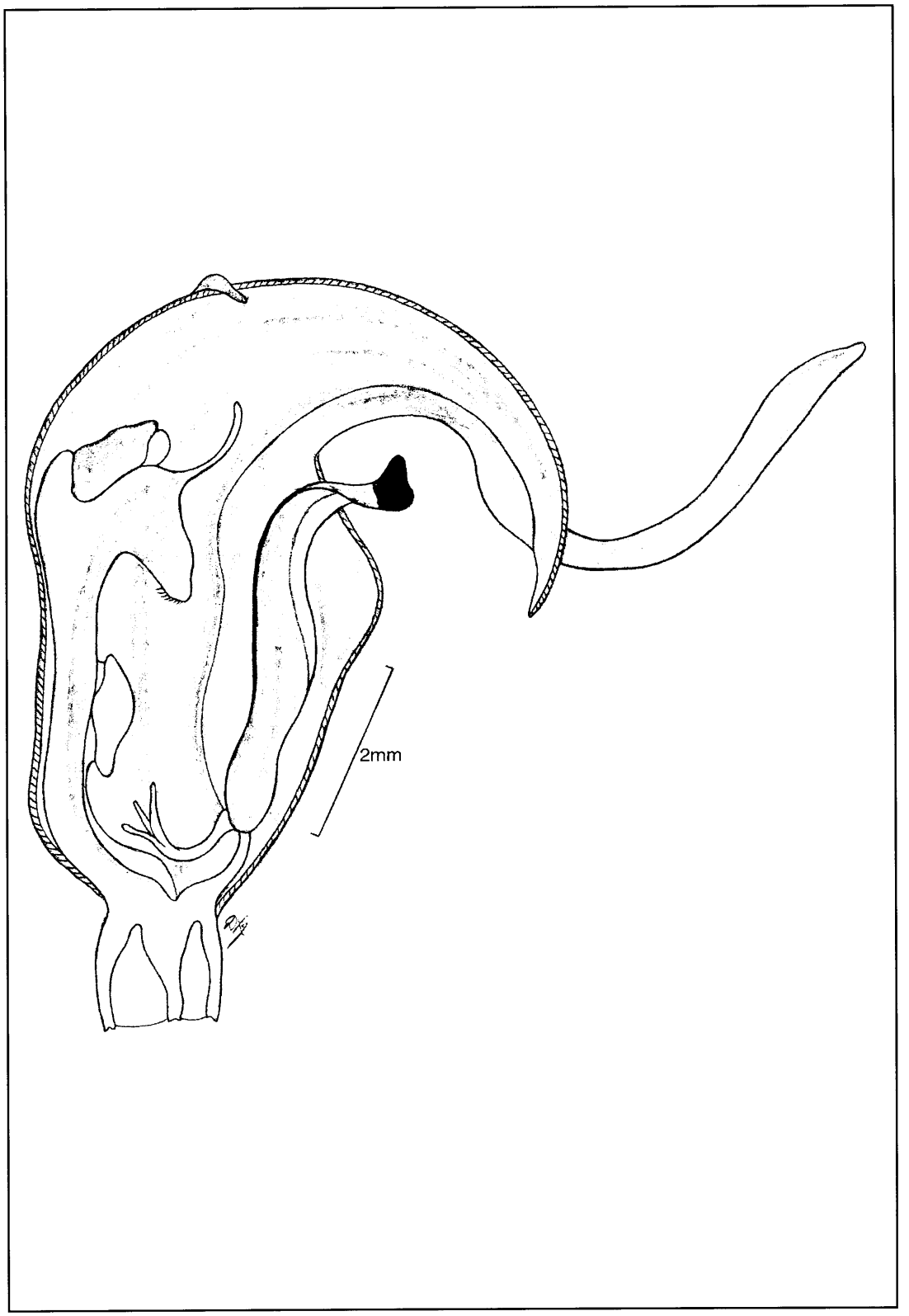

Fig. 2.18 Longitudinal section of flower of ***Petrorchis bicornis*** (labellum in set position).

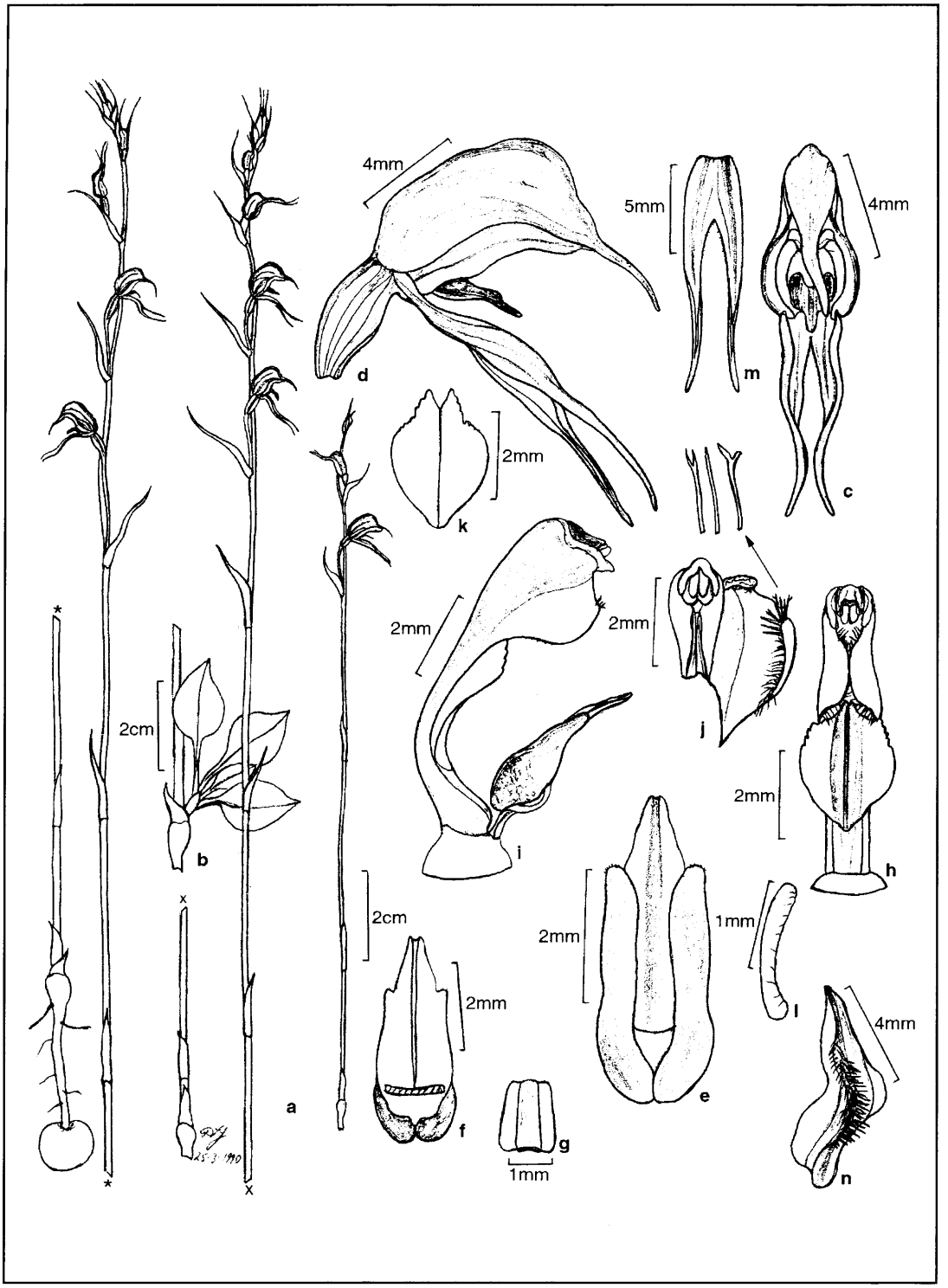

Fig. 2.19 ***Pharochilum daintreanum***, Sassafras, NSW, *D.Jones*.
a. flowering plants; **b**. lateral rosette arising from base of scape; **c**. flower from front; **d**. flower from side; **e**. labellum from above, flattened out; **f**. labellum from below; **g**. labellum hinge; **h**. column from front; **i**. column and labellum from side; **j**. top of column and interior of column wing with enlarged barrier trichomes; **k**. stigma; **l**. pollinium; **m**. synsepalum; **n**. petal.

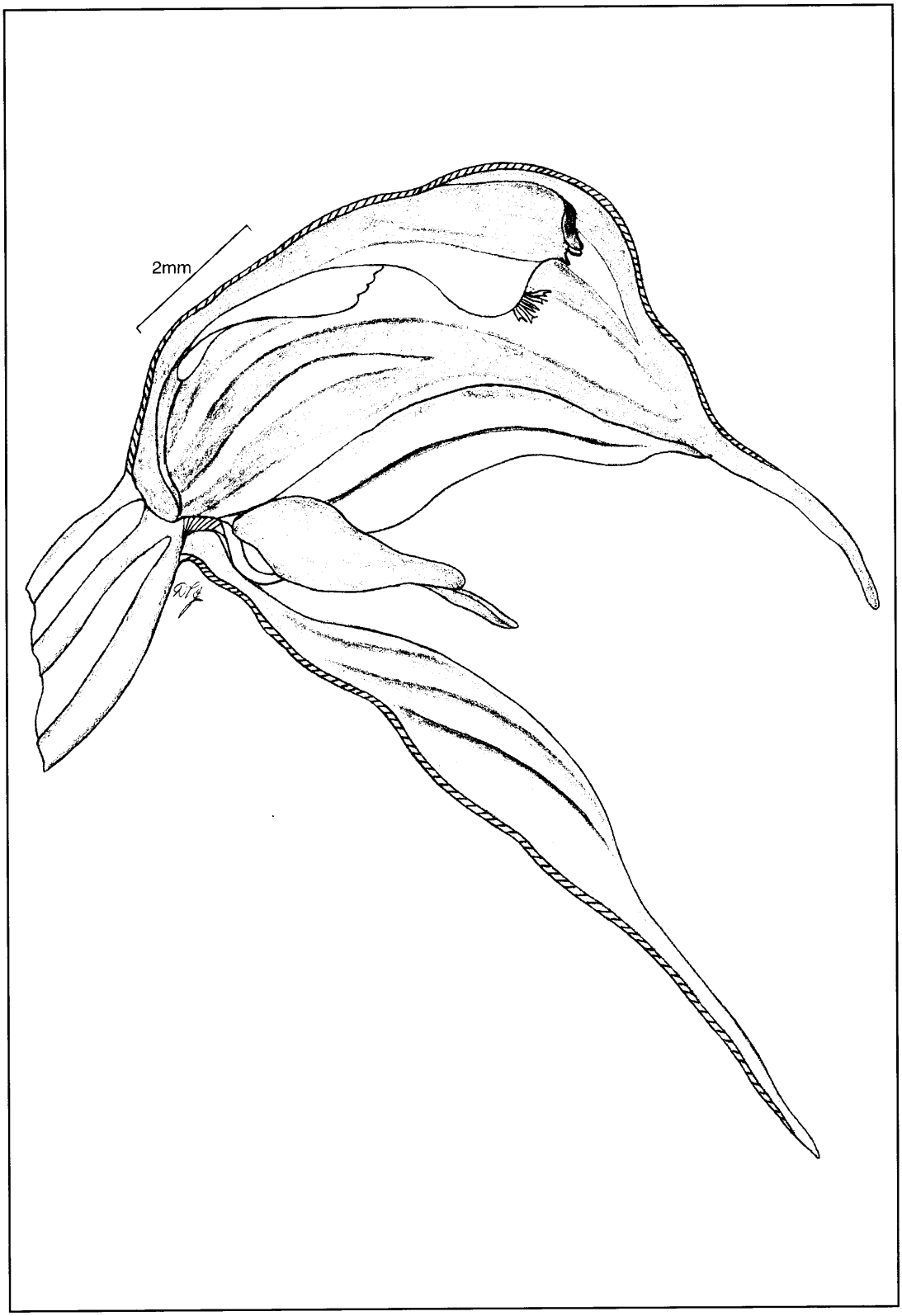

Fig. 2.20 Longitudinal section of flower of ***Pharochilum daintreanum*** (labellum in set position).

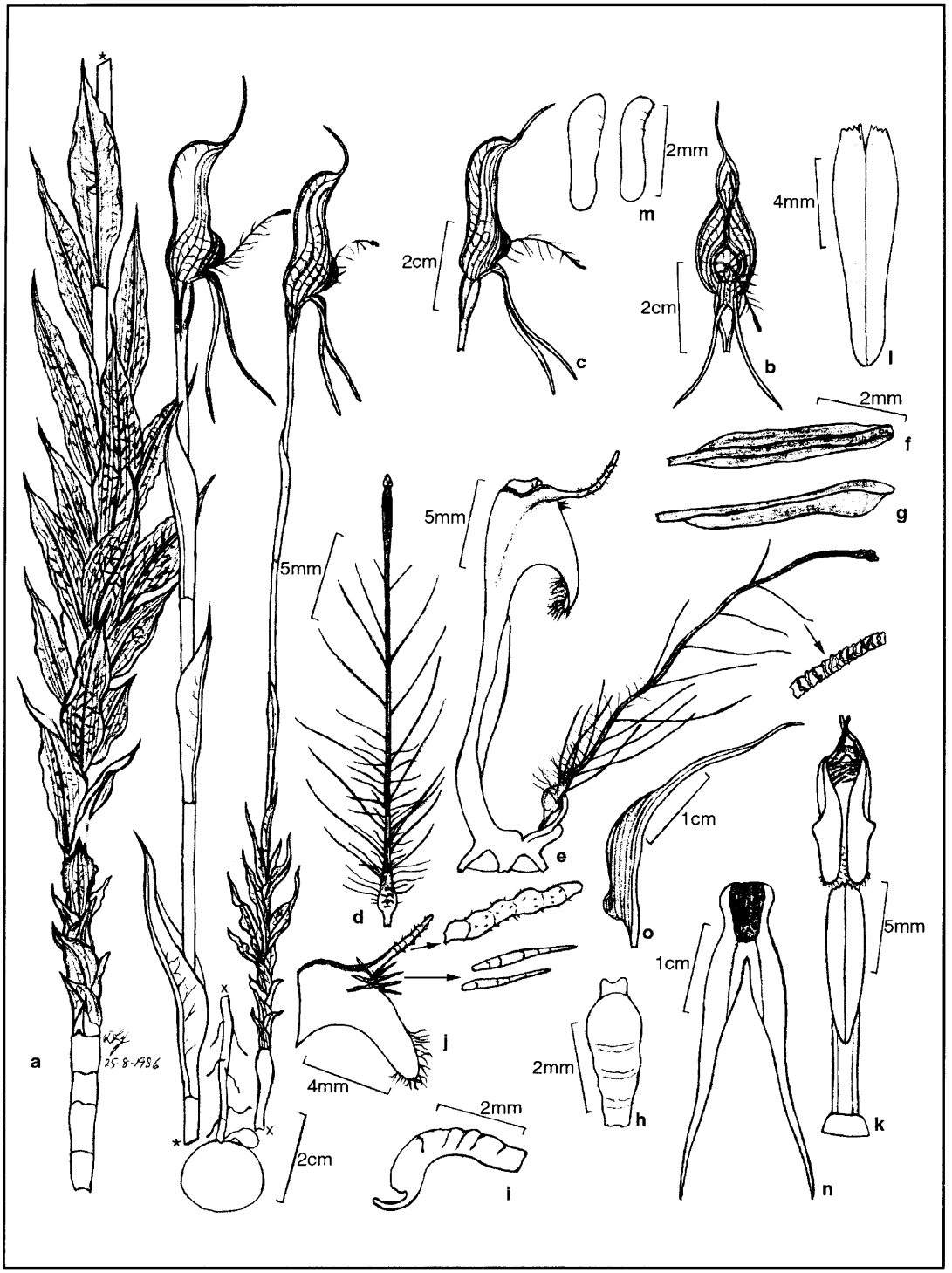

Fig. 2.21 ***Plumatichilos barbatum***, Carmel, WA, *D.Jones 2342*.
a. flowering plants; **b**. flower from front; **c**. flower from side; **d**. labellum from above, flattened out; **e**. column and labellum from side, with enlargement of part of labellum hair; **f**. labellum apical knob, from above; **g**. labellum apical knob, from side; **h**. labellum base, from above; **i**. labellum base, from side; **j**. interior view of column wing, with enlarged apical lobule and barrier trichomes; **k**. column from front; **l**. stigma; **m**. pollinia; **n**. synsepalum; **o**. petal.

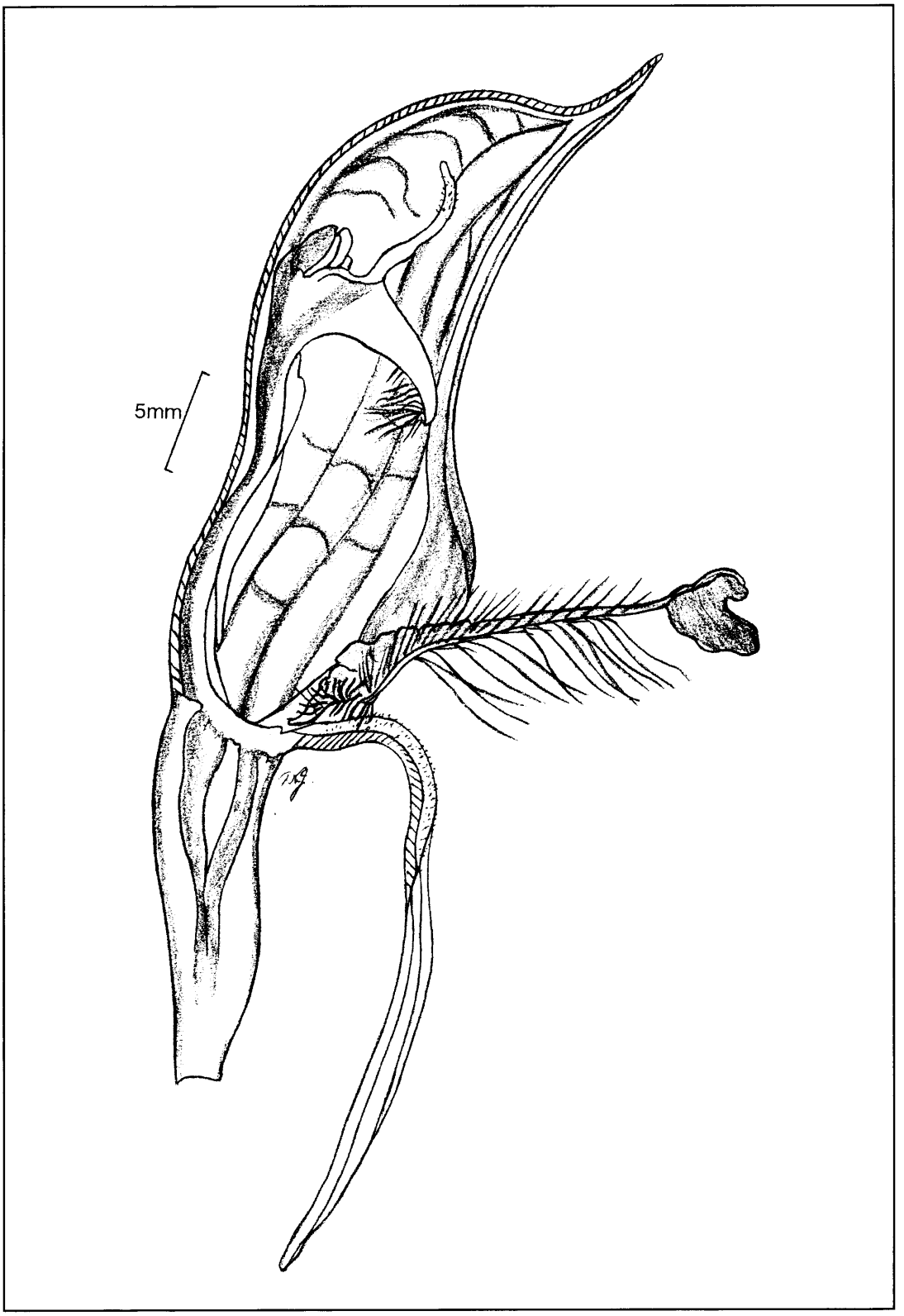

Fig. 2.22 Longitudinal section of flower of ***Plumatichilos barbatum*** (labellum in closed position).

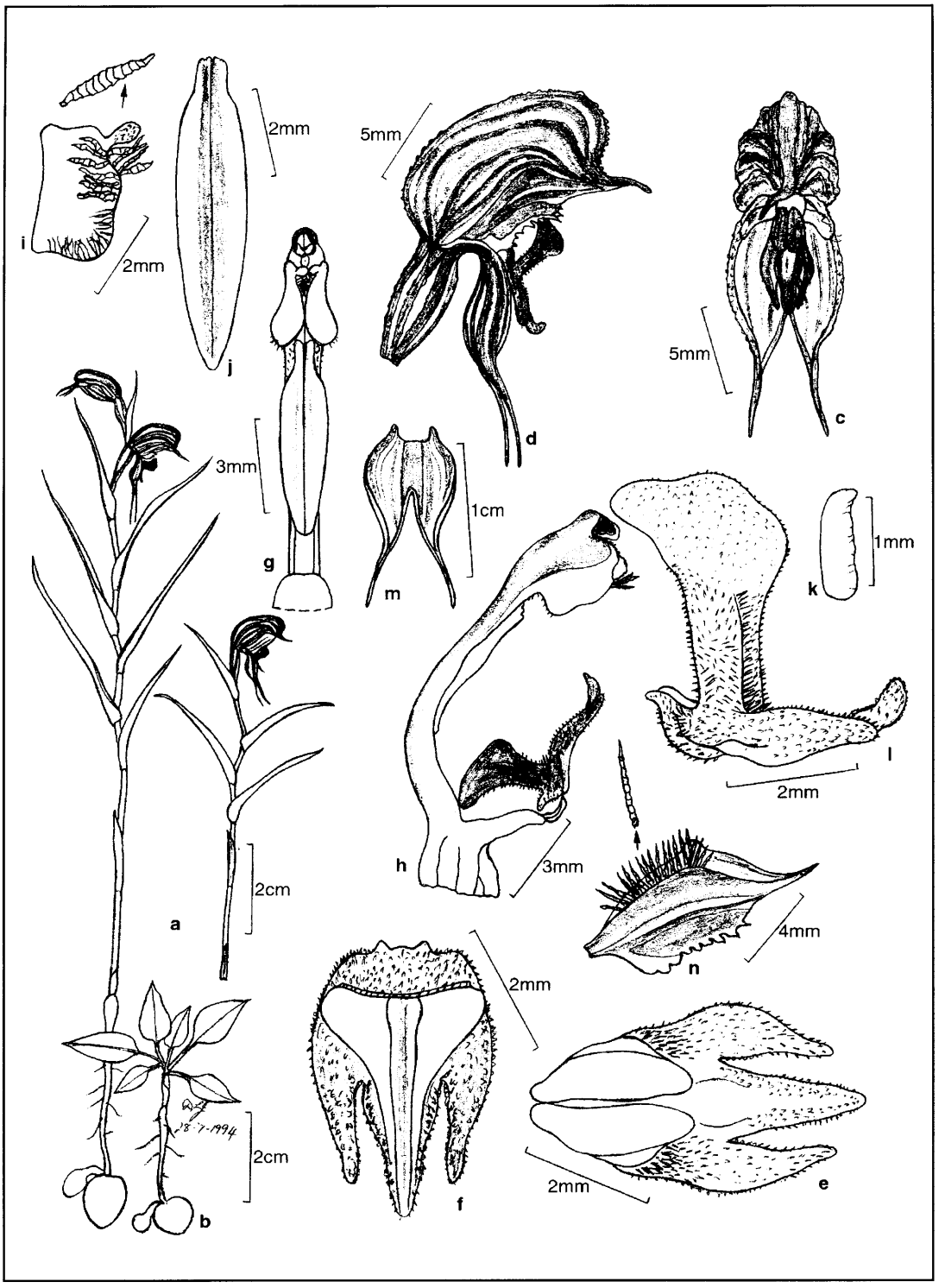

Fig. 2.23 ***Ranorchis sargentii***, Gunapin, WA, *C.French (Jones 13180).*
a. flowering plants; **b**. sterile plant (rosette); **c**. flower from front; **d**. flower from side; **e**. labellum from above; **f**. labellum from below; **g**. column from front; **h**. column and labellum from side; **i**. column wing, interior view with enlarged barrier trichome; **j**. stigma; **k**. pollinium; **l**. labellum from side; **m**. synsepalum; **n**. petal with enlarged petaline trichome.

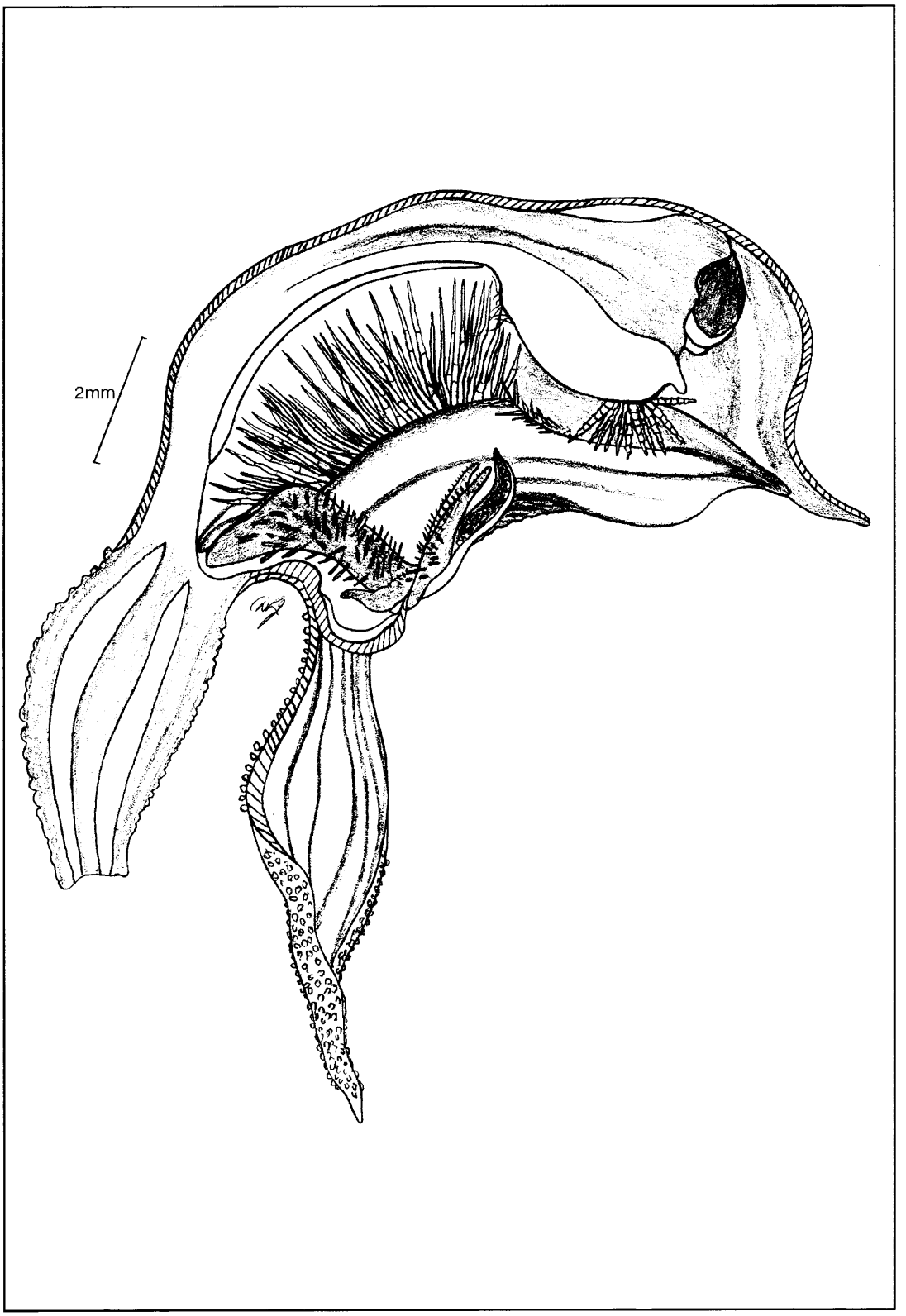

Fig. 2.24 Longitudinal section of flower of ***Ranorchis sargentii*** (labellum in closed position).

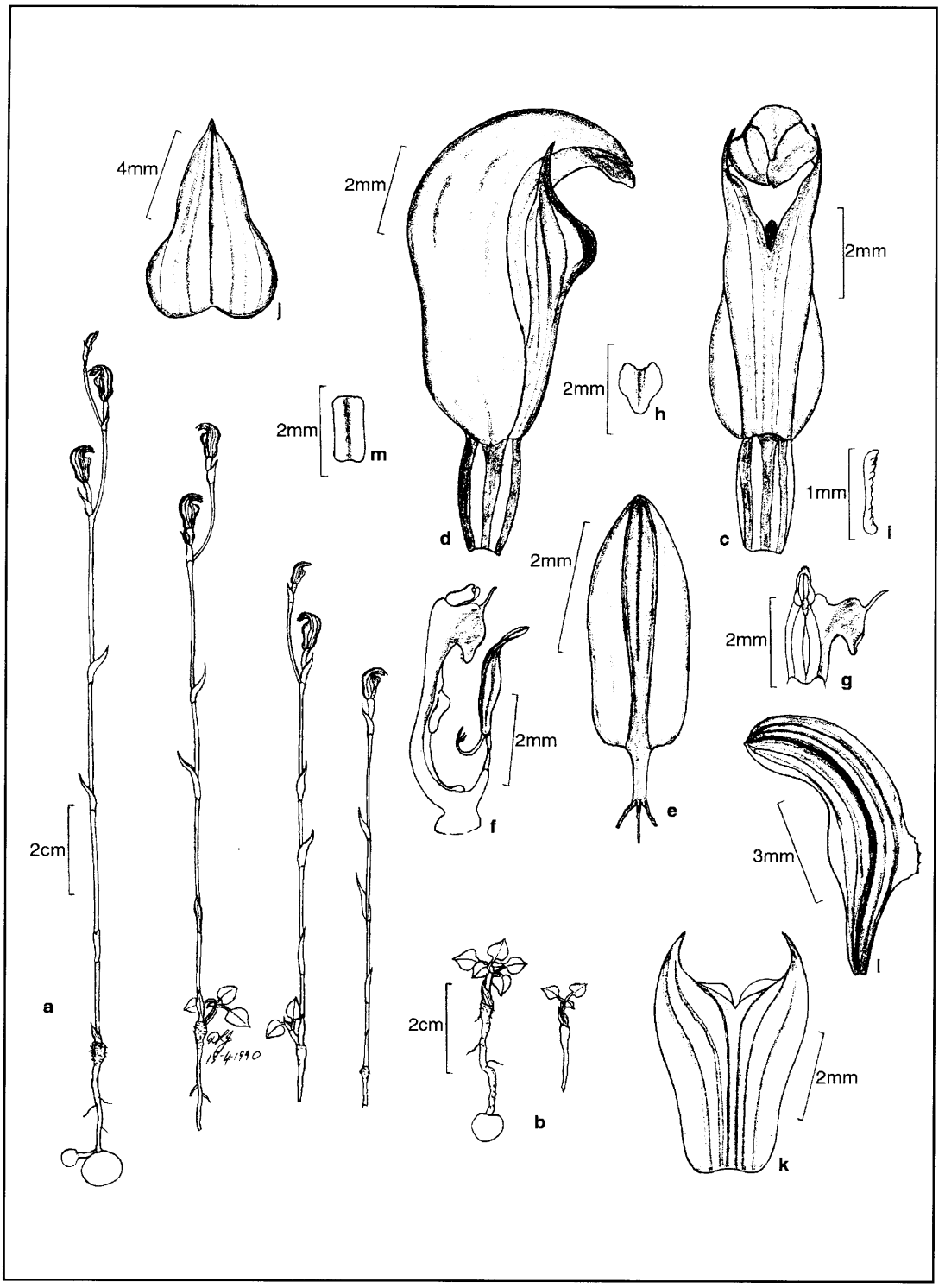

Fig. 2.25 ***Speculantha parviflora***, Manning Lookout, NSW, *D.Jones*.
a. flowering plants, two with lateral rosettes; **b**. sterile plants (rosette); **c**. flower from front; **d**. flower from side; **e**. labellum from above, flattened out; **f**. column and labellum from side; **g**. top of column and internal view of column wing; **h**. stigma; **i**. pollinium; **j**. dorsal sepal; **k**. synsepalum; **l**. petal; **m**. labellum hinge.

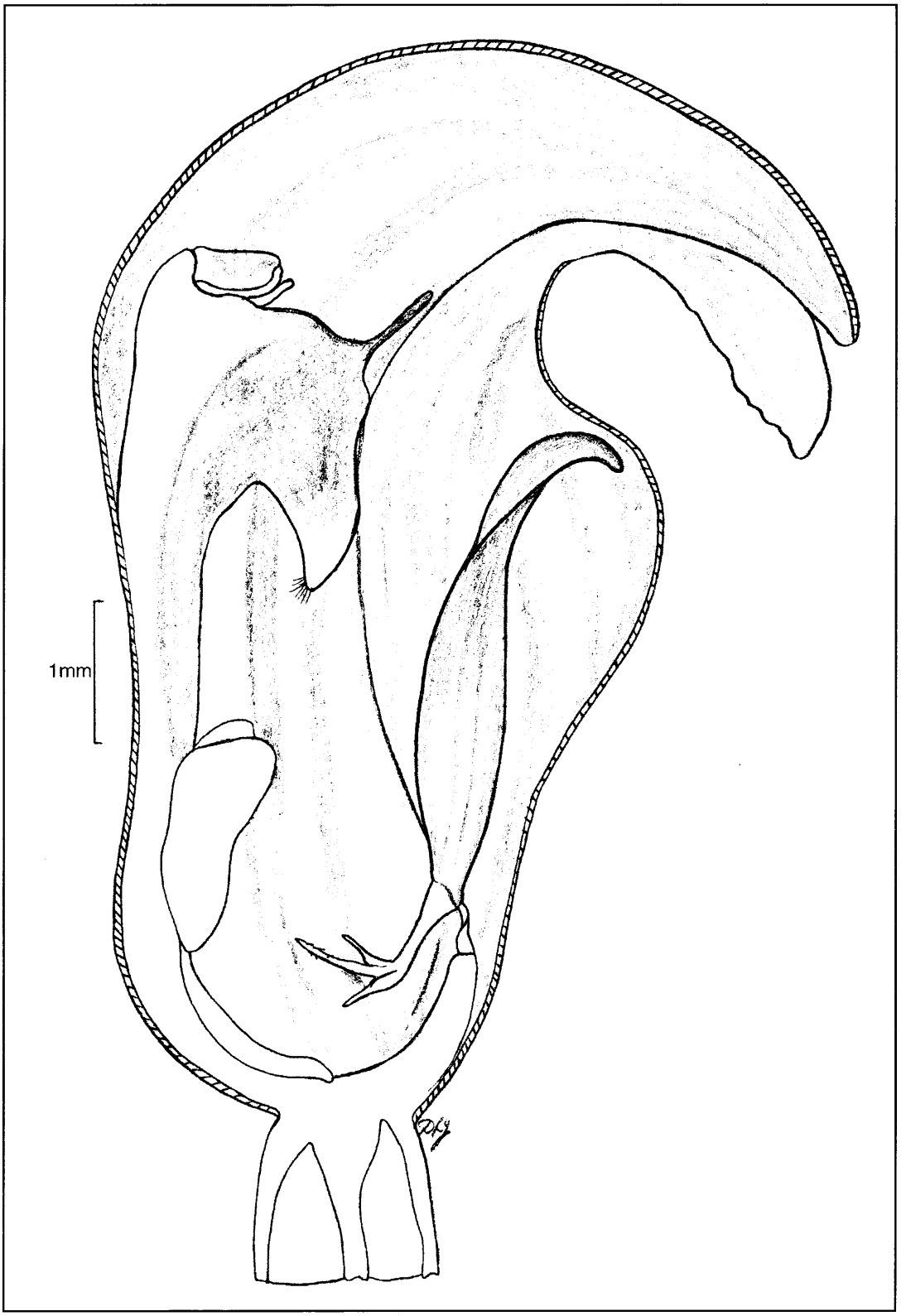

Fig. 2.26 Longitudinal section of flower of ***Speculantha parviflora*** (labellum in set position).

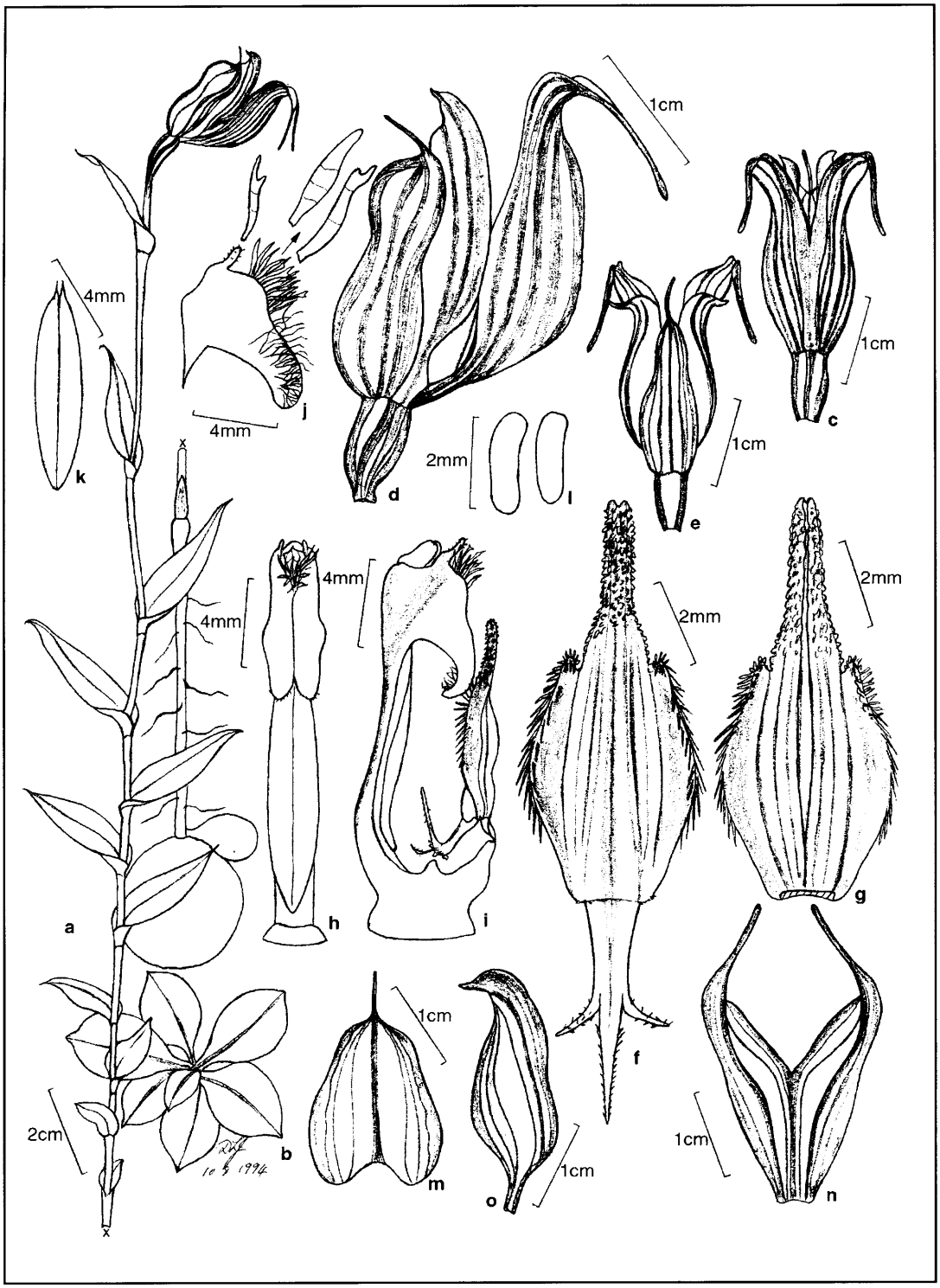

Fig. 2.27 ***Stamnorchis recurva***, Broke Inlet, WA, *C.French.*
a. flowering plant; **b**. sterile plant (rosette); **c**. flower from front; **d**. flower from side; **e**. flower from rear; **f**. labellum from above; **g**. labellum from below; **h**. column from front; **i**. column and labellum from side; **j**. column wing, interior view with enlarged barrier trichomes; **k**. stigma; **l**. pollinia; **m**. dorsal sepal; **n**. synsepalum; **o**. petal.

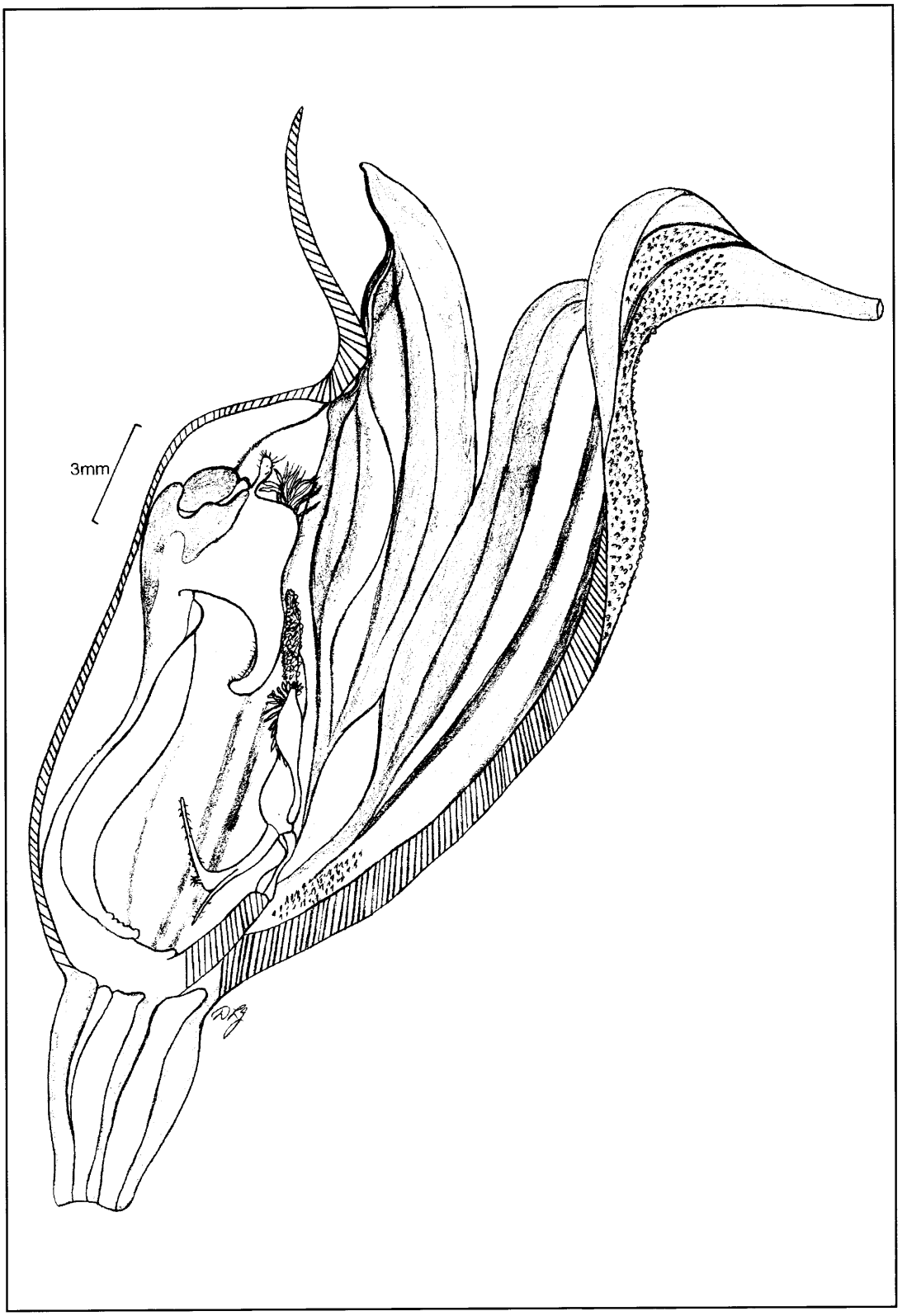

Fig. 2.28 Longitudinal section of flower of ***Stamnorchis recurva*** (labellum in closed position).

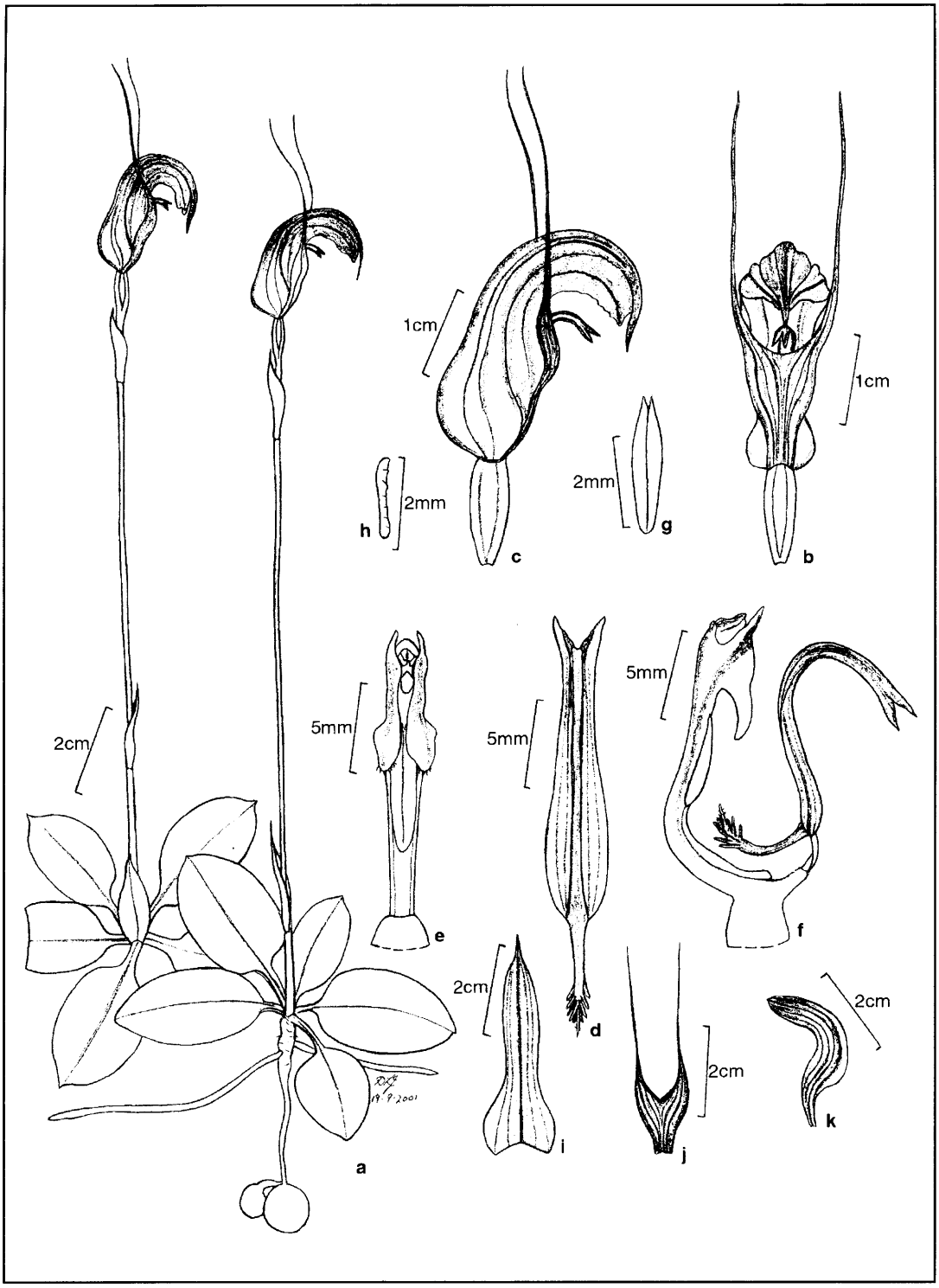

Fig. 2.29 ***Taurantha ophioglossa***, Castlereagh State Forest, NSW, *R.Tunstall*.
a. flowering plants; **b**. flower from front; **c**. flower from side; **d**. labellum from above, flattened out; **e**. column from front; **f**. column and labellum from side; **g**. stigma; **h**. pollinium; **i**. dorsal sepal; **j**. synsepalum; **k**. petal.

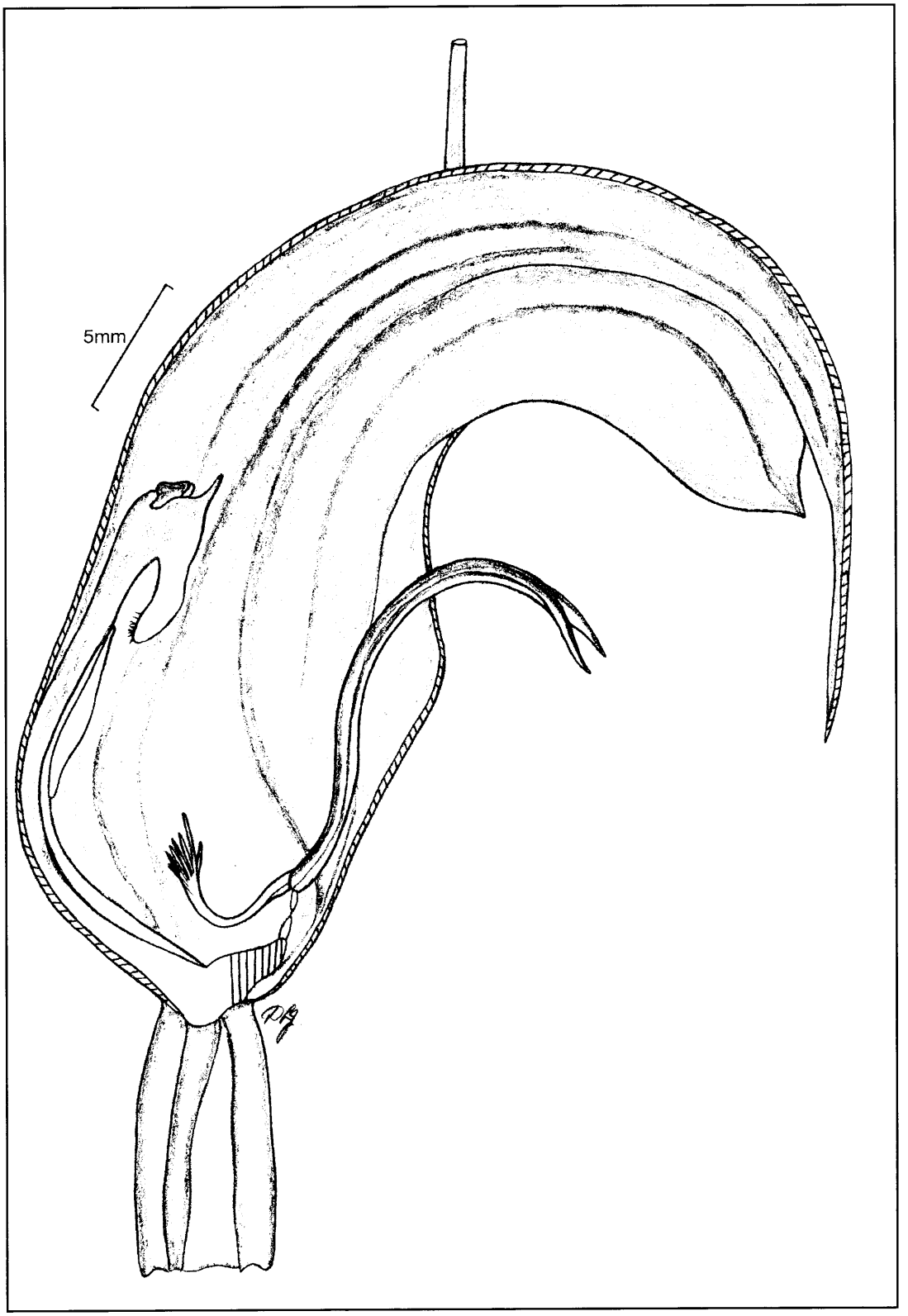

Fig. 2.30 Longitudinal section of flower of ***Taurantha ophioglossa*** (labellum in set position).

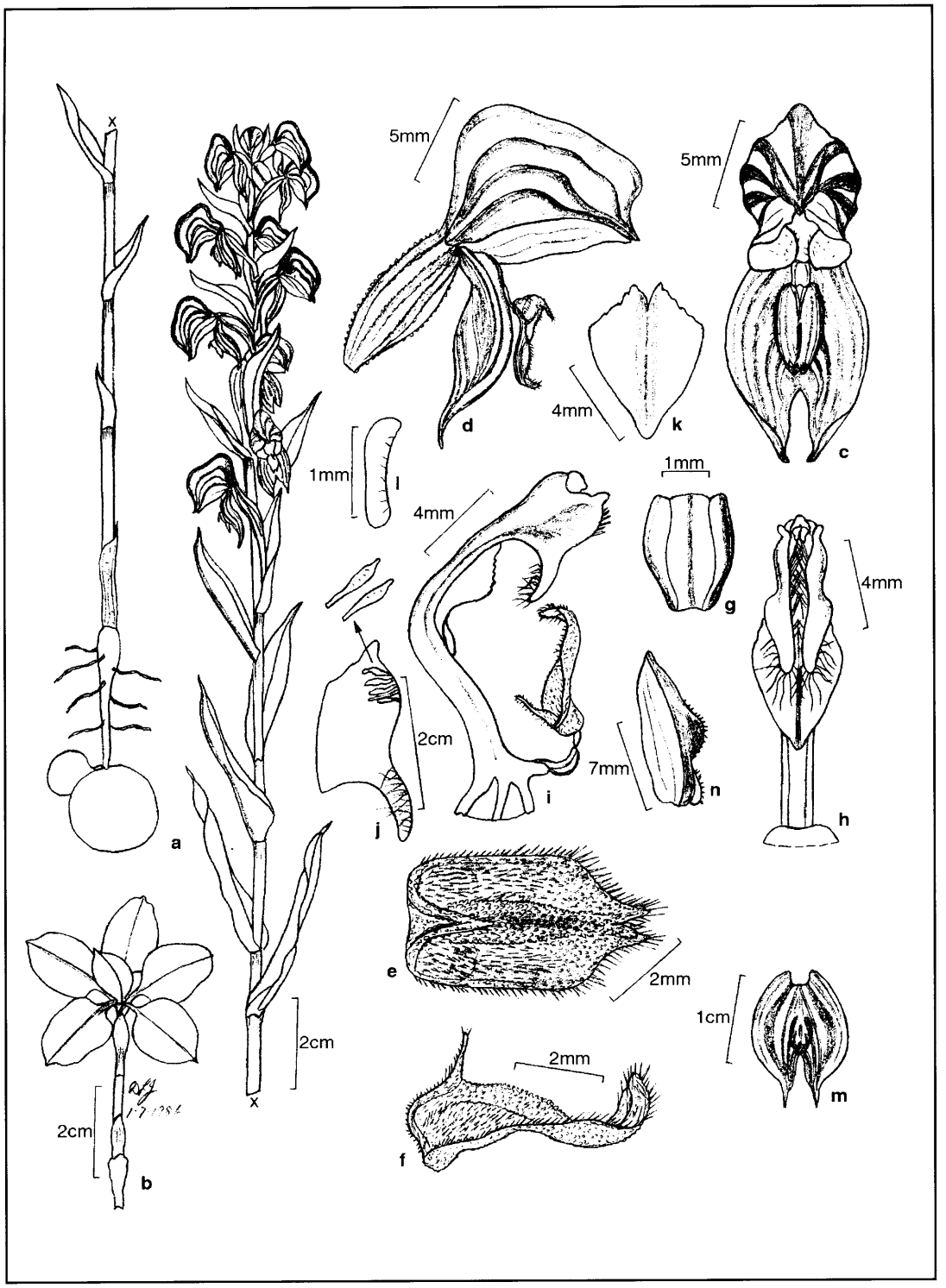

Fig. 2.31 ***Urochilus vittatus***, Albany, WA, *R.Heberle*.
a. flowering plant; **b**. sterile plant (rosette); **c**. flower from front; **d**. flower from side; **e**. labellum from above; **f**. labellum from side; **g**. labellum hinge; **h**. column from front; **i**. column and labellum from side; **j**. column wing, interior view with enlarged barrier trichomes; **k**. stigma; **l**. pollinium; **m**. synsepalum; **n**. petal.

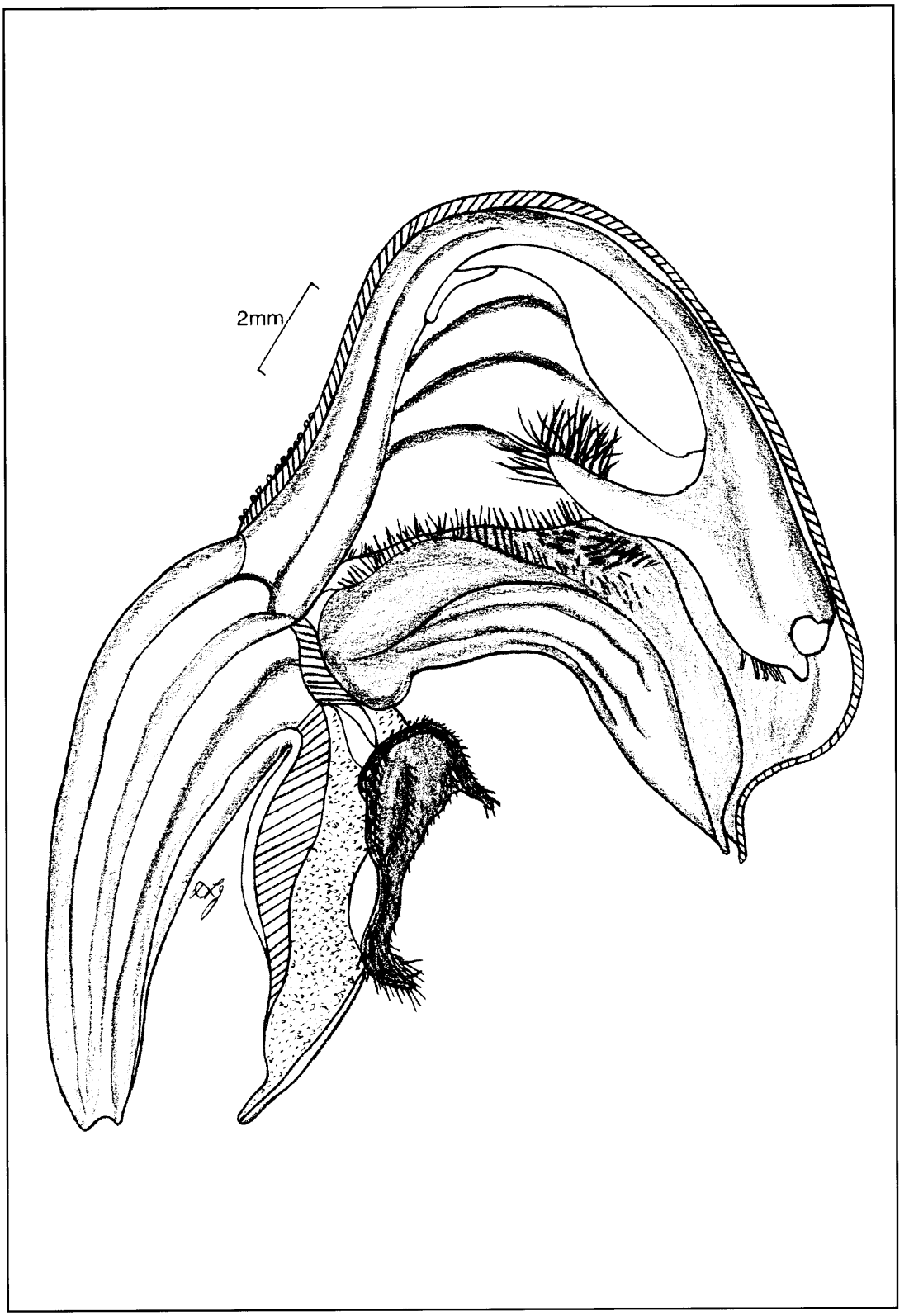

Fig. 2.32 Longitudinal section of flower of ***Urochilus vittatus*** (labellum in set position).

Table 2.1. Diagnostic features of Pterostylidinae

Character	*Pterostylis*	*Diplodium*	*Crangonorchis*	*Eremorchis*	*Taurantha*
Formation of clonal colonies	yes	yes	yes	yes	yes
Sterile and fertile plants	monomorphic	most species dimorphic; few monomorphic	monomorphic	monomorphic	mono-morphic
Rosette arrangement	basal	mostly separate; few basal	basal	basal	basal
Leaf attachment on rosette	petiolate and sessile	petiolate and sessile	petiolate	petiolate	petiolate
Flower number	one(two)	one(two)	one	one	one
Flower attitude	outward	outward	outward	outward	outward
Floral scent	none	none	none	none	none
Synsepalum attitude	erect	erect	erect	erect	erect
Synsepalum micropapillae	absent	absent	absent	absent	absent
Synsepalum pit	absent	absent	absent	absent	absent
Length of free points	long	long	long	long	long
Free point attitude	erect	erect	erect	erect	erect
Shape of free points	narrowly tapered; filiform-terete	filiform-terete	filiform-terete	filiform-terete	filiform-terete
Labellum exposure	partly	partly; rarely enclosed	enclosed	partly	partly
Labellum lobing	unlobed	unlobed	unlobed	unlobed	unlobed
Labellum setae	absent	absent	absent	absent	absent
Basal appendage	penicillate	penicillate	penicillate	penicillate	penicillate
Synsepalum lobule	absent	absent	absent	double	absent
Ridged floral veins	absent	absent	absent	absent	absent
Barrier trichomes	absent	absent	absent	absent	absent

Character	*Linguella*	*Speculantha*	*Petrorchis*	*Stamnorchis*	*Pharochilum*
Formation of clonal colonies	yes	no	no	no	no
Sterile and fertile plants	most species monomorphic; one dimorphic	dimorphic	dimorphic	dimorphic	dimorphic
Rosette arrangement	mostly separate; one basal	lateral	lateral	separate	lateral
Leaf attachment on rosette	petiolate and sessile	petiolate	petiolate	petiolate	petiolate
Flower number	one	multiple	multiple	multiple	multiple
Flower attitude	outward	inward	inward	outward	outward
Floral scent	none	semen	semen	none	none
Synsepalum attitude	erect	erect	erect	obliquely erect	obliquely deflexed
Synsepalum micropapillae	absent	absent	absent	absent	absent
Synsepalum pit	absent	absent	absent	absent	absent
Length of free points	long	short	short	long	short
Free point attitude	erect	erect	erect	recurved	obliquely deflexed
Shape of free points	filiform-terete	triangular	triangular	filiform-terete	filiform-terete
Labellum exposure	enclosed	partly enclosed	partly	enclosed	partly
Labellum lobing	unlobed	unlobed	unlobed	three-lobed	three-lobed
Labellum setae	absent	absent	absent	absent	absent
Basal appendage	penicillate	tripartite/ penicillate	tripartite	penicillate	absent
Synsepalum lobule	present	absent	absent	absent	absent
Ridged floral veins	absent	absent	absent	present	absent
Barrier trichomes	absent	absent	absent	present	present

Character	*Oligochaeto-chilus*	*Hymenochilus*	*Plumatichilos*	*Ranorchis*	*Bunochilus*	*Urochilus*
Formation of clonal colonies	no	no	no	no	no	no
Sterile and fertile plants	monomorphic	monomorphic	mono-morphic	dimorphic	dimorphic	dimorphic
Rosette arrangement	basal	basal	basal	separate	separate	separate
Leaf attachment on rosette	sessile	sessile	sessile	petiolate	petiolate	petiolate
Flower number	multiple	multiple	one	multiple	multiple	multiple
Flower attitude	outward	outward	outward	outward	outward	outward
Floral scent	none	none	none	none	none	none
Synsepalum attitude	deflexed	deflexed	deflexed	deflexed	deflexed	deflexed
Synsepalum micropapillae	absent	absent	absent	absent	present	present
Synsepalum pit	absent	absent	absent	absent	absent	present
Length of free points	short to long	short	long	long	short	short
Free point attitude	deflexed	deflexed	deflexed	deflexed	deflexed	deflexed
Shape of free points	filiform-terete	triangular	linear-oblong	filiform-terete	triangular	triangular
Labellum exposure	fully	fully	fully	fully	fully	fully
Labellum lobing	unlobed	unlobed	unlobed	three-lobed	three-lobed	three-lobed
Labellum setae	white/ moniliform	absent	yellow/ moniliform	absent	absent	absent
Basal appendage	absent	ligulate/ rostrate	sessile/ rostrate	tripartite	absent	caudate
Synsepalum lobule	absent	absent	absent	absent	absent	absent
Ridged floral veins	absent	absent	absent	absent	absent	absent
Barrier trichomes	present	present	present	present	present	present

3. A Synopsis of the Subtribe Pterostylidinae

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ABSTRACT

A synopsis of the new interpretation of the subtribe Pterostylidinae is presented, including nomenclatural details, typification, synonymy and distribution. Lectotypifications are made for *P. australis* Hook.f., *P. celans* Rupp, *P. clavigera* Fitzg., *P. emarginata* Colenso, *P. graminea* Hook.f., *P. mackibbinii* F.Muell., *P. micromega* Hook.f., *P. papuana* var. *seranica* J.J.Sm., *P. semirubra* F.Muell., *P. speciosa* Colenso and *P. vereenae* R.S.Rogers. *P. trullifolia* Hook.f. is relectotypified, the typification of *P. humilis* R.S.Rogers is clarified, *P. speciosa* Colenso is reduced to a synonym of *P. patens* Colenso, *P. papuana* var. *seranica* J.J.Sm. to a synonym of *P. novoguineensis* Ridley and *P. reflexa* var. *intermedia* Ewart to a synonym of *Diplodium striatum* (Fitzg.) D.L.Jones et M.A.Clem.

INTRODUCTION

As a result of the studies presented in the preceding two papers of this volume (Jones & Clements 2002a, Jones & Clements 2002b), and those of the *ad hoc* treatment of *Pterostylis* by Szlachetko (2001), taxonomic and nomenclatural changes have been made to the interpretation of most taxa within the subtribe Pterostylidinae. To reduce confusion as to the placement of taxa, a synopsis of the subtribe is presented here, and an index and summary table (Table 3.1) are provided for cross-referencing. Place of publication, typification, synonymy and distribution are presented alphabetically within genera or infrageneric groupings for all accepted taxa.

Abbreviations: NI (North Island); SI (South Island); ChI (Chatham Island); PKI (Poor Knights Island); StI (Stewart Island); Qld (Queensland); NSW (New South Wales); Vic (Victoria); Tas (Tasmania); SA (South Australia); WA (Western Australia); LHI (Lord Howe Island).

PTEROSTYLIDINAE Pfitzer, *Entwurf Anordn. Orch.* 97 (Jan.-April 1887) (as 'Pterostylideae'). Type: *Pterostylis* R.Br.

Pterostylideae (Pfitzer) P.Royen, *Alpine Fl. New Guinea* 2: 88-89 (1979).

Bunochilus

Bunochilus D.L.Jones et M.A.Clem., *Austral. Orch. Res.* 4: 66 (2002). Type species: *Bunochilus longifolius* (R.Br.) D.L.Jones et M.A.Clem. (*Pterostylis longifolia* R.Br.).

Oligochaetochilus D.L.Szlachetko subgen. *Apicuchilos* D.L.Szlachetko, *Polish Bot. J.* 46(1): 23 (2001), (*pro parte*). Type species: *Pterostylis vittata* Lindl.

sect. *Bunochilus*

Pterostylis R.Br. sect. *Squamatae* G. Don in Loudon's, *Hortus Brittanicus* 369 (1830). Lectotype species: *Bunochilus longifolius* (R.Br.) D.L.Jones et M.A.Clem. (*Pterostylis longifolia* R.Br.), *fide* Jones & Clements (2002).

Bunochilus longifolius (R.Br.) D.L.Jones et M.A.Clem., *Austral. Orch. Res.* 4: 66 (2002); *Pterostylis longifolia* R.Br., *Prod.* 327 (1810). Type: "(J.) D.Caley & Bauer *v.s.*" [New South Wales. Port Jackson, North Brush, June 1804, *G.Caley s.n.*] (lecto BM!, *fide* Clements 1989; isolecto AD!, W!). Dist: Australia (NSW).

Bunochilus melagrammus (D.L.Jones) D.L.Jones et M.A.Clem., *Austral. Orch. Res.* 4: 66 (2002); *Pterostylis melagramma* D.L.Jones, *Austral. Orch. Res.* 3: 145-146, fig. 7.6 (1998). Type: Tasmania. King Island, Pegarah, 4 Nov. 1991, *D.L.Jones 8461* (holo CANB!; iso AD!, BRI!, HO!, MEL!, NSW!). Dist: Australia (NSW, Vic, Tas, SA).

Bunochilus tunstallii (D.L.Jones et M.A. Clem.) D.L.Jones et M.A.Clem., *Austral. Orch. Res.* 4: 66 (2002); *Pterostylis tunstallii* D.L.Jones et M.A.Clem., *Austral. Orch. Res.* 1: 128 (1989). Type: New South Wales. Nowra-Braidwood road, 200 m N of Tomerong intersection, June 1987, *R.G.Tunstall 201* (holo CANB!). Dist: Australia (NSW, Vic, Tas).

Bunochilus williamsonii (D.L.Jones) D.L.Jones et M.A.Clem., *Austral. Orch. Res.* 4: 66 (2002); *Pterostylis williamsonii* D.L.Jones, *Austral. Orch. Res.* 3: 157-158, fig. 7.16 (1998). Type: Tasmania. Coles Bay, 25 July 1991, *Ron & Kath Williamson (Jones 7532)* (holo CANB!; iso HO!). Dist: Australia (Tas).

sect. *Smaragdyni* D.L.Jones et M.A.Clem., *Austral. Orch. Res.* 4: 67 (2002). Type species: *Bunochilus smaragdynus* (D.L.Jones et M.A.Clem.) D.L.Jones et M.A.Clem. (*Pterostylis smaragdyna* D.L.Jones et M.A.Clem.).

Bunochilus chlorogrammus (D.L.Jones et M. A.Clem.) D.L.Jones et M.A.Clem., *Austral. Orch. Res.* 4: 67 (2002). *Pterostylis chlorogramma* D.L.Jones et M.A.Clem., *Muelleria* 8(1): 78-79, fig.1j-m (1993). Type: Victoria. Near Grantville, 21 Aug. 1991, *G.Glare (Jones 7585)* (holo CANB!; iso MEL!). Dist: Australia (Vic, ?SA)

Bunochilus smaragdynus (D.L.Jones et M.A. Clem.) D.L.Jones et M.A.Clem., *Austral. Orch. Res.* 4: 67 (2002). *Pterostylis smaragdyna* D.L.Jones et M.A.Clem., *Muelleria* 8(1): 82-83, fig.1f-i (1993). Type: Victoria. Ironbark Road, Diamond Creek, 9 July 1987, *H.M.E.Richards 201* (holo CANB!; iso MEL!). Dist: Australia (Vic, SA).

Bunochilus stenochilus (D.L.Jones) D.L.Jones et M.A.Clem., *Austral. Orch. Res.* 4: 67 (2002); *Pterostylis stenochila* D.L.Jones, *Austral. Orch. Res.* 3: 153-154, fig. 7.12 (1998). Type: Tasmania. Brooks Bay, 22 Aug. 1992, *Wapstra (Jones 9918)* (holo CANB!; iso HO!). Dist: Australia (Tas).

Crangonorchis

Crangonorchis D.L.Jones et M.A.Clem., *Austral. Orch. Res.* 4: 67 (2002). Type species: *Crangonorchis pedoglossa* (Fitzg.) D.L.Jones et M.A.Clem. (*Pterostylis pedoglossa* Fitzg.).

Crangonorchis depauperata (F.M.Bailey) D.L.Jones et M.A.Clem., *Austral. Orch. Res.* 4: 67 (2002); *Pterostylis depauperata* F.M.Bailey, *Bot. Bull. Dept. Agric. Queensland* 4: 18 (1891). Type: Queensland. Near Cairns, 1890, *C.J.Wild s.n.* (lecto BRI!, *fide* Clements 1989). Dist: Australia (Qld).

Pterostylis carinata Dockr., *North Queensland Naturalist* 23(110): 4-5, fig. (1955). Type: Queensland. Ravenshoe District, North Queensland, 16 April 1954, *W.W.Abell & W.G. McPherson s.n.* (holo NSW!).

Crangonorchis pedoglossa (Fitzg.) D.L.Jones et M.A.Clem., *Austral. Orch. Res.* 4: 67 (2002); *Pterostylis pedoglossa* Fitzg., *Austral. orch.* 1(3): [t.5] (1877). Type: New South Wales. Long Bay, Sydney, June 1873, *R.D.FitzGerald s.n.* (lecto FitzGerald's plate, *fide* Clements 1989). Dist: Australia (Qld, NSW, Vic, Tas).

Diplodium

Diplodium Sw., *Ges. Naturf. Freunde Berlin Mag. Neuesten Entdeck. Gesammten Naturk* 4: 84 (July 1810). Type species: *Disperis alata* Labill.

Pterostylis R.Br. sect. *Foliosae* G.Don in Loudon's, *Hortus Brittanicus* 369 (1830). Lectotype species: *Pterostylis grandiflora* R.Br., *fide* Jones & Clements (2002).

Pterostylis R.Br. sect. *Alatae* Rchb.f., *Beitr. Syst. Planz.* 68-70 (1871). Lectotype species: *Pterostylis alata* (Labill.) Rchb.f., *fide* Jones & Clements (2002).

Pterostylis R.Br. sect. *Antennaea* Benth., *Flora Australiensis* 6: 353-354 (1873). Lectotype species: *Pterostylis grandiflora* R.Br., *fide* Jones & Clements (2002).

Pterostylis R.Br. sect. *Antennaea* Benth. ser. *Grandiflorae* Benth., *Flora Australiensis* 6: 353-354 (1873). Lectotype species: *Pterostylis grandiflora* R.Br., *fide* Jones & Clements (2002).

Diplodium abruptum (D.L.Jones) D.L.Jones et M.A.Clem., *Austral. Orch. Res.* 4: 70 (2002). *Pterostylis abrupta* D.L.Jones, *Orchadian* 8(6): 122-123, fig. (1985). Type: New South Wales. Barrington Tops, 20 Jan. 1985, *D.L.Jones 1798, A.Barton & T.D.Jones* (holo NSW!; iso BRI!, MEL!). Dist: Australia (NSW).

Diplodium aestivum (D.L.Jones) D.L.Jones et M.A.Clem., *Austral. Orch. Res.* 4: 70 (2002); *Pterostylis aestiva* D.L.Jones, *Muelleria* 2(3): 151-154, fig. 50 (1972). Type: Victoria. About 6 miles directly NNW of Wulgulmerang Post Office, NE Gippsland, 8 Jan. 1971, *A.C.Beauglehole 35911* (holo MEL!; iso K!, NSW!). Dist: Australia (NSW, ACT, Vic).

Diplodium alatum (Labill.) D.L.Jones et M.A.Clem., *Austral. Orch. Res.* 4: 70 (2002); *Disperis alata* Labill., Nov. Holl. pl. 2: 59-60, t. 210 (1806); *Pterostylis alata* (Labill.) Rchb.f, *Beitr. Syst. Pflanzenk.* 70 (1871). Type: "Habitat in capite Van-Diemen." [Tasmania], 1792, *Labillardière 33, 38* (syn FI!). Dist: Australia (Tas).

Diplodium australe Sw., *Ges. Naturf. Freunde Berlin Mag.* 4: 84 (1810).Type: "Habitat in capite Van-Diemen." [Tasmania], 1792, *Labillardière 33, 38* (syn FI!)

Pterostylis praecox Lindl., *Gen. sp. orchid. pl.* 388 (1840). Type: "Hab. In Tasmania, in saxetis siccis, Julio florens", [Tasmania. Circular Head, July 1837], *R.Gunn 751* (holo K-LINDL!; iso HO!, P!, W!).

Diplodium alobulum (Hatch) D.L.Jones, M.A. Clem. et Molloy, *Austral. Orch. Res.* 4: 70 (2002); *Pterostylis trullifolia* Hook.f. var. *alobula* Hatch, *Trans. & Proc. Roy. Soc. New Zealand* 77: 244, t. 30, fig. 3E-H (1949). Type: New Zealand. Laingholm, July 1945, *E.D.Hatch 566* (holo AK 24608!). Dist: New Zealand (NI, SI, TKI, PKI).

Diplodium alveatum (Garnet) D.L.Jones et M.A.Clem., *Austral. Orch. Res.* 4: 70 (2002); *Pterostylis alveata* Garnet, *Victorian Naturalist* 59: 91-94, fig. (1939). Type: Victoria. Snake Island, a small island off Corner Inlet, Wilsons Promontory, June 1939, *E.Rossiter* ex *J.R.Garnet* (holo MEL!; iso MEL!). Dist: Australia (NSW, Vic); New Zealand (SI).

Pterostylis crypta Nicholls, *Victorian Naturalist* 61: 207-208, fig. A-F (1948). Type: Victoria. "Hoddle Ranges, Toora, S.-East Victoria", May 1941, *R.Clark* ex *A.J.Tadgell* in herb. *W.H. Nicholls 1004, 1031* (holo MEL!).

Diplodium angustum (A.S.George) D.L.Jones et M.A.Clem., *Austral. Orch. Res.* 4: 70 (2002); *Pterostylis angusta* A.S.George, *Nuytsia* 1(2): 164, fig. 4 (1971). Type: Western Australia. West of Mt Trio, Stirling Range, 2 Aug. 1969, *A.S.George 9480* (holo PERTH!; iso K!, MEL!, NSW!). Dist: Australia (WA).

Diplodium aquilonium (D.L.Jones et B.Gray) D.L.Jones et M.A.Clem., *Austral. Orch. Res.* 4: 70 (2002); *Pterostylis aquilonia* D.L.Jones et B.Gray, *Orchadian* 12(6): 246-247, fig. (1997). Type: Queensland. Cook District; Herberton Range, 22 May 1990, *B.Gray 5193* (holo CANB!). Dist: Australia (Qld).

Diplodium asperum (D.L.Jones et M.A.Clem.) D.L.Jones et M.A.Clem., *Austral. Orch. Res.* 4: 70 (2002); *Pterostylis aspera* D.L.Jones et M.A.Clem., *Austral. Orch. Res.* 1: 120 (1989). Type: Western Australia. Eaton, NE of Bunbury, 26 June 1977, *A.S.George 14606* (holo PERTH!; iso CANB!). Dist: Australia (WA).

Diplodium atrans (D.L.Jones) D.L.Jones et M.A.Clem., *Austral. Orch. Res.* 4: 70 (2002); *Pterostylis atrans* D.L.Jones, *Muelleria* 8(2): 185-186, fig. 3a-d (1994). Type: Australian Capital Territory. Brindabella Ranges, c. 4.3 km along Bendora Dam Road from Bulls Head, 22 Feb. 1992, *D.L.Jones 9092 & B.E.Jones* (holo CANB!; iso MEL!, NSW!, HO!). Dist: Australia (NSW, ACT, Vic, Tas).

Diplodium brumalis (L.B.Moore) D.L.Jones, M.A.Clem. et Molloy, *Austral. Orch. Res.* 4: 70 (2002). *Pterostylis brumalis* L.B.Moore, *New Zealand J. Bot.* 6: 485 (1969). Type: New Zealand. Laingholm near Auckland, 20 June 1966, *E.D.Hatch s.n.* (holo CHR 177314!). Dist. New Zealand (NI).

[*Pterostylis rubella auct. non* Colenso: Hatch, *Trans. & Proc. Roy. Soc. New Zealand* 77: 244 (1949).]

[*Pterostylis trullifolia* Hook.f. var. *rubella sensu* Hatch, *Trans. & Proc. Roy. Soc. New Zealand* 77: 244 (1949).]

Diplodium bryophilum (D.L.Jones) D.L.Jones et M.A.Clem., *Austral. Orch. Res.* 4: 70 (2002); *Pterostylis bryophila* D.L.Jones, *Orchadian* 12(4): 180-184, fig. (1997). Type: South Australia. Hindmarsh Valley Reservoir, 19 May 1995, *D.E.Murfet 2183a* (holo CANB!; iso AD!). Dist. Australia (SA).

Diplodium coccinum (Fitzg.) D.L.Jones et M.A.Clem., *Austral. Orch. Res.* 4: 71 (2002); *Pterostylis coccina* Fitzg., *Austral. orch.* 1(4): [t. 3] (1878). Type: New South Wales. On a swampy talus at the base Hassans Walls, Bowenfels, and also from Guy Faux pass, near Grafton, Feb., *R.D.FitzGerald s.n.* (lecto FitzGerald's plate, *fide* Clements 1989). Dist. Australia (NSW, ACT, Vic).

Diplodium decurvum (R.S.Rogers) D.L.Jones et M.A.Clem., *Austral. Orch. Res.* 4: 71 (2002); *Pterostylis decurva* R.S.Rogers, *Trans. & Proc. Roy. Soc. South Australia* 47: 339-340, t. 27 (1923). Type: Victoria. Fern-tree Gully, 20 Nov. 1920, *E.E.Pescott & A.N.Burns* (lecto AD!, *fide* Clements 1989). Dist: Australia (NSW, ACT, Vic, Tas).

Diplodium dolichochilum (D.L.Jones et M.A. Clem.) D.L.Jones et M.A.Clem., *Austral. Orch. Res.* 4: 71 (2002); *Pterostylis dolichochila* D.L.Jones et M.A.Clem. in Jessop & Toelken, *Fl. S. Austral.* Part IV: 2117-2118, fig. 982B (1986). Type: South Australia. 20 km E of Bowhill, 10 June 1981, *R.Bates 959* (holo AD!; iso AD!, BRI!, CANB!). Dist: Australia (Vic, SA).

Diplodium elegans (D.L.Jones) D.L.Jones et M.A.Clem., *Austral. Orch. Res.* 4: 71 (2002); *Pterostylis elegans* D.L.Jones, *Orchadian* 12 (6): 247-248, fig. (1997). Type: New South Wales. Northern Tablelands, near New Country Swamp, Enfield State Forest, 31 March 1997, *P.Metcalfe (ORG 688)* (holo CANB!; iso BRI!, MEL!, NSW!). Dist: Australia (NSW).

Diplodium erythroconcha (M.A.Clem. et D.L.Jones) D.L.Jones et M.A.Clem., *Austral. Orch. Res.* 4: 71 (2002); *Pterostylis erythroconcha* M.A.Clem. et D.L.Jones in Jessop & Toelken, *Fl. S. Austral.* Part IV: 2118, fig. 983 (1986). Type: South Australia.

Corny Point, 9 Aug. 1956, *H.Goldsack 683* (holo AD!; iso BRI!, CANB!). Dist: Australia (SA).

Diplodium fischii (Nicholls) D.L.Jones et M.A. Clem., *Austral. Orch. Res.* 4: 71 (2002); *Pterostylis fischii* Nicholls, *Victorian Naturalist* 67: 45-46, fig. A-J (1950). Type: Victoria. Woodside, 30 May 1950, *P.Fisch s.n.* (holo MEL!). Dist: Australia (Qld, NSW, ACT, Vic).

Diplodium grandiflorum (R.Br.) D.L.Jones et M.A.Clem., *Austral. Orch. Res.* 4: 71 (2002); *Pterostylis grandiflora* R.Br., *Prod.* 327 (1810). Type: "(J.) D.Bauer & Caley *v.s.*" [New South Wales. Port Jackson, 1804, *F.Bauer s.n.*] (lecto BM!, *fide* Clements 1989). Dist: Australia (Qld, NSW, Vic, Tas).

Diplodium hamiltonii (Nicholls) D.L.Jones et M.A.Clem., *Austral. Orch. Res.* 4: 71 (2002); *Pterostylis hamiltonii* Nicholls, *Victorian Naturalist* 50: 89-91, fig. D-G (1933). Type: Western Australia. Boyup Brook, June-July 1927-1930, *E.Corker s.n.* (syn MEL!, PERTH). Dist: Australia (WA).

Diplodium hians (D.L.Jones) D.L.Jones et M. A.Clem., *Austral. Orch. Res.* 4: 71 (2002); *Pterostylis hians* D.L.Jones, *Orchadian* 12(4): 185-187, fig. (1997). Type: New South Wales. Near Manyana, 3 March 1989, *D.L.Jones 3757 & R.Tunstall* (holo CANB!). Dist: Australia (NSW).

Diplodium laxum (Blackmore) D.L.Jones et M. A.Clem., *Austral. Orch. Res.* 4: 71 (2002); *Pterostylis laxa* Blackmore, *Orchadian* 3: 2-4, fig. (1968). Type: New South Wales. Upper Grose Valley, 10 March 1962, *J.A.P.Blackmore s.n.* (holo NSW!; iso BRI!, MEL!, P!). Dist: Australia (NSW, ACT, Vic).

Diplodium longicurvum (Rupp) D.L.Jones et M.A.Clem., *Austral. Orch. Res.* 4: 71 (2002); *Pterostylis longicurva* Rupp, *Contr. New South Wales Natl. Herb.* 1(3): 125, fig. 3a-c (1941). Type: New South Wales. Nandewar Range, near the Horton Falls, Barraba District, April 1914, *H.M.R.Rupp s.n.* (holo NSW!; iso NSW!). Dist: Australia (Qld, NSW).

Diplodium longipetalum (Rupp) D.L.Jones et M.A.Clem., *Austral. Orch. Res.* 4: 71 (2002); *Pterostylis longipetala* Rupp, *Proc. Linn. Soc. New South Wales* 68: 9 (1943). Type: New South Wales. Bateman's Bay, June 1931, *E. Nubling s.n.* (holo NSW!). Dist: Australia (NSW, Vic).

Diplodium metcalfei (D.L.Jones) D.L.Jones et M.A.Clem., *Austral. Orch. Res.* 4: 71 (2002); *Pterostylis metcalfei* D.L.Jones, *Orchadian* 12(6): 248-250, fig. (1997). Type: New South Wales. Northern Tablelands; Doughboy Mountain, c. 10 km S of Wongwibindi, on the road to Wollomombi, 8 May 1994, *P.Metcalfe (D.L.Jones 12996)* (holo CANB!; iso AD!, MEL!, NSW!). Dist: Australia (NSW).

Diplodium obtusum (R.Br.) D.L.Jones et M.A. Clem., *Austral. Orch. Res.* 4: 71 (2002); *Pterostylis obtusa* R.Br., *Prod.* 327 (1810). Type: "(J.) v.v." [New South Wales. Port Jackson, 1804, *R.Brown s.n.*] (lecto BM!, *fide* Clements 1989; isolecto BM!, E!, FI!, P!, W!). Dist: Australia (NSW, LHI).

Diplodium pulchellum (Messmer) D.L.Jones et M.A.Clem., *Austral. Orch. Res.* 4: 71 (2002); *Pterostylis pulchella* Messmer, *Proc. Linn. Soc. New South Wales* 58: 429-430, fig. 1-10 (1933). Type: New South Wales. Growing on rocks in the moist shade of the gorge of Fitzroy Falls, 1933, *P.Messmer s.n.* (holo NSW!). Dist: Australia (NSW).

Diplodium reflexum (R.Br.) D.L.Jones et M.A. Clem., *Austral. Orch. Res.* 4: 71 (2002); *Pterostylis reflexa* R.Br., *Prod.* 327 (1810). Type: "(J.) v.v." [New South Wales. Port Jackson, 1803, *R.Brown s.n.*] (lecto BM!, *fide* Clements 1989). Dist: Australia (NSW).

Diplodium revolutum (R.Br.) D.L.Jones et M. A.Clem., *Austral. Orch. Res.* 4: 71 (2002); *Pterostylis revoluta* R.Br., *Prod.* 327 (1810). Type: "(J.) v.v." [New South Wales. Port Jackson, 1803, *R.Brown s.n.*] (lecto BM!, *fide* Clements 1989; isolecto AD!, BM!, FI!, K!, P!, W!). Dist: Australia (Qld, NSW, ACT, Vic).

Pterostylis speciosa T.E.Hunt, *Queensland Naturalist* 16: 7-9, fig. (1958), *non* Colenso (1890). Type: Queensland. Moreton District, Stradbroke Island between Dunwich and Myora, 4 April 1958, *W.Bristow & T.E.Hunt s.n.* (holo BRI!).

Diplodium robustum (R.S.Rogers) D.L.Jones et M.A.Clem., *Austral. Orch. Res.* 4: 71 (2002); *Pterostylis robusta* R.S.Rogers, *Trans. & Proc. Roy. Soc. South Australia* 51: 296-297 (1927);

Pterostylis scabra Lindl. var. *robusta* (R.S.Rogers) A.S.George, *Nuytsia* 1(2): 191 (1971); *Pterostylis alata* (Labill.) Rchb.f. var. *robusta* (R.S.Rogers) J.Weber et R.Bates, *Fl. S. Austral.* ed.3, 1:437 (1978), *nom. illeg.* Type: South Australia. National Park, Belair, 28 May 1905, *R.S.Rogers s.n.* (lecto AD!, *fide* George 1971). Dist: Australia (NSW, Vic, SA).

Pterostylis praecox Lindl.var. *robusta* Ewart, *Proc. Roy. Soc. Victoria* (new ser.) 28(1): 234, *in obs.* (1916); *Pterostylis alata* (Labill.) Rchb.f. var.

robusta (Ewart) Tovey et P.Morris, *Proc. Roy. Soc. Victoria* (new ser.) 35(1): 87 (1922). Type: South Australia. Encounter Bay, 1896, *Hussey s.n.* (holo MEL).

Diplodium rogersii (E.Coleman) D.L.Jones et M.A.Clem., *Austral. Orch. Res.* 4: 71 (2002). *Pterostylis rogersii* E.Coleman, *Victorian Naturalist* 46: 100-101, t.5 (1929). Type: Western Australia. Busselton, June 1928 and July 1929, *E.Bryant s.n.* (lecto MEL!, *fide* George 1971). Dist: Australia (WA).

Diplodium russellii (T.E.Hunt) D.L.Jones et M.A.Clem., *Austral. Orch. Res.* 4: 71 (2002); *Pterostylis russellii* T.E.Hunt, *Orchid J.*, 1(1): 42, fig. 1 (1952). Type: cult. Brisbane, Aug. 1984, *T.E.Hunt 189* ex Queensland: Moreton District, Cedar Creek, Aug. 1944, *A.J.Russell & T.E.Hunt s.n.* (lecto BRI!, *fide* Clements 1989; isolecto MEL!, NSW!). Dist: Australia (Qld, NSW).

Diplodium scabrum (Lindl.) D.L.Jones et M. A.Clem., *Austral. Orch. Res.* 4: 71 (2002); *Pterostylis scabra* Lindl. in Edwards', *Bot. Reg.* 1-23: *Swan Riv. Append.* liii (1840). Type: Western Australia. Swan River, 1839, *J. Drummond* [*847*] (holo K-LINDL!; iso K!, W!). Dist: Australia (WA).

Pterostylis constricta O.Sarg., *J. Western Australian Nat. Hist.* Soc. 2(4): 24-25 (1907); *Pterostylis reflexa* R.Br. var. *constricta* (O.Sarg.) Ewart, White et Tovey, *Trans. Roy. Soc. New South Wales* 42: 193 (1908). Type: Western Australia. Kindelans Road, near York, 21 July 1907, *O.H.Sargent s.n.* (lecto PERTH!, *fide* George 1971).

Diplodium scoliosum (D.L.Jones) D.L.Jones et M.A.Clem., *Austral. Orch. Res.* 4: 71 (2002); *Pterostylis scoliosa* D.L.Jones, *Orchadian* 12(6): 250-251, fig. (1997). Type: Queensland. Morton District; Cabbage Tree Range Rd., Brisbane Forest Park, 30 April 1990, *R.Crane 410* (holo CANB!; iso AD!, MEL!, NSW!). Dist: Australia (Qld).

Diplodium striatum (Fitzg.) D.L.Jones et M.A.Clem., *Austral. Orch. Res.* 4: 71 (2002); *Pterostylis striata* Fitzg., *Austral. orch.* 1(3): [t.5] (1877). Type: New South Wales. Yass, May [1876], *S.A.Fox s.n.* (lecto FitzGerald's plate, *fide* Clements 1989). Dist: Australia (NSW, Vic, ?SA).

Pterostylis reflexa R.Br. var. *intermedia* Ewart, *Proc. Roy. Soc. Victoria* (new ser.) 20(1): 84-85 (1907). Type: Victoria. Mentone, June 1907, *J.R.Tovey & C.French s.n.* (lecto MEL!, *fide* Clements 1989). ***syn. nov.***

Diplodium tenuissimum (Nicholls) D.L.Jones et M.A.Clem., *Austral. Orch. Res.* 4: 72 (2002); *Pterostylis tenuissima* Nicholls, *Victorian Naturalist* 67: 46-48, fig. K-P (1950). Type: Victoria. Nelson, far SW Victoria, Oct. 1946, *A.C.Beauglehole s.n.* (holo MEL!). Dist: Australia (Vic, SA).

Diplodium torquatum (D.L.Jones) D.L.Jones et M.A.Clem., *Austral. Orch. Res.* 4: 72 (2002); *Pterostylis torquata* D.L.Jones, *Orchadian* 12(6): 251-258, fig. (1997). Type: New South Wales. Northern Tablelands; c. 2.6 km NW of Backwater, 4 May 1994, *D.L.Jones 12956 & B.E.Jones* (holo CANB!; iso BRI!, MEL!, NSW!). Dist: Australia (NSW).

Diplodium trullifolium (Hook.f.) D.L.Jones, M. A.Clem. et Molloy, *Austral. Orch. Res.* 4: 72 (2002); *Pterostylis trullifolia* Hook.f., *Fl. nov.-zel.* 1: 249 (1853). Type: New Zealand. "Northern Island. Bay of Islands, *Edgerley*, *Colenso, etc.* Auckland, *Sinclair*" (lecto *Colenso* plant labelled (a) K!, here designated); Notes: Relecto-typification was necessary because the type chosen by George is a mixed collection of two species. Accordingly, in this second lecto-typification, we have chosen a single specimen that will preserve the current usage of the name *P. trullifolia*. Dist: New Zealand (NI, SI).

Pterostylis rubella Colenso, *Trans. & Proc. New Zealand Inst.* 18: 271 (1886); *Pterostylis trullifolia* Hook.f. var. *rubella* (Colenso) Cheesem., *Trans. & Proc. New Zealand Inst.* 47: 46 (1915). Type: New Zealand. Whangaroa, County of Mangonui, 1884, *R.W.Rawson s.n.* (holo WELT!, *fide* Moore 1968).

Pterostylis trullifolia Hook.f. var. *gracilis* Cheesem., *Trans. & Proc. New Zealand Inst.* 47: 46 (1915). Types: [New Zealand.] North Island: Vicinity of Auckland, Waitakarei, and Hunua Ranges, *T.F.Cheeseman s.n.* (lecto K!, *fide* Moore & Edgar 1970).

Diplodium truncatum (Fitzg.) D.L.Jones et M. A.Clem., *Austral. Orch. Res.* 4: 72 (2002); *Pterostylis truncata* Fitzg., *Austral. orch.* 1(4): [t.3] (1878). Type: New South Wales. Mittagong, April, *E.Daintrey s.n.* (lecto FitzGerald's plate, *fide* Clements 1989). Dist: Australia (NSW, Vic).

Eremorchis

Eremorchis D.L.Jones et M.A.Clem., *Austral. Orch. Res.* 4: 72 (2002). Type species: *Eremorchis allantoidea* (R.S.Rogers) D.L.Jones et M.A.Clem. (*Pterostylis allantoidea* R.S. Rogers).

Eremorchis allantoidea (R.S.Rogers) D.L.Jones et M.A.Clem., *Austral. Orch. Res.* 4: 72 (2002); *Pterostylis allantoidea* R.S.Rogers, *Trans. & Proc. Roy. Soc. South Australia* 64: 139 (1940). Type: Western Australia. Kumarl, near Salmon Gums, Sep. 1938, *L.Horbury s.n.* (holo AD!). Dist: Australia (WA).

Hymenochilus

Hymenochilus D.L.Jones et M.A.Clem., *Austral. Orch. Res.* 4: 72 (2002). Type species: *Hymenochilus muticus* (R.Br.) D.L.Jones et M.A.Clem. (*Pterostylis mutica* R.Br.).

Oligochaetochilus D.L.Szlachetko subgen. *Glabrichilos* D.L.Szlachetko, *Polish Bot. J.* 46(1): 23 (2001), (*pro parte*). Type species: *Hymenochilus cycnocephalus* (Fitzg.) D.L.Jones et M.A.Clem. (*Pterostylis cycnocephala* Fitzg.).

Hymenochilus bicolor (M.A.Clem. et D.L.Jones) D.L.Jones et M.A.Clem., *Austral. Orch. Res.* 4: 74 (2002); *Pterostylis bicolor* M.A.Clem. et D.L.Jones, *Proc. Roy. Soc. Queensland* 98: 126-128, fig. 3 (1987). Type: New South Wales. 24 km N of Cowra on Forbes road, 16 Oct. 1984, *M.A.Clements 3539* (holo CANB!; iso BRI!, K!, NSW!). Dist: Australia (Qld, NSW, ACT, Vic).

[*Pterostylis mutica auct. non* R.Br.; Fitzg., *Austral. orch.* 1(2): [t.7] (1876).]

Hymenochilus cycnocephalus (Fitzg.) D.L.Jones et M.A.Clem., *Austral. Orch. Res.* 4: 74 (2002); *Pterostylis cycnocephala* Fitzg., *Austral. orch.* 1(2): [t.7] (1876). Type: New South Wales. Molong, *Ross s.n.* (lecto BM!, *fide* Clements 1989). Dist: Australia (NSW, ACT, Vic, Tas).

Hymenochilus muticus (R.Br.) D.L.Jones et M.A.Clem., *Austral. Orch. Res.* 4: 74 (2002); *Pterostylis mutica* R.Br., *Prod.* 328 (1810). Type: "(J.) *v.v.*" [New South Wales. Port Jackson, raceground, Sep.-Oct. 1803, *R. Brown s.n.*] (lecto BM!, *fide* Clements 1989; isolecto BM!). Dist: Australia (Qld, NSW, Vic, ?Tas).

Hymenochilus pratensis (D.L.Jones) D.L.Jones et M.A.Clem., *Austral. Orch. Res.* 4: 74 (2002); *Pterostylis pratensis* D.L.Jones, *Austral. Orch. Res.* 3: 149-150, fig. 7.8 (1998). Type: Tasmania. Liawenee Moor, Lake Highway, Great Lake, 5 Dec. 1997, *J.E. & A.Wapstra (ORG 1059)* (holo CANB!; iso HO!). Dist: Australia (Tas).

Hymenochilus rubenachii (D.L.Jones) D.L.Jones et M.A.Clem., *Austral. Orch. Res.* 4: 76 (2002); *Pterostylis rubenachii* D.L.Jones, *Austral. Orch. Res.* 3: 150-151, fig. 7.9 (1998). Type: Tasmania, Western Plains, 4 Nov. 1837, *R.C.Gunn s.n.* (holo HO!; iso HO!). Dist: Australia (Tas).

Hymenochilus tanypodus (D.L.Jones, Molloy et M.A.Clem.) D.L.Jones, M.A.Clem. et Molloy, *Austral. Orch. Res.* 4: 74 (2002); *Pterostylis tanypoda* D.L.Jones, Molloy et M.A.Clem., *Orchadian* 12(6): 273-274, fig. 6 (1997). Type: New Zealand. South Island, Castle Hill Basin, Canterbury, 3 Dec. 1993, *B.P.J.Molloy s.n.* (holo CHR!; iso CANB!, WELT!). Dist: New Zealand (SI).

[*Pterostylis cycnocephala auct. non* Fitzg.; Hatch, *Trans. & Proc. Roy. Soc. New Zealand Inst.* 79: 323-7 (1953).]

Hymenochilus tristis (Colenso) D.L.Jones, M. A.Clem. et Molloy, *Austral. Orch. Res.* 4: 74 (2002); *Pterostylis tristis* Colenso, *Trans. & Proc. New Zealand Inst.* 18: 271 (1886). Type: [New Zealand.] Open turfy spots, flat lands, south bank of the river Waipawa, 1885, *H.Hill s.n.* (holo WELT 24282!; iso K!). Dist: New Zealand (NI, SI).

[*Pterostylis mutica auct. non* R.Br.; Cheesem., *Trans. & Proc. New Zealand Inst.* 15: 300 (1882)].

Hymenochilus wapstrarum (D.L.Jones) D.L.Jones et M.A.Clem., *Austral. Orch. Res.* 4: 74 (2002); *Pterostylis wapstrarum* [as *wapstreorum*] D.L.Jones, *Austral. Orch. Res.* 3: 156-157, fig. 7.15 (1998). Type: Tasmania. Pontville Army Rifle Range, 3 Nov. 1996, *J.E. & A.Wapstra (ORG 394)* (holo CANB!; iso AD!, CANB!, HO!, MEL!, NSW!). Dist: Australia (Tas).

Hymenochilus ziegeleri (D.L.Jones) D.L.Jones et M.A.Clem., *Austral. Orch. Res.* 4: 74 (2002); *Pterostylis ziegeleri* D.L.Jones, *Austral. Orch. Res.* 3: 158-159, fig. 7.17 (1998). Type: Tasmania. Cape Portland, 2 Oct. 1983, *A.Moscal 3057* (holo HO!; iso HO!). Dist: Australia (Tas).

Linguella

Linguella D.L.Jones et M.A.Clem., *Austral. Orch. Res.* 4: 74 (2002). Type species: *Linguella nana* (R.Br.) D.L.Jones et M.A.Clem. (*Pterostylis nana* R.Br.).

subgen. *Linguella* sect. *Linguella*

Linguella clavigera (Fitzg.) D.L.Jones et M.A. Clem., *Austral. Orch. Res.* 4: 75 (2002); *Pterostylis clavigera* Fitzg., *J. Bot.* 23: 138 (1885). Type: New South Wales. [*Anon*] (lecto FitzGerald's unpublished plate, Mitchell Library, Sydney, here selected). Dist: Australia (NSW, ?Vic, ?SA).

Linguella nana (R.Br.) D.L.Jones et M.A. Clem., *Austral. Orch. Res.* 4: 75 (2002); *Pterostylis nana* R.Br., *Prod.* 327 (1810). Type: "(D.) D.Paterson. *v.s.*" [Tasmania. Port Dalrymple, *Paterson s.n.*] (lecto BM!, *fide* Clements 1989). Dist: Australia (Vic, Tas).

Pterostylis nana R.Br. var. *typica* Domin, *J. Linn. Soc. Bot.* 41: 250, *in obs.* (1912), *nom. illeg.*

Pterostylis celans Rupp, *Victorian Naturalist* 61: 106-7, fig. (1944). Type: Victoria. Portland,

Oct. 1944, *G.Bennett & K.Mellblom s.n.* (lecto MEL!, here designated; isolecto NSW!).

Linguella puberula (Hook.f.) D.L.Jones, M.A.Clem. et Molloy, *Austral. Orch. Res.* 4: 75 (2002); *Pterostylis puberula* Hook.f., *Fl. nov.-zel.* 1: 249 (1853). Type: New Zealand. Northern Island. Auckland, *A.Sinclair s.n.* (holo K!; iso BM!, K-LINDL!). Dist: New Zealand (NI).

[*Pterostylis nana auct., non* R.Br.: Cheesem., *Man. New Zeal. Fl.* (1906).]

[*Pterostylis nana auct., non* R.Br.: Rupp, *Victorian Naturalist* 49: 152 (1932).]

subgen. *Linguella* sect. *Pyramidalae* D.L.Jones et M.A.Clem., *Austral. Orch. Res.* 4: 75 (2002). Type species: *Linguella pyramidalis* (Lindl.) D.L.Jones et M.A.Clem. (*Pterostylis pyramidalis* Lindl.).

Linguella pyramidalis (Lindl.) D.L.Jones et M. A.Clem., *Austral. Orch. Res.* 4: 75 (2002); *Pterostylis pyramidalis* Lindl. in Edwards', *Bot. Reg.* 1-23: *Swan Riv. Append.* liii (1840); *Pterostylis nana* R.Br. var. *pyramidalis* (Lindl.) Ewart, *Proc. Roy. Soc. Victoria* 24: 72 (1911); *Pterostylis nana* R.Br. var. *pyramidalis* (Lindl.) Domin, *J. Proc. Linn. Soc., Bot.* 41: 250 *in obs.* (1912), *nom. illeg.* Type: [Western Australia.] Swan River, 1839, *J.Drummond [163]* (holo K-LINDL!; iso K!, W!). Dist: Australia (WA).

subgen. *Dilatatae* D.L.Jones et M.A.Clem., *Austral. Orch. Res.* 4: 75 (2002). Type species: *Linguella dilatata* (A.S.George) D.L.Jones et M.A.Clem. (*Pterostylis dilatata* A.S.George).

Linguella dilatata (A.S.George) D.L.Jones et M.A.Clem., *Austral. Orch. Res.* 4: 75 (2002); *Pterostylis dilatata* A.S.George, *Nuytsia* 5(1): 61, fig. (1984). Type: Western Australia. Below N side of Bluff Knoll, Stirling Range, 6 July 1969, *A.S.George 9390* (holo PERTH!; iso CANB!). Dist: Australia (WA).

Oligochaetochilus

Oligochaetochilus D.L.Szlachetko, *Polish Bot. J.* 46(1): 23 (2001). Type species: *Oligochaetochilus rufus* (R.Br.) D.L. Szlachetko (*Pterostylis rufa* R.Br.).

sect. *Oligochaetochilus*

Oligochaetochilus aciculiformis (Nicholls) D. L.Szlachetko, *Polish Bot. J.* 46(1): 23 (2001); *Pterostylis pusilla* R.S.Rogers var. *aciculiformis* Nicholls, *Victorian Naturalist* 52: 167, fig. D-F (1936); *Pterostylis aciculiformis* (Nicholls) D.L.Jones et M.A.Clem., *Austral. Orch. Res.* 1: 118-119 (1989); *Pterostylis rufa* R.Br. subsp. *aciculiformis* (Nicholls) Blackmore et Clemesha, *Orchadian* 2(12): 164-166 (1968). Type: Victoria. Clydesdale, Sep. 1935, *M.Ritter in herb. W.H.Nicholls* 691 (lecto MEL!, *fide* Clements 1989). Dist: Australia (NSW, ACT, Vic).

[*Pterostylis mitchellii sensu* Fitzg., *Austral. orch.* 1(6): [t.6] (1880), *non* Lindl.(1843)].

Oligochaetochilus praetermissus (M.A.Clem. et D.L.Jones) D.L.Szlachetko, *Polish Bot. J.* 46(1): 25 (2001); *Pterostylis praetermissa* M.A.Clem. et D.L.Jones, *Austral. Orch. Res.* 1: 125, fig. 5E-H (1989). Type: New South Wales. In forests adjacent to Mount Kaputar National Park, 17 Oct. 1986, *R.G.Tunstall 146* (holo CANB!; iso BRI!, K!, NSW!). Dist: Australia (NSW).

Oligochaetochilus pusillus (R.S.Rogers) D.L. Szlachetko, *Polish Bot. J.* 46(1): 25 (2001); *Pterostylis pusilla* R.S.Rogers, *Trans. & Proc. Roy Soc. South Australia* 42: 26 (1918). Type: South Australia. Geranium, 3-12 Oct. 1917, *N.E.Jacobs s.n.* (lecto AD!, *fide* Clements 1989; isolecto K!). Dist: Australia (NSW, Vic, SA).

Oligochaetochilus rufus (R.Br.) D.L. Szlachetko, *Polish Bot. J.* 46(1): 25 (2001); *Pterostylis rufa* R. Br., *Prod.* 327-328 (1810). Type: "(J.) *v.v.*" [New South Wales. Port Jackson, Cow pasture plains, Oct. 1803, *R.Brown s.n.*] (lecto BM!, *fide* Clements 1989; isolecto BM!, E!, FI!, G!, K!, L!, P!, W!). Dist: Australia (?Qld, NSW).

Pterostylis pusilla R.S.Rogers var. *prominens* Rupp, *Proc. Linn. Soc. New South Wales* 56: 137 (1931). Type: New South Wales. Weston, Oct. 1930, *Minchell & H.M.R.Rupp s.n.* (holo NSW!).

Oligochaetochilus squamatus (R.Br.) D.L. Szlachetko, *Polish Bot. J.* 46(1): 25 (2001); *Pterostylis squamata* R. Br., Prod. 327 (1810); *Pterostylis rufa* R.Br. var. *squamata* (R.Br.) Fitzg. in Moore & Betch, *Handb. Fl. New South Wales* 401 (1893). Type: "(D.) *v.v.*" [Tasmania. Table Mountain, 1805, *R.Brown s.n.*] (lecto BM!, *fide* Clements 1989; isolecto W! [a single flower]). Dist: Australia (NSW, ACT, Vic, Tas).

[*Pterostylis rufa* R.Br. subsp. *rufa auct., non* R.Br.; W.M. Curtis, *Student's Fl. Tas.* 4A: 27 (1979)].

sect. *Biseta* D.L.Jones et M.A.Clem., *Austral. Orch. Res.* 4: 75 (2002). Type species: *Oligochaetochilus bisetus* (Blackmore et Clemesha) D.L.Szlachetko (*Pterostylis biseta* Blackmore et Clemesha).

Oligochaetochilus bisetus (Blackmore et Clemesha) D.L.Szlachetko, *Polish Bot. J.* 46(1): 23 (2001); *Pterostylis biseta* Blackmore et Clemesha, *Orchadian* 2: 152 (1968). Type: South Australia. Blackwood, 24 Nov. 1906, *R.S.Rogers s.n.* (holo NSW!; iso AD!). Dist: Australia (SA, ?Vic).

Oligochaetochilus cheraphilus (D.L.Jones et M.A.Clem.) D.L.Jones et M.A.Clem., *Austral. Orch. Res.* 4: 77 (2002); *Pterostylis cheraphila* D.L.Jones et M.A.Clem., *Muelleria* 8(1): 76-78, fig. 2e-h (1993). Type: Victoria. Wimmera River, near Dimboola, 20 Oct. 1989, *P. Branwhite s.n.* (*D.L.Jones* 5333) (holo CANB!; iso CANB!, MEL!). Dist: Australia (Vic, ?SA).

Oligochaetochilus commutatus (D.L.Jones) D.L.Szlachetko, *Polish Bot. J.* 46(1): 24 (2001); *Pterostylis commutata* D.L.Jones, *Muelleria* 8(2): 186-189, fig. 3e-g (1994). Type: Tasmania. Charlton, Ross district, 14 Jan. 1987, *L.Gilfedder s.n.* (holo HO!). Dist: Australia (Tas).

Oligochaetochilus despectans (Nicholls) D.L. Szlachetko, *Polish Bot. J.* 46(1): 24 (2001); *Pterostylis rufa* R.Br. var. *despectans* Nicholls, *Victorian Naturalist* 66: 215, fig. D (1950); *Pterostylis despectans* (Nicholls) D.L.Jones et M.A.Clem., *Austral. Orch. Res.* 1: 122 (1989). Type: Victoria. Maryborough, Nov. 1947, *W.H. Nicholls* (holo MEL!). Dist: Australia (Vic, SA).

Oligochaetochilus maximus (M.A.Clem. et D. L.Jones) D.L.Szlachetko, *Polish Bot. J.* 46(1): 24 (2001); *Pterostylis maxima* M.A.Clem. et D.L.Jones, *Austral. Orch. Res.* 1: 124, fig. 6A-D (1989). Type: Victoria. Skylark Dam, Whipstick Scrub, Bendigo, 10 Nov. 1973, *W.Perry s.n.* (holo MEL!; iso CANB!). Dist: Australia (NSW, Vic, ?SA).

Oligochaetochilus petrosus (D.L.Jones et M. A.Clem.) D.L.Jones et M.A.Clem., *Austral. Orch. Res.* 4: 77 (2002); *Pterostylis petrosa* D.L.Jones et M.A.Clem., *Muelleria* 8(1): 79-81, fig. 3 (1993). Type: New South Wales. The Rock, 7 Dec. 1988, *A.E.Logan s.n.* (holo CANB!; iso NSW!). Dist: Australia (NSW).

Oligochaetochilus planulatus (D.L.Jones et M.A.Clem.) D.L.Jones et M.A.Clem., *Austral. Orch. Res.* 4: 77 (2002); *Pterostylis planulata* D.L.Jones et M.A.Clem., *Muelleria* 8(1): 81-82, fig. 2i-l (1993). Type: Victoria. Mt Zero, N end of Grampians, 26 Nov. 1991, *P.Branwhite s.n. (D.L.Jones 8591)* (holo CANB!; iso CANB!, MEL!). Dist: Australia (Vic, ?SA).

sect. *Boormania* D.L.Jones et M.A.Clem., *Austral. Orch. Res.* 4: 77 (2002). Type species: *Oligochaetochilus boormanii* (Rupp) D.L. Szlachetko (*Pterostylis boormanii* Rupp).

Oligochaetochilus boormanii (Rupp) D.L. Szlachetko, *Polish Bot. J.* 46(1): 24 (2001); *Pterostylis boormanii* Rupp, *Orchids New South Wales* 98 (1943). Type: New South Wales. Peak Hill, Oct. 1906, *J.L.Boorman s.n.* (holo NSW!, iso AD! NSW!). Dist: Australia (?Qld, NSW, Vic, SA).

sect. *Chaetophora* D.L.Jones et M.A.Clem., *Austral. Orch. Res.* 4: 77 (2002). Type species: *Oligochaetochilus chaetophorus* (M.A.Clem. et D.L.Jones) D.L.Szlachetko (*Pterostylis chaetophora* M.A.Clem. et D.L.Jones).

Oligochaetochilus chaetophorus (M.A.Clem. et D.L.Jones) D.L.Szlachetko, *Polish Bot. J.* 46(1): 24 (2001); *Pterostylis chaetophora* M.A.Clem. et D.L.Jones, *Austral. Orch. Res.* 1: 120 (1989). Type: cult. ANBG, 21 Nov. 1982, *M.A.Clements 2485* ex New South Wales, Neath, *D.McAlpine s.n.* (holo CANB!). Dist: Australia (NSW).

[*Pterostylis gibbosa* R.Br. subsp. *mitchellii sensu* Blackmore et Clemesha, *Orchadian* 2: 161 (1968), *non* Lindl.(1848)].

sect. *Excelsa* D.L.Jones et M.A.Clem., *Austral. Orch. Res.* 4: 77 (2002). Type species: *Oligochaetochilus excelsa* (M.A.Clem.) D.L. Szlachetko (*Pterostylis excelsa* M.A.Clem.).

Oligochaetochilus arenicola (M.A.Clem. et J. Stewart) D.L.Szlachetko, *Polish Bot. J.* 46(1): 23 (2001); *Pterostylis arenicola* M.A.Clem. et J.Stewart, *Austral. Orch. Res.* 1: 120, fig. 2E-H (1989). Type: cult. ANBG, 10 Oct. 1986, *M.A.Clements* ex South Australia, under trees in *Callitris* forest, c. 10 km S of Tailem Bend, Sep. 1986, *M.A.Clements 4327 & J.Stewart* (holo CANB!; iso AD!, K!). Dist: Australia (SA).

Oligochaetochilus basalticus (D.L.Jones et M.A.Clem.) D.L.Jones et M.A.Clem., *Austral. Orch. Res.* 4: 78 (2002); *Pterostylis basaltica* D.L.Jones et M.A.Clem., *Muelleria* 8(1): 75-76, fig. 2a-d (1993). Type: Victoria. Near Woorndoo, 31 Dec. 1991, *P.Barnett s.n.* (*D.L.Jones 8689*) (holo CANB!; iso AD!, CANB!, MEL!). Dist: Australia (Vic).

Oligochaetochilus ciliatus (M.A.Clem. et D.L.Jones) D.L.Szlachetko, *Polish Bot. J.* 46(1): 24 (2001); *Pterostylis ciliata* M.A.Clem. et D.L.Jones, *Austral. Orch. Res.* 1: 120 (1989). Type: Western Australia. Darling District; c. 28 km along Brookton Highway towards Perth, 15 Oct. 1988, *D.L.Jones 3095 &*

M.A.Clements (holo CANB!; iso PERTH!). Dist: Australia (WA).

Oligochaetochilus cobarensis (M.A.Clem.) D.L.Szlachetko, *Polish Bot. J.* 46(1): 24 (2001); *Pterostylis cobarensis* M.A.Clem., *Austral. Orch. Res.* 1: 121 (1989). Type: New South Wales. 7.5 km SE of Cobar, 10 Sep. 1978, *M.D.Crisp 4296* (holo CANB!; iso NSW!). Dist: Australia (?Qld, NSW, ?SA).

Oligochaetochilus excelsus (M.A.Clem.) D. L.Szlachetko, *Polish Bot. J.* 46(1): 24 (2001); *Pterostylis excelsa* M.A.Clem. in Jessop & Toelken, *Fl. S. Austral.* Part IV: 2118, fig. 983 (1986). Type: cult. ANBG ex South Australia, Eyre Peninsula, Koongawa, Waddikee Rocks, 28 Nov. 1978, *M.A.Clements 1600E* (holo CANB!; iso AD!). Dist: Australia (SA).

Oligochaetochilus leptochilus (M.A.Clem. et D.L.Jones) D.L.Szlachetko, *Polish Bot. J.* 46(1): 24 (2001); *Pterostylis leptochila* M.A.Clem. et D.L.Jones, *Austral. Orch. Res.* 1: 123 (1989). Type: Western Australia. 8 km E of Ravensthorpe, 21 Oct. 1988, *D.L.Jones 3386 & M.A.Clements* (holo CANB!; iso K!, PERTH!). Dist: Australia (WA).

Oligochaetochilus mitchellii (Lindl.) D.L. Szlachetko, *Polish Bot. J.* 46(1): 24 (2001); *Pterostylis mitchellii* Lindl., *J. Exped. Trop. Australia* 365 (1848); *Pterostylis rufa* R.Br. var. *mitchellii* (Lindl.) Fitzg., *Handb. fl. pl. N.S.W.* 401 (1893); *Pterostylis gibbosa* R.Br. subsp. *mitchellii* (Lindl.) Blackmore et Clemesha, *Orchadian* 2: 161 (1968). Type: Queensland. Sub-Tropical New Holland, No. 569 Range SE of Camp 27 [Mount Kennedy, N. of Mitchell], Sep. 1846, *T.L.Mitchell s.n.* (holo K-LINDL!; iso K!, W!). Dist: Australia (Qld, ?NSW).

Oligochaetochilus pictus (M.A.Clem.) D.L. Szlachetko, *Polish Bot. J.* 46(1): 24 (2001); *Pterostylis picta* M.A. Clem., *Austral. Orch. Res.* 1: 125 (1989). Type: Western Australia. Moora, 7 Oct. 1980, *M.A.Clements 2223* (holo CANB!; iso K!, PERTH!). Dist: Australia (WA).

Oligochaetochilus roensis (M.A.Clem. et D.L.Jones) D.L.Szlachetko, *Polish Bot. J.* 46(1): 25 (2001); *Pterostylis roensis* M.A.Clem. et D.L.Jones, *Austral. Orch. Res.* 1: 125 (1989). Type: Western Australia. Roe District; Dundas Rocks c. 20 km S of Norseman on Esperance road, 11 Oct. 1988, *D.L.Jones 2973 & M.A.Clements* (holo CANB!; iso CANB!, K!, PERTH!).

Oligochaetochilus validus (Nicholls) D.L.Jones et M.A.Clem., *Austral. Orch. Res.* 4: 78 (2002); *Pterostylis squamata* R.Br. var. *valida* Nicholls, *Victorian Naturalist* 58: 115, fig. A-E (1941); *Pterostylis valida* (Nicholls) D.L.Jones, *Muelleria* 8(2): 191 (1994). Type: Victoria. Mt Tarrengower, Maldon, 23 Oct. 1941, *J.von Bibra s.n.* (holo MEL!; iso MEL!). Dist: Australia (Vic).

Oligochaetochilus xerophilus (M.A.Clem.) D. L.Szlachetko, *Polish Bot. J.* 46(1): 25 (2001); *Pterostylis xerophila* M.A.Clem. in Jessop & Toelken, *Fl. S. Austral.* Part IV: 2130, fig. 996 (1986). Type: cult. Adelaide ex Wynbring, Great Victorian Desert, South Australia, 22 Oct. 1978, *R.Bates s.n.* (holo AD!). Dist: Australia (Vic, SA).

sect. *Gibbosa* D.L.Jones et M.A.Clem., *Austral. Orch. Res.* 4: 78 (2002). Type species: *Oligochaetochilus gibbosus* (R.Br.) D.L. Szlachetko (*Pterostylis gibbosa* R.Br.).

Oligochaetochilus gibbosus (R.Br.) D.L. Szlachetko, *Polish Bot. J.* 46(1): 24 (2001); *Pterostylis gibbosa* R.Br., *Prod.* 328 (1810). Type: "(J.) v.v." [New South Wales. Port Jackson, 1804, *R.Brown s.n.*] (lecto BM!, *fide* Clements 1989, isolecto BM!, W!; icon Bauer's plate BM!). Dist: Australia (NSW).

Pterostylis ceriflora Blackmore et Clemesha, *Orchadian* 2: 156-8, fig. A (1968). Type: New South Wales. Lake Illawarra, 27 Sep. 1967, *J.A.P.Blackmore s.n.* (holo NSW!).

Oligochaetochilus saxicola (D.L.Jones et M. A.Clem.) D.L.Jones et M.A.Clem., *Austral. Orch. Res.* 4: 78 (2002). *Pterostylis saxicola* D.L.Jones et M.A.Clem., *Orchadian* 12(3): 132-134 (1997). Type: New South Wales. Peter Meadows Creek, Kentlyn, 25 Oct. 1990, *D.L.Jones 6813, C.H.Broers & J.Riley* (holo CANB!; iso BRI!, CANB!, MEL!, NSW!). Dist: Australia (NSW).

sect. *Hamata* D.L.Jones et M.A.Clem., *Austral. Orch. Res.* 4: 77 (2002). Type species: *Oligochaetochilus hamatus* (Blackmore et Clemesha) D.L.Szlachetko (*Pterostylis hamata* Blackmore et Clemesha).

Oligochaetochilus calceolus (M.A.Clem.) D. L.Szlachetko, *Polish Bot. J.* 46(1): 24 (2001); *Pterostylis calceolus* M.A.Clem., *Austral. Orch. Res.* 1: 120 (1989). Type: New South Wales. Bungonia Gorge, 13 Oct. 1985, *M.A.Clements 3850, B.Whitehead & R.G.Tunstall* (holo CANB!; iso K!, NSW!). Dist: Australia (NSW).

Oligochaetochilus hamatus (Blackmore et Clemesha) D.L.Szlachetko, *Polish Bot. J.* 46 (1): 24 (2001); *Pterostylis hamata* Blackmore et Clemesha, *Orchadian* 2: 154-6, fig. (1968). Type: New South

Wales. Koorawatha, 29 Oct. 1966, *B.Whitehead s.n.* (holo NSW!). Dist: Australia (NSW, Vic).

[*Pterostylis squamata auct., non* Nicholls, *Victorian Naturalist* 53: 135-6, fig. (1936).]

sect. *Insectifera* D.L.Jones et M.A.Clem., *Austral. Orch. Res.* 4: 77 (2002). Type species: *Oligochaetochilus insectifera* (M.A.Clem.) D.L. Szlachetko (*Pterostylis insectifera* M.A. Clem.).

Oligochaetochilus insectifer (M.A.Clem.) D. L.Szlachetko, *Polish Bot. J.* 46(1): 24 (2001); *Pterostylis insectifera* M.A.Clem,, *Austral. Orch. Res.* 1: 123 (1989). Type: cult. ANBG, 13 Nov. 1980, *M.A.Clements 2234* ex Western Australia: c. 88 km E of Hyden towards Norseman, just S of Lake Cronin, Aug. 1980, *M.A.Clements 1773A* (holo CANB!). Dist: Australia (WA).

sect. *Lingua* D.L.Jones et M.A.Clem., *Austral. Orch. Res.* 4: 77 (2002). Type species: *Oligochaetochilus linguus* (M.A.Clem.) D.L. Szlachetko (*Pterostylis lingua* M.A.Clem.).

Oligochaetochilus linguus (M.A.Clem.) D.L. Szlachetko, *Polish Bot. J.* 46(1): 24 (2001); *Pterostylis lingua* M.A.Clem., *Austral. Orch. Res.* 1: 123, fig. 5A-D (1989). Type: New South Wales. S end of Cocopara National Park, near Mt. Caley on Barry Scenic Drive, 12 Oct. 1986, *R.G.Tunstall 94* (holo CANB!; iso K!, NSW!). Dist: Australia (NSW, Vic, ?SA).

[*Pterostylis squamata auct., non* R.Br.: Fitzg., *Austral. orch.* 1(6): [t.6] (1880).]

Oligochaetochilus ovatus (M.A.Clem.) D.L. Szlachetko, *Polish Bot. J.* 46(1): 24 (2001); *Pterostylis ovata* M.A. Clem. in Jessop & Toelken, *Fl. S. Austral.* Part IV: 2124, fig. 989 (1986). Type: cult. Canberra ex South Australia: Gawler Ranges, hills and SE edge of Lake Acraman, 17 Oct. 1977, *M.A.Clements 2458* (holo CANB!; iso AD! K!, PERTH!). Dist: Australia (SA).

sect. *Longicaudis* D.L.Jones et M.A. Clem., *Austral. Orch. Res.* 4: 78 (2002). Type species: *Oligochaetochilus woollsii* (Fitzg) D.L. Szlachetko (*Pterostylis woollsii* Fitzg.).

Oligochaetochilus woollsii (Fitzg) D.L. Szlachetko, *Polish Bot. J.* 46(1): 25 (2001); *Pterostylis woollsii* Fitzg., *Austral. orch.* 1(2): [t.8] (1876). Type: New South Wales. Richmond, *Woolls s.n.* (lecto BM!, *fide* Clements 1989).

sect. *Setifera* D.L.Jones et M.A.Clem., *Austral. Orch. Res.* 4: 77 (2002). Type species: *Oligochaetochilus setiferus* (M.A.Clem., Matthias et D.L.Jones) D.L.Szlachetko (*Pterostylis setifera* M.A.Clem.).

Oligochaetochilus setifer (M.A.Clem., Matthias et D.L.Jones) D.L.Szlachetko, *Polish Bot. J.* 46(1): 25 (2001); *Pterostylis setifera* M.A.Clem., Matthias et D.L.Jones, *Kew Bull.* 40(1): 77-80 (1985). Type: New South Wales. Ingalba Nature Reserve, Temora, 31 Oct. 1978, *L.Thompson s.n.* (holo CANB!).

sect. *Spathulata* D.L.Jones et M.A.Clem., *Austral. Orch. Res.* 4: 77 (2002). Type species: *Oligochaetochilus spathulata* (M.A.Clem.) D.L.Szlachetko (*Pterostylis spathulata* M.A.Clem.).

Oligochaetochilus macrocalymmus (M.A. Clem. et D.L.Jones) D.L.Szlachetko, *Polish Bot. J.* 46(1): 24 (2001); *Pterostylis macrocalymma* M.A.Clem. et D.L.Jones, *Austral. Orch. Res.* 1: 124, fig. 6E-G (1989). Type: Western Australia. Murchison River, NW Coastal Highway, 2 Sep. 1960, *A.S.George 1509* (holo PERTH!; iso CANB!, K!). Dist: Australia (WA).

Oligochaetochilus spathulatus (M.A. Clem.) D.L.Szlachetko, *Polish Bot. J.* 46(1): 25 (2001); *Pterostylis spathulata* M.A.Clem., *Austral. Orch. Res.* 1: 125 (1989). Type: Western Australia. Moora, 7 Oct. 1980, *M.A.Clements 2222* (holo CANB!; iso K!, PERTH!). Dist: Australia (WA).

Petrorchis

Petrorchis D.L.Jones et M.A.Clem., *Austral. Orch. Res.* 4: 78 (2002). Type species: *Petrorchis bicornis* (D.L.Jones et M.A.Clem.) D. L.Jones et M.A.Clem. (*Pterostylis bicornis* D.L.Jones et M.A.Clem.).

Petrorchis bicornis (D.L.Jones et M.A.Clem.) D.L.Jones et M.A.Clem., *Austral. Orch. Res.* 4: 83 (2002). *Pterostylis bicornis* D.L.Jones et M.A.Clem., *Proc. Roy. Soc. Queensland* 98: 124-6, fig. 4 (1987). Type: Queensland. Mount Maroon, 27 June 1978, *J.Clarkson & M.Olsen s.n.* (holo BRI!). Dist: Australia (Qld, NSW).

Pharochilum

Pharochilum D.L.Jones et M.A.Clem., *Austral. Orch. Res.* 4: 80 (2002). Type species: *Pharochilum daintreanum* (Benth.) D.L.Jones et M.A.Clem. (*Pterostylis daintreana* Benth.).

Oligochaetochilus D.L.Szlachetko subgen. *Glabrichilos* D.L.Szlachetko, *Polish Bot. J.* 46(1): 23 (2001), (*pro parte*). Type: *Hymenochilus cycnocephala* (Fitzg.) D.L.Jones et M.A.Clem. (*Pterostylis cycnocephala* Fitzg.).

Pharochilum daintreanum (Benth.) D.L.Jones et M.A.Clem., *Austral. Orch. Res.* 4: 80 (2002); *Pterostylis daintreana* Benth., *Fl. Austral.* 6: 360 (1873). Type: New South Wales. Near Sydney, *Daintree [Daintrey] s.n.* (holo K!). Dist: Australia (Qld, NSW).

Plumatichilos

Plumatichilos D.L.Szlachetko, *Polish Bot. J.* 46(1): 22 (2001). Type species: *Plumatichilos barbatum* (Lindl.) D.L.Szlachetko (*Pterostylis barbata* Lindl.)

sect. *Plumatichilos*

Pterostylis R.Br. sect. *Catochilus* Benth., *Flora Australiensis* 6: 354, 361 (1873). Lectotype species: *Pterostylis barbata* Lindl., *fide* Jones & Clements (2002).

Pterostylis R.Br. sect. *Filiformae* Rupp, *Proc. Linn. Soc. New South Wales* 58: 423 (1933). Lectotype species: *Pterostylis barbata* Lindl., *fide* Jones & Clements (2002).

Plumatichilos barbatum (Lindl.) D.L. Szlachetko, *Polish Bot. J.* 46(1): 23 (2001); *Pterostylis barbata* Lindl., in Edwards', *Bot. Reg.* 1-23: *Swan Riv. Append* liii (1840). Type: Western Australia. Swan River, 1839, *J.Drummond [159]* (holo K-L!; iso BM!, E!, K!, W!). Dist: Australia (WA).

[*Pterostylis turfosa auct non* Endl.; Fitzg., *Austral. orch.* 2(2): [t.9] (1885).]

sect. *Plumosa* D.L.Jones et M.A.Clem., *Austral. Orch. Res.* 4: 80 (2002). Type species: *Plumatichilos plumosum* (Cady) D.L. Szlachetko (*Pterostylis plumosa* Cady).

Plumatichilos plumosum (Cady) D.L. Szlachetko, *Polish Bot. J.* 46(1): 23 (2001); *Pterostylis plumosa* Cady, *Austral. Pl.* 5(39): 138, fig. B-P (1969). Type: New South Wales. Road to Abercrombie Caves, Oct. 1961, *W.Brinsley s.n.* (holo NSW!). Dist: Australia (NSW).

[*Pterostylis barbata auct. non* Lindl.; Fitzg., *Aust. orch.* 1(7): [t. 7] (1882).]

Plumatichilos tasmanicum (D.L.Jones) D.L. Szlachetko, *Polish Bot. J.* 46(1): 23 (2001); *Pterostylis tasmanica* D.L.Jones, *Muelleria* 8(2): 190-191, fig. 2k-l (1994). Type: Tasmania, Rebecca Creek, north of Temma, 5 Nov. 1990, *D.L.Jones 7030 & C.H.Broers* (holo CANB!; iso HO!, MEL!). Dist: Australia (NSW, Vic, Tas, SA); New Zealand (NI, SI, TKI).

[*Pterostylis squamata auct. non* R.Br.; Hook.f., *Fl. nov-zel.* 1: 249 (1853).]

[*Pterostylis barbata auct. non* Lindl.; Cheesem., *Trans. & Proc. New Zealand Inst.* 7: 352 (1874).]

[*Pterostylis plumosa auct. non* Cady; Johns et Molloy, *Native Orchids of New Zealand* 45 (1983).]

Plumatichilos turfosum (Endl.) D.L. Szlachetko, *Polish Bot. J.* 46(1): 23 (2001); *Pterostylis turfosa* Endl. in Lehm., *Pl. Preiss* 2: 5 (1846). Type: Western Australia. Stirling Terrace [Albany], 20 Sep. 1840, *Preiss 2632* (holo LD!; iso W!). Dist: Australia (WA).

Pterostylis

Pterostylis R.Br., *Prod.* 326 (1810) (*nom. cons.*). Type species: *Pterostylis curta* R.Br. (type cons.).

subgen. *Pterostylis*

Pterostylis sect. *Nudicaules* G.Don in Loudon's *Hortus Brittanicus* 369 (1830). Lectotype species: *Pterostylis curta* R.Br.

Pterostylis sect. *Acuminatae* Rchb.f., *Beitr. Syst. Pflanz.* 68 (1871). Lectotype species: *Pterostylis acuminata* R.Br.

Pterostylis sect. *Laminatae* Rupp, *Proc. Linn. Soc. New South Wales* 58: 423 (1933). Lectotype species: *Pterostylis curta* R.Br.

Pterostylis acuminata R.Br., *Prod.* 326-327 (1810). Type: "(J.) *v.v.*" [New South Wales. Port Jackson, near Sydney, March, 1803-5, *R.Brown s.n.*] (lecto BM!, *fide* Clements 1989; isolecto AD!, BM!, E!, P!, W!). Dist: Australia (Qld, NSW).

Pterostylis anatona D.L.Jones, *Orchadian* 12 (6): 245-246, fig. (1997). Type: Queensland. South Kennedy District; Crediton Rd, Eungella, 4 July 1990, *S.Pearson (D.L.Jones 6099)* (holo CANB!; iso BRI!, CANB!, MEL!, NSW!, QRS!). Dist: Australia (Qld).

Pterostylis baptistii Fitzg., *Austral. orch.* 1(1): [t. 2] (1875). Type: New South Wales. Sydney, Hen and Chickens Bay, *R.D.FitzGerald s.n.* (holo BM!; iso BM!). Dist: Australia (Qld, NSW, Vic).

Pterostylis curta R.Br. var. *grandiflora* Benth., *Fl. Austral.* 6: 355 (1873). Type: Queensland. Brisbane River, Moreton Bay, *F.Mueller s.n.* (lecto K!, *fide* Clements 1998; isolecto MEL!).

Pterostylis curta R.Br., *Prod.* 326 (1810). Type: "(J. T.) *v.v.*" [New South Wales. Port Jackson, 1803, *R.Brown s.n.*] (lecto BM!; isolecto BM!, K-L!, P!, W!). Dist: Australia (Qld, NSW, ACT, Vic, Tas, SA, LHI).

Pterostylis erecta T.E.Hunt, *Proc. Roy. Soc. Queensland* 69: 89, fig. (1958). Type: Queensland. Moreton District: Cedar Creek, near Samford, Sep. 1956, *A.J.Russell & T.E.Hunt 718* (holo BRI!; iso MEL!). Dist: Australia (Qld, NSW).

Pterostylis hildae Nicholls, *Queensland Naturalist* 10: 39-40, t. 3 (1937). Type: Queensland. Tamborine Mountain, 9 Sep. 1924, *H.Geissman s.n.* (holo MEL, found in AD!, *fide* Clements 1989). Dist: Australia (Qld, NSW).

Pterostylis hispidula Fitzg., *Austral. orch.* 1(6): [t. 5] (1880); *Pterostylis nutans* R.Br. var. *hispidula* (Fitzg.) C.Moore et Betche, *Handb. fl. N.S.W.* 399 (1893). Type: New South Wales. Springwood on the Blue Mountains, May, *R.D.FitzGerald s.n.* (lecto FitzGerald's plate, *fide* Clements 1989). Dist: Australia (Qld, NSW).

Pterostylis nutans R.Br., *Prod.* 327 (1810). Type: "(J.) *v.v.*" [New South Wales. Port Jackson, North Rocks, July 1804, *R.Brown s.n.*] (lecto BM!; isolecto BM!, P!, W!). Dist: Australia (Qld, NSW, ACT, Vic, Tas, SA); New Zealand (NI).

Pterostylis matthewsii Cheesem., *Trans. & Proc. New Zealand Inst.* 47: 46 (1915). Type: [New Zealand.] North Island, Mangonui County, crest of ridge leading to Pukemiro Hill, near Kaitaia, *H.B.Matthews s.n.* (holo AK 3518!; iso K!).

Pterostylis pedunculata R.Br., *Prod.* 327 (1810). Type: "(D.) D.Paterson. *v.s.*" [Tasmania. Port Dalrymple, June, *Paterson s.n.*] (lecto BM!; isolecto BM!). Dist: Australia (NSW, ACT, Vic, Tas, SA, LHI).

Pterostylis semirubra F.Muell., *Fragm.* 8: 249 (1874). Type: [Victoria.] In truncis arbori- filicum prope Apollo-Bay [on tree ferns near Apollo Bay], *C.Walter s.n.* (lecto MEL!, here designated).

Pterostylis procera D.L.Jones et M.A. Clem., *Austral. Orch. Res.* 1: 125, fig. 3A-C (1989). Type: Queensland. Moomin, 2 May 1988, *L.Lawler 12* (holo CANB!). Dist: Australia (Qld).

Pterostylis stricta Clemesha et B.Gray, *Orchadian* 4 (2): 18-22, fig. (1972). Type: Queensland. Near Ravenshoe north Queensland, 15 April 1969, *B.Gray s.n.* (holo NSW!). Dist: Australia (Qld).

Natural Hybrids:

Pterostylis* X *aenigma D.L.Jones et M.A. Clem., *Muelleria* 8(1): 73-75, fig. 1a-e (1993). Type: Victoria. Knocker Track, Omeo, 11 Dec. 1989, *R.Clark s.n.* (holo CANB!; iso CANB!, MEL!). Dist: Australia (Vic).

Pterostylis* X *ingens (Rupp) D.L.Jones, *Orchadian* 5: 54 (1976); *Pterostylis acuminata* R.Br. var. *ingens* Rupp, *Proc. Linn. Soc. New South Wales* 53: 558 (1928). Type: Victoria. Healesville, 1926, *A.J.Tadgell* ex *W.H. Nicholls s.n.* (holo NSW!). Dist: Australia (?NSW, Vic).

subgen. *Cucullatae* (Rchb.f.) D.L.Jones et M.A.Clem., *Austral. Orch. Res.* 4: 65 (2002); *Pterostylis* sect. *Cucullatae* Rchb.f., *Beitr. Syst. Pflanz.* 68-69 (1871). Lectotype species: *Pterostylis cucullata* R.Br.

Pterostylis alpina R.S.Rogers, *Proc. Roy. Soc. Victoria* (new ser.) 28: 108-109, t. 9 (1915). Type: Victoria: Fernshaw, 27 Sep. 1912, *C.French s.n.* (lecto AD!, *fide* Clements 1989; isolecto AD!). Dist: Australia (NSW, ACT, Vic, Tas).

Pterostylis arfakensis (J.J.Sm.) D.L.Jones et M.A.Clem., *Austral. Orch. Res.* 4: 65 (2002); *Pterostylis papuana* Rolfe var. *arfakensis* J.J.Sm. in L.S.Gibbs, *Fl. Arfak mts.* 107-108 (1917). Types: Indonesia. West Irian; Arfak Mtns, Angi Lakes, terrestrial under edge of forest patch by lake, 7000', Dec., *L.S.Gibbs 5713 & 5890* (syn BM!). Dist: Indonesia: (Irian Jaya).

Pterostylis braemii H.Mohr, *Schlechteriana* 1990(1): 20-21, t. (1990). Type: Papua New Guinea. Jimmy Gap, ca. 2400 m. über N.N., 1987, *G.J.Braem s.n.* (holo SCHLE 871105/1). Dist: Papua New Guinea.

Pterostylis bureaviana Schltr., *Bot. Jahrb* 39: 38 (1906). Type: New Caledonia. Southern District: At forest borders on rocks, on the mountains near Paita (on Kariconyé), alt. 600 m, Oct. 1902, *R.Schlechter 14970* (holo B†). Dist: New Caledonia.

Pterostylis affinis Guillaumin, *Mem. Mus. Hist. Nat. Paris*, Bot. 8: 44 (1957). Type: New Caledonia. Terrestre, Mt. Bouo, 700m, serpentine, 20 April 1951, A.*Guillaumin & R.A.L.Baumann 12663* (holo Z!).

Pterostylis caulescens L.O.Williams, *Bot. Mus. Leafl.* 12: 149-150, t. 21 (1946). Type: British New Guinea: alpine, bush margin, Rawlinson Range, Morobe District, alt. 10,000-12,000 ft., flowers flesh pink, 22 Sep. 1941, *M.S.Clemens s.n.* (holo AMES!). Dist: Papua New Guinea.

Pterostylis cucullata R.Br., *Prod.* 327 (1810). Type: "(D.) *v.v.*" [Tasmania. Port Dalrymple, *Paterson s.n.*] (lecto specimen (a) BM!, *fide* Clements 1989). Dist: Australia (Vic, Tas, SA).

Pterostylis mackibbinii F.Muell., *Victorian Naturalist* 9: 93 (1892). Type: Tasmania. On King's Island and Swan Island, Nov. 1888, *J.MacKibbin s.n.* (lecto MEL!, here designated; isolecto K! NSW!). Note: The collection selected as the lectotype matches the protologue and is the only collection made by MacKibbin.

Pterostylis dubia R.Br., *Prod.* 328 (1810). Type: [Tasmania. Derwent, April 1804, *R.Brown s.n.*] (lecto BM!, *fide* Clements 1989). Dist: Australia (Tas).

Pterostylis falcata R.S.Rogers, *Proc. Roy. Soc. Victoria* (new ser.) 28(1): 106-107, t. 9 (1915). Type: Victoria. Dandenong Creek near Oakleigh, Oct. 1911, *C.French s.n.* (lecto AD!, *fide* Clements 1989; isolecto MEL!). Dist: Australia (Qld, NSW, ACT, Vic, Tas, SA).

Pterostylis foliata Hook.f., *Fl. nov.-zel.* 1: 249 (1853). Type: New Zealand. Northern Island, marshy places, east coast and Ruahine Mountains, *W.Colenso* [*1906*] (lecto K!, *fide* Clements 1989; isolecto K!). Dist: Australia: (NSW, Vic, Tas); New Zealand (NI, SI).

Pterostylis gracilis Nicholls, *Victorian Naturalist* 43: 324-326, fig. (1927). Type: Victoria. Wilsons Promontory, Sep. 1926, *R.S.Rogers & E.Coleman s.n.* (lecto MEL!, *fide* Clements 1989).

Pterostylis vereenae R.S.Rogers, *Trans. & Proc. Roy. Soc. South Australia* 38: 360-361, fig. 18(2) (1914). Type: South Australia. Growing in fair numbers amongst *Hakea*, *Tetratheca*, etc., in stony soil at Cherry Gardens, Sep. [1914], *V.Jacobs s.n.* (holo AD, not found; lecto plate XVIII (II), here designated). Note: The holotype has not been found and the illustration accompanying the description is chosen as the lectotype.

Pterostylis furcata Lindl., *Gen. sp. orchid. pl.* 390 (1840). Type: "Hab. In Tasmannia" [Tasmania. In wet places a few miles from Launceston], *R.Gunn 602* (holo K-LINDL!: iso K!). Dist: Australia (Tas).

Pterostylis furcata Lindl.var. *typica* Hatch, *Trans. Roy. Soc. New Zealand* 77: 243 (1949), *nom. illeg.*

Pterostylis humilis R.S.Rogers, *Trans. & Proc. Roy. Soc. South Australia* 46: 151-152 (1922). Type: New Zealand. The Haunted Whare, near Waimarino, [Jan. 1921], *H.B.Matthews s.n.* (holo AK!; iso CHR in Carse Herbarium!). Notes: In the Auckland Museum there is a collection labelled with this name comprising three specimens and a packet that contains two photographic prints. Hatch (1949) cites a mature fruiting specimen on the left of the sheet as the lectotype for *P. humilis* but it does not match anything described in the protologue and has no standing as a type. On the right hand side is a whole plant consisting of two tubers a stem and three leaves in a rosette with a withered and deformed flower. This is one of the two original specimens sent to Rogers, is described in the protologue and thus the holotype. Dist: New Zealand (NI, SI).

Pterostylis micromega Hook.f., *Fl. nov.-zel.* 1: 248 (1853); *Pterostylis furcata* Lindl. var. *micromega* (Hook.f.) Hatch, *Trans. & Proc. Roy. Soc. New Zealand* 80: 326 (1953). Type: New Zealand. East coast, *W.Colenso* [512] (lecto K! here designated; isolecto W!); Notes: The lectotype matches the protologue and is the left hand side plant immediately above the label written in Colenso's hand. Dist: New Zealand (NI, SI, ChI).

Pterostylis polyphila Colenso, *Trans. Roy. Soc. New Zealand* 22: 489-490 (1890). Type: New Zealand. Near Mount Tongariro, County of East Taupo, 1889, *H.Hill s.n.* (holo not found). Note: We cannot find a type for this name but from the protologue there can be little doubt about its placement.

Pterostylis monticola D.L.Jones, *Muelleria* 8(2): 189-190, fig. 3h-k (1994). Type: Australian Capital Territory. Brindabella Ranges, just south of Bendora Arboretum, 14 Feb. 1993, *D.L.Jones 11355 & B.E.Jones* (holo CANB!; iso MEL! NSW!). Dist: Australia (NSW, Vic).

Pterostylis neocaledonica Schltr., *Bot. Jahrb.* 39: 38-39 (1906). Type: New Caledonia. Northern District: on open grassy areas, on the mountains near Oubatche, alt. c.1400 m, Jan. 1902, *R.Schlechter 15472* (holo B†; iso K!, P!). Dist: New Caledonia.

[*Pterostylis curta auct. non* R.Br.: Halle, *Fl. Nouv.-Cal. Dep.* 8: 451-453, fig. 181 (1977)].

Pterostylis novoguineensis Ridley, *Trans. Linn. Soc. London Bot.* (ser. 2) 9: 208 (1916). Type: Dutch New Guinea Camp XI to XII, 8300 to 11,000 ft., *C.B.Kloss s.n.* (holo BM!). Dist: Indonesia (West Irian, Malaku [Seram]); Papua New Guinea.

Pterostylis papuana var. *seranica* J.J.Sm., Orchidaceae Seranenses, *Bull. Jard. Bot.* 10(series iii): 91-92 (1928), ***syn. nov.*** Type: [Indonesia.] Central Ceram: Goenoeng Pinaia, c. 2750 m, Aug. 1911, *E.Stresemann 295* (lecto L!, here selected). Note: The lectotype was chosen because it was used to compile the description.

[*Pterostylis acuminata auct., non* R.Br.: P.Royen, *Alp. Orch. New Guinea* 2: 94 (1972)].

Pterostylis oliveri Petrie, *Trans. & Proc. New Zealand Inst.* 26: 270 (1894). Type: New Zealand. Open scrub and low bush on the banks of Kelly's Creek, Otia River (1,100 ft.). Jan. 1893, *D.Petrie s.n.* (lecto WELT 3651!, *fide* Moore & Edgar, 1970; isolecto K!). Dist: New Zealand (SI).

Pterostylis oreophila Clemesha, *Orchadian* 4 (11): 110, fig. (1974). Type: New South Wales. Kiandra, on the bank of a small permanent stream, 18 Dec. 1967, *S.C.Clemesha & B.Whitehead s.n.* (holo & iso NSW!). Dist: Australia (NSW, ACT, Vic).

Pterostylis paludosa D.L.Jones, Molloy et M. A.Clem., *Orchadian* 12(6): 271-272, fig. 4 (1997). Type: New Zealand. South Island, Pahiki, between Taylorville and Cobden, Greymouth, 19 Nov. 1968, *D.G.Drury 68W/94* (holo CHR!). Dist: New Zealand (NI, SI).

Pterostylis furcata Lindl. var. *linearis* Hatch, *Trans. & Proc. Roy. Soc. New Zealand* 77: 243, t. 29, fig. 2f-j (1949). Type: New Zealand. Murimotu, Dec. 1944, *E.D.Hatch 565* (holo AK!).

Pterostylis papuana Rolfe, *Kew Bull.* 112 (1899). Type: [Papua New Guinea.] Mount Scratchley, 12200 ft., [1897], *A.Guillianetti s.n.* (holo K!). Dist: Papua New Guinea.

Pterostylis porrecta D.L.Jones, Molloy et M.A. Clem., *Orchadian* 12(6): 272-273, fig. 5. (1997). Type: New Zealand. South Island, Hackett Creek Scenic Reserve, Nelson, 13 Dec. 1985, *B.P.J.Molloy s.n.* (holo CHR!). Dist: New Zealand (NI).

Pterostylis scabrida Lindl., *Gen. sp. orchid. pl.* 389 (1840). Type: "Hab. In Tasmannia, ad ripas fluminis nigri, solo udo arenoso humo intermixto, locis dense obumbratis" [Tasmania. Black River Circular Head, Nov. 1837], *R.Gunn 906* (holo K-LINDL!, iso K!). Dist: Australia (Tas).

Pterostylis venosa Colenso, *Trans. & Proc. New Zealand Inst.* 28: 610-611 (1896). Type: New Zealand. Ruahine Mountain-range, east side, 1894, *A.Olsen s.n.* (holo WELT 24384!). Dist: New Zealand (NI, SI, StI).

Pterostylis trifolia Colenso, *Trans. & Proc. New Zealand Inst.* 31: 281 (1899). Type: New Zealand. Ruahine Mountain-range, east side, near secondary summits, 1898, *A.Olsen s.n.* (holo not found). Note: We cannot find a type for this name but the protologue matches the description of *P. venosa*.

Pterostylis confertifolia Allan, *Trans. & Proc. New Zealand Inst.* 56: 32-33 (1926). Type: New Zealand. North Island, Wellington Botanical District - on margins of subalpine scrub, and in lower subalpine herb-field, about 1,200 m. altitude, Ruahine Mountains, near Apiti, *H.H.Allan s.n.* (lecto CHR!, *fide* Moore and Edgar, 1970).

subgen. ***Graminifoliae*** D.L.Jones et M.A. Clem., *Austral. Orch. Res.* 4: 66 (2002). Type species: *Pterostylis banksii* A.Cunn.

Pterostylis agathicola D.L.Jones, Molloy et M. A.Clem., *Orchadian* 12(6): 266-267, fig. 1 (1997). Type: New Zealand. North Island, Parau, Waitakere Flat, 5 Aug. 1992, *E.D.Hatch s.n.* (holo CHR!; iso AK!, CANB!, WELT!). Dist: New Zealand (NI).

Pterostylis graminea Hook.f. var. *rubricaulis* H.B.Matthews ex Cheesem., *Man. New Zealand Fl.* 351 (1925); *Pterostylis montana* Hatch var. *rubricaulis* (H.B.Matthews ex Cheesem.) Hatch, *Trans. & Proc. Roy. Soc. New Zealand* 77: 240, fig. (1949), *nom. inval.* Type: *non designatus*, *fide* Moore & Edgar (1970).

Pterostylis areolata Petrie, *Trans. & Proc. New Zealand Inst.* 50: 210-211 (1918). Type: New Zealand. Base of Shingle Peak, Awatere Valley, Marlborough, 3,000 ft., *L.Cockayne s.n.* (lecto WELT 3648!, *fide* Moore & Edgar 1970). Dist: New Zealand (SI).

Pterostylis auriculata Colenso, *Trans. & Proc. New Zealand Inst.* 22: 489 (1890). Type: New Zealand. Open fern land, Fortrose, Invercargill, 1889, [*W.Colenso s.n.*] (holo WELT 24280!). Dist: New Zealand (SI).

Pterostylis australis Hook.f., *Fl. nov.-zel.* 1: 248 (1853). Type: New Zealand. Middle and Southern Islands. Port William and Thompson's Sound, *D.Lyall s.n.* (lecto specimen (a) K! here designated); *s.loc, Lyall s.n.* (syn K!, K-LINDL!). Note: The lectotype matches the protologue, is lodged in Hooker's herbarium, is labelled in his hand and collected by D.Lyall. Dist: New Zealand (NI, SI, ChI).

Pterostylis banksii A.Cunn. in Edwards', *Bot. Mag.* 59: t. 3172 (1832). Type: cultivated England ex New Zealand: Bay of Islands, 1826, *A.Cunningham s.n.* (holo Bauer's illustration in Bot. Mag. T. 3172!). Dist: New Zealand (NI, SI, ChI, PKI).

Pterostylis macrophylla A.Cunn. ex Hook.f. in Edwards', *Bot. Mag.* 59: t. 3172 (1832), *nom. illeg.*

Pterostylis emarginata Colenso, *Trans. & Proc. New Zealand Inst.* 15: 328-329 (1883). Type: New Zealand. In low forests, banks of streams descending from the east flank of Te Tuahine Mountain Range, Hawke's Bay district, North Island, 1847-1852, *W.Colenso s.n.* (lecto W!, here designated). Note: The specimen chosen as the lectotype matches the protologue.

Pterostylis banksii A.Cunn. var. *typica* Hatch, *Trans. & Proc. Roy. Soc. New Zealand* 77: 241 (1949), *nom. illeg.*

Pterostylis cardiostigma D.Cooper, *New Zealand J. Bot.* 21: 97 (1983). Type: New Zealand. Days Bay, Wellington, 21 Oct. 1980, *D.Cooper s.n.* (holo CHR 369753!). Dist: New Zealand (NI, SI).

Pterostylis cernua D.L.Jones, Molloy et M.A. Clem., *Orchadian* 12(6): 267-269, fig. 2 (1997). Type: New Zealand. South Island, roadside, State Highway 73, near Okuku Reserve, culvert 53, 9 Dec. 1995, *D.L.Jones, M.A.Clements & B.P.J.Molloy s.n.* (holo CHR!; iso AK!, CANB!, WELT!). Dist: New Zealand (SI).

Pterostylis graminea Hook.f., *Fl. nov.-zel.* 1: 248 (1853). Type: New Zealand. East coast, *W.Colenso [1742]* (lecto K specimen (a), here designated). Notes: The lectotype has a label in Colenso's hand which states "*Pterostylis graminifolia* n. sp. WC." and in Hooker's hand labelled *P. graminea*, to which is attached Hooker's pencil sketch of the flower. Dist: New Zealand (NI, SI, StI).

Pterostylis irsoniana Hatch, *Trans. & Proc. Roy. Soc. New Zealand* 78: 104-5, t. 18 (1950). Type: New Zealand. North Egmont Hostel, 3,800 ft., Dec. 1948, *O.E.Gibson ex Hatch 568* (holo AK 24604!). Dist: New Zealand (NI, SI, StI).

Pterostylis irwinii D.L.Jones, Molloy et M.A. Clem., *Orchadian* 12(6): 269-271, fig. 3. (1997). Type: New Zealand. North Island, South Auckland Land District, near Erua township; floodplain of Waimarino Stream, alt. 730 m, 20 Dec. 1995, *A.C.Jones s.n.* (holo CHR!; iso CANB!). Dist: New Zealand (NI).

Pterostylis montana Hatch, *Trans. & Proc. Roy. Soc. New Zealand* 77: 239-240, t. 22 (1949). Type: New Zealand. Halfmoon Bay, Stewart Island [at sea level], Nov. 1946, *C.Smith ex E.D.Hatch 564* (holo AK!). Dist: New Zealand (NI, SI, StI).

Pterostylis montana Hatch var. *typica* Hatch, *Trans. & Proc. Roy. Soc. New Zealand* 77: 239 (1949), *nom. illeg.*

Pterostylis patens Colenso, *Trans. & Proc. New Zealand Inst.* 18: 270 (1886); *Pterostylis banksii* A.Cunn. var. *patens* (Colenso) Hatch, *Trans. & Proc. Roy. Soc. New Zealand* 75: 370 (1945). Types: New Zealand. Forests, hilly country, near Norsewood, County of Waipawa, 1883-84, *W.Colenso s.n.* (syn not found); Glenross, County of Hawke's Bay, 1884, *D.P.Balfour s.n.* (syn not found). Neotype, here selected! 'Lake Waikaremoana, Hawkes Bay, 24 Nov. 1965, *D.Wellman* 128007A&B (CHR!); including spirit material. Dist: New Zealand (NI).

Pterostylis speciosa Colenso, *Trans. & Proc. New Zealand Inst.* 22: 488-489 (1890), ***syn. nov.*** Type: New Zealand. Near Mount Tongariro, County of East Taupo, 1889, *H. Hill s.n.* (lecto K!, here designated, isolecto WELT 24279!). Notes: The lectotype chosen fits Colenso's protologue in all respects. We are of the opinion that this name correctly applies to *P. patens*.

Pterostylis subsimilis Colenso, *Trans. & Proc. New Zealand Inst.* 28: 611 (1896). Type: New Zealand. Ruahine Mountain-range, east side, 1894, *A.Olsen s.n.* (holo WELT 24282!).

Pterostylis silvicultrix (F.Muell.) Molloy, D.L.Jones et M.A.Clem., *Austral. Orch. Res.* 4: 66 (2002); *Pterostylis banksii* Cunn var. *silvicultrix* F. Muell., *Veg. Chatham Is.* 51 (1864). Type: Chatham Island, in woods only, *H.Travers 30* (holo MEL!; iso W!). Dist: New Zealand (ChI).

Ranorchis

Ranorchis D.L.Jones et M.A.Clem., *Austral. Orch. Res.* 4: 82 (2002). Type species: *Ranorchis sargentii* (C.R.P.Andrews) D.L.Jones et M.A.Clem. (*Pterostylis sargentii* C.R.P.Andrews).

Oligochaetochilus D.L.Szlachetko subgen. *Apicuchilos* D.L.Szlachetko, *Polish Bot. J.* 46(1): 23 (2001), (*pro parte*). Type species: *Urochilus vittata* (Lindl.) D.L.Jones et M.A.Clem. (*Pterostylis vittata* Lindl.).

Ranorchis sargentii (C.R.P.Andrews) D.L.Jones et M.A.Clem., *Austral. Orch. Res.* 4: 82 (2002); *Pterostylis sargentii* C.R.P. Andrews, *J. Western Australia Nat. Hist.* Soc. 2(2): 57 (1905). Type: Western Australia. York, Aug. 1904, *O.H.Sargent ex W.E. Blackall s.n.* (lecto PERTH!, *fide* George 1971). Dist: Australia (WA).

Speculantha

Speculantha D.L.Jones et M.A.Clem., *Austral. Orch. Res.* 4: 82 (2002). Type species: *Speculantha parviflora* (R.Br.) D.L.Jones et M.A.Clem. (*Pterostylis parviflora* R.Br.).

sect. *Speculantha*

Speculantha aphylla (Lindl.) D.L.Jones et M. A.Clem., *Austral. Orch. Res.* 4: 82 (2002); *Pterostylis aphylla* Lindl., *Gen. sp. orchid. pl.* 392 (1840); *Pterostylis parviflora* R.Br. var. *aphylla* (Lindl.) Ewart et J. White, *Proc. Roy. Soc. Victoria* 24: 71 (1911). Type: "Hab. In Tasmania; juxta Circular Head frequens, in sabuletis sterilibus, hieme udis, fructicibus Myrtaceis Epacridaceis Endogenisque plurimis abundandtibus vix autem graminosis", [Tasmania. Circular Head, Dec. 1837], *R.Gunn 903* (holo K-LINDL!, iso E!, W!). Dist: Australia (Tas).

Speculantha atriola (D.L.Jones) D.L.Jones et M.A.Clem., *Austral. Orch. Res.* 4: 82 (2002); *Pterostylis atriola* D.L.Jones, *Austral. Orch. Res.* 3: 140-141, fig. 7.3 (1998). Type: Tasmania. Snug Plains, 600m, 3 March 1997, *J.E. & A.Wapstra (ORG 607)* (holo CANB!; iso HO!, MEL!). Dist: Australia (Tas).

Speculantha nigricans (D.L.Jones et M.A. Clem.) D.L.Jones et M.A.Clem., *Austral. Orch. Res.* 4: 83 (2002); *Pterostylis nigricans* D.L.Jones et M.A.Clem., *Austrobaileya* 2(5): 550-551, fig. 2E,F&G (1988). Type: Queensland. Moreton District: Stradbroke Island, open forest and heathland, 26 May 1987, *D.L.Jones 2482* (holo BRI!; iso AD!, AMES!, BRI!, CANB!, K!, MO!, NSW!, US!). Dist: Australia (Qld, NSW).

Speculantha parviflora (R.Br.) D.L.Jones et M.A.Clem., *Austral. Orch. Res.* 4: 83 (2002); *Pterostylis parviflora* R.Br., *Prod.* 327 (1810). Type: "(J.) *v.v.*" [New South Wales. Port Jackson, between Sydney and Parramatta near Aiten's Bridge, April 1805, *R.Brown s.n.*] (lecto BM!, *fide* Clements 1989; isolecto BM!, W!). Dist: Australia (Qld, NSW, Vic, Tas, SA).

Pterostylis whitei F.M.Bailey, *Queensland Agric. J.* 25(1): 11 (1910). Type: Queensland. Glasshouse Mountains [Top of Mt. Ngun Ngun], May 1910, *C.T.White s.n.* (holo BRI!; iso K!).

sect. *Elongatae* D.L.Jones et M.A.Clem., *Austral. Orch. Res.* 4: 83 (2002). Type species: *Speculantha uliginosa* (D.L.Jones) D.L.Jones et M.A.Clem. (*Pterostylis uliginosa* D.L.Jones).

Speculantha uliginosa (D.L.Jones) D.L.Jones et M.A.Clem., *Austral. Orch. Res.* 4: 83 (2002); *Pterostylis uliginosa* D.L.Jones, *Austral. Orch. Res.* 3: 155-156, fig. 7.14 (1998). Type: New South Wales. Beside Appin-Bulli Rd, 7 Jan. 1993, *D.L.Jones 11120* (holo CANB!; iso AD!, BRI!, HO!, MEL!, NSW!). Dist: Australia (NSW, Vic, Tas, SA).

Stamnorchis

Stamnorchis D.L.Jones et M.A.Clem., *Austral. Orch. Res.* 4: 83 (2002). Type species: *Stamnorchis recurva* (Benth.) D.L.Jones et M.A.Clem. (*Pterostylis recurva* Benth.).

Stamnorchis recurva (Benth.) D.L.Jones et M. A.Clem., *Austral. Orch. Res.* 4: 83 (2002); *Pterostylis recurva* Benth., *Fl. Austral.* 6: 360 (1873). Type: Western Australia. Swan River, *J.Drummond s.n.* (lecto K!, *fide* George 1971). Dist: Australia (WA).

Taurantha

Taurantha D.L.Jones et M.A.Clem., *Austral. Orch. Res.* 4: 85 (2002). Type species: *Taurantha ophioglossa* (R.Br.) D.L.Jones et M.A.Clem. (*Pterostylis ophioglossa* R.Br.).

Taurantha collina (Rupp) D.L.Jones et M.A. Clem., *Austral. Orch. Res.* 4: 85 (2002); *Pterostylis ophioglossa* R.Br. var. *collina* Rupp, *Proc. Linn. Soc. New South Wales* 54: 552 (1929); *Pterostylis collina* (Rupp) M.A.Clem. et D.L.Jones in M.A. Clem., *Austral. Orch. Res.* 1: 121 (1989). Type: New South Wales. Hungry Hill, Paterson, June 1926, *H.M.R.Rupp s.n.* (holo NSW!). Dist: Australia (NSW).

Taurantha concinna (R.Br.) D.L.Jones et M.A. Clem., *Austral. Orch. Res.* 4: 85 (2002); *Pterostylis concinna* R.Br., *Prod.* 326 (1810). Type: "(J.) *v.v.*" [New South Wales. Port Jackson, Bennelong Point Sydney Cove, 18 Aug. 1803, *R.Brown s.n.*] (lecto BM!, *fide* Clements 1989; isolecto E!, K!, K-L!, P!, W!). Dist: Australia (NSW, Vic, Tas, SA).

Taurantha ophioglossa (R.Br.) D.L.Jones et M.A.Clem., *Austral. Orch. Res.* 4: 85 (2002); *Pterostylis ophioglossa* R.Br., *Prod.* 326 (1810). Type: "(J.T.) *v.v.*" [New South Wales. Port Jackson, vicinity of Sydney Cove, 1803-5, *R.Brown s.n.*] (lecto BM!, *fide* Clements 1989; isolecto BM!, E!, P!). Dist: Australia (Qld, NSW).

Taurantha splendens (D.L.Jones et M.A. Clem.) D.L.Jones et M.A.Clem., *Austral. Orch. Res.* 4: 85 (2002); *Pterostylis splendens* D.L.Jones et M.A.Clem., *Orchadian* 12(7): 322-325, fig. (1998). Type: cult. ANBG, Canberra (CBG9212947) ex New Caledonia: Mt Do, 22 July 1994, *Clements 7812* (holo CANB!; iso P!). Dist: New Caledonia.

Taurantha taurus (M.A.Clem. et D.L.Jones) D.L.Jones et M.A.Clem., *Austral. Orch. Res.* 4: 85 (2002); *Pterostylis taurus* M.A.Clem. et D.L.Jones, *Austral. Orch. Res.* 1: 127 (1998). Type: cult. ANBG, 7 June 1985, *M.A.Clements 3667* ex Queensland, Cook District, Ravenshoe, 16 July 1979, *M.A. Clements 1661* (holo CANB!; iso BRI!, K!). Dist: Australia (Qld).

[*Pterostylis ophioglossa* R. Br., var. *collina sensu* Dockr., *Aust. indig. orch.* 1: 148, fig. (1969), *non* Rupp (1929)].

Pterostylis ophioglossa R.Br. subsp. *fusca* Clemesha, *Orchadian* 7(1): 13 (1981). Type: Queensland. Near Herberton, north Queensland, 7 June 1973, *B.Gray s.n.* (holo BRI!).

Taurantha tenuicauda (Kraenzl.) D.L.Jones et M.A. Clem., *Austral. Orch. Res.* 4: 85 (2002); *Pterostylis tenuicauda* Kraenzl., *Neu-Caledon. orchid.* 63 (1909). Type: New Caledonia. W Ignambi au-dessus de Pemboa, 4 June 1925, *A.O.Däniker 1729* (holo Z!). Dist: New Caledonia.

[*Pterostylis ophioglossa auct., non* R.Br.: Schltr., *Bot. Jahrb.* 39: 38 (1906)].

Natural hybrid:

Taurantha* X *conoglossa (Upton) D.L.Jones et M.A.Clem., *Austral Orch. Res.* 4: 85 (2002); *Pterostylis* X *conoglossa* Upton, *Orchadian* 2(9): 114, fig. (1967). Type: New South Wales. Swansea, 18 June 1967, *W.T.Upton s.n.* (holo NSW!). Dist: Australia (NSW).

Urochilus

Urochilus D.L.Jones et M.A.Clem., *Austral. Orch. Res.* 4: 87 (2002). Type species: *Urochilus vittatus* (Lindl.) D.L.Jones et M.A. Clem. (*Pterostylis vittata* Lindl.).

Oligochaetochilus D.L.Szlachetko subgen. *Apicuchilos* D.L.Szlachetko, *Polish Bot. J.* 46(1): 23 (2001), (*pro parte*). Type species: *Urochilus vittatus* (Lindl.) D.L.Jones et M.A.Clem. (*Pterostylis vittata* Lindl.).

Urochilus concavus (D.L.Jones et M.A.Clem.) D.L.Jones et M.A.Clem., *Austral. Orch. Res.* 4: 87 (2002); *Pterostylis concava* D.L.Jones et M.A.Clem., *Austral. Orch. Res.* 1: 121, fig. 4E-H (1989). Type: Western Australia. Between Boyup ook and Cranbrook, 6 July 1969, *A.S.George 9385* (holo PERTH!; iso CANB!, K!, NSW!). Dist: Australia (WA).

Pterostylis vittata Lindl. var. *subdifformis* Nicholls, *Victorian Naturalist* 49: 253 (1933). Type: Western Australia. Boyup Brook, May 1925, *E.Crocker s.n.* (holo MEL!; iso NSW!).

Urochilus sanguineus (D.L.Jones et M.A. Clem.) D.L.Jones et M.A.Clem., *Austral. Orch. Res.* 4: 87 (2002); *Pterostylis sanguinea* D.L.Jones et M.A.Clem., *Austral. Orch. Res.* 1: 126-7, fig. 4A-D (1989). Type: South Australia. Belair Recreation Reserve, 70 acre Flora Reserve, behind Pines Oval, 9 July 1986, *M.A.Clements 4097 & A.S.Clements* (holo CANB!; iso AD!, K!). Dist: Australia (Tas, Vic, SA, ?WA).

Urochilus vittatus (Lindl.) D.L.Jones et M.A. Clem., *Austral. Orch. Res.* 4: 87 (2002); *Pterostylis vittata* Lindl. in Edwards', *Bot. Reg.* 1-23: *Swan Riv. Append.* liii (1840). Type: Western Australia. Interior of King George Sound, *A.Collie s.n.* (lecto K-LINDL!, *fide* George 1971; isolecto K!). Dist: Australia (WA).

Pterostylis vittata Lindl. var. *major* Endl. in Lehm., *Pl. Preiss.* 2: 5 (1846), *nom. nud.*

Pterostylis vittata Lindl. var. *minor* Endl. in Lehm., *Pl. Preiss.* 2: 5 (1846), *nom. nud.*

Pterostylis vittata Lindl.var. *viridiflora* Nicholls, *Victorian Naturalist* 49: 253-254 (1933). Type: Western Australia. Boyup Brook, July-Aug. [1915], *E.Corker s.n.* (holo MEL!).

X *Taurodium*

X *Taurodium* D.L.Jones et M.A.Clem., *Austral. Orch. Res.* 4: 87 (2002).

Hybrid between *Taurantha* D.L.Jones et M.A.Clem. and *Diplodium* Sw.

X Taurodium* X *furcillatum (Rupp) D.L.Jones et M.A.Clem., *Austral Orch. Res.* 4: 87 (2002); *Pterostylis* X *furcillata* Rupp, *Proc. Linn. Soc. New South Wales* 55: 415 (1930). Type: New South Wales. North Coast, Kurri Kurri, [Found in *Melaleuca* scrub not very far from the Kurri Kurri Hospital grounds, April 1930], *H.M.R.Rupp s.n.* (holo NSW!). Dist: Australia (NSW).

Note: A rare natural hybrid originating from a cross between *Taurantha ophioglossa* and probably *Diplodium alveata* (= *Pterostylis obtusa sensu* Rupp).

X *Taurodium* X *toveyanum* (Ewart et Sharman) D.L.Jones et M.A.Clem., *Austral Orch. Res.* 4: 87 (2002); *Pterostylis* X *toveyana* Ewart et Sharman, *Proc. Roy. Soc. Victoria* (new ser.) 28(2): 235-236 (1916). Types: Victoria. Mentone, 1907, 1909, 1913, 1914, 1915, *J.R.Tovey s.n.* (syn MEL). Dist: Australia (Vic).

Pterostylis concinna R.Br. X *Pterostylis reflexa* R.Br. var. *intermedia* Ewart, *Proc. Roy. Soc. Victoria* (new ser.) 20(2): 134 (1908).

Note: A rare natural hybrid originating from a cross between *Taurantha concinna* and *Diplodium striatum.*

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Table 3.1. Summary table of described genera and species within Pterostylidinae

Bunochilus	***Crangonorchis***	***Diplodium***	***Eremorchis***	***Hymenochilus***	***Linguella***
chlorogrammus	*depauperata*	*abruptum*	*allantoidea*	*bicolour*	*clavigera*
longifolius	*pedoglossa*	*aestivum*		*cycnocephalus*	*dilatata*
melagrammus		*alatum*		*muticus*	*nana*
smaragdynus		*alobulum*		*pratensis*	*puberula*
stenochilus		*alveatum*		*rubenachii*	*pyramidalis*
tunstallii		*angustum*		*tanypodus*	
williamsonii		*aquilonium*		*tristis*	
		asperum		*wapstrarum*	
		atrans		*ziegeleri*	
		brumalis			
		bryophilum			
		coccinum			
		decurvum			
		dolichochilum			
		elegans			
		erythroconcha			
		fischii			
		grandiflorum			
		hamiltonii			
		hians			
		laxum			
		longicurvum			
		longipetalum			
		metcalfei			
		obtusum			
		pulchellum			
		reflexum			
		revolutum			
		robustum			
		rogersii			
		russellii			
		scabrum			
		scoliosum			
		striatum			
		tenuissimum			
		torquatum			
		trullifolium			
		truncatum			

Oligochaetochilus	*Petrorchis*	*Pharochilum*	*Plumatichilos*	*Pterostylis*	*Ranorchis*
aciculiformis	*bicornis*	*daintreanum*	*barbatum*	*acuminata*	*sargentii*
arenicola			*plumosum*	*agathicola*	
basalticus			*tasmanicum*	*alpina*	
bisetus			*turfosum*	*anatona*	
boormanii				*areolata*	
calceolus				*arfakensis*	
chaetophorus				*auriculata*	
cheraphilus				*australis*	
ciliatus				*banksii*	
cobarensis				*baptistii*	
commutatus				*braemii*	
despectans				*bureaviana*	
excelsus				*cardiostigma*	
gibbosus				*caulescens*	
hamatus				*cernua*	
insectifer				*cucullata*	
leptochilus				*curta*	
linguus				*dubia*	
macrocalymmus				*erecta*	
maximus				*falcata*	
mitchellii				*foliata*	
ovatus				*furcata*	
petrosus				*graminea*	
pictus				*hildae*	
planulatus				*hispidula*	
praetermissus				*humilis*	
pusillus				*irsoniana*	
roensis				*irwinii*	
rufus				*micromega*	
saxicola				*montana*	
setifer				*monticola*	
spathulatus				*neocaledonica*	
squamatus				*novoguineensis*	
validus				*nutans*	
woollsii				*oliveri*	
xerophilus				*oreophila*	
				paludosa	
				papuana	
				patens	
				pedunculata	
				porrecta	
				procera	
				scabrida	
				silvicultrix	
				stricta	
				venosa	
				X *aenigma*	
				X *ingens*	

Speculantha	*Stamnorchis*	*Taurantha*	*Urochilus*	X *Taurodium*
aphylla	*recurva*	*collina*	*concavus*	X *furcillatum*
atriola		*concinna*	*sanguineus*	X *toveyanum*
nigricans		*ophioglossa*	*vittatus*	
parviflora		*splendens*		
uliginosa		*taurus*		
		tenuicauda		
		X *conoglossa*		

Photo: D.L. Jones

Petrorchis bicornis from Mount Maroon, Queensland.

Names Index and Checklist for the Pterostylidinae

Arethusa tetrapetala R.Br. ex J.Britten = ***Diplodium revolutum***
Bunochilus D.L.Jones et M.A.Clem.
Bunochilus sect. ***Bunochilus***
Bunochilus sect. ***Smaragdyna*** D.L.Jones et M.A.Clem.
Bunochilus chlorogrammus (D.L.Jones et M.A.Clem.) D.L.Jones et M.A.Clem.
Bunochilus longifolius (R.Br.) D.L.Jones et M.A.Clem.
Bunochilus melagrammus (D.L.Jones) D.L.Jones et M.A.Clem.
Bunochilus smaragdynus (D.L.Jones et M.A.Clem.) D.L.Jones et M.A.Clem.
Bunochilus stenochilus (D.L.Jones) D.L.Jones et M.A.Clem.
Bunochilus tunstallii (D.L.Jones et M.A.Clem.) D.L.Jones et M.A.Clem.
Bunochilus williamsonii (D.L.Jones) D.L.Jones et M.A.Clem.
Crangonorchis D.L.Jones et M.A.Clem.
Crangonorchis depauperata (F.M.Bailey) D.L.Jones et M.A.Clem.
Crangonorchis pedoglossa (Fitzg.) D.L.Jones et M.A.Clem.
Diplodium Sw.
Diplodium abruptum (D.L.Jones) D.L.Jones et M.A.Clem.
Diplodium aestivum (D.L.Jones) D.L.Jones et M.A.Clem.
Diplodium alatum (Labill.) D.L.Jones et M.A.Clem.
Diplodium alobulum (Hatch) D.L.Jones et M.A.Clem.
Diplodium alveatum (Garnet) D.L.Jones et M.A.Clem.
Diplodium angustum (A.S.George) D.L.Jones et M.A.Clem.
Diplodium aquilonium (D.L.Jones et B.Gray) D.L.Jones et M.A. Clem.
Diplodium asperum (D.L.Jones et M.A.Clem.) D.L.Jones et M.A.Clem.
Diplodium atrans (D.L.Jones) D.L.Jones et M.A.Clem.
Diplodium australe Sw. = ***Diplodium alatum***
Diplodium brumalis (L.B.Moore) D.L.Jones et M.A.Clem.
Diplodium bryophilum (D.L.Jones) D.L.Jones et M.A.Clem.
Diplodium coccinum (Fitzg.) D.L.Jones et M.A.Clem.
Diplodium decurvum (R.S.Rogers) D.L.Jones et M.A.Clem.
Diplodium dolichochilum (D.L.Jones et M.A.Clem.) D.L.Jones et M.A.Clem.
Diplodium elegans (D.L.Jones) D.L.Jones et M.A.Clem.
Diplodium erythroconchum (M.A.Clem. et D.L.Jones) D.L.Jones et M.A.Clem.
Diplodium fischii (Nicholls) D.L.Jones et M.A.Clem.
Diplodium grandiflorum (R.Br.) D.L.Jones et M.A.Clem.
Diplodium hamiltonii (Nicholls) D.L.Jones et M.A.Clem.
Diplodium hians (D.L.Jones) D.L.Jones et M.A.Clem.
Diplodium laxum (Blackmore) D.L.Jones et M.A.Clem.
Diplodium longicurvum (Rupp) D.L.Jones et M.A.Clem.
Diplodium metcalfei (D.L.Jones) D.L.Jones et M.A.Clem.
Diplodium obtusum (R.Br.) D.L.Jones et M.A.Clem.
Diplodium pulchellum (Messmer) D.L.Jones et M.A.Clem.
Diplodium reflexum (R.Br.) D.L.Jones et M.A.Clem.
Diplodium revolutum (R.Br.) D.L.Jones et M.A.Clem.
Diplodium robustum (R.S.Rogers) D.L.Jones et M.A.Clem.
Diplodium rogersii (E.Coleman) D.L.Jones et M.A.Clem.
Diplodium russellii (T.E.Hunt) D.L.Jones et M.A.Clem.
Diplodium scabrum (Lindl.) D.L.Jones et M.A.Clem.
Diplodium scoliosum (D.L.Jones) D.L.Jones et M.A.Clem.
Diplodium striatum (Fitzg.) D.L.Jones et M.A.Clem.
Diplodium tenuissimum (Nicholls) D.L.Jones et M.A.Clem.
Diplodium torquatum (D.L.Jones) D.L.Jones et M.A.Clem.
Diplodium trullifolium (Hook.f.) D.L.Jones et M.A.Clem.

Diplodium truncatum (Fitzg.) D.L.Jones et M.A.Clem.
Diplodium X furcillatum (Rupp) D.L.Jones et M.A.Clem.
Diplodium X toveyanum (Ewart et Sharman) D.L.Jones et M.A.Clem.
Disperis alata Labill. = ***Diplodium alatum***
Eremorchis D.L.Jones et M.A.Clem.
Eremorchis allantoidea (R.S.Rogers) D.L.Jones et M.A.Clem.
Hymenochilus D.L.Jones et M.A.Clem.
Hymenochilus bicolor (M.A.Clem. et D.L.Jones) D.L.Jones et M.A.Clem.
Hymenochilus cycnocephalus (Fitzg.) D.L.Jones et M.A.Clem.
Hymenochilus muticus (R.Br.) D.L.Jones et M.A.Clem.
Hymenochilus pratensis (D.L.Jones) D.L.Jones et M.A.Clem.
Hymenochilus rubenachii (D.L.Jones) D.L.Jones et M.A.Clem.
Hymenochilus tanypodus (D.L.Jones, Molloy et M.A.Clem.) D.L.Jones et M.A.Clem.
Hymenochilus tristis (Colenso) D.L.Jones et M.A.Clem.
Hymenochilus wapstrarum (D.L.Jones) D.L.Jones et M.A.Clem.
Hymenochilus ziegeleri (D.L.Jones) D.L.Jones et M.A.Clem.
Linguella D.L.Jones et M.A.Clem.
Linguella subgen. ***Dilatatae*** D.L.Jones et M.A.Clem.
Linguella subgen. ***Linguella*** sect. ***Linguella***
Linguella subgen. ***Linguella*** sect. ***Pyramidalis*** D.L.Jones et M.A.Clem.
Linguella clavigera (Fitzg.) D.L.Jones et M.A.Clem.
Linguella dilatata (A.S.George) D.L.Jones et M.A.Clem.
Linguella nana (R.Br.) D.L.Jones et M.A.Clem.
Linguella puberula (Hook.f.) D.L.Jones et M.A.Clem.
Linguella pyramidalis (Lindl.) D.L.Jones et M.A.Clem.
Oligochaetochilus D.L.Szlachetko
Oligochaetochilus subgen. *Apicuchilos* D.L.Szlachetko (*pro parte*) = ***Urochilus***
Oligochaetochilus subgen. *Apicuchilos* D.L.Szlachetko (*pro parte*) = ***Bunochilus***
Oligochaetochilus subgen. *Apicuchilos* D.L.Szlachetko (*pro parte*) = ***Ranorchis***
Oligochaetochilus subgen. *Glabrichilos* D.L.Szlachetko (*pro parte*) = ***Hymenochilus***
Oligochaetochilus subgen. *Glabrichilos* D.L.Szlachetko (*pro parte*) = ***Pharochilum***
Oligochaetochilus subgen. *Oligochaetochilus* = ***Oligochaetochilus***
Oligochaetochilus sect. ***Biseta*** D.L.Jones et M.A.Clem.
Oligochaetochilus sect. ***Boormania*** D.L.Jones et M.A.Clem.
Oligochaetochilus sect. ***Chaetophora*** D.L.Jones et M.A.Clem.
Oligochaetochilus sect. ***Excelsa*** D.L.Jones et M.A.Clem.
Oligochaetochilus sect. ***Gibbosa*** D.L.Jones et M.A.Clem.
Oligochaetochilus sect. ***Hamata*** D.L.Jones et M.A.Clem.
Oligochaetochilus sect. ***Insectifera*** D.L.Jones et M.A.Clem.
Oligochaetochilus sect. ***Lingua*** D.L.Jones et M.A.Clem.
Oligochaetochilus sect. ***Longicaudis*** D.L.Jones et M.A.Clem.
Oligochaetochilus sect. ***Setifera*** D.L.Jones et M.A.Clem.
Oligochaetochilus sect. ***Spathulata*** D.L.Jones et M.A.Clem.
Oligochaetochilus aciculiformis (Nicholls) D.L.Szlachetko
Oligochaetochilus arenicola (M.A.Clem. et J.Stewart) D.L.Szlachetko
Oligochaetochilus basalticus (D.L.Jones et M.A.Clem.) D.L.Jones et M.A.Clem.
Oligochaetochilus bisetus (Blackmore et Clemesha) D.L.Szlachetko
Oligochaetochilus boormanii (Rupp) D.L.Szlachetko
Oligochaetochilus calceolus (M.A.Clem.) D.L.Szlachetko
Oligochaetochilus chaetophorus (M.A.Clem. et D.L.Jones) D.L.Szlachetko
Oligochaetochilus cheraphilus (D.L.Jones et M.A.Clem.) D.L.Jones et M.A.Clem.
Oligochaetochilus ciliatus (M.A.Clem. et D.L.Jones) D.L.Szlachetko
Oligochaetochilus cobarensis (M.A.Clem.) D.L.Szlachetko
Oligochaetochilus commutatus (D.L.Jones) D.L.Szlachetko

Oligochaetochilus despectans (Nicholls) D.L.Szlachetko
Oligochaetochilus excelsus (M.A.Clem.) D.L.Szlachetko
Oligochaetochilus gibbosus (R.Br.) D.L.Szlachetko
Oligochaetochilus hamatus (Blackmore et Clemesha) D.L.Szlachetko
Oligochaetochilus insectifer (M.A.Clem. et D.L.Jones) D.L.Szlachetko
Oligochaetochilus leptochilus (M.A.Clem. et D.L.Jones) D.L.Szlachetko
Oligochaetochilus linguus (M.A.Clem.) D.L.Szlachetko
Oligochaetochilus macrocalymmus (M.A.Clem. et D.L.Jones) D.L.Szlachetko
Oligochaetochilus maximus (M.A.Clem. et D.L.Jones) D.L.Szlachetko
Oligochaetochilus mitchellii (Lindl.) D.L.Szlachetko
Oligochaetochilus ovatus (M.A.Clem.) D.L.Szlachetko
Oligochaetochilus petrosus (D.L.Jones et M.A.Clem.) D.L.Jones et M.A.Clem.
Oligochaetochilus pictus (M.A.Clem.) D.L.Szlachetko
Oligochaetochilus planulatus (D.L.Jones et M.A.Clem.) D.L.Jones et M.A.Clem.
Oligochaetochilus praetermissus (M.A.Clem. et D.L.Jones) D.L.Szlachetko
Oligochaetochilus pusillus (R.S.Rogers) D.L.Szlachetko
Oligochaetochilus roensis (M.A.Clem. et D.L.Jones) D.L.Szlachetko
Oligochaetochilus rufus (R.Br.) D.L.Szlachetko
Oligochaetochilus saxicola (D.L.Jones et M.A.Clem.) D.L.Jones et M.A.Clem.
Oligochaetochilus setifer (M.A.Clem., Matthias et D.L.Jones) D.L.Szlachetko
Oligochaetochilus spathulatus (M.A.Clem.) D.L.Szlachetko
Oligochaetochilus squamatus (R.Br.) D.L.Szlachetko
Oligochaetochilus validus (Nicholls) D.L.Jones et M.A.Clem.
Oligochaetochilus woollsii (Fitzg) D.L.Szlachetko
Oligochaetochilus xerophilus (M.A.Clem.) D.L.Szlachetko
Petrorchis D.L.Jones et M.A.Clem.
Petrorchis bicornis (D.L.Jones et M.A.Clem.) D.L.Jones et M.A.Clem.
Pharochilum D.L.Jones et M.A.Clem.
Pharochilum daintreanum (Benth.) D.L.Jones et M.A.Clem.
Plumatichilos D.L.Szlachetko
Plumatichilos **sect.** ***Plumatichilos***
Plumatichilos **sect.** ***Plumosae*** D.L.Jones et M.A.Clem.
Plumatochilos barbatum (Lindl.) D.L.Szlachetko
Plumatochilos plumosum (Cady) D.L.Szlachetko
Plumatochilos tasmanicum (D.L.Jones) D.L.Szlachetko
Plumatochilos turfosum (Endl.) D.L.Szlachetko
Pterostylis R.Br.
Pterostylis subgen. ***Cucullatae*** D.L.Jones et M.A.Clem.
Pterostylis subgen. ***Graminifoliae*** D.L.Jones et M.A.Clem.
Pterostylis subgen. ***Pterostylis***
Pterostylis sect. *Alatae* Rchb.f. = ***Diplodium***
Pterostylis sect. *Antennaea* Benth. = ***Diplodium***
Pterostylis sect. *Antennaea* Benth. Ser. *Grandiflorae* Benth. = ***Diplodium***
Pterostylis sect. *Catochilus* Benth. = ***Plumatichilos***
Pterostylis sect. *Filiformae* Rupp = ***Plumatichilos***
Pterostylis sect. *Foliosae* G.Don = ***Diplodium***
Pterostylis sect. *Squamatae* G.Don = ***Bunochilus***
Pterostylis abrupta D.L.Jones = ***Diplodium abruptum***
Pterostylis aciculiformis (Nicholls) D.L.Jones et M.A.Clem. = ***Oligochaetochilus aciculiformis***
Pterostylis acuminata auct., non R.Br.: P.Royen = ***Pterostylis novoguineensis***
Pterostylis acuminata R.Br.
Pterostylis aestiva D.L.Jones = ***Diplodium aestivum***
Pterostylis affinis Guillaumin = ***Pterostylis bureaviana***
Pterostylis agathicola D.L.Jones, Molloy et M.A.Clem.

Pterostylis alata (Labill.) Rchb.f. = ***Diplodium alatum***
Pterostylis alata var. *robusta* (Ewart) Tovey et P.Morris = ***Diplodium robustum***
Pterostylis alata var. *robusta* (R.S.Rogers) J.Weber et R.Bates = ***Diplodium robustum***
Pterostylis allantoidea R.S.Rogers = ***Eremorchis allantoidea***
Pterostylis alpina R.S.Rogers
Pterostylis alveata Garnet = ***Diplodium alveatum***
Pterostylis anatona D.L.Jones
Pterostylis angusta A.S.George = ***Diplodium angustum***
Pterostylis aphylla Lindl. = ***Speculantha aphylla***
Pterostylis aquilonia D.L.Jones et B.Gray = ***Diplodium aquilonium***
Pterostylis arenicola M.A.Clem. et J.Stewart = ***Oligochaetochilus arenicola***
Pterostylis areolata Petrie
Pterostylis arfakensis (J.J.Sm.) D.L.Jones et M.A.Clem.
Pterostylis aspera D.L.Jones et M.A.Clem. = ***Diplodium asperum***
Pterostylis atrans D.L.Jones = ***Diplodium atrans***
Pterostylis atriola D.L.Jones = ***Speculantha atriola***
Pterostylis auriculata Colenso
Pterostylis australis Hook.f.
Pterostylis banksii A.Cunn.
Pterostylis banksii var. *silvicultrix* F. Muell. = ***Pterostylis silvicultrix***
Pterostylis banksii var. *typica* Hatch = ***Pterostylis banksii***
Pterostylis baptistii Fitzg.
Pterostylis barbata auct., non Lindl.: Cheesem. = ***Plumatichilos tasmanicum***
Pterostylis barbata auct., non Lindl.: Fitzg. = ***Plumatichilos plumosum***
Pterostylis barbata Lindl. = ***Plumatichilos barbatum***
Pterostylis basaltica D.L.Jones et M.A.Clem. = ***Oligochaetochilus basalticus***
Pterostylis bicolor M.A.Clem. et D.L.Jones = ***Hymenochilus bicolor***
Pterostylis bicornis D.L.Jones et M.A.Clem. = ***Petrorchis bicornis***
Pterostylis biseta Blackmore et Clemesha = ***Oligochaetochilus bisetus***
Pterostylis boormanii Rupp = ***Oligochaetochilus boormanii***
Pterostylis braemii H.Mohr
Pterostylis brumalis L.B.Moore = ***Diplodium brumalis***
Pterostylis bryophila D.L.Jones = ***Diplodium bryophilum***
Pterostylis bureaviana Schltr.
Pterostylis calceolus M.A.Clem. = ***Oligochaetochilus calceolus***
Pterostylis cardiostigma D.Cooper
Pterostylis carinata Dockr. = ***Crangonorchis depauperata***
Pterostylis caulescens L.O.Williams
Pterostylis celans Rupp = ***Linguella nana***
Pterostylis ceriflora Blackmore et Clemesha = ***Oligochaetochilus gibbosus***
Pterostylis cernua D.L.Jones, Molloy et M.A.Clem.
Pterostylis chaetophora M.A.Clem. et D.L.Jones = ***Oligochaetochilus chaetophorus***
Pterostylis cheraphila D.L.Jones et M.A.Clem. = ***Oligochaetochilus cheraphilus***
Pterostylis chlorogramma D.L.Jones et M.A.Clem. = ***Bunochilus chlorogrammus***
Pterostylis ciliata M.A.Clem. et D.L.Jones = ***Oligochaetochilus ciliatus***
Pterostylis clavigera Fitzg. = ***Linguella clavigera***
Pterostylis cobarensis M.A.Clem. = ***Oligochaetochilus cobarensis***
Pterostylis coccina Fitzg. = ***Diplodium coccinum***
Pterostylis commutata D.L.Jones = ***Oligochaetochilus commutatus***
Pterostylis concava D.L.Jones et M.A.Clem. = ***Urochilus concavus***
Pterostylis concinna R.Br. = ***Taurantha concinna***
Pterostylis concinna R.Br. X *Pterostylis reflexa* var. *intermedia* Ewart = **X *Taurodium toveyanum***
Pterostylis confertifolia Allan = ***Pterostylis venosa***
Pterostylis constricta O.Sarg. = ***Diplodium scabrum***

Pterostylis crypta Nicholls = ***Diplodium alveatum***
Pterostylis cucullata R.Br.
Pterostylis curta auct. non R.Br.; Hallé = ***Pterostylis neocaledonica***
Pterostylis curta R.Br.
Pterostylis curta var. *grandiflora* Benth. = ***Pterostylis baptistii***
Pterostylis cycnocephala auct. non Fitzg.; Hatch = ***Hymenochilus tanypoda***
Pterostylis cycnocephala Fitzg. = ***Hymenochilus cycnocephalus***
Pterostylis daintreana Benth. = ***Pharochilum daintreanum***
Pterostylis decurva R.S.Rogers = ***Diplodium decurvum***
Pterostylis depauperata F.M.Bailey = ***Crangonorchis depauperata***
Pterostylis despectans (Nicholls) D.L.Jones et M.A.Clem. = ***Oligochaetochilus despectans***
Pterostylis dicheata F.Muell. ex Rchb.f., *nom. nud.*
Pterostylis dilatata A.S.George = ***Linguella dilatata***
Pterostylis dolichochila D.L.Jones et M.A.Clem. = ***Diplodium dolichochilum***
Pterostylis dubia R.Br.
Pterostylis elegans D.L.Jones = ***Diplodium elegans***
Pterostylis emarginata Colenso = ***Pterostylis banksii***
Pterostylis erecta T.E.Hunt
Pterostylis erythroconcha M.A.Clem. et D.L.Jones = ***Diplodium erythroconcha***
Pterostylis excelsa M.A.Clem. = ***Oligochaetochilus excelsus***
Pterostylis falcata R.S.Rogers
Pterostylis fischii Nicholls = ***Diplodium fischii***
Pterostylis foliata Hook.f.
Pterostylis furcata Lindl.
Pterostylis furcata var. *linearis* Hatch = ***Pterostylis paludosa***
Pterostylis furcata var. *typica* Hatch = ***Pterostylis furcata***
Pterostylis X furcillata Rupp = **X *Taurodium furcillatum*** (Rupp) D.L.Jones et M.A.Clem.
Pterostylis gibbosa R.Br. = ***Oligochaetochilus gibbosus***
Pterostylis gibbosa subsp. *gibbosa* = ***Oligochaetochilus gibbosus***
Pterostylis gibbosa subsp. *mitchellii* (Lindl.) Blackmore et Clemesha = ***Oligochaetochilus mitchellii***
Pterostylis gibbosa subsp. *mitchellii sensu* Blackmore et Clemesha = ***Oligochaetochilus chaetophorus***
Pterostylis gracilis Nicholls = ***Pterostylis foliata***
Pterostylis graminea Hook.f.
Pterostylis graminea var. *rubricaulis* H.B.Matthews ex Cheesem. = ***Pterostylis agathicola***
Pterostylis grandiflora R.Br. = ***Diplodium grandiflorum***
Pterostylis hamata Blackmore et Clemesha = ***Oligochaetochilus hamatus***
Pterostylis hamiltonii Nicholls = ***Diplodium hamiltonii***
Pterostylis hians D.L.Jones = ***Diplodium hians***
Pterostylis hildae Nicholls
Pterostylis hispidula Fitzg.
Pterostylis humilis R.S.Rogers
Pterostylis insectifera M.A.Clem.= ***Oligochaetochilus insectifer***
Pterostylis irsoniana Hatch
Pterostylis irwinii D.L.Jones, Molloy et M.A.Clem.
Pterostylis laxa Blackmore = ***Diplodium laxum***
Pterostylis leptochila M.A.Clem. et D.L.Jones = ***Oligochaetochilus leptochilus***
Pterostylis lingua M.A.Clem. = ***Oligochaetochilus linguus***
Pterostylis longicurva Rupp = ***Diplodium longicurvum***
Pterostylis longifolia R.Br. = ***Bunochilus longifolius***
Pterostylis longipetala Rupp = ***Diplodium longipetalum***
Pterostylis mackibbinii F.Muell. = ***Pterostylis cucullata***
Pterostylis macrocalymma M.A.Clem. et D.L.Jones = ***Oligochaetochilus macrocalymmus***
Pterostylis macrophylla A.Cunn. ex Hook.f. = ***Pterostylis banksii***
Pterostylis matthewsii Cheesem. = ***Pterostylis nutans***

Pterostylis maxima M.A.Clem. et D.L.Jones = ***Oligochaetochilus maximus***
Pterostylis melagramma D.L.Jones = ***Bunochilus melagrammus***
Pterostylis metcalfei D.L.Jones = ***Diplodium metcalfei***
Pterostylis micromega Hook.f.
Pterostylis mitchellii Lindl. = ***Oligochaetochilus mitchellii***
Pterostylis mitchellii sensu Fitzg. = ***Oligochaetochilus aciculiformis***
Pterostylis montana Hatch
Pterostylis montana var. *typica* Hatch = ***Pterostylis montana***
Pterostylis monticola D.L.Jones
Pterostylis mutica auct. non R.Br.; Cheesem. = ***Hymenochilus tristis***
Pterostylis mutica auct. non R.Br.; Fitzg. = ***Hymenochilus bicolor***
Pterostylis mutica R.Br. = ***Hymenochilus muticus***
Pterostylis nana auct. non R.Br.; Cheesem. = ***Linguella puberula***
Pterostylis nana auct. non Rupp; Rupp = ***Linguella puberula***
Pterostylis nana R.Br. = ***Linguella nana***
Pterostylis nana var. *typica* Domin = ***Linguella nana***
Pterostylis neocaledonica Schltr.
Pterostylis nigricans D.L.Jones et M.A.Clem. = ***Speculantha nigricans***
Pterostylis novoguineensis Ridley
Pterostylis nutans R.Br.
Pterostylis obtusa R.Br. = ***Diplodium obtusum***
Pterostylis oliveri Petrie
Pterostylis ophioglossa R.Br. = ***Taurantha ophioglossa***
Pterostylis ophioglossa auct. non R.Br.: Schltr. = ***Taurantha tenuicauda***
Pterostylis ophioglossa subsp. *fusca* Clemesha = ***Taurantha taurus***
Pterostylis ophioglossa var. *collina* Rupp = ***Taurantha collina***
Pterostylis ophioglossa var. *collina sensu* Dockr. = ***Taurantha taurus***
Pterostylis oreophila Clemesha
Pterostylis ovata M.A.Clem. = ***Oligochaetochilus ovatus***
Pterostylis paludosa D.L.Jones, Molloy et M.A.Clem.
Pterostylis papuana Rolfe
Pterostylis papuana var. *arfakensis* J.J.Sm. = ***Pterostylis arfakensis***
Pterostylis papuana var. *seranica* J.J.Sm. = ***Pterostylis novoguineensis***
Pterostylis parviflora R.Br. = ***Speculantha parviflora***
Pterostylis parviflora var. *aphylla* (Lindl.) Ewart et J.White = ***Speculantha aphylla***
Pterostylis patens Colenso
Pterostylis pedoglossa Fitzg. = ***Crangonorchis pedoglossa***
Pterostylis pedunculata R.Br.
Pterostylis petrosa D.L.Jones et M.A.Clem. = ***Oligochaetochilus petrosus***
Pterostylis picta M.A.Clem. = ***Oligochaetochilus pictus***
Pterostylis planulata D.L.Jones et M.A.Clem. = ***Oligochaetochilus planulatus***
Pterostylis plumosa auct. non Cady; Johns et Molloy = ***Plumatichilos tasmanicum***
Pterostylis plumosa Cady = ***Plumatichilos plumosum***
Pterostylis polyphila Colenso = ***Pterostylis micromega***
Pterostylis porrecta D.L.Jones, Molloy et M.A.Clem.
Pterostylis praecox Lindl. = ***Diplodium alatum***
Pterostylis praecox var. *robusta* Ewart = ***Diplodium robustum***
Pterostylis praetermissa M.A.Clem. et D.L.Jones = ***Oligochaetochilus praetermissus***
Pterostylis pratensis D.L.Jones = ***Hymenochilus pratensis***
Pterostylis procera D.L.Jones et M.A.Clem.
Pterostylis puberula Hook.f. = ***Linguella puberula***
Pterostylis pulchella Messmer = ***Diplodium pulchellum***
Pterostylis pusilla R.S.Rogers = ***Oligochaetochilus pusillus***
Pterostylis pusilla var. *aciculiformis* Nicholls = ***Oligochaetochilus aciculiformis***

Pterostylis pusilla var. *prominens* Rupp = ***Oligochaetochilus rufus***
Pterostylis pyramidalis Lindl. = ***Linguella pyramidalis***
Pterostylis recurva Benth. = ***Stamnorchis recurva***
Pterostylis reflexa R.Br. = ***Diplodium reflexum***
Pterostylis reflexa var. *intermedia* Ewart = ***Diplodium striatum***
Pterostylis revoluta R.Br. = ***Diplodium revolutum***
Pterostylis robusta R.S.Rogers = ***Diplodium robustum***
Pterostylis roensis M.A. Clem. et D.L.Jones = ***Oligochaetochilus roensis***
Pterostylis rogersii E.Coleman = ***Diplodium rogersii***
Pterostylis rubella auct. non Colenso; Hatch = ***Diplodium brumalis***
Pterostylis rubella Colenso = ***Diplodium trullifolium***
Pterostylis rubenachii D.L.Jones = ***Hymenochilus rubenachii***
Pterostylis rufa R. Br. = ***Oligochaetochilus rufus***
Pterostylis rufa subsp. *aciculiformis* (Nicholls) Blackmore et Clemesha = ***Oligochaetochilus aciculiformis***
Pterostylis rufa subsp. *rufa* = ***Oligochaetochilus rufus***
Pterostylis rufa subsp. *rufa auct. non* R.Br.; W.M. Curtis = ***Oligochaetochilus squamatus***
Pterostylis rufa var. *despectans* Nicholls = ***Oligochaetochilus despectans***
Pterostylis rufa var. *mitchellii* (Lindl.) Fitzg. = ***Oligochaetochilus mitchellii***
Pterostylis rufa var. *squamata* (R.Br.) Fitzg. = ***Oligochaetochilus squamatus***
Pterostylis russellii T.E.Hunt = ***Diplodium russellii***
Pterostylis sanguinea D.L.Jones et M.A.Clem. = ***Urochilus sanguineus***
Pterostylis sargentii C.R.P.Andrews = ***Ranorchis sargentii***
Pterostylis saxicola D.L.Jones et M.A.Clem. = ***Oligochaetochilus saxicola***
Pterostylis scabra Lindl.= ***Diplodium scabrum***
Pterostylis scabra var. *robusta* (R.S.Rogers) A.S.George = ***Diplodium robustum***
Pterostylis scabrida Lindl.
Pterostylis scoliosa D.L.Jones = ***Diplodium scoliosum***
Pterostylis semirubra F.Muell. = ***Pterostylis pedunculata***
Pterostylis setifera M.A.Clem., Matthias et D.L.Jones = ***Oligochaetochilus setifer***
Pterostylis silvicultrix (F.Muell.) Molloy, D.L.Jones et M.A.Clem.
Pterostylis smaragdyna D.L.Jones et M.A.Clem. = ***Bunochilus smaragdynus***
Pterostylis spathulata M.A.Clem. = ***Oligochaetochilus spathulatus***
Pterostylis speciosa Colenso = ***Pterostylis patens***
Pterostylis speciosa T.E.Hunt = ***Diplodium revolutum***
Pterostylis splendens D.L.Jones et M.A.Clem. = ***Taurantha splendens***
Pterostylis squamata auct. non R.Br.: Fitzg. = ***Oligochaetochilus linguus***
Pterostylis squamata auct. non R.Br.: Hook.f. = ***Plumatichilos tasmanicum***
Pterostylis squamata auct. non R.Br.: Nicholls = ***Oligochaetochilus hamatus***
Pterostylis squamata R. Br. = ***Oligochaetochilus squamatus***
Pterostylis squamata var. *valida* Nicholls = ***Oligochaetochilus validus***
Pterostylis stenochila D.L.Jones = ***Bunochilus stenochilus***
Pterostylis striata Fitzg. = ***Diplodium striatum***
Pterostylis stricta Clemesha et B.Gray
Pterostylis subsimilis Colenso = ***Pterostylis patens***
Pterostylis tanypoda D.L.Jones, Molloy et M.A.Clem. = ***Hymenochilus tanypodus***
Pterostylis tasmanica D.L. Jones = ***Plumatichilos tasmanicum***
Pterostylis taurus M.A.Clem. et D.L.Jones = ***Taurantha taurus***
Pterostylis tenuicauda Kraenzl. = ***Taurantha tenuicauda***
Pterostylis tenuissima Nicholls = ***Diplodium tenuissimum***
Pterostylis torquata D.L.Jones = ***Diplodium torquatum***
Pterostylis trifolia Colenso = ***Pterostylis venosa***
Pterostylis tristis Colenso = ***Hymenochilus tristis***
Pterostylis trullifolia Hook.f. = ***Diplodium trullifolium***

Pterostylis trullifolia var. *alobula* Hatch = ***Diplodium alobulum***
Pterostylis trullifolia var. *gracilis* Cheesem. = ***Diplodium trullifolium***
Pterostylis trullifolia var. *rubella* (Colenso) Cheesem. = ***Diplodium trullifolium***
Pterostylis trullifolia var. *rubella sensu* Hatch = ***Diplodium brumalis***
Pterostylis truncata Fitzg. = ***Diplodium truncatum***
Pterostylis tunstallii D.L.Jones et M.A.Clem. = ***Bunochilus tunstallii***
Pterostylis turfosa auct. non Endl.; Fitzg. = ***Plumatichilos barbatum***
Pterostylis turfosa Endl. = ***Plumatichilos turfosum***
Pterostylis uliginosa D.L.Jones = ***Speculantha uliginosa***
Pterostylis valida (Nicholls) D.L.Jones = ***Oligochaetochilus validus***
Pterostylis venosa Colenso
Pterostylis vereenae R.S.Rogers = ***Pterostylis foliata***
Pterostylis vittata Lindl. = ***Urochilus vittatus***
Pterostylis vittata var. *major* Endl. = ***Urochilus vittatus***
Pterostylis vittata var. *minor* Endl. = ***Urochilus vittatus***
Pterostylis vittata var. *subdifformis* Nicholls = ***Urochilus concavus***
Pterostylis vittata var. *viridiflora* Nicholls = ***Urochilus vittatus***
Pterostylis wapstreorum D.L.Jones = ***Hymenochilus wapstrarum***
Pterostylis whitei F.M.Bailey = ***Speculantha parviflora***
Pterostylis williamsonii D.L.Jones = ***Bunochilus williamsonii***
Pterostylis woollsii Fitzg. = ***Oligochaetochilus woollsii***
Pterostylis* X *aenigma D.L.Jones et M.A.Clem.
Pterostylis X *conoglossa* Upton = ***Taurantha* X *conoglossa***
Pterostylis X *furcillata* Rupp = **X *Taurodium furcillatum***
Pterostylis* X *ingens (Rupp) D.L.Jones
Pterostylis X *toveyana* Ewart et Sharman = **X *Taurodium toveyanum***
Pterostylis xerophila M.A.Clem. = ***Oligochaetochilus xerophilus***
Pterostylis ziegeleri D.L.Jones = ***Hymenochilus ziegeleri***
Ranorchis D.L.Jones et M.A. Clem.
Ranorchis sargentii (C.R.P.Andrews) D.L.Jones et M.A.Clem.
Speculantha D.L.Jones et M.A.Clem.
Speculantha sect. ***Elongatae*** D.L.Jones et M.A.Clem.
Speculantha sect. ***Speculantha***
Speculantha aphylla (Lindl.) D.L.Jones et M.A.Clem.
Speculantha atriola (D.L.Jones) D.L.Jones et M.A.Clem.
Speculantha nigricans (D.L.Jones et M.A.Clem.) D.L. Jones et M.A.Clem.
Speculantha parviflora (R.Br.) D.L.Jones et M.A.Clem.
Speculantha uliginosa (D.L.Jones) D.L.Jones et M.A.Clem.
Stamnorchis D.L.Jones et M.A.Clem.
Stamnorchis recurva (Benth.) D.L.Jones et M.A.Clem.
Taurantha D.L.Jones et M.A.Clem.
Taurantha collina (Rupp) D.L.Jones et M.A.Clem.
Taurantha concinna (R.Br.) D.L.Jones et M.A. Clem.
Taurantha ophioglossa (R.Br.) D.L.Jones et M.A.Clem.
Taurantha splendens (D.L.Jones et M.A.Clem.) D.L.Jones et M.A.Clem.
Taurantha taurus (M.A.Clem. et D.L. Jones) D.L.Jones et M.A.Clem.
Taurantha tenuicauda (Kraenzl.) D.L. Jones et M.A. Clem.
Taurantha* X *conoglossa (Upton) D.L.Jones et M.A.Clem.
Urochilus D.L.Jones et M.A.Clem.
Urochilus concavus (D.L.Jones et M.A.Clem.) D.L.Jones et M.A.Clem.
Urochilus sanguineus (D.L.Jones et M.A.Clem.) D.L.Jones et M.A.Clem.
Urochilus vittatus (Lindl.) D.L.Jones et M.A.Clem.
X *Taurodium furcillatum* (Rupp) D.L.Jones et M.A.Clem.
X *Taurodium toveyanum* (Ewart et Sharman) D.L.Jones et M.A.Clem.

1 D.L. Jones
Rosettes of ***Diplodium aestivum***. Cultivated ex Wulgulmerang, Vic.

2 D.L. Jones
Rosettes of ***Diplodium grandiflorum***, Whian Whian State Forest, NSW.

3 D.L. Jones
Rosette of ***Speculantha* sp. aff. *parviflora***, Black Mountain, ACT.

4 D.L. Jones
Rosette of ***Plumatichilos plumosum***. Cultivated ex Abercrombie Caves, NSW.

5 D.L. Jones
Rosette of ***Bunochilus longifolius***. Cultivated ex Nowra, NSW.

6 D.L. Jones
Rosette of ***Urochilus vittatus***. Cultivated ex Perth, WA.

7 D.L. Jones
Rosettes of ***Oligochaetochilus*** **sp. aff.** ***bisetus***, Flinders Ranges, SA.

8 D.L. Jones
Rosettes and developing inflorescences of ***Oligochaetochilus pictus***, Wagin, WA.

9 J. Fanning

Anterior view of distal part of column of ***Diplodium alveatum***, showing column wings with erect apical lobules, erect dehisced anther and stigma with pollen attached following autogamy.

10 J. Fanning

Anterior view of distal part of column of ***Diplodium truncatum***, showing column wings with erect apical lobules and anther and gap between the upper part of the column wings.

11 J. Fanning

Side view of column and labellum, with penicillate basal appendage, of ***Diplodium revolutum***; labellum in closed position.

12 J. Fanning

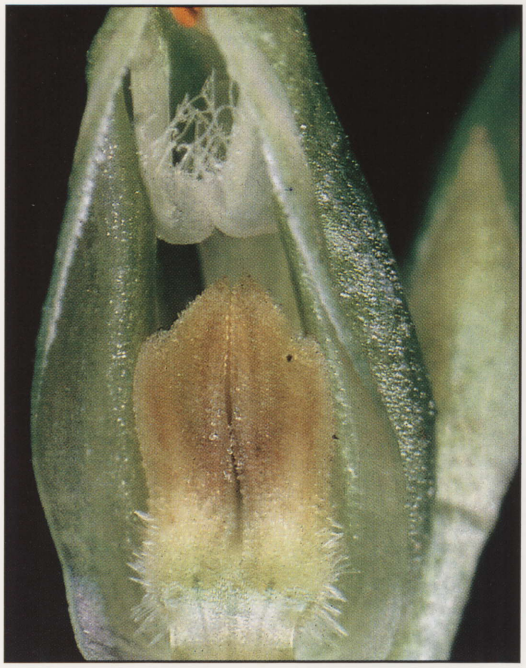
Semi-anterior view of column and labellum of ***Speculantha* sp. aff. *parviflora*** showing basal siting of stigma; labellum in closed position.

13 M.A. Clements

Longitudinal section of flower of ***Linguella nana*** showing column and labellum in the closed position.

14 J. Fanning

Side view of part of flower of ***Bunochilus melagrammus***; labellum is in the set position; transparent organ above the labellum is the petal.



15 J. Fanning

Anterior view of the galea of ***Bunochilus melagrammus***; labellum is in the closed position; note barrier trichomes blocking lower gap in column wings.

16 M.A. Clements

Longitudinal section of flower of ***Bunochilus* sp. aff. *melagrammus*** showing column and labellum in the closed position.

17 J. Fanning
Pterostylis curta, Warrandyte, Vic.

18 J. Fanning
Pterostylis falcata, Toorongo, Vic.

19 M.A. Clements
Cultivated plants of ***Pterostylis cucullata***, ex Fairview Park, SA.

20 M.A. Clements
Pterostylis bureauviana, near Yaté, New Caledonia.

21 M.A. Clements
Pterostylis oliveri, near Arthurs Pass, New Zealand.

22 M.A. Clements
Pterostylis areolata, Taieria, New Zealand.

23 M.A. Clements
Pterostylis papuana, Nugent, Papua New Guinea.

24 M.A. Clements
Pterostylis novoguineense, Irian Jaya.

25 M.A. Clements
Speculantha parviflora, Blue Mountains, NSW.

26 M.A. Clements
Speculantha atriola, Snug Plains, Tas.

27 M.A. Clements
Speculantha uliginosa, Myponga, SA.

28 M.A. Clements
Petrorchis bicornis, Mt Maroon, Qld.

29 M.A. Clements
Diplodium longicurvum, Texas, Qld.

30 M.A. Clements
Diplodium dolichochilum, Tailem Bend, SA.

31 M.A. Clements
Diplodium erythroconcha, Yorke Peninsula, SA.

32 D.L. Jones
Diplodium obtusum, Mt Gibraltar, NSW.

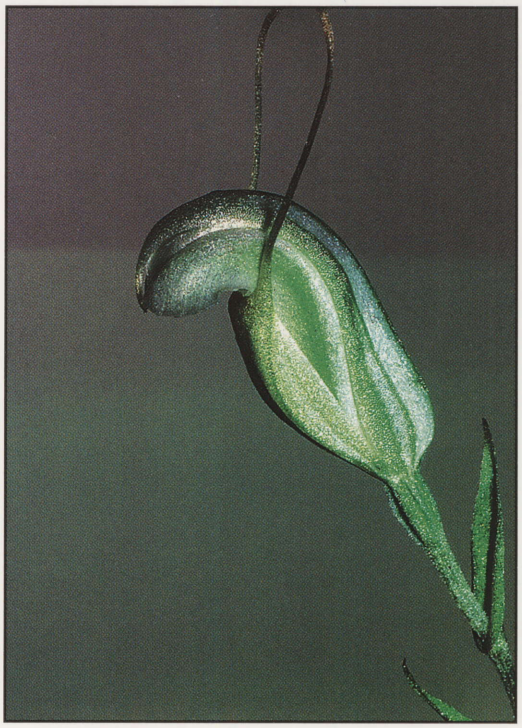
33 M.A. Clements
Crangonorchis pedoglossa, Nowra, NSW.

34 M.A. Clements
Crangonorchis pedoglossa, Coles Bay, Tas.

35 M.A. Clements
Crangonorchis depauperata, Herberton Range, Qld.

36 M.A. Clements
Eremorchis allantoidea, Ravensthorpe, WA.

37 M.A. Clements
Linguella clavigera, Gloucester, NSW.



38 M.A. Clements
Linguella dilatata, near Perth, WA.

39 J. Fanning
Taurantha concinna, Stony Point, Vic.

40 M.A. Clements
Taurantha taurus, Herberton Range, Qld.

41 J. Johnson
Stamnorchis recurva, Albany, WA.

42 J. Fanning
Stamnorchis recurva, Albany, WA.

43 D.L. Jones
Pharochilum daintreanum, Sassafras, NSW.

44 M.A. Clements
Pharochilum daintreanum, Mt Norman, Qld.

45 M.A. Clements

Bunochilus* sp. aff. *longifolius, Enfield State Forest, NSW.

46 M.A. Clements

Bunochilus williamsonii, Coles Bay, Tas.

47 D.L. Jones

Urochilus vittatus, Broomehill, WA.

48 D.L. Jones

Urochilus concavus, Broomehill, WA; one labellum set, the other closed.

49 M.A. Clements
Ranorchis sargentii, Gunapin, WA.

50 M. Rohrlach
Ranorchis sargentii, Brookton, WA.

51 M.A. Clements
Hymenochilus pratensis, Liawenee Moor, Tas.

52 M.A. Clements
Hymenochilus muticus, Blinman, SA.

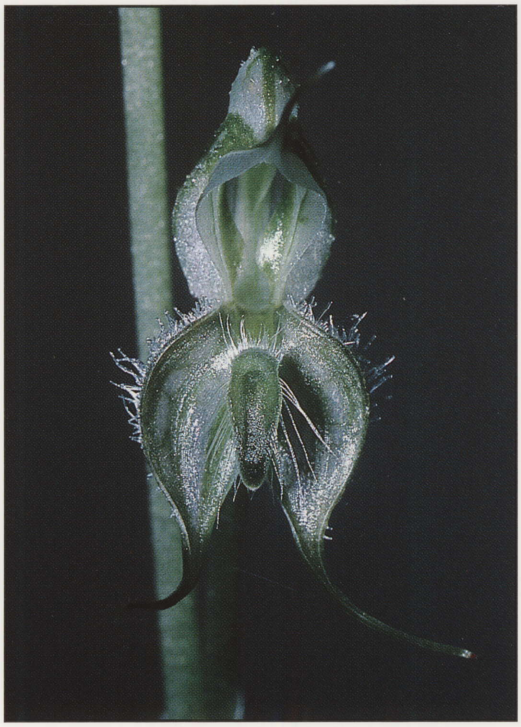
53 M.A. Clements
Oligochaetochilus pusillus, Peake, SA.

54 J. Fanning
Oligochaetochilus aciculiformis, Rushworth, Vic.

55 M.A. Clements
Oligochaetochilus arenicola, Tailem Bend, SA.

56 M.A. Clements
Oligochaetochilus ovatus, Gawler Ranges, SA.

57 M.A. Clements
Oligochaetochilus gibbosus, Yallah, NSW.



58 M.A. Clements
Oligochaetochilus ciliatus, Brookton, WA.

59 M.A. Clements
Oligochaetochilus setifer, Bethungra, NSW; front view.

60 M.A. Clements
Oligochaetochilus setifer, Bethungra, NSW; side view.

61 M.A. Clements
Plumatichilos turfosum, Bremer Bay, WA.

62 M.A. Clements
Plumatichilos barbatum, Darling Scarp, WA.

63 M.A. Clements
Plumatichilos tasmanicum, King Island, Tas.

64 M.A. Clements
Plumatichilos tasmanicum, showing partly emergent microdipteran.

Colour Photographs (refer pages 153-168)

1. *Diplodium aestivum*
2. *Diplodium grandiflorum*
3. *Speculantha* **sp. aff.** *parviflora*
4. *Plumatichilos plumosum*
5. *Bunochilus longifolius*
6. *Urochilus vittatus*
7. *Oligochaetochilus* **sp. aff.** *bisetus*
8. *Oligochaetochilus pictus*
9. *Diplodium alveatum*
10. *Diplodium truncatum*
11. *Diplodium revolutum*
12.. *Speculantha* **sp. aff.** *parviflora*
13. *Linguella nana*
14. *Bunochilus melagrammus*
15. *Bunochilus melagrammus*
16. *Bunochilus* **sp. aff.** *melagrammus*
17. *Pterostylis curta*
18. *Pterostylis falcata*
19. *Pterostylis cucullata*
20. *Pterostylis bureauviana*
21. *Pterostylis oliveri*
22. *Pterostylis areolata*
23. *Pterostylis papuana*
24. *Pterostylis novoguineense*
25. *Speculantha parviflora*
26. *Speculantha atriola*
27. *Speculantha uliginosa*
28. *Petrorchis bicornis*
29. *Diplodium longicurvum*
30. *Diplodium dolichochilum*
31. *Diplodium erythroconcha*
32. *Diplodium obtusum*
33. *Crangonorchis pedoglossa*
34. *Crangonorchis pedoglossa*
35. *Crangonorchis depauperata*
36. *Eremorchis allantoidea*
37. *Linguella clavigera*
38. *Linguella dilatata*
39. *Taurantha concinna*
40. *Taurantha taurus*
41. *Stamnorchis recurva*
42. *Stamnorchis recurva*
43. *Pharochilum daintreanum*
44. *Pharochilum daintreanum*
45. *Bunochilus* **sp. aff.** *longifolius*
46. *Bunochilus williamsonii*
47. *Urochilus vittatus*
48. *Urochilus concavus*
49. *Ranorchis sargentii*
50. *Ranorchis sargentii*
51. *Hymenochilus pratensis*
52. *Hymenochilus muticus*
53. *Oligochaetochilus pusillus*
54. *Oligochaetochilus aciculiformis*
55. *Oligochaetochilus arenicola*
56. *Oligochaetochilus ovatus*
57. *Oligochaetochilus gibbosus*
58. *Oligochaetochilus ciliatus*
59. *Oligochaetochilus setifer*
60. *Oligochaetochilus setifer*
61. *Plumatichilos turfosum*
62. *Plumatichilos barbatum*
63. *Plumatichilos tasmanicum*
64. *Plumatichilos tasmanicum*

Diplodium coccinum from Bowral, New South Wales.

Diplodium hamiltonii from Wagin, Western Australia


Australian Orchid Foundation

SUPPLEMENT TO

AUSTRALIAN ORCHID RESEARCH

VOLUME 4, 2002

Illustrations of *Pterostylis* (Orchidaceae)

AUSTRALIAN ORCHID FOUNDATION

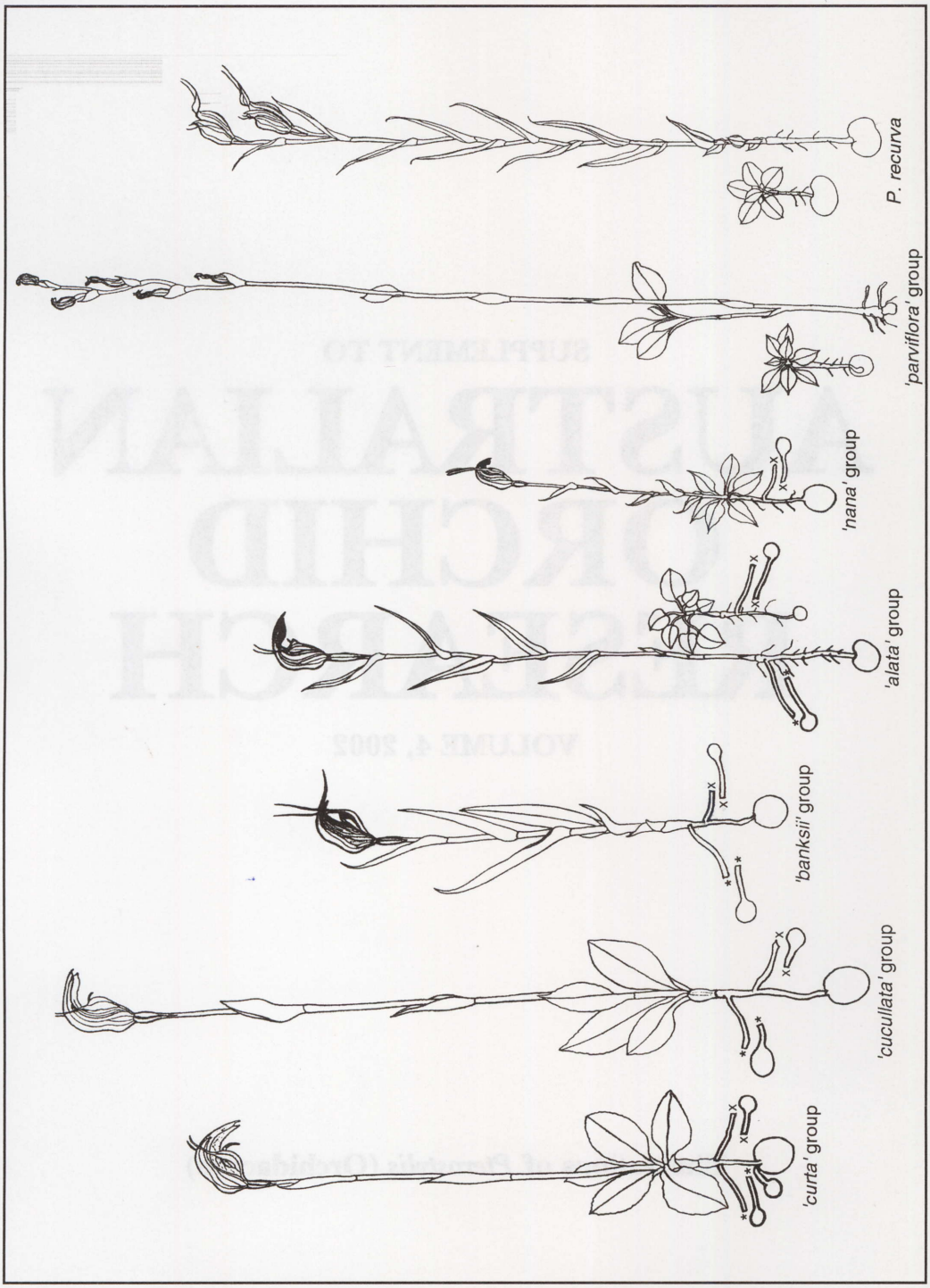


Fig. 1.1. Flowering plants of *Pterostylis* species with an erect synsepalum showing tuberous system, leaf arrangement, including rosette habit and cauline leaves, and generalised flower arrangement.

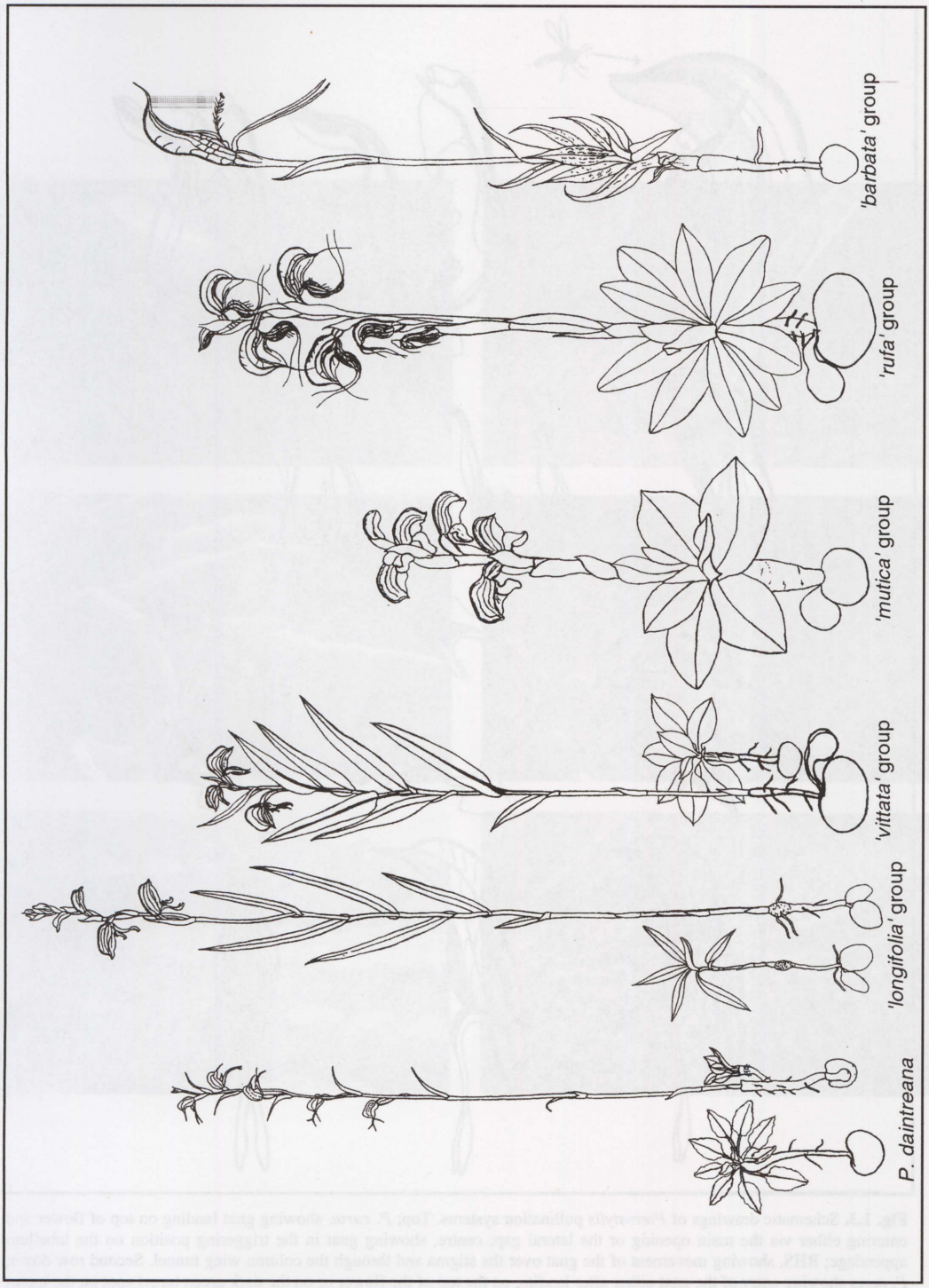


Fig. 1.2. Flowering plants of *Pterostylis* species with a deflexed synsepalum showing tuberous system, leaf arrangement, including rosette habit and cauline leaves, and generalised flower arrangement.

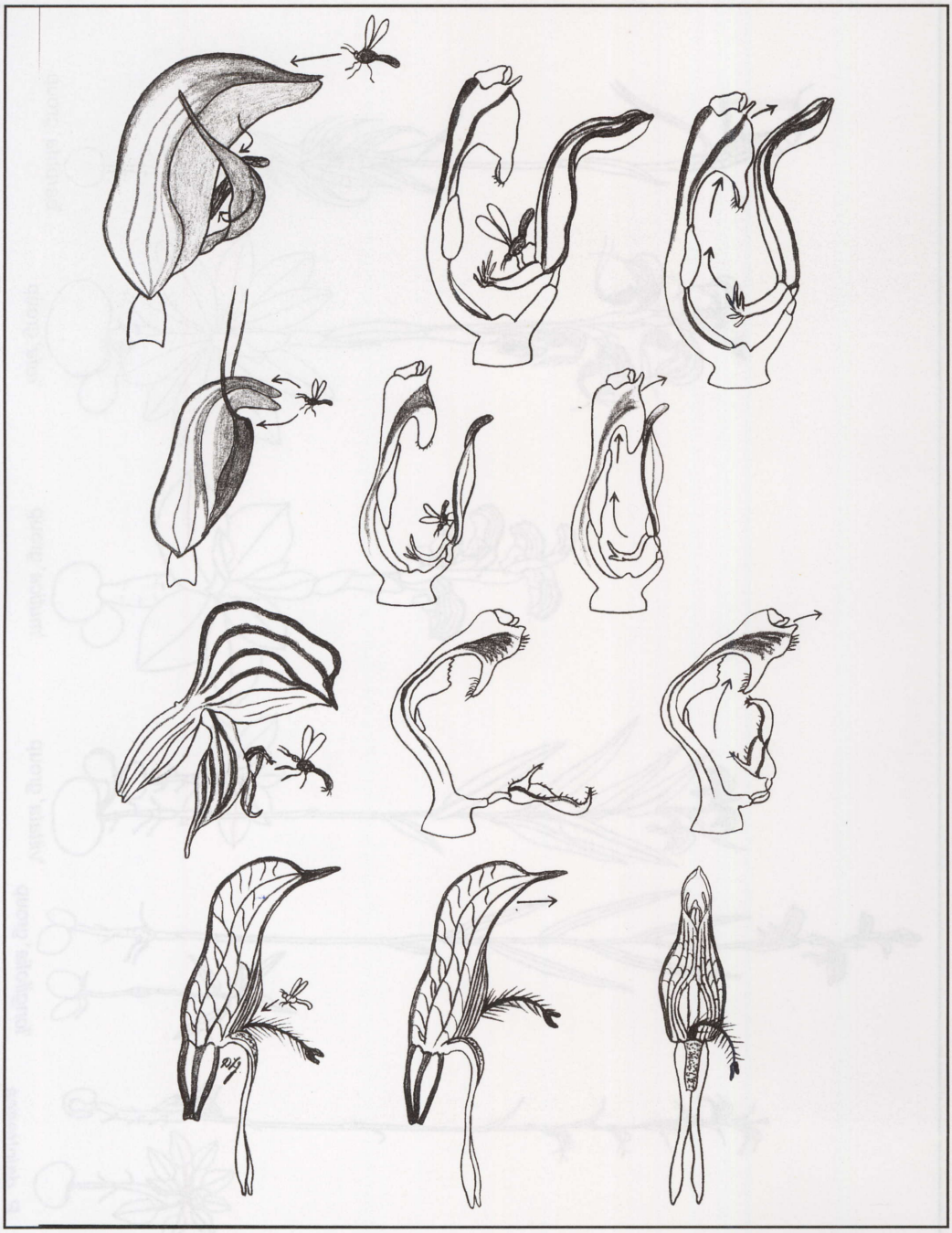


Fig. 1.3. Schematic drawings of *Pterostylis* pollination systems. Top; *P. curta,* showing gnat landing on top of flower and entering either via the main opening or the lateral gap; centre, showing gnat in the triggering position on the labellum appendage; RHS, showing movement of the gnat over the stigma and through the column wing tunnel. Second row down; *P. nana* showing entry of the gnat either after landing on the top of the flower or on the dark green target spot on the top of the synsepalum; centre, showing gnat in the triggering position on the labellum appendage; RHS, showing movement of the gnat over the stigma and through the column wing tunnel. Third row down; *P. vittata* showing gnat landing on labellum; centre, column with labellum in the set position; RHS, column with labellum in the closed position. Bottom; *P. plumosa* showing gnat entering flower via lower opening and, centre, exiting via upper opening; RHS, front view of flower showing lower and upper galea openings.

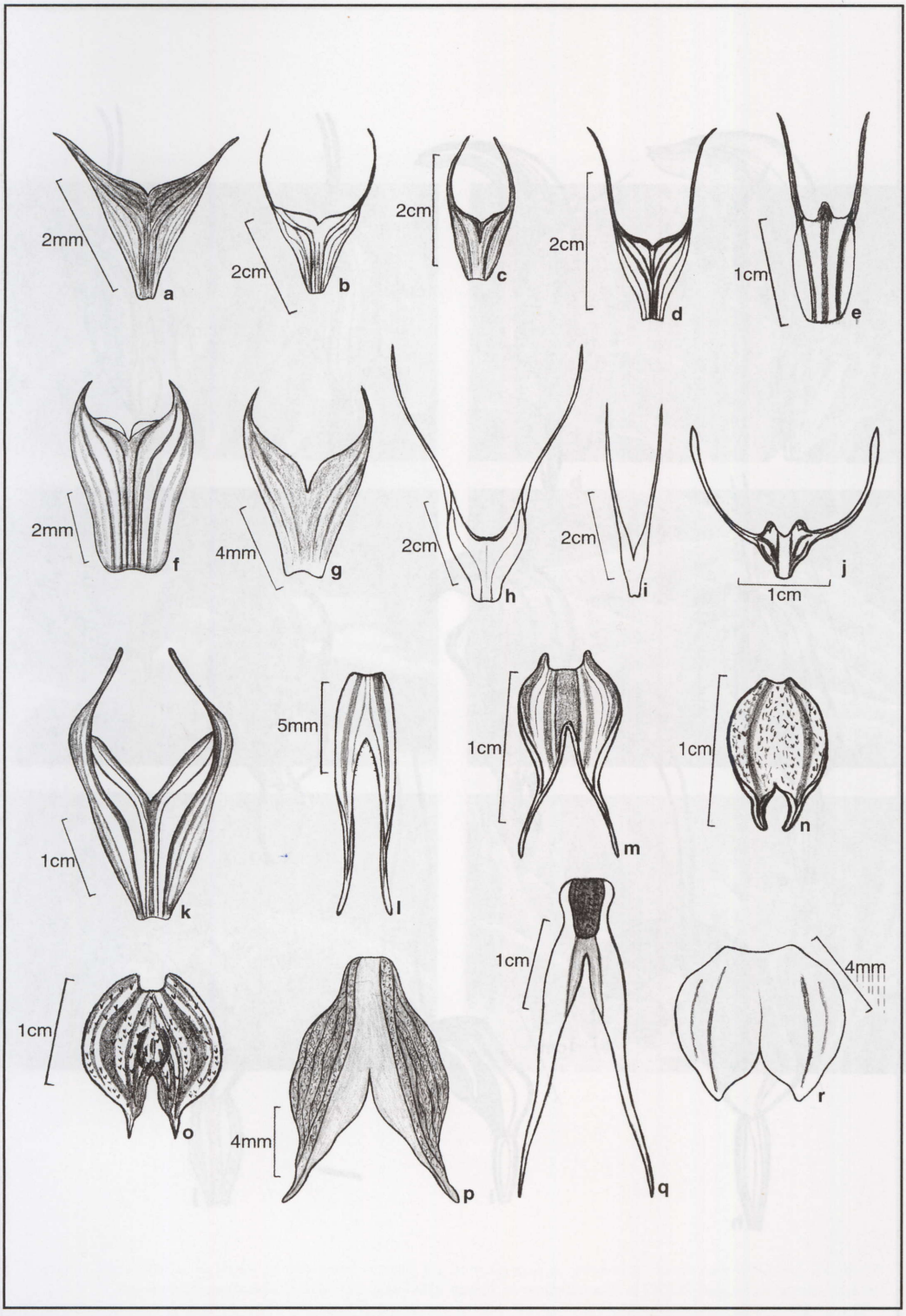


Fig. 1.4. *Pterostylis* synsepala. **a**. *P. curta*; **b**. *P. alpina*; **c**. *P. foliata*; **d**. *P. alata*; **e**. *P. nana*; **f**. *P. parviflora*; **g**. *P. bicornis*; **h**. *P. ophioglossa*; **i**. *P. pedoglossa*; **j**. *P. allantoidea*; **k**. *P. recurva*; **l**. *P. daintreana*; **m**. *P. sargentii*; **n**. *P. longifolia*; **o**. *P. vittata*; **p**. *P. rufa*; **q**. *P. barbata*; **r**. *P. mutica*.

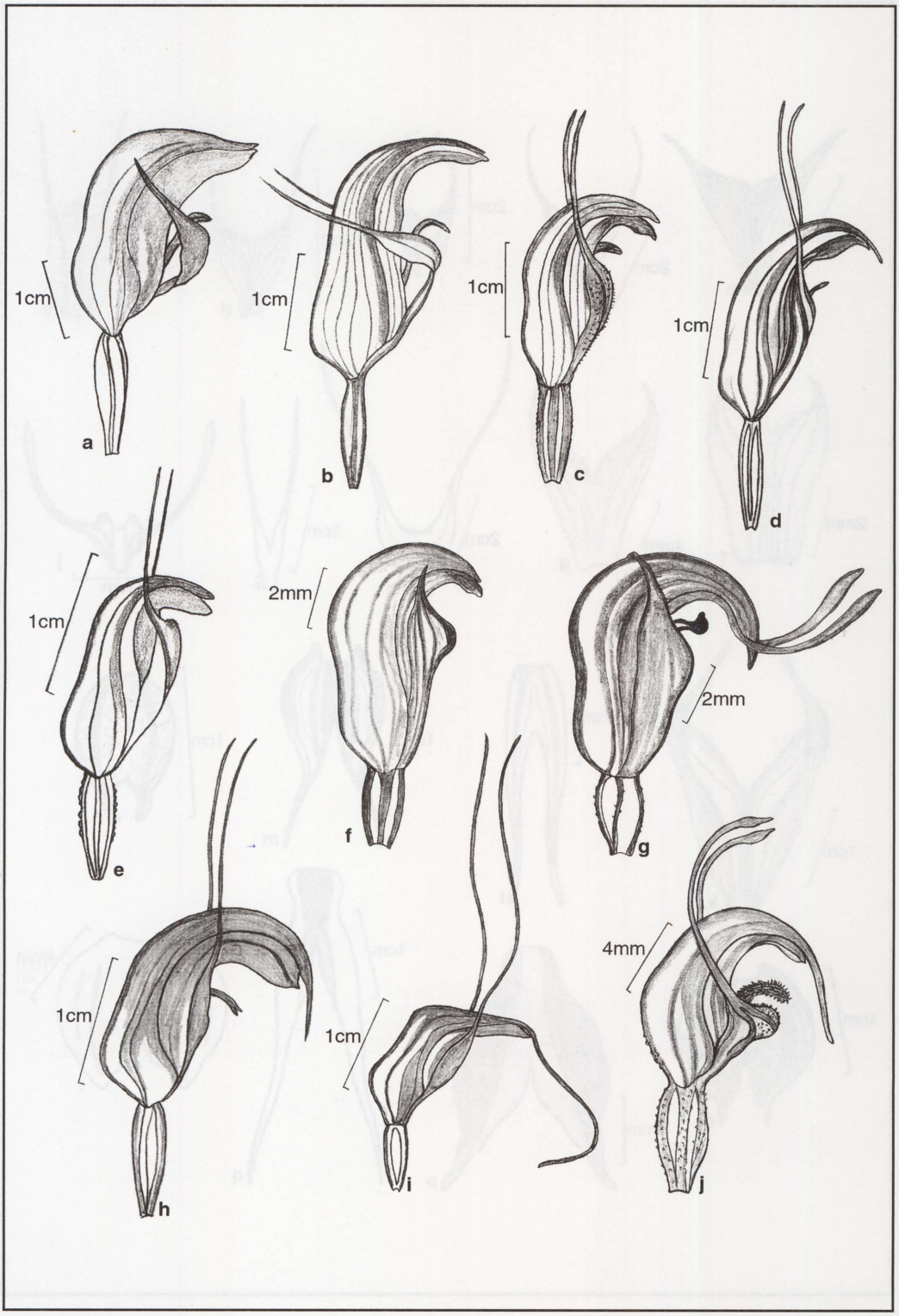


Fig. 1.5. Side view of *Pterostylis* flowers with erect lateral sepals. **a**. *P. curta*; **b**. *P. alpina*; **c**. *P. foliata*; **d**. *P. alata*; **e**. *P. nana*; **f**. *P. parviflora*; **g**. *P. bicornis*; **h**. *P. ophioglossa*; **i**. *P. pedoglossa*; **j**. *P. allantoidea*.

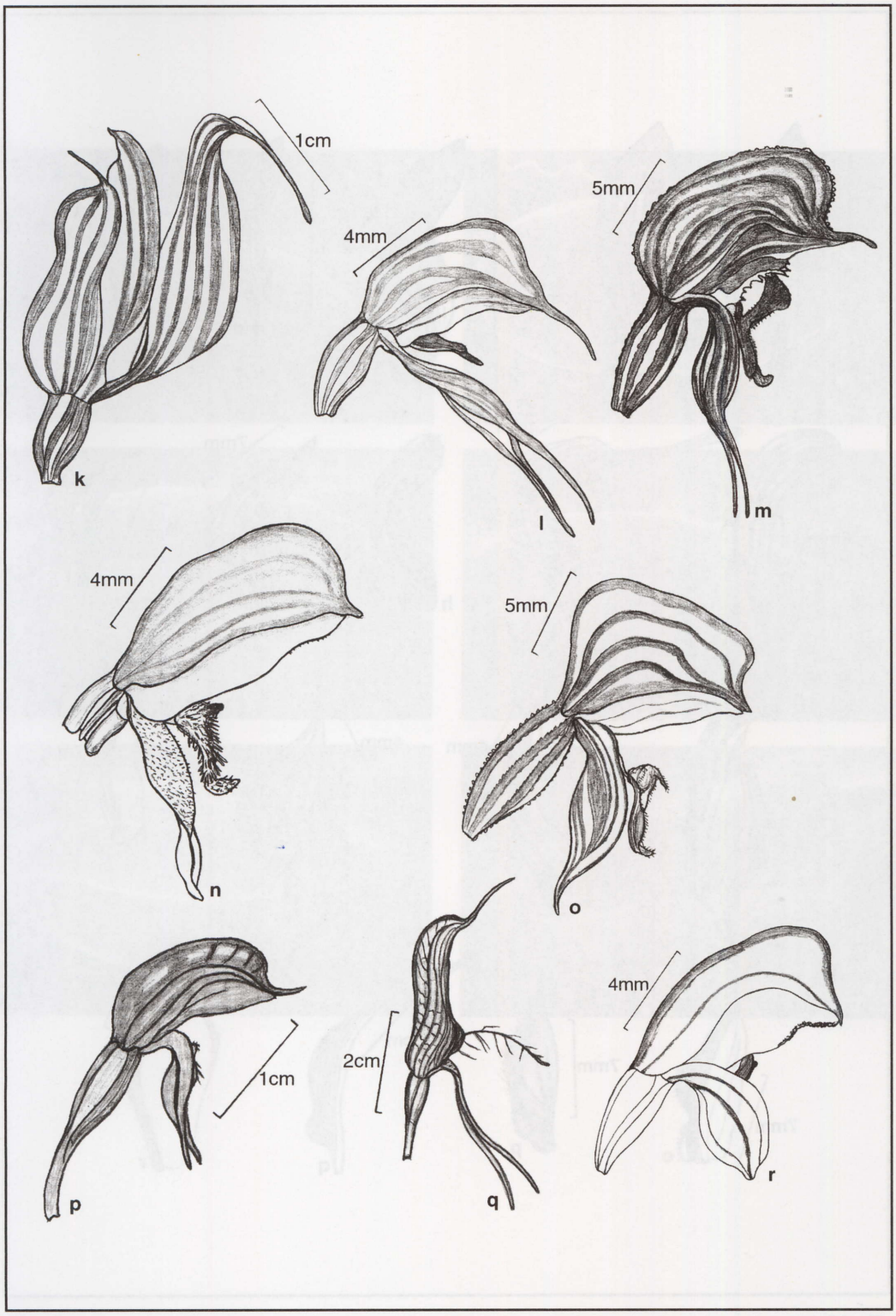


Fig. 1.6. Side view of *Pterostylis* flowers with deflexed lateral sepals. **k**. *P. recurva*; **l**. *P. daintreana*; **m**. *P. sargentii*; **n**. *P. longifolia*; **o**. *P. vittata*; **p**. *P. rufa*; **q**. *P. barbata*; **r**. *P. mutica*.

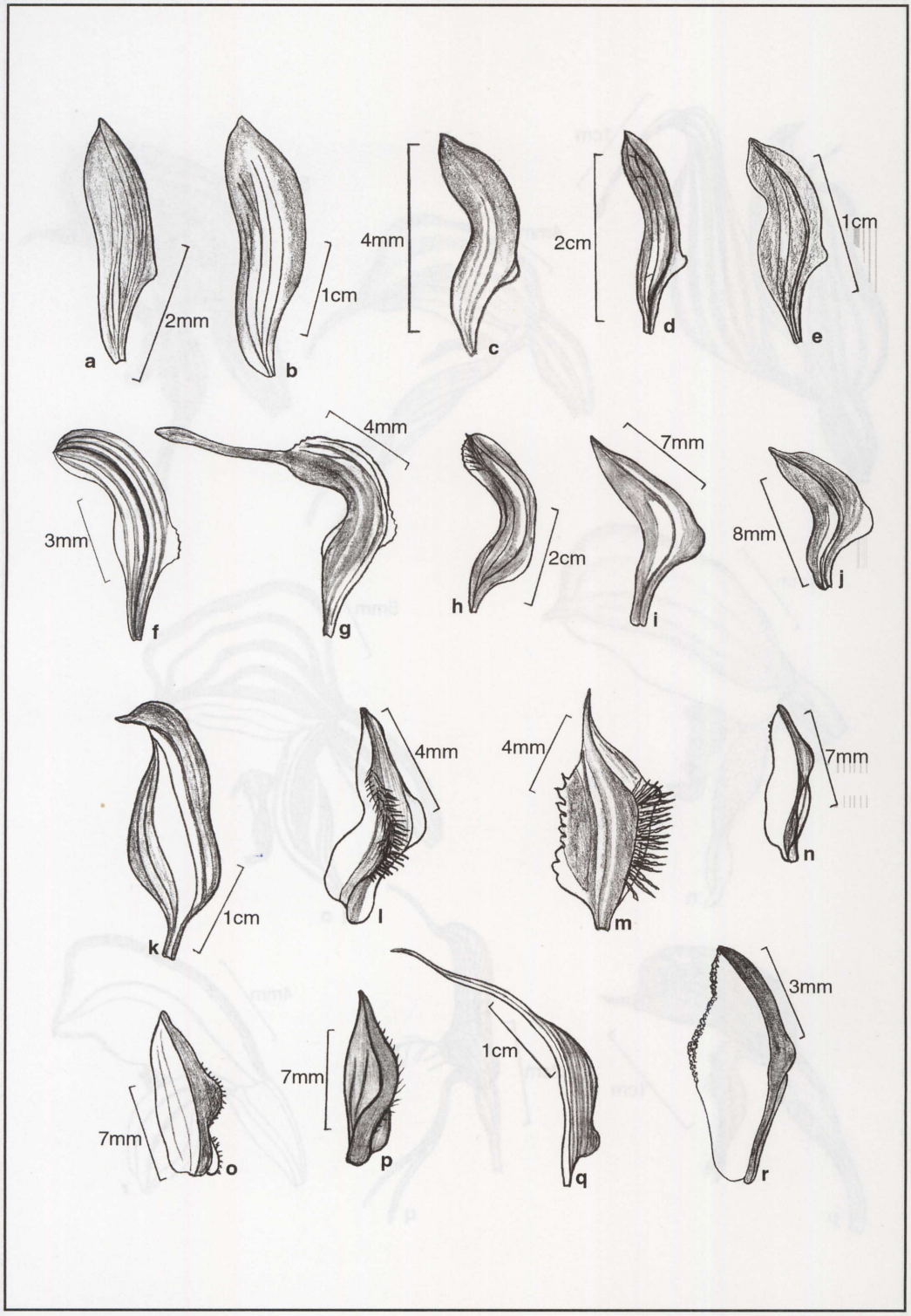


Fig. 1.7. *Pterostylis* petals. **a**. *P. curta*; **b**. *P. alpina*; **c**. *P. foliata*; **d**. *P. alata*; **e**. *P. nana*; **f**. *P. parviflora*; **g**. *P. bicornis*; **h**. *P. ophioglossa*; **i**. *P. pedoglossa*; **j**. *P. allantoidea*; **k**. *P. recurva*; **l**. *P. daintreana*; **m**. *P. sargentii*; **n**. *P. longifolia*; **o**. *P. vittata*; **p**. *P. rufa*; **q**. *P. barbata*; **r**. *P. mutica*.

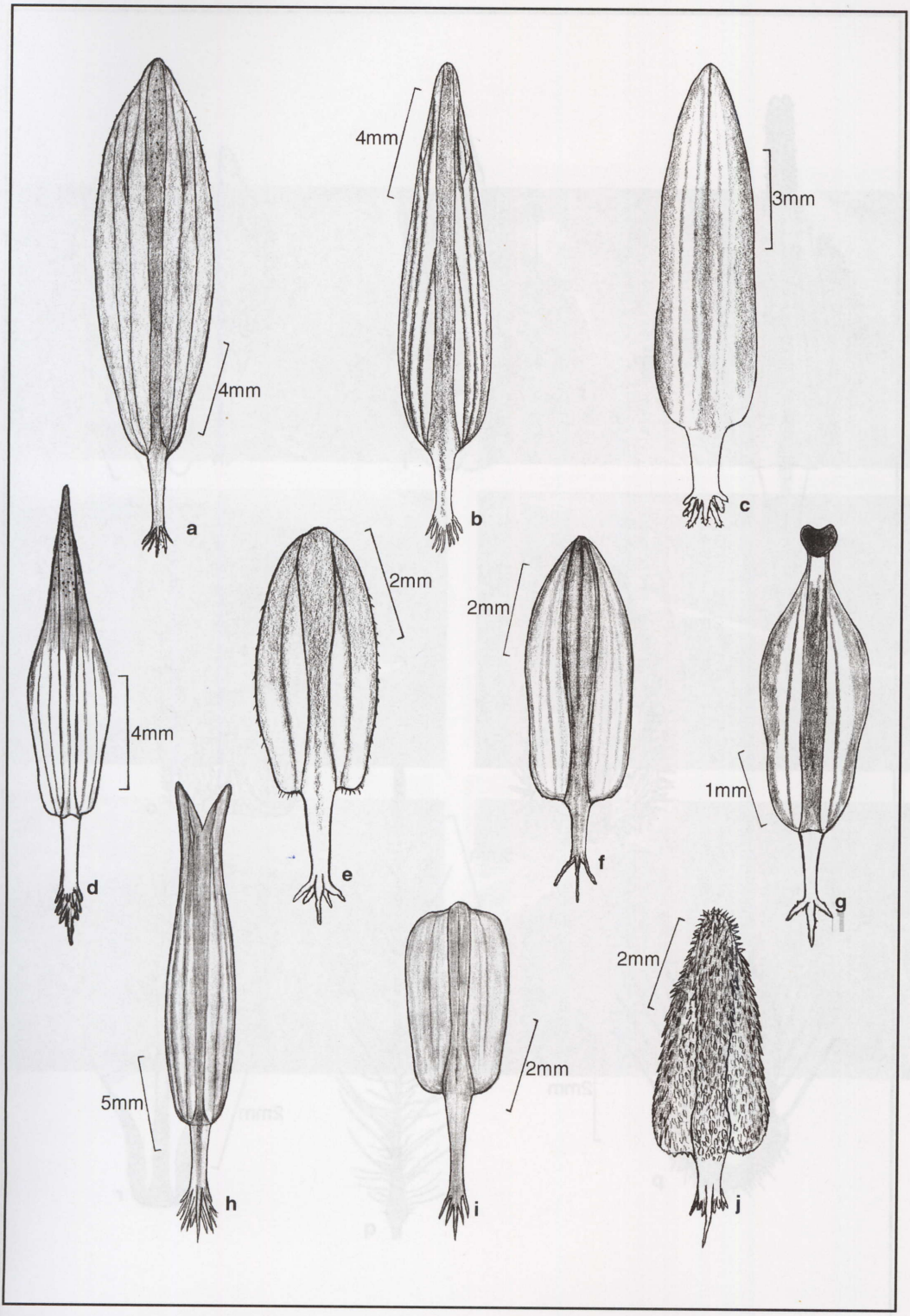


Fig. 1.8. *Pterostylis* labella, from species with erect lateral sepals. **a**. *P. curta*; **b**. *P. alpina*; **c**. *P. foliata*; **d**. *P. alata*; **e**. *P. nana*; **f**. *P. parviflora*; **g**. *P. bicornis*; **h**. *P. ophioglossa*; **i**. *P. pedoglossa*; **j**. *P. allantoidea*.

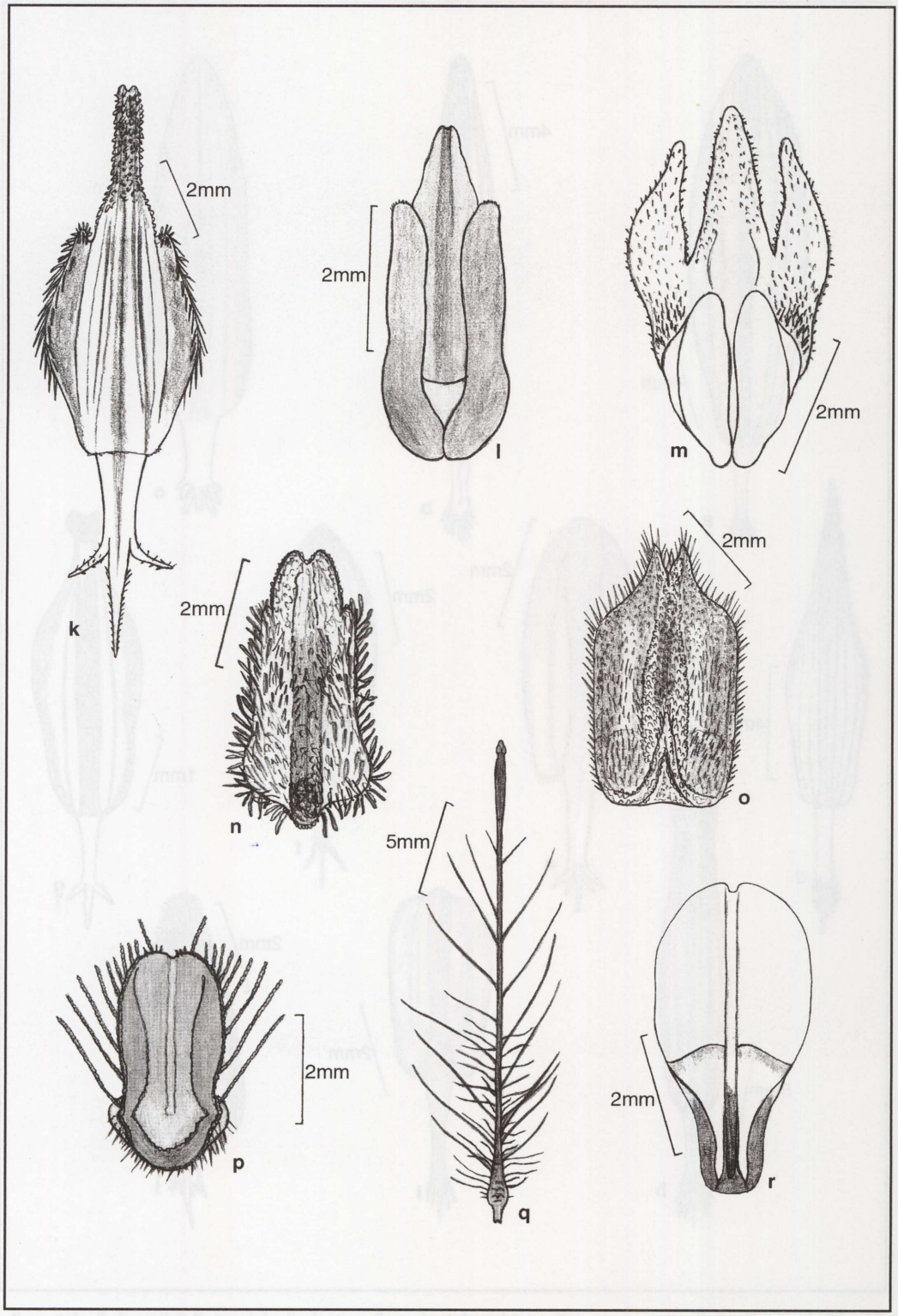


Fig. 1.9. *Pterostylis* labella, from species with deflexed lateral sepals. **k**. *P. recurva*; **l**. *P. daintreana*; **m**. *P. sargentii*; **n**. *P. longifolia*; **o**. *P. vittata*; **p**. *P. rufa*; **q**. *P. barbata*; **r**. *P. mutica*.

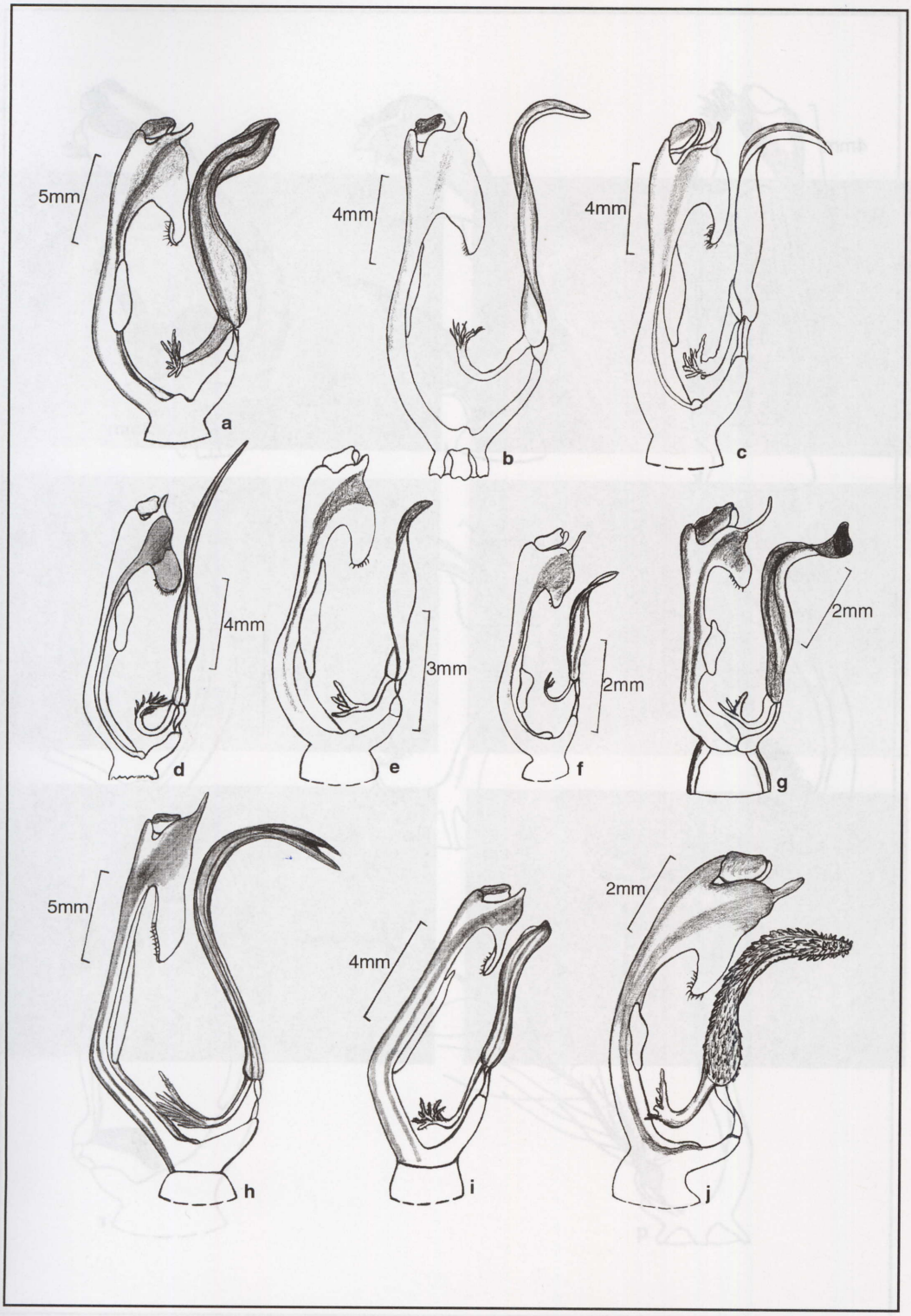


Fig. 1.10. Side view of *Pterostylis* columns and labella, from species with erect lateral sepals. **a**. *P. curta*; **b**. *P. alpina*; **c**. *P. foliata*; **d**. *P. alata*; **e**. *P. nana*; **f**. *P. parviflora*; **g**. *P. bicornis*; **h**. *P. ophioglossa*; **i**. *P. pedoglossa*; **j**. *P. allantoidea*.

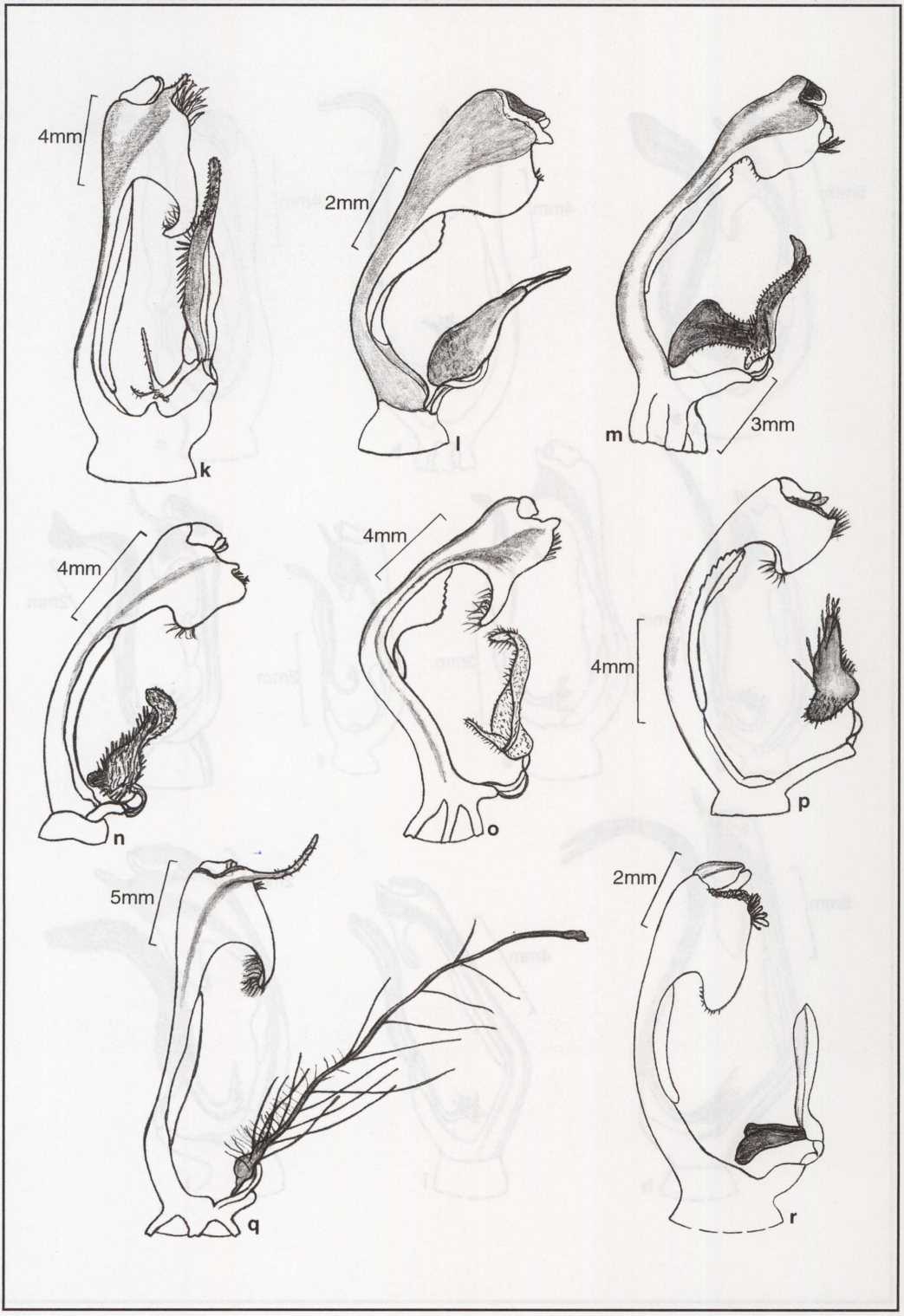


Fig. 1.11. Side view of *Pterostylis* columns and labella, from species with deflexed lateral sepals. **k**. *P. recurva*; **l**. *P. daintreana*; **m**. *P. sargentii*; **n**. *P. longifolia*; **o**. *P. vittata*; **p**. *P. rufa*; **q**. *P. barbata*; **r**. *P. mutica*.

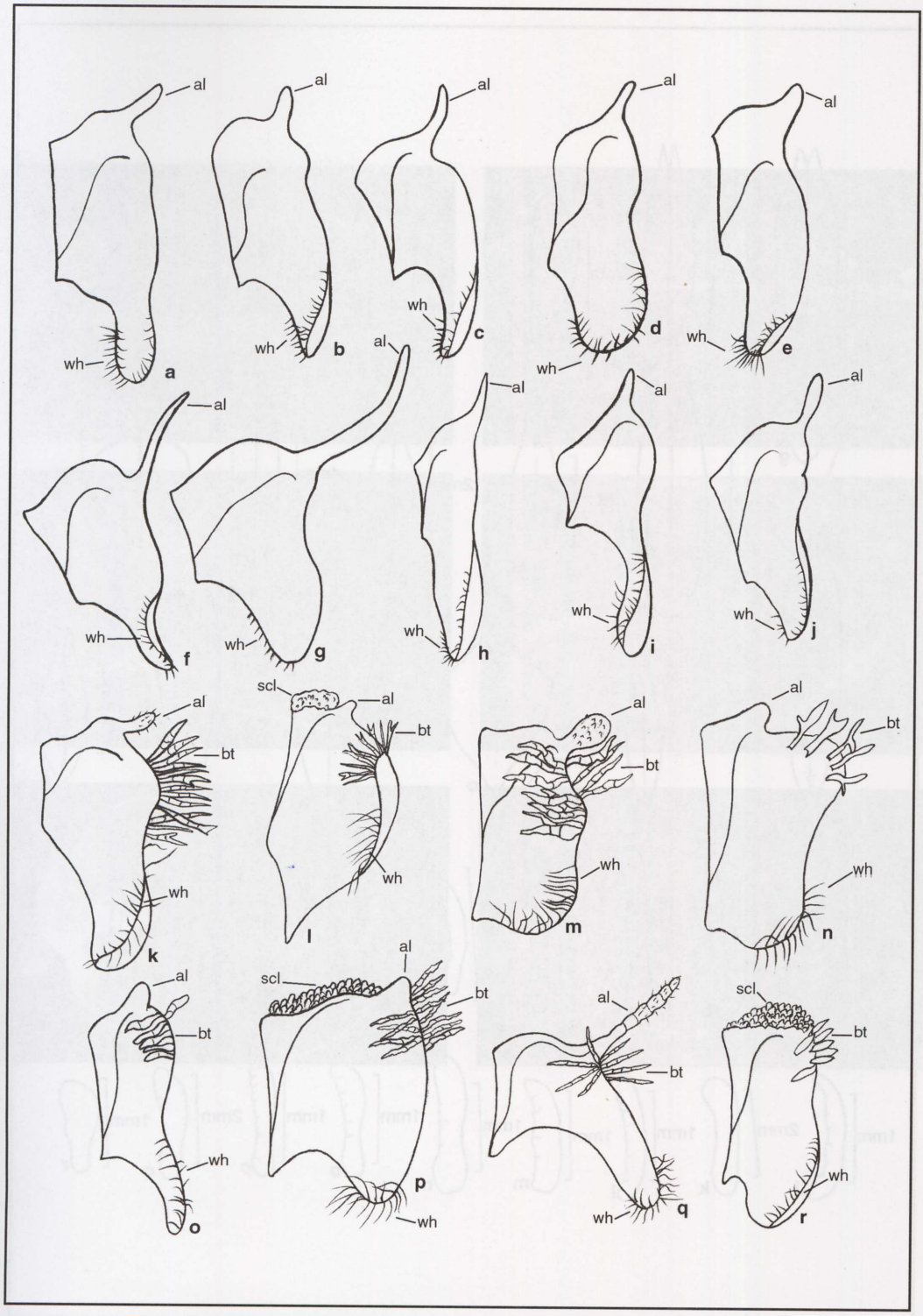


Fig. 1.12. *Pterostylis* column wing, interior view (al=apical lobule; bt=barrier trichomes; scl=siliceous cells; wh=wing hairs). **a**. *P. curta*; **b**. *P. alpina*; **c**. *P. foliata*; **d**. *P. alata*; **e**. *P. nana*; **f**. *P. parviflora*; **g**. *P. bicornis*; **h**. *P. ophioglossa*; **i**. *P. pedoglossa*; **j**. *P. allantoidea*; **k**. *P. recurva*; **l**. *P. daintreana*; **m**. *P. sargentii*; **n**. *P. longifolia*; **o**. *P. vittata*; **p**. *P. rufa*; **q**. *P. barbata*; **r**. *P. mutica*.

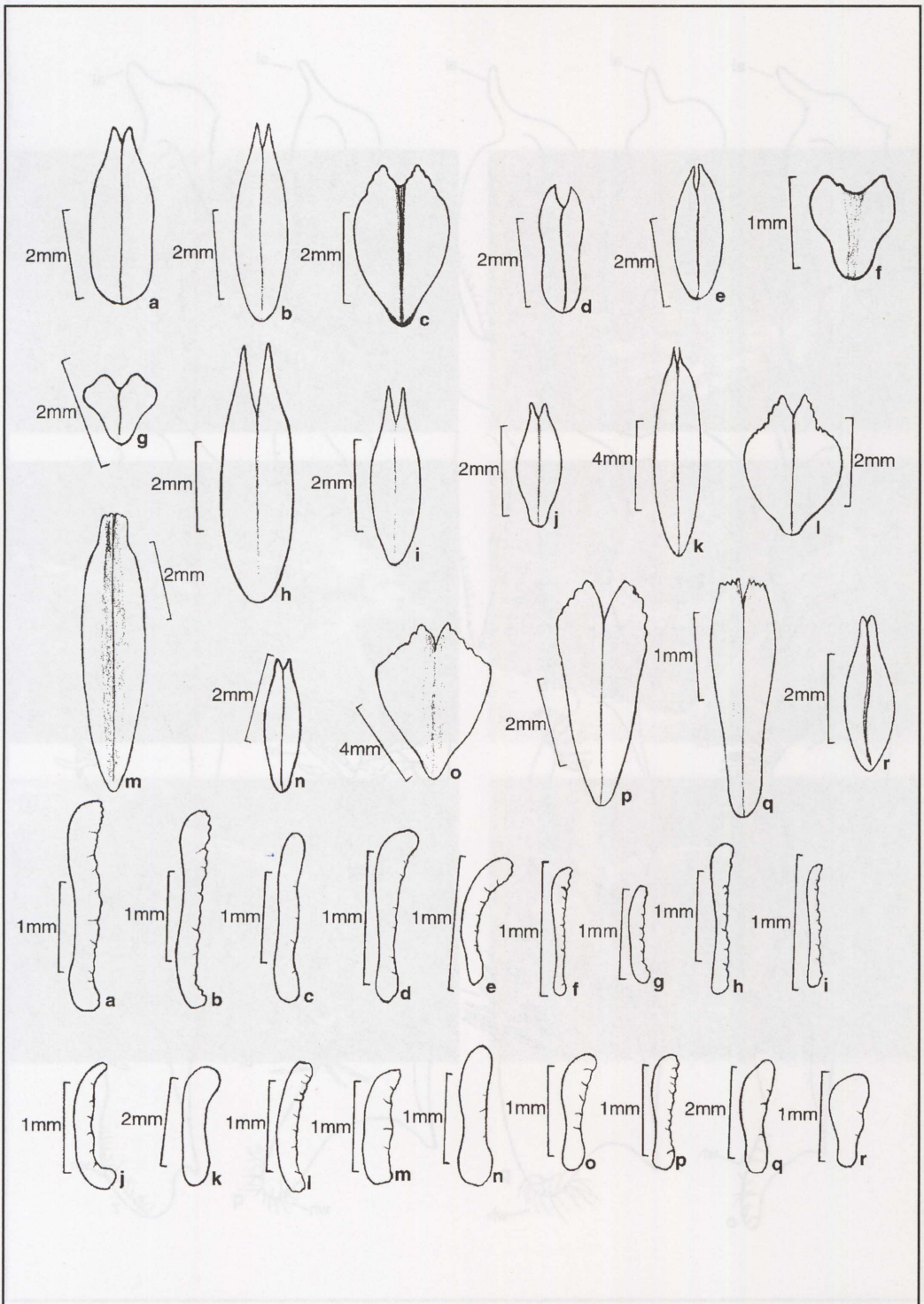


Fig. 1.13. *Pterostylis* stigmas and pollinia. **a**. *P. curta*; **b**. *P. alpina*; **c**. *P. foliata*; **d**. *P. alata*; **e**. *P. nana*; **f**. *P. parviflora*; **g**. *P. bicornis*; **h**. *P. ophioglossa*; **i**. *P. pedoglossa*; **j**. *P. allantoidea*; **k**. *P. recurva*; **l**. *P. daintreana*; **m**. *P. sargentii*; **n**. *P. longifolia*; **o**. *P. vittata*; **p**. *P. rufa*; **q**. *P. barbata*; **r**. *P. mutica*.

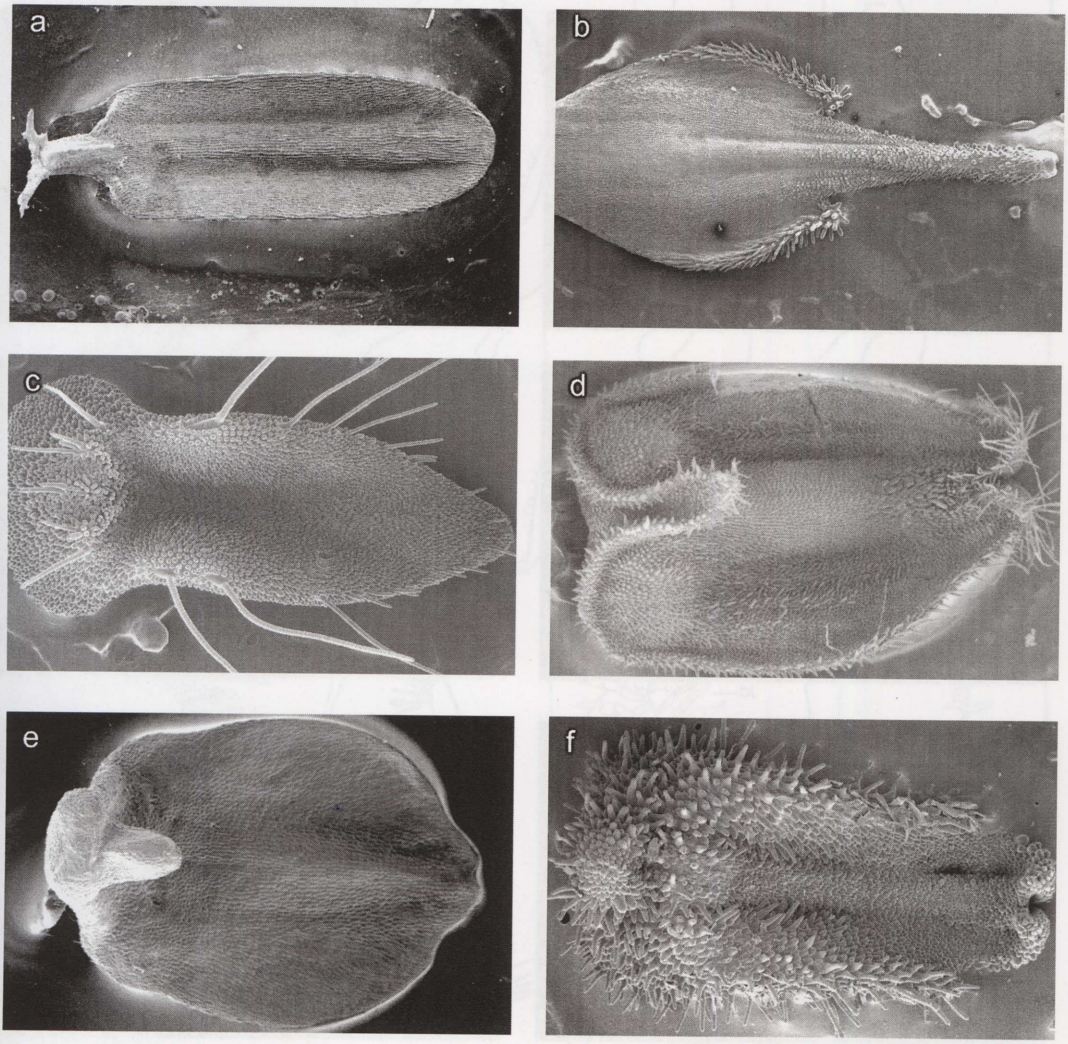


Plate 1. Abaxial views of *Pterostylis* labella. **a.** *P.* sp. aff. *parviflora*, Kurnell, NSW; **b.** *P. recurva*, near Walpole, WA; **c.** *P. basaltica*, Woorndoo, Vic.; **d**. *P. sanguinea*, Belair, SA; **e**. *P. cycnocephala*, Ardlethan, NSW; **f**. *P.* sp. aff. *longifolia*, Point Lookout, NSW.

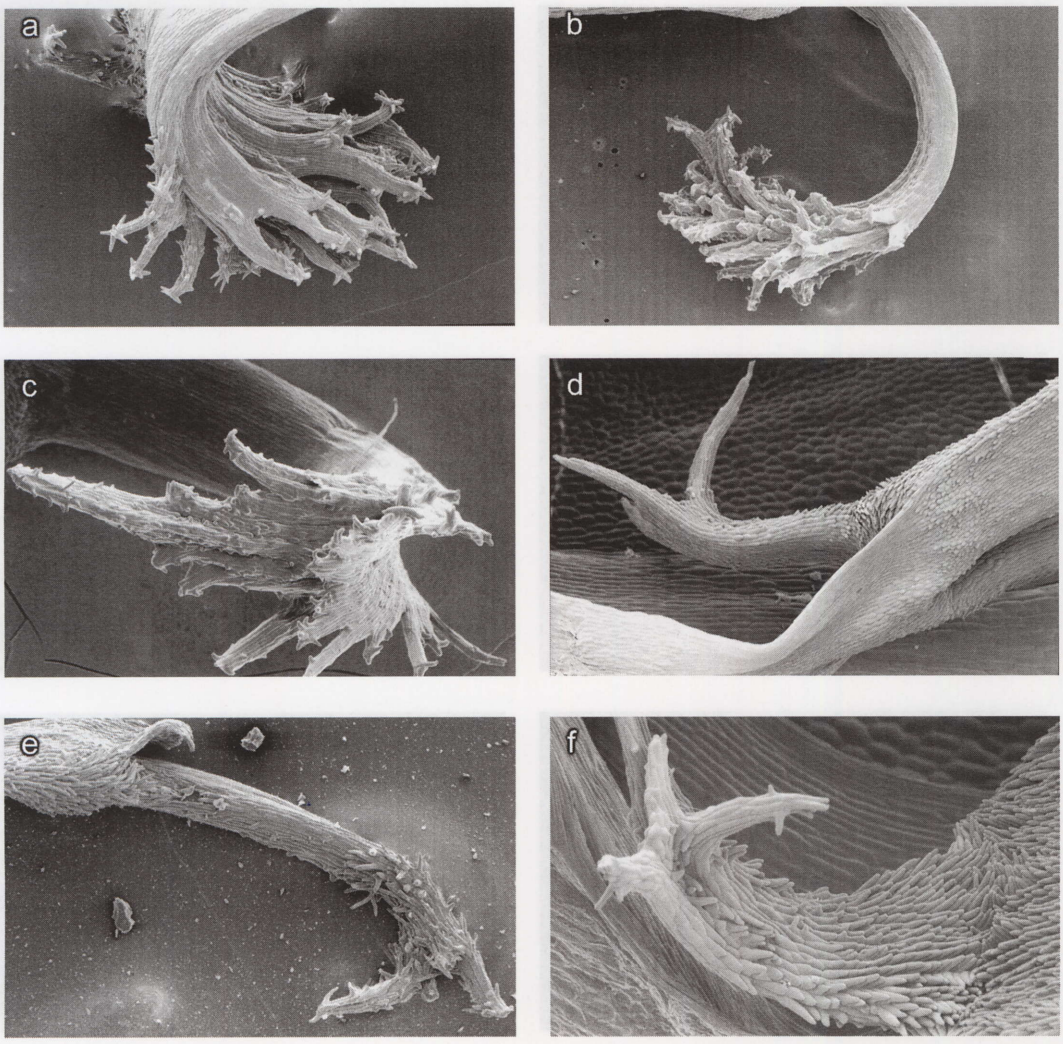


Plate 2. Labellum basal appendages. **a.** *P. bureauviana*, New Caledonia; **b.** *P. angusta*, Bunbury, WA; **c**. *P. decurva*, Brindabella Range, ACT; **d**. *P.* sp. aff. *parviflora*, Black Mountain, ACT; **e**. *P.* sp. aff. *nana*, Margaret River, WA; **f**. *P. bicornis*, Mt Maroon, Qld.

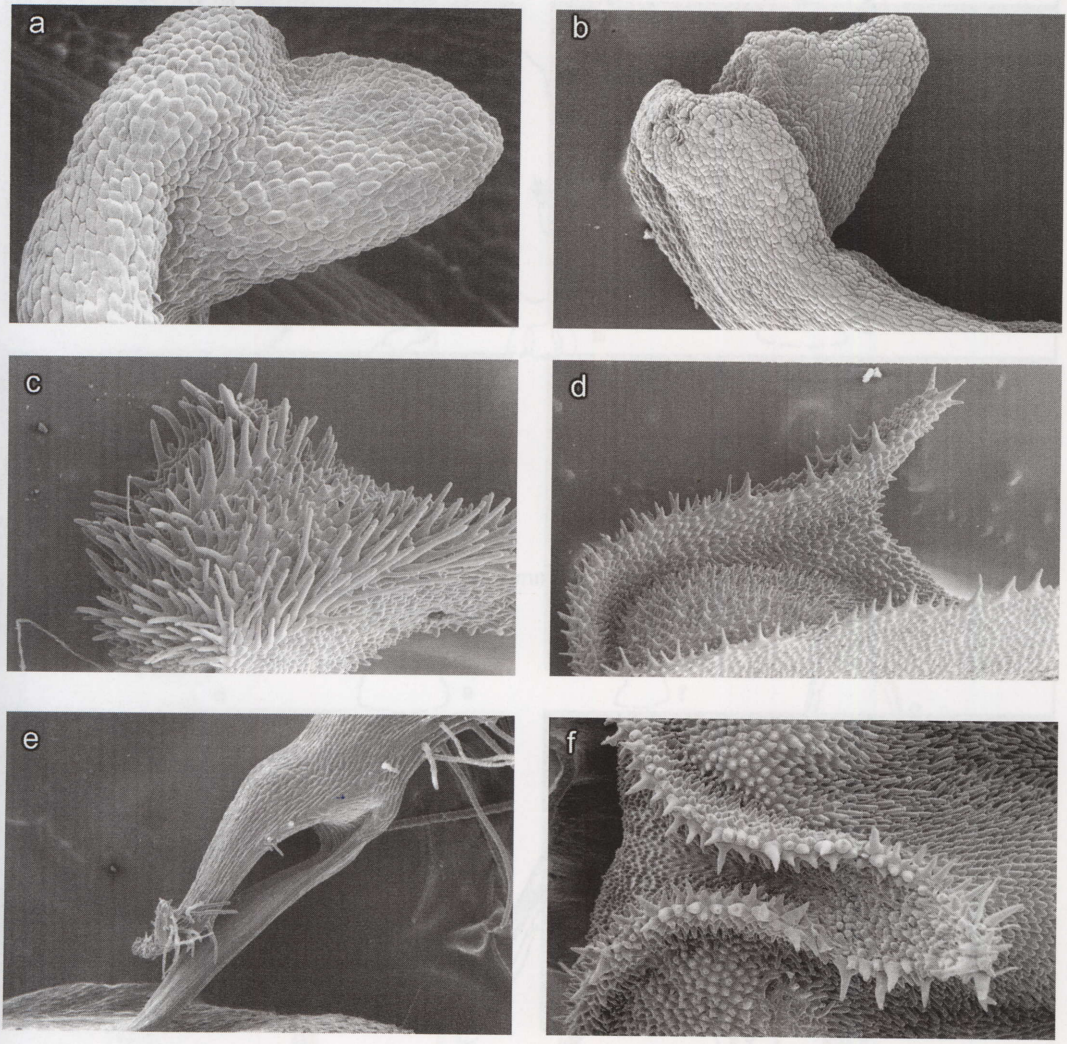


Plate 3. Labellum basal appendages continued. **a.** *P. cycnocephala*, side view, Ardlethan, NSW; **b.** *P.* sp. aff. *cycnocephala*, side view, Monarto, SA; **c**. *P.* sp. aff. *longifolia*, side view, Point Lookout, NSW; **d**. *P. vittata*, side view, Perth, WA; **e**. *P. barbata*, side view, Darling scarp, WA; **f**. *P. sanguinea*, from above, Belair, SA.

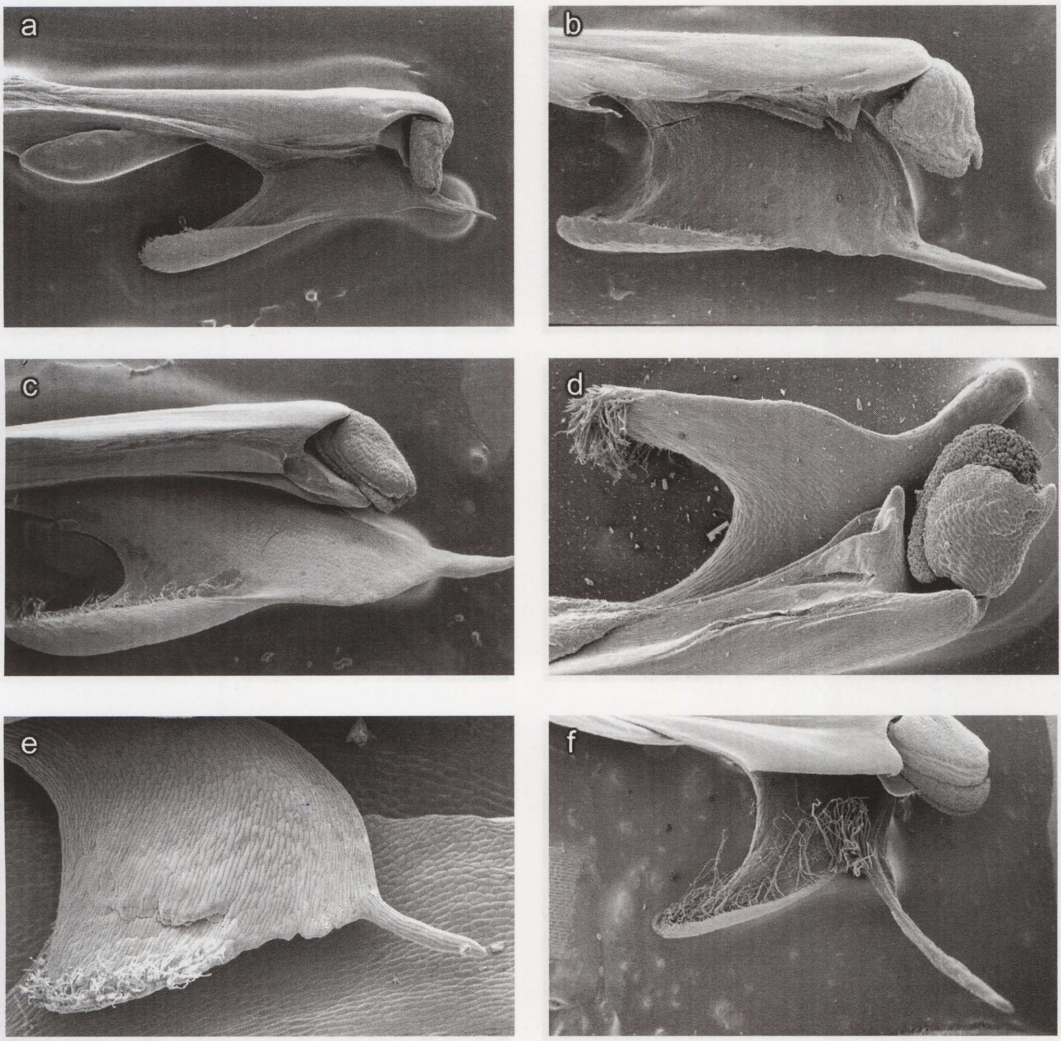


Plate 4. Internal view of a column wing. **a.** *P. angusta*, Bunbury, WA; **b.** *P. bureauviana*, New Caledonia; **c**. *P. coccina*, Point Lookout, NSW; **d**. *P.* sp. aff. *nana*, Margaret River, WA; **e**. *P.* sp. aff. *parviflora*, Kurnell, NSW; **f**. *P.* sp. aff. *plumosa*, Monarto, SA.

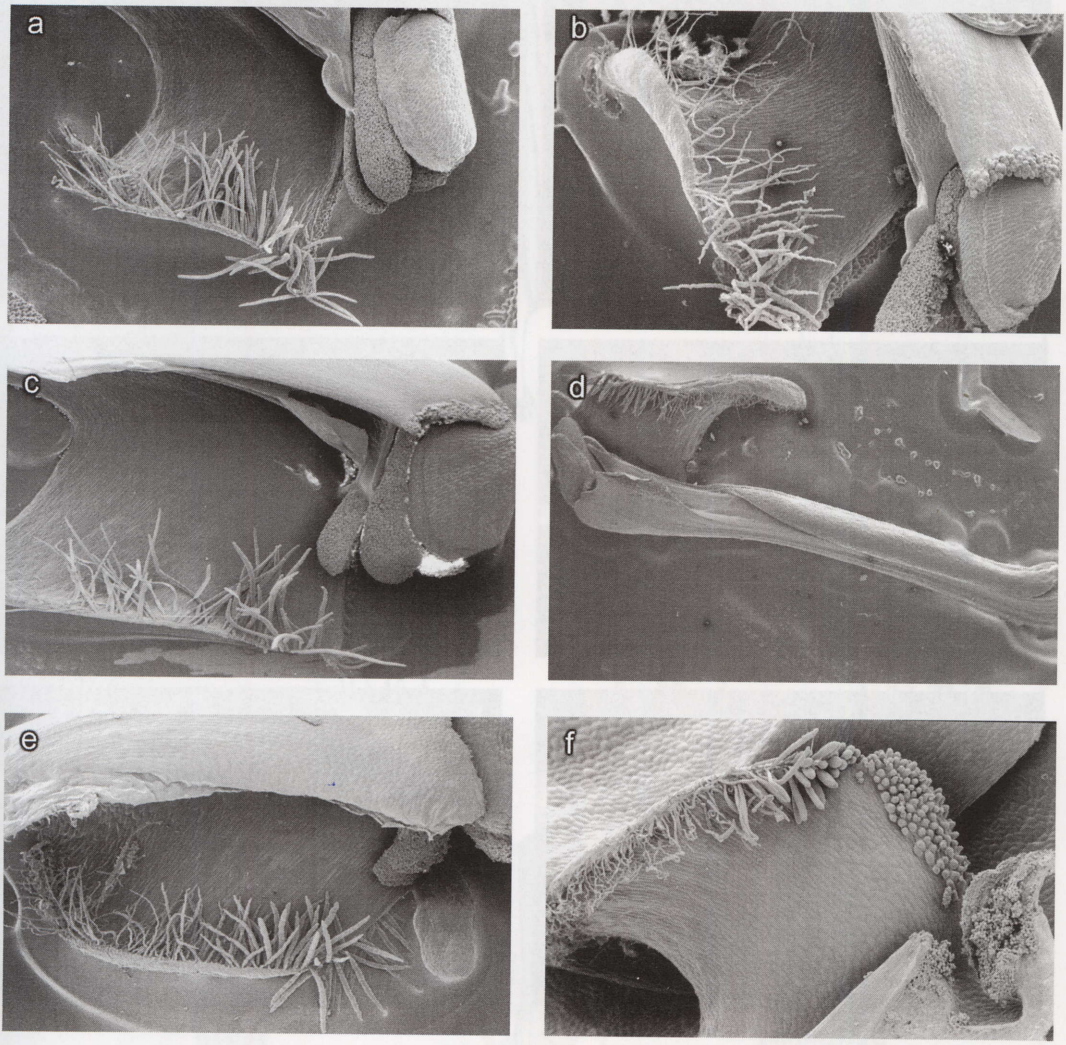


Plate 5. Internal view of a column wing continued. **a.** *P. basaltica*, Woorndoo, Vic; **b.** *P. pusilla*, Flinders Ranges, SA; **c**. *P. biseta*, Monarto, SA.; **d**. *P. recurva*, near Walpole, WA; **e**. *P. sargentii*, Mullewa, WA; **f**. *P. pratensis*, Liawenee, Tas.

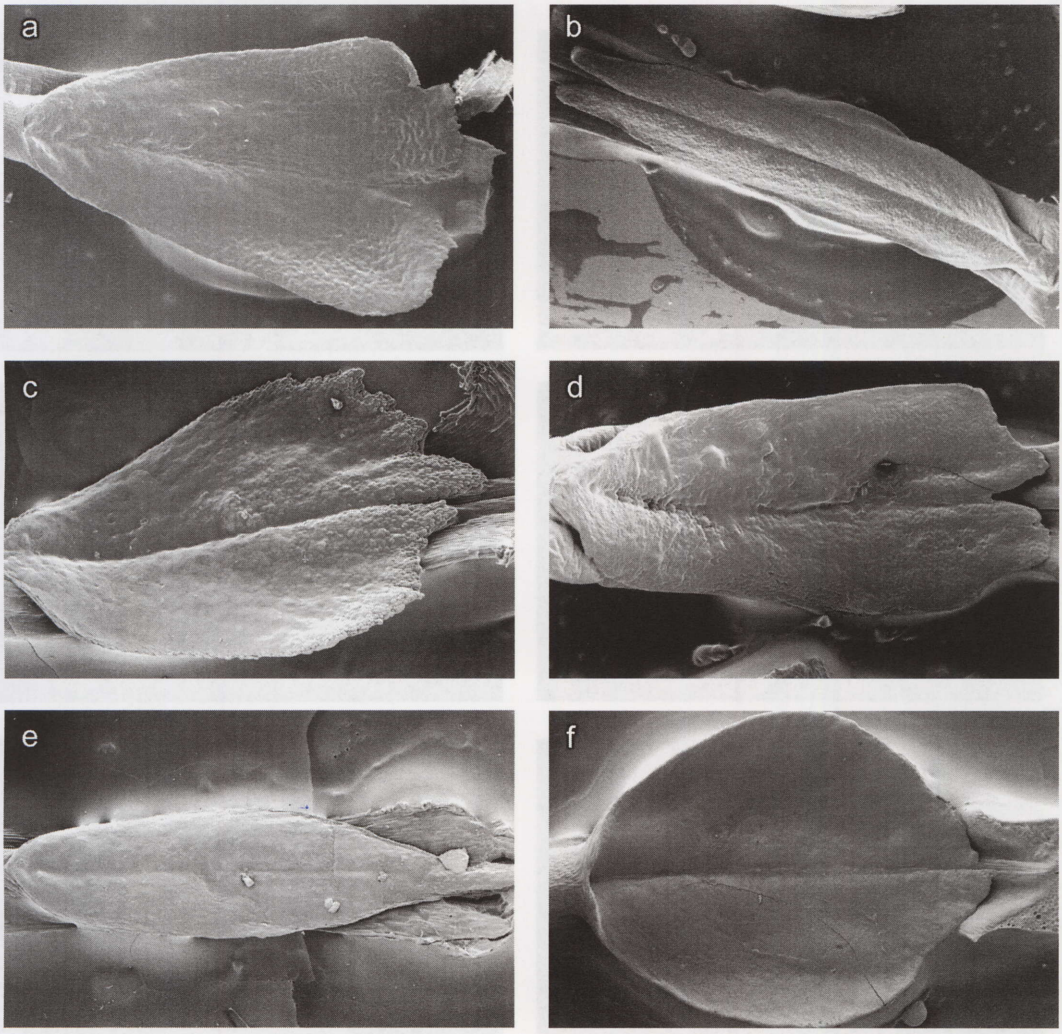


Plate 6. Anterior view of stigma. **a.** *P. pusilla*, Flinders Ranges, SA; **b.** *P. biseta*, Monarto, SA; **c**. *P. daintreana*, Helensburgh, NSW; **d**. *P. smaragdyna*, Adelaide Hills, SA.; **e**. *P. sargentii*, Mullewa, WA; **f**. *P. vittata*, Perth, WA.

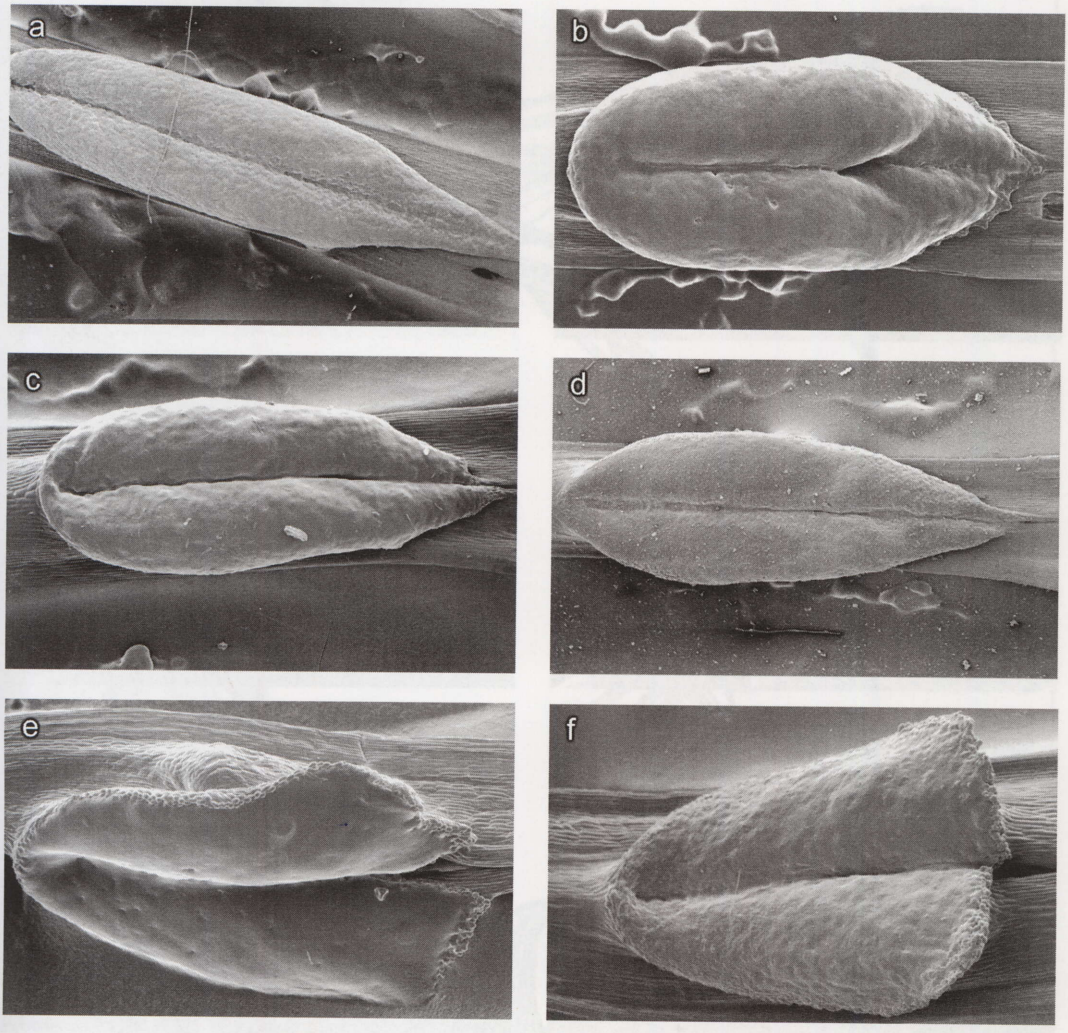


Plate 7. Anterior view of stigma continued. **a.** *P. ophioglossa*, Nelson Bay, NSW; **b.** *P. concinna*, Broulee, NSW; **c**. *P.* sp. aff. *nana*, Moora, WA; **d**. *P.* sp. aff. *nana*, Margaret River, WA; **e**. *P.* sp. aff. *parviflora*, Blue Mountains, NSW; **f**. *P.* sp. aff. *parviflora*, Brindabella Range, ACT.

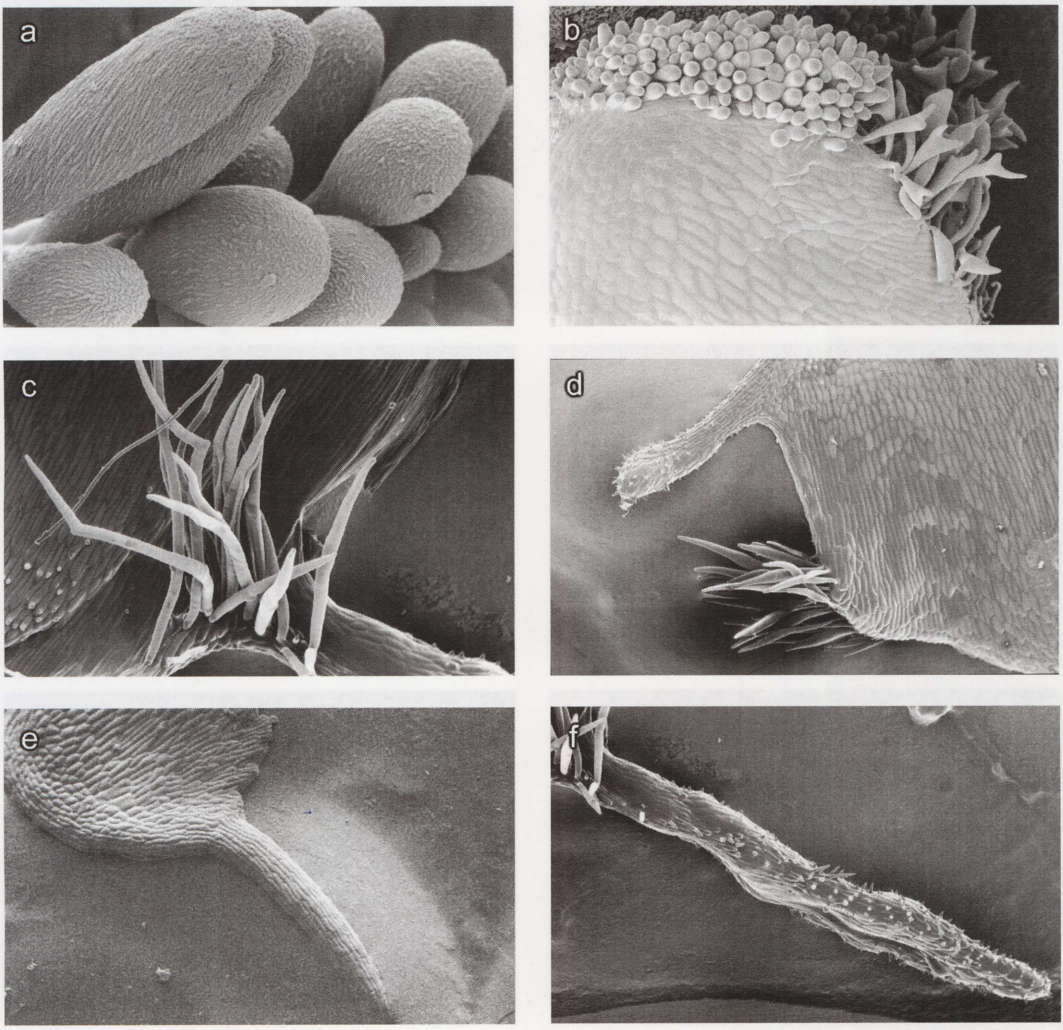


Plate 8. Column wing structures. **a.** Barrier trichomes, *P. pratensis*, Liawenee, Tas; **b.** Beaded siliceous cells and barrier trichomes, *P. cycnocephala*, Ardlethan, NSW; **c**. Barrier trichomes, *P*. sp. aff. *turfosa*, near Margaret River, WA; **d**. Apical lobule and barrier trichomes, *P. recurva*, near Walpole, WA; **e**. Apical lobule, *P. bicornis*, Mt Maroon, Qld; **f**. Apical lobule, *P*. sp. aff. *turfosa*, near Margaret River, WA.

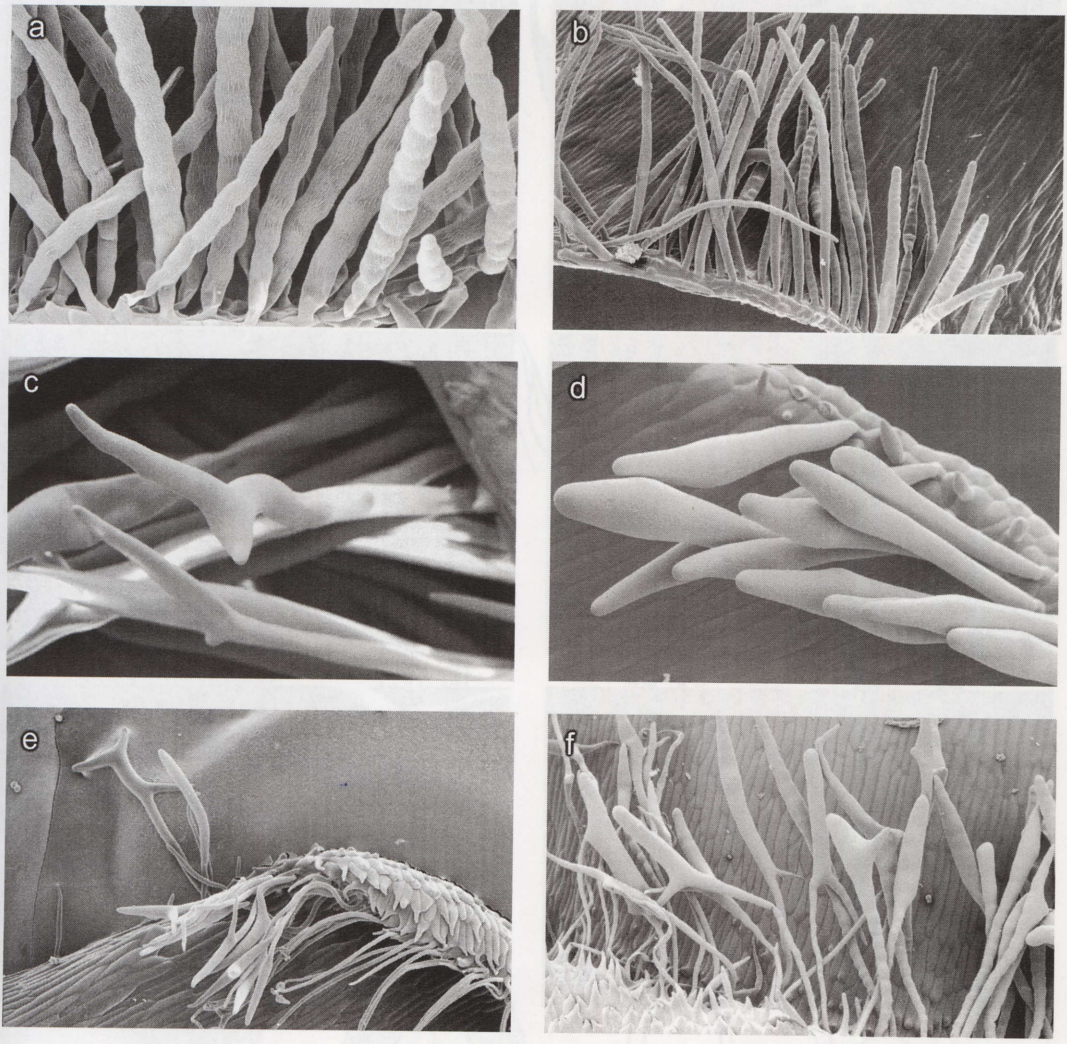


Plate 9. Barrier trichomes of column wings. **a**. *P. sargentii*, Mullewa, WA; **b.** *P. basaltica*, Woorndoo, Vic; **c**. *P. recurva*, Serpentine, WA; **d**. *P. vittata*, Perth, WA; **e**. *P. daintreana*, Helensburgh, NSW; **f**. *P. smaragdyna*, Adelaide Hills, SA.

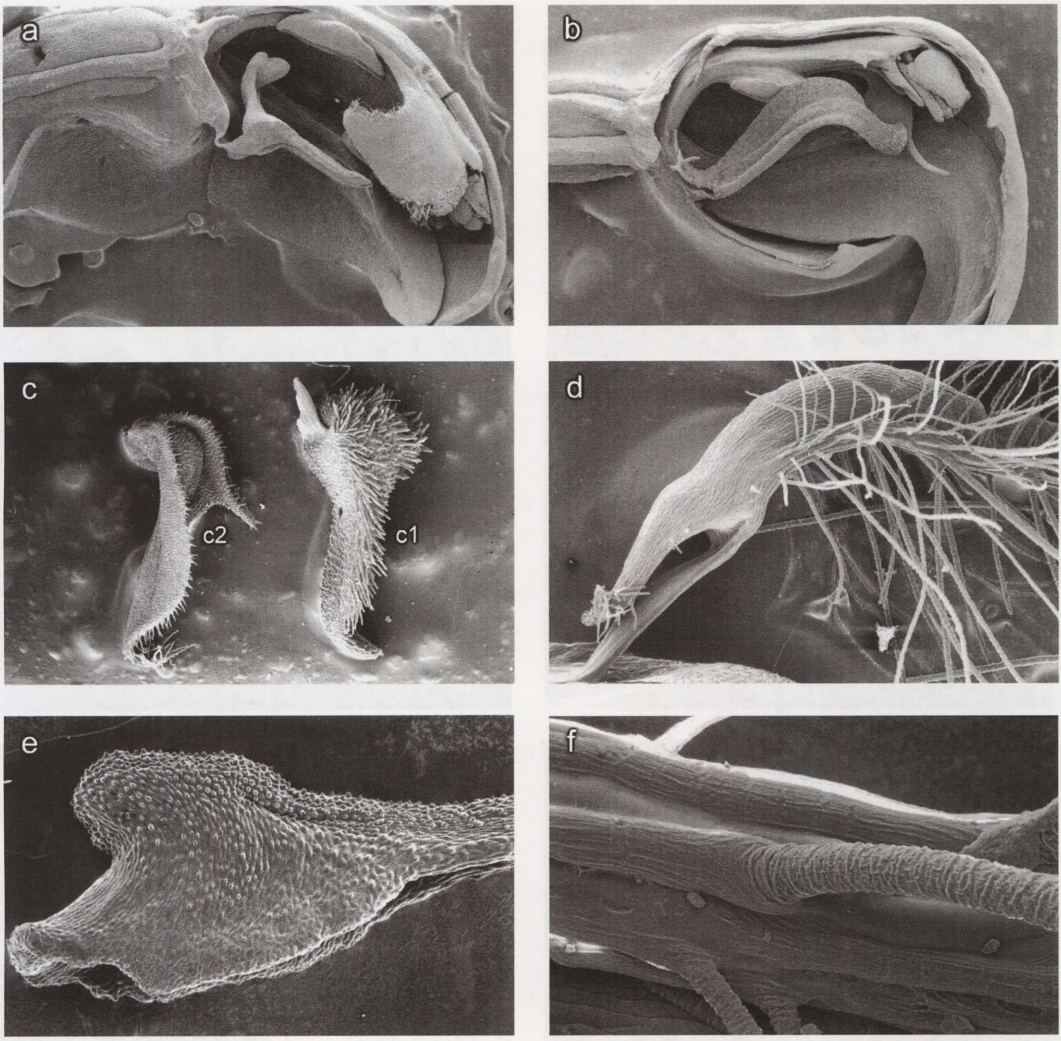


Plate 10. Miscellaneous floral structures. **a.** Lateral view of flower, one petal and half of dorsal sepal removed, *P. cycnocephala*, Ardlethan, NSW; **b.** Lateral view of flower, one petal and half of dorsal sepal removed, *P. bicornis*, Mt Maroon, Qld; **c**. Side views of labella; **c1**, *P.* sp. aff. *longifolia*, Point Lookout, NSW; **c2**, *P. vittata*, Perth WA; **d**. Proximal part of labellum showing basal beak, hinge and trichomes, *P.* sp. aff. *turfosa*, near Margaret River, WA; **e**. Labellum apical knob, *P.* sp. aff. *turfosa*, near Margaret River, WA; **f**. Proximal part of labellum trichome and attachment to lamina, *P. plumosa*, Conimbla, NSW.

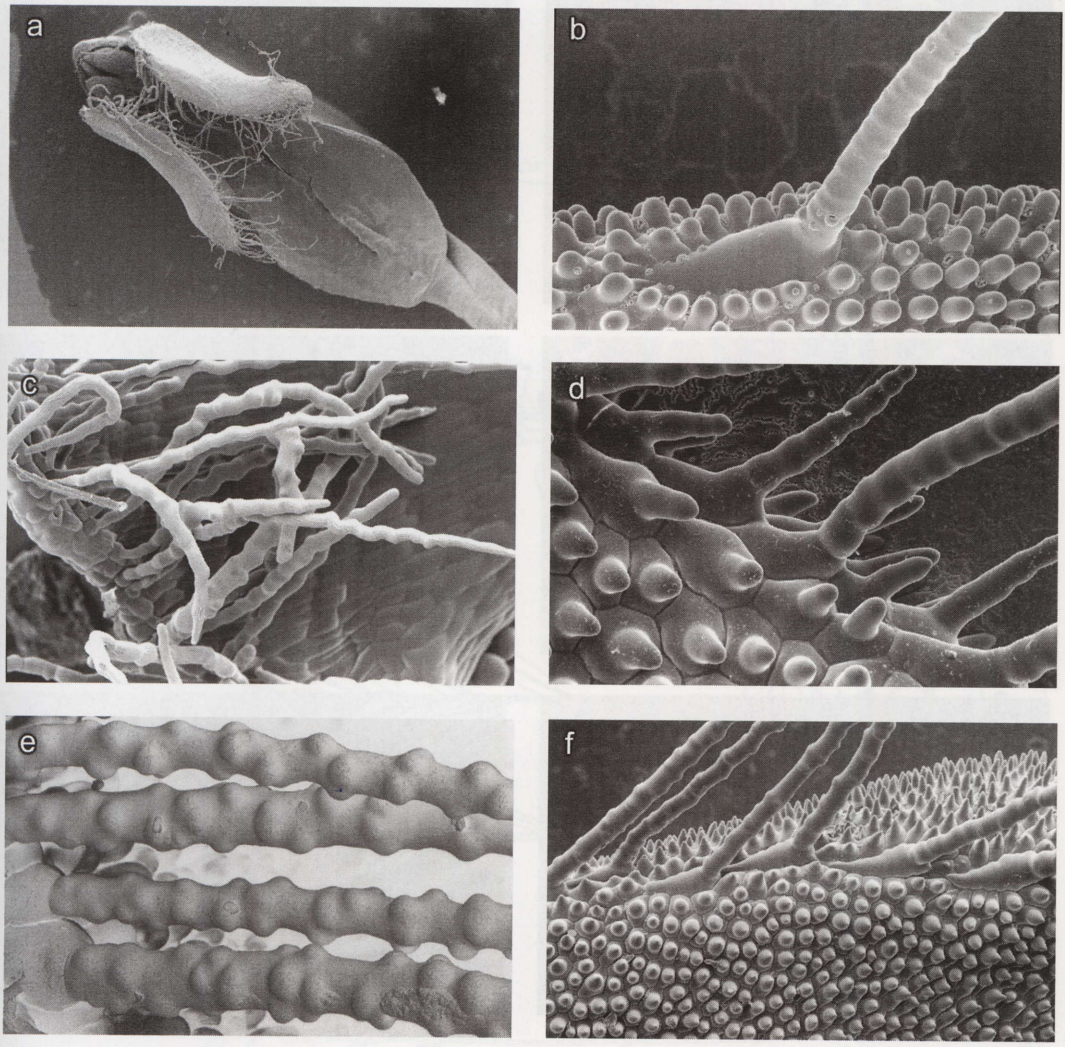


Plate 11. Miscellaneous floral structures – all of the '*rufa*' group. **a.** Anterior view of distal half of column showing stigma, anther and column wings, *P. insectifera*, Brookton, WA; **b.** Proximal part of labellum trichome and attachment to lamina, *P. basaltica*, Woorndoo, Vic; **c**. Barrier trichomes, *P. pusilla*, Flinders Ranges, SA; **d.** Labellum marginal trichomes, *P.* sp. aff. *biseta*, West Wyalong, NSW; **e.** Labellum basal setae, *P. setifera*, Bethungra, NSW; **f.** Labellum marginal trichomes, *P. picta*, Peak Charles, WA.

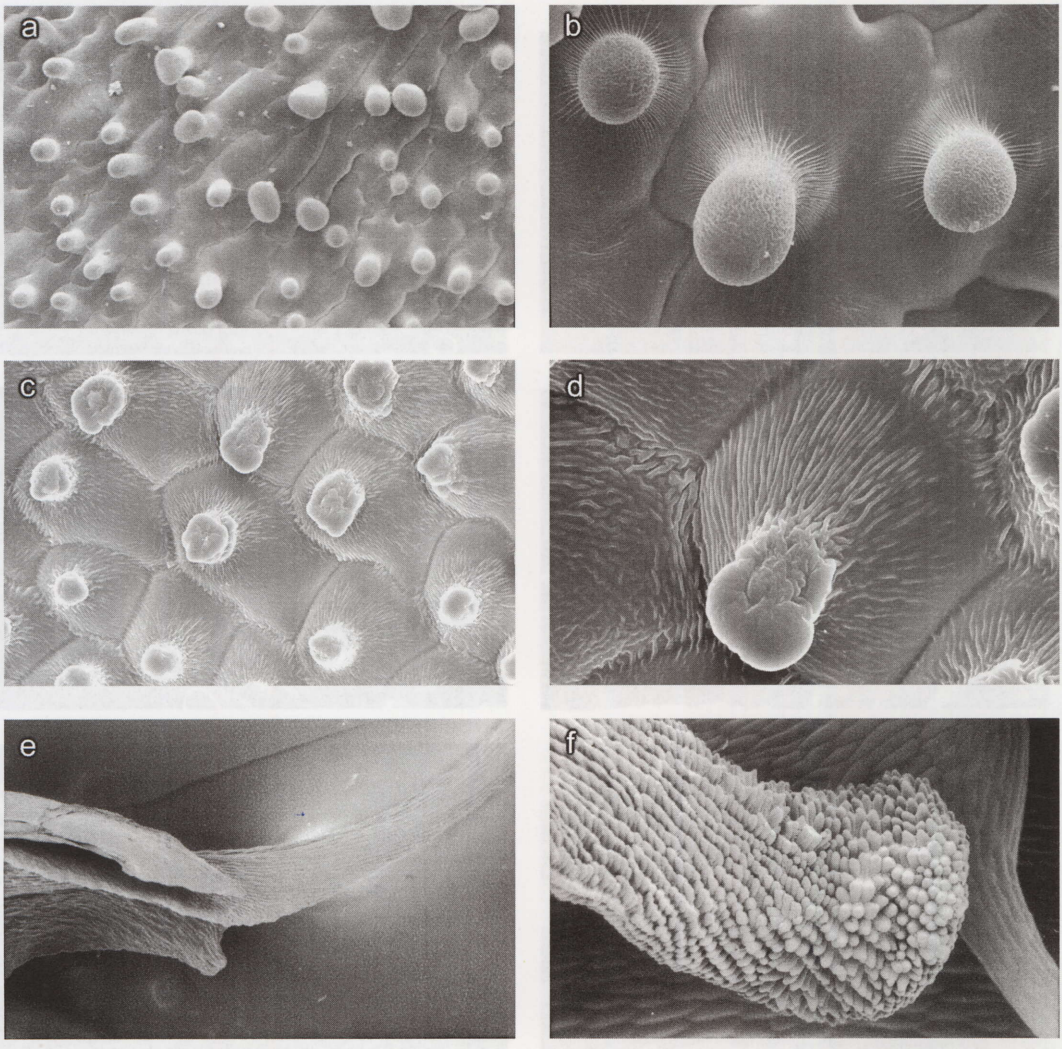


Plate 12. Miscellaneous floral structures. **a., b.** Micropapillae on the anterior surface of the synsepalum, *P. longifolia*, Bundana, NSW; **c., d.** Micropapillae on the anterior surface of the synsepalum, *P. vittata*, Perth, WA; **e.** Horn-like structure on petal apex, *P. bicornis*, Mt Maroon, Qld; **f.** Labellum apical knob, *P. bicornis*, Mt Maroon, Qld.

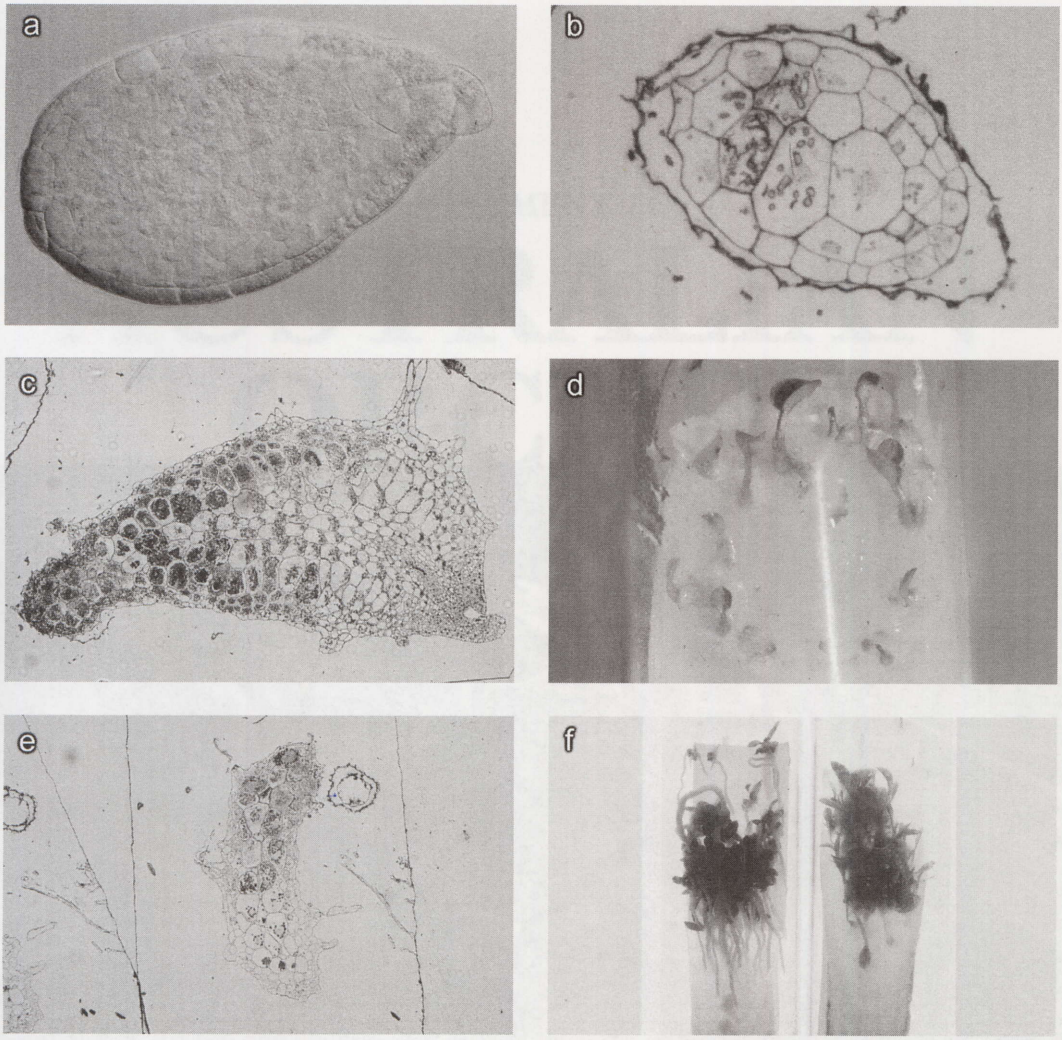


Plate 13. Seed and protocorm structures. **a**. Light micrograph of a mature embryo of *P. cucullata* isolated from the outer integuments, c. x 40; **b.** Median longitudinal section through a seed of *P. cucullata* with the basal cortical cells infected with mycorrhizal fungal hyphae, prior to germination, c. x 30; **c.** Median longitudinal section through a protocorm of *P. cucullata* with many cortical and subcortical cells infected with mycorrhizal fungal hyphae in the basal half, central cortical containing starch grains, and the first vascular cells visible near the meristematic end of the structure, c. x 10; **d.** Germinating seedlings of *P. cucullata* showing the obovoid protocorm-seedling type, c. x 2; **e.** Median longitudinal section through a partially developed obovoid-deorsum type protocorm of *P. rufa* with cortical and subcortical cells infected with mycorrhizal fungal hyphae in the upper (basal) half, c. x 10; **f.** Germinating seedlings of *P. rufa* showing the obovoid-deorsum protocorm-seedling type, c. x 1.

Photo: D.L. Jones

Petrorchis bicornis from Mount Maroon, Queensland.


Australian Orchid Foundation