The New Zealand Forms of *Thelymitra* J. R. and G. Forster and Appendices

PART I

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Introduction

Thelymitra is not an easy genus to work, and it is difficult accurately to determine dried specimens. Only one or two species can be distinguished by characteristics of leaf and stem, and classification is based in the main upon the form of the column and its appendages. The genus ranges from sea-level to 4,500 ft. and occurs in almost every class of country. As a consequence there is a fair amount of epharmonic variation within each species, a confusion which is added to by the fact that the column form varies considerably between the early bud stages and maturity. Crossing is another cause of column variation, and hybrids have been recorded between *longifolia* and *pauciflora, longifolia* and *caesia, caesia* and *pauciflora, caesia* and *decora,* and between *pauciflora* and *decora.* It will be noted that these are all within the related groups (f) and (g). The differences between juvenile and adult vary with species, but as a rule young plants are small and few-flowered, the leaf erect, terete or narrowly concave, without exterior ridges and the flower colour pale. Mature plants are frequently robust and many-flowered, the leaf coarse with exterior ridges developed, and the flower colour bright. The column form is roughly similar in both. What follows is based upon mature flowers at about the time of anther dehiscence. Unless otherwise indicated, the descriptions have been drawn up from living material examined by the writer.

Throughout this series of papers the distribution has been quoted by means of the Botanical Districts enumerated by L. Cockayne in *Die Vegetation der Erde.* 14. 1928 (*Veg. N.Z.*) pp. 380–400, maps 2 and 3. (Refer also L. Cockayne *Monog. N.Z. Beech Forests* 1, 1926, 68–71.) In the earlier revisions the numbers only of the districts were given, but since this has caused confusion, the writer has in the present paper added the names of the districts also.

Thelymitra colensoi Hook. f. *Handbk. N.Z. Flor.* 1867, 271, is considered invalid. The original description is hardly complete, the locality is given simply as " North Island " and the holotype is no longer available. Cheeseman was unable to place the species, and it has never been certainly collected since Colenso's first discovery. To the best of the writer's fairly wide knowledge of the subject, no " yellow " flowered species occurs in New Zealand, and it seems best to write it off as a *nomen dubium.*

Historical

Thelymitra was described and recognisably figured by the Forsters from material collected by them in the South Island of New Zealand during Cook's second voyage (*Characteres generum plantarum, etc.*, 1776, 97–8, t49). This book is the first taxonomic account ever to be published of New Zealand plants. The genotype is *Th. longifolia*. This species had also been collected by Banks at Tologa Bay during Cook's first voyage, in 1769, and had been described by Solander as *Serapias regularis* but never published, and illustrated in the banksian plates.

Reproduction

The column is designed for cross-pollination by *Diptera* (the elaborate column-wings serving the same purpose as the specialised labellum in other genera), but in New Zealand the genus is largely self-fertile and often completely cleistogamic. Moisture reduces the pollen to a sterile pulp, and since the simple perianth when open provides no cover for the anther, the flower is frequently forced to remain closed. Cleistogamy is the natural result of such conditions, and probably accounts for the relatively small amount of local differentiation to be observed in the New Zealand species. Such few hybrids as have been recorded had had the open-flowered species *caesia* or *pauciflora* as one parent. Vegetative reproduction, by the formation of additional tubers, is an important means of increase. Experiments with cultivated plants prove that *Thelymitra* reacts in a manner similar to that observed in *Pterostylis* with regard to the relation between tuber-size and the stage of development (cf. *Trans. R.S.N.Z.*, 77, 1949, 245). The arrangement of the chromosomes in *Th. longifolia* is recorded and figured by Hair (*Trans. R.S.N.Z.*, 71, 1942, 272, fl).

Origin and Evolution

Thelymitra appears to have originated in the south and to have moved northwards into Tasmania and Australia at a comparatively early date. In contrast to *Pterostylis* (cf. *Trans. R.S.N.Z.*, 77, 1949, 234) there seems to have been no northward movement into New Zealand. The local species can all be traced back, directly or indirectly, to an Australian ancestry, and were probably windborne originally across the Tasman. Until the Australian jordanons are dealt with as a whole, coherently described and adequately illustrated, it is impossible to define the phylogeny of half the New Zealand species. In a generic revision *Thelymitra* would be divided into two subgenera, and these again into a number of superspecies in the sense of Mayr. (*Systematics and the origin of species*, New York, 1942). Such delimitation is not advisable in a paper of this nature, so the subgenera have been provisionally called sections and the superspecies called groups, in anticipation of an eventual revision of the whole genus.

Section (i)—in which the column-wings consist of two primary lateral lobes, large, more or less erect, usually simple, but occasionally fimbriate.

Section (ii)—in which the primary lobes have been welded together into a large midlobe which usually carries two secondary lobes, either ciliate or variously crenulate.

Section (i) appears to be the more primitive and often has a complicated crest in the sinus of the lobes. Section (ii) has possibly originated from (i) by the gradual expansion of this crest, filling the space between the primary lobes and giving rise to the tubercles and calli which are to be found on the midlobe of the more primitive members of the second section. Several species (*Th. pulchella* the only one in New Zealand) show intermediate characters between the two sections. In section (ii) the erect, non-ciliate form of the secondary lobes to be found in group (d) is probably more primitive than the elaborately ciliate condition of groups (e), (f) and (g). The erect midlobe of group (f) is probably more primitive than the culcullate condition of group (g). The non-ciliate secondary lobes in *T. sanscilia* are retrograde rather than primitive and the species appears to be derived from a ciliate ancestor. *Thelymitra* has affinities and possibly a common ancestry with *Calochilus*, but very far back. In its simple, regular perianth and divided column *Thelymitra* shows decidedly primitive characters.

Summary of Genus *Thelymitra*

Section (i)

Group (a) includes *venosa magnifica* Rupp.; 1a *venosa typica*; 1b *venosa cedricsmithii*; 1c *venosa cyanea.*

Group (b) includes *variegata* Ldl.; 2 *matthewsii.*

Group (c), 3 *pulchella.*

Section (ii)

Group (d) includes *rubra typica* R. D. Fitzg., *rubra magnanthera* Rupp., *flexuosa* Endl., *carnea typica* R. Br.; 4a *carnea imberbis.*

Group (e) includes *ixioides subdiformis* Nich., *media* R. Br., *circumsepta* R. D. Fitzg., *purpurata* Rupp., *canaliculata* R. Br.; 5a *ixioides typica*; 6 *aemula.*

Group (f), 7 *decora*; 8 *pachyphylla*; 9 *caesia.*

Group (g) includes *nuda* R. Br., *longifolia* 'australis,' *longifolia* 'neocaledonica.' 10 *aristata*; 11a *longifolia forsteri* (Jords. i and ii); 11b *longifolia stenopetala*; 11c *longifolia intermedia*; 12 *pauciflora*; 13 *sanscilia.*

Key to the Species

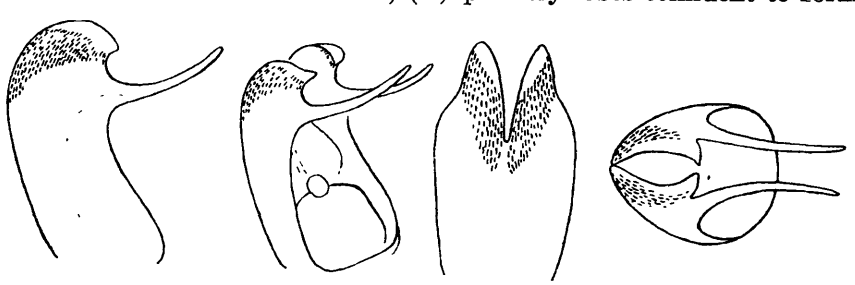
1.	Midlobe absent, lateral lobes primary	2
	Midlobe present, lateral lobes secondary	3
2.	Lobes simple, without appendages	4
	Lobes fimbriate	*pulchella*
4.	Lobes very large, oblong-falcate, fleshy (leaf expanded at the base then abruptly constricted)	*matthewsii*
	Lobes acuminate, spirally involute, erect, entire ..	5
	Lobes acuminate, hardly involute, recumbent, bifid ..	*venosa cyanea*
5.	Lobes shorter than the anther, labellum sepaloid ..	*venosa cedricsmithii*
	Lobes higher than the anther, labellum crenulate and repand	*venosa typica*

3.	Midlobe crested, secondary lobes without cilia (stem flexuose, leaf terete, flowers creamy-red)	*carnea imberbis*
	Midlobe crested, secondary lobes with cilia	6
	Midlobe not crested, secondary lobes usually with cilia	7
6.	Crest of tall calli (sepals spotted with brown) ..	*uvioides*
	Crest denticulate (sepals not spotted) raceme in the bud resembling an ear of wheat	*aemula*
7	Midlobe erect, shorter than the anther, secondary cilia white (flowers pink)	*longifolia intermedia*
	Midlobe erect, higher than the anther, secondary cilia yellow	8
	Midlobe cucullate, secondary cilia where present, white	9
8	Midlobe apiculate, dark brown	*caesia*
	Midlobe emarginate, pinkish-yellow	*pachyphylla*
	Midlobe sinuate, black (with small darker tubercles just below the top, sepals spotted with brown) ..	*decora*
9	Midlobe truncate or emarginate	10
	Midlobe deeply bifid, yellow, secondary lobes with cilia	*pauciflora*
	Midlobe deeply bifid, green, secondary lobes without cilia	*sanscilia*
10.	Tip of midlobe faced with yellow or white .. .	11
	Tip of midlobe dark all over	*aristata*
11.	Secondary cilia very dense, short	*longifolia forsteri*
	Secondary cilia rather lax, long	*longifolia stenopetala*

DESCRIPTIONS

THELYMITRA J. R. and G. Forster

Terrestrial, usually glabrous herbs with oblong or ovoid tubers. Leaf solitary, chanelled or terete, more or less succulent, linear-acuminate, or more rarely expanded at the base and constricted above. Peduncle often tall with several foliaceous bracts. Floral bracts acute or acuminate, rarely foliaceous. Flowers ranging from white through red and yellow to blue and purple. 1–40 in a lax terminal raceme. Perianth almost regular, the labellum differing only slightly from the sepals and sepaloid petals. Column in two parts—(i) a central portion with the 2-celled stigma and rostellum on one face, and having the other face concave to support the protruding anther-cells; and (ii) a posterior portion consisting of two filaments confluent with the column-wings and carrying the rostrate anther-connective and the pendent 2-celled anther. Column-wings prominent and extremely variable, showing two main lines of development—(i) 2 primary lateral lobes, large, more or less erect, usually simple, rarely fimbriate, with a variable crest of small calli in the sinus; (ii) primary lobes confluent to form



Thelymitra sanscilia Irwin. Column, showing from left to right: side, half front, rear and top.

an erect midlobe with 2 highly specialised secondary lobes and occasional extra, often unbalanced appendages. Pollinia 2 to each anther-cell. Pollen granular.

A genus of rather more than 60 species, with its present headquarters in Australia and extending to Tasmania, New Guinea, New Caledonia, Timor, Java, the Philippines and New Zealand.

SECTION (i)

Group (a)

1. **Th. venosa** R. Br. *Prodr.*, 1810, 314

A compound species of 4 closely related jordanons adapted for but not entirely confined to life in subalpine bogs. One jordanon is endemic in Australia, one endemic in New Zealand, and the other two occur in both countries.

(a) *Th. venosa* var. **typica** Hh. *n.nom.*
Th. venosa R. Br. *l.c. sens. strict.* Cheeseman, *Man. N.Z. Flor.*, 1925, 343. Hatch, *Trans. R.S.N.Z*, 76, 1946, 58
Macdonaldia venosa (R. Br.) Ldl. *Swan River App.*, 1839, 50

Up to 80 cm. high. Leaf up to 40 cm. long, recurved, concave with exterior ridges, linear-acuminate. Flowers 1–12, purple with conspicuously darker striae, perianth segments up to 18 mm. long. Labellum broad at the apex and tending to be crenulate. Column inclined backwards, purplish at the base, with 0–3 broad blue vertical striae. Column-wings bright yellow. Midlobe absent, lateral lobes primary, erect, almost invariably entire, spirally involute and higher than the anther.

Distribution. Australia—not uncommon in high country bogs throughout Tasmania, South Australia, Victoria and New South Wales. New Zealand—*3b.* (Waikato) Rukuhia, Ohaupo, 12.1919, *H. B. Matthews. 5.* (Volcanic Plateau) Tirau, Rotorua, *T. F. Cheeseman.* Taupo, 12.1944, *T. W. Mellor. 6.* (Egmont-Wanganui) Ngaire, *T. F. Cheeseman. 7.* (Ruahine-Cook) Tararua Ranges, 12.1938, *V. D. Zotov.*

Flowers Dec.–Jan., 500–2,000 ft.; almost always confined to swamps and bogs; rather rare.

(b) *Th. venosa* var. **cedricsmithii** Hh. *n.nom.*
Th. uniflora Cheesemn. in part (not of Hook. f.)
Epiblema grandiflora Buch. *Trans. N.Z. Inst.*, 14, 1882, 357 (not of R. Br.)

Up to 40 cm. high. Similar to but considerably smaller than var. *typica,* differing mainly in the simple labellum and in the lobes of the column-wing, which are shorter than the anther.

Distribution. Endemic—*4.* (East Cape), *5.* (Volcanic Plateau), *6.* (Egmont-Wanganui), *7.* (Ruahine-Cook), *9.* (North-eastern), *10.* (North-western), *11.* (Western), *12.* (Eastern), *13.* (North Otago), *14.* (Fiord), *15.* (South Otago). Montane and subalpine areas throughout.

Flowers Dec.–Jan., 2,000–4,000 ft.; abundant in bogs and along river banks, often extending to drier situations. Probably derived from var. *typica.* The illustration over the name *Th. unifolia* (Cheeseman, *Illus. N.Z. Flora*, 2. 1914, t193a) can be regarded as the hypotype of the variety, which is gratefully dedicated to Mr. Cedric Smith, of Stewart Island, whose enthusiastic assistance has proved invaluable.

(c) *Th. venosa* var. **cyanea** (Ldl.) Hh. *n.comb.*
Th. uniflora Hook. f. *Flor. Ant.*, 1, 1844, 70, *sens. strict.*
Th. cyanea (Ldl.) Benth. *Flor. Austr.*, 6, 1873, 323
Th. venosa Hook. f. *Flor. Tasmn.*, 1, 1860, t102 (not of R. Br.)
Macdonaldia cyanea Ldl. *Swan River App.*, 1839, 50
Refer also Hatch, *Trans. R.S.N.Z.*, 76, 1946, 58

Up to 30 cm. high. Similar to var. *cedricsmithii,* differing in the narrower perianth segments and the recumbent, hardly involute, distinctly bifid lobes of the column-wing.

Distribution. Tasmania—occasional throughout. New Zealand—2. (North Auckland) Kaikohe, Jan.–Feb., 1950, *J. Jones. 16.* (Stewart) Stewart Island, 1.1949–50, *C. Smith.* Auckland Islands, 2.1943–5, *J. F. Findlay.*

Flowers Jan.–Feb., sea-level–1,000 ft.; bogs and stream banks, often in grass. Probably derived from var. *typica.* Hooker's illustration over the name *Th. venosa* (*Flor. Tasmn., l.c.*) can be regarded as the hypotype of the variety. (Refer also Bentham, *Flor. Austr., l.c.*)

When Hooker described *Th. uniflora,* he stressed the many similarities which that species shared with the Tasmanian *Th. cyanea* (Ldl.) Benth. Cheeseman (*Manl. N.Z. Flor.,* 1906, 672) suggested that the two might even prove to be identical. Later, however (refer hypotype var. *cedricsmithii*), he illustrated a plant from Mt. Ruapehu which was quite unlike the Tasmanian species as described by Lindley and illustrated by Hooker. In 1945 the writer compared Ruapehu plants with sketches, photographs and dried specimens of *cyanea* and found them distinct. (*Trans. R.S.N.Z.,* 76, 1946, 58.) In 1947 Smith suggested that the Stewart Island form of *uniflora* was in fact *cyanea* and sent living material to prove his point. These specimens not only agreed with *cyanea* exactly, but were quite unlike the plants from Ruapehu. It was then left to discover the true nature of the Auckland Island jordanon, which was the type of Hooker's *uniflora.* To this end the writer studied the orchid collections made in the Auckland and Campbell Islands by the Cape Expedition during 1943–5. All the specimens there labelled "uniflora" were in fact *cyanea,* and Hooker's name had perforce to give way to the earlier nomenclature of Lindley, leaving the Ruapehu jordanon without a name. Since the latter was undoubtedly distinct from *cyanea,* the name *cedricsmithii* was proposed. (*Int. Rules Bot. Nom.*, Art. 56.) The earlier writers, following Lindley, had used the bifid tips of the column-wings, or their absence, as major specific characteristics. In 1949 the writer studied the development of the column-wings and found the bifid tips to be unstable. Jordanons given specific rank on that account were not really entitled to it and in the present paper are treated as varieties. In *cyanea* the tips are distinctly bifid in the bud, but one point grows faster than the other, causing the mature lobes to be irregularly bifid, or if the flower is not immediately pollinated, almost entirely acuminate. In *cedricsmithii* and *venosa* the tips are only very slightly bifid in the bud, and by the same process of lopsided development, almost invariably acuminate at maturity.

Group (b)

2. **Th. matthewsii** Cheesemn. *Trans. N.Z. Inst.*, 43, 1910, 177
Hatch, *Trans. R.S.N.Z.*, 76, 1946, 59

Th. d'altonii Rog. *Trans. R.S.S.A.*, 54, 1930, 42

Up to 15 cm high. Leaf up to 9 cm. long, expanded at the base, then abruptly constricted into a narrow-linear blade, spirally coiled so as to encircle the stem. Flowers 1–2, dark purple with darker striae, perianth segments up to 14 mm. long. Column erect, purplish at the base, merging to yellow at the top. Midlobe absent, lateral lobes primary (often connected at the back with a series of small calli), oblong-falcate, obtuse, simple, erect, as high as the anther, bright yellow. Anther connective protruding conspicuously.

Distribution. Australia—occasional throughout Victoria. New Zealand—*2.* (North Auckland), Kaitaia, 11.1908–24, *R. H. and H. B. Matthews*

Flowers Oct.–Nov., sea-level–1,000 ft.; rather rare; related to and probably derived from the Westralian *Th. variegata* Ldl. The description has been adapted from Cheeseman's original and carefully compared with Matthew's photographs of the living plant and with dried specimens from both sides of the Tasman. Lectotype in Herb. Cheeseman, in the Auckland Museum Lake Tangonge, 9.1911. H. B. Matthews. Sheet No. 25890.

Group (c)

The following species is something of an intermediate between the two sections of the genus, showing perhaps the manner in which the midlobe may have developed. It is an isolated form with no obvious forerunners.

3. **Th. pulchella** Hook. f. *Flor. Nov. Zel.*, 1, 1853, 244

Up to 50 cm. high Leaf up to 30 cm. long, erect, narrow-concave with exterior ridges, linear-acuminate, dark greeny-purple to glaucus. Flowers 1–20, blue-purple, perianth segments rather narrow, up to 2 cm. long, with rolled margins. Column erect, pale blue or white with a broad pinkish band near the top. Midlobe either absent or very slightly developed, tuberculate when present. Lateral lobes primary, erect or inclined forward, irregularly denticulate along the upper margin and furnished with oblique secondary lobes bearing sparse yellow fimbriae.

The column is frequently deformed, only one side being developed.

Distribution. Endemic—*2.* (North Auckland), *3a.* (Kaipara), *3b.* (Waikato), *3c.* (Thames), frequent throughout. *5.* (Volcanic Plateau), common about Rotorua and becoming less frequent towards Taupo. Mt. Ruapehu, 1.1943–50, *Hatch, Gibson, Trevarthen. 6.* (Egmont-Wanganui), Ngaire, 12 1948, *Irwin* and *Gibson*. Waitaanga, 11.1949, *J B. Irwin.*

Flowers Nov.–Jan., sea-level–3,000 ft.; large colonies in swamp, open mossy scrub, or tussock.

SECTION (ii)

Group (d)

4. **Th. carnea** R. Br. *Prodr.*, 1810, 314

A compound species of 2 jordanons, 1 in New South Wales and Victoria, and 1 in New Zealand. Probably derived from *Th. rubra typica.*

(a) *Th. carnea* var. **imberbis** (Hook. f.) Rupp and Hh. *Proc. Linn. Soc. N.S.W.*, 70, 1945, 59. Hatch, *Trans. R.S.N.Z.*, 76, 1946, 60
Th. imberbis Hook. f. *Flor. Nov. Zel.*, 1, 1853, 244

Up to 30 cm. high. Leaf up to 20 cm. long, recurved, almost terete, narrow-linear. Stem very slender and conspicuously flexuose. Flowers 1–6, creamy-pink on rather long, slender pedicles, perianth segments up to 8 mm. long. Column inclined slightly backwards, pinkish with a darker band near the top. Midlobe hardly as high as the anther, slightly cucullate, bright yellow with finely denticulate margin. Lateral lobes secondary, oblique, narrow, bright yellow with denticulate upper margins and *no cilia*. Anther connective pale green.

Distribution. Endemic—*2.* (North Auckland), *3a.* (Kaipara), *3b.* (Waikato), *3c.* Thames), *5.* (Volcanic Plateau), common throughout.

Flowers Sep.–Nov., sea-level–1,500 ft.; small colonies or scattered, particularly in "gumland" associations, with their typical combination of short *Leptospermum* scrub and open mossy patches.

Group (e)

5. **Th. ixioides** Sw. *Vet. Akad.*, 21, 1800, 228, t3L

A compound species with 2 jordanons in Australia. Only the typical form extends to New Zealand.

(a) *Th. ixioides* var. **typica** Hh. *n.nom.*
Th. ixioides Sw. *sens. strict.* Hatch, *Trans. R.S.N.Z.*, 76, 1946, 58
Th. iridioides Seib. ex Benth. *Flor. Austr.*, 6, 1873, 317
Th. juncifolia Ldl. *Gen. et Spec. Orch.*, 1840, 522
Th. lilacina F. Muel. ex Ldl. *Linnaea*, 26, 1855, 242

Up to 70 cm. high. Leaf up to 40 cm. long, recurved, concave with exterior ridges, linear-acuminate. Flowers 1–20, bright blue, pink or white, the lateral sepals and often the petals spotted with brown, perianth segments up to 23 mm. long. Column inclined slightly backwards, pale blue with a transverse violet band near the top. Midlobe higher than the anther, not cucullate, the upper margin bright yellow or red and studded with tall calli. Lateral lobes secondary, oblique, with thin tufts of white cilia.

Distribution. Australia—common throughout all the States. New Zealand—*2* (North Auckland), Kaitaia, Ahipara, 10.1920, *H. B. Matthews.* Kaikohe, 10.1949, *Irwin* and *Gibson. 3.* (Kaipara), Birkdale, Henderson, 10.1922, *H. B. Matthews.* Silverdale, 10.1949, *F. W. Bartlett.* Waiheke Island, 11.1948, *Auck. Bot. Soc. 5.* (Volcanic Plateau), not uncommon between Rotorua and Taupo, *Allison, Mellor, Hatch. 7.* (Ruahine-Cook), Wallaceville, 10.1949, *A. P. Druce.*

Flowers Oct.–Dec., sea-level–2,000ft.; small groups or scattered, in scrub or along roadsides.

6. **Th. aemula** Cheesmn. *Trans. N.Z. Inst.*, 51, 1919, 94

Up to 50 cm. high. Leaf up to 30 cm. long, erect, shallow-concave with exterior ridges, linear-acuminate, pale green. Flowers 1–35, pale mauve, packed rather closely, the raceme in the bud resembling an ear of wheat, perianth segments up to 12 mm. long. Column erect, pale purple with yellow striae, and a narrow purple band near the top. Midlobe as high as the anther, not cucullate, the upper margin bright

yellow and irregularly denticulate. Lateral lobes secondary, horizontal, with thin tufts of white cilia.

Distribution. Endemic—*2* (North Auckland), *3a.* (Kaipara), common throughout. *5.* (Volcanic Plateau), Rangitaiki, 1.1934, *K. W. Allison.* Flowers Sep.–Jan., sea-level–1,000 ft.; large colonies in scrub and along roadsides. Related to and probably derived from the typical form of *T. ixioides.* Lectotype in Herb. Cheeseman, in the Auckland Museum Birkdale, 11 1920, H B Matthews Sheet No. 3364.

Group (f)

The next 3 species are related to each other and to *aristata,* but the exact relationships are at the moment obscure and probably go back to Australian congeners unknown to the writer.

7. **Th. decora** Cheesmn *Manl. N.Z. Flor.,* 1, 1906, 1151

Up to 40 cm. high. Leaf up to 20 cm. long, recurved, concave with exterior ridges, linear-acuminate. Flowers 1–9, dark blue, the lateral petals irregularly spotted with brown, perianth segments up to 12 mm. long. Column inclined backwards, blue with paler margins. Midlobe higher than the anther, slightly cucullate, almost black with finely denticulate margin, back studded with very dark, quite conspicuous tubercles. Lateral lobes secondary, short, horizontal, with thick erect tufts of white cilia.

Distribution Endemic—*2.* (North Auckland), *3a.* (Kaipara), *3b.* (Waikato), *3c* (Thames), *5* (Volcanic Plateau), occasional throughout, becoming common about Mt. Ruapehu *6.* (Egmont-Wanganui), Mt Egmont, 12.1948, *O. E. Gibson.* *7* (Ruahine-Cook), Wallaceville Hill, 12.1946, *J. Johnston.* Silverstream, 11.1949, *A. P. Druce.*

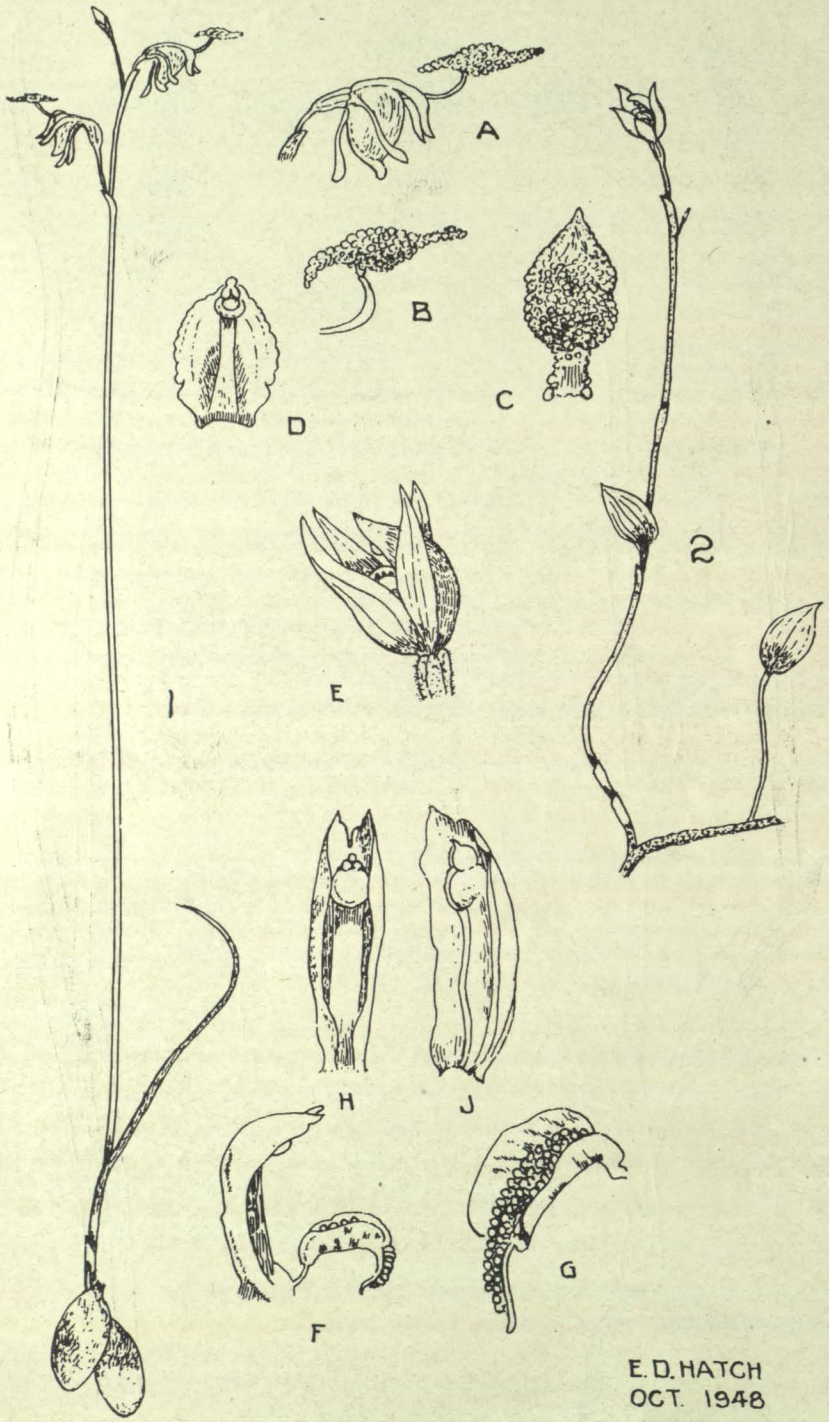
Flowers Dec.-Jan., sea-level–4,500 ft.; tussock and roadsides and about the margins of swamps and bogs, occasional in scrub. Lectotype in Herb. Cheeseman, in the Auckland Museum. Summit of Mt. Kakaramea, 1.1905, T. F. Cheeseman. Sheet No 3361.

8 **Th. pachyphylla** Cheesmn. *Manl N.Z. Flor.*, 1, 1906, 1151

Up to 40 cm high. Leaf up to 30 cm. long, recurved, concave with exterior ridges, linear-acuminate. Flowers 1–15, bright blue, shading to mauve, perianth segments up to 12 mm. long. Column erect, the upper portion red-brown and paling towards the top. Midlobe as high as the anther, hardly cucullate, pinkish-yellow with irregularly and minutely denticulate, more or less truncate margin. Lateral lobes secondary, short, oblique with coarse bright-yellow fimbriae.

Distribution Endemic—*4* (East Cape), Lake Waikaremoana, 11.1949, *C Trevarthen.* *5* (Volcanic Plateau), National Park and Erua, 12.1920, *H. B. Matthews.* Pokaka, 11.1949, *J. B. Irwin.* *6.* (Egmont-Wanganui), Pouakai Ranges, 11.1948, *O. E. Gibson.* Waitaanga, 11.1949, *J. B. Irwin.* Waitotara, 12.1949, *J. B. Irwin.* Also common throughout the whole of the South and Stewart Islands.

Flowers Nov.–Dec., sea-level–3,000 ft.; large colonies in tussock or scrub and along roadsides; related to and probably having a common origin with *Th caesia* Petr. Lectotype in Herb. Cheeseman, in the



1. *Caleana minor*, natural size. a, flower from side; b, lamina of labellum from side. c, lamina of labellum from above; d, column from front.
2. *Adenochilus gracilis*, natural size. e, flower from side; f, column and labellum from side; g, labellum from half-front; h, column from front; j, column from side. (with one column-wing removed).

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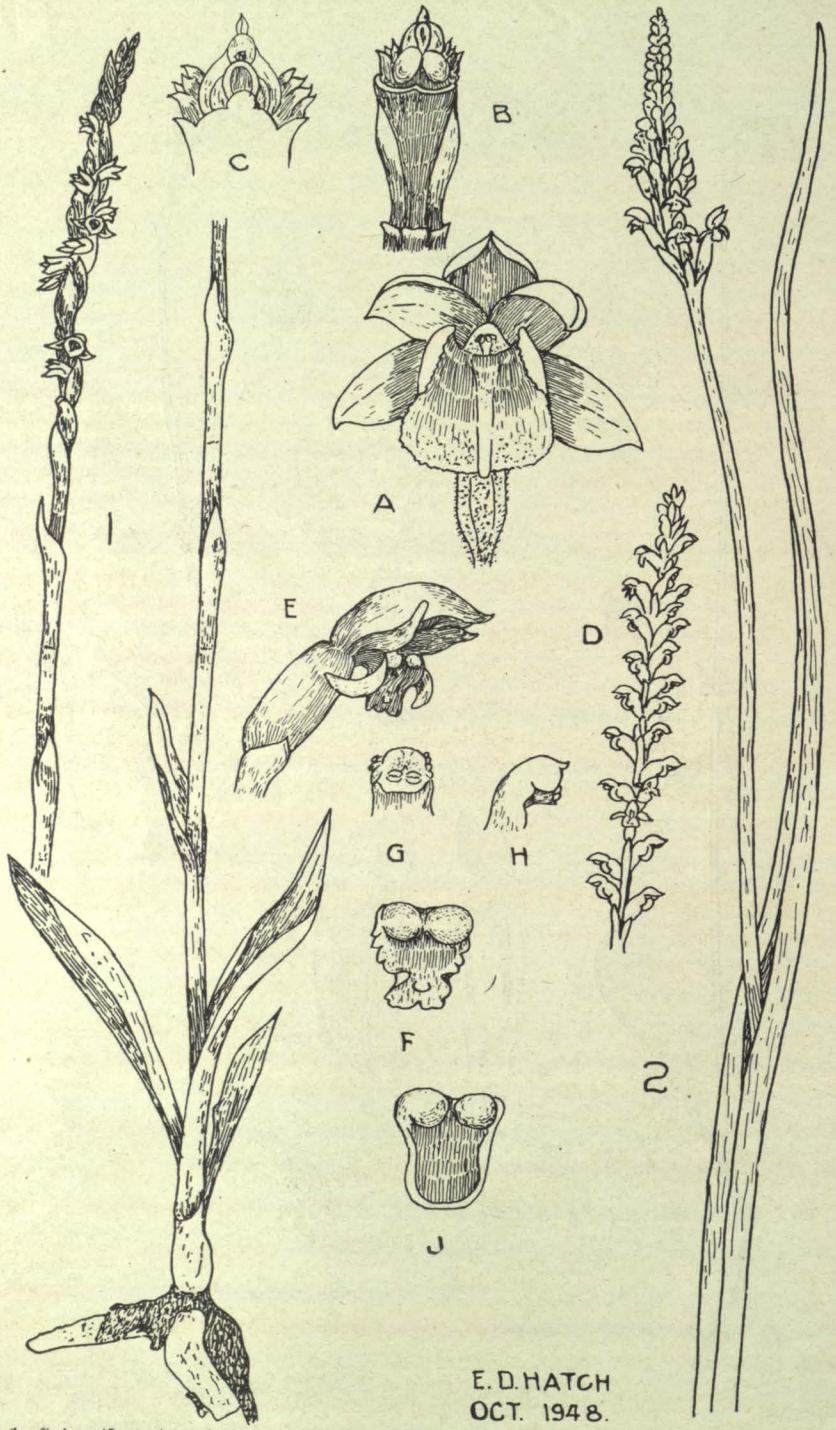
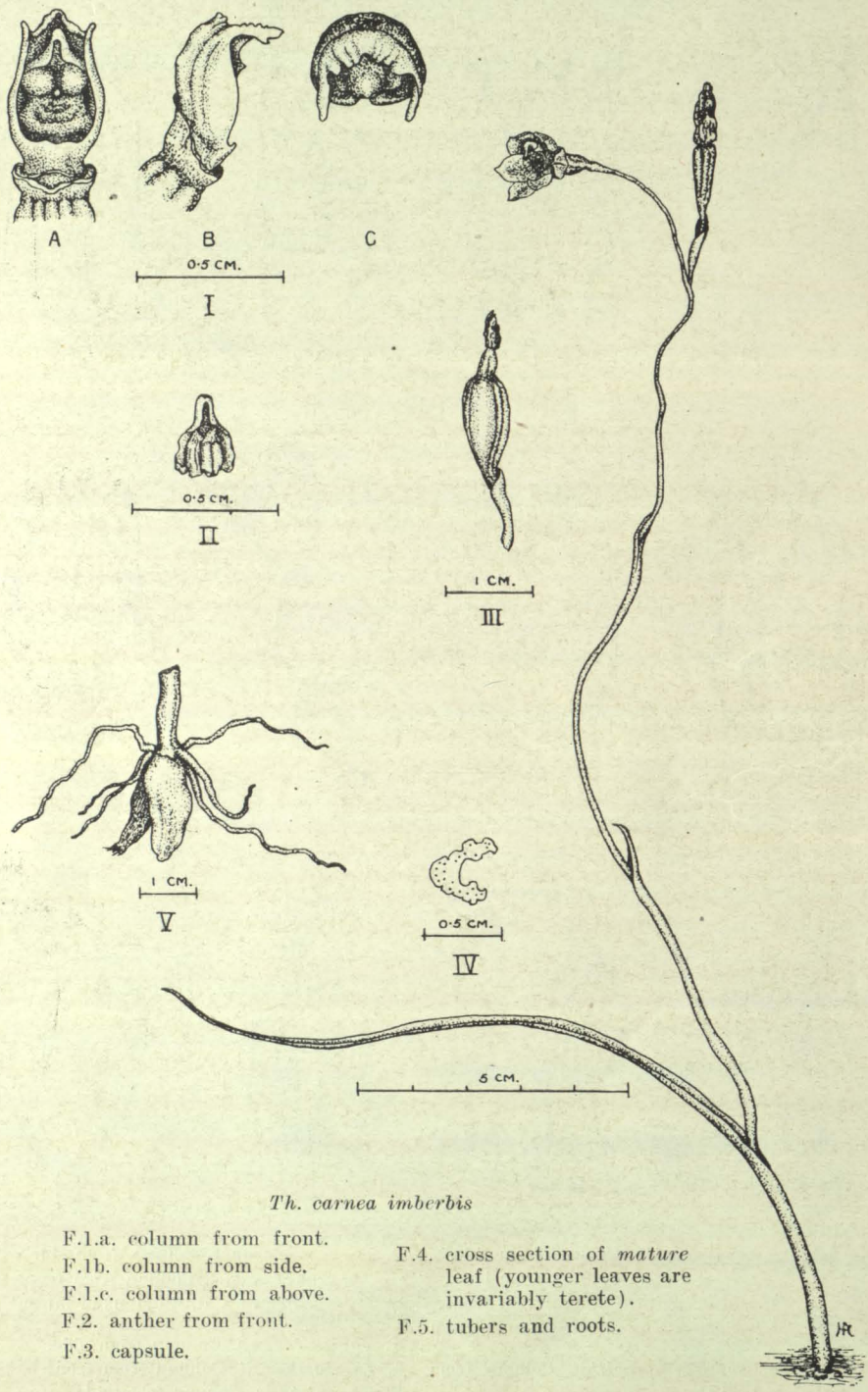


1. *Spiranthes sinensis*, natural size. a, flower from front; b, column from front; c, top of column from back.
2. *Microtis unifolia*, natural size (young raceme). d, raceme at maturity; e, flower from side; f, labellum from front; g, column from front; h, column from side j, labellum of *M. parviflora* from front.

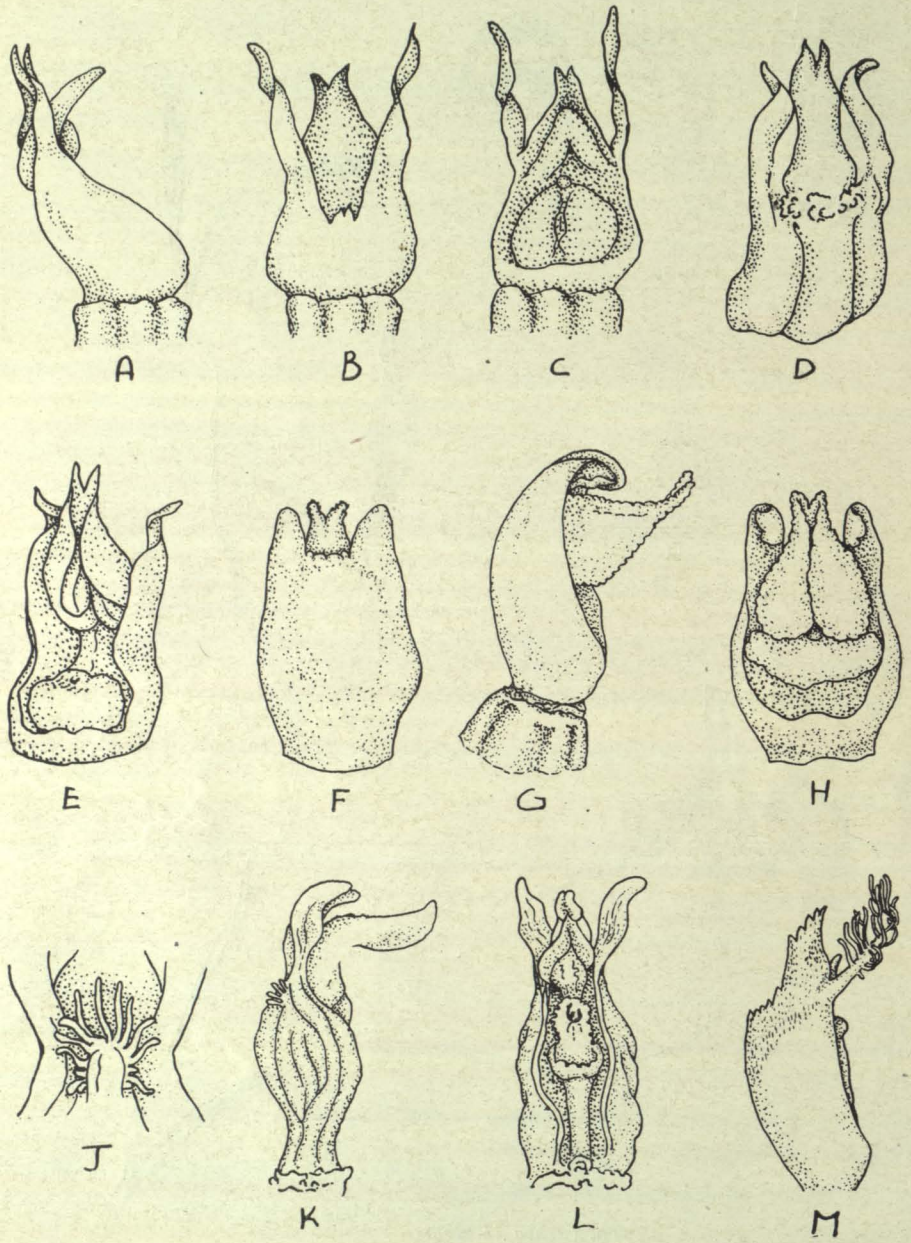
Orthoceras strictum, natural size. a, flower from side; b, labellum from above; c, column from back; d, column from side.

Th. longifolia. The first illustration.
Drawn on board the *Endeavour*, under the direction of Sir Joseph Banks; from plants collected by himself and Solander from the East Cape area, towards the end of October, 1769. The first *Thelymitra* to be seen by European eyes.



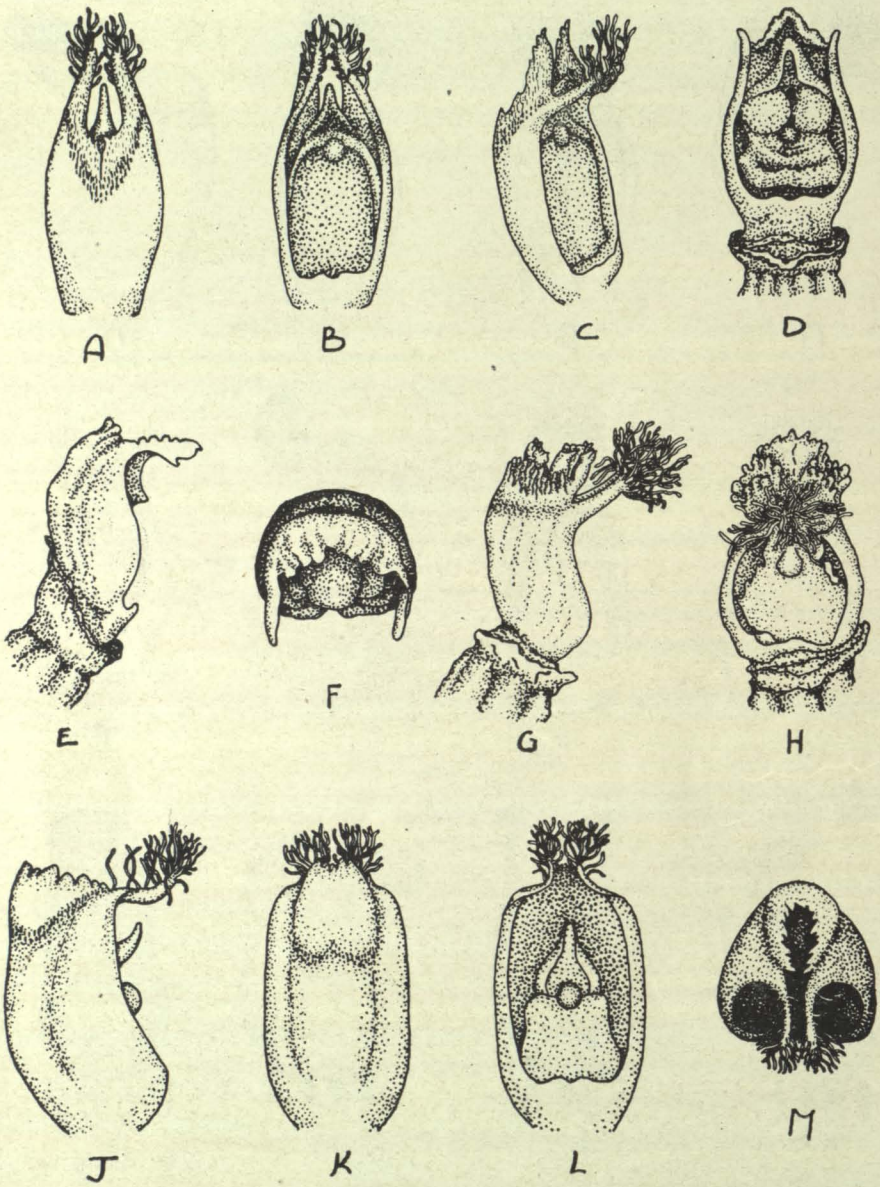
Th. carnea imberbis

F.1.a. column from front.
F.1b. column from side.
F.1.c. column from above.
F.2. anther from front.
F.3. capsule.
F.4. cross section of *mature* leaf (younger leaves are invariably terete).
F.5. tubers and roots.



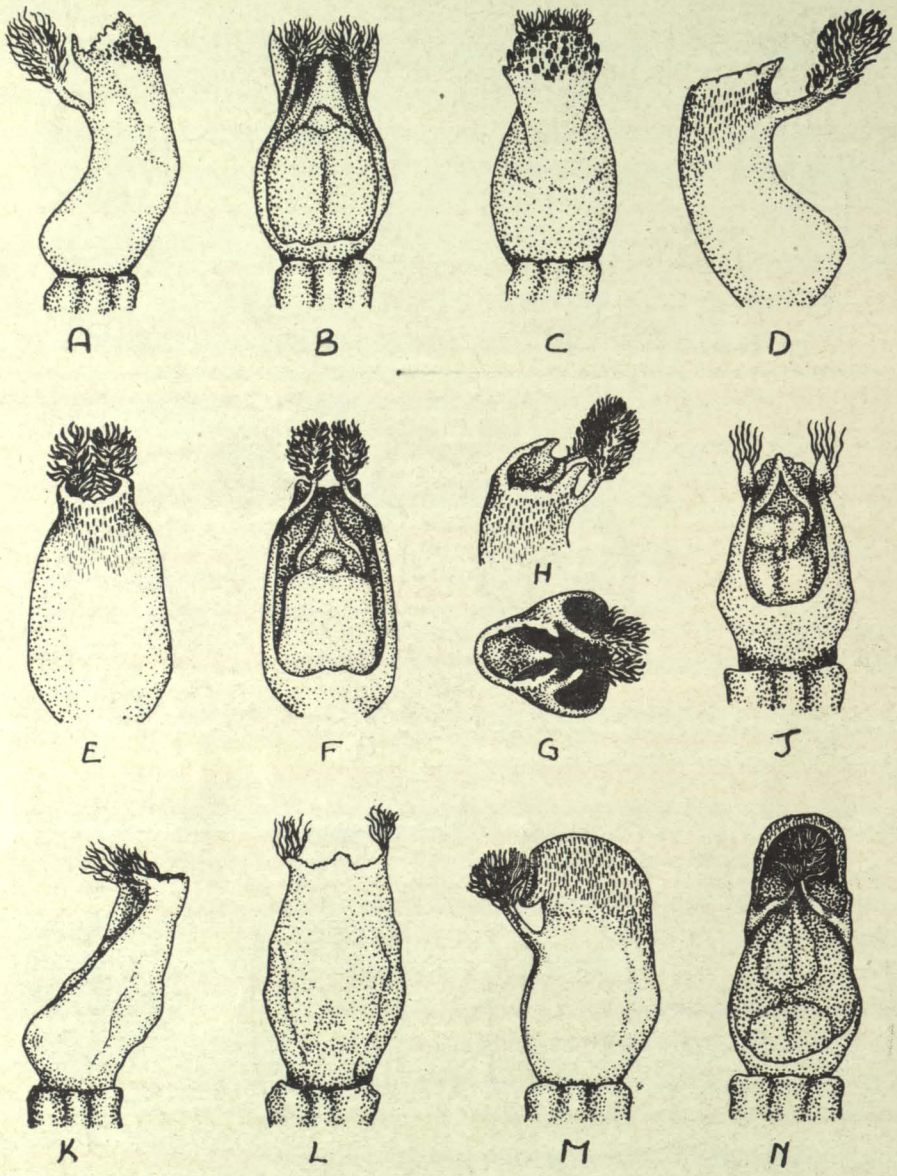
A. *Th. venosa typica.* Column from side.
B. *Th. venosa typica.* Column from back.
C. *Th. venosa typica.* Column from front.
D. *Th. venosa cedricsmithii.* Column from back.
E. *Th. venosa cedricsmithii.* Column from front.
F. *Th. venosa cyanea.* Column from back.
G. *Th. venosa cyanea.* Column from side.
H. *Th. venosa cyanea.* Column from front.
J. *Th. matthewsii.* Calli in sinus of lateral lobes.
K. *Th. matthewsii.* Column from side.
L. *Th. matthewsii.* Column from front.
M. *Th. pulchella.* Column from side.

D, E, after Smith. F, G, H, after Hooker. J, K, L, after Nicholls.

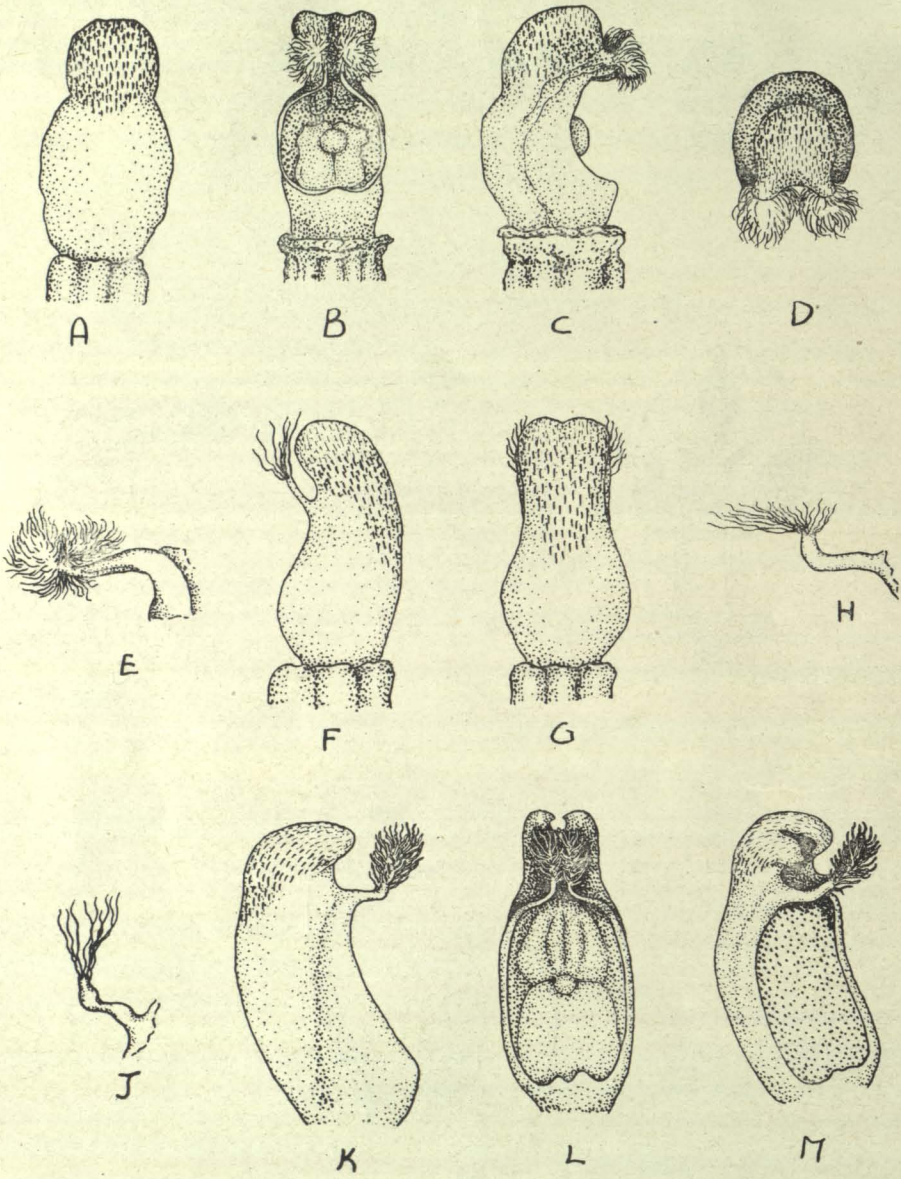


A. *Th. pulchella.* Column from back.
B. *Th. pulchella.* Column from front.
C. *Th. pulchella.* Column from half front.
D. *Th. carnea imberbis.* Column from front.
E. *Th. carnea imberbis.* Column from side.
F. *Th. carnea imberbis.* Column from above.
G. *Th. ixioides typica.* Column from side.
H. *Th. ixioides typica.* Column from front.
J. *Th. aemula.* Column from side.
K. *Th. aemula.* Column from back.
L. *Th. aemula.* Column from front.
M. *Th. aemula.* Column from above.

G, H, after Scammel.

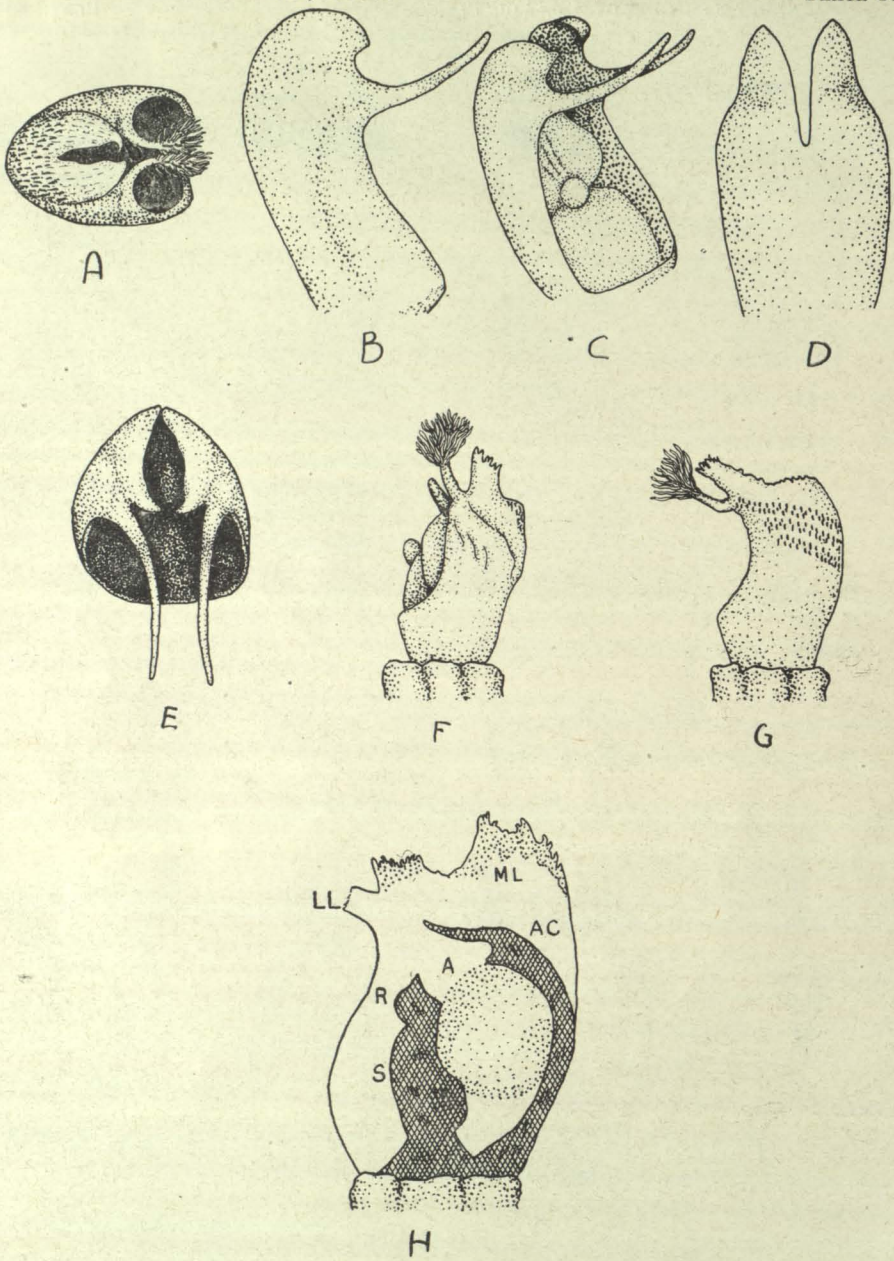


A. *Th. decora.* Column from side.
B. *Th. decora.* Column from front.
C. *Th. decora.* Column from back.
D. *Th. pachyphylla.* Column from side.
E. *Th. pachyphylla.* Column from back.
F. *Th. pachyphylla.* Column from front.
G. *Th. pachyphylla.* Column from above.
H. *Th. pachyphylla.* Top of column from half back.
J. *Th. caesia.* Column from front.
K. *Th. caesia.* Column from side.
L. *Th. caesia.* Column from back.
M. *Th. aristata.* Column from side.
N. *Th. aristata.* Column from front.



A. *Th. aristata.* Column from back.
B. *Th. longifolia forsteri.* Column from front.
C. *Th. longifolia forsteri.* Column from side.
D. *Th. longifolia forsteri.* Column from above.
E. *Th. longifolia forsteri.* Secondary cilia.
F. *Th. longifolia stenopetala.* Column from side.
G. *Th. longifolia stenopetala.* Column from back.
H. *Th. longifolia stenopetala.* Secondary cilia.
J. *Th. longifolia intermedia.* Secondary cilia.
K. *Th. pauciflora.* Column from side.
L. *Th. pauciflora.* Column from front.
M. *Th. pauciflora.* Column from half front.

Facing plate 79]



A. *Th. pauciflora*. Column from above.
B. *Th. sanscilia*. Column from side.
C. *Th. sanscilia*. Column from half front.
D. *Th. sanscilia*. Column from back.
E. *Th. sanscilia*. Column from above.
F. *Th. pachyphylla* (South Island jordanon) from an upper (immature) bud.
G. *Th. pachyphylla* from a lower bud on the same plant, showing differences in column form during development.
H. *Th. acmula*. Diagrammatic section of column, showing arrangement of parts.
LL, base of lateral lobe. ML, midlobe. AC, anther connective. A, anther, R, rostellum. S, stigma.

Auckland Museum. Vicinity Westport, 11.1905, W. Townson. Sheet No. 3376(1).*

9. **Th. caesia** Petr. *Trans. N.Z. Inst.*, 51, 1919, 107

Up to 90 cm. high. Leaf up to 32 cm. long, recurved, concave with exterior ridges, linear-acuminate. Flowers 1–6, deep mauve with darker striae, perianth segments up to 15 mm. long. Column inclined backwards, reddish-blue with darker striae. Midlobe erect, as high as or higher than the anther, but not cucullate, reddish-brown with paler margins. Lateral lobes secondary, short, oblique, with bright yellow fimbriae.

Distribution Endemic—*2* (North Auckland), *3a.* (Kaipara), common throughout, from Kaikohe to the Waitakere Ranges, *Matthews, Irwin, Bartlett, Hatch*, etc. *5.* (Volcanic Plateau), National Park, 12.1948, *J. B. Irwin. 7.* (Ruahine-Cook), Wallaceville Hill, 12.1946, *J. Johnston.* Silverstream and Upper Hutt, 11.1949, *A. P. Druce. 10.* (North-western), Westport, 12.1947, *W. R. B. Oliver.*

Flowers Oct.–Dec., sea-level–2,000 ft.; scattered in scrub or tussock and along roadsides. Related to *Th. pachyphylla* Cheesmn.

Group (g)

10. **Th. aristata** Ldl. *Gen. et Spec. Orch.*, 1840, 521. Hatch, *Trans. R.S.N.Z.*, 76, 1946, 59

Th. grandis F. Muel. ex Benth. *Flor. Austr.*, 6, 1873, 319
Th. angustifolia Hook. f. *Flor. Tasmn.*, 2, 1860, 5 (not of R. Br.)
Th megcalyptra R. D. Fitzg *Austr. Orch.*, 1, 1879, 5

Up to 30 cm. high. Leaf up to 10 cm. long (Australian specimens have been recorded with leaves up to 40 cm. long, but the New Zealand plants seem to have uniformly short leaves), shallow-concave with exterior ridges, linear-obtuse. Flowers 1–10, pale mauve, fragrant, perianth segments up to 10 mm. long. Column inclined slightly backwards, pale pink. Midlobe higher than the anther, cucullate, more or less emarginate, brownish-black all over. Lateral lobes secondary, horizontal, with short dense tufts of white or pink cilia.

Distribution. Australia—not uncommon throughout all the States. New Zealand—*2.* (North Auckland), Kaitaia, 10.1920, *H. B. Matthews.* Kaikohe, 10.1949, *Irwin and Gibson. 3a.* (Kaipara), Nihotupu, 11.1946, *E. D. Hatch 4.* (East Cape), Lake Waikaremoana, 11.1949, *C. Trevarthen.*

Flowers Oct.–Dec , sea-level–2,000 ft.; scattered along tracks, roadsides, and in scrub and grass. New South Wales has a jordanon in which the midlobe tends towards the *longifolia* type, and suggests perhaps the manner in which that complex came into being.

11. **Th. longifolia** J R. and G. Forst. *Char. Gen. Plant.*, 1776, 98, t49

A compound species of 6 jordanons, 1 in south-eastern Australia and Tasmania, 1 in New Caledonia, 1 in the Auckland Islands, and 3 in New Zealand proper.

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* Since writing the above, *Th. pachyphylla* has been found to consist of two distinct jordanons, one in the North Island (Plate 79, Figs. D–H) and one in the South and Stewart Islands (Plate 81, Figs. F–G). *Th. venosa typica* and *Th. ixioides typica* have been recorded from New Caledonia.

(a) *Th. longifolia* var. **forsteri** (Sw.) Hh. *n.comb.*
Th. longifolia Forst. *sens. strict.*
Th. forsteri Sw. *Vet. Akad.*, 21, 1800, 228
Th. nemoralis Col. *Trans. N.Z. Inst.*, 17, 1885, 249
Th. purpurea-fusca Col. *l.c.*
Th. cornuta Col., ibid., 20, 1888, 206

Jord. (i). Up to 60 cm. high. Leaf up to 90 cm. long by 4 cm. broad (extreme measurements, seldom found as large as this), recurved, concave in young plants, flat in old, with exterior ridges, linear-acuminate. Flowers 1–24, white, pink, pale blue or maroon, perianth segments up to 14 mm. long; column inclined slightly backwards, pale pink. Midlobe higher than the anther, cucullate, truncate, emarginate or almost bifid, brownish with a conspicuous yellow margin. Lateral lobes secondary, horizontal with short dense tufts of white cilia.

Jord (ii). Morphologically similar to (i), but the whole plant pale green, the flowers and column pure white, the midlobe reddish brown with white instead of yellow margins.

Syn. *Th. longifolia* var. *alba* (Col.) Cheesmn. *Man. N Z. Flor*, 2, 1925, 339. *Th. alba* Col. *Trans. N.Z. Inst.*, 18, 1886, 272.

In the writer's opinion, Jord. (ii) is only a true-breeding colour form and cannot be given varietal rank—see *Trans. R.S.N.Z.*, 77, 1949, 401—under *Caladenia carnea.*

Distribution. Endemic—both forms are abundant throughout the North and South Islands, extending to Stewart and the Chatham Islands.

Flowers Oct.–Dec., sea-level–5,000 ft. Jord. (i) appears to be derived from the Australian variety of *longifolia*, while Jord. (ii) is derived from Jord. (i). Large colonies or scattered in almost any situation from the summer snowline on Mt Ruapehu to the salt-drenched cliffs of the West Coast, from the depths of the Urewera forests to the middle of a brick-dust footpath at Laingholm. It rivals *Microtis unifolia* in being the commonest orchid in the country. Forster's plate, quoted above, can be regarded as the hypotype of the variety.

(b) *Th. longifolia* var. **stenopetala** (Hook. f.) Hh. *n.comb.*
Th. stenopetala Hook. f. *Flor. Ant.*, 1, 1844, 69

Superficially similar to var. *forsteri*, differing in the rather large midlobe and the lateral lobes with their cilia finer, longer, more lax and set more after the manner of *Th. pauciflora.*

Distribution. Endemic—Auckland Islands, 2.1943–5, *J. F. Findlay.*

Flowers Dec.–Feb., sea-level–500 ft.; related to and probably derived from var. *forsteri* (Jord. (i). All the specimens collected from these islands and referred to *longifolia* by Hooker and subsequent writers, probably belong to this jordanon. Certainly during three seasons the Cape Expedition were on the Aucklands only the one form appeared to occur.

(c) *Th. longifolia* var. **intermedia** (Bergg.) Hh. *n.comb.*
Th. intermedia Bergg. *Minneskr. Fisiog.*, 1877, 21, t5, f21–4

Up to 30 cm. high. Leaf up to 20 cm. long, recurved, shallow concave or eventually flat with exterior ridges, linear-acuminate. Flowers 1–6, rose-pink, perianth segments up to 8 mm. long. Column erect, rather narrow, pale pink (sometimes with darker striae). Midlobe shorter than the anther, slightly cucullate, bifid or truncate. Lateral lobes secondary, oblique, with thin tufts of white cilia.

Distribution. Endemic—*2.* (North Auckland), *3a.* (Kaipara), *3b.* (Waikato), *3c.* (Thames), *5.* (Volcanic Plateau), occasional throughout, particularly common in the Hunua Ranges.

Flowers Nov.–Jan., sea-level–2,000 ft.; small colonies in scrub. Related to and probably derived from *var. forsteri* Jord. (i).

Cheeseman (*Illus. N.Z. Flor.*, 2, 1914, letterpress to t192a) expressed the opinion that the Australian form of *longifolia* would be better treated as a variety since it differed in many respects from the New Zealand form. Rupp (*Orch. N.S.W.*, 1943, 8) came to the same conclusion, but did not make the necessary changes. The present writer studied the whole group and found that the usual conception of *longifolia* actually consisted of 6 quite distinct jordanons. No attempt has been made here to define the Australian and New Caledonian jordanons beyond suggesting that the name var. *australis* be given to the Australian form and var. *neocaledonica* to the New Caledonian. Hooker's *stenopetala* has been resurrected for the Auckland Islands form and Swartz' *forsteri* for the typical New Zealand jordanon, thus confirming Hooker's original opinion: ". . . my . . . *stenopetala* is probably a variety of . . . *forsteri* . . ." Berggren's *intermedia* is so frequently mistaken for *longifolia* that it seems better to include it as a variety. It is undoubtedly derived from var. *forsteri* and is very closely related to it indeed.

12. **Th. pauciflora** R. Br. *Prodr.*, 1810, 314

Up to 40 cm. high. Leaf up to 30 cm. long, recurved, concave with exterior ridges, linear-acuminate. Flowers 1–10, pale- to deep-blue, shading to maroon, perianth segments up to 12 mm. long. Column inclined slightly backwards, pale blue Midlobe higher than the anther, cucullate, deeply bifid, reddish-brown shading to bright yellow at the top. Lateral lobes secondary, shortly horizontal, then abruptly erect and tipped with short tufts of white cilia.

Distribution Australia—occasional throughout New South Wales, Victoria and South Australia. New Zealand—*2.* (North Auckland), *3a.* (Kaipara), *3b.* (Waikato), *3c.* (Thames), abundant throughout. *5.* (Volcanic Plateau), Tangiwai, 1.1945. *E. D. Hatch. 7.* (Ruahine-Cook), Wallaceville Hill, 12.1946, *J. Johnston.* Silverstream, 11.1949, *A. P. Druce.*

Flowers Sep.–Jan., sea-level–2,500 ft.; scattered in grass, scrub and along roadsides; probably derived from *aristata.*

13 **Th. sanscilia** *Irwin* ex Hh. *n.sp.*

Thelymitra pauciflora affinis, subsimilis. Differentis in habitus gracilis, in alae columnae vis late bifida et pulli-viridis, et in lobae laterales vis horizontalis et nullus cilia,

Up to 25 cm. high, stem very slender and distinctly reddish. Leaf up to 15 cm. long, suberect, narrow-concave with exterior ridges, linear acuminate. Flowers 1–3, dark violet-blue, perianth segments up to 9 mm. long. Column inclined slightly backwards, pale blue. Midlobe higher than the anther, rather widely bifid, dark-green with narrow yellow margins and short yellow anterior points. Lateral lobes secondary, horizontal, *without* cilia.

Distribution. 2. (North Auckland), Kaimaumau, 10.1949, *J. B. Irwin.* Ahipara, 10.1949, *O. E. Gibson.*

Flowers Oct.–Nov., sea-level–1,000 ft.; related to and probably derived from *Th. pauciflora.* Irwin's illustration, reproduced here, can be regarded as the hypotype of the species. *Holotype* in Herb. Hatch. No. 570—cultivated at New Plymouth from tubers collected by Gibson at Ahipara, 19.10.1949.

Acknowledgments. The writer is indebted to Messrs. J. B. Irwin, O. E. Gibson, F. W. Bartlett, Cedric Smith, W. H. Nicholls, Robert Cooper, C. Trevarthen, Dr. W. R. B. Oliver, and Miss L. B. Moore for much material and a great deal of assistance.

APPENDICES

This section is merely intended to integrate and summarise the series of notes and generic reviews which have gone before.

(A) In any revision of a family there are bound to be a few species about which nothing new can usefully be said. The six plants enumerated here have been adequately dealt with by Cheeseman and others, but in order to preserve the uniformity of the series the writer has included illustrations.

(i) **Adenochilus gracilis** Hook. f. *Flor. Nov. Zel.,* 1, 1853, 246, t56a. Cheeseman, *Man. N.Z. Flor.,* 2, 1925, 362. Hatch, *Trans. R.S.N.Z.,* 77, 1949, 227.

(ii) **Caleana minor** R. Br. *Prodr.,* 1810, 329. Cheeseman, *ibid.,* 348.

(iii) **Orthoceras strictum** R. Br. *Prodr.,* 1810, 317. Cheeseman, *ibid.,* 344

(iv) **Microtis unifolia** (Forst. f.) Reichb. f. *Beitr.,* 62, 1871. Cheeseman, *ibid.,* 345. Nicholls, *Vict. Natr.,* 66, 1949, 91, t

(v) **Microtis parviflora** R. Br. *Prodr.,* 1810, 321. Rupp, *Orch. N.S.W.,* 1943, 21. Nicholls, *Vict. Natr.,* 66, 1949, 91, t. Hatch, *Trans. R.S.N.Z.,* 76, 1949, 59

(vi) **Spiranthes sinensis** (Pers.) Ames. *Orch.,* 2, 1908, 53. Cheeseman, *ibid.,* 337 [as *Sp. australis* (R. Br.) Ldl.]. Hatch, *Trans. R.S.N.Z.,* 76, 1946, 60

The genus *Spiranthes* is at present being revised by the Canadian botanist L. A. Garay, who advises the writer that the species *sinensis* is highly compound and that the New Zealand form will probably be reduced to varietal rank.

(B) Description:

Orchidaceae Juss

In New Zealand the family comprises perennial herbs; either leafy terrestrials with small tubers and fibrous roots; or saprophytic terres-

trials with fleshy rhizomes; or epiphytes with creeping stems and rhizomes. Leaves simple, alternate, often distichous, sheathing at the base. Flowers solitary or in loose or spicate racemes, hermaphrodite, zygomorphic. Perianth epigynous, composed of 6 segments in 2 whorls, which are sometimes similar, or more often with the lateral petals paired and the lateral sepals paired and the middle segments of both whorls modified to a greater or less extent, the middle petal (labellum) particularly, often becoming extremely complicated in structure. The ovary is usually twisted through 180°, bringing the labellum into the abaxial position. Theoretically there are 6 stamens in 2 whorls; the 2 lateral of the outer whorl confluent with the middle petal to form the labellum, the third of the outer whorl fertile at the apex of the column; the 2 lateral of the inner whorl modified into various appendages (column-wings); the third of the inner whorl confluent with the front of the column. (In *Petalochilus* it appears as a sigmoid appendage at the base of the column.) Anther 2-celled, introrse, opening by a slit lengthwise; pollen granular, or generally agglutinated into mealy or waxy masses (pollinia), which may be extended at one end into a sterile caudicle. Pollinia free in the anther-cells or loosely united. Ovary inferior, 1-celled with 3 parietal placentas. Stamens and style combined to form a variable structure (column) in the centre of the flower. Stigmata 3, the lateral 2 fertile, the third modified to form the rostellum, to which the pollinia are frequently attached. Ovules very numerous, minute, anatropous. Fruit a capsule, opening by longitudinal slits. Seeds very numerous, minute, without endosperm. Embryo not differentiated.

It must be made clear that the above description is only intended to cover New Zealand genera. In other members of the family the leaves may be opposite, or the flowers polygamous or monoecious. There may be 2 fertile stamens or 3 fertile stigmata, or the ovary may be 3-celled with axile placentas, or the seed may be winged.

(C) The following system of classification is based upon Schlechter (*Notizbl. Bot. Gart. Berl.*, 9, 1926, 567) and was prepared for this paper by Mr. Leslie A. Garay, of the University of Toronto, Canada. It is a considerable advance upon the system at present used in Australia (refer Rupp, *Orch. N.S.W.*, 1943, 2) since it gives a more natural position to *Calochilus, Microtis* and *Prasophyllum.*

Family	ORCHIDACEAE
subfamily	MONANDRAE
division	ACROTONAE
tribe	POLYCHONDREAE
subtribe	PTEROSTYLIDEAE—***Pterostylis***
„	DIURIDEAE—***Orthoceras***
„	THELYMITREAE—***Thelymitra, Calochilus***
„	PRASOPHYLLEAE—***Prasophyllum, Microtis***
„	DRAKAEAE—***Chiloglottis, Caleana***
„	CALADENIEAE—***Caladenia, Petalochilus, Lyperanthus, Adenochilus, Aporostylis***
„	ACIANTHEAE—***Acianthus, Townsonia***
„	CORYBADEAE—***Corybas***
„	GASTRODIEAE—***Gastrodia***
„	SPIRANTHEAE—***Spiranthes***
tribe	KEROSPHAEREAE
series	ACRANTHAE
subtribe	DENDROBIEAE—***Dendrobium***
„	GLOMEREAE—***Earina***

series	PLEURANTHAE
subseries	SYMPODIALES
subtribe	BULBOPHYLLEAE—*Bulbophyllum*
subseries	MONOPODIALES
subtribe	SARCANTHEAE
section	SARCOCHILINAE—*Sarcochilus*

(D) In *Trans. R.S.N.Z.*, 76, 1946, 58, the writer endeavoured to show how close was the relationship between the orchid floras of Australia and New Zealand. This may be accounted for when we consider the various trends of distribution which have and are still affecting the South Pacific floras.

(a) It was originally considered (Rupp and Hatch, *Proc. Linn. Soc. N.S.W.*, 70, 1945, 57) that 7 genera showed signs of having differentiated in a south-to-north direction. This opinion, for which the present writer was alone responsible, has had to be revised from time to time until at present the only genera showing definite signs of south-to-north evolution are *Pterostylis* (Hatch, *Trans. R.S.N.Z.*, 77, 1949, 234) and *Thelymitra*. These genera are presumed to have originated in the paleozelanic continent which the evidence leads us to believe extended considerably to the southward of the present position of New Zealand (but hardly to Antarctica) and also to Tasmania, during early Cretaceous times.

(b) The second trend was presumably an overland movement by way of Malaya, Java, New Guinea, New Caledonia, Lord Howe Island, etc. This brought us the truly Asiatic genera *Corybas, Gastrodia, Spiranthes, Microtis, Dendrobium, Bulbophyllum, Sarcochilus.* (*Earina,* originating in New Caledonia, probably came to New Zealand by this route also.)

(c) There is a distinctly powerful west-to-east, probably windborne movement which brings East African orchids to Western Australia, Eastern Australian orchids to New Zealand and New Caledonia, and thence to the Chathams and Polynesia. This gave us the Australia-originating genera *Caladenia, Lyperanthus, Chiloglottis, Townsonia, Adenochilus, Acianthus, Orthoceras, Prasophyllum, Caleana* and *Calochilus,* and in addition odd Australian species of genera which normally arrived by other routes (*Pterostylis, Thelymitra, Corybas, Gastrodia, Microtis*). That these have crossed the Tasman in dust storms in the past cannot be denied, but we must also consider the possibility of Australian orchids continuing to do so at the present time. How else to account for the isolated occurrence of *Townsonia* on Mt. Ruapehu, *Pterostylis nutans* on the Whangaparoa Peninsula, or *Pt. mutica* on the Waiouru Hills? And lastly the occurrence of *Thelymitra venosa cyanea,* which occurs in New Zealand only in Stewart and the Auckland Islands, at Kaikohe in the far north?

(d) And lastly the tendency to local evolution which produced *Petalochilus* from *Caladenia,* and *Aporostylis* from a combination of *Caladenia* and *Chiloglottis,* and which led and is still leading to the differentiation of endemic species in the larger genera.

These trends apply equally of course to the flora as a whole, particularly (a), (b) and (d), but section (c) applies more directly to the orchids than to other families because the minute seeds are more easily carried in dust storms and by high winds. Also these seeds

(according to Ames and others) are frequently detached as protocorms after infection by fungi, and so arrive at their destination with germination already begun and with their mycorrhizal partner aboard, and so can begin in a new locality even though the particular fungus to which they are used, and without which they cannot normally germinate, may be absent from the area. Then by vegetative reproduction they can build up a small colony which can eventually begin to spread abroad by sexual means.

The abundance in New Zealand of certain Australian species which are comparatively rare in their homeland (not to mention the great development of *Acianthus*, also *Lyperanthus* and its allied genera in New Caledonia) must be mentioned, although it cannot at present be adequately explained. *Chiloglottis cornuta, Pterostylis furcata, Thelymtira longifolia, Caladenia carnea minor* and *Adenochilus* are all more widespread here and to be found in far greater numbers than on the Australian side of the Tasman.

(E) Study of the ecology of some species often confirms their origin. At Silverdale, near Auckland, Mr. F. W. Bartlett has a fine plantation of old-established Eucalypts in which *Corybas aconitiflorus* and *Gastrodia sesamoides* grow with a vigour and abundance seldom seen elsewhere In another Eucalypt plantation in the Kaitoke Ranges *Chiloglottis cornuta* is larger and more abundant than in the native bush alongside. The obvious inference is that these Australian species prefer an Australian environment.

(F) Since the publication of the various parts of this revision, several new localities of interest have been recorded, and confirmed by the writer:

Corybas macranthus longipetalus—6. Koru, 9.1945; Wanganui, 7.1947, *J. B. Irwin.* New Plymouth, 10.1947, *O. E. Gibson. 16.* Stewart Island, 10.1947, *C. Smith. 3b.* Raglan, 9.1948, *M. C. Gudex.*

Townsonia viridis—southern slopes of Mt. Ruapehu, 1.1949. *O. E. Gibson.*

Gastrodia minor—Waihohonui Hut, Mt. Ruapehu, 1.1949, *O. E. Gibson.*

Pterostylis trullifolia alobula—3b. Raglan, 9.1948, *M. C. Gudex. 6.* Wanganui, 8.1949, *J. B. Irwin.*

Pterostylis foliata—3b Mt. Pirongia, 10.1949, *J. B. Irwin.*

Pterostylis irsoniana—"very common Mt. Egmont," 10.1949, *O. E. Gibson.*

Prasophyllum nudum—10. Charleston, 3.1949, *W. R. B. Oliver. 3b* Arapuni, 4.1949; Mairoa, 5.1949, *J. B. Irwin.*

Caladenia lyallii—16. Mason's Bay, Stewart Island, 11.1949, *O. A. Allan* (cf. Hatch, *Trans. R.S.N.Z.*, 77, 1949, 401)

Spiranthes sinensis—2 Lake Rotokawau, 11.1949, *R. Cooper.*

(G) In *Trans. R.S.N.Z.*, 78, 1950, 103, the writer gave the number of *Bulbophyllum* species to be found in Australia as 14. This was an error. Hunt and Rupp (*Proc. R.S. Queensland,* 60, 1949, 55) list 28 Australian species which they consider valid and 3 more which are doubtfully so.

PART II

Acknowledgments

The death of my father in 1949 put an end to the series of excellent drawings which had illustrated my botanical papers in *Transactions*. The accompanying figures were drawn in the first place by my friends J. Bruce Irwin, Owen E. Gibson, and Colwyn Trevarthen. These originals were then enlarged and drawn to a uniform scale by H. C. Abraham, Cable Bay.

New Localities

Fresh data concerning the distribution of the orchids is constantly coming to hand. Since the list appended to the first part of this paper the following new localities have been recorded and confirmed:

Townsonia viridis (Hook. f.) Schltr. Titiroa Mountains, above Lake Monowai, Southland. *Nothofagus* forest, 2,500 ft. 1.1951, *C. Trevarthen.*

Gastrodia cunninghamii Hook. f. Mt. Egmont. Along the bed of the Waiwakaiho River at 3,500 ft. 12.1950, *Gibson* and *Hatch.*

Pterostylis irsoniana Hh. "The Puffer," Hutt Valley, Wellington. 12.1950, *Irwin* and *Druce.*

Pterostylis foliata Hook. f. Not uncommon throughout the Hutt Valley, Wellington. 12.1950, *Irwin* and *Druce.*

Thelymitra aristata Ldl. Pukerua Bay (Wellington) and along the old hill road to Paekakariki. 12.1950, *E. D. Hatch.* "The Puffer," Hutt Valley, Wellington. 12.1950, *J. B. Irwin.* Seatoun. 25.11.1951, *W. R. B. Oliver.*