Chapter 4

REVISION OF COELOGYNE SECTION SPECIOSAE (ORCHIDACEAE)*

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SUMMARY

Section *Speciosae* Pfitzer & Kraenzl. of the genus *Coelogyne* Lindl. is revised using morphological and molecular characters. Sixteen species are recognised, including one new (*C. tommii*) and one dubious species (*C. dichroantha*). Three former varieties are raised to subspecies level (*C. speciosa* subsp. *speciosa*, subsp. *incarnata* and subsp. *fimbriata*). Two species formerly included in sect. *Speciosae* by several authors are excluded (*C. eberhardtii* and *C. lawrenceana*). A total evidence analysis of morphological characters and ITS and *matK* sequence data supports the monophyly of the section as here recognised. Two major clades in the section are identified: the first one consists of species from Peninsular Malaysia, Sumatra, Java, Borneo, Sulawesi and the Moluccas; the second one comprises species of Sulawesi, New Guinea and the Pacific islands.

Key words: *Coelogyne* sect. *Speciosae*, orchids, systematics, phylogeny, *matK*, nuclear rDNA ITS.

INTRODUCTION

Within the subtribe Coelogyninae sixteen genera are presently recognised (Pedersen et al., 1997). One of these genera is *Coelogyne* Lindl., which contains over 200 species, distributed from mainland southeast Asia, Malaysia, Singapore, Indonesia, Philippines, Brunei and Papua New Guinea to the Pacific Islands.

Lindley (1821) described the genus, naming it *Caelogyne* (from the Greek 'koilos' = 'hollow', and 'gyne' = 'female') because of the concave stigma. Soon after he corrected this spelling to *Coelogyne* (Lindley, 1825) and later subdivided the genus into five sections: *Erectae, Filiferae*, *Flaccidae*, *Flexuosae* and *Proliferae* (Lindley, 1854). Reichenbach f. (1861) also used this subdivision. Pfitzer & Kraenzlin (1907c) published thirteen new section names: *Ancipites, Carinatae, Cristatae, Elatae*, *Fuliginosae, Fuscescentes, Lentiginosae, Longifoliae, Ocellatae, Speciosae*, *Tomentosae, Venustae* and *Verrucosae*. They maintained only one section of Lindley: *Proliferae.* Section *Speciosae* of Pfitzer & Kraenzlin was maintained by nearly all later authors. Only Smith (1933a), followed by Comber (1990), included sect. *Speciosae* and *Fuliginosae* in sect. *Longifoliae*. Holttum (1953, 1964) just used numbered, nameless sections.

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In this study sect. *Speciosae* is partly recognised according to Pfitzer & Kraenzlin (1907c). They distinguished sect. *Speciosae* from the other sections by the following characters: few, showy and large flowers which open in succession; lip with few (rarely many) interrupted, hairy, warty or lobed keels; floral bract which covers the entire flower bud; peduncle with naked base. Not all of these characters appeared to apply to all species within the section. Therefore, we abandoned some of the characters of Pfitzer & Kraenzlin and transformed the remaining into the combination: average lip length larger than 32 mm (with the exception of *C. carinata*); no sterile bracts at the base of the scape; all or only the apical internodes of the rhachis slightly curved.

Pfitzer & Kraenzlin (1907c) listed a total of 11 species in sect. *Speciosae* of which three are reduced to synonymy here. Schlechter (1911) added *C. fragrans* and Smith (1917) suggested that *C. celebensis* should be included. Holttum (1953) included *C. xyrekes* and *C. tiomanensis* and according to Butzin (1974) *C. guamensis* should also be a member of this section. Lewis & Cribb (1991) added *C. susanae* and O'Byrne (1995) assumed *C. tomiensis* to belong to the section as well. We think that *C. dichroantha* should be placed in the section because of the absence of sterile bracts at the base of the peduncle and rhachis and the few, large flowers. In our view, all these species are more related to each other than to any other *Coelogyne* species. Therefore, we include them in sect. *Speciosae*.

Pfitzer & Kraenzlin (1907c) included *C. lawrenceana*, in which they were followed by Butzin (1974, 1992a) and Seidenfaden (1975). In addition the latter author included *C. eberhardtii*. However, both species have completely white flowers with yellow, completely plate-like, incised keels and shining green, smooth pseudobulbs. The species here recognised as belonging to sect. *Speciosae* have cream coloured, yellowish, greenish or salmon coloured flowers with papillose, warty or partly plate-like keels which are hairy or glabrous, and dull green, angular pseudobulbs.

Coelogyne carinata was included in sect. *Longifoliae* by Pfitzer & Kraenzlin (1907d) and Butzin (1974) and in sect. *Lentiginosae* by Schlechter (1911) and nearly all later authors because of the small, simultaneously opening flowers. In this study, however, *C. carinata* individuals appeared to have successively opening flowers as well, varying in size from small to medium-sized. Moreover, the species is in its floral characters very similar to *C. fragrans*; hence, it is included in sect. *Speciosae*.

The sectional classifications of *Coelogyne* in current use are based on a few diagnostic characters only, and no phylogenetic analyses with all species assigned to sect. *Speciosae* were performed so far. The main objectives of this study were:
1) to check the monophyly of sect. *Speciosae* as here recognised;
2) to study interspecific relationships within the section.

A taxonomic revision was made, and phylogenetic analyses were performed based on morphological and molecular characters obtained by sequencing the plastid *matK* gene and the nuclear rDNA ITS regions. The *matK* gene was chosen because of its proven utility at the generic and subgeneric level in Orchidaceae (Ryan et al., 2000). The nuclear rDNA ITS regions have been used extensively to infer phylogenetic relationships in Orchidaceae at both generic (Pridgeon et al., 1997; Douzery et al., 1999) and species level (Cox et al., 1997).

MATERIALS AND METHODS

Sampling

To determine the monophyly and interspecific relationships of sect. *Speciosae*, 20 taxa were analysed. The sampling includes 13 of the 16 species here recognised within the section. No living material was available of *C. dichroantha, C. guamensis* and *C. salmonicolor*. Four species of putatively allied sections were analysed, too. Unfortunately, *C. eberhardtii* and *C. lawrenceana* could not be included in the analyses performed for this chapter, due to lack of material for the collection of a morphological data set. The following characters and character states were used:

1. Pseudobulbs: 1 = ovate; 2 = oblong; 3 = cylindrical.
2. Pseudobulbs: 1 = 1-leafed; 2 = 2-leafed.
3. Scape: 1 = with sterile bracts on its base; 2 = without sterile bracts on its base.
4. Rhachis: 1 = slightly curved; 2 = distinctly curved at the apex; 3 = zigzagging; 4 = straight.
5. Rhachis: 1 = internodes flat; 2 = internodes swollen.
6. Floral bract: 1 = ovate; 2 = oblong.
7. Floral bract: 1 = caducous; 2 = persistent.
8. Lip: 1 = 8–32 mm long; 2 = longer than 32 mm.
9. Flowers: 1 = opening in succession; 2 = opening nearly simultaneously.
10. Hypochile base: 1 = straight; 2 = slightly saccate; 3 = extremely saccate; 4 = spurred.
11. Hypochile apex: 1 = straight; 2 = slightly saccate.
12. Hypochile lateral lobes: 1 = rounded in front; 2 = obtuse to acute in front.
13. Hypochile keels, number: 1 = 2–3; 2 = more than 3.
14. Hypochile keels, number of projections: 1 = consisting of 1 transverse row of projections; 2 = consisting of 2 transverse rows of projections; 3 = consisting of 5 transverse rows of projections.
15. Hypochile keels, indument: 1 = covered with hairs; 2 = covered with small papillae; 3 = covered with elongate papillae.
16. Hypochile keels, shape: 1 = plate-like with straight margin; 2 = consisting of warts; 3 = consisting of ridges; 4 = consisting of rounded projections; 5 = longitudinally grooved; 6 = consisting of tapering, branched projections with stellately arranged hairs at their apices; 7 = plate-like with undulating margin; 8 = plate-like with fimbriate margin.
17. Epichile, shape: 1 = ovate; 2 = elliptic.
18. Epichile, apex: 1 = clearly raised; 2 = flat.
19. Epichile, apex ornamentation: 1 = covered with warts; 2 = glabrous.
20. Epichile lateral lobes: 1 = cleary pronounced; 2 = absent.
21. Epichile keels, number: 1 = 0–3; 2 = more than 3.
22. Epichile keels, shape: 1 = consisting of warts; 2 = plate-like with straight margin; 3 = plate-like with undulating margin; 4 = longitudinally grooved.
23. Epichile, apex: 1 = extremely recurved; 2 = not or only slightly recurved.
24. Column: 1 = straight; 2 = bent.
25. Pollinia: 1 = all obliquely elliptic; 2 = abaxial pair obliquely elliptic, adaxial pair orbicular; 3 = all orbicular.

Table 4.1. List of species analysed. Arranged by (sub)tribe and genus according to Dressler (1990).

Subtribe	Genus and species	Section	Geographic origin	Voucher
Thuniinae	*Thunia alba* (Lindl.) Rchb.f.		unknown	*Chase 589* (K)
Coelogyninae	*Pleione bulbocodioides* (Franch.) Rolfe		unknown	*Leiden cult. 990010* (L)
	Pleione formosana Hayata		unknown	*Leiden cult. 91051* (L)
	Coelogyne cristata Lindl.	*Coelogyne*	unknown	*Leiden cult. 2214* (L)
	Coelogyne flaccida Lindl.	*Flaccidae*	unknown	*Leiden cult. 940707* (L)
	Coelogyne trinervis Lindl.	*Flaccidae*	unknown	*Leiden cult. 26940* (L)
	Coelogyne fimbriata Lindl.	*Fuliginosae*	unknown	*Leiden cult. 30759* (L)
	Coelogyne beccarii Rchb.f.	*Speciosae*	PNG, Kutubu	*Leiden cult. 32230* (L)
	Coelogyne carinata Rolfe	*Speciosae*	unknown	*Leiden cult. 30725* (L)
	Coelogyne celebensis J.J. Sm.	*Speciosae*	Sulawesi	*Leiden cult. 950057* (L)
	Coelogyne fragrans Schltr.	*Speciosae*	PNG, Tari	*Leiden cult. 32320* (L)
	Coelogyne lycastoides F. Muell. & Kraenzl.	*Speciosae*	Fiji	*Leiden cult. 914325* (L)
	Coelogyne macdonaldii F. Muell. & Kraenzl.	*Speciosae*	Vanuatu	*Leiden cult. 25836* (L)
	Coelogyne rumphii Lindl.	*Speciosae*	Buru	*Leiden cult. 24505* (L)
	Coelogyne septemcostata J.J. Sm.	*Speciosae*	Kalimantan, Apo Kayan	*Leiden cult. 970678* (L)
	Coelogyne susanae P.J. Cribb & B.A. Lewis	*Speciosae*	Bougainville	*Cribb & Morrison 1922* (K)
	Coelogyne speciosa (Blume) Lindl.	*Speciosae*	Java	*Leiden cult. 950058* (L)
	Coelogyne tiomanensis M.R. Hend.	*Speciosae*	Malaysia, Pulau Tioman	*Leiden cult. 990047* (L)
	Coelogyne tommii Gravendeel & O'Byrne	*Speciosae*	unknown	*Leiden cult. 21526* (L)
	Coelogyne xyrekes Ridl.	*Speciosae*	Malaysia, Bukit Larut	*Leiden cult. 960160* (L)

Outgroups were sampled from subtribe Thuniinae and Coelogyninae, based on the placement of representatives of these subtribes as sister taxa to *Coelogyne* using morphological data (Burns-Balogh & Funk, 1986), *ndhF* (Neyland & Urbatsch, 1996), *rbcL* (Cameron et al., 1999), *nad1*b–c (Freudenstein et al., 2000) and *matK* evidence (Chase et al., unpubl.; Gravendeel et al., in prep.). Plant material was obtained from the living orchid collections of the Hortus Botanicus Leiden, Royal Botanic Gardens Kew, Kebun Raya Bogor and private collections in Australia, England en Singapore. Plants were collected during several expeditions to Peninsular Malaysia, Sumatra, Borneo, Java, Buru, New Guinea and Bougainville. Voucher specimens of accessions surveyed, with their origins, are listed in Table 4.1 and deposited at K or L.

Herbarium material was studied from the following herbaria: AAU, AMES, B, BM, BO, BRI, BSIP, C, CAL, CANB, CBG, G, HBG, K, KEP, L, LAE, MEL, NY, P, S, SAN, SAR, SING, W, WA and WRSL. The dimensions given in the descriptions are based on spirit collections and living material only due to degradation of flower structures in dried specimens. When only herbarium material was measured this is mentioned.

Maps were made with the program KORT (© Bertel Hansen, C). Coordinates were partly found with the COOR database (© Peter van Welzen, L).

DNA extractions

Total genomic DNA was extracted from 50 mg of fresh young leaf tissue following the CTAB method of Doyle & Doyle (1987). Some samples were purified through a cesium chloride/ethidium bromide gradient (1.55 g ml^{-1}). Leaf material was taken from one individual per species.

matK and ITS amplifications

The *trnK* intron (mostly *matK*) was amplified with the following four primers: -19F (5'-CGTTCTGACCATATTGCACTATG-3') and 881R (5'-TMTTCAT-CAGAATAAGAGT- 3'); 731F (5'-TCTGGAGTCTTTCTTGAGCGA-3') and 2R (5'-AACTAGTCG-GATGGAGTAG-3'). All primers were designed at the Royal Botanic Gardens, Kew, except for 2R (Johnson & Soltis, 1994). The thermal cycling protocol comprised 28 cycles, each with 1 min. denaturation at 94 ºC, 30 sec. annealing at 48 ºC, an extension of 1 min. at 72 ºC, concluding with an extension of 7 min. at 72 ºC. All PCR products were sequenced directly after purification with QIAquick purification columns (QIAGEN, Amsterdam, The Netherlands). Four sequencing reactions were performed for each completed sequence, one with each of the four PCR primers, and these generated nearly complete overlapping single strand sequences for the *trnK* intron fragments.

ITS1 and ITS2 spacers along with the 5.8S gene were amplified with the primers 17 SE (5'-ACGAATTCATGGTCCGGTGAAGTGTTCG-3') and 26SE (5'-TAGAATTCCCCGGTTCGCTCGCCGTTAC-3') from Sun et al. (1994). The thermal cycling protocol comprised 26 cycles, each with 10 sec. denaturation at 96 ºC, 5 sec. annealing at 50 ºC and extension of 4 min. at 60 ºC. All PCR products were cloned following the protocol of Promega's pGEM-T Easy Vector System and then reamplified from transformed bacterial colonies by touching them with a sterile pipet tip and using that as template. Two sequencing reactions were performed for each completed sequence, one with each of the two PCR primers, and these generated nearly complete overlapping single strand sequences for the entire ITS fragments.

All amplified, double-stranded DNA fragments were purified using Wizard PCR minicolumns (Promega, Madison, Wisconsin, USA) and sequenced on an ABI 377 automated sequencer (PE Applied Biosystems, Inc.), using standard dye-terminator chemistry following the manufacturer's protocols.

Phylogenetic analyses

All characters were assessed as independent, unordered and equally weighted, using Fitch parsimony (Fitch, 1971). For the morphological characters multistate coding was used. When multiple states occurred within one species, they were treated as polymorphisms. Sequences were aligned with MegAlign version 4.03 (DNASTAR, Inc. 1999) and subsequent adjustment by hand. Gaps in the sequence data were coded as missing values. The morphological data matrix and *matK* and ITS alignments are available from the first author upon request (gravendeel@nhn.leidenuniv.nl). Maximum parsimony analyses were performed on the morphological and sequence data with PAUP* version 4.0b64 (Swofford, 1999) using random additions and the MULPARS option. *Thunia alba*, *Pleione bulbocodioides* and *Pleione formosana* were used as outgroups in all analyses. The relative robustness for clades found in each parsimony

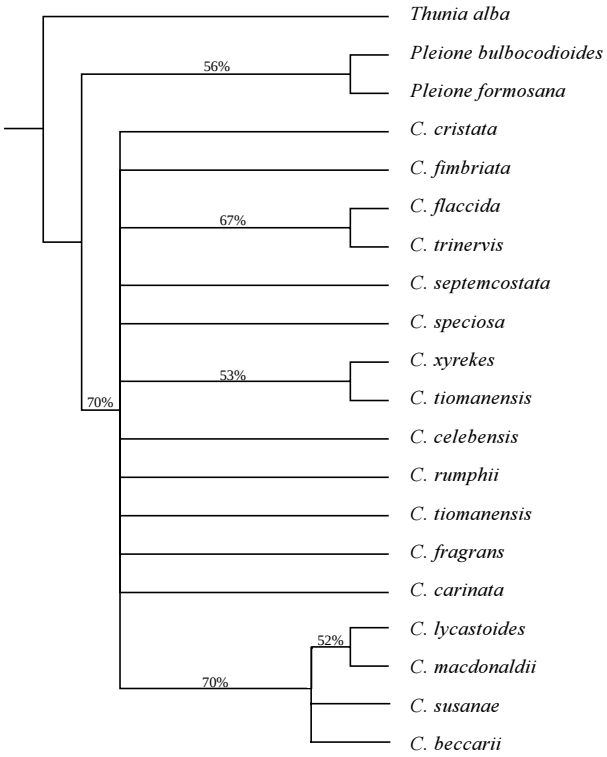


Fig. 4.1. Bootstrap consensus of 25 trees from parsimony analysis of morphological data (only percentages > 50% are given).

analysis was assessed by performing 1000 replicates of bootstrapping (Felsenstein, 1995), using simple stepwise additions, SPR swapping, MULTREES on, and holding only 10 trees per replicate. Congruence of the separate data sets was assessed by visual inspection of the individual bootstrap consensus trees. Bootstrap trees were considered incongruent only if they displayed hard (> 80% supported) incongruencies (Wiens, 1998). Character state evolution of all morphological characters was reconstructed using the assumptions of maximum parsimony with the Trace Character facility in MACCLADE version 3.04 (Maddison & Maddison, 1992).

SPECIES DELIMITATION

Distinct species are recognised when at least two morphological characters indicate differences. These criteria follow from the rules and recommendations for taxonomists as stated by Van Steenis (1957). For most of the species in the section this appeared not to be problematic. However, between *C. carinata* and *C. fragrans* the variation in most morphological characters studied appeared to be more or less continuous. Principal Component and cluster analyses were used to find gaps in multivariate morphometric space and search for a good combination of delimitating characters.

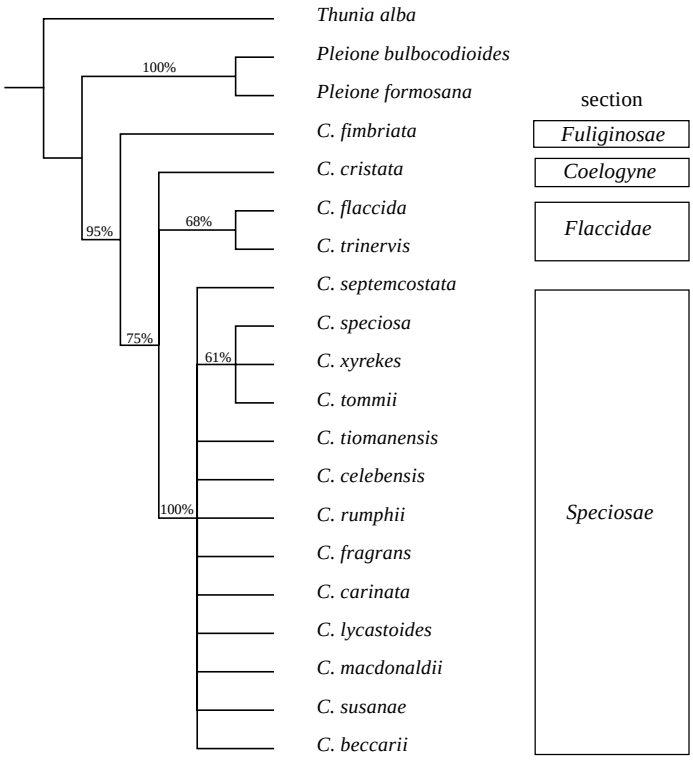


Fig. 4.2. Bootstrap consensus of 1877 trees from parsimony analysis of *matK* sequence data (only percentages > 50% are given).

RESULTS

Morphology

All 25 characters scored were phylogenetic informative. The MP analyses yielded 25 most parsimonious trees (MPTs) (length = 82, CI = 0.48, RI = 0.65; Table 4.2). The bootstrap consensus topology and the corresponding branch supports are indicated in Fig. 4.1.

The morphological consensus tree shows little resolution. All Coelogyninae species are united in a weakly supported clade (70%). Other weakly supported clades unite *C. lycastoides* plus *C. macdonaldii* (52%), *C. lycastoides*, *C. macdonaldii*, *C. susanae* and *C. beccarii* (70%), *C. tiomanensis* plus *C. xyrekes* (53%), all species sampled of sect. *Flaccidae* (67%) and *Pleione* (56%).

matK and ITS sequences

Boundaries of the *matK* gene were taken from Johnson & Soltis (1994). The •nal alignment has a total length of 1844 sites (1544 bp for the *matK* gene and 300 bp in the flanking *trnK* sequences), of which 113 are variable and 47 phylogenetically informative, and contains one autapomorphic indel of nine bp in the *matK* gene and four synapomorphic indels in the flanking *trnK* sequences, ranging in size from

1–9 bp. The MP analysis yielded 1877 MPTs (length = 129, CI = 0.91, RI = 0.92; Table 4.2). The bootstrap consensus topology and the corresponding branch supports are indicated in Fig. 4.2.

The *matK* bootstrap consensus tree shows more resolution than the morphological bootstrap consensus. Monophyly of *Pleione, Coelogyne* and sect. *Speciosae* is strongly supported (100%, 95% and 100% resp.). Two weakly supported clades unite the species sampled of sect. *Flaccidae* (68%) and *C. speciosa, C. tommii* plus *C. xyrekes* (61%). Length ranges of nuclear rDNA ITS sequences were 213–240 bp, 159–160 bp, and 222–261 bp, resp. Boundaries from the 5.8S gene are taken from Hershkovitz & Lewis (1996). The final alignment has a total length of 683 sites (249, 162 and 272 sites for ITS1, 5.8S and ITS2, respectively). Of the included positions, 243 are variable and 106 phylogenetically informative, which is in accordance with variation levels in most angiosperms (Baldwin et al., 1995). The MP analysis yielded 24 MPTs (length = 393, CI = 0.74, RI = 0.73; Table 4.2). The bootstrap consensus topology and the corresponding branch supports are indicated in Fig. 4.3.

The ITS bootstrap consensus tree shows more resolution than either the morphological or *matK* bootstrap consensus. Three clades receive strong support: all *Pleione* species sampled (100%), *C. celebensis, C. rumphii, C. tiomanensis* plus *C. xyrekes* (86%) and *C. fragrans, C. carinata, C. beccarii, C. susanae, C. lycastoides* plus *C. macdonaldii* (84%). Weakly supported clades unite *C. celebensis* plus *C. rumphii* (58%), *C. tiomanensis* plus *C. xyrekes* (52%), *C. celebensis, C. rumphii, C. tiomanensis, C. xyrekes* plus *C. speciosa* (69%), *C. carinata* plus *C. beccarii* (66%),*C. fragrans, C. carinata, C. beccarii* plus *C. susanae* (55%), *C. lycastoides* plus *C. macdonaldii* (53%), *C. tommii, C. fragrans, C. carinata, C. beccarii, C. susanae, C. lycastoides* plus *C. macdonaldii* (72%) and *C. fimbriata, C. flaccida, C. trinervis, C. tommii, C. fragrans, C. carinata, C. beccarii, C. susanae, C. lycastoides* plus *C. macdonaldii* (73%).

Table 4.2. Values and statistics from parsimony analyses of morphology, *matK* and nuclear rDNA ITS sequences, and combined data.

	Morphology	*matK*	ITS1-5.8S-ITS2	Total evidence
Total number of characters	25	1844	683	2552
Number of variable characters	25 (100%)	113 (6%)	243 (36%)	381 (15%)
Number of phylogenetically informative characters	24	47	106	177
Average number of changes per variable site	3.7	1.1	3.7	–
Number of MPTs	25	1877	24	1
Tree length (steps)	82	129	393	642
CI	0.48	0.91	0.74	0.70
RI	0.65	0.92	0.73	0.70
Number of clades in bootstrap consensus with >80% support	0	3	3	10

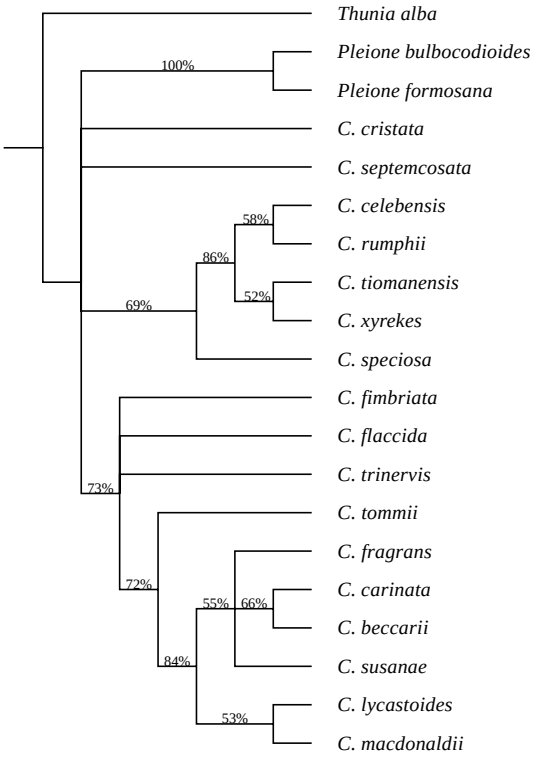


Fig. 4.3. Bootstrap consensus of 24 trees from parsimony analysis of ITS1-5.8S-ITS2 sequence data (only percentages > 50% are given).

Total evidence analysis

Bootstrap consensus trees of the three individual data sets revealed no hard incongruences. To improve sampling, a combined analysis of all three data sets was performed. The combined matrix yielded a single MPT (length = 642, CI = 0.70; RI = 0.70). Bootstrap analyses of the combined data set provided more resolution and higher internal support for relationships than did any of the individual data sets (Table 4.2). The bootstrap consensus topology and the corresponding branch supports are shown in Fig. 4.4.

Strongly supported clades unite all species of *Coelogyne* and *Pleione* sampled (80% and 100% respectively), all species sampled of sect. *Flaccidae* (92%), sect. *Flaccidae* plus sect. *Fuliginosae* (99%) and all species sampled of sect. *Speciosae* (86%). Two major clades within sect. *Speciosae* are strongly supported:

1) *C. septemcostata*, *C. speciosa*, *C. xyrekes*, *C. tiomanensis*, *C. celebensis* plus *C. rumphii* (88%); and
2) *C. fragrans*, *C. carinata*, *C. lycastoides*, *C. macdonaldii*, *C. susanae* plus *C. beccarii* (97%). Within the first major clade *C. celebensis* plus *C. rumphii* (93%) and *C. xyrekes* plus *C. tiomanensis* (92%) form strongly supported subclades. Weaker supported subclades unite *C. xyrekes*, *C. tiomanensis*, *C. celebensis* plus *C. rumphii*

(85%) and *C. speciosa*, *C. xyrekes*, *C. tiomanensis*, *C. celebensis* plus *C. rumphii* (65%). Within the second clade *C. lycastoides* plus *C. macdonaldii* and *C. susanae* plus *C. beccarii* form weakly supported subclades (65% and 79% respectively). Another weakly supported subclade unites *C. beccarii*, *C. lycastoides*, *C. macdonaldii* plus *C. susanae* (64%). One strongly supported subclade unites *C. carinata* with *C. fragrans* (84%). *Coelogyne tommii* is placed at the base of the second major clade in sect. *Speciosae*, although support for this position is weak (64%).

DISCUSSION

Separate and combined analyses of morphological and molecular data of almost all species indicate that sect. *Speciosae* as here recognised is monophyletic. Unfortunately, not all putatively allied species (such as *C. eberhardtii* and *C. lawrenceana*) could be included in the analyses performed for this chapter. However, the molecular phylogeny constructed in Chapter 2 indicates that at least *C. eberhardtii* is clearly separated from the other species of sect. *Speciosae* sampled.

The species of sect. *Speciosae* as here recognised have the following unique character combination in *Coelogyne*: average lip length larger than 32 mm (with the exception of *C. carinata*); no sterile bracts at the base of the scape; all or only the apical internodes of the rhachis slightly curved. All other *Coelogyne* species analysed have an average lip length smaller than 32 mm, sterile bracts at the base of the scape and/or a rhachis with zigzagging or straight internodes.

Within sect. *Speciosae*, two strongly supported major clades are present. The first major clade consists of *C. septemcostata*, *C. speciosa*, *C. xyrekes*, *C. tiomanensis*, *C. celebensis* plus *C. rumphii*, which occur in Peninsular Malaysia, Sumatra, Java, Borneo, Sulawesi and the Moluccas. These species all have unifoliate pseudobulbs (with the exception of *C. celebensis* and *C. speciosa*, which can also have some bifoliate pseudobulbs), successively opening flowers and keels on the hypochile, which are longitudinally grooved, plate-like with undulating margin or shaped like rounded or tapering projections with stellately arranged hairs at their apices. A well supported group within this first major clade consist of *C. tiomanensis* and *C. xyrekes*, which share a hypochile with slightly saccate base and apically rounded lateral lobes, and a row of undulating plate-like projections on the hypochile and epichile. Another well supported subclade unites *C. celebensis* and *C. rumphii*, which both have oblong floral bracts, rounded projections on the hypochile and warts on the epichile.

The second major subclade consists of *C. fragrans*, *C. carinata*, *C. lycastoides*, *C. macdonaldii*, *C. susanae* plus *C. beccarii*, which occur in Sulawesi, New Guinea and the Pacific islands. These species all have longitudinally grooved keels or warts or ridges on the hypochile and warts on the epichile. A well supported group within this second major clade consists of *C. carinata* and *C. fragrans*. Both species have a slightly saccate hypochile apex, longitudinally grooved keels on the hypochile and an epichile with glabrous apex. A subclade within this second major clade with weak support consists of *C. beccarii* and *C. susanae*, *C. lycastoides* and *C. macdonaldii*. These four species all have a rhachis with incrassate internodes, warts or ridges on the hypochile and a bent column. Another weakly supported subclade unites *C. lycastoides* with *C. macdonaldii*, which share persistent floral bracts, a relatively

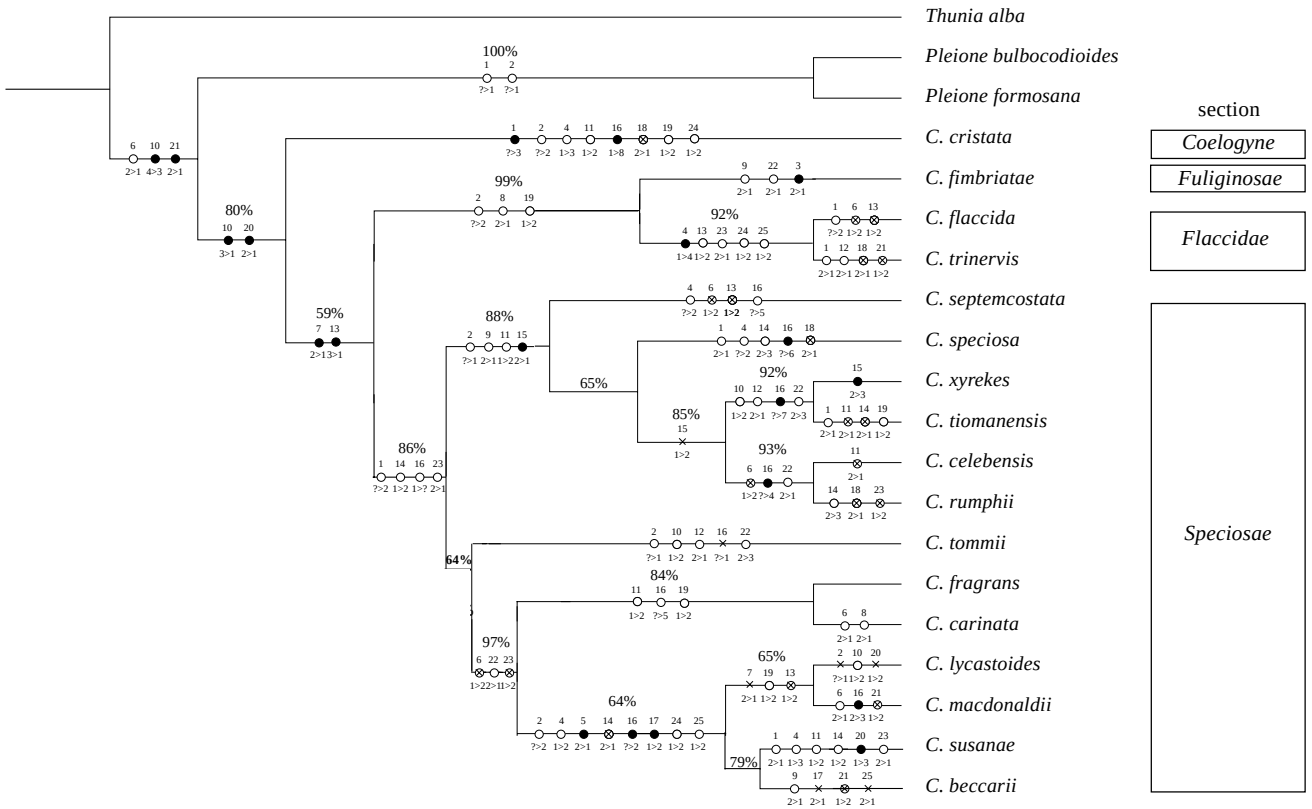


Fig. 4.4. Single MTP from total evidence analysis with bootstrap support values (only percentages >50% are given). The character state changes of the morphological characters used were traced with MACCLADE version 3.04 (Maddison & Maddison, 1992). Legends: ● = unique apomorphy; ○ = parallelism; x = reversal; ⊗ = parallel reversal.

high number of keels on the hypochile and an epichile with glabrous apex. A third subclade within the second major clade in sect. *Speciosae* unites *C. beccarii* with *C. susanae*. This subclade is based on sequence data only, and no morphological synapomorphies are present to characterise this group of species.

The results of the total evidence analysis identified *C. fimbriata*, *C. flaccida* and *C. trinervis* as nearest neighbours to the species of sect. *Speciosae*. These species share the caducous floral bracts with most of the species of sect. *Speciosae* and differ from them by the intermediate-sized flowers and the straight internodes of the rhachis (*C. flaccida* and *C. trinervis*) or sterile bracts on the base of the scape (*C. fimbriata*).

To determine whether traditionally used key characters for sectional delimitation in *Coelogyne* are phylogenetically informative, their character state evolution was reconstructed on the single MPT from the total evidence analysis (see Fig. 4.4). Characters with high phylogenetic potential are the diameter of the internodes of the rhachis, length of the lip and number and shape of the keels on the hypochile. Shape and number of leaves of the pseudobulbs show many parallelisms and reversals and appear not to be phylogenetically useful for the set of taxa analysed.

CHARACTERS

The general morphology of *Coelogyne* is described in Butzin (1992a), De Vogel (1992) and Dressler (1993). For easy reference, the most important diagnostic characters for the species within sect. *Speciosae* will be discussed here.

Pseudobulbs

When fresh the pseudobulbs of nearly all species of the section are obtusely 4-angled. *Coelogyne salmonicolor* and *C. xyrekes* can be recognised by the distinctly ribbed pseudobulbs (Fig. 4.13f, 4.19f). The shape of the pseudobulbs varies from ovoid to oblongoid, sometimes within one species as in *C. carinata* and *C. tommii*. The number of leaves on the pseudobulb is either one or two; both states may occur within one species as in *C. carinata*, *C. celebensis* and *C. fragrans* and even within a single specimen, as in *C. speciosa* (Fig. 4.15a).

Inflorescence

Synanthous inflorescences are predominant in the section: the inflorescence-bearing shoot has an immature pseudobulb hidden in the basal scales and the young leaf or leaves on top of this bulb are partly hidden and partly extending from the scales. After anthesis the pseudobulb starts swelling and the leaf or leaves fully develop. When the pseudobulb is fully grown the remainder of the decayed inflorescence (sometimes with fruits) is often persistent on top. The dry remnants of the scales of the inflorescence-bearing shoot envelope the pseudobulbs (Fig. 4.5f).

Coelogyne tommii is the only species within the section with proteranthous inflorescences: the leaf from the immature pseudobulb at the base is still hidden in the scales of the inflorescence-bearing young shoot during anthesis (Fig. 4.18f).

Coelogyne eberhardtii and *C. lawrenceana* have hysteranthous inflorescences: the inflorescence develops on top of a pseudobulb in full-grown state, with full-grown leaves.

Rhachis

The rhachis of the inflorescence varies from (sub)erect (about two thirds of the species studied) (Fig. 4.18f) to semi-pendulous (Fig. 4.10f). *Coelogyne septemcostata* is easily recognised by the strongly curved internodes of the rhachis (Fig. 4.14f). The internodes of the rhachis may be slightly swollen (majority of the species studied) (Fig. 4.19f) or incrassate as in *C. beccarii*, *C. guamensis*, *C. lycastoides*, *C. macdonaldii* and *C. susanae* (Fig. 4.11f).

Floral bracts

Usually the floral bracts are deciduous just after anthesis, although persistent bracts also occur (*C. lycastoides*, *C. macdonaldii* and *C. salmonicolor*). *Coelogyne carinata* and *C. fragrans* are variable in this character.

Flowers

Few [2–7(–22)], medium-sized to large flowers are typical for *Coelogyne* sect. *Speciosae*. Diagnostic characters can be found in the floral parts, mainly in the lip. The flowers open in succession (starting with the basal flowers) in most of the species of the section. Flowers which open more or less simultaneously occur in *C. lycastoides*, *C. macdonaldii*, *C. salmonicolor* and *C. tommii*. In *C. carinata* and *C. fragrans* both character states are present.

Hypochile — number of keels

The number of keels on the hypochile varies from 2 or 3 (most of the species studied) to 5–8 (*C. beccarii*, *C. guamensis*, *C. lycastoides* and *C. septemcostata*) to 9–13 (*C. macdonaldii* and *C. susanae*).

Hypochile — ornamentation of keels

The following keel ornamentations are found: a thick callus (*C. beccarii*) (Plate 4.1n); a decurrent and undulating plate with entire margin (*C. guamensis*, *C. tiomanensis*, *C. tommii* and *C. xyrekes*) (Plate 4.1m, 4.1o) or interrupted margin (*C. dichroantha*) (Plate 4.5a); more or less fused irregularly shaped, rounded warts or ridges (*C. lycastoides*, *C. macdonaldii* and *C. susanae*) (Plate 4.1j–l); elongate rounded projections, sometimes with a longitudinal groove in between (*C. celebensis* and *C. rumphii*) (Plate 4.1c, 4.1f); two, often interrupted undulating rows of irregularly rounded warts on each side of the crest, with a broad longitudinal groove in between (*C. carinata*, *C. fragrans*, *C. salmonicolor* and *C. septemcostata*) (Plate 4.1a, 4.1b, 4.1d, 4.1e); elongate tapering projections with stellately arranged hairs at their apices (*C. speciosa*) (Plate 4.1g–i). All species have minute papillae on the keels. Some species have elongate projections (also minutely papillose) (*C. xyrekes*) (Plate 4.1m) or multi- or unicellular hairs of various length (*C. salmonicolor*, *C. septemcostata*, *C. speciosa*) (Plate 4.1d, 4.1e, 4.1g–i) on the keels as well.

Hypochile — number of keel projections per row

The number of keel projections per row, counted in cross section is also informative. This number varies from 1 (one third of the species studied) to 2 (half of the species studied) to 5 (*C. rumphii* and *C. speciosa*).

Epichile

On the basal part of the epichile (claw and plate) the ornamentation of the keels is often identical to the ornamentation on the hypochile. On the apical part the keels vary from tightly packed irregularly rounded warts (most species) (Plate 4.1a) to irregularly undulating plate-like projections (five of the species studied) (Plate 4.1o) to an irregular semi-orbicular plate-like projection (*C. tiomanensis* and *C. xyrekes*) (Plate 4.1m). Scattered warts on the lateral lobes and epichile apex are typical for nearly two thirds of the species studied (Fig. 18a). About one third of the species has glabrous epichile apices. The margin of the claw epichile varies from entire (*C. tiomanensis*) (Fig. 17a) to erose (*C. rumphii*, *C. speciosa* subsp. *speciosa* and subsp. *incarnata*, and *C. xyrekes*) (Fig. 12a) to fimbriate (*C. speciosa* subsp. *fimbriata*) (Fig. 15b).

Fruit

In most cases, remnants of the perianth are still attached to the fruit (Fig. 15a). When some details of the keels are visible these can be good identification tools.

SYSTEMATIC TREATMENT

Coelogyne section Speciosae

Coelogyne Lindl. sect. *Speciosae* Pfitzer & Kraenzl. in Engl., Pflanzenr. 32 (1907) 28; Schltr., Feddes Repert. Beih. 1 (1911) 101; J.J. Sm., Feddes Repert. Spec. Nov. Regni Veg. 32 (1933) 168; Butzin, Willdenowia 7 (1974) 247; Seidenf., Dansk Bot. Ark. 29 (1975) 9; Butzin in Brieger et al., Die Orchideeen 1A (1992) 923; De Vogel, Proc. 14th World Orch. Conf. (1994) 203. — Type species: *Coelogyne speciosa* (Blume) Lindl.

Creeping, medium-sized to large epiphytes, sometimes terrestrials or lithophytes. Roots along the entire rhizome, rather slender to sturdy. Rhizome short, creeping, terete; rhizome scales 1– 6, soon eroding. Inflorescence-bearing shoot covered with scales at the base; scales tightly imbricate, 5 or 6. *Pseudobulbs* 1- or 2-leafed (in some species 1- and 2-leafed pseudobulbs may occur on the same plant). *Leaves* stiff herbaceous. Petiole short to long, almost orbicular in section and channelled. Blade oblong to linear-lanceolate, striate and plaited, small to large; base decurrent onto the petiole, sometimes laterally notched; apex acute, acuminate or cuspidate. *Inflorescence* erect, proteranthous or synanthous with the partially to entirely developed leaves, 2–7(–22)-flowered, glabrous. Peduncle ovoid in section, broadening to the apex, during flowering at the base enclosed by the leafblade(s) and/or scales of the young shoot, in a later stage by the petiole(s), usually long and elongating after anthesis. Rhachis (sub)erect to curved, terete, zigzag, with slightly to distinctly curved internodes, each with a swollen base bearing a flower. *Floral bracts* deciduous or persistent, attached around the base of the petiole, the lowest bract longer and broader than the higher bracts; lanceolate to ovate to oblong; apex acute or acuminate or cuspidate. *Flowers* widely open, opening in succession or (nearly) simultaneously, distichous, medium-sized to large, finely papillose. Pedicel terete, slightly twisted, glabrous; ovary twisted, 6-ribbed, glabrous. *Median sepal* boat-shaped, broadly sessile, ovate or (ovate-)oblong or (obovate-)lanceolate, glabrous; apex obtuse, acute, acuminate or apiculate; nerves 7–15, often with smaller cross veins, the midrib a rounded keel. *Lateral sepals* oblique,

boat-shaped, ovate, (ovate-)oblong or ((ob)ovate-)lanceolate, glabrous; apex emarginate, obtuse, acute, acuminate or cuspidate; nerves 7–17, often with smaller cross veins, the midrib a rounded keel. *Petals* slightly to extremely recurved, with (a)centric midrib, linear, glabrous; apex emarginate, obtuse, acute, acuminate, cuspidate, apiculate or mucronate; nerves 1–5, midrib prominent. *Lip* immobile, boat-shaped, 3-lobed, when flattened pandurate in outline, nerves 9–21. *Hypochile* broadly attached, flat or slightly saccate at the base; flat or slightly saccate towards the apex; lateral lobes erect, with acute, broadly rounded or obtuse sinus which is sometimes absent, in front rounded, obtuse or acute, slightly converging or diverging, with slightly to extremely irregularly erose front margin; keels 2–13, mostly widened along the crest, a thick callus by fusion of the keels (*C. beccarii*), a decurrent and undulating plate with entire margin (*C. guamensis*, *C. tiomanensis*, *C. tommii* and *C. xyrekes*) or interrupted margin (*C. dichroantha*), more or less fused irregularly rounded warts or ridges (*C. lycastoides*, *C. macdonaldii* and *C. susanae*), elongate rounded projections (*C. celebensis* and *C. rumphii*), two, often interrupted, undulating rows of irregularly shaped rounded warts on each side of the crest, with a broad longitudinal groove in between (*C. carinata*, *C. fragrans*, *C. salmonicolor* and *C. septemcostata*) or elongate tapering projections with stellately arranged hairs at their apices (*C. speciosa*); all keels have minute papillae, some have elongate projections (also minutely papillose) (*C. xyrekes*) or hairs as well (*C. salmonicolor*, *C. septemcostata*, *C. speciosa*). *Epichile* convex, when flattened obrhomboid, (ob)ovate, orbicular, elliptic or broadly spathulate, with or without a broad, short claw; base broadly attached; apex emarginate, retuse, rounded, obtuse or acute, (slightly) raised, with an obtuse, acute or acuminate apex; margin (slightly) erose or entire, recurved; sides either or not pronounced as lateral lobes, with or without warts; keels 2–9, on the claw and plate either identical with the ornamentations on the hypochile or changing into more or less tightly packed irregularly rounded warts towards the apex of the hypochile. *Column* curved to the front, when flattened spathulate; hood with winged margins, widest below the apex, gradually narrowing to the base, its apical margin more or less truncate or dentate, laterally notched where the wings are attached and sometimes with an additional notch or cuneate projection above, the middle part (slightly) rounded, recurved. Filament short. Anther basiversatile, broadly, oblongly or elongately bell-shaped in outline, near the place of attachment with a rounded, elongate or acute projecting apex; apex with or without notch. Pollinia four, flattened to one side, obliquely elliptic or obliquely orbicular, each with an oblique, earshaped depression which becomes shallower towards the caudicle, all connate at the apex by a caudicle; caudicle flattened, broadly triangular in outline, granular. *Stigma* cup-shaped, semi-orbicular with elevated, recurved margin; margin apex with or without an apical notch; rostellum more or less triangular, lateral margins incurved, with a truncate, obtuse, broadly rounded or acute apex with or without apical notch. *Fruit* body ellipsoid, beaked by the persistent column and remnants of the perianth; valvae keeled, keels plate-like; juga band-like with a pronounced longitudinal ridge, with or without incisions.

Distribution — The sixteen species of the section are distributed from mainland southeast Asia (Thailand), all over Malesia to the islands in the Pacific Ocean (Marianas, Solomon Islands, Vanuatu, New Caledonia, Fiji, Tonga, Samoa). No main centres of diversity can be distinguished.

Habitat & Ecology — Epiphytes, sometimes terrestrials or lithophytes in shady to exposed environments. Most species grow in lowland to montane forests or sometimes in secondary vegetations, usually in the range of 400–1500 m.

Cultivation — Only *Coelogyne fragrans*, *C. speciosa* subsp. *speciosa* and subsp. *incarnata* are widely cultivated. Within *Coelogyne*, three groups can be distinguished, based on the temperature requirements: a warm group (the real tropical species), which should be cultured at 18–23 °C; an intermediate group, which should be cultured at 15–18 °C; and a cool group (the species from higher altitudes), which should be cultured at 10–18 °C, but which can survive lower temperatures. The species of the cool group have a resting period of sometimes several months before new roots emerge. During this resting period, it is recommended to stop watering.

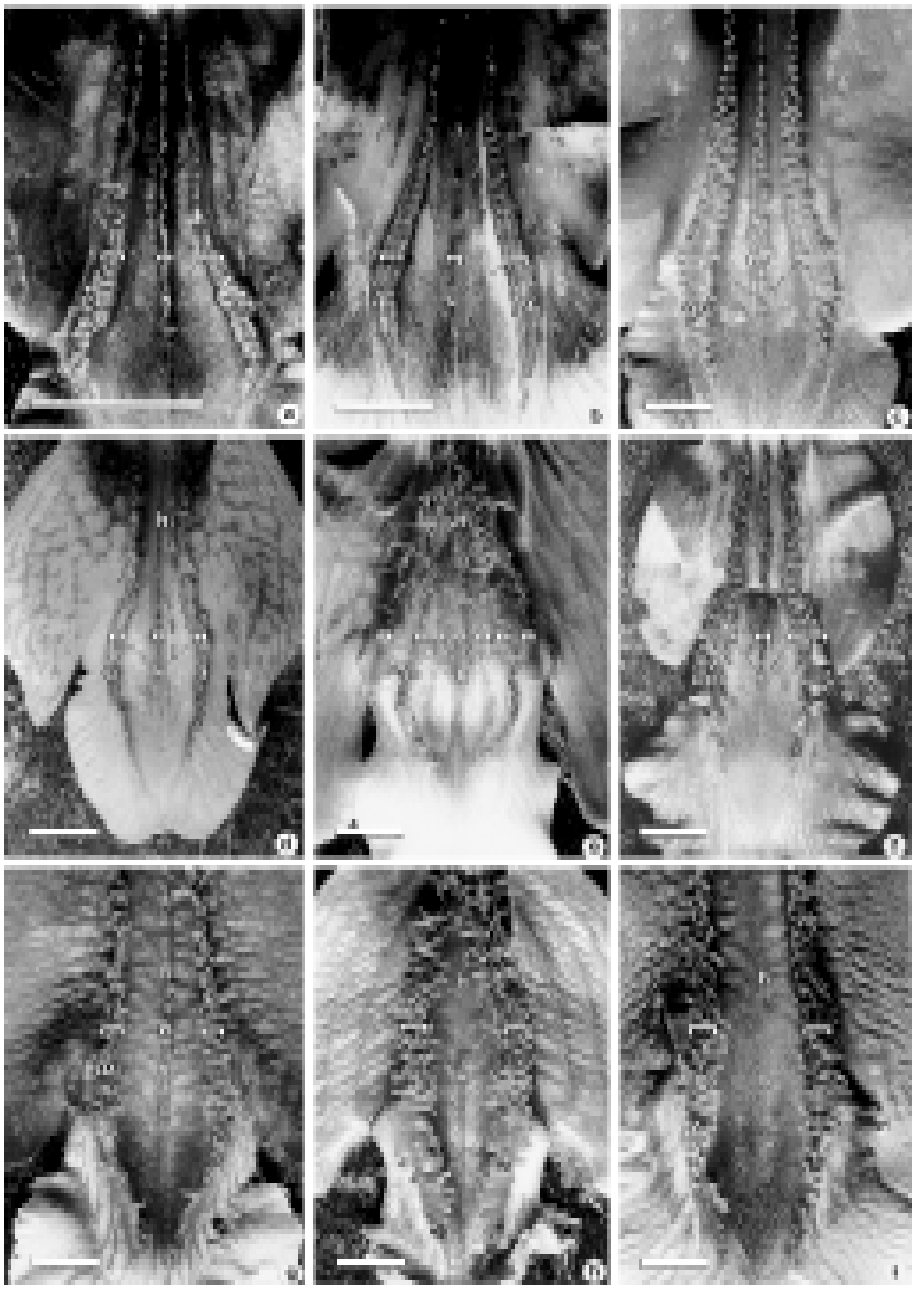
A loose mixture of fern root and hardwood bark or charcoal with *Sphagnum* is recommended for a good drainage as all *Coelogyne* species are very intolerant of wet roots. Watering should be regular and atmospheric humidity should be rather high. Spraying of the leaves is beneficial for the plants. When developing new shoots the plants require more water and diluted manure. Repotting or division of plants is best done in this growing stage and only when absolutely necessary as the plants often require several years to recover from repotting before flowering again. The plants prefer moderate shade and flower for several days to a week (after Hawkes, 1965).

Artificial hybrids — Many attempts have been made to cross species of sect. *Speciosae* with *Coelogyne* species of other sections. Curtis (1950) mentions *C. x colmanii*, a cross between *C. speciosa* var. *major* and *C. cristata* var. *alba*, made by Colman in 1900. Butzin (1992a) reports *C. x gattonensis*, a hybrid between *C. speciosa* and *C. sanderae*. Erfkamp & Gruß (1996) mention several hybrids: *Green Magic*, a hybrid between *C. parishii* and *C. speciosa*, made by Stevenson in 1986; *Memoria Soedjana Kassan*, a hybrid between *C. speciosa* and *C. asperata*, made by Parnata in 1976; *Shibata*, a hybrid between *C. flaccida* and *C. speciosa*, made by Sibata in 1923; *Speciosa-colmanii*, a hybrid between *C. speciosa* and *C. x colmanii*, made by Colman in 1918. Crosses between species within sect. *Speciosae* have also been made. *Neroli Cannon*, a hybrid between *C. speciosa* and *C. fragrans* was made by Cannon in 1981. In 1996, *C. x Andrée Millar*, a cross between *C. beccarii* and *C. speciosa* was produced by Spence (Royal Horticultural Society, 1996).

KEY TO THE SPECIES

1a. Keels on the lip with hairs or with elongate papillae (Fig. 4.19a); flowers opening in succession 2
b. Keels on the lip with minute papillae; flowers opening in succession or (nearly) simultaneously 5
2a. Keels on the lip with elongate papillae (0.1–0.25 mm long); keels plate-like, undulating (Plate 4.1m) . . . . . **15. C. xyrekes**
b. Keels on the lip with hairs; keels with 2 projections over the width of the keel, separated by a longitudinal groove (Fig. 4.14a) or with up to 5 projections over the width of the keel (Fig. 4.15a) 3

3a. Number of keels on the lip 5–8; hairs on these keels 0.7–1.5 cm long . . . . . **10. C. septemcostata**
b. Number of keels on the lip 2 or 3; hairs on these keels 0.1–0.5 mm long . . . 4
4a. Keels on the lip with 2 projections over the width of the keel; hairs implanted on the rims of the longitudinal groove of each keel (Plate 4.1d); lip 27–34 mm long . . . . . **9. C. salmonicolor**
b. Keels on the lip with up to 5 elongate projections over the width of the keel; hairs more or less stellately arranged at the apex of the elongated projections of the keels (Plate 4.1g–i); lip 33–61 mm long . . . . . **11. C. speciosa**
5a. Number of keels on the lip 2–13; pseudobulbs at least twice as wide as long 6
b. Number of keels on the lip 2–4; pseudobulbs up to twice as wide as long . . . 8
6a. Leaves of the flowering shoot (partly) developed or still undeveloped during anthesis; keels on the lip plate-like (Plate 4.1o) or with (un)interrupted margin (Plate 4.5a) 7
b. Leaves of the flowering shoot (partly) developed during anthesis; keels on the lip plate-like or consisting of callus patches (Plate 4.1j–l, 4.1n) 12
7a. Leaves 2 per pseudobulb; keels on the lip with interrupted margin and white . . . . . **16. C. dichroantha**
b. Leaves 1 per pseudobulb; keels on the lip with uninterrupted margin and brown . . . . . **14. C. tommii**
8a. Keels on the lip with 5 elongate projections over the width of the keel (Plate 4.1f) or plate-like (Fig. 4.17a) 9
b. Keels on the lip with 1 projection or with 2 projections over the width of the keel, separated by a longitudinal groove (Fig. 4.7a, 4.8a) 10
9a. Keels on the lip with 5 elongate projections over the width of the keel (Fig.4. 12a); midlobe of lip warty; lip 32–42 mm long . . . . . **8. C. rumphii**
b. Keels on the lip plate-like, undulating (Fig. 4.17a); midlobe of lip smooth; lip 24–37 mm long . . . . . **13. C. tiomanensis**
10a. Hypochile 1.5 times as long as epichile; midlobe of lip with scattered warts . . . . . **3. C. celebensis**
b. Hypochile as long as epichile; midlobe of lip smooth 11
11a. Lip shorter than 28 mm; lateral sepals shorter than 33 mm; flowers not fragrant . . . . . **2. C. carinata**
b. Lip longer than 28 mm; lateral sepals longer than 33 mm; flowers fragrant . . . . . **4. C. fragrans**
12a. Flowers opening simultaneously; number of leaves per pseudobulb 1 or 2 . 13
b. Flowers opening in succession; number of leaves per pseudobulb 2 14
13a. Leaves 1 per pseudobulb; sidelobes of lip not projecting in front (Fig. 4.10a) . . . . . **6. C. lycastoides**
b. Leaves 2 per pseudobulb; sidelobes of lip clearly projecting in front (Fig. 4.11a) . . . . . **7. C. macdonaldii**
14a. Keels on the base of the lip plate-like (Fig. 9a); hypochile about as long as epichile . . . . . **5. C. guamensis**
b. Keels on the lip consisting of low callus patches (Plate 4.1n) or many warts (Plate 4.1l); hypochile much shorter than epichile 15



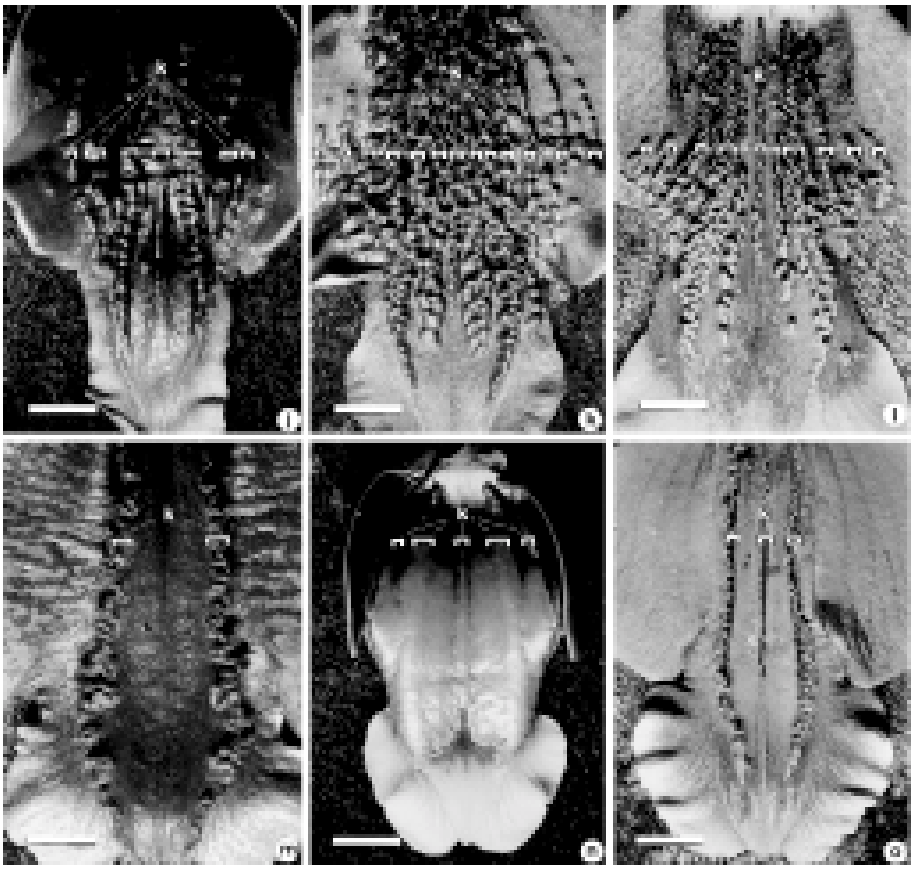


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Plate 4.1. Details of keels on lip. – a. *Coelogyne carinata* Rolfe [*Leiden cult. (De Vogel) 30714*]. – b. *C. fragrans* Schltr. [*Leiden cult. (De Vogel) 30720*]. – c. *C. celebensis* J.J. Sm. [*Leiden cult. (De Vogel) 27369*]. – d. *C. salmonicolor* Rchb.f. [*Leiden cult. (De Vogel) 24393*]. – e. *C. septemcostata* J.J. Sm. [*Leiden cult. (Nooteboom) 23187*]. – f. *C. rumphii* Lindl. [*Leiden cult. (De Vogel) 24505*]. – g. *C. speciosa* (Blume) Lindl. subsp. *speciosa* [*Leiden cult. (De Vogel) 19930*]. – h. *C. speciosa* subsp. *fimbriata* (J.J. Sm.) Gravendeel *(Bogor cult. 992-XI-311)*. – i. *C. speciosa* subsp. *incarnata* Gravendeel [*Leiden cult. (De Vogel) 950058*]. – j. *C. lycastoides* F. Muell. & Kraenzl. [*Leiden cult. (De Vogel) 914325*]. – k. *C. macdonaldii* F. Muell. & Kraenzl. [*Leiden cult. (Cribb & Morrisson) 25836*]. – l. *C. susanae* P.J. Cribb & B.A. Lewis *(Cruttwell 3185)*. – m. *C. xyrekes* Ridl. [*Leiden cult. (Roelfsema, Vogel & Van Balgooy) 960160*]. – n. *C. beccarii* Rchb.f. [*Leiden cult. (Schuiteman, Mulder & Vogel) 32078*]. – o. *C. tommii* Gravendeel & O'Byrne [*Leiden cult. (De Vogel) 21524*]. – Scale bar = 5 mm; g = longitudinal groove, h = hair, k = keel, p = projection.

15a. Main nerves of leaves 3–5; keels on the lip consisting of low, broad and large callus patches (Fig. 4.5a); lip 29–41 mm long . . . . . **1. C. beccarii**
b. Main nerves of leaves 5–7; keels on the lip consisting of many rows of small warts (Fig. 4.16a); lip 40–55 mm long . . . . . **12. C. susanae**

1. Coelogyne beccarii Rchb.f. — Fig. 4.5, Map 4.1, Plate 4.1n, 4.2a

Coelogyne beccarii Rchb.f., Bot. Centralbl. 28 (1886) 344; Pfitzer & Kraenzl. in Engl., Pflanzenr. 32 (1907) 32; J.J. Sm., Nova Guinea 8 (1911) 136; Schltr., Feddes Repert. Beih. 1 (1914) 103; Ridl., Trans. Linn. Soc. London 2, 9 (1916) 202; Schltr., Feddes Repert. Beih. 21 (1923) f. 137; Andrée Millar, Orchids of Papua New Guinea (1978) 74; Howcroft, Orchadian 7 (1983) 154, f. 1–2; O'Byrne, Lowland Orchids of Papua New Guinea (1994) 74. — Type: *Beccari P.P. 888* (holo FI), Papua New Guinea, Mt Arfak.

Coelogyne beccarii var. *tropidophora* Schltr., Feddes Repert. Beih. 1 (1914) 103. — Lectotype (here chosen): *Schlechter 19110* (holo B†; iso AMES, G, K, L), Papua New Guinea, Finisterre Mts.

Coelogyne micholitziana Kraenzl., Gard. Chron. 3, 10 (1891) 300 '*micholicziana*'; Xenia Orchid. 3 (1892) 100, t. 256; Rolfe, Kew Bull. 4 (1900) 104; Pfitzer & Kraenzl. in Engl., Pflanzenr. 32 (1907) 32, f. 8A–E; Sander's Orch. Guide (1927) 125. — *Coelogyne beccarii* var. *micholitziana* Schltr., Orchideen (1915) 135. — Type: *Micholitz s.n.* (holo K), Papua New Guinea.

Roots 1.8–3 mm diam. Rhizome 7–12.2 mm thick. Scale-covered part of the inflorescence-bearing young shoot 7.5–14.3 cm long. *Pseudobulbs* up to 0.9 cm apart, oblongoid, obtusely 4-angled when fresh, 4.8–8.5 cm long. *Leaves* two per pseudobulb. Petiole 2.3–8.5 cm long. Blade linear to linear-lanceolate, 22–35.4 by 1.9–6 cm; apex acuminate; main nerves 3–5. *Inflorescence* synanthous with the partially to entirely developed leaves, 2–7(–13)-flowered. Peduncle during flowering at the base enclosed by the petiole and scales of the young shoot, 18.5–44 cm long. Rhachis (sub)erect, zigzag, 1.9–7 cm long; internodes 15.5–28 mm long, slightly to distinctly curved, incrassate. *Floral bracts* lanceolate to ovate-lanceolate, 40–54 by 10.5–18 mm, deciduous; apex acuminate; nerves 11–13. *Flowers* opening in succession. Pedicel 5–8 by 2.5–2.7 mm; ovary 10–20 by 4–7 mm. *Median sepal* ovate, 34.5–44 by 18–22 mm; apex acute; nerves 9–13, the midrib a rounded keel 0.5–1 mm high. *Lateral sepals* ovate, 34–44 by 14–19 mm; apex acuminate; nerves 9–12, the midrib a rounded keel 0.3–1 mm high. *Petals* slightly recurved, 32–43 by 3.6–5.5 mm; apex acuminate; nerves 5, midrib centric. *Lip* 29–41 by 26–28 mm, nerves 11–15. *Hypochile* when flattened 15–18 by 26–28 mm; base attached over 6–19 mm, not saccate; lateral lobes in front rounded to obtuse, extending 2.8–3.5 mm in front and slightly converging, front margin at the base irregularly erose; with acute sinus; apex not saccate; keels 3–7, widened along the crest, more or (rarely) less fused together into a thick callus 1.9–3.1 mm high (Plate 4.1n), with papillae but without hairs, all keels starting at the base of the lip and there 0.5–0.9 mm high, developed on the hypochile and the apical half of the epichile, the median keel lower than the lateral ones. *Epichile* highly convex, when flattened obrhomboid to orbicular, 15–22 by 15–19 mm, with a broad, short claw 2–2.9 mm thick; base attached over 12.5–14 mm; apex acute, slightly raised, with an acute apex with warts 0.4–0.75 mm high; margin slightly erose, recurved; sides pronounced as lateral lobes, with warts 0.5–1 mm high, centre 0.48–0.5 mm thick, margin 0.2–0.3 mm thick; keels 5–7, ending 4–8 mm from the apex of the

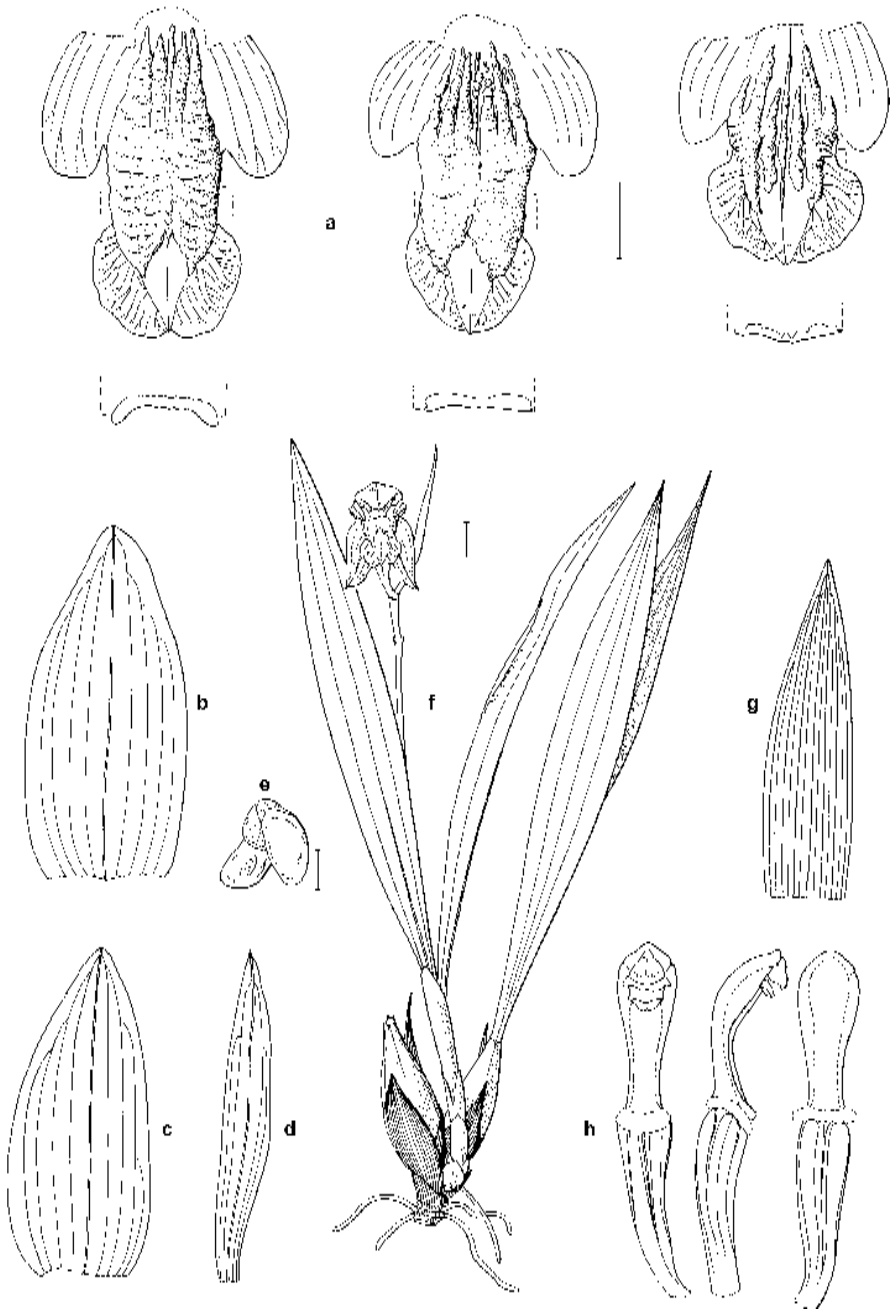


Fig. 4.5. *Coelogyne beccarii* Rchb.f. a. Variation in lip ornamentation with cross section of claw, from left to right: *Leiden cult. (Schuiteman, Mulder & Vogel) 31883*, *Leiden cult. (Woods) 22059*, *Leiden cult. (Reeve) 22284*; b. median sepal; c. lateral sepal; d. petal; e. pollinia; f. habit; g. floral bract; h. column: front, lateral and rear view [*Leiden cult. (Schuiteman, Mulder & Vogel) 32230*]. — Scale bars: 1 cm (a–d, f–h); 1 mm (e).

epichile, on the claw identical with the keels on the hypochile, on the plate changing into a row of tightly packed irregularly rounded warts, with papillae but without hairs. *Column* 19–23 by 7–8 mm; hood with more or less acute apical margin, laterally notched or with two small cuneate projections where the wings are attached and with an additional notch above, the middle part rounded, recurved. Anther broadly bell-shaped in outline, 3–5 by 4.9–5 mm, near the place of attachment with a little rounded projecting apex; apex with or without notch. Pollinia obliquely ellipsoid, 2.1–3 by 1.2–1.9 mm; caudicle 1.3–1.5 by 0.8–1.1 mm. *Stigma* 3.9–4 by 4.6–6 mm; margin apex notched; rostellum 3–4 by 5.5–6.7 mm, with an obtuse apex with or without notch. *Fruit* body 58–65 by 24–36 mm; valvae keels 8.5–9 mm high; juga with a pronounced longitudinal ridge 5–5.5 mm high without incisions.

Distribution — Irian Jaya, Papua New Guinea, New Britain, Solomon Islands (Guadalcanal).

Habitat & Ecology — Epiphyte, rarely terrestrial in rain forest and secondary vegetations. Altitude 26–1500 m. Flowering: January, March, April, June, August–December (June–November in greenhouse).

Notes — 1. Ovary light green. Sepals and petals pale green to yellowish white. Lip white, lateral lobes, margin of the claw of the midlobe and base of the midlobe blackish brown, base of hypochile red brown, callus cream coloured to light brown to reddish orange to purplish brown, bordered with brownish red. Column white, base blackish brown to brownish red. Anther cream coloured to pale ochre. Stigma inside light green. No smell.

2. The epithet *beccarii* refers to O. Beccari, who collected the type specimen in the Arfak mountains in W Papua New Guinea.

3. As the variation in the number and structure of the keels on the lip of the specimens studied appeared to be continuous, it is concluded that *C. beccarii* var. *tropidophora* and *C. beccarii* var. *micholitziana* are synonyms of *C. beccarii*.

4. The species is easily recognised by the thick callus on the lip, the broad lateral lobes of the hypochile with obtuse to rounded front margin and the linear-lanceolate leaves.

2. Coelogyne carinata Rolfe — Fig. 4.6, Map 4.1, Plate 4.1a, 4.3a

Coelogyne carinata Rolfe, Kew Bull. (1895) 191. — Type: *Sander & Co. s.n.*, 1895 (holo K), unknown locality.

Coelogyne sarasinorum Kraenzl. in Engl., Pflanzenr. 4 (1907) 29. — Type: *Sarasin & Sarasin 700* (holo B†), Celebes, near Tomohon.

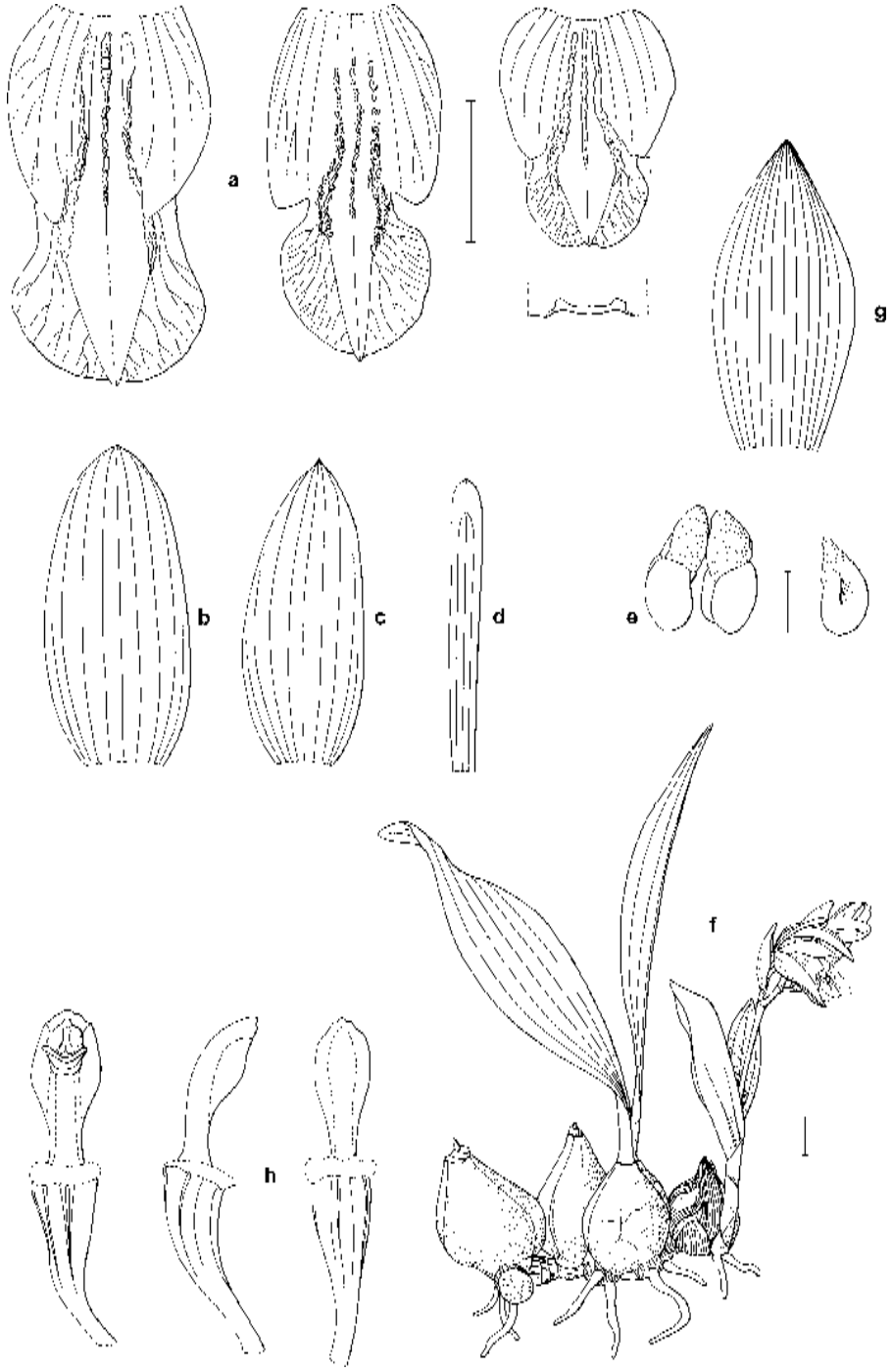
Coelogyne truncicola Schltr., Feddes Repert. Beih. 1 (1914) 104; 21 (1923) 138, t. 40; O'Byrne, Lowland Orchids of Papua New Guinea (1994) 72. — Type: *Schlechter 19618* (holo B†), Papua New Guinea, Kaiser Wilhelm Mts, Govidjoa.

Coelogyne oligantha Schltr., Feddes Repert. Beih. 16 (1919) 44. — Type: *Kempf s.n.* (holo B†), Papua New Guinea, Waria.

Coelogyne alata Andrée Millar, Orchids of Papua New Guinea (1978) 75, nom. nud.

∅

Fig. 4.6. *Coelogyne carinata* Rolfe. a. Variation in lip ornamentation with cross section of claw, from left to right: *Leiden cult. (De Vogel) 30725*, *NGF (Millar) 23543*, *Leiden cult. (De Vogel) 30714*; b. median sepal; c. lateral sepal; d. petal; e. pollinia; f. habit; g. floral bract; h. column: front, lateral and rear view [*Leiden cult. (De Vogel) 30714*]. — Scale bars: 1 cm (a–d, f–h); 1 mm (e).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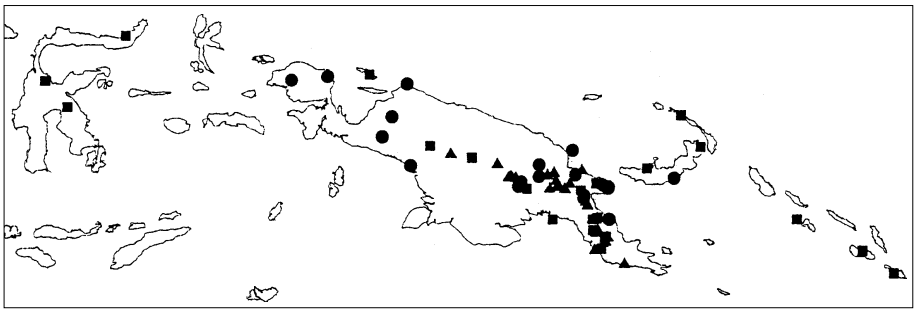


Map 4.1. Distribution of *Coelogyne beccarii* Rchb.f. (l), *C. carinata* Rolfe (n) and *C. fragrans* Schltr. (s).

Roots 1–2.8 mm diam. Rhizome 5.1–11 mm thick. Scale-covered part of the inflorescence-bearing young shoot 3.5–16 cm long. *Pseudobulbs* up to 1–2.3 cm apart, ovoid to oblongoid when fresh, 4.8–11 cm long. *Leaves* one or two per pseudobulb. Petiole 0.9–5 cm long. Blade obovate-lanceolate, 8.1–37 by 3.1–7.2 cm; apex acuminate; main nerves 5–7. *Inflorescence* synanthous with partially to entirely developed leaves, 2–8-flowered. Peduncle during flowering at the base enclosed by the petiole and scales of the young shoot, 6.4–29 cm long. Rhachis (sub)erect, zigzag, 1–9.5 cm long; internodes 8–20.5 mm long, slightly curved, (slightly) thickened. *Floral bracts* ovate, 16.2–61 by 7–14 mm, deciduous or persistent; apex acute; nerves 11–15. *Flowers* opening in succession. Pedicel 4–10 by 1.2–2.7 mm; ovary 9–13 by 3–4.4 mm. *Median sepal* ovate, 18.5–22.5 by 5.5–9.5 mm; apex apiculate; nerves 9, the midrib a rounded keel 0.5–0.7 mm high. *Lateral sepals* ovate-oblong, 16–33 by 4–7.5 mm; apex acuminate; nerves 8 or 9, the midrib a rounded keel 0.5–0.6 mm high. *Petals* slightly recurved, 15–20 by 1–2.5 mm; apex apiculate; nerves 3, midrib centric. *Lip* 16–28 by 5–12 mm, nerves 9–11. *Hypochile* when flattened 7–12 by 5–12 mm; base attached over 4–13 mm, not saccate; lateral lobes in front obtuse, extending 0.5–1.4 mm in front and slightly diverging, front margin at the base irregularly erose, with acute sinus; apex slightly saccate; keels 3, widened along the crest, consisting of two, often interrupted, undulating rows of irregularly rounded warts on each side of the crest 0.2–0.3 mm high, with papillae but without hairs, separated by a longitudinal groove (Plate 4.1a); all keels starting at the base of the lip and there 0.1–0.2 mm high, diverging towards the apex of the hypochile, converging again on the epichile, the lateral keels up to 1 mm high, the median keel lower than the lateral ones. *Epichile* convex, when flattened circular to elliptic, 5–7.5 by 3.5–9 mm, with a broad, short claw 0.15–0.2 mm thick; base broadly attached over 3–7.5 mm; apex acute, slightly raised, with an obtuse apex; margin slightly elevated, recurved; sides pronounced as lateral lobes, without warts, centre 0.15–0.2 mm thick, margin 0.1–0.3 mm thick; keels 3, ending 3.1–5.5 mm from the apex of the epichile, on the claw identical with the ornamentations on the hypochile, on the plate sometimes changing into a row of tightly packed irregularly rounded warts c. 1 mm high, with papillae but without hairs. *Column* 11.5–13 by 3–4.5 mm; hood with more or less truncate apical margin, laterally notched where the wings are attached and with an additional notch above, the middle part

rounded, recurved. Anther broadly bell-shaped in outline, 2.2–2.5 by 2.5–3 mm, near the place of attachment with a rounded projecting apex; apex without notch. Pollinia obliquely ellipsoid, 1.2–1.5 by 0.8–1 mm; caudicle 1–1.5 by 1.5–1.8 mm. *Stigma* 2.2–3 by 2–2.3 mm; margin apex (slightly) notched; rostellum 1.7–2 by 2–2.2 mm, with an obtuse apex without notch. *Fruit* body 44–46 by 23–32 mm; valvae keels 6–7.5 mm high; juga with a pronounced longitudinal ridge 3.5–4.5 mm high with up to 4 incisions up to 1.5 mm deep.

Distribution — Sulawesi, Biak, Irian Jaya, Papua New Guinea, New Britain, New Ireland, Solomon Islands (New Georgia, Guadalcanal, San Cristobal).

Habitat & Ecology — Epiphyte in oak forest, rubber tree plantations, primary rain forest along rivers, in logged areas, coastal vegetation on limestone rock and flood plains, rarely terrestrial. Altitude 105–2300 m. Flowering: March, May–July, September, October (February, April–June in greenhouse).

Notes — 1. Sepals and petals pale green. Hypochile very pale green to green, lobes inside with orange brown open reticulate markings, keels with light orange brown sides and much paler crest, between the keels orange brown. Epichile base as on hypochile, front part white, median tinged greenish. Column whitish green, stigma with faint pale brownish markings. Anther pale yellowish green. No smell.

2. The epithet *carinata* refers to the keels on the lip.

3. In some cases, the species is difficult to keep apart from *C. fragrans*. Especially specimens from the surroundings of Morobe tend to have intermediate floral sizes and may be hybrids between the two species. *Coelogyne carinata* can be distinguished from *C. fragrans* by a lip length shorter than 28 mm and nonfragrant flowers.

3. Coelogyne celebensis J.J. Sm. — Fig. 4.7, Map 4.2, Plate 4.1c, 4.3c

Coelogyne celebensis J.J. Sm., Bull. Jard. Bot. Buitenzorg II, 25 (1917) 3; Burkill, Gard. Bull. Straits Settlem. 3 (1924) 292; Bouman-Houtman, Trop. Natuur 15 (1926) 95, f. 1. — Lectotype (here chosen): *Bogor cult. (Elbert) s.n.* (L), Kolaka, Sulawesi. Paratypes: *Bogor cult. (Elbert) 4; Van Vuuren 1912, 1913; Noerkas 388; Rachmat 29, 678* (BO?, not found).

Coelogyne platyphylla Schltr., Feddes Repert. Beih. 21 (1925) 129. — Type: *Becker cult. (native collector) s.n.* (holo B†), Sulawesi, Dongala.

Roots 1.5–1.8 mm diam. Rhizome 7.8–13 mm thick. Scale-covered part of the inflorescence-bearing young shoot 8–15 cm long. *Pseudobulbs* 0–2.5 cm apart, oblongoid, distinctly 4-ridged when fresh, 5.7–14 cm long. *Leaves* one or two per pseudobulb. Petiole 1.1–4 cm long. Blade obovate-lanceolate, 33–62 by 8.1–14 cm; apex acuminate; main nerves 7. *Inflorescence* synanthous with the partially to entirely developed leaf or leaves, 3–7-flowered. Peduncle during flowering at the base enclosed by the petiole and scales of the young shoot, 27–30.5 cm long. Rhachis (sub)erect, zigzag, 3.5–11.5 cm long; internodes 15.5–24 mm long, slightly curved, hardly thickened. *Floral bracts* ovate-lanceolate, 49–69 by 13–18 mm, deciduous; apex acuminate; nerves 17–19. *Flowers* opening in succession. Pedicel 4–8 by 1.9–2.2 mm; ovary 7.4–13 by 3.3–5 mm. *Median sepal* oblong, 49–56 by 16–21 mm; apex acuminate; nerves 11–15, the midrib a rounded keel 0.6–1 mm high. *Lateral sepals* oblong, 44–53 by 13–16 mm; apex acuminate; nerves 10–16, the midrib a rounded keel 0.5–0.7 mm high. *Petals* slightly recurved, 49–54 by 2.8–3.5 mm; apex acuminate; nerves 3,

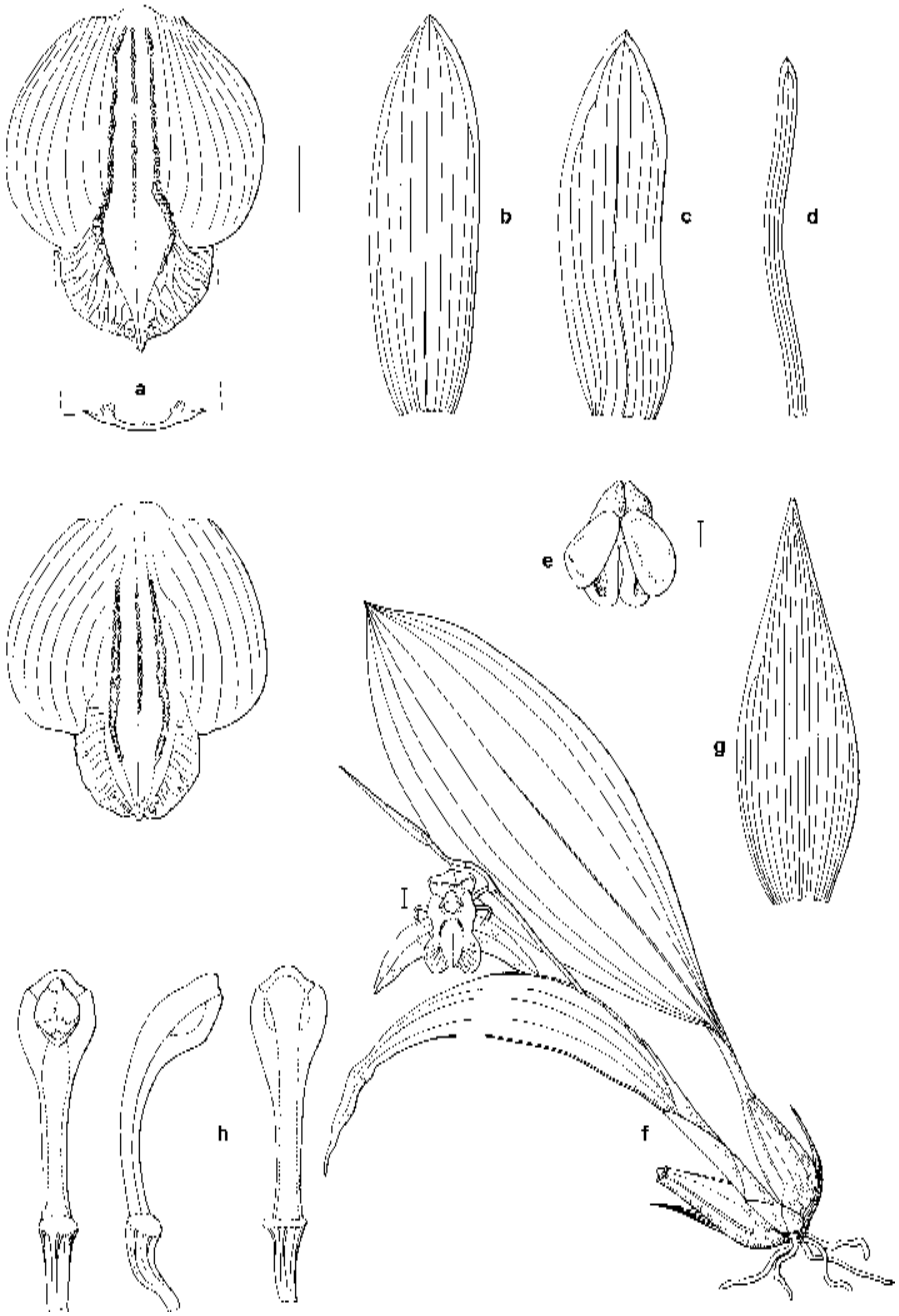
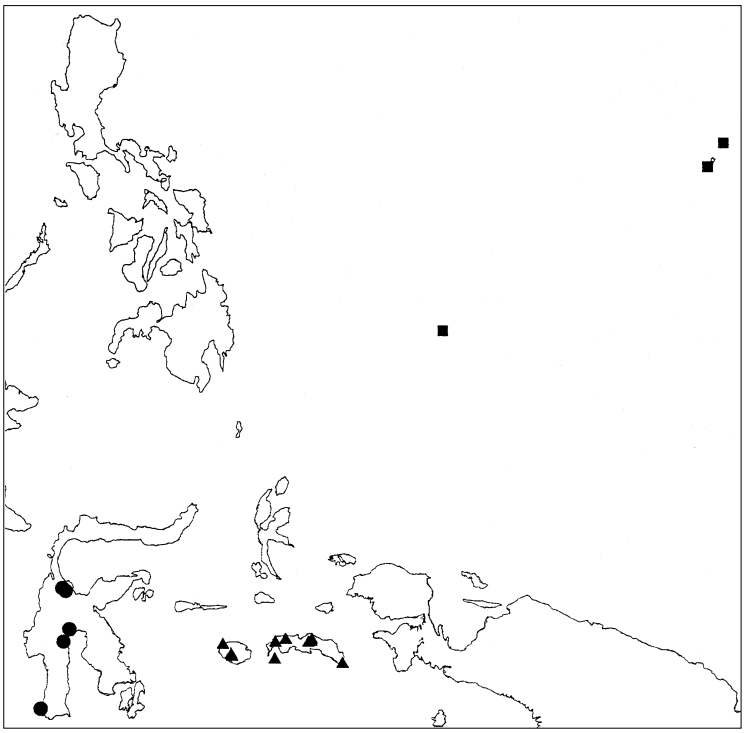


Fig. 4.7. *Coelogyne celebensis* J.J. Sm. a. Variation in lip ornamentation with cross section of claw, from top to bottom: *Leiden cult. (De Vogel) 20202*, *Leiden cult. (De Vogel) 27369*; b. median sepal; c. lateral sepal; d. petal [*Leiden cult. (De Vogel) 21099*]; e. pollinia; f. habit [*Leiden cult. (De Vogel) 27369*]; g. floral bract [*Leiden cult. (De Vogel) 20202*]; h. column: front, lateral and rear view [*Leiden cult. (De Vogel) 30714*]. — Scale bars: 1 cm (a–d, f–h); 1 mm (e).

midrib eccentric. *Lip* 46–52 by 35–39 mm, nerves 17–19. *Hypochile* when flattened 33–36 by 35–39 mm; base attached over 19–22 mm, not saccate; lateral lobes in front obtuse, extending 5.5–9 mm in front and slightly diverging, front margin at the base slightly irregularly erose to entire, with acute sinus; apex not saccate; keels 3, starting at the basal quarter of the lip and there 0.4–0.6 mm high, all keels widened along the crest, with many slender, tapering, either or not branched, elongate and sometimes plate-like projections 0.5–1 mm high, with papillae but without hairs (Plate 4.1c); the lateral keels up to 1.3 mm high, diverging towards the apex of the hypochile, converging again on the epichile, the median keel only developed in the basal half to two thirds of the hypochile, lower than the lateral ones. *Epichile* convex, when flattened elliptic, 12–24 by 18.6–25.4 mm, with a broad, short claw 0.1–0.5 mm thick; base attached over 14–18 mm; apex retuse, slightly raised, with an acute apex with warts 0.3–0.45 mm high; margin slightly erose, recurved; sides pronounced as lateral lobes, with warts at the base 0.3–0.45 mm high, centre 0.25–0.5 mm thick, margin 0.2–0.3 mm thick; keels 2, ending 9–14 mm from the apex of the epichile, on the claw and plate changing into one or two, irregularly interrupted rows of slender, tapering, either or not branched plate-like projections with papillae but without hairs, sometimes with a narrow longitudinal groove between the rows, the inner row shorter than the outer row. *Column* 36–37 by 9–11 mm; hood with truncate apical margin, irregularly dentate,



Map 4.2. Distribution of *Coelogyne celebensis* J.J. Sm. (l), *C. guamensis* Ames (n), and *C. rumphii* Lindl. (s).

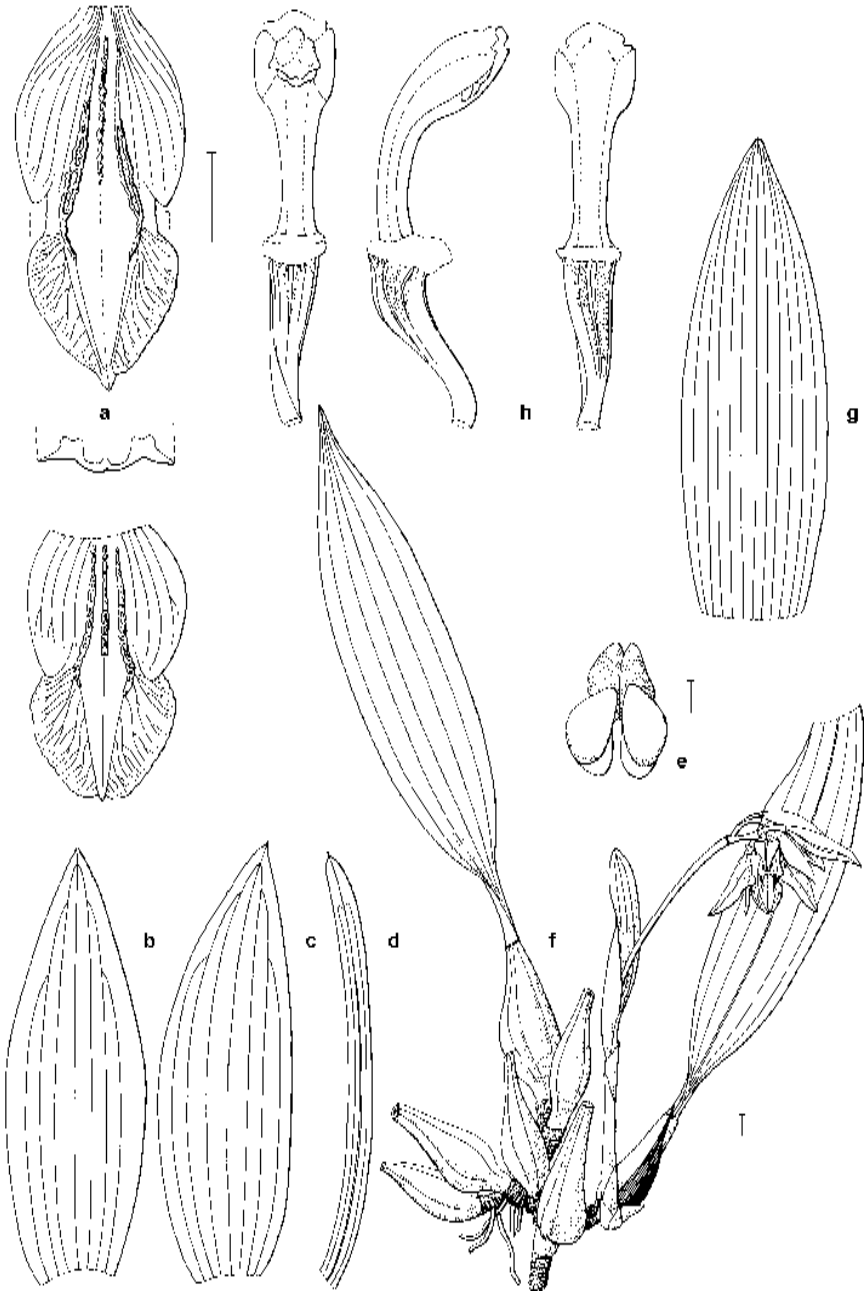


Fig. 4.8. *Coelogyne fragrans* Schltr. a. Variation in lip ornamentation with cross section of claw, from top to bottom: *Leiden cult. (Schuiteman, Mulder & Vogel) 31508*, *Leiden cult. (De Vogel) 25670*; b. median sepal; c. lateral sepal; d. petal [*Leiden cult. (Schuiteman, Mulder & Vogel) 32268*]; e. pollinia; f. habit [*Leiden cult. (Schuiteman, Mulder & Vogel) 31598*]; g. floral bract; h. column: front, lateral and rear view [*Leiden cult. (Schuiteman, Mulder & Vogel) 32268*]. — Scale bars: 1 cm (a–d, f–h); 1 mm (e).

laterally notched where the wings are attached, the middle part slightly rounded, recurved. Anther elongate bell-shaped in outline, 7.5–9 by 6–7 mm, near the place of attachment with a little rounded projecting apex; apex acute, without notch. Pollinia obliquely ellipsoid, 3–4 by 1.7–2.2 mm; caudicle 1.5–3 by 1.5–2 mm. *Stigma* 4–4.4 by 4–5 mm; margin apex with a more or less pronounced notch; rostellum 4–5.8 by 5.5–7 mm, with an acute apex without notch. *Fruit* body 41–43 by 27–28 mm; valvae keels 6.5–8.5 mm high; juga with a pronounced longitudinal ridge 4–5 mm high without incisions.

Distribution — Sulawesi.

Habitat & Ecology — Epiphyte in primary forest. Altitude 0–1000 m. Flowering: February–March (March–July in greenhouse).

Notes — 1. Sepals and petals pale green, translucent. Lip ground colour whitish, at the base, between the keels and at the base of the epichile very dark brown, rest suffused with dark brown, keels dark brown, sometimes with few small white dots. Column pale green grading to orange at the apex, hood margins citron yellow. Anther cream coloured. No smell.

2. The epithet *celebensis* refers to the island Sulawesi, formerly called Celebes, where the type specimen was collected by Elbert.

3. The species is easily recognised by the dark brown lip with elongate, tapering projections on the keels and broad sidelobes with obtuse front margin.

4. Coelogyne fragrans Schltr. — Fig. 4.8, Map 4.1, Plate 4.1b, 4.3b

Coelogyne fragrans Schltr., Feddes Repert. Beih. 1, 1 (1914) 102; 21 (1923) f. 136; Chadim, Orchadian 7, 3 (1982) 60, f. 8–10; 84, f. 1–6; O'Byrne, Lowland Orchids of Papua New Guinea (1994) 76. — Lectotype (here chosen): *Schlechter 18216* (K; iso AMES, G, L), Papua New Guinea, Kaiser-Wilhelmsland. Paratype: *Schlechter 18083* (BO, G, K, L).

Roots 1.8–2.4 mm diam. Rhizome 8–13.4 mm thick. Scale-covered part of the inflorescence-bearing young shoot 9–13.4 cm long. *Pseudobulbs* up to 1.5 cm apart, oblongoid, obtusely 4-angled when fresh, 6.5–10 cm long. *Leaves* one or two per pseudobulb. Petiole 3–5 cm long. Blade lanceolate, 21–38.5 by 3.8–6.8 cm; apex acuminate; main nerves 5–7. *Inflorescence* synanthous with the partially to entirely developed leaves, 2–6-flowered. Peduncle during flowering at the base enclosed by the petiole and scales of the young shoot, 18–38 cm long. Rhachis (sub)erect, zigzag, 2.6–9.5 cm long; internodes 13–20.4 mm long, slightly curved, (slightly) thickened. *Floral bracts* ovate-lanceolate, 33–53 by 8–12 mm, deciduous or persistent; apex acute; nerves 11–13. *Flowers* opening (nearly) simultaneously or in succession. Pedicel 6–8 by 1.5–2.6 mm; ovary 8–14 by 3–4 mm. *Median sepal* oblong, 34–49 by 9–17 mm; apex acuminate; nerves 7–9, the midrib a rounded keel 0.6–1 mm high. *Lateral sepals* oblong, 33–46 by 9–14 mm; apex acuminate; nerves 6 or 7, the midrib a rounded keel 0.7–1 mm high. *Petals* recurved, 31–45.2 by 2–5 mm; apex acuminate; nerves 3. *Lip* 28–45 by 15–22 mm, nerves 13–15, midrib eccentric. *Hypochile* when flattened 15–22 by 15–22 mm; base attached over 9–17 mm, not saccate; lateral lobes in front obtuse, extending 3–6 mm in front and slightly diverging, front margin at the base slightly irregularly erose, with acute sinus; apex slightly saccate; keels 3, not widened along the crest, all keels starting at the base of the lip and there 0.5–1 mm high, diverging

towards the apex of the hypochile, converging again on the epichile, the lateral keels up to 2.5 mm high, consisting of two, often interrupted, undulating rows of irregularly rounded warts on each side of the crest 0.5–0.8 mm high, with papillae but without hairs, separated by a longitudinal groove (Plate 4.1b), the median keel lower than the lateral ones and consisting of one, at a few places interrupted row of undulating, irregularly rounded warts with papillae but without hairs. *Epichile* convex, when flattened elliptic, 13–20 by 11–22 mm, with a broad, short claw 0.2–0.25 mm thick; base attached over 10–11 mm; apex retuse, slightly raised, with an acute apex; margin slightly erose, recurved; sides not pronounced as lateral lobes, without warts, centre 0.4–0.5 mm thick, margin 0.25–0.35 mm thick; keels 2 or 3, ending 9–28 mm from the apex of the epichile, on the claw and plate identical with the ornamentations on the hypochile. *Column* 24–26.7 by 7–8.3 mm; hood with more or less truncate apical margin, laterally notched where the wings are attached, the middle part slightly rounded, recurved. Anther broadly bell-shaped in outline, 5.3–6 by 4.5–5 mm, near the place of attachment with a rounded projecting apex; apex with or without notch. Pollinia obliquely ellipsoid, 2.8–3.5 by 1.6–1.8 mm; caudicle 0.6–2.6 by 2.2–2.3 mm. *Stigma* 3.5–5 by 3.3–3.8 mm; margin apex notched; rostellum 2.7–5.2 by 4.2–5 mm, with an acute apex without notch. *Fruit* body 54–60 by 26–38 mm; valvae keels 7–11 mm high; juga with a pronounced longitudinal ridge 3.5–6 mm high without incisions.

Distribution — Irian Jaya, Papua New Guinea.

Habitat & Ecology — Common. Epiphyte in (un)disturbed rain forest on slopes, secondary forest and oak forests, less frequently terrestrial. Altitude 100–2000 m. Flowering: April, August–November (January–September, December in greenhouse).

Notes — 1. Ovary bright green. Sepals and petals light green to golden yellow. Lip greenish white or cream coloured, at the base tinged pale green to orange, on the keels brown, warts on keels brown to light orange, epichile base and lateral margins at the base brownish to orange to yellow, lateral lobes along the margins with brownish to bright orange to dark yellow markings, which continue along the margins of the claw. Front half of the epichile cream coloured to greenish white. Column stalk greenish grading to bright yellowish green on the hood, margins of the hood orange; in front below the stigma with two brown lines. Anther creamy yellow. No smell just after start of anthesis, later very fragrant.

2. The epithet *fragrans* refers to the strong fragrance of the flowers during a limited period of time during anthesis.

3. In some cases, the species is difficult to keep apart from *C. carinata* (see note 3 under *C. carinata*).

5. Coelogyne guamensis Ames — Fig. 4.9, Map 4.2

Coelogyne guamensis Ames, Philipp. J. Sci., Bot. 9 (1914) 11; Schltr., Bot. Jahrb. Syst. 56 (1921) 457; Tuyama, J. Jap. Bot. 17 (1941) 505. — Type: *Thompson's collector 195* (holo not found), Guam, Experiment station.

Coelogyne palawensis Tuyama, J. Jap. Bot. 17 (1941) 506. — Type: *Tuyama s.n.*, 15-8-1939 (holo TI, not seen), Carolina Islands, Palau, Baobeltaob, Ngatpang (Gaspan).

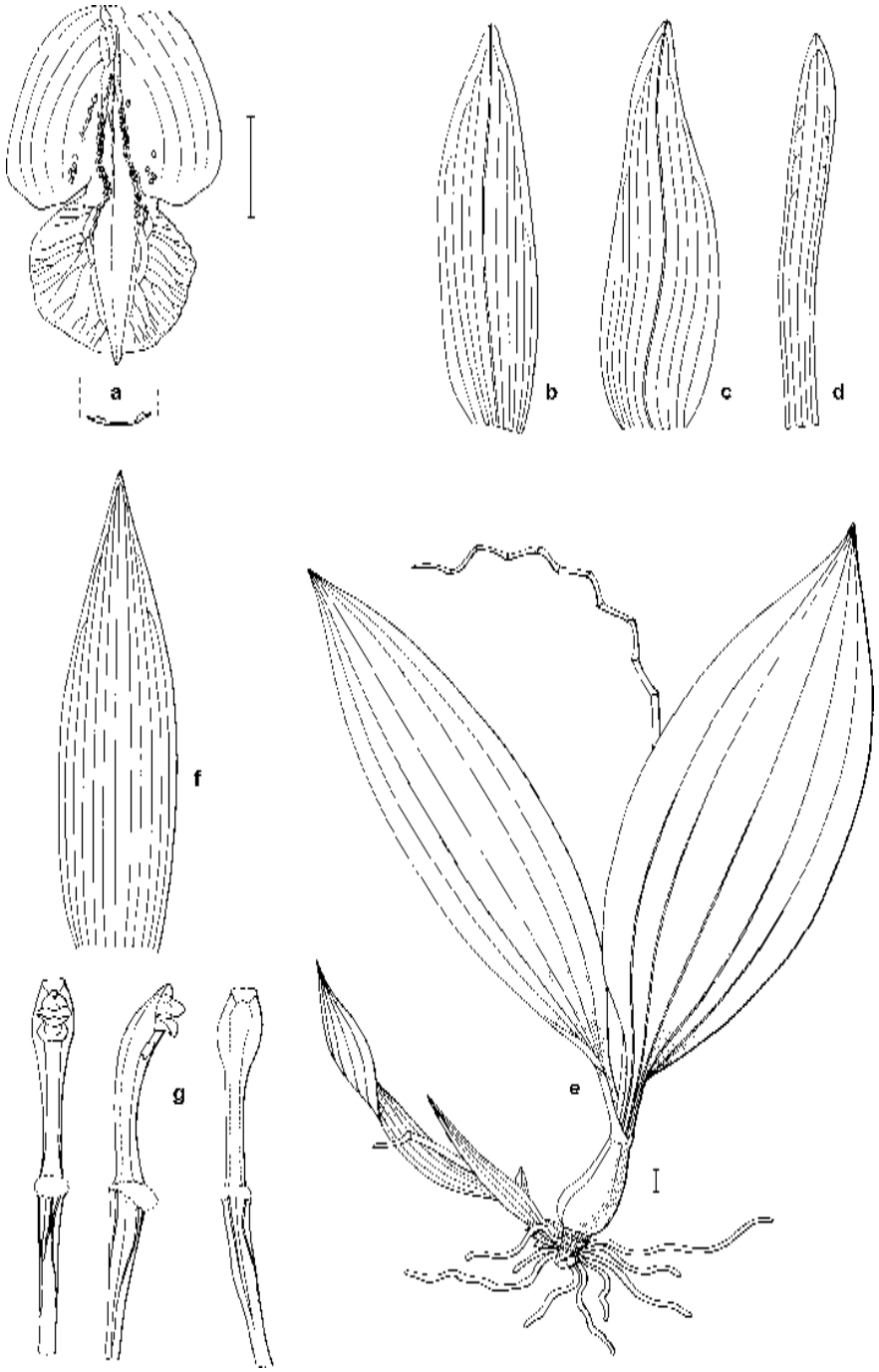


Fig. 4.9. *Coelogyne guamensis* Ames. a. Lip ornamentation with cross section of claw; b. median sepal; c. lateral sepal; d. petal; e. habit; f. floral bract; g. column: front, lateral and rear view (*Rinehart LR 7689*). — Scale bars: 1 cm.

Roots 1.5–2.2 mm diam. Rhizome 6.5–15.5 mm thick. Scale-covered part of the inflorescence-bearing young shoot c. 3.6 cm long. *Pseudobulbs* up to 1 cm apart, oblongoid, not seen when fresh, 5.1–8 cm long. *Leaves* two per pseudobulb. Petiole 2.5–5 cm long. Blade lanceolate, 26–36 by 3.9–9.4 cm; apex acuminate; main nerves (3–)5–7. *Inflorescence* synanthous with the partially to entirely developed leaves, 4–11-flowered. Peduncle during flowering at the base enclosed by the petiole and scales of the young shoot, 8.5–20 cm long. Rhachis curved, zigzag, 1.6–12 cm long; internodes 14–21 mm long, distinctly curved, incrassate. *Floral bracts* lanceolate to ovate-lanceolate, 37–49 by 11–14 mm, deciduous; apex acuminate; nerves 9–11. *Flowers* opening in succession. Pedicel 4.7–7.5 by 1–1.5 mm; ovary 9–14 by 2–4 mm. *Median sepal* ovate-lanceolate, 37–42 by 8–10 mm; apex acuminate; nerves 10–12, the midrib a rounded keel 0.1–0.4 mm high. *Lateral sepals* ovate-lanceolate, 35–41 by 8.5–11 mm; apex acuminate; nerves 9–11, the midrib a rounded keel 0.1–0.5 mm high. *Petals* not seen when fresh, midrib centric, 35–38 by 2–4 mm; apex acuminate; nerves 3–5. *Lip* 28–36 by 15–22 mm, nerves 13–15. *Hypochile* when flattened 15–20 by 15–22 mm; base attached over 4.5–9 mm; lateral lobes in front obtuse, extending 2.5–4 mm in front, not seen when fresh, front margin at the base irregularly erose, with acute sinus; keels 5, starting at the base of the lip and there 0.4–0.5 mm high, all keels slightly widened along the crest, raised, plate-like, decurrent towards the centre of the hypochile, crest slightly undulating, entire, papillose, halfway along the hypochile changing into a slightly elevated row with two pronounced, irregularly shaped transversal ridges, with papillae but without hairs, the three median keels parallel on the base of the hypochile, diverging towards the apex of the hypochile, the outer two median keels converging again on the epichile, up to 1.3 mm high, the most central of these keels only developed on the hypochile, up to 2 mm high, the two lateral keels starting at the base of the hypochile or halfway towards the epichile, only developed on the hypochile, lower than the median keels. *Epichile* slightly convex, when flattened broadly ovate, 14–16 by 13–17 mm, with a broad, short claw 0.1–0.3 mm thick; base attached over 7–10 mm; apex acuminate, slightly raised, with an acute apex without warts; margin slightly erose, recurved; sides pronounced as lateral lobes, without warts, centre 0.1–0.3 mm thick, margin 0.1–0.5 mm thick; keels 3, ending 8–12 mm from the apex of the epichile, on the claw identical with the keels on the apical half of the hypochile, on the blade changing into irregular plate-like projections, decurrent towards the apex of the epichile, crest heavily undulating, interrupted, with papillae but without hairs. *Column* 12–19 by 3–5.5 mm; hood with more or less truncate apical margin, not laterally notched where the wings are attached, the middle part rounded, slightly recurved. Anther broadly bell-shaped in outline, 3.3–4 by 3–4.5 mm, near the place of attachment with a little rounded projecting apex; apex without notch. Pollinia not seen; caudicle not seen. *Stigma* 3–4.5 by 4–5.5 mm; margin apex notched; rostellum 3–5 by 2.5–5.5 mm, with an obtuse apex without notch. *Fruit* body 73–75 by 29–33 mm; valvae keels 7–9 mm high; juga with a pronounced longitudinal ridge 4–4.5 mm high without incisions.

Distribution — Palau Islands (Aimiriik, Coral Island), Mariana Islands (Guam, Rota).

Habitat & Ecology — Epiphyte in damp rain forest. Altitude 425 m. Flowering: July–September (not in cultivation).

Notes — 1. No colours and smell recorded.

2. The epithet *guamensis* refers to the island Guam, where the type collection was made under the direction of J.B. Thompson in 1912.

3. The holotype of *C. palawensis* [*Tuyama s.n.* (15-8-1939), Palau TI] was not studied, but the vegetative and floral characters of the paratype (*Kanehira 1949*, Aimiriik NY) are identical with the studied material of *C. guamensis*. Therefore it is concluded that these species must be synonyms.

4. The dimensions in the description refer to herbarium material only.

5. The species can be recognised by five undulating, plate-like keels with entire margin on the lip.

6. Coelogyne lycastoides F. Muell. & Kraenzl. — Fig. 4.10, Map 4.3, Plate 4.1j, 4.2b

Coelogyne lycastoides F. Muell. & Kraenzl., Oesterr. Bot. Z. 45 (1895) 179; Pfitzer & Kraenzl. in Engl., Pflanzenr. 32 (1907) 32, f. 8F; B.A. Lewis & P.J. Cribb, Orchids of Vanuatu (1989) 59; Kores, Allertonia 5 (1989) 68. — Type: *Betche s.n.*, 24-11-1880 (holo MEL?, not seen), Samoa, Upolu.

Coelogyne whitmeei Schltr., Feddes Repert. Spec. Nov. Regni Veg. 11 (1912) 41. — Type: *Whitmee s.n.* (holo B†; iso K), Samoa.

Roots 2.2–3 mm diam. Rhizome 8–11.5 mm thick. Scale-covered part of the inflorescence-bearing young shoot 11–14 cm long. *Pseudobulbs* up to 1.2 cm apart, oblongoid, obtusely 4-angled when fresh, 61–80 cm long. *Leaves* one per pseudobulb. Petiole 1.5–3 cm long. Blade ovate-lanceolate, 26–43 by 8–11.5 cm; apex acuminate; main nerves 7–9. *Inflorescence* synanthous with the partially to entirely developed leaves, 2–4-flowered. Peduncle during flowering at the base enclosed by the petiole and scales of the young shoot, 24–27 cm long. Rhachis (sub)erect, zigzag, 4–5.5 cm long; internodes 20–27 mm long, slightly to distinctly curved, incrassate. *Floral bracts* ovate-lanceolate to ovate-oblong, 41–61 by 11–26 mm, persistent; apex acute; nerves 11–21. *Flowers* opening (almost) simultaneously. Pedicel 4–5 by 2.2–2.7 mm; ovary 14–24 by 6–7 mm. *Median sepal* ovate-oblong, 42–45 by 15–17 mm; apex acuminate; nerves 9, the midrib a rounded keel 0.45–0.5 mm high. *Lateral sepals* ovate-lanceolate, 42–46 by 13–14.5 mm; apex acuminate; nerves 8, the midrib a rounded keel 0.35–0.5 mm high. *Petals* slightly recurved, midrib eccentric, 42–43 by 3.5–7 mm; apex acuminate; nerves 3. *Lip* 37–39 by 22–29 mm, nerves 15–17. *Hypochile* when flattened 21–22 by 22–29 mm; base attached over 12–14 mm, slightly saccate; lateral lobes in front obtuse, not extending in front, front margin at the base slightly irregularly erose, without sinus; apex not saccate; keels 5–7, not widened along the crest, each consisting of a slightly elevated row of undulating, irregularly shaped, rounded warts 0.5–1.4 mm high, with papillae but without hairs (Plate 4.1j), the median 3 keels parallel at the base of the hypochile and there 0.3–0.35 mm high, diverging towards the apex of the hypochile, converging again on the epichile, the most median one shorter and lower than the lateral ones, the 2–4 lateral keels starting at the middle to the apex of the hypochile, much shorter than the median keels. *Epichile* oblong, when flattened broadly obovate to broadly spathulate, 17–18 by 12–12.5 mm, with a broad, short claw 0.25–0.3 mm thick; base attached over 11–14 mm; apex retuse, slightly raised, with an acute to obtuse apex without warts; margin slightly erose, recurved; sides not pronounced as lateral lobes, without warts, centre 0.25–0.3 mm thick, margin 0.2–

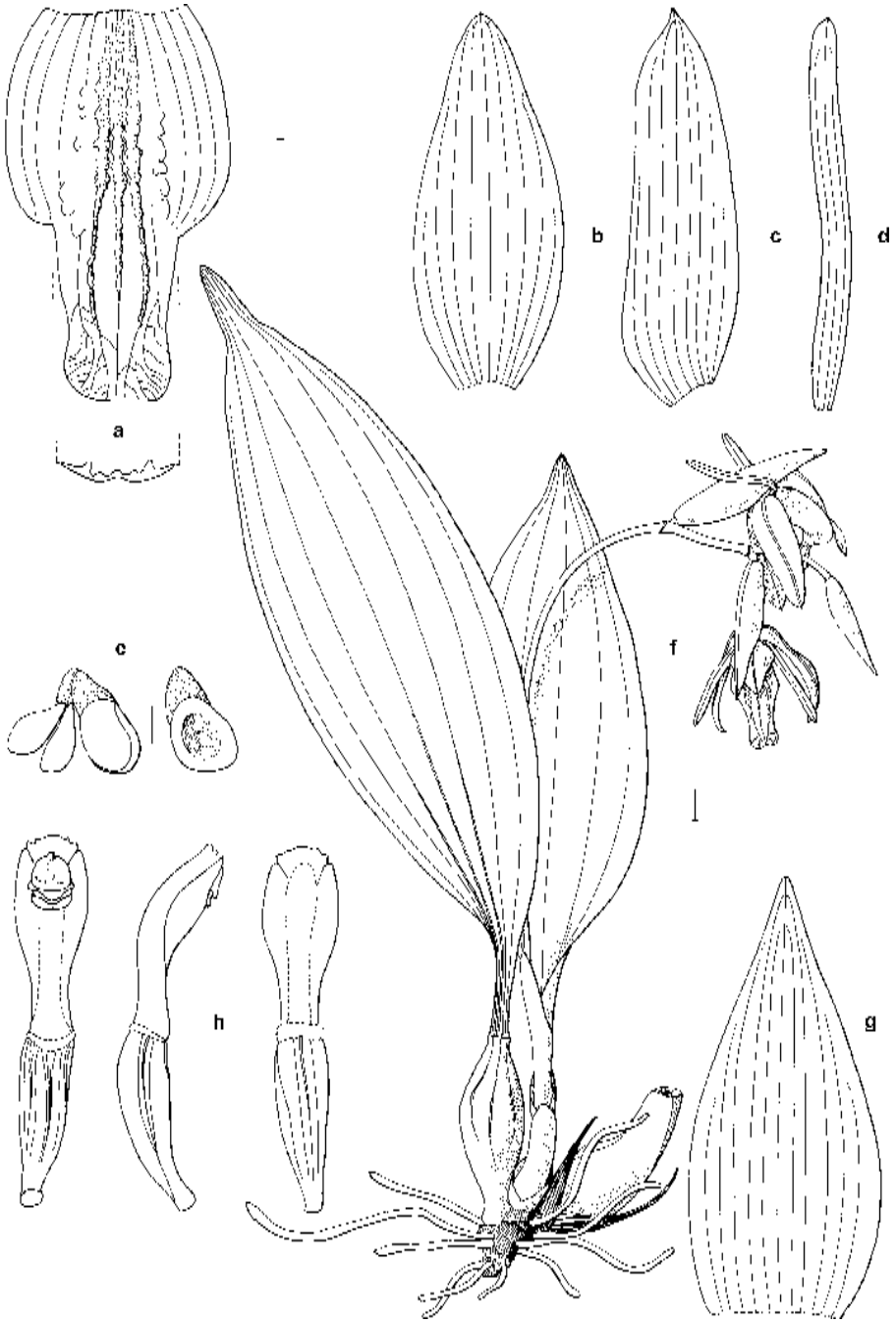
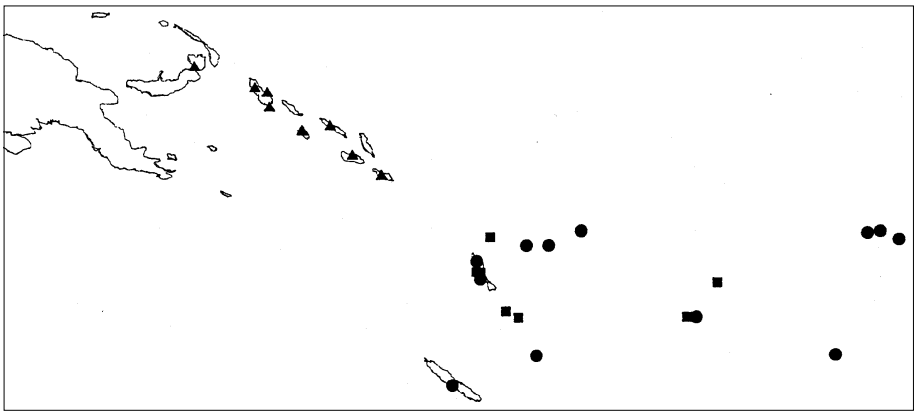


Fig. 4.10. *Coelogyne lycastoides* F. Muell. & Kraenzl. a. Lip ornamentation with cross section of claw; b. median sepal; c. lateral sepal; d. petal [*Leiden cult. (Mulder) 913070*]; e. pollinia; f. habit; g. floral bract [*Leiden cult. (De Vogel) 914325*]; h. column: front, lateral and rear view [*Leiden cult. (Mulder) 913070*]. — Scale bars: 1 cm (a–d, f–h); 1 mm (e).



Map 4.3. Distribution of *Coelogyne lycastoides* F. Muell. & Kraenzl. (l), *C. macdonaldii* F. Muell. & Kraenzl. (n), and *C. susanae* P. J. Cribb & B.A. Lewis (s).

0.25 mm thick; keels 3–5, ending 7.5–9 mm from the apex of the epichile, on the claw identical with the keels on the hypochile, on the claw changing into a row of tightly packed irregularly rounded warts 0.8–1.4 mm high, with papillae but without hairs. *Column* 23–27 by 8–9 mm; hood with more or less truncate apical margin, laterally notched where the wings are attached and above, the middle part rounded, recurved. Anther broadly bell-shaped in outline, 4–5 by 4.5–5 mm, near the place of attachment with a little rounded projecting apex; apex slightly notched. Pollinia obliquely ellipsoid to obliquely orbicular, 2.5–2.8 by 1.5–1.8 mm; caudicle 1.8–2 by 2–4 mm. *Stigma* 2.8–3 by 4–4.5 mm; margin apex notched; rostellum 3–5 by 4–6 mm, with an obtuse apex without notch. *Fruit* body 50–64 by 24–34 mm; valvae keels 6–10 mm high, juga with a pronounced longitudinal ridge 4–5 mm high without incisions.

Distribution — Vanuatu, New Caledonia, Fiji, Tonga, Samoa.

Habitat & Ecology — Epiphyte in primary rain forest and open woodland. Altitude 300–1550 m. Flowering: January–August (August–September in greenhouse).

Notes — 1. Ovary pale green. Sepals and petals very pale green. Lip whitish, for the greater part tinged orange brown, except for the margins and apical half of the midlobe; keels orange brown. Column whitish green. Anther pale yellow. No smell to slightly fragrant.

2. The epithet *lycastoides* refers to the morphological similarity with species within the genus *Lycaste*.

3. The species may be confused with *C. macdonaldii*, but can be recognised by the one-leafed pseudobulbs and nearly confluent rows of undulating, irregularly rounded warts on the lip.

7. Coelogyne macdonaldii F. Muell. & Kraenzl. — Fig. 4.11, Map 4.3, Plate 4.1k, 4.2c

Coelogyne macdonaldii F. Muell. & Kraenzl., Oesterr. Bot. Z. 44 (1894) 209 [‘M’Donaldi’]; Pfitzer & Kraenzl. in Engl., Pflanzenr. 32 (1907) 31 [‘M’Donaldi’]; B.A. Lewis & P.J. Cribb, Orchids of Vanuatu (1989) 60; Kores, Allertonia 5 (1989) 68. — Type: *Melbourne cult. (MacDonald) s.n.* (holo MEL?, not seen), (said to come from) the New Hebrides.

Coelogyne lamellata Rolfe, Kew Bull. (1895) 36; 4 (1900) 103; Pfitzer & Kraenzl. in Engl., Pflanzenr. 32 (1907) 28, f. 7F. — Type: *Sander & Co. cult. s.n.*, ?-8-1895 (holo K), New Hebrides.

Roots 2.5–3 mm diam. Rhizome 7–9.5 mm thick. Scale-covered part of the inflorescence-bearing young shoot 8–15 cm long. *Pseudobulbs* up to 1.8 cm apart, oblongoid, obtusely 4-angled when fresh, 5–7.5 cm long. *Leaves* two per pseudobulb. Petiole 1.6–2.5 cm long. Blade ovate-lanceolate, 20–29.8 by 5.1–11.5 cm; apex acuminate; main nerves 5–7. *Inflorescence* synanthous with the partially to entirely developed leaves, 3–5-flowered. Peduncle during flowering at the base enclosed by the petiole and scales of the young shoot, 11.5–16.5 cm long. Rhachis (sub)erect, zigzag, 2.7–5.6 cm long; internodes 10.5–20 mm long, slightly to distinctly curved, incrassate. *Floral bracts* ovate-oblong, 51–70 by 21–29 mm, persistent; apex acuminate; nerves 11–13. *Flowers* opening (almost) simultaneously. Pedicel 9–10 by 2.2–2.7 mm; ovary 16–25 by 5.5–7 mm. *Median sepal* ovate-oblong, 42–52 by 15.5–22 mm; apex obtuse; nerves 9, the midrib a rounded keel 0.4–0.5 mm high. *Lateral sepals* ovate-oblong, 40–50 by 15–16 mm; apex obtuse; nerves 9 or 10, the midrib a rounded keel 0.5–0.9 mm high. *Petals* slightly recurved, 41–48 by 4.1–4.7 mm; apex acute; nerves 3–5, midrib centric. *Lip* 35–45 by 25–28 mm, nerves 15–17. *Hypochile* when flattened 20–22 by 25–28 mm; base attached over 7–10 mm, not saccate; lateral lobes in front obtuse, extending 2.8–3 mm in front and slightly converging, front margin at the base irregularly erose, with acute sinus; apex not saccate; keels 9–13, consisting of longitudinal rows of irregularly shaped ridges 0.7–2.1 mm high, with papillae but without hairs (Plate 4.1k), not widened along the crest, the most median 4–7 keels parallel at the base of the hypochile and there 0.7–1 mm high, diverging towards the apex of the hypochile and converging again on the epichile, the lateral 4–6 keels only developed on the hypochile and sometimes on the basal half of the epichile, lower than the median keels. *Epichile* convex, when flattened obovate to elliptic to ovate, 15–18 by 11–15 mm, with a broad, short claw 0.2–0.9 mm thick; base broadly attached over 11–13 mm; apex rounded to retuse, slightly raised, with an acuminate to acute apex without warts; margin slightly erose, recurved; sides more or less pronounced as lateral lobes, without warts, centre 0.25–0.4 mm thick, margin 0.1–0.2 mm thick; keels 5–7, ending 7–10 mm from the apex of the epichile, on the claw and plate identical with the keels on the hypochile. *Column* 19–23 by 7.6–8 mm; hood with more or less truncate apical margin, laterally notched where the wings are attached, the middle part rounded, recurved. Anther broadly bell-shaped in outline, 4.9–5 by 5–5.5 mm, near the place of attachment with a little slightly elongate projecting apex; apex with small notch. Pollinia obliquely ellipsoid to obliquely orbicular, 2.5–3 by 1.7–2 mm; caudicle 3–3.5 by 3–4 mm. *Stigma* 3–4 by 4–5 mm; margin apex notched; rostellum 3–4 by 5–6 mm, with an obtuse apex without notch. *Fruit* body 62–76 by 21.5–32 mm; valvae keels 7–11 mm high; juga with a pronounced longitudinal ridge 5–8 mm high with 9–12 incisions up to 6.3 mm deep.

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Plate 4.2. – a. *Coelogyne beccarii* Rchb.f. [*Leiden cult. (Schuiteman, Mulder & Vogel) 32230*, Papua New Guinea]. Photograph C.G. Koops. – b. *C. lycastoides* F. Muell. & Kraenzl. [*Leiden cult. (Mulder) 914325*, Fiji]. Photograph C.G. Koops. – c. *C. macdonaldii* F. Muell. & Kraenzl. [*Leiden cult. (Cribb & Morrisson) 25836*, Vanuatu]. Photograph C.G. Koops. – d. *C. susanae* P.J. Cribb & B.A. Lewis (Bougainville). Photograph J.B. Comber.

a. *Coelogyne beccarii*

b. *Coelogyne lycastoides*

c. *Coelogyne macdonaldii*

d. *Coelogyne susanae*

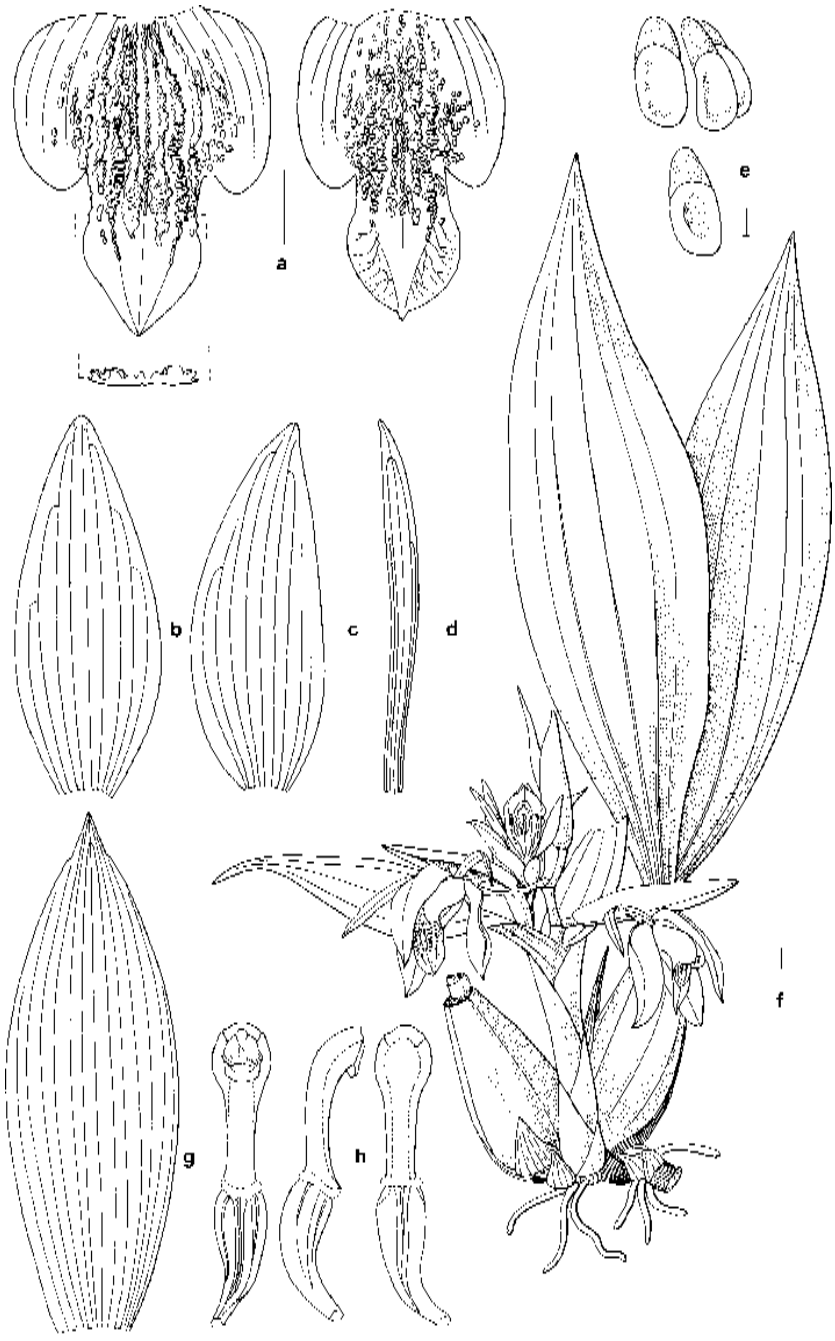

Fig. 4.11. *Coelogyne macdonaldii* F. Muell. & Kraenzl. a. Variation in lip ornamentation with cross section of claw; b. median sepal; c. lateral sepal; d. petal; e. pollinia; f. habit; g. floral bract; h. column: front, lateral and rear view [*Leiden cult. (Cribb & Morrisson) 25836*]. — Scale bars: 1 cm (a–d, f–h); 1 mm (e).

Distribution — Banks Islands (Vanua Lava), Vanuatu (Espirito Santo, Ambae, Pentecost, Efate, Erromango), Fiji.

Habitat & Ecology — Epiphyte in rain forest. Altitude 300–1100 m. Flowering: September–March (July–November in greenhouse).

Notes — 1. Sepals and petals very pale green to whitish green. Lip greenish white, inside light orange brown with lighter spots, the low warts cream, darker brown at the base of the midlobe, outside of the lip the brown shimmering through. Column greenish white, anther cream to pale brown. Fragrant.

2. The epithet *macdonaldii* refers to rev. M. McDonald, who collected the type specimen, probably somewhere on the New Hebrides as McDonalds' collections principally come from these islands [Index Herbariorum 2 (1976) 4: 480].

3. The species may be confused with *C. lycastoides* (see note 3 under *C. lycastoides*).

8. Coelogyne rumphii Lindl. — Fig. 4.12, Map 4.2, Plate 4.1f, 4.3d

Coelogyne rumphii Lindl., Fol. Orchid. 1, 14 (1854) nr. 36; Miq., Fl. Ned. Ind. 3 (1859) 668; Rchb.f., Ann. Bot. Syst. 6 (1861) 234; J.J. Sm., Orch. Ambon (1905) 16; Pfitzer & Kraenzl. in Engl., Pflanzenr. 32 (1907) 28; J.J. Sm., Teysmannia 31 (1920) 254. — *Angraecum nervosum* Rumph., Herb. Amboin. 6 (1750) 106, t. 48. — *Pleione rumphii* (Lindl.) Kuntze, Rev. Gen. Pl. 2 (1891) 680. — Type: Rumphius, Herb. Amboin. (1750) t. 48.

Coelogyne psittacina Rchb.f., Xenia Orchid. 2 (1868) 141, t. 153. — *Pleione psittacina* (Rchb.f.) Kuntze, Rev. Gen. Pl. 2 (1891) 680. — Type: *Doleschall 90* (holo W), Ambon.

Coelogyne psittacina Rchb.f. var. *huttonii* Rchb.f., Gard. Chron. 32 (1870) 1053. — Type: *Hutton s.n.* (holo W), Moluccas.

Roots 1.7–2.1 mm diam. Rhizome 6.6–10.4 mm thick. Scale-covered part of the inflorescence-bearing young shoot 7.3–18.7 cm long. *Pseudobulbs* up to 1.5 cm apart, oblongoid, obtusely 4-angled when fresh, 5.4–13.4 cm long. *Leaves* one per pseudobulb. Petiole 2.5–3.8 cm long. Blade lanceolate, 28–59 by 8–12.9 cm; apex acuminate; main nerves 7. *Inflorescence* synanthous with the partially to entirely developed leaf, 2–6-flowered. Peduncle during flowering at the base enclosed by the petiole and scales of the young shoot, 24–51 cm long. Rhachis (sub)erect, zigzag, 1.9–7.5 cm long; internodes 16–19 mm long, slightly curved, hardly thickened. *Floral bracts* ovate-lanceolate to lanceolate, 53–65.7 by 10.7–15 mm, deciduous; apex cuspidate; nerves 11–13. *Flowers* opening in succession. Pedicel 6.5–8.2 by 2–2.2 mm; ovary 9–14.4 by 3.3–4.5 mm. *Median sepal* oblong, 39.1–50.7 by 15–17.5 mm; apex acuminate; nerves 9–11, the midrib a rounded keel 0.8–1 mm high. *Lateral sepals* oblong, 37.6–47.3 by 11.8–14.3 mm; apex acuminate; nerves 9, the midrib a rounded keel 0.7–0.8 mm high. *Petals* slightly to extremely recurved, 38–46 by 3–4 mm; apex acute; nerves 3, midrib centric. *Lip* 31.8–42 by 20–22.4 mm, nerves 13–15. *Hypochile* when flattened 18–22.4 by 20–22.4 mm; base attached over 13.7–14 mm, not saccate; lateral lobes in front obtuse, extending 4–5.3 mm in front and slightly diverging, front margin

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Plate 4.3. – a. *Coelogyne carinata* Rolfe [*Leiden cult. (De Vogel) 30714*, Sulawesi]. Photograph C.G. Koops. – b. *C. fragrans* Schltr. [*Leiden cult. (Schuiteman, Mulder & Vogel) 31598*, Papua New Guinea]. Photograph C.G. Koops. – c. *C. celebensis* J.J. Sm. [*Leiden cult. (De Vogel) 27369*, Sulawesi]. Photograph B. Kieft. – d. *C. rumphii* Lindl. [*Leiden cult. (De Vogel) 24505*, Buru]. Photograph A. Vogel.

a. *Coelogyne carinata*

b. *Coelogyne fragrans*

c. *Coelogyne celebensis*

d. *Coelogyne rumphii*

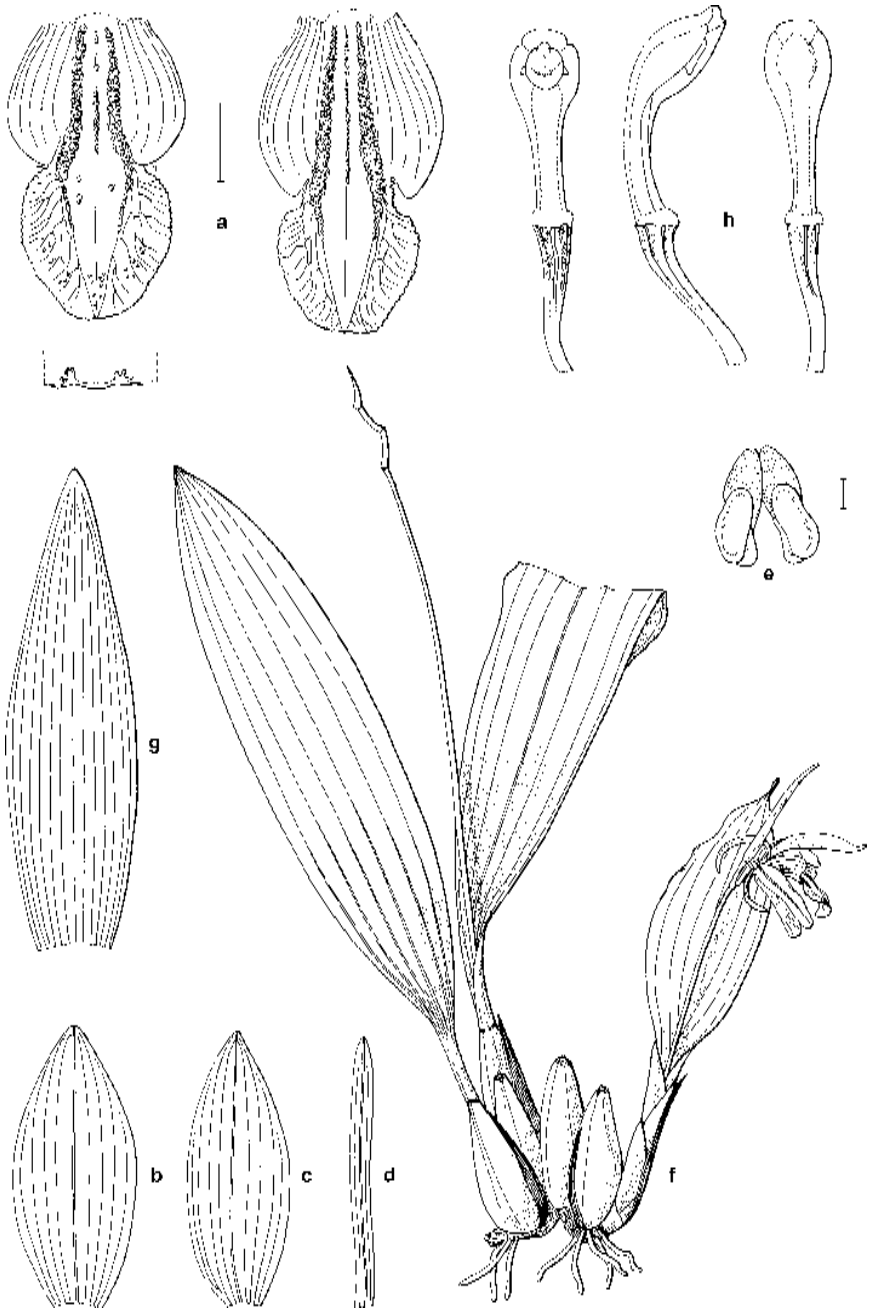

Fig. 4.12. *Coelogyne rumphii* Lindl. a. Variation in lip ornamentation with cross section of claw, from left to right: *Dickson MD 129*, *Leiden cult. (De Vogel) 21524*; b. median sepal; c. lateral sepal; d. petal [*Leiden cult. (De Vogel) 21537*]; e. pollinia; f. habit [*Leiden cult. (De Vogel) 21524*]; g. floral bract [*Leiden cult. (De Vogel) 24504*]; h. column: front, lateral and rear view [*Leiden cult. (De Vogel) 21537*]. — Scale bars: 1 cm (a–d, f–h); 1 mm (e).

at the base irregularly erose, with acute sinus; apex slightly saccate; keels 3, starting at the base of the lip and there 0.8–0.9 mm high, the lateral keels parallel at the basal half of the hypochile, diverging towards the apex of the hypochile, converging again on the epichile, up to 1.5 mm high, widened along the crest, with up to 5 rows of slender, tapering, undulating plate-like projections 1.1–1.4 mm high, with papillae but without hairs (Plate 4.1f), the median keel only developed on the hypochile (sometimes also on a small part of the epichile), lower than the lateral ones and consisting of up to 2 rows of slender, tapering plate-like projections with papillae but without hairs. *Epichile* convex, when flattened (transversely) elliptic to obrhomboid, 14–16.3 by 16.2–18 mm, with a broad, short claw 0.25–0.4 mm thick; base attached over 9.3–12.3 mm; apex weakly retuse, raised, with an acute apex with few warts 0–0.5 mm high; margin erose, recurved; sides pronounced as lateral lobes, with radiating rows of low warts 0.4–0.6 mm high, centre 0.25–0.5 mm thick, margin 0.15–0.3 mm thick; keels 2, ending 9.5–15 mm from the apex of the epichile, identical with the keels on the hypochile. *Column* 23.7–28.6 by 7.3–9.4 mm; hood irregularly dentate, its apical margin slightly rounded to more or less truncate, laterally notched where the wings are attached, the middle part rounded, slightly recurved. Anther broadly bell-shaped in outline, 5–6 by 4.9–5.4 mm, near the place of attachment with a little rounded projecting apex; apex without notch. Pollinia obliquely ellipsoid, 2.7–3.5 by 1.6–2.2 mm; caudicle 1–2 by 1.5–3 mm. *Stigma* 3.3–4.5 by 3.4–3.5 mm; margin apex notched; rostellum 3.1–5 by 4.4–4.9 mm, with an acute apex without notch. *Fruit* body 68.9–84 by 27.6–36.5 mm; valvae keels 8–9 mm high; juga with a pronounced longitudinal ridge 4–5.1 mm high with up to 3 incisions c. 0.2 mm deep.

Distribution — Moluccas: Buru, Ambon, Ceram.

Habitat & Ecology — Epiphyte on trees in riverine forest. Altitude 100–1100 m. Flowering: August–November (January–July in greenhouse).

Notes — 1. Ovary bright green. Sepals and petals greenish yellow to yellowish cream. Lip cream coloured to whitish, at the base orange yellow, lateral lobes tinged red to orange brown, inside with red brown lines, junction of epichile and hypochile and the projections on the keels red brown, apices of papillae on the lateral keels and the entire central keel red brown, epichile at the base with a transverse W-shaped light brown band, back orange. Column cream coloured to light green, with orange margin, front with red brown minute spots, hood bright yellow. Anther light yellow to cream coloured, with brown margins. Slightly fragrant.

2. The epithet *rumphii* refers to G.E. Rumpf (Rumphius), who described and depicted the species in his Herbarium Amboinense in 1750.

3. The species is easily recognised by the five rows of slender, tapering, undulating plate-like projections on the keels (Fig. 4.12a).

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Plate 4.4. – a. *Coelogyne salmonicolor* Rchb.f. [*Leiden cult. (De Vogel) 28002*, Sumatra]. Photograph B. Kieft. – b. *C. septemcostata* J.J. Sm. [*Leiden cult. (Van Balgooy) 960143*, Peninsular Malaysia]. Photograph A. Vogel. – c. *C. speciosa* (Blume) Lindl. subsp. *speciosa* [*Leiden cult. (De Vogel) 911353*, Java]. Photograph C.G. Koops. – d. *C. speciosa* subsp. *incarnata* Gravendeel [*Leiden cult. (De Vogel & Vermeulen) 25441*, Sumatra]. Photograph C.G. Koops.

a. *Coelogyne salmonicolor*

b. *Coelogyne septemcostata*

c. *Coelogyne speciosa* subsp. *speciosa*

d. *Coelogyne speciosa* subsp. *incarnata*

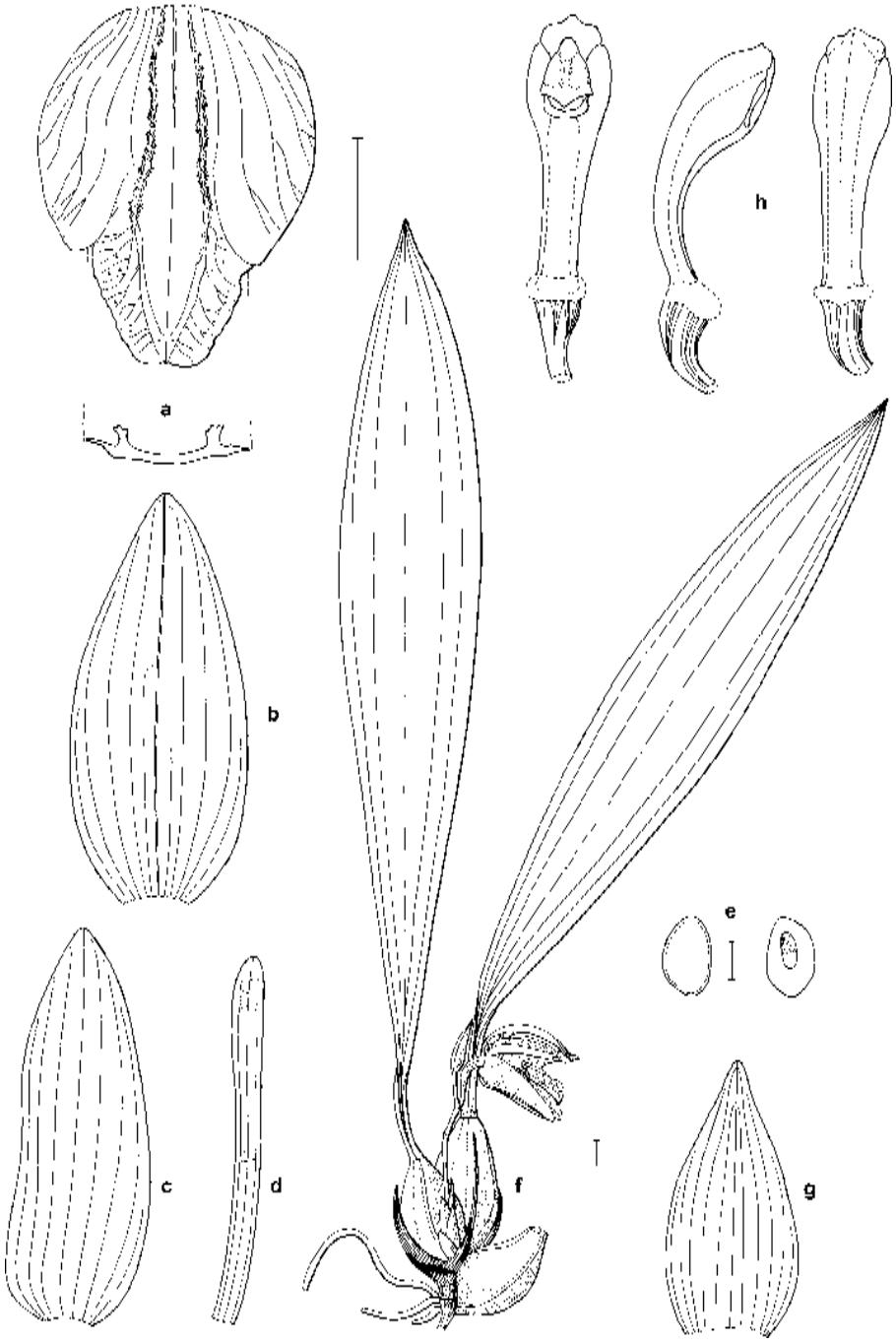


Fig. 4.13. *Coelogyne salmonicolor* Rchb.f. a. Lip ornamentation with cross section of claw; b. median sepal; c. lateral sepal; d. petal; e. pollinia; f. habit; g. floral bract; h. column: front, lateral and rear view [*Leiden cult. (De Vogel) 28002*]. — Scale bars: 1 cm (a–d, f–h); 1 mm (e).

9. Coelogyne salmonicolor Rchb.f. — Fig. 4.13, Map 4.5, Plate 4.1d, 4.4a

Coelogyne salmonicolor Rchb.f. in Gard. Chron. 2, 20 (1883) 328; Rolfe, Kew Bull. 4 (1900) 104; Pfitzer & Kraenzl. in Engl., Pflanzenr. 32 (1907) 29; Latif, Bunga Anggerik (1953) 98. — *Coelogyne speciosa* (Blume) Lindl. var. *salmonicolor* Schltr., Orchideen (1915) 146; J.J. Sm., Bull. Jard. Bot. Buitenzorg III, 8 (1927) 353; Feddes Repert. Beih. 32 (1933) 168. — Type: *Veitch 410 (Curtis)* (holo W), Sunda Islands.

Coelogyne bella Schltr. in Engl., Bot. Jahrb. Syst. 104 (1911) 5. — Type: *Schlechter 15921* (holo B†), Sumatra.

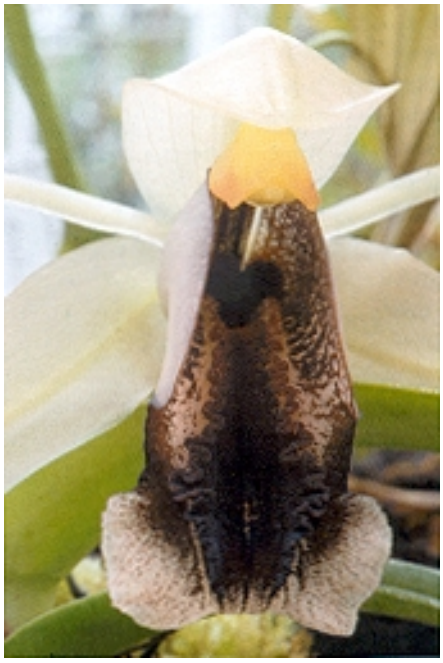
Coelogyne salmonicolor Rchb.f. var. *virescentibus* J.J. Sm. ex Dakkus, Orch. Ned. Ind. 3 (1935) 89. — Type: not designated.

Roots 1.3–1.8 mm diam. Rhizome 4.9–5.5 mm thick. Scale-covered part of the inflorescence-bearing young shoot 3.5–5 cm long. *Pseudobulbs* up to 1 cm apart, ovoid, distinctly 4-ridged when fresh, 2.5–4.2 cm long. *Leaves* one per pseudobulb. Petiole 2.1–3.2 cm long. Blade lanceolate, 21–27 by 3.9–4.4 cm; apex acuminate; main nerves 5. *Inflorescence* synanthous with the partially to entirely developed leaves, 2–4-flowered. Peduncle during flowering at the base enclosed by the petiole and scales of the young shoot, 2.2–3.8 cm long. Rhachis (sub)erect, zigzag, 2–3.7 cm long; internodes 9–13 mm long, slightly to distinctly curved, hardly thickened. *Floral bracts* ovate-oblong, 20–26 by 8–11 mm, persistent; apex acuminate; nerves 11–13. *Flowers* opening (almost) simultaneously. Pedicel 3–4 by 1–1.2 mm; ovary 5–5.5 by 2–2.5 mm. *Median sepal* ovate-oblong, 28–33 by 10–14 mm; apex obtuse; nerves 9–11, the midrib a rounded keel 0.5–0.55 mm high. *Lateral sepals* ovate-oblong, 31–32 by 10–12 mm; apex obtuse; nerves 8, the midrib a rounded keel 0.4–0.5 mm high. *Petals* slightly recurved, 31–32 by 2.3–2.8 mm; apex obtuse; nerves 3, midrib centric. *Lip* 27–34 by 19–22 mm, nerves 13–15. *Hypochile* when flattened 19–20 by 19–22 mm; base attached over 8–9 mm, slightly saccate; lateral lobes in front obtuse, extending 5–5.5 mm in front and slightly diverging, front margin at the base slightly irregularly erose, with acute sinus; apex slightly saccate; keels 2–4, starting at the base of the lip and there 0.25–0.5 mm high, all keels widened along the crest, with two slightly elevated rows of irregularly shaped, tapering projections 0.5–0.6 mm high on each side of the crest, with a longitudinal groove with hairs 0.1–0.2 mm long implanted on the rims, with papillae (Plate 4.1d), the two lateral keels parallel on the base of the hypochile, diverging towards the apex of the hypochile, converging again on the epichile, the median keels (if present) developed on the basal two thirds of the hypochile, lower than the lateral ones. *Epichile* convex, when flattened obovate to orbicular, 9.5–10 by 12.5–13 mm, with a broad, short claw 0.25–0.5 mm thick; base broadly attached over 9–9.5 mm; apex retuse, slightly raised, with an obtuse apex with few warts 0.5–0.6 mm high; the margin slightly erose, recurved; sides not pronounced as lateral lobes, with warts 0.4–0.5 mm high, centre 0.25–0.45 mm thick, margin 0.2–0.4 mm thick; keels 2, ending 6–6.5 mm from the apex of the epichile, on the

∅

Plate 4.5. – a. *Coelogyne dichroantha* Gagnep. (*Eberhardt s.n.*, Vietnam). Photograph B. Kieft. – b. *C. xyrekes* Ridl. [*Leiden cult. (Roelfsema, Vogel & Van Balgooy) 960160*, Peninsular Malaysia]. Photograph C.G. Koops. – c. *C. tiomanensis* M.R. Hend. (Pulau Tioman). Photograph J.B. Comber. – d. *C. tommii* Gravendeel & O'Byrne [*Leiden cult. (De Vogel) 21524*, Singapore Botanical Gardens]. Photograph C.G. Koops.

a. *Coelogyne dichroantha*



b. *Coelogyne xyrekes*

c. *Coelogyne tiomanensis*

d. *Coelogyne tommii*

claw identical with the keels on the hypochile, on the plate changing into one row of tightly packed irregularly waving plate-like projections with papillae and hairs. *Column* 18–21 by 6–6.3 mm; hood irregularly dentate, its apical margin more or less obtuse, laterally notched where the wings are attached and sometimes with a small additional notch above, the middle part rounded, slightly recurved. Anther oblong bell-shaped in outline, 4.5–5 by 3.5–3.6 mm, near the place of attachment with a little elongate projecting apex; apex not to slightly notched. Pollinia obliquely ellipsoid, 2.1–2.2 by 1.5–1.8 mm; caudicle 1.5–2 by 2–3.5 mm. *Stigma* 2.5–3 by 3–3.5 mm; margin apex notched; rostellum 2.9–3.5 by 3.5–4 mm, with an acute apex without notch. *Fruit* body 51–53 by 21.5–24 mm; valvae keels plate-like, 6–6.5 mm high; juga with a pronounced longitudinal ridge 4–4.1 mm high without incisions.

Distribution — Sumatra.

Habitat & Ecology — Epiphyte in montane rain forest. Altitude 900–1500 m. Flowering: February, March, June, August, September, December (April in greenhouse).

Notes — 1. Sepals and petals pale salmon or creamy white with a greenish tint. Lip pale salmon or creamy white with a pale salmon flush on the midlobe, sidelobes with light orange-brownish reticulate lines, keels and central median streak on the lip similarly coloured, the very base of the lip more orange coloured. Column cream or creamy yellow coloured, anther cream or yellow brown coloured tinged slightly yellow. No smell.

2. The epithet *salmonicolor* refers to the salmon colour of the flowers.

3. The species is easily recognised by the pale pink flowers with 2–4 keels with small hairs on the lip. It can be kept apart from *C. speciosa* subsp. *incarnata* by the longitudinally grooved keels.

10. Coelogyne septemcostata J.J. Sm. — Fig. 4.14, Map 4.5, Plate 4.1e, 4.4b

Coelogyne septemcostata J.J. Sm., Icon. Bogor. 2 (1903) 23, t. 106A; Pfitzer & Kraenzl. in Engl., Pflanzenr. 32 (1907) 31; Seidenf. & J.J. Wood, Orchids of Penins. Malaysia and Singapore (1992) 205, f. 86 E–F. — Type: *Nieuwenhuis s.n.* (holo BO?, not found), Borneo.

Coelogyne membranifolia Carr, Gard. Bull. Straits Settlem. 7 (1932) 2, pl. 1; Holttum, Orchids of Malaya 3 (1964) 243. — Type: *Carr s.n.* (holo SING), Malay Peninsula, Pahang, Tembeling.

Roots 1.9–2.3 mm diam. Rhizome 5.6–10.5 mm thick. Scale-covered part of the inflorescence-bearing young shoot 4.8–8 cm long. *Pseudobulbs* up to 0.7 cm apart, oblongoid, obtusely 4-angled when fresh, 4.3–9 cm long. *Leaves* one per pseudobulb. Petiole 2.2–4.7 cm long, with lateral notches at the apex. Blade oblong, 23–42 by 5.8–12.5 cm; apex acuminate; main nerves 5–7. *Inflorescence* synanthous with the partially to entirely developed leaf, 2–4(–22)-flowered. Peduncle during flowering at the base enclosed by the petiole and scales of the young shoot, 8.8–39 cm long. Rhachis (sub)erect to curved, zigzag, 2–32 cm long; internodes 17–23 mm long, distinctly curved, hardly thickened. *Floral bracts* ovate-lanceolate, 31–40 by 7–10 mm, deciduous; apex acuminate; nerves 9–11. *Flowers* opening in succession, finely papillose. Pedicel 5–7 by 1.5–2.3 mm; ovary 5.3–9.5 by 3–5.5 mm. *Median sepal* ovate-oblong, 34–48 by 16–23 mm; apex mucronate; nerves 11–13, the midrib a rounded keel 0.5–1 mm high. *Lateral sepals* oblong, 34–46 by 15–19 mm; apex mucronate; nerves

9–11, the midrib a rounded keel 0.6–1 mm high. *Petals* slightly recurved, 36–46 by 2–3 mm; apex mucronate; nerves 3, midrib eccentric. *Lip* 34–43 by 36–44 mm, nerves 19–21. *Hypochile* when flattened 29–33 by 36–44 mm; base attached over 17–22 mm, not saccate; lateral lobes in front obtuse, extending 7–12 mm in front and slightly convergent, front margin at the base slightly irregularly erose to entire, with acute sinus; apex slightly saccate; keels 5–7(–8), starting at the base of the lip and there 0.5–1 mm high, all keels more or less widened along the crest, with a longitudinal groove, at both margins drawn out in many hairlike projections 0.7–1.5 cm long, with papillae but without hairs (Plate 4.1e); all keels parallel at the base of the hypochile, the 2–5 lateral keels only developed on the basal half to three quarters of the hypochile, up to 3 mm high, the 3 median keels diverging towards the apex of the hypochile, converging again on the epichile, lower than the lateral keels and with shorter projections at the basal half of the hypochile. *Epichile* convex, when flattened elliptic, 5–8 by 13–19 mm, with a broad, short claw 0.25–1.1 mm thick; base broadly attached over 14–16 mm; apex retuse, slightly raised, with an acute apex with warts 0.25–0.4 mm high; margin slightly erose, recurved; sides pronounced as lateral lobes, with warts at the base 0.5–0.8 mm high, centre 0.3–1 mm thick, margin 0.2–0.3 mm thick; keels 2, ending 6–11 mm from the apex of the epichile, on the claw and plate changing into an uninterrupted, undulating row of plate-like projections 0.1–0.6 mm high with papillae but without hairs. *Column* 27–34 by 9–11 mm; hood irregularly dentate to entire, its apical margin more or less obtuse, laterally notched or with 2 small cuneate projections where the wings are attached, the middle part rounded, slightly recurved. Anther broadly bell-shaped in outline, 5.2–7 by 4.5–6.5 mm, near the place of attachment with a little rounded projecting apex; apex slightly notched to entire. Pollinia obliquely ellipsoid, 3–4 by 1.5–2 mm; caudicle 1–3 by 1–2 mm. *Stigma* 4–5 by 4–6 mm; margin apex slightly notched; rostellum 4–6 by 5–8 mm, with a truncate to obtuse to acute apex without notch. *Fruit* body 53–68 by 29–35 mm; valvae keels plate-like, 7–9 mm high; juga with a pronounced longitudinal ridge 4–6.5 mm high without incisions.

Distribution — Thailand, Peninsular Malaysia, Sarawak, Brunei, Sabah, Kalimantan.

Habitat & Ecology — Epiphyte, rarely terrestrial in shady rain forest or mixed forest on a variety of soil types. Altitude 50–2278 m. Flowering: February–July (July–August in greenhouse).

Notes — 1. Ovary pale green. Sepals and petals green to very pale green. Lip whitish to medium cream, lateral lobes orange to dull orange brown, very dark brown on the margin in the sinus; keels orange to orange brown, more dull brown in front, projections on the keels orange; epichile creamy white, at the base with a transverse brown band. Column stalk cream coloured, in front at the base tinged orange to orange brown. Anther light yellow. No smell to slightly fragrant.

2. The epithet *septemcostata* refers to the number of keels on the lip of the type specimen. However, the number of keels of the specimens studied varies between 5 and 8.

3. The species is easily recognised by the 5–8 keels on the lip with long hairs at their margins and strongly curved rhachis.

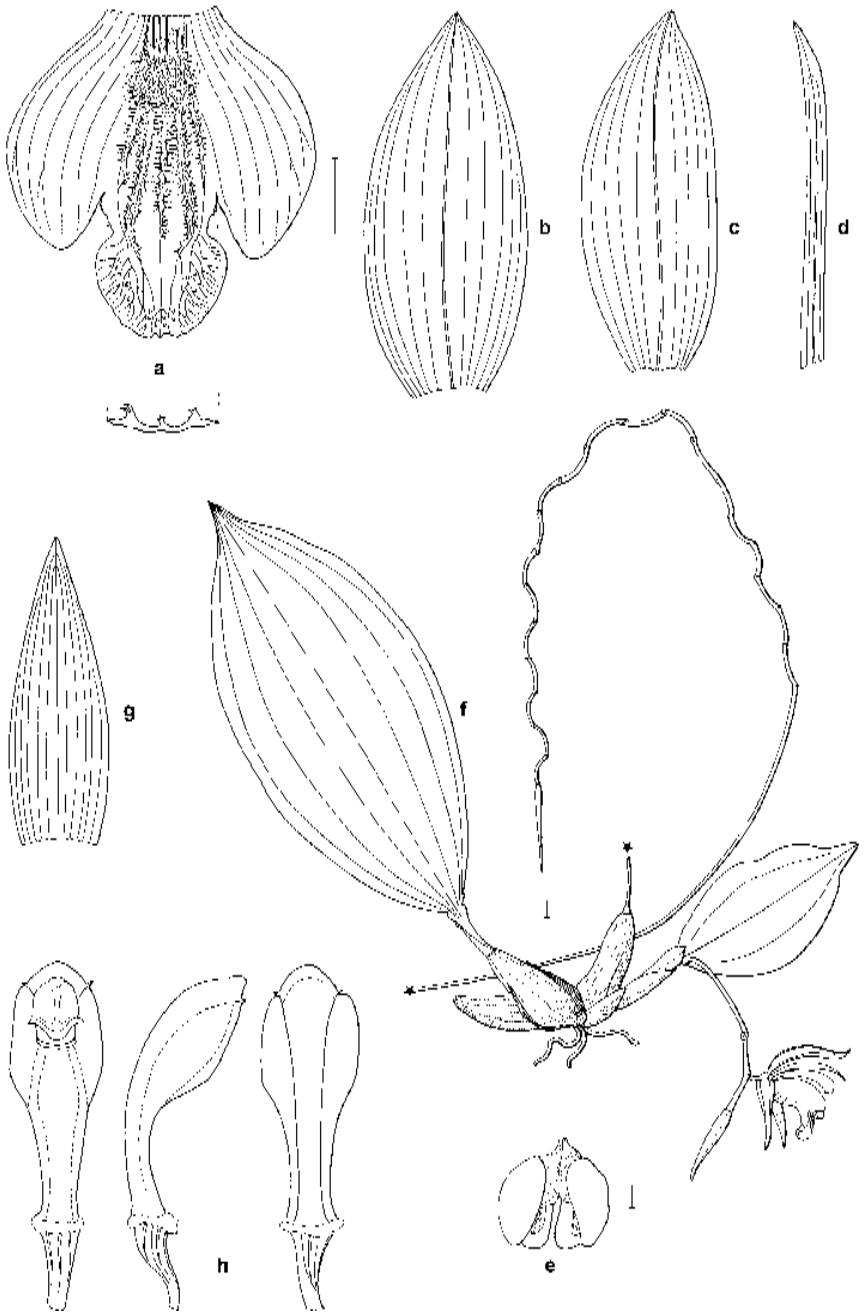


Fig. 4.14. *Coelogyne septemcostata* J.J. Sm. a. Lip ornamentation with cross section of claw [*Leiden cult. (Nooteboom) 23184*]; b. median sepal; c. lateral sepal; d. petal; e. pollinia; f. habit [*Leiden cult. (Van Balgooy) 960143*]; g. floral bract [*Leiden cult. (Nooteboom) 23187*]; h. column: front, lateral and rear view [*Leiden cult. (Van Balgooy) 960143*]. — Scale bars: 1 cm (a–d, f–h); 1 mm (e).

11. Coelogyne speciosa (Blume) Lindl.

Literature: see under the subspecies.

Pseudobulbs ovoid, obtusely 4-angled when fresh. *Leaves* one or two per pseudobulb. Blade obovate-lanceolate to linear-lanceolate to lanceolate; apex acuminate or cuspidate; main nerves 3–5. *Inflorescence* synanthous with the partially to entirely developed leaves. Peduncle during flowering at the base enclosed by the petiole and scales of the young shoot. Rhachis (sub)erect, zigzag, internodes slightly to distinctly curved, hardly thickened. *Floral bracts* ovate-oblong to oblong, deciduous; apex acute. *Flowers* opening in succession. *Median sepal* oblong or lanceolate; apex emarginate to acuminate. *Lateral sepals* oblong or ovate-lanceolate; apex emarginate to acuminate. *Petals* slightly to extremely recurved, 52–56.7 by 2.5–3.3 mm; apex emarginate to acute to acuminate; nerves 1–3; midrib centric. *Hypochile* base not saccate; lateral lobes rounded to obtuse to acute, slightly diverging in front; front margin at the base slightly to extremely irregularly erose, with broadly rounded to acute sinus; apex slightly saccate; keels 2 or 3, starting at the base of the lip, all keels widened along the crest, with up to 5 rows of slender, tapering, either or not branched, elongate and sometimes plate-like projections, with papillae and stellately arranged multicellulate hairs at their apices, the lateral keels parallel at the basal half of the hypochile, diverging towards the apex of the hypochile, converging again on the epichile, the median keel only developed in the basal one to three quarters of the hypochile, lower than the lateral ones. *Epichile* convex, when flattened (semi-)orbicular to transversely elliptic to obrhomboid, with a broad, short claw; apex retuse to emarginate, raised, with an acute apex with warts; margin more or less erose or fringed, recurved; sides more or less pronounced as lateral lobes, with radiating rows of warts; keels 2, on the (basal half of the) claw identical with the keels on the hypochile, on the apical half of the claw or plate changing into a row of successive undulating plate-like projections, which are not widened along the crest, with shorter hairs, in front continuing into rows of low warts. *Column* hood with irregularly dentate or truncate apical margin, laterally notched where the wings are attached, the middle part rounded, slightly recurved. Anther broadly bell-shaped in outline, near the place of attachment with a rounded or elongate projecting apex; apex without notch. Pollinia obliquely ellipsoid. *Stigma* margin apex with a more or less pronounced notch; rostellum with a broadly rounded or obtuse apex without notch. *Fruit* with juga with a pronounced longitudinal ridge with or without incisions.

Notes — 1. Three different subspecies can be recognised, based on the size of the sepals, petals and lip, the length of the projections of the margin of the lip and the colour of the flowers. The rank of subspecies is chosen because the infraspecific taxa of *C. speciosa* seem to occupy distinct distribution areas: *C. speciosa* subsp. *fimbriata* on the mountain range between Mt Bandahara and Mt Kerintji in Sumatra, *C. speciosa* subsp. *incarnata* on the mountain range between Mt Mamas and Mt Barisan in Sumatra and on the mountain range between Mt Gedé and Mt Halimun in Java and *C. speciosa* subsp. *speciosa* on Mt Gedé, Mt Muria, Mt Papandajan, Mt Raung, Mt Salak, Mt Semeru, Mt Tengger and Mt Ungarang in Java and throughout Flores. It must be stressed, however, that many of the studied collections lack colour descriptions and/or indications of localities. Therefore, the assumption of distinct geographic areas

is only based on a few collections and may be rejected when more collections are made.

2. The species is easily recognised by the ornamentation of the keels of the lip: five rows of tapering, elongate or plate-like projections, with stellately arranged multicellulate hairs at their apices.

KEY TO THE SUBSPECIES

1a. Petals and sepals yellowish green; lateral sepals shorter than 50 mm 2
b. Petals and sepals salmon coloured; lateral sepals longer than 56 mm . . . . . **c.** subsp. **incarnata**
2a. Margin of midlobe of lip irregularly erose. — Java and Flores . . . . . **a.** subsp. **speciosa**
b. Margin of midlobe of lip fimbriate, with projections up to 3.5 mm long. — Sumatra . . . . . **b.** subsp. **fimbriata**

a. subsp. **speciosa** — Fig. 4.15a, Map 4.4, Plate 4.1g, 4.4c

Coelogyne speciosa (Blume) Lindl., Gen. Sp. Orchid. Pl. (1830) 39; Fol. Orchid. (1854) 11; Bot. Mag. 81 (1855) t. 4889; Rchb.f., Ann. Bot. Syst. 6 (1861) 231; Cogn. & Gooss., Dict. Icon. Orch. (1903) t. 3; J.J. Sm., Orch. Java (1905) 138; Pfitzer & Kraenzl. in Engl., Pflanzenr. 32 (1907) 29; Schltr., Orchideen (1915) 145; Koord., Fl. Tjibodas (1919) 42; J.J. Sm., Teysmannia 31 (1920) 253; Bremek., Trop. Natuur 11 (1922) 181, f. 2; Dakkus, Orch. Ned. Ind. 2 (1931) 73; C.F. Sander, F.K. Sander & L.L. Sander, Sander's Orch. Guide (1927) 128; J.J. Sm., Feddes Repert. Beih. 32 (1933) 168; Dakkus, Orch. Ned. Ind. 3 (1935) 90; Backer & Bakh.f., Fl. Java 3, 12 (1952) 127; Latif, Bunga Anggerik (1953) 98; Backer & Bakh.f., Fl. Java 3 (1968) 280; Bechtel in P.J. Cribb & Launert, Orch. Atl. (1980) 105, f. 5, photo p. 185; J.B. Comber, Orchids of Java (1990) 111. — *Chelonanthera speciosa* Blume, Bijdr. (1825) 384, t. 52. — *Pleione speciosa* (Blume) Kuntze, Rev. Gen. Pl. 2 (1891) 680. — Type: *Blume s.n.* (?-1-1822) (holo W), Java, Mt Salak.

Coelogyne speciosa (Blume) Lindl. var. *albicans* H.J. Veitch, Man. Orchid. Pl. (1890) 50, pl. 6; Cogn. & Gooss., Dict. Icon. Orch. (1903) t. 3. — Lectotype (here chosen): H.J. Veitch, Man. Orchid. Pl. (1890) 50, pl. 6.

Coelogyne speciosa (Blume) Lindl. var. *alba* Hort., Gard. Chron. 3, 37 (1905) 205; J.J. Sm., Teysmannia 6 (1920) 254; Dakkus, Orch. Ned. Ind. 2 (1931) 73; 3 (1935) 91. — Type: not designated.

Coelogyne speciosa (Blume) Lindl. var. *rubiginosa* Hort., Orch. Rev. 30 (1922) 37. — Type: not designated.

Roots 1.5–2 mm diam. Rhizome 4–7 mm thick. Scale-covered part of the inflorescence-bearing young shoot 5.2–8.2 cm long. *Pseudobulbs* up to 0.8 cm apart, 4.4–7 cm long. *Leaves* one or two per pseudobulb. Petiole 2.5–4 cm long. Blade lanceolate, 22.5–35 by 3.7–8.4 cm. *Inflorescence* 3–8-flowered. Peduncle 14–20 cm long. Rhachis 4–7.5 cm long; internodes 13–19 mm long. *Floral bracts* ovate-oblong, 23–39 by 6–18 mm; nerves 11–15. Pedicel 4.8–8 by 1–2.5 mm; ovary 5–13 by 2.5–5.7 mm. *Median sepal* oblong, 49.6–55 by 18.3–20.6 mm; apex emarginate; nerves 9–11, the midrib a rounded keel 0.7–1 mm high. *Lateral sepals* oblong, 47.5–50.5 by 14.6–17 mm; apex emarginate; nerves 8–10, the midrib a rounded keel 0.5–1 mm high. *Petals* 52–56.7 by 2.5–3.3 mm; apex emarginate to acute. *Lip* when flattened 44.3–53 by 33.1–42.7 mm, nerves 11–13. *Hypochile* when flattened 28.2–47.2 by 33.1–42.7 mm;

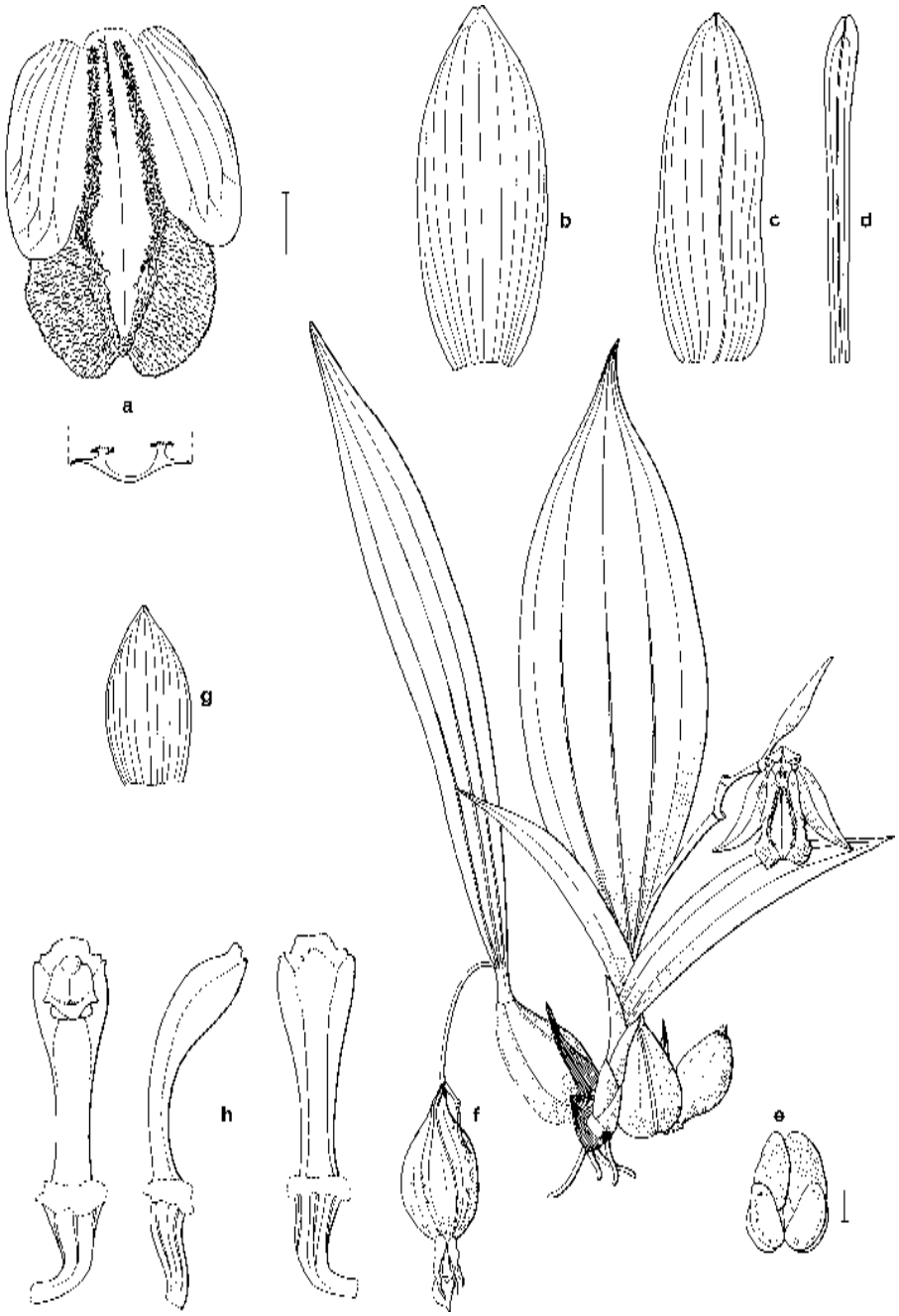


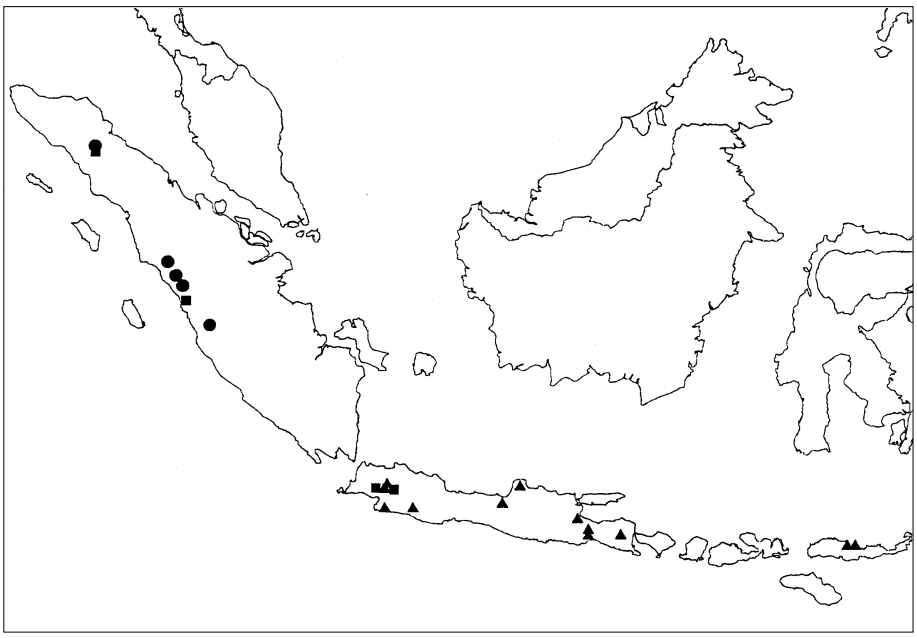
Fig. 4.15a. *Coelogyne speciosa* (Blume) Lindl. subsp. *speciosa.* a. Lip ornamentation with cross section of claw; b. median sepal; c. lateral sepal; d. petal; e. pollinia; f. habit; g. floral bract; h. column: front, lateral and rear view [*Leiden cult. (De Vogel) 911339*]. — Scale bars: 1 cm (a–d, f–h); 1 mm (e).

base attached over 12.2–16.3 mm; lateral lobes in front rounded to obtuse, extending 2–6 mm in front, front margin at the base irregularly erose, with broadly rounded to acute sinus; keels 3, at the base of the lip 0.5–1 mm high, the lateral keels up to 1.5 mm high, projections 1.6–2.1 mm high, hairs 0.25–0.3 mm long (Plate 4.1g). *Epichile* when flattened semi-orbicular to transversely elliptic, 16.8–19.5 by 27–30.2 mm, with a broad, short claw 0.25–0.8 mm thick; base attached over 17–23 mm; apex retuse to emarginate, apex with warts 1–1.7 mm high; margin more or less erose; sides pronounced as lateral lobes, with radiating rows of warts 0.2–0.8 mm high, centre 0.6–1 mm thick, margin 0.25–0.3 mm thick; keels ending 9–12 mm from the apex of the epichile. *Column* 29–37 by 6.6–10.2 mm; hood with irregularly dentate apical margin. Anther broadly bell-shaped in outline, 6.3–8.5 by 5.6–7.4 mm, near the place of attachment with a rounded projecting apex. Pollinia 2.5–3.7 by 1.3–2.2 mm; caudicle 2.5–3.5 by 2.5–3 mm. *Stigma* 2.8–4.8 by 4–5.7 mm; margin apex with a more or less pronounced notch; rostellum 4–5.7 by 5–7.1 mm, with a broadly rounded apex. *Fruit* body 62–65 by 27–27.5 mm; valvae keels 8.5–9 mm high; longitudinal ridge of juga 3.5–4 mm high with up to 4 incisions up to 2.5 mm deep.

Distribution — Java, Lesser Sunda Islands (Flores).

Habitat & Ecology — Epiphyte on forest trees, rarely terrestrial. Common. Altitude 760–2000 m. Flowering: February, April–July, October–December (whole year round in greenhouse).

Notes — 1. Ovary light green. Sepals and petals light green to yellowish green, transparent. Lip white to cream with dense dark red to orange brown markings inside,



Map 4.4. Distribution of *Coelogyne speciosa* (Blume) Lindl.: subsp. *fimbriata* (J.J. Sm.) Gravendeel (l), subsp. *incarnata* Gravendeel (n), and subsp. *speciosa* (s).

shimmering through on the outside, midlobe creamy white with orange to brown lines on the base. Column light green, front of stalk tinged brownish, its apex pale yellowish, wings cream coloured. Anther pale yellow, pollinia bright yellow. Stigma pale yellow, rostellum white. No smell to slightly fragrant.

2. The epithet *speciosa* (which is Latin for beautiful) refers to the showy flowers.

3. The type specimen of *C. speciosa* subsp. *speciosa* is described by Blume as having white yellow sepals, and lip white grey outside and yellow inside.

b. subsp. **fimbriata** (J.J. Sm.) Gravendeel, *stat. nov.* — Fig. 4.15b, Map 4.4, Plate 4.1h

Coelogyne speciosa (Blume) Lindl. var. *fimbriata* J.J. Sm., Bull. Dép. Agric. Indes Néerl. 5 (1907) 1; Schltr., Bot. Jahrb. Syst. 104 (1911) 6; J.J. Sm., Teysmannia 31 (1920) 254; Dakkus, Orch. Ned. Ind. 2 (1931) 73; J.J. Sm., Feddes Repert. Beih. 32 (1933) 168; Dakkus, Orch. Ned. Ind. 3 (1935) 91; Latif, Bunga Anggerik (1953), col. pl. 21. — Type: *Storm van 's Gravesande s.n.* (holo BO?, not found), Sumatra, Padang Pandjang.

Roots 1.7–3 mm diam. Rhizome 7.5–9 mm thick. Scale-covered part of the inflorescence-bearing young shoot 5.2–10.3 cm long. *Pseudobulbs* up to 0.7 cm apart, not seen when fresh, 3.2–7.2 cm long. *Leaves* one per pseudobulb. Petiole 4.5–10.5 cm long. Blade obovate-lanceolate to linear-lanceolate, 26–43.5 by 4.5–8 cm; apex acuminate to cuspidate; main nerves 5. *Inflorescence* 2–4(–20)-flowered. Peduncle 8–27 cm long. Rhachis 2–37 cm long; internodes 14–22 mm long. *Floral bracts* ovate-oblong, 35–42.5 by 14–16 mm; nerves 11–13. Pedicel 3–3.5 by 3.5–4 mm; ovary 6–6.5 by 3.5–4 mm. *Median sepal* lanceolate, 47–50 by 15–19 mm; apex acuminate; nerves 9–11, the midrib a rounded keel 0.5–0.7 mm high. *Lateral sepals* ovate-lanceolate, 43–48 by 12–15 mm; apex acuminate; nerves 8 or 9, the midrib a rounded keel 0.7–1 mm high. *Petals* 44–49 by 2.5–3.5 mm; apex acuminate. *Lip* when flattened 33–43 by 27–35 mm, nerves 13–15. *Hypochile* when flattened 23–30 by 27–35 mm; base attached over 10–18 mm; lateral lobes in front acute to rounded, extending 2.5–4 mm in front, front margin at the base slightly to extremely irregularly erose, with rounded to acute sinus; keels 2 or 3, at the base of the lip 0.5–1.5 mm high, the lateral keels up to 1.5 mm high, with projections 2–4 mm high on the basal part of the hypochile, 1.5–2 mm high on the apical part of the hypochile, with hairs 0.15–0.2 mm long, projections of median keel 1–1.5 mm high, with papillae but without hairs (Plate 4.1h). *Epichile* when flattened orbicular to obrhomboid, 8–15 by 15–22 mm, claw (if present) broad and short, 0.6–0.65 mm thick; base attached over 7–20 mm; apex (slightly) retuse; apex with few warts 0.4–1 mm high; margin fringed with elongate projections 0.5–3.5 mm long, with papillae but without hairs; sides more or less pronounced as lateral lobes, with few, irregularly placed warts 0.4–1 mm high, centre 0.5–0.6 mm thick, margin 0.2–0.5 mm thick; keels ending 3.5–9 mm from the apex of the epichile. *Column* 28–32 by 5.5–8 mm; hood with more or less truncate

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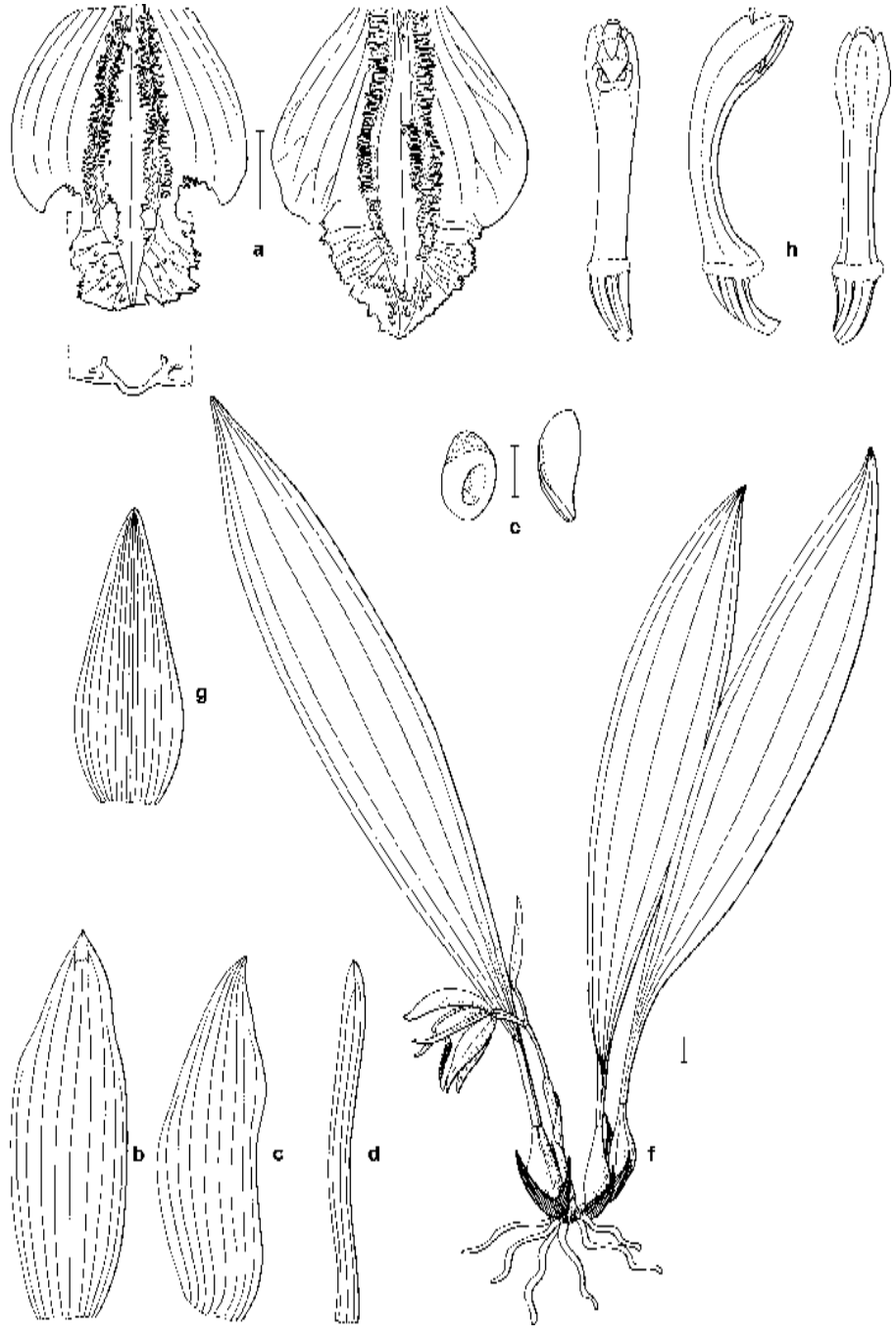
Fig. 4.15b. *Coelogyne speciosa* (Blume) Lindl. subsp. *fimbriata* (J.J. Sm.) Gravendeel. a. Lip ornamentation with cross section of claw, from left to right: *Bogor cult. 992-XI-311*, *De Wilde & De Wilde-Duyfjes 15579*; b. median sepal; c. lateral sepal; d. petal; e. pollinia (*Bogor cult. 992-XI-311*); f. habit (*Bünnemeijer 1094*); g. floral bract; h. column: front, lateral and rear view (*Bogor cult. 992-XI-311*). — Scale bars: 1 cm (a–d, f–h); 1 mm (e).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apical margin. Anther elongate bell-shaped in outline, 6.3–6.7 by 4–5.5 mm, near the place of attachment with an elongate projecting apex. Pollinia 1.7–3.2 by 1–1.5 mm; caudicle c. 2.5 by c. 1.5 mm. *Stigma* 2.5–4 by 3.5–4.5 mm; margin apex without notch; rostellum 4.5–5 by 4–5.25 mm, with an obtuse apex. *Fruit* body c. 54 by c. 36 mm; valvae keels 7–8.5 mm high; juga with a pronounced longitudinal ridge 3.5–4 mm high without incisions.

Distribution — Sumatra.

Habitat & Ecology — Epiphyte in rain forest. Altitude 800–1100 m. Flowering: January, March, May, June (November in greenhouse).

Notes — 1. Ovary not documented. Sepals and petals ochrish yellow. Lip cream coloured, with a reticulate pattern of brown lines inside on the lateral lobes which shimmers through on the outside, inside median orange, keels at the base of the lip orange, to the front brown. Column yellowish, in front with few brown markings. No smell.

2. The epithet *fimbriata* refers to the fringed margins of the epichile.

c. subsp. **incarnata** Gravendeel, *subsp. nov.* — Fig. 4.15c, Map 4.4, Plate 4.1i, 4.4d

> Subspecies nova, quoad pseudobulbis, foliis fructibusque ad *C. speciosam* subsp. *speciosam* accedit, sed ab ea praecipue sepalis petalisque majoribus, labello multo longiore et floribus incarnatis differt. — Typus: *De Wilde & De Wilde-Duyfjes 15767* (holo L; iso K), Sumatra, Mt Mamas.

Coelogyne speciosa auct. non (Blume) Lindl.: Lindl., Bot. Reg. 33 (1847) t. 23. — Type: *Veitch cult. (Lobb) s.n.* (holo K), Java.

Coelogyne speciosa (Blume) Lindl. var. *major* C.F. Sander, F.K. Sander & L.L. Sander, Sander's Orch. Guide (1927) 128. — Type: not designated.

Roots 1.5–2.5 mm diam. Rhizome 5–8 mm thick. Scale-covered part of the inflorescence-bearing young shoot 6–10.7 cm long. *Pseudobulbs* up to 1 cm apart, 4.7–7.3 cm long. *Leaves* one or two per pseudobulb. Petiole 3–5.2 cm long. Blade lanceolate, 19–38 by 3.4–6 cm. *Inflorescence* 2–3(–11)-flowered. Peduncle 9.5–17.5 cm long. Rhachis 1.4–3.5 cm long; internodes 14–24 mm long. *Floral bracts* ovate-oblong to oblong, 22–52 by 8–35 mm; nerves 11–13. Pedicel 4–7 by 2–2.5 mm; ovary 10–18 by 4.2–6 mm. *Median sepal* oblong, 54.5–72 by 20–24 mm; apex emarginate; nerves 9, the midrib a rounded keel 0.7–1 mm high. *Lateral sepals* oblong, 56.8–68 by 17.5–20 mm; apex emarginate; nerves 8 or 9, the midrib a rounded keel 0.75–1.5 mm high. *Petals* 53.7–68 by 2.3–4 mm; apex emarginate to acute. *Lip* when flattened 45.9–61 by 40–45 mm, nerves 13–15. *Hypochile* when flattened 33–38 by 40–45 mm; base attached over 12–20 mm; lateral lobes in front rounded to obtuse, extending 2.3–5 mm in front; front margin at the base irregularly erose, with broadly rounded to acute sinus; keels 3, at the base of the lip 0.5–1.1 mm high, the lateral keels up to 1.1

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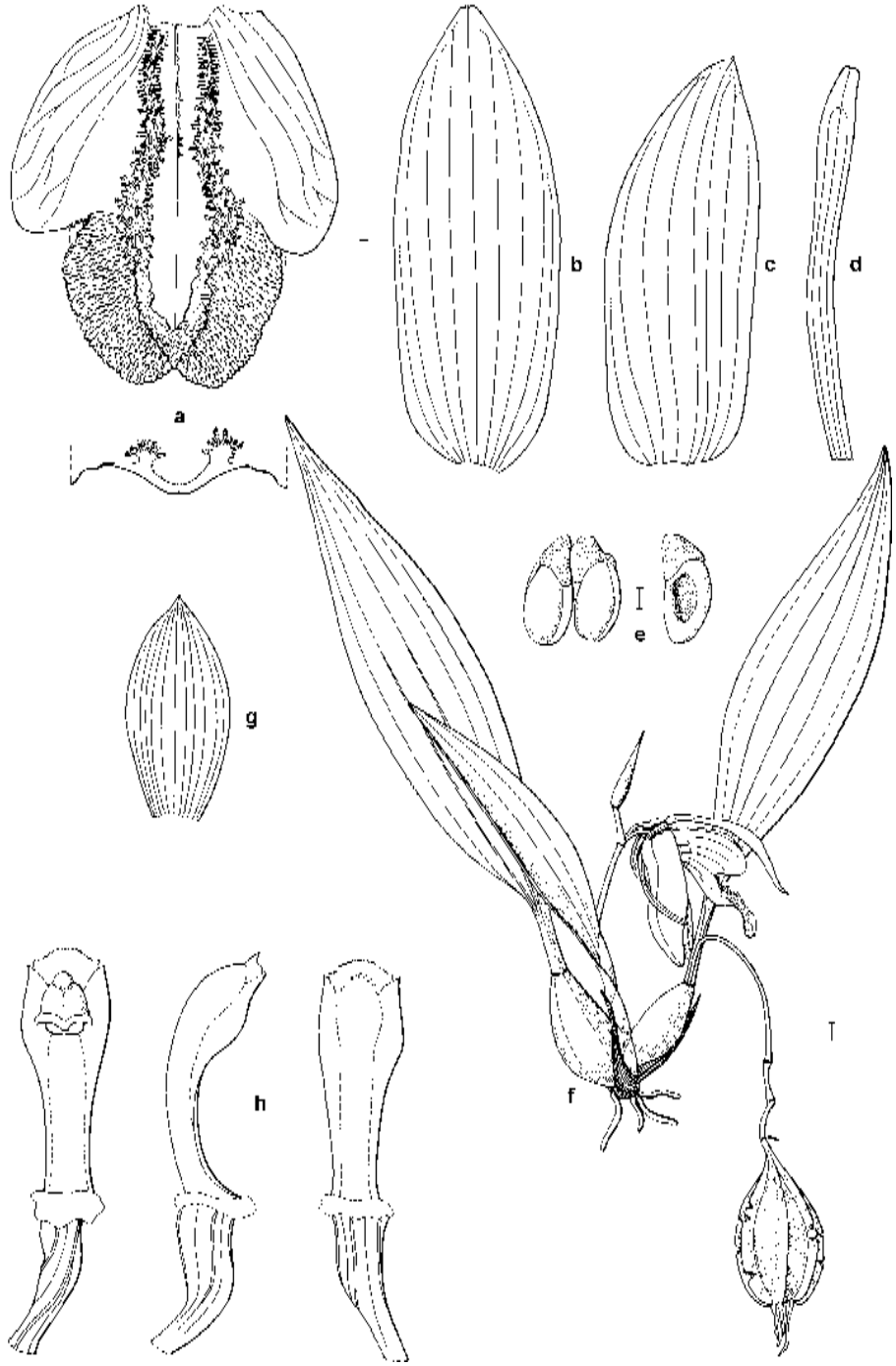
Fig. 4.15c. *Coelogyne speciosa* (Blume) Lindl. subsp. *incarnata* Gravendeel. a. Lip ornamentation with cross section of claw; b. median sepal; c. lateral sepal; d. petal; e. pollinia [*Leiden cult. (De Vogel) 940790*]; f. habit [*Leiden cult. (Roelfsema, Vogel & Van Balgooy) 960608*]; g. floral bract; h. column: front, lateral and rear view [*Leiden cult. (De Vogel) 940790*]. — Scale bars: 1 cm (a–d, f–h); 1 mm (e).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mm high, projections 1–4 mm high, hairs 0.3–0.5 mm long (Plate 4.1i). *Epichile* when flattened semi-orbicular to transversely elliptic, 17–24 by 23.3–31 mm, with a broad, short claw 0.4–1 mm thick; base attached over 17.2–22.2 mm; apex retuse to emarginate; apex with warts 0.8–2 mm high; margin more or less erose; sides pronounced as lateral lobes, with radiating rows of warts 0.5–1.5 high, centre 0.8–1.5 mm thick, margin 0.3–0.6 mm thick; keels ending 1–11 mm from the apex of the epichile. *Column* 32.7–43 by 9–13 mm; hood with irregularly dentate apical margin. Anther broadly bell-shaped in outline, 6.6–8 by 5.5–7.7 mm, near the place of attachment with a rounded projecting apex. Pollinia 2.5–3.5 by 1.3–1.5 mm; caudicle 2.7–3.5 by 2.5–2.8 mm. *Stigma* 1.5–5 by 4.5–6.3 mm, with a more or less pronounced notched margin; rostellum 4.1–7.5 by 5.5–7.5 mm, with a broadly rounded apex. *Fruit* body 54–71 by 28–33.5 mm; valvae keels 8–9.5 mm high; pronounced longitudinal ridge of juga 3.5–4 mm high with up to 9 incisions up to 4 mm deep.

Distribution — Sumatra, Java.

Habitat & Ecology — Epiphyte on forest trees in montane forest, old deserted coffee and tea plantations and pole tree forest. Altitude 900–1500 m. Flowering: March, October (April, July–December in greenhouse).

Notes — 1. Ovary olive green tinged salmon. Sepals and petals greenish cream tinged salmon to salmon to brownish salmon. Lip outside salmon with a brownish tinge, hypochile deep brown to red brown with lighter spots, at the base yellowish; lateral lobes brown to red brown with creamy white spots, lateral keels red brown, median keel yellow, projections on keels creamy white; epichile white to creamy white with at the base some brown markings; margins of the claw red brown. Column white to greenish cream, front of stalk tinged brown to red brown. Anther pale yellow, pollinia bright yellow. Stigma pale yellow, rostellum white with dark brown margin. No smell to slightly fragrant.

2. The epithet *incarnata* refers to the flesh-coloured flowers.

3. Horticulturists often use the epithet *salmonicolor* for *C. speciosa* subsp. *incarnata*. To prevent further confusion with the distinct species *C. salmonicolor* Rchb.f. (synonym *C. speciosa* Lindl. var. *salmonicolor* Schltr.), the epithet *incarnata* is chosen.

4. The dimensions in the description refer to herbarium material only.

12. Coelogyne susanae P.J. Cribb & B.A. Lewis — Fig. 4.16, Map 4.3, Plate 4.1l, 4.2d

Coelogyne susanae P.J. Cribb & B.A. Lewis, Kew Bull. 46 (1991) 317; Orchids of the Solomon Islands and Bougainville (1991) 90, f. 18. — Type: *Wickison 40* (holo K), Solomon Islands.

Roots 2–3 mm diam. Rhizome 9.5–15 mm thick. Scale-covered part of the inflorescence-bearing young shoot 10–11.5 cm long. *Pseudobulbs* up to 2 cm apart, oblongoid, obtusely 4-angled when fresh, 6.8–17 cm long. *Leaves* two per pseudobulb, stiff herbaceous. Petiole 3–7 cm long. Blade linear-lanceolate, 32–45 by 6.5–8.7 cm; apex acuminate to cuspidate; main nerves 5–7. *Inflorescence* synanthous with the partially

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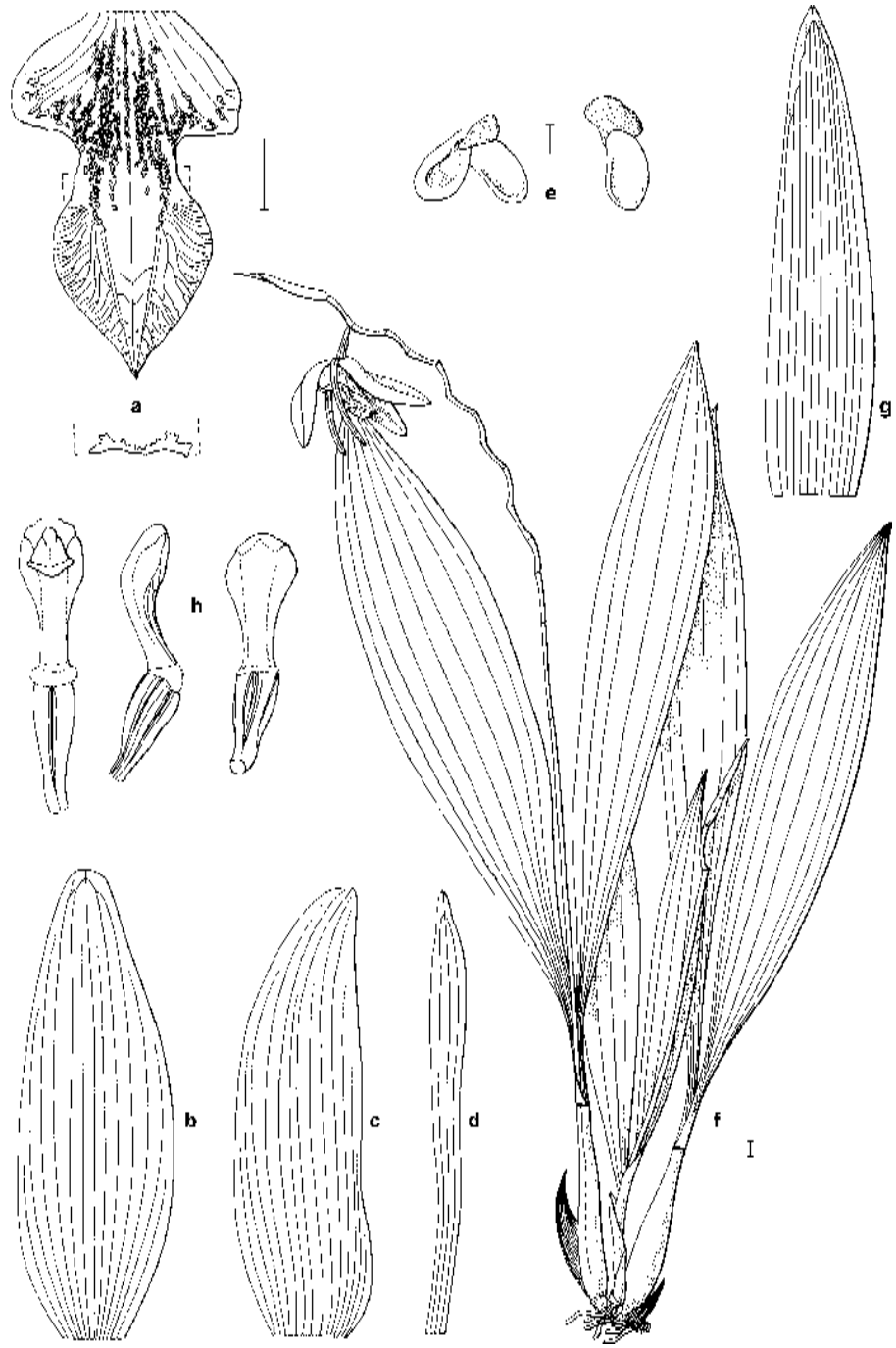
Fig. 4.16. *Coelogyne susanae* P.J. Cribb & B.A. Lewis. a. Lip ornamentation with cross section of claw (*Cruttwell 3185*); b. median sepal; c. lateral sepal; d. petal; e. pollinia (*Cribb 1922*); f. habit (*Craven 206*); g. floral bract [*NGF (Millar) 38405*]; h. column: front, lateral and rear view (*Hunt 2205*). — Scale bars: 1 cm (a–d, f–h); 1 mm (e).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to entirely developed leaves, 2–18-flowered. Peduncle during flowering at the base enclosed by the petiole and scales of the young shoot, 7–41.5 cm long. Rhachis (sub)erect, zigzag, 2.5–32 cm long; internodes 14–32 mm long, distinctly curved, incrassate, each with a swollen base bearing a flower. *Floral bracts* ovate-lanceolate, 41–67 by 14–15 mm, deciduous; apex acute; nerves 11–13. *Flowers* opening in succession. Pedicel 5–9 by 2.5–3.2 mm; ovary 14–28 by 5–7.5 mm. *Median sepal* ovate-oblong, 50–67 by 17–23 mm; apex obtuse; nerves 13–15, the midrib a rounded keel 0.5–0.8 mm high. *Lateral sepals* ovate-lanceolate, 56–62 by 16–19.5 mm; apex acute; nerves 13–17, the midrib a rounded keel 0.5–0.8 mm high. *Petals* slightly recurved, 50–67 by 3.5–5 mm; apex acuminate; nerves 3, midrib centric. *Lip* 40–55 by 31–36 mm, nerves 15–19. *Hypochile* when flattened 18–23 by 31–36 mm; base attached over 16–27 mm, not saccate; lateral lobes in front obtuse, extending 1–4 mm in front, front margin at the base slightly irregularly erose, with obtuse sinus; apex not saccate; keels 11–13, each consisting of a row of irregularly shaped, elongate warts 1–2 mm high with papillae but without hairs on the basal quarter of the hypochile and a slightly elevated row with irregularly shaped horizontal ridges 1.2–2 mm high with papillae but without hairs on the apical parts of the hypochile, not widened along the crest, the 5 median keels parallel at the base of the hypochile and there 0.5–1 mm high, diverging on the apical half of the epichile, converging again on the basal half of the epichile, the 3 most median keels developed on the hypochile and the basal half of the epichile, the 6–8 lateral keels only developed on the apical half of the hypochile, lower than the median keels (Plate 4.1l). *Epichile* convex, when flattened elliptic to ovate to orbicular, 21–37 by 19–21 mm, with a broad, relatively long claw 0.2–0.7 mm in cross section; base broadly attached over 12–15.5 mm; apex retuse, slightly raised, with an acute apex with warts 0.3–0.5 mm high; margin slightly erose, recurved; sides not to slightly pronounced as lateral lobes, with a few warts 0.8–1 mm high, centre 0.4–0.9 mm in cross section, margin 0.2–0.25 mm in cross section; keels 7–9, the 2 longest ones ending 12–15 mm from the apex of the epichile, on the claw identical with the keels on the hypochile, on the plate changing into a row of irregularly shaped, elongate warts with papillae but without hairs. *Column* 22.5–23.5 by 8–10.5 mm; hood with truncate apical margin, laterally notched where the wings are attached and above, the middle part rounded, recurved. Anther oblong bell-shaped in outline, 5.5–6 by 5.9–6 mm, near the place of attachment with a little elongate projecting apex; apex without notch. Pollinia obliquely ellipsoid, 2.5–3.2 by 1.5–1.7 mm; caudicle flattened, broadly triangular in outline, 1.5–1.8 by 1.5–3.5 mm. *Stigma* 4–6 by 6–7 mm; margin apex notched; rostellum 3.8–6 by 6–7 mm, with an obtuse apex with or without notch. *Fruit* not seen.

Distribution — New Britain, Bougainville, Shortland Islands, Solomon Islands (Kolombangara, New Georgia, Guadalcanal, San Cristobal).

Habitat & Ecology — Epiphyte in rain forest, rarely terrestrial. Altitude 25–1250 m. Flowering: April–January (not in cultivation).

Notes — 1. Sepals and petals pale yellow green to creamy green with an orange or red brown lip and a white or pale yellow apex. Column whitish, brown on ventral surface. Fragrant.

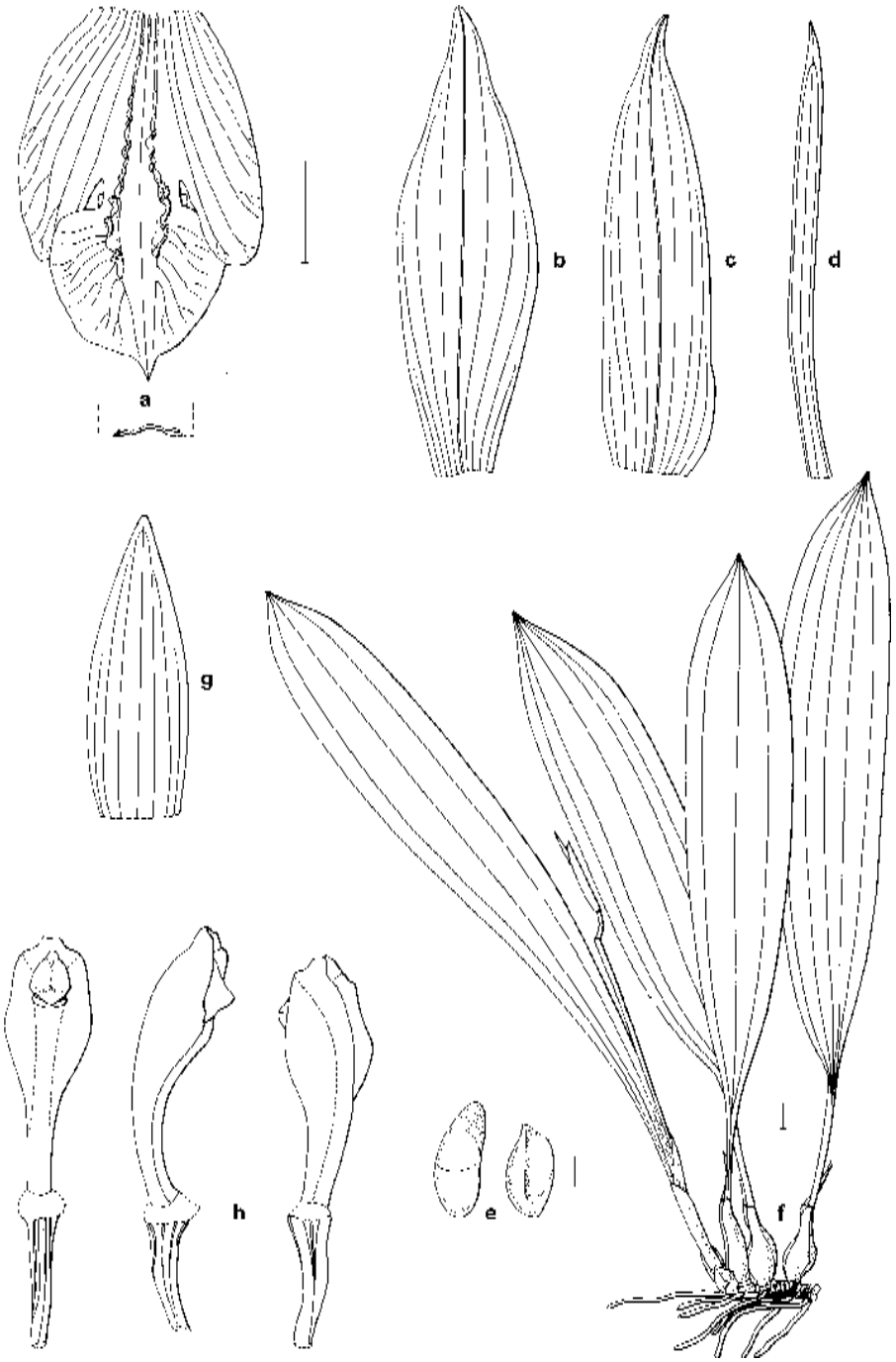
2. The epithet *susanae* refers to Sue Wickison, who collected the type specimen in New Georgia.

3. The species can be distinguished from *C. macdonaldii* by the obtuse sinus of the hypochile, orange/red brown keels and much larger flowers.

13. Coelogyne tiomanensis M.R. Hend. — Fig. 4.17, Map 4.5, Plate 4.5c

Coelogyne tiomanensis M.R. Hend., Gard. Bull. Straits Settlem. 5 (1930) 80; Holttum, Orchids of Malaya 3 (1964) 243; Seidenf. & J.J. Wood, Orchids of Penins. Malaysia and Singapore (1992) 205, f. 86c–d, pl. 12A. — Type: *SF (Henderson) 18397* (holo SING?, not found), Tioman Island, Mt Rokam.

Roots 1.7–2.7 mm diam., very long and tough. Rhizome 5–7.5 mm thick. Scale-covered part of the inflorescence-bearing young shoot 6.8–11 cm long. *Pseudobulbs* up to 3 cm apart, ovoid, flattened bilaterally, obtusely 4-angled when fresh, 2.2–5 cm long. *Leaves* one per pseudobulb. Petiole 3–6 cm long. Blade lanceolate, 21–32 by 3.2–6.5 cm; apex acuminate to cuspidate; main nerves 3–5. *Inflorescence* synanthous with the partially to entirely developed leaves, 2–10-flowered. Peduncle during flowering at the base enclosed by the petiole and scales of the young shoot, 11.5–20 cm long. Rhachis (sub)erect, zigzag, 1.1–10 cm long; internodes 9–15 mm long, slightly curved, hardly thickened. *Floral bracts* ovate-oblong, 23–30 by 8.5–11 mm, deciduous; apex acuminate; nerves 7–9. *Flowers* opening in succession, finely papillose. Pedicel c. 5 by 1–1.1 mm; ovary c. 6 by 1.1–1.5 mm. *Median sepal* lanceolate, 31–47 by 8–12 mm; apex acuminate; nerves 9, the midrib a rounded keel 0.2–0.7 mm high. *Lateral sepals* ovate-lanceolate, 24–43 by 6–11 mm; apex cuspidate; nerves 8 or 9, the midrib a rounded keel 0.2–0.6 mm high. *Petals* slightly recurved, 30–42 by 1.5–1.9 mm; apex cuspidate; nerves 3, midrib centric. *Lip* 24–37 by 16–22 mm, nerves 15–17. *Hypochile* when flattened 18–26 by 16–22 mm; base broadly attached over 5–12 mm; lateral lobes in front rounded, extending 3–9 mm in front and diverging, front margin at the base entire, with acute sinus; keels 2 or 3, starting at the base of the lip and there 0.2–1 mm high, all keels widened along the crest, plate-like, undulating, 1–2 mm high, with papillae but without hairs, the lateral keels parallel on the base of the hypochile, diverging towards the apex of the hypochile, converging again on the epichile, the median keel (if present) only developed in the upper quarter of the hypochile, lower than the lateral ones. *Epichile* convex, when flattened obrhomboid to obovate, 6–11 by 11–15 mm, with a broad, short claw 0.2–0.4 mm thick; base attached over 6–8 mm; apex acuminate, slightly raised, with an acute apex without warts; margin entire, recurved; sides pronounced as lateral lobes, without warts, centre 0.25–0.3 mm thick, margin 0.1–0.25 mm thick; keels 2, ending 4–9 mm from the apex of the epichile, on the claw identical with the keels on the hypochile, on the plate changing into a row of waving irregularly plate-like projections 1–2 mm high, with papillae but without hairs. *Column* 18–27 by 8–12 mm; hood with truncate apical margin, laterally notched where the wings are attached and with an additional notch above, the middle part rounded, slightly recurved. Anther broadly bell-shaped in outline, 3.5–6 by 3.5–5 mm, near the place of attachment with a little rounded projecting apex; apex without notch. Pollinia obliquely ellipsoid, 3–3.5 by 1.4–1.5 mm; caudicle 2.5–2.6 by 1.5–1.6 mm. *Stigma* 2.5–4 by 1.5–5 mm; margin apex slightly notched; rostellum 2.5–5 by 2–5 mm, with an obtuse apex without notch. *Fruit* body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36–38 by c. 14 mm; valvae keels 3–3.5 mm high; juga with a pronounced longitudinal ridge 2.5–3 mm high without incisions.

Distribution — Peninsular Malaysia (Tioman Island).

Habitat & Ecology — Epiphyte and lithophyte in mossy, montane dwarf forest. Altitude 600–1040 m. Flowering: May, August (not in cultivation).

Notes — 1. Sepals yellow to pale salmon, petals pale greenish to pale salmon. Lip side lobes white with brown veins; centre dark brown; edges light brown; side lobes paler with brown veins. Column greenish with two faint brown streaks below; hood reddish brown to orange. No smell.

2. The epithet *tiomanensis* refers to the island Tioman, where the type specimen was collected by Murray Ross Henderson.

3. The species is easily recognised by the dark brown lip and undulating, plate-like keels (Fig. 4.17a).

14. Coelogyne tommii Gravendeel & O'Byrne, *spec. nov.* — Fig. 4.18, Plate 4.1o, 4.5d

Herba epiphytica. Pseudobulbi monophylli, oblongi vel ovoidei, in vivo obtuso-angulati, 4.1–7.3 cm longi. Folia lanceolata, 20.5–25 cm longa, 4.3–5.2 cm lata, nervis 5. Inflorescentia erecta, proterantha, pauciflora (floribus 4 vel 5). Rhachis (sub)erecta, internodiis 17–18 mm longis. Florum bracteae ovate-oblongae, 24–26 mm longae, 12–14 mm latae, caducae, nervis 11–13. Flores fere simultanei expandent. Sepalum dorsale lanceolatum, 40–41 mm longum, 13–13.5 mm latum, nervis 9. Sepala lateralia obliqua, ovato-lanceolata, 37–39 mm longa, 10–11 mm lata, nervis 8 vel 9. Petala paulo recurvata, linearia, 36–38 mm longa, 3–3.5 mm lata, nervis 3 vel 5. Labellum immobile, cymbiforme, 3-lobatum, ubi applanatum panduratum, 33–35 mm longum, 24–26 mm latum, nervis 13 vel 15. Hypochile ubi applanatum 19–22 mm longum, 24–26 mm latum; lobi laterales erecti, antice acuti, 2.5–3 mm longi et aliquantum divergentes, sinu acuto; carinae 3 e basi labelli, 0.5–0.7 mm altae, alato-erectae, lamelliformes, crista irregulariter crenulata 1.5–2.5 mm alta, papillis 0.1–0.15 mm altis, in dimidio hypochilii mutata in projecturis prominentibus 1–1.2 mm altis, contractis, ramosis vel simplicibus, marginibus irregulariter crenulatis, papillis 0.1–0.15 mm altis, carinae medianae parallelae in hypochilii parte basali, distaliter paulo divergentes, epichilii in parte convergentes, carina intermedia exterioribus humilior et brevior. Epichile convexum, ubi applanatum obrhomboideum vel orbiculare, 13–14 mm longum, 18–18.5 mm latum; apex acutus verrucis 0.3–0.4 mm altis; margo irregulariter denticulata, recurvata, lateraliter lobata verrucis 0.25–0.3 mm altis; carinae 3–5, duae exteriores quam adsunt in epichilii parte quarta apicali evolutae, 10.5–11 mm infra epichilii apicem terminantes, duae medianae in epichilii dimidio apicali evolutae, 6–7.5 mm infra epichilii apicem terminantes, carina mediana quam adest in epichilii parte quarta basali, 12–13 mm infra epichilii apicem terminantes. — Typus: *Sing cult. s.n.* (holo K; iso L), unknown locality.

Coelogyne tomiensis O'Byrne, Malayan Orchid Rev. 29 (1995) 33, nom. invalid.

Roots 1.5–1.6 mm diam. Rhizome 8–8.5 mm thick. Scale-covered part of the inflorescence-bearing young shoot c. 4.9 cm long. *Pseudobulbs* up to 1.2 cm apart, oblongoid

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Fig. 4.17. *Coelogyne tiomanensis* M.R. Hend. a. Lip ornamentation with cross section of claw; b. median sepal; c. lateral sepal; d. petal; e. pollinia; f. habit (*Dunleavy 101*); g. floral bract [*SF (Henderson) 21668*]; h. column: front, lateral and rear view (*Dunleavy 101*). — Scale bars: 1 cm (a–d, f–h); 1 mm (e).

to ovoid, obtusely 4-angled when fresh, 4.1–7.3 cm long. *Leaves* one per pseudobulb. Petiole 2.5–3.5 cm long. Blade lanceolate, 20.5–25 by 4.3–5.2 cm; apex acuminate; main nerves 5. *Inflorescence* proteranthous, 4–5-flowered. Peduncle during flowering at the base enclosed by the scales of the young shoot, c. 6 cm long. Rhachis (sub)erect, zigzag, c. 3.8 cm long; internodes 17–18 mm long, slightly curved, hardly thickened. *Floral bracts* ovate-oblong, 24–26 by 12–14 mm, deciduous; apex acute; nerves 11–13. *Flowers* opening (almost) simultaneously. Pedicel 7–8 by 2.3–2.7 mm; ovary 10–11 by 3–4.5 mm. *Median sepal* lanceolate, 40–41 by 13–13.5 mm; apex retuse to acute; nerves 9, the midrib a rounded keel 0.7–0.75 mm high. *Lateral sepals* ovate-lanceolate, 37–39 by 10–11 mm; apex acute; nerves 8 or 9, the midrib a rounded keel 0.65–0.9 mm high. *Petals* slightly recurved, 36–38 by 3–3.5 mm; apex acute; nerves 3–5, midrib centric. *Lip* 33–35 by 24–26 mm, nerves 13–15. *Hypochile* when flattened 19–22 by 24–26 mm; base broadly attached over 8–10 mm, slightly saccate; lateral lobes in front rounded, extending 2.5–3 mm in front and slightly diverging, front margin at the base irregularly erose, with acute sinus; apex not saccate; keels 3, starting at the base of the lip and there 0.5–0.7 mm high, all keels widened along the crest, on the basal part of the hypochile raised, plate-like, with undulating and heavily fringed margin 1.5–2.5 mm high, with papillae 0.1–0.15 mm long, but without hairs, halfway along the hypochile changing into slender, tapering, either or not branched, irregularly shaped projections with undulating, irregular margin 1–1.2 mm high, with papillae 0.1–0.15 mm long, but without hairs, the three median keels parallel on the basal part of the hypochile, slightly diverging towards the apical part of the hypochile, converging again on the epichile, the most median keel lower than the lateral ones (Plate 4.1o). *Epichile* convex, when flattened obrhomboid to orbicular, 13–14 by 18–18.5 mm, with a broad, short claw 0.8–1.6 mm thick; base attached over 11–12 mm; apex acute, slightly raised, with an acute apex with warts 0.3–0.4 mm high; margin slightly erose, recurved; sides pronounced as lateral lobes, with warts 0.25–0.3 mm high, centre 0.3–0.35 mm thick, margin 0.15–0.2 mm thick; keels 3–5, on the claw and plate identical with the keels on the basal half of the hypochile, the outer two keels (if present) developed on the apical quarter of the epichile, ending 10.5–11 mm from the apex of the epichile, the median two keels developed on the apical half of the epichile, ending 6–7.5 mm from the apex of the epichile, the most median keel (if present on the epichile) developed on the basal quarter of the epichile, ending 12–13 mm from the apex of the epichile. *Column* 22–27 by 7.5–8 mm; hood with more or less truncate apical margin, irregularly dentate, laterally notched where the wings are attached, the middle part rounded, slightly recurved. Anther broadly bell-shaped in outline, 3.5–5.5 by 2.5–5 mm, near the place of attachment with a little rounded projecting apex; apex slightly notched. Pollinia obliquely ellipsoid, 2–2.5 by 1.2–1.5 mm; caudicle 1–1.5 by 1.5–1.6 mm. *Stigma* 2.5–3 by 3–3.5 mm; margin apex slightly notched; rostellum 3–4.5 by 3.5–4 mm, with an obtuse apex without notch. *Fruit* not seen.

Distribution — Unknown.

Habitat & Ecology — Flowering: April, October–December in greenhouse.

Notes — 1. Ovary yellowish green. Sepals and petals light green to creamy yellow, transparent. Lip light brown to rusty brown inside with red brown veins shimmering

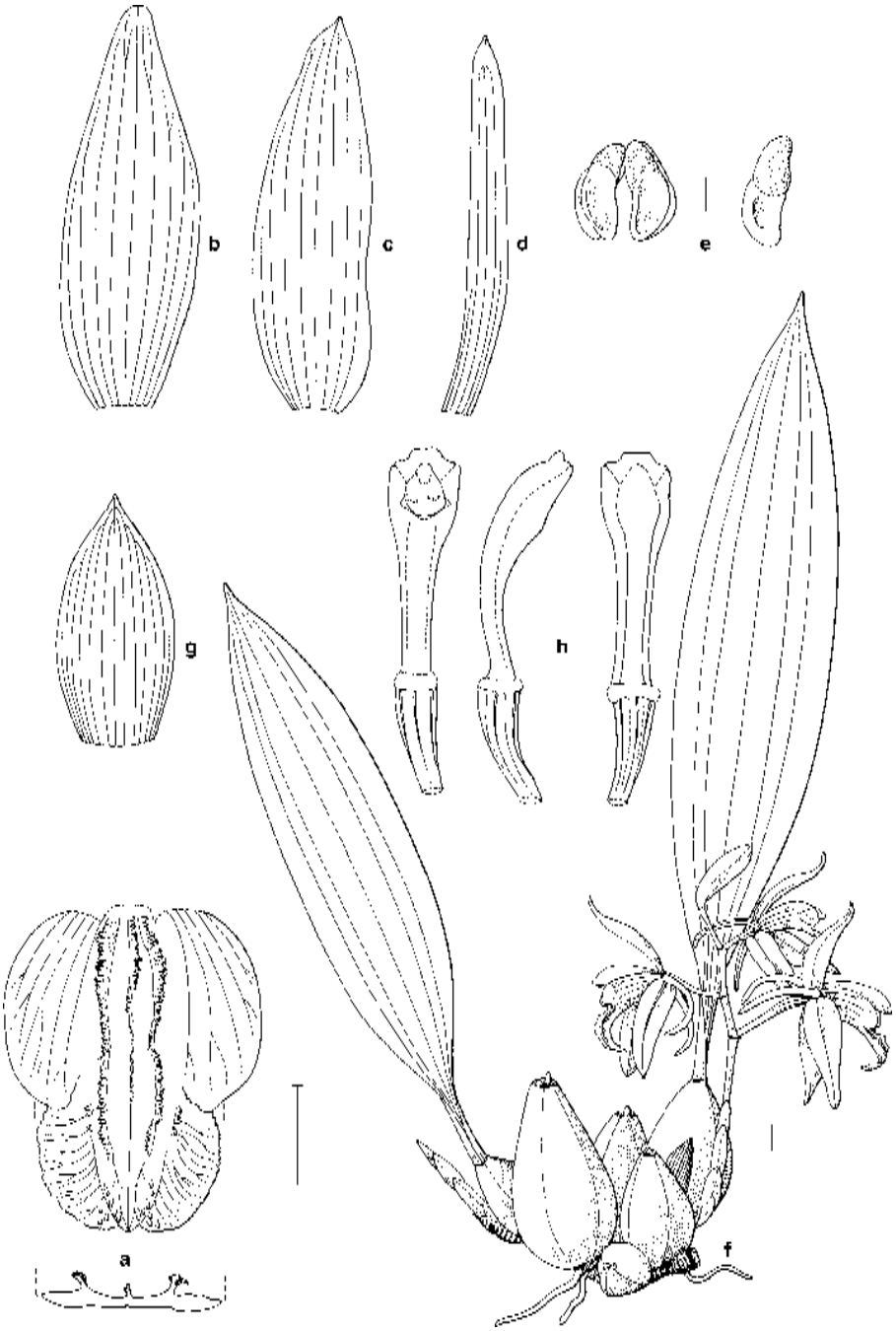
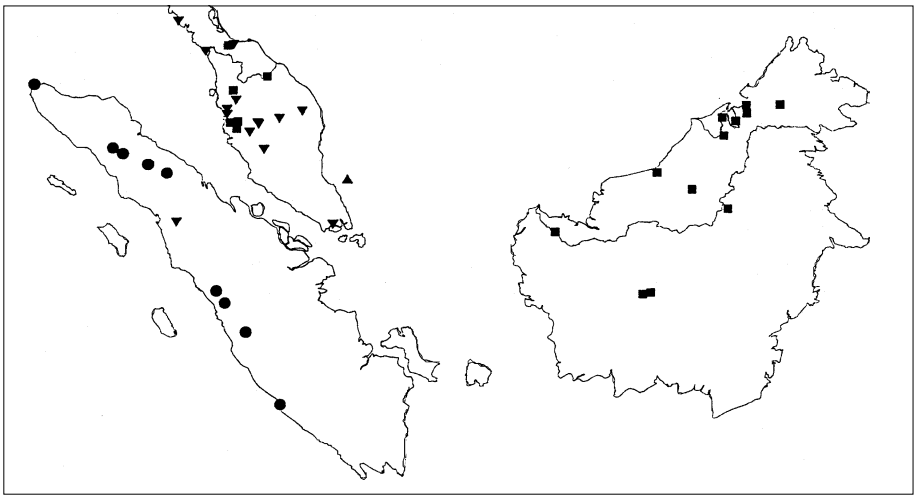


Fig. 4.18. *Coelogyne tommii* Gravendeel & O'Byrne. a. Lip ornamentation with cross section of claw; b. median sepal; c. lateral sepal; d. petal; e. pollinia; f. habit; g. floral bract; h. column: front, lateral and rear view [*Leiden cult. (Kebun Raya Bogor) 21526*]. — Scale bars: 1 cm (a–d, f–h); 1 mm (e).



Map 4.5. Distribution of *Coelogyne salmonicolor* Rchb.f. (l), *C. septemcostata* J. J. Sm. (n), *C. tiomanensis* M.R. Hend. (s), and *C. xyrekes* Lindl. (t).

through on the outside, midlobe light brown with creamy white apex, with 5 brown keels. Column creamy yellow to light green, front of stalk with 3 brown lines, its apex white, wings cream coloured. Anther and stigma pale yellow, pollinia bright yellow, rostellum light brown. Fragrant.

2. The former epithet *tomiensis* is changed to *tommii*, the proper orthographic form to commemorate Mr. Tommy Sng, who grew the plant from which the type collection was made in his garden in Singapore.

3. It is concluded that this species is not conspecific with *C. dichroantha* Gagnep. because the pseudobulbs have two leaves (instead of one) and the lip is completely rusty brown (instead of brown and cream) with 4 or 5 keels instead of only 3 as depicted in Eberhardt's picture of *C. dichroantha*.

4. The species is easily recognized by the proteranthous inflorescence and (nearly) simultaneously opening flowers with plate-like keels.

15. Coelogyne xyrekes Ridl. — Fig. 4.19, Map 4.5, Plate 4.1m, 4.5b

Coelogyne xyrekes Ridl., J. Fed. Malay States Mus. 6 (1915) 181; Fl. Malay Penins. 4 (1924) 134; Seidenf. & Smitinand, Orch. Thail. (1959) 109; Holttum, Orchids of Malaya 3 (1964) 243; Seidenf., Dansk Bot. Ark. 29, 4 (1975) 11, f. 2; Seidenf. & J.J. Wood, Orchids of Penins. Malaysia and Singapore (1992) 203, f. 86a–b. — Type: *Ridley 16282* (holo SING; iso K), Malay Peninsula, Pahang, Mt Tahan.

Coelogyne xanthoglossa Ridl., J. Fed. Malay States Mus. 6 (1915) 180; Fl. Malay Penins. 4 (1924) 134; Holttum, Orchids of Malaya 3 (1964) 243; Seidenf. & J.J. Wood, Orchids of Penins. Malaysia and Singapore (1992) 205. — Type: *Ridley s.n.* (holo K), Malay Peninsula, Pahang, Mt Tahan.

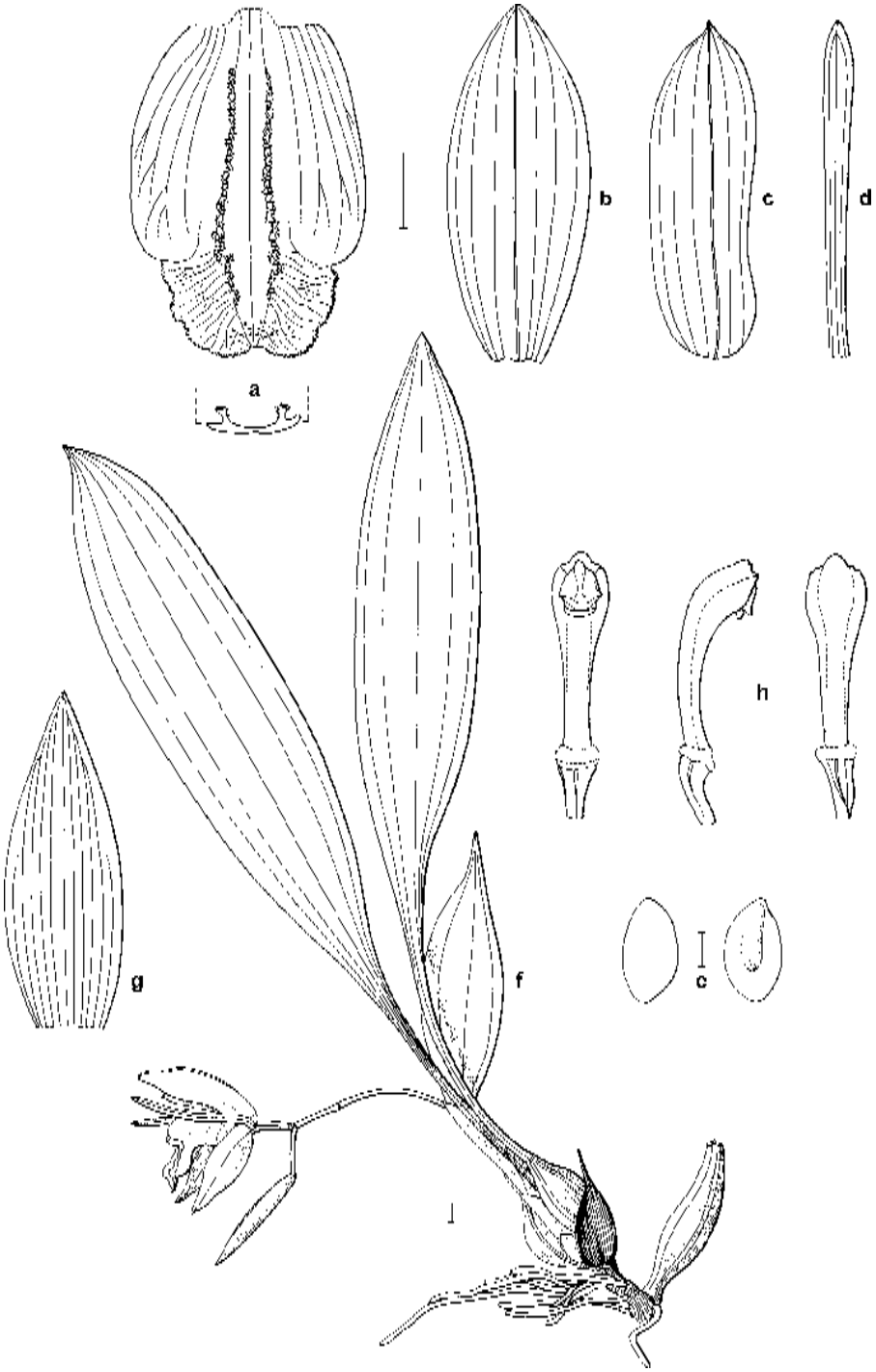
Roots 1.5–2.1 mm diam. Rhizome 5–8 mm thick. Scale-covered part of the inflorescence-bearing young shoot 6.5–9 cm long. *Pseudobulbs* up to 1.5 cm apart, oblongoid, not seen when fresh, distinctly 4-ridged when dried, 4–5.5 cm long. *Leaves* one per

pseudobulb. Petiole 3.5–9 cm long. Blade obovate-lanceolate, 20.5–36.5 by 4.1–9.2 cm; apex acuminate; main nerves 5. *Inflorescence* synanthous with the partially to entirely developed leaves, 2–4-flowered. Peduncle during flowering at the base enclosed by the petiole and scales of the young shoot, 7–15 cm long. Rhachis (sub)erect, zigzag, 1.8–5.8 cm long; internodes 16–22.5 mm long, slightly curved, hardly thickened. *Floral bracts* ovate-oblong, 29–56.5 by 9–18 mm, deciduous; apex acute; nerves 9–11. *Flowers* opening in succession. Pedicel 4.5–8 by 1.3–1.5 mm; ovary 6–11 by 2.5–4 mm. *Median sepal* ovate-oblong, 43–56 by 16–23.5 mm; apex acute; nerves 7–13, the midrib a rounded keel 0.9–1 mm high. *Lateral sepals* obovate-lanceolate, 41–59 by 14–16 mm; apex acute; nerves 6–10, the midrib a rounded keel 0.7–1.3 mm high. *Petals* slightly recurved, 42–55 by 2.3–3.5 mm; apex acute; nerves 3, midrib centric. *Lip* 36–49 by 29–44 mm, nerves 15–17. *Hypochile* when flattened 30–36 by 29–40 mm; base attached over 7–24 mm, slightly saccate; lateral lobes in front rounded, extending 3.5–5.5 mm in front and slightly diverging, front margin at the base irregularly erose, with acute sinus; apex slightly saccate; keels 2, starting at the base of the lip and there 0.5–1 mm high, widened along the crest, plate-like, undulating, cm long. Blade lanceolate, 15–18 by c. 4 cm; apex acute; main nerves 7. *Inflorescence* synanthous, 3-flowered. Peduncle during flowering at the base enclosed by the scales of the young shoot, c. 3.8 cm long. Rhachis curved, zigzag, c. 1.8 cm long; internodes c. 14 mm long, slightly curved, thickened. *Floral bracts* ovate-lanceolate, c. 25 mm long, persistent; apex acute; nerves not seen. *Flowers* opening in succession. Pedicel c. 10 by 1.5 mm; ovary not seen. *Median sepal* oblong, 2.5 by 1 cm; apex acute; nerves not seen. *Lateral sepals* falcate, 2.2 by 0.7 cm; apex acute; nerves not seen. *Petals* slightly recurved, 22–24 by 1 mm; apex acute; nerves not seen, midrib centric. *Lip* c. 18 by 13 mm, nerves not seen. *Hypochile* not seen when flattened; base not seen; lateral lobes in front acute, extending c. 1 mm in front and slightly diverging, front margin entire, with acute sinus; keels 3, plate-like with an interrupted margin, all keels starting at the base of the lip, continuing on the epichile, the median keel shorter than the lateral keels. *Epichile* convex, when flattened not seen, with a broad, short claw; apex subacute with an acute apex; margin entire, recurved; sides not pronounced as lateral lobes; keels 3, ending 8–11 mm from the apex of the epichile, on the claw and plate identical with the keels on the hypochile. *Column* hood with acute apical margin. Anther not seen. Pollinia not seen. *Stigma* not seen. *Fruit* not seen.

Distribution — Thailand, Peninsular Malaysia, Sumatra.

Habitat & Ecology — Epiphyte in (montane) rain forest. Altitude 700–1900 m. Flowering: February–December (February–March in greenhouse).

Notes — 1. Sepals and petals brownish salmon tinged olive on the outside, transparent. Lip pale salmon, heavily reticulated with dark brown inside, keels blackish brown, outside greyish salmon. Column cream coloured tinged salmon, anther greenish yellow. Ovary and pedicel olive brown. No smell. 2. The epithet *xyrekes* (which is Greek for smooth, clean-shaven) refers to the absence of long hairs on the keels, in contrast with *C. speciosa* (according to Ridley a closely related species), which has keels with relatively long hairs. 3. The vegetative parts and the keels of the (immature) flower of the type specimen of *C. xanthoglossa* match very well with *C. xyrekes*. Therefore it is concluded that these names must be synonyms. 4. The species is easily recognized by the purple colour of the young leaves and undulating, plate-like keels on the lip with long papillae (Fig. 15a).


a
b
c
d
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INSUFFICIENTLY KNOWN SPECIES

16. Coelogyne dichroantha Gagnep. — Plate 4.5a

Coelogyne dichroantha Gagnep., Bull. Mus. Hist. Nat. (Paris) 2, 22, 4 (1950) 506; Notul. Syst. (Paris) 14, 2 (1951) 122; Seidenf., Contr. Orch. Fl. of Cambodia, Laos and Vietnam (1975) 32; Aver., Prelim. List of Vietn. Orchids 1 (1988) 89; Vasc. Plants Syn. Vietn. Flora 1 (1990) 55; Seidenf., Opera Bot. (1992) 114, pl. 7A. — Type: An unnumbered watercolour by Eberhardt (holo P).

Roots 1–1.8 mm diam. Rhizome 5–6 mm thick. Scale-covered part of the inflorescence-bearing young shoot c. 3.7 mm long. *Pseudobulbs* up to 1.2 cm apart, oblongoid, obtusely 4-angled when fresh, c. 5 cm long. *Leaves* two per pseudobulb. Petiole c. 1.5 cm long. Blade lanceolate, 15–18 by c. 4 cm; apex acute; main nerves 7. *Inflorescence* synanthous, 3-flowered. Peduncle during flowering at the base enclosed by the scales of the young shoot, c. 3.8 cm long. Rhachis curved, zigzag, c. 1.8 cm long; internodes c. 14 mm long, slightly curved, thickened. *Floral bracts* ovate-lanceolate, c. 25 mm long, persistent; apex acute; nerves not seen. *Flowers* opening in succession. Pedicel c. 10 by 1.5 mm; ovary not seen. *Median sepal* oblong, 2.5 by 1 cm; apex acute; nerves not seen. *Lateral sepals* falcate, 2.2 by 0.7 cm; apex acute; nerves not seen. *Petals* slightly recurved, 22–24 by 1 mm; apex acute; nerves not seen, midrib centric. *Lip* c. 18 by 13 mm, nerves not seen. *Hypochile* not seen when flattened; base not seen; lateral lobes in front acute, extending c. 1 mm in front and slightly diverging, front margin entire, with acute sinus; keels 3, plate-like with an interrupted margin, all keels starting at the base of the lip, continuing on the epichile, the median keel shorter than the lateral keels. *Epichile* convex, when flattened not seen, with a broad, short claw; apex subacute with an acute apex; margin entire, recurved; sides not pronounced as lateral lobes; keels 3, ending 8–11 mm from the apex of the epichile, on the claw and plate identical with the keels on the hypochile. *Column* hood with acute apical margin. Anther not seen. Pollinia not seen. *Stigma* not seen. *Fruit* not seen.

Distribution — Vietnam.

Habitat & Ecology — Unknown.

Notes — 1. Sepals and petals light green. Lip light green outside, white inside, with yellowish purple margin and yellowish keels.

2. The epithet *dichroantha* refers to the two colours (yellowish green and brown) of the flowers.

3. The description above is based on the type collection (a watercolour) and the type description. Sterile bracts at the base of the peduncle or rhachis are lacking and the plant has few, large flowers, which suggests its position in sect. *Speciosae*. The exact details of the keels are not clearly visible on the aquarelle, however, hence it is doubtful whether the species really belongs to this section.

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Fig. 4.19. *Coelogyne xyrekes* Ridl. a. Lip ornamentation with cross section of claw; b. median sepal; c. lateral sepal; d. petal; e. pollinia [*Leiden cult. (De Vogel) 28024*]; f. habit [*SF (Henderson) 17701, (Sinclair & Kiah) 38722*]; g. floral bract (*Hislop* ?-7-1952); h. column: front, lateral and rear view [*Leiden cult. (De Vogel) 28024*]. — Scale bars: 1 cm (a–d, f–h); 1 mm (e).

EXCLUDED SPECIES

17. *Coelogyne eberhardtii* Gagnep., Bull. Mus. Hist. Nat. (Paris) 2, 2, 1 (1930) 423; Fl. Indo-Chine 6 (1934) 311, f. 27; Notul. Syst. (Paris) 14, 2 (1951) 122; Seidenf., Contr. Orch. Fl. of Cambodia, Laos and Vietnam (1975) 32, f. 6; Aver., Prelimin. List of Vietn. Orchids 1 (1988) 90; Vasc. Plants Syn. Vietn. Flora 1 (1990) 55; Seidenf., Orchids of Indochina (1992) 109, pl. 7A. — Type: *Eberhardt 1887* (holo P), Vietnam, Langbian.

Note — The molecular phylogeny of *Coelogyne* constructed in chapter 2 indicates that *C. eberhardtii* is clearly separated from the species of sect. *Speciosae* sampled. Hysteranthous inflorescences, yellowish white coloured flowers and shining green pseudobulbs are not present in sect. *Speciosae*, hence it is concluded that this species does not belong to this section. According to the molecular phylogeny constructed in chapter 2, *C. eberhardtii* is closer related to *C. miniata* (subgenus *Hologyne*), *C. barbata* (sect. *Elatae*) and *C. cristata* (sect. *Coelogyne*), which also have hysteranthous inflorescences, yellowish white coloured flowers and/or shining green pseudobulbs.

18. *Coelogyne lawrenceana* Rolfe, Gard. Chron. 1 (1905) 227; Bot. Mag. 4, 3 (1907) 8164; Ridl., J. Nat. Hist. Soc. Siam 4, 3 (1921) 117; Gagnep., Fl. Indo-Chine (1934) 314; Notul. Syst. (Paris) 14, 2 (1951) 123; Guillaumin, Bull. Mus. Hist. Nat. (Paris) 2, 28, 5 (1956) 488; Seidenf., Contr. Orch. Fl. of Cambodia, Laos and Vietnam (1975) 33; Aver., Prelimin. List of Vietn. Orchids 1 (1988) 91; Vasc. Plants Syn. Vietn. Flora 1 (1990) 56. — Type: *Micholitz s.n.* (holo not found), Vietnam, Annam.

Coelogyne fleuryi Gagnep., Bull. Mus. Hist. Nat. (Paris) 2, 2, 1 (1930) 424; Fl. Indo-Chine (1934) 314. — Syntypes: *Poilane 5975* (NY, P), *Chevallier 30900* (P), Vietnam, Annam.

Note — Hysteranthous inflorescences, yellowish white coloured flowers and shining green, smooth pseudobulbs are not present in other species of sect. *Speciosae*, hence it is concluded that this species does not belong to this section. We assume *C. lawrenceana* to be closely related to *C. eberhardtii*, and therefore exclude this species from sect. *Speciosae*, too.

ACKNOWLEDGEMENTS

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IDENTIFICATION LIST

Dates are used if the number of the collection is unknown. If only the year is known, it is placed between brackets.

A series (Cuadra) 1429: 10; (Kadir) 2059: 10 — Aarhus cult. 32839: 10 — Afriastini 2007: 3; 2455: 15 — d'Alleizette ?/6/1909: 18 — Amsterdam cult. (De Vogel) 794597 A: 2; 794597 B: 2; 794617 B: 2; 794643: 2; 794942: 2; 795175: 3; 795178: 3; 795178 B: 3; 795180 A: 3; 795286 A: 3; 795540: 3 — Anderson 322: 5 — Averyanow 0/135 LE (colour photo): 17.

Barcock 400: 15 — Barnes ?/10/1900: 15 — Batten Pooll (1939): 15; ?/11/1939: 15 — Beauverd cult. 29/9/1903: 1; 30/8/1911: 1 — Beccari 1869: 10; 10329: 1 — Bergman 534: 4; 589: 4 — Berlin cult. (Schwerdtfeger) 18270: 3; 25094: 3 — Blume ?/1/1822: 11a — Boden Kloss 3/8/1912: 1; 7/11/1913: 1; ?/4/1918: 18 — Bogor cult. 34: 8; 35: 10; 36: 11b; 40: 9; 42: 8; 43: 8; 44: 10; 45: 10; B 57: 8; 62: 9; 65: 11b; 78: 10; 108: 11b; (Rachmat) 124: 2; 145: 11b; 154: 1; 155: 1; 156: 1; (Jacobson) C 220: 9; 992-XI-311: 11b — Bowden (via Anonymous 3) 20/7/1976: 7 — Brass 3397: 12; 5211: 2; 5241: 4; 13225: 2; 24914: 1; 24915: 2; 32057: 4 — Bregulla 11: 7; 116: 7 — Bruges 1914: 11a — BSIP series (Dennis) 4637: 2 — Bünnemeijer 1094: 11b; 3327: 11b; 9048: 9 — Buysman 22: 11a.

Cabalion 451: 6 — Canberra cult. (Taylor) 437: 4 — Carr 77: 15; 2109: 9; 10160: 1; 10212: 4 — Castle-Smith 13: 10 — Chadim K 3: 1; 156: 4 — Cheesman 82: 4; 1414: 1 — Chevalier 30900: 18 — Church, Mahyar & Afriastini 1974: 10 — Clayton cult. (1996): 8 — Clemens 1278: 1; 1654: 1 — Clements 5942: 1; 6440 A: 2; 6440 B: 1; 6486: 4; 6658: 1; 6669: 2; 6845: 2 — Comber 1465: 11a — Coode 6487: 10 — Cox 211: 6 — Craven 206: 12 — Cribb 1922: 12 — Cribb & Wheatley 48: 7 — Cruttwell 110: 4; 3185: 12.

De la Rue 15/9/1936: 7 — De Vogel 5781: 2; 7735: 11c — De Wilde & De Wilde-Duyfjes 13016: 15; 13391: 15; 14709: 15; 15579: 11b; 15767: 11c; 19056: 9 — Degener 14761: 7 — Dennis 3/10/1983: 12; ?/8/1987: 1 — Dickson 18: 2; MD 104: 8; MD 129: 8; 181: 8; MD 237: 8 — Docters van Leeuwen 10460: 1; 10779: 1 — Doleschall 90: 8; II 142: 8 — Dolman 28206: 15 — Dransfield 889: 15 — Dunleavy 101: 13.

Eberhardt 1887: 17 — Everett (1893): 10.

Fleischer ?/11/1910: 11c — Forbes 24: 2; 388: 2 — Franck 1194: 15.

Gjellerup 1084: 1 — Glasnevin cult. ?/10/1904: 1; 9/10/1954: 8 — Grimes 1063: 3; 1198: 3 — Gulliver cult. (1893): 1.

Haegens et al. 524: 10 — Hansen 367: 10 — Haywood ?/8/1896: 1 — Henderson 11131: 15; 25097: 10 — Himson 4/7/1956: 4 — Hislop ?/7/1952: 15 — Hoock ?/11/1974: 6 — Hoogland & Pullen 6180: 4; 6222: 4 — Hunt 2202: 2; 2205: 12; 2250: 12 — Hutton 31/12/1864: 8.

Im Thurn 310: 7.

Jacobson cult. (Groeneveldt) 224: 9; 262: 9 — Jacquet 627: 18 — Johansson 141: 3.

Kalkman 4425: 4 — Kanehira 110: 5; 1949: 5 — Kaudern 133: 2 — Kerr 536: 15; 572: 15; 710: 15; 798: 15; ?/4/1928: 15; 28/4/1930: 15 — Kew cult. A 190: 8; (Seimund) 334-14: 15; 19748: 4; 46147: 1 — Keysser 3: 4 — King's collector 6348: 15 — Koorders 31766 B: 11a — Kornassi 48: 8 — Kostermans 6315: 11a — Krebb 26/3/1930: 15.

LAE series (Foreman & Vinas) 60084: 4; (Croft) 65600: 2 — Lahaie 974: 8 — Lamb 491/85: 10; ?/4/1981: 10 — Larsen & Larsen 32839: 10 — Larsen et al. 42440: 10 — Latif 202: 11b — Lecoufle 29/5/1974: 4 — Leiden cult. (De Vogel) 5563: 3; 19930: 11a; 19959: 3; 20202: 3; 20216: 3; 21099: 3; 21524: 8; (Kebun Raya Bogor) 21526: 14; (De Vogel) 21536: 11a; 21537: 8; (Woods) 21654: 4; 22054: 4; 22059: 1; (De Vogel) 22088: 2; (Woods) 22089: 4; 22093: 4; 22098: 4; 22099: 4; 22101: 4; 22278: 2; (Reeve) 22284: 1; (De Vogel) 22911: 11a; (Nooteboom) 23171: 10; 23184: 10; 23187: 10; (De Vogel) 24393: 9; 24504: 8; 24505: 8; 25246: 11c; 25248: 11c; 25343: 11c; (De Vogel & Vermeulen) 25441: 11c; (De Vogel) 25670: 4; (Cribb & Morrisson) 25836: 7; (De Vogel) 27088: 11a; 27369: 3; 28002: 9; 28024: 15; 30707: 4; 30714: 2; 30720: 4; 30725: 2; (Schuiteman, Mulder & Vogel) 31464: 4; 31508: 4; 31578: 4; 31598: 4; 31874: 4; 31883: 1; 31892: 4; 31899: 4; 31909: 4; 32078: 1; 32214: 1; 32226: 1; 32230: 1; 32268: 4; 32273: 4; 32284: 1; 32313: 4; 32320: 4; 32389: 4; (De Vogel) 911339: 11a; 911353: 11a; (Mulder) 913070: 6; 913112: 6; (De Vogel) 913188: 10; 913265: 10; 914325: 6; 940790: 11c; 950057: 3;

950058: 11c; (Van Balgooy) 960143: 10; (Roelfsema, Vogel & Van Balgooy) 960160: 15; (De Vogel) 960608: 11c; 970730: 11a; (Vogel, Schuiteman & Roelfsema) 980282: 10 — Lever 22/10/1936: 12 — Lewis & McDonagh 37: 6.

Maclennan 36: 2; 37: 1 — Mansfeld 201: 6; 1964: 6; 2298: 6 — Mason cult. 1: 4; 3: 4; 61: 4; 1720: 1 — McKee 32188: 6; 32602: 6; 43566: 6 — Meijer 9797: 2 — Milliken 1515: 2 — Morat 5421: 6; 6442: 6 — Morrison 1754: 7; 30/6/1896: 6 — Müller 4: 9.

Native collector 837: 4 — NGF series (Womersley & Kazakof) 7928: 2; (Womersley) 11728: 4; (Millar) 11765: 2; (Sayers) 21299: 4; (Millar) 22665: 2; 22773: 4; 23326: 1; 23400: 1; 23543: 2; (Sayers) 24214: 1; (Womersley) 24869: 7; (Streimann) 30926: 4; (Isles & Vinas) 33886: 2; (Katik & Taho) 37957: 2; (Ridsdale & Katik) 38053: 12; (Millar) 38405: 12; 40996: 4; (Croft & Vinas) 41357: 2; (Isgar & Galore) 41539: 4; (Kairo) 45060: 2; (Streimann & Kairo) 45262: 4; (Millar) ?/12/1955: 1 — Nooteboom 5249: 8; 5300: 8.

O'Byrne Sum 010.C: 9; C.X.010: 14 — Orolfo 6289: 10.

Pierrière cult. 21/8/1901: 1; 2/10/1913: 1 — Poilane 5975: 18; 22036: 18 — Polak 978: 1 — Powell 254: 6 — Pridgeon 4/6/1978: 2 — Pulle 242: 1.

Rahmat Si Boeea 10225: 9; 10455: 15; 10490: 15; 10619: 15; 11034: 15 — Raulerson 13243: 5 — Raynal 15988: 7 — Rees & Reeve 356: 1 — Reeve 668: 2; 818: 2; 821: 4; 1609: 4; 5187: 1; 5376: 1; 5691: 1 — Ridley 5198: 15; 13840: 15; 16282: 15; 138200: 15; ?/3/1889: 15; (1891): 10; ?/8/1891: 10; (1904): 15; ?/7/1911: 15; ?/3/1915: 10 — Rinehart LR 7689: 5 — Robinson 7: 8 — Robinson & Kloss 18/5/1914: 11b; 11/6/1914: 11b — Rothschild cult. 21/8/1916: 1 — RSNH series (Green) 1131: 6; 1345: 7; (Hallé) 6420: 6; (Raynal) 16323: 7 — Rutten 48: 8; 311: 8; W 1562: 8; 1793: 8.

S series (Haron) 21103: 10; (Luang) 21763: 10; (Primack) 43344: 10 — SAN series (Leopold & Dewol) 60239: 10; (Sigin, Ismail et al.) 60264: 10; (Mansus, Gambio & Tuyuk) 109235: 10 — Sander & Co. cult. 6/6/1895: 2; ?/8/1895: 7; 22/8/1901: 8; 19/10/1901: 8 — Schlechter 14323: 1; 15922: 11b; 16560: 1; 18083: 4; 18216: 4; 19110: 1 — Schmutz 5857: 11a; 6039: 11a — SF series (Burkill & Holttum) 8512: 15; (Henderson) 17701: 15; 18263: 13; (Nur) 20051: 10; (Hanif) 21067: 10; (Henderson) 21668: 13; (Symington) 24342: 15; (Moysey & Kiah) 33920: 15; (Sinclair & Kiah) 38722: 15 — Shah, Samsuri & Shukor MS 3512: 10 — Sidek bin Kiah S.287: 10 — Sigalis C.R.S.T. 192: 18 — Simmonds 30/10/1951: 6; 20/10/1952: 7; 7/10/1956: 6 — Singapore cult. (Pereira) (1896): 8; (Burkill) ?/4/1924: 15 — Sitanala 11211: 1 — Slade ?/1/1981: 1 — Smith 005: 3; 247: 11a — SMV 90-578: 1 — Suprin 369: 6.

TGH series (Hartley) 13171: 4 — Thomsen 891: 1 — Toxopeus 4: 8; 453: 8.

Van Balgooy 4674: 8 — Van Royen 11476: 4 — Van Steenis 9930: 9 — Van Vuuren 124: 2 — Veillon 2430: 7; 2685: 6 — Veitch (Curtis) 410: 9; cult. ?/11/1886: 11c; cult. ?/9/1889: 11c.

Webb (1838): 8 — Wheatley 77: 6; 108: 7; 410: 7 — Whistler W 1400: 6; W 2612: 6; 11/1/1994: 6 — Whitmee ?/3/1878: 6 — Wickison 40: 12 — Wigams cult. ?/8/1899: 1 — Woods 136: 4 — Wray Jr. 955: 15; ?/3/1892: 10.

Ziesing 262: 6 — Zollinger 2940: 11a.

INDEX

Accepted species are in roman type, new species and combinations in **bold** and synonyms, excluded and insufficiently known species in *italics*. Numbers refer to the species number as used in this revision.