

REVISION OF THE ORCHID GENERA *CHRYSOGLOSSUM*, *COLLABIUM*, *DIGLYPHOSA*, AND *PILOPHYLLUM* (SUBTRIBE *COLLABIINAE*)

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(Drawings by M. Nakajima and A. Schuiteman)

SUMMARY

This article contains a taxonomic revision of four orchid genera of the subtribe *Collabiinae*: *Chrysoglossum* (4 species), *Collabium* (11 species), *Diglyphosa* (2 species), and *Pilophyllum* (1 species). Three species are described as new: *Chrysoglossum ensigerum*, *Collabium acuticalcar* and *Collabium carinatum*. *Chrysoglossum halbergii*, *Ch. maculatum*, *Ch. gibbsiae*, and *Ch. cyrtopetalum* are reduced to *Chrysoglossum ornatum*. *Diglyphosa macrophyllum*, *D. celebica* and *D. elmeri* are reduced to *Diglyphosa latifolia*. Keys to the genera and species are given. Synonymy, descriptions, colour notes, distribution, habitat notes, and detailed illustrations are given for the genera and species.

INTRODUCTION

This revision deals with 4 closely related orchid genera: *Chrysoglossum*, *Collabium* and *Diglyphosa* (all established by Blume, 1825), and *Pilophyllum* (established by Schlechter, 1914). Most species of these genera are terrestrial; few specimens are recorded to be epiphytes but they probably grow on bases of trees or logs close to the ground. These genera have several characters in common, like a creeping sympodium of which the individual shoots are terminated by a pseudobulb consisting of a single internode. Two types of pseudobulbs are present on a plant: relatively large leaf-bearing ones and small inflorescence-bearing pseudobulbs. Leaf-bearing pseudobulbs normally carry a single leaf (exceptionally two leaves are present). One or several of these leaf-bearing pseudobulbs alternate with one inflorescence-bearing pseudobulb. The latter is in many cases hard to distinguish from the scape, which has often confused earlier investigators who described the inflorescence as lateral. Other features these plants have in common are the possession of a clearly 2-celled anther and 2 pollinia, which are waxy, free, and without appendages. The structure of the flowers in these four genera is quite different and they can easily be distinguished.

The systematic position of this group has given rise to some discussion. Blume (1825) placed *Chrysoglossum* (2 species) and *Diglyphosa* (1 species) close together. According to his key, the base of the lip and the column form a spur or sac and the plants possess two free pollinia. *Collabium* (1 species), which according to the key has the lip attached to the lateral sepals and also has two free pollinia, was placed far apart. Lindley (1831) classified the two genera in different subtribes of the tribe Malaxideae: *Chrysoglossum* (l.c.: 13) in the Pleurothalleae, *Diglyphosa* (l.c.: 62) in the Dendrobieae, while *Collabium* (l.c.: 96) was placed in the tribe Epidendreae. Lindley based this opinion entirely on Blume's descriptions which are very terse; he did not have access to Blume's plants. Bentham & Hooker (1883) placed *Collabium* and *Chrysoglossum* (including *Diglyphosa*) close together. This inclusion of *Diglyphosa* in *Chrysoglossum* was at first followed by King & Pantling (1894)

who described a new species, *Chrysoglossum macrophyllum*, but already in 1898 they re-established *Diglyphosa* to which they transferred this species. Since then all authors have kept *Chrysoglossum* and *Diglyphosa* separate. In 1888 Pfitzer introduced the name *Collabiinae* for the group of orchids formed by *Chrysoglossum*, *Collabium* and *Diglyphosa*, together with *Nephelaphyllum*. In 1890 Hooker included *Chrysoglossum* in the subtribe Dendrobieae. He described three new species, *Ch. assamicum*, *Ch. erraticum*, and *Ch. maculatum*; the latter two are here regarded as synonyms of *Chrysoglossum ornatum*. The only species he listed under *Collabium* was *C. wrayi*, which, however, is *Thecostele alata*. In 1891 Hooker suggested that the genus *Collabium* might be placed in the Vandaeae close to *Eulophia*.

J.J. Smith (1905) maintained Pfitzer's Collabiinae, with *Chrysoglossum* (including *Collabium*), *Diglyphosa* and *Nephelaphyllum*, and also included *Tainia* in this group. He considered this subtribe to be close to the Coelogyninae and the Phajinae (now called Bletiinae). Schlechter (1911) kept *Chrysoglossum* and *Collabium* apart. J.J. Smith maintained a fusion of the two genera, proposing in 1912 a division of *Chrysoglossum* into three sections: sect. *Euchrysoglossum*, sect. *Collabium* and sect. *Discoglossum*, the latter with one species, *Ch. villosum*. This latter species was by Schlechter (1914) transferred to his new genus *Pilophyllum*. Schlechter later revised his system of orchid classification (published posthumously in 1926), but regarding the Collabiinae he maintained his viewpoint from 1914, placing this subtribe close to the Bletiinae.

Dressler and Dodson presented in 1960 a new classification of the orchids, pointing out that they wanted to create a system based on resemblances instead of differences. Except for not separating Epidendreae from Vandaeae, they stayed close to Schlechter's system. They retained subtribe *Collabiinae* which included *Chrysoglossum*, *Collabium*, *Diglyphosa* and *Pilophyllum*, together with *Tainia*, *Nephelaphyllum*, *Mischobulbum*, and *Hancockia*. They pointed out (l.c.: 51) that the subtribe was related to the Bletiinae (mainly through *Tainia* and *Nephelaphyllum*) on one side, and to the Cyrtopodiinae (through *Chrysoglossum*, *Collabium*, *Diglyphosa* and *Pilophyllum*) on the other side. This viewpoint was elaborated by Dressler (1981). In his new system he placed *Chrysoglossum* and *Diglyphosa* within the subtribe Cyrtopodiinae, tribe Cymbidieae, subfamily Vandoideae. *Collabium* and *Pilophyllum* do not feature in his classification; perhaps Dressler accepted J.J. Smith's viewpoint and included the latter two genera in *Chrysoglossum*, although he nowhere specifically stated so. *Tainia* and related genera were included by him in the subtribe Bletiinae, tribe Arethuseae, subfamily Epidendroideae. Dressler's tribe Cymbidieae contains all vandoid orchids with 2 pollinia except the Vandaeae. He himself pointed out the weakness of the system, which ignored the possible reduction of 4 to 2 pollinia, and thus does not take in account possible natural relationships. His Cyrtopodiinae are, amongst others, characterized by (Dressler, 1981: 254): an anther with reduced partitions, and 2 pollinia, notched or cleft, with viscidium and usually with stipe. *Chrysoglossum*, *Collabium*, *Diglyphosa*, and *Pilophyllum* are deviating because they have a perfectly 2-celled anther and 2 entire pollinia without stipe or viscidium. In his most recent classification Dressler (1993) did not alter his position regarding *Tainia* and its most nearly related genera. However, he now places the three genera *Chrysoglossum* (in which he includes *Pilophyllum*), *Collabium* and *Diglyphosa* together in the subtribe Collabiinae. To express his uncertainty about the systematic position of the Collabiinae, he relegates it to an assemblage entitled "Misfits and Leftovers" (1993: 212).

Senghas (1984) follows Schlechter (1914) in recognizing the subtribe Collabiinae, comprising *Chrysoglossum*, *Collabium*, *Diglyphosa*, *Pilophyllum* together with *Hancockia*, *Mischobulbum*, *Nephelaphyllum* and *Tainia*.

In this revision the classification by Schlechter/Senghas is followed. *Hancockia*, *Mischobulbum*, *Tainia* and *Nephelaphyllum* resemble *Chrysoglossum* and *Collabium* in their vegetative architecture, although their floral structure is different and they have 8 pollinia. They are probably closer related to each other than to the other genera in the subtribe.

The different number of pollinia is not necessarily an obstacle to a close relationship of these genera, as reduction or duplication of pollinia is more often observed, even within genera (e.g. *Bulbophyllum*). Placing the Collabiinae close to the Bletiinae, as Dressler and Dodson did in 1960, is more in agreement with the floral structure of this latter group, which is comparable with among others *Tainia*, although the plants differ vegetatively.

REFERENCES

- Bentham, G. & J.D. Hooker. 1883. *Genera Plantarum* 3. London.
- Blume, C.L. 1825. *Bijdragen tot de Flora van Nederlandsch Indië*. Batavia.
- Blume, C.L. 1825. *Tabellen en Platen voor de Javaansche Orchideën*. Batavia.
- Dressler, R.L. 1981. *The Orchids: natural history and classification*. Harvard Univ. Press, Cambridge, Mass. & London.
- Dressler, R.L. 1993. *Phylogeny and classification of the orchid family*. Cambridge Univ. Press / Dioscorides Press, Cambridge & Melbourne.
- Dressler, R.L. & C.H. Dodson. 1960. Classification and phylogeny in the Orchidaceae. *Ann. Missouri Bot. Gard.* 47: 25-68.
- Hooker, J.D. 1890. *Flora of British India* 5. London.
- Hooker, J.D. 1891. *Icones Plantarum*: 2065.
- King, G. & R. Pantling. 1894. On some new orchids from Sikkim. *J. As. Soc. Beng.* 63, 2: 329-344.
- King, G. & R. Pantling. 1898. The orchids of the Sikkim Himalaya. *Ann. Roy. Bot. Gard. Calc.* 8.
- Lindley, J. 1830-1840. *The genera and species of orchidaceous plants*. London.
- Pfitzer, E. 1889. Orchidaceae, Monandrae-Polystachyinae. In: A. Engler & K. Prantl, *Die natürlichen Pflanzenfamilien* II, 6. Leipzig.
- Schlechter, R. 1911. Die Orchidaceen von Deutsch Neu-Guinea. Collabiinae. In: *Fedde, Rep.*, Beih. 1: 96-101.
- Schlechter, R. 1914. Die Orchideen, ed. 1. Collabiinae: 128-132.
- Schlechter, R. 1926. Das System der Orchidaceen. *Notizbl. Bot. Gart. Berl.-Dahl.* 9, 88: 563-591.
- Senghas, K. 1984. Subtribus Collabiinae. In: R. Schlechter, *Die Orchideen*, ed. 3, 1/A: 839-856.
- Smith, J.J. 1905. *Die Orchideen von Java*. Leiden.
- Smith, J.J. 1912. Die Gruppe der Collabiinae. *Bull. Jard. Bot. Buitenzorg* II, 8: 1-6.

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The areas visited for these studies are:

- Borneo: Sarawak (Bahagian Kuching, Kapit)
 Brunei (Belait, Tutong and Temburong District)
 Sabah (Bahagian Pantai Barat, Pedalaman)
 Celebes: Sulawesi Utara, Sulawesi Tengah, Sulawesi Selatan
 Java: Jawa Barat
 Sumatra: Sumatera Barat, Sumatera Utara

KEY TO THE GENERA OF THE COLLABIINAE

- 1a. Pollinia 2, free. Anther 2-celled 2
- b. Pollinia 8, connected in pairs by strands of adhesive matter. Anther imperfectly 4- or 8-celled 5
- 2a. Plant densely covered with yellowish brown hairs. Flowers not resupinate **4. Pilophyllum**
- b. Plant glabrous. Flowers resupinate 3
- 3a. Foot of the column simple, without spur. Lip without a distinct claw; either slightly pandurate without lateral lobes or with distinct lateral lobes at the base of the lip; keels 2 or 5, the large ones converging to the top of the lip **3. Diglyphosa**
- b. Foot of the column with a distinct, smaller or larger spur. Lip with a distinct claw, either about spatulate without lateral lobes or with more or less large lateral lobes beyond the claw; keels 2 or 3, not converging to the top of the lip 4
- 4a. Lip mobile. Claw of the hypochilium with distinctly pleated margins. Keels on the lip 3, their margin on the hypochilium not abruptly drawn out in a lobe or a pyramidal structure. Column in front at the base with 2 fleshy keels, laterally on either side of the upper parts of these keels with an narrow seam which is far below the stigma drawn out into a distinct wing **1. Chrysoglossum**
- b. Lip not mobile. Claw of the hypochilium with straight margins. Keels on the lip 2 or 3, lateral ones beyond the claw drawn out into a pyramidal structure or a distinct, more or less ligulate lobe. Column in front without fleshy keels at the base, laterally on either side from base to top with a narrow seam, which is either entire or drawn out in a small lobe in the region of the stigma **2. Collabium**
- 5a. One flower per inflorescence **Hancockia** Rolfe*
- b. Two or more flowers per inflorescence 6
- 6a. Flowers not resupinate; lip with a blunt or shallowly 2-lobed spur **Nephelaphyllum** Blume
- b. Flowers resupinate; lip without spur, or with a spur formed by the column foot and the base of the lip 7
- 7a. Leaf base (sub)cordate in mature plants; leaf without petiole **Mischobulbum** Schltr.*
- b. Leaf base acute, more or less decurrent along the petiole **Tainia** Blume*

*) See Orchid Monographs 6 (1992).

1. CHRYSOGLOSSUM

Chrysoglossum Blume, Bijdr. (1825) 337; Tab. Pl. Jav. Orch. (1825) t. 4, fig. 7; Lindley, Gen. Sp. Orch. (1830) 13; Endl., Gen. Pl. (1837) 188; Meissn., Pl. Vasc. Gen. (1842) 368; Comment. (1842) 276.11; Miq., Fl. Ind. Bat. 3 (1855) 625; Blume, Fl. Javae Nov. Ser. 1 (1858) 136; Coll. Orch. (1859) 161; Hook. f., Fl. Brit. India 5 (1890) 783; J.J. Smith, Orch. Java (1905) 173; Bull. Jard. Bot. Buitenzorg II, 8 (1912) 1, 2; Schltr., Orch. (1914) 131; Notizbl. Berl.-Dahl. 9, 88 (1926) 586; J.J. Smith, Blumea 1 (1934) 202, 211; Mansfeld, Flora 142 (1954) 75; A. C. Smith, J. Arnold Arbor. 36 (1955) 276, p.p.; Schweinf. in Whitner, The Orchids (1959) 518; Dressler & Dodson, Ann. Missouri Bot. Gard. 47 (1960) 40; Holttum, Orch. Malaya, ed. 3 (1964) 178; Hawkes, Encycl. Cult. Orch. (1965) 111; Hatus., Sci. Rep. Yokusuka City Mus. 13 (1967) 30; Backer & Bakh. f., Fl. Java 3 (1968) 289; Hallé, Fl. Nouv.-Caléd. et Dép. 8 (1977) 257; Dressler, The Orchids (1981) 254; Seidenf., Opera Bot. (1983) 19; Senghas in Schltr., Orch., ed. 3, I/A (1984) 843; Kores, Allertonia 5 (1989) 65, p.p.; Lewis & Cribb, Orch. Vanuatu (1989) 151; Comber, Orch. Java (1990) 371; Kores in A. C. Smith, Fl. Vitiensis Nova 5 (1991) 395, p.p.; Seidenf., Opera Bot. 114 (1992) 322; Seidenf. & Wood, Orch. Penins. Malaysia & Sing. (1992) 531; Dressler, Phyl. Class. Orch. Fam. (1993) 212, 278; Chan et al., Orch. Borneo 1 (1994) 95. — Type species: *Chrysoglossum ornatum* Blume.

Terrestrial, rarely epiphytical herbs, glabrous except for minute hairs on lip or bracts or both. Roots filiform, not branching. Rhizome creeping, terete, not branching. Rhizome scales soon caducous, membranous. *Pseudobulbs* alternately 1–6 bearing a leaf and 1 bearing an inflorescence, ascending, more or less clearly articulated at the junction with petiole or scape; when dried all finely longitudinally wrinkled. Pseudobulb scales tubular, membranous, soon caducous. Leaf 1 per pseudobulb, convolute, petiolate. Petiole semi-orbicular, channelled; main nerves prominent. *Raceme* erect, unbranched, with both scape and rhachis elongating during anthesis. Scape terete; scales more or less persistent, tubular, membranous. Rhachis terete. *Bracts* persistent during anthesis. *Flowers* resupinate, rather widely spaced, most open at the same time, turned to all sides, patent, more or less widely open. *Lateral sepals* inserted on the column foot, equal in size and shape. *Petals* equal in size and shape. *Lip* mobile, narrowly attached on the column foot, 3-lobed, more or less fleshy. *Hypochilium* with the claw on either side more or less strongly pleated; front part on either side with an erect lateral lobe; lateral keels 2, nowhere abruptly elevated; median keel starting at the base as a little lobe, continuing as a much lower ridge, between the lateral lobes high again. *Epichilium* recurved, more or less concave, lateral margins incurvate to inrolled. *Column* erect, semi-orbicular in section; starting between the front lobes with 2 large, lateral, fleshy keels which continue upwards on the column where they end and fuse; on the margin of the column laterally on either side with a narrow seam which is drawn out into a distinct, flat wing, continuing upwards as a narrow seam which ends laterally of the stigma; column foot distinct, with a saccate spur with a narrow entrance; the front of the column foot with a small lobe. *Anther* 2-celled, elliptic to rectangular in outline; top obtuse to truncate, with an acute, narrowly triangular tip. Pollinia conical, waxy, without appendages.

Distribution — Mainland Southeast Asia: Sikkim, India (eastern parts), Sri Lanka, Thailand, Cambodia, Taiwan, China (Kwangsi). Malesia: Malay Peninsula, Sumatra, Java, Borneo, Sulawesi, New Guinea. Pacific: New Hebrides, Fiji Islands, New Caledonia.

Habitat & Ecology — Terrestrial forest plants, rarely epiphytes on the base of trees or on dead wood on the ground. Altitude 300–2700 m altitude.

Note — Blume did not select a type species in 1825 when he described the genus *Chrysoglossum* with 2 species: *Ch. ornatum* and *Ch. villosum*. J.J. Smith, in his article “Die

Gruppe der Collabiinae" in Bull. Jard. Bot. Buitenzorg II, 8 (1912) included the related genus *Collabium* in *Chrysoglossum*. He distinguished three sections in this combined genus: *Euchrysoglossum*, *Collabium* and *Discoglossum*. In the type section *Euchrysoglossum* he included *Chrysoglossum ornatum*, stating explicitly that he regards this species as the type species of the genus. The section *Discoglossum* is monotypic, including only *Ch. villosum*. Schlechter (1914: 131) transferred *Ch. villosum* to a new monotypic genus *Pilophyllum*, and kept *Collabium* separated from *Chrysoglossum*. Hallé (1977) superfluously selected *Ch. villosum* as the type species of *Chrysoglossum*.

KEY TO THE SPECIES OF CHRYSOGLOSSUM

- 1a. Pleats at the base of the lip glabrous or very finely papillose; lateral keels on the lip with an entire margin 2
- b. Pleats at the base of the lip velvety hairy; central part of the lateral keels on the lip with a double margin 3
- 2a. Leaf blade 5–7.5 cm wide. Lateral sepals 10–16 mm long. Margins of the claw of the lip with one pleat, and one shallow wave which can be absent, glabrous. Spur of the column foot short and wide, less than 1.5 times as long as broad, 0.5–2.5 mm long. Margin of the stigma entire **3. *Ch. ornatum***
- b. Leaf blade c. 4.5 cm wide. Lateral sepals 7–7.5 mm long. Margins of the claw of the lip with 2 shallow pleats and once folded downwards; very finely papillose. Spur of the column foot slender, more than twice as long as broad, 2.5–3.3 mm long. Base of the margin of the stigma laterally on either side with a distinct protruding point **1. *Ch. assamicum***
- 3a. Bracts ovate, 9–13 by 5.5–6.2 mm. Margins of the claw of the lip with a single pleat. Spur of the column foot short and stout, 1–1.3 mm long. Wings of the column ligulate, somewhat curved downwards, in lateral view covering the top part of the fleshy keels at the base of the column **4. *Ch. reticulatum***
- b. Bracts lanceolate, c. 8 by 2.5 mm. Margins of the claw of the lip with a double pleat: one downwards, one upwards. Spur of the column foot slender, somewhat constricted in the middle, c. 3 mm long. Wings of the column triangular, projecting upwards, in lateral view situated well above the fleshy keels at the base of the column **2. *Ch. ensigerum***

1. *Chrysoglossum assamicum* Hook. f. — Fig. 67

Chrysoglossum assamicum Hook. f., Fl. Brit. India 5 (1890) 748; Ic. Pl. (1891) t. 2063; Mitra, Flow. Pl. East India 1 (1958) 303; Pradhan, Indian Orch. 2 (1979) 240; Seidenf., Opera Bot. 72 (1983) 24; Senghas in Schltr., Orch., ed. 3, I/A (1984) 844. — *Collabium assamicum* (Hook. f.) Seidenf., Opera Bot. 72 (1983) 24, fig. 8. — Type: *Griffith 1233/1322* (K holo; W).

Chrysoglossum sinense Mansfeld in Fedde, Rep. 27 (1929) 295; Hu, Quart. J. Taiwan Mus. 25 (1972) 217; Senghas in Schltr., Orch., ed. 3, I/A (1984) 844. — Type: *S.S. Sin 8091* (PE holo, not seen).

Plant c. 45 cm high excluding the inflorescence, glabrous except for minute hairs on the inside of the bracts. Roots 8–10 on each rhizome part between 2 pseudobulbs, to 10 cm long, 1–2 mm diam. Rhizome over 6 cm long, 3–3.5 mm diam. Rhizome scales soon caducous, only remnants seen. *Pseudobulbs* alternately 1 bearing a leaf and 1 bearing an

inflorescence, 2–4 cm apart, cylindrical, somewhat tapering, slender; leaf-bearing ones c. 4.5 cm long, 4 mm diam.; inflorescence-bearing ones c. 15 mm long, 4 mm diam. Pseudobulb scales on leaf-bearing pseudobulbs c. 8.4 cm long, 6 mm diam., top acute, nerves c. 20; on inflorescence-bearing pseudobulbs c. 1.4 cm long, 5 mm diam., top acute, nerves c. 15. Petiole c. 12 cm by 2.5 mm. *Leaf blade* lanceolate, c. 27 by 4.5 cm; top acute; base attenuate; main nerves 5, below prominent, above somewhat prominent; small nerves many. *Raceme* 8–12-flowered. Scape c. 45 cm long, 2 mm diam.; internodes 3, lower one c. 5.5 cm long, middle one c. 10.8 cm long, top one incomplete; scales about equal, 24–30 mm long, 3–3.5 mm diam., top acute, apiculate, nerves c. 15. Rhachis terete, incomplete, probably to 15 cm long, c. 1.5 mm diam.; internodes 3–25 mm long. *Bracts* patent, narrowly triangular, to 8.8–9 by 2.1–3 mm; top acute; nerves 3. Pedicel shallowly longitudinally grooved, 3.5–8 by 0.2–0.3 mm; ovary shallowly longitudinally grooved, 2.5–4 by c. 0.5 mm. *Median sepal* slightly incurvate, linear-obovate, c. 8 by 1.8 mm top; top somewhat acuminate; nerves 3, midrib not pronounced. *Lateral sepals* rather broadly inserted on the column foot, linear-lanceolate, slightly falcate, 7–7.5 by 1.3–1.4 mm; top obtuse; nerves 3, midrib not pronounced. *Petals* lanceolate, somewhat falcate, 7–9 by 1.9–2.5 mm; top obtuse to acute; nerves 3–5, midrib not pronounced. *Lip* 6.8–7 mm long. *Hypochilium* parallel to the column, 4.3–5 by c. 5 mm; claw c. 2 by 1.5–2 mm, on either side with 2 shallow pleats and once folded downwards, these folds somewhat curved upwards and very finely papillose; front part on either side with an erect, obliquely ligulate, 1.6–1.8 by 1.8 mm big lateral lobe with a rounded top and an entire margin; lateral keels 2, starting c. 0.5 mm from the base of the lip, to c. 0.4 mm high, margin entire and in the distal part somewhat undulating, abruptly ending about halfway the epichilium; median keel fleshy, starting almost at the base of the lip and there c. 0.3 mm high, continuing as a much lower ridge, between the lateral lobes again c. 0.3 mm high, the margin somewhat undulating in the distal half, ending on the base of the epichilium, c. 1.5 mm shorter than the lateral keels. *Epichilium* in outline obovate to spatulate, 2.3–2.5 by c. 3 mm; top truncate, somewhat emarginate when flattened; lateral and top margins somewhat incurvate. *Column* slender, upper part slightly curved forward, somewhat swollen at the top, 5–6 by 0.5–0.6 mm; starting between the front lobes with 2 large, semi-elliptic, c. 2–2.5 by 1 mm big keels which continue upwards on the column where they end and fuse just below the lateral wings; on the margin of the column laterally on either side of the keels with a narrow seam which is drawn out into a distinct, flat, ligulate, forwards and downwards projecting, 0.5–1 by 0.8–1 mm big wing with a rounded top, continuing upwards as a narrow seam which ends laterally of the stigma and is there not drawn out in a point; column foot 1.5–2 by c. 0.5 mm, with a slender, somewhat tapering, laterally somewhat flattened, blunt, 2–2.5 mm long, c. 0.5 by 0.3 mm wide spur with a narrow entrance; the front of the column foot on either side with a small, ligulate, fleshy, 0.4–0.5 by 0.4–0.5 mm big lobe. *Anther* and pollinia not seen. *Stigma* ligulate, 1–1.2 by 0.5–0.8 mm, margin at the base with 2 small triangular points; rostellum a truncate ridge, c. 0.3 by 0.5–0.8 mm. *Fruit* not seen.

Distribution — Southeast Asia: India (Assam), China (Kwangsi).

Habitat & Ecology — No information.

Notes — 1. The description of *Chrysoglossum assamicum* is based on the Kew type specimen with only a few damaged flowers, and one reasonably well preserved flower of the type in Herbarium Reichenbach.

2. Seidenfaden (1983: 24, fig. 8) classified *Chrysoglossum sinense* as a synonym of *Ch. assamicum*, which he transferred to *Collabium*. The type of *Ch. sinense* was not available for this study, but based on Seidenfaden's illustration the conclusion can be drawn that the two are conspecific. *Chrysoglossum assamicum* is, however, wrongly placed in *Collabium*. The ornamentation of the column with the fleshy keels along the column foot and the wings halfway, the mobile lip with the claw with undulating and plaited margins and the three low keels indicate without doubt its position in *Chrysoglossum*.

2. *Chrysoglossum ensigerum* W. Burgh & de Vogel, *spec. nov.* — Fig. 68

Chrysoglossum ornatum auct. non Blume: Ames & Schweinf., Contr. Arnold Arbor. 8 (1934) 23.

Herba epiphytica foliis paulo latis lanceolatis acutis, bracteis lanceolatis acuminatis, carinis labelli triae, carinae lateraliae pro parte marginibus duplicibus, columna cum auriculis ensiformis, pede columnae longo sacciforme. — Typus: C.N. & W.N. Bangham 1123 (AMES holo).

Plant c. 25 cm high excluding the inflorescence, glabrous except for minute hairs on the bracts and the pleats of the lip. Roots, rhizome and rhizome scales not seen. Pseudobulb arrangement not seen; leaf-bearing ones tapering to the top, c. 2 cm long, 4 mm diam.; inflorescence-bearing ones not seen. Pseudobulb scales on leaf-bearing pseudobulbs c. 4.5 mm long, 6 mm diam., top not seen (missing), nerves c. 20; those on inflorescence-bearing pseudobulbs not seen. Petiole c. 4.8 cm by 2 mm. *Leaf blade* lanceolate, c. 17.5 by 4.5 cm; top acuminate; base attenuate; main nerves 5, below prominent, above somewhat prominent; small nerves many. *Raceme* c. 12-flowered. Scape c. 42 cm long, 3 mm diam.; internodes 4, lowest one incomplete, middle ones 12.3 and 13.3 cm long, highest one c. 10.5 cm long; scales 20–37 mm long, c. 4 mm diam., top acute, nerves c. 15. Rhachis to 21 cm long, 1.5 mm diam.; internodes 11–37 mm long. *Bracts* patent, lanceolate, 7.5–12 by 2–4 mm; top acuminate; nerves 5; inside covered with short scattered hairs. Pedicel shallowly longitudinally grooved, c. 7 by 5 mm; ovary shallowly longitudinally furrowed, c. 5 by 0.6 mm. *Median sepal* slightly incurved, linear-lanceolate, c. 19 by 2.5 mm; top acute; nerves 3, not prominent. *Lateral sepals* broadly inserted on the column foot, lanceolate, somewhat falcate, c. 15 by 3 mm; top acuminate; nerves 3, not prominent, with some very faint transverse small nerves. *Petals* obovate-lanceolate, slightly falcate, c. 17 by 3.5 mm; top acuminate; nerves 3, not prominent, with some very faint transverse small nerves. *Lip* c. 10 mm long. *Hypochilium* somewhat patent, c. 4 by 7 mm; claw c. 2 by 3 mm, on either side with a double pleat (one downwards, one upwards), these folds somewhat curved upwards and shortly velvety hairy; front part on either side with an erect, obliquely broad ligulate, c. 3 by 3–3.7 mm big lateral lobe with a rounded top and an entire margin; lateral keels 2, starting c. 0.7 mm from the base of the lip, fleshy, beyond the claw up to c. 0.7 mm high, margin entire, but in the central 2 mm between the lateral lobes the margin double and slightly undulating, ending about halfway the epichilium; median keel fleshy, starting at the base of the lip and there c. 0.6 mm high, continuing as a much lower ridge, between the lateral lobes again c. 0.6 mm high, the margin somewhat undulating, entire, ending on the basal half of the epichilium, c. 1.5 mm shorter than the lateral keels. *Epichilium* rather fleshy, in outline obovate, c. 5 by 5 mm; top obtuse when flattened; top margins somewhat incurvate. *Column* rather slender, upper part somewhat curved forward, slightly swollen at the truncate, sharp-tipped top, c. 7 by 1 mm, in front at the base with 2 large, lateral, semi-elliptic, thin, fleshy, c. 4 by 2 mm big keels which continue up-

wards on the column where they end and fuse between the lateral wings, on the margin of the column laterally on either side of the keels with a narrow seam which is higher up drawn out into a distinct, flat, triangular, upwards projecting, c. 1.2 by 0.8 mm big wing with an acute top which in lateral view is situated well above the keels, continuing upwards as a narrow seam which is just below the base of the stigma drawn out into a small, triangular, upward projecting, 0.3 mm big point with an acute top; column foot c. 3 by 1 mm, with a saccate, cylindrical, halfway somewhat constricted, laterally flattened, at the tip rounded, c. 3 mm long, c. 1 by 0.5 mm wide spur with a narrow entrance, on either side of the column foot side with a small, ligulate, fleshy, c. 1 by 1 mm big lobe. *Anther* c. 0.4 by 1 mm. Pollinia not seen. *Stigma* semi-orbicular, c. 1 by 1 mm, at the base with 2 minute, rounded auricles; rostellum a truncate ridge c. 0.3 by 1 mm. *Fruit* not seen.

Collector's notes — Leaf variegate, silver-streaked. Flowers green outside, creamy green inside.

Distribution — Endemic in Sumatra (Sumatera Utara), only known from the type.

Habitat & Ecology — Probably terrestrial, but recorded as an epiphyte (see note 2). Altitude 1360–1500 m. Fl. Feb.

Notes — 1. *Chrysoglossum ensigerum* is based on a single specimen, consisting of a single leaf with pseudobulb and an incomplete raceme with only 2 flowers left. The rhizome is missing.

2. It is unlikely that this plant is a true epiphyte as is stated on the label. Probably it grew on the base of a tree trunk or on a fallen log, which occurs more often in this genus.

3. This specimen was misidentified as *Chrysoglossum ornatum* by Ames & Schweinfurth in Contr. Arnold Arbor. 8 (1934) 23.

3. *Chrysoglossum ornatum* Blume — Fig. 69; Plate 7a

Chrysoglossum ornatum Blume, Bijdr. (1825) 338; Lindley, Gen. & Sp. Orch. (1830) 14; Miq., Fl. Ind. Bat. 3 (1855) 625, 739; Rchb. f., Bonplandia 5, 3 (1857) 58; Blume, Flora Javae (1858) 136, pl. 46; Costerus & J.J. Smith, Ann. Jard. Bot. Buitenzorg 19 (1904) 74; J.J. Smith, Orch. Java (1905) 175; Koord., Exk. Fl. Java, Monocot. (1911) 367; J.J. Smith, Bull. Jard. Bot. Buitenzorg II, 8 (1912) 1; Koord., Fl. Tijb. (1919) 40; J.J. Smith in Fedde, Rep. 32 (1933) 159; Bot. Jahrb. 65 (1933) 458; Schltr., Candollea 6 (1936) 442; Williams, Bot. Mus. Leaflet. 5, 7 (1938) 117; Holttum, Orch. Malaya, ed. 3 (1964) 177; Hawkes, Encycl. Cult. Orch. (1965) 111; Seidenf. & Smitinand, Orch. Thail. 4, 2 (1965) 748; Backer & Bakh. f., Fl. Java 3 (1968) 290; Parham, Pl. Fiji Isl. (1972) 330; Liu & Su, Fl. Taiwan 5 (1978) 925, fig. 1563; Seidenf., Nord. J. Bot. 2 (1982) 203; Opera Bot. 72 (1983) 20, fig. 7; Senghas in Schltr., Orch., ed. 3, I/A (1984) 843, fig. 647; Kores, Allertonia 5 (1989) 66; in A.C. Smith, Fl. Vitiensis Nova 5 (1991) 398. — Type: *Blume* 295 (L holo).

Ania maculata Thwaites, Enum. Pl. Zeyl. (1861) 301. — *Chrysoglossum maculatum* (Thwaites) Hook. f., Fl. Brit. India 5 (1890) 784; Ic. Pl. (1891) t. 2064; Gamble, Fl. Pres. Madras 3 (1928) 1421; Pradhan, Indian Orch. 2 (1979) 239; Dassanayake & Fosberg, Rev. Handb. Fl. Ceylon 2 (1981) 126; Senghas in Schltr., Orch., ed. 3, I/A (1984) 844. — *Tainia maculata* (Thwaites) Hook. f., Fl. Brit. India 5 (1890) 821. — Type: *Thwaites s.n.* (not seen); syn. nov.

Chrysoglossum erraticum Hook. f., Fl. Brit. India 5 (1890) 784; Ic. Pl. (1891) t. 2062; King & Pantl., Ann. Roy. Bot. Gard. Calc. 8 (1898) 97, pl. 135; Mitra, Flow. Pl. East India 1 (1958) 303; Guillaumin, Bull. Mus. Hist. Nat. Paris sér. 2, 33, 3 (1961) 333; Cumberlege & Cumb., Nat. Hist. Bull. Siam Soc. 20, 3 (1963) 160; Seidenf. & Smitinand, Orch. Thail. 4, 2 (1965) 748; Banerji & Thapa, J. Bomb. Nat. Hist. Soc. 68 (1971) 29; Rao & Balakrishnan, Rec. Bot. Surv. India 20, 2 (1973) 207; Seidenf., Contr. Rev. Orch. Fl. Camb., Laos & Vietnam 5 (1975) 25; Pradhan, Indian Orch. 2 (1979) 239; Seidenf., Nord. J. Bot. 2 (1982) 203. — Type: *Clarke* 12314 (K holo).

- Chrysoglossum neocaledonicum* Schltr., Bot. Jahrb. 39 (1907) 58; Guillaumin, Not. Syst. 10 (1941) 85; Hallé, Fl. Nouv. Caléd. et Dép. 8 (1977) 257, fig. 10; Senghas in Schltr., Orch., ed. 3, I/A (1984) 845. — Type: *Schlechter 15477* (B holo, probably lost; K lecto, here chosen).
- Chrysoglossum gibbsiae* Rolfe in Gibbs, J. Linn. Soc. Bot. 39 (1909) 175; Williams, Bot. Mus. Leaf. 5, 7 (1938) 117; Parham, Pl. Fiji Isl. (1972) 330; Whistler, Bull. Pac. Trop. Bot. Gard. 9 (1979) 36 (as *Chrysophyllum gibbsiae*); Senghas in Schltr., Orch., ed. 3, I/A (1984) 845. — Type: *Gibbs 886* (BM lecto, here chosen; K iso); syn. nov.
- Chrysoglossum cyrtopetalum* Schltr. in Fedde, Rep., Beih. 1 (1911) 96; *ibid.* 21 (1923) t. 38, fig. 132; Senghas in Schltr., Orch., ed. 3, I/A (1984) 845. — Type: *Schlechter 18584* (holo B, probably lost; lecto plate 38, fig. 132 in Schltr. in Fedde Rep. 21, here chosen); syn. nov.
- Chrysoglossum formosanum* Hayata, J. Coll. Sci. Imp. Un. Tokyo 30, 1 (1911) 318; Schltr. in Fedde, Rep. 4 (1919) 182; Sasaki, Cat. Gov. Herb. (1930) 142; Hsieh, Quart. J. Taiwan Mus. 8 (1955) 226; Hu, Quart. J. Taiwan Mus. 25 (1972) 216. — Type: *Kawakami & Mori 3490* (TH holo)
- Chrysoglossum hallbergii* Blatter, J. Bomb. Nat. Hist. Soc. 32, 3 (1928) 519; Gamble, Fl. Pres. Madras 3 (1928) 1422. — Type: *Blatter & Hallberg 26488* (K holo); syn. nov.
- Chrysoglossum vesicatum* auct. non Rchb. f.: Lewis & Cribb, Orch. Vanuatu (1989) 151.

Plant to 60 cm high excluding the inflorescence, glabrous except for minute hairs on the bracts. Roots 2–7 on each rhizome part between two pseudobulbs, to 10 cm long, 1.5–3 mm diam. Rhizome to 20 cm long, 4–7 mm diam. Rhizome scales 8–21 mm long, 6–8 mm diam., top acute to minutely apiculate; nerves c. 20. *Pseudobulbs* alternately 1–6 bearing a leaf and 1 bearing an inflorescence, 10–20 mm apart, terete, somewhat tapering or ovoid; leaf-bearing ones 2.8–5.3 cm by 4–10 mm; inflorescence-bearing ones 5–15 by 4–6 mm. Pseudobulb scales on leaf-bearing pseudobulbs 6–8.5 cm long, 4–6 mm diam., top acute, nerves c. 20; on inflorescence-bearing pseudobulbs 15–20 mm long, 5–6 mm diam.; top acute, nerves c. 20. Petiole 6–21 cm by 2–2.5 mm. *Leaf blade* lanceolate, 17–32 by 5–7.5 cm; top acuminate; base attenuate; main nerves 5, below prominent, above somewhat prominent; small nerves many. *Raceme* 10–25-flowered. Scape 25–63 cm long, 2.5–3 mm diam.; internodes 3 or 4, lowest one 4.2–12 cm long, highest one 7.5–28(–32) cm long; scales 20–52 mm long, 3–6 mm diam., top obtuse to somewhat acuminate, nerves c. 19. Rhachis to 34.5 cm long, 1–3 mm diam.; internodes 4–25(–32) mm long. *Bracts* patent, lanceolate-ovate, 7–12 by 1.3–3.2 mm; top acute; nerves 3–5. Pedicel about terete to more or less deeply longitudinally grooved, 4–8 by 0.5–1 mm; ovary somewhat longitudinally grooved, 4–5 by 0.5–1.2 mm. *Median sepal* somewhat incurvate, linear-lanceolate, 10–19 by 1.8–4 mm; top acute; nerves 3–5, not prominent. *Lateral sepals* rather broadly inserted on the column foot, narrowly triangular to lanceolate, slightly falcate, 10.3–15.7 by 1.7–3.5 mm; top acute to somewhat acuminate, nerves 3 (or 4) not prominent. *Petals* lanceolate, slightly falcate, 10.5–16.1 by 2.5–4.6 mm; top acute; nerves 5, not prominent. *Lip* somewhat fleshy, 8.2–10 mm long. *Hypochilium* parallel to the column, 4–6 by 6.5–9 mm; claw 1.8–2.2 by 2.4–3 mm, on either side with a shallow wave which can be absent, and with one more or less strong pleat (once folded upwards and once downwards again) these folds slightly curved upwards; front part on either side with an erect, more or less obliquely ligulate or triangular, sometimes somewhat falcate, 2–3.2 by (1.5–)2–3.5 mm big lateral lobe with a rounded top and an entire margin; lateral keels 2, starting 0.4–1 mm from the base of the lip, fleshy, 0.3–0.5 mm high, in the central part between the lateral lobes 0.7–1 mm high, margin entire and undulating or sometimes straight, keels ending on the basal half of the epichilium; median keel fleshy, starting at the base of the lip and there 0.4–0.7 mm high, continuing as a much lower ridge, be-

tween the lateral lobes again 0.4–0.7 mm high, the margin somewhat undulating, keel either or not reaching the base of the epichilium, 1–2 mm shorter than the lateral keels. *Epichilium* concave, in outline obovate, 3.1–5 by 3.4–5 mm; top obtuse to somewhat retuse; lateral margins incurvate to inrolled. *Column* slender to rather stout, upper part hardly to strongly curved forward, slightly swollen at the obtuse to truncate, blunt or sharp-tipped top, 5–7.5 by 1–1.3 mm; starting between the front lobes with 2 large, lateral, semi-orbicular, fleshy, 1.5–3 by 0.5–0.8 mm big keels which continue upwards on the column where they end and fuse between the lateral wings; on the margin of the column laterally on either side of the keels with a narrow seam which is drawn out into a distinct, flat ligulate to triangular, sometimes slightly falcate, forwards projecting, 1–1.5 by 0.4–1 mm big wing with a rounded or obtuse top, continuing upwards as a narrow seam which ends laterally of the stigma; column foot 1.5–2.7 by 0.5–0.8 mm, with a saccate, cylindrical to somewhat conical, blunt, laterally somewhat flattened, 1.3–2.5 mm long, 0.5–2.5 mm high, 0.5–1 mm wide spur with a narrow entrance; the front of the column foot on either side with a small, semi-orbicular, fleshy, 0.5–0.8 by 0.3–0.5 mm big lobe. *Anther* 0.6–1 by 1–1.6 mm; central part of connective somewhat elevated, sometimes shallowly cleft. *Pollinia* 0.4–0.5 by 0.4–0.5 mm. *Stigma* semi-orbicular or ligulate, 0.5–1.3 by 0.5–1 mm; rostellum a narrow, 0.2–0.3 by 0.7–1 mm big ridge. *Fruit* reflexed, ellipsoid, body c. 2.5 cm by 4 mm; column and remains of perianth more or less persistent.

Collector's notes — Leaves, pseudobulbs, rhachis and bracts green, sometimes tinged purple. Pedicel and ovary purple. Sepals and petals green or yellow, nerves sometimes dotted with red-brown spots. Lip white or yellowish, with yellow keels, sometimes with small purple spots at the top and somewhat larger purple spots in the middle. Column white with a yellow top or entirely yellow.

Distribution — Southeast Asia: Sri Lanka, India (East coast), Darjeeling, Sikkim, Thailand, Cambodia, Taiwan. Malesia: Malay Peninsula, Sumatra, Java, Sulawesi, New Guinea. Pacific: Vanuatu, New Caledonia, Fiji Islands (Viti Levu, Vanua Levu, Taveuni), and according to Kores (1989) in Samoa (Upolu). This distribution suggests that *Chrysoglossum ornatum* possibly also occurs in Burma, the southeastern parts of China and in Borneo.

Habitat & Ecology — Terrestrials in undistributed forest, rarely epiphytes, sometimes on dead wood on the ground. Altitude 300–2700 m, but in most areas recorded to have a much more restricted range: e.g. in Sikkim occurring from 1330–2670 m, in Java from 650–1750 m, in Fiji from 300–1100 m. Fl. probably throughout the year, at least in Java; recorded from May–Aug. in India, Jan.–July in Thailand, Aug.–Sept. in New Guinea, Sept.–Jan. in Fiji, May and June in Sulawesi. Records from other areas are restricted to one month only: Cambodia (Jan.), Taiwan (Jan.), Malay Peninsula (Aug.), New Caledonia (Dec.).

Notes — 1. *Chrysoglossum ornatum* is variable in the shape of several floral parts: a) the sidelobes of the lip can be ligulate or obliquely ligulate, somewhat falcate, triangular, or obliquely triangular; b) the column can be rather slender or more stout, it can be more or less straight or rather strongly curved forwards, and its wings can be triangular or ligulate; c) the spur of the column foot can be conical or cylindrical, 0.5–2.5 mm long. Despite this variability, it proved impossible to separate infraspecific taxa based on these characters.

2. *Chrysoglossum cyrtopetalum* Schltr. from New Guinea is here regarded as a synonym of *Ch. ornatum*. Seidenfaden (1983: 21) already suggested this to be conspecific,

without formally making the reduction. As far as known the type and possible other specimens named as such are lost, the only extant information being Schlechter's drawing and description. According to this description his plants differ slightly from *Ch. ornatum*. His drawing is accurate enough to establish with certainty that it is conspecific with *Ch. ornatum*. All New Guinea specimens seen so far belong without doubt to *Ch. ornatum*.

3. The type specimen of *Chrysoglossum formosanum* is a rather small-flowered form of *Ch. ornatum*. The conclusion by Liu & Su that it is a synonym of this species is supported here.

4. Seidenfaden (1983: 21) reduced *Chrysoglossum neocaledonicum* to *Ch. ornatum* and suggested that *Ch. gibbsiae* is also conspecific. Kores (1989: 66) formally reduced *Ch. gibbsiae* to *Ch. neocaledonicum*. Comparison of the types of these species with the type of *Ch. ornatum* confirm these reductions.

5. The flower on the type of *Chrysoglossum hallbergii*, although damaged, agrees very well with those of *Ch. ornatum*. The type specimen of *Ch. maculatum*, collected in Ceylon, was not available for this revision. Several other, more recently collected plants labelled *Ch. maculatum* agree very well with Hooker's description (1890: 748) and drawing (1891). They all represented rather large specimens of *Ch. ornatum*. There is hardly any doubt that *Ch. maculatum* is conspecific with *Ch. ornatum*.

4. *Chrysoglossum reticulatum* Carr — Fig. 70

Chrysoglossum reticulatum Carr, Gard. Bull. Str. Settl. 8 (1935) 197; Masamune, Enum. Phan. Born. (1942) 138; Wood, Beaman & Beaman, Pl. Mt. Kinabalu 2, Orchids (1993) 33, 135, 390, pl. 20c; Chan et al., Orch. Borneo 1 (1994) 95, fig. 16, plate 3 E, F. — Syntypes: Carr 3314, SF 27060 (K lecto; SING iso), Clemens s.n. (BM).

Plant to 48 cm high excluding the inflorescence, glabrous except for minute hairs on the bracts and the pleats at the base of the lip. Roots 3–6 on each rhizome part between 2 pseudobulbs, to 13 cm long, c. 2 mm diam. Rhizome to 11 cm long, c. 5 mm diam. Rhizome scales partly covering the pseudobulb scale, ovate, to 30 by 8 mm; top acute to minutely apiculate; nerves c. 15. *Pseudobulbs* alternately 1 to 3 bearing a leaf and 1 bearing an inflorescence, 5–15 mm apart, slender; leaf-bearing ones terete, tapering to the top, 2.5–3.8 cm long, to 5 mm diam., inflorescence-bearing ones cylindrical, 1–2.5 cm long, to 5 mm diam. Pseudobulb scales on leaf-bearing pseudobulbs 3–10 cm long, 5–7 mm diam., top acute to acuminate, nerves c. 15; on inflorescence-bearing pseudobulbs 2.5–5.5 cm long, 3–4 mm diam., top acute, nerves c. 15. Petiole 6–21.5 cm by 1–2 mm. *Leaf blade* linear-lanceolate, 15–23 by 2.4–4.5 cm; top acuminate; base attenuate; main nerves 3–5, below prominent, above somewhat prominent; small nerves many. *Raceme* 15–30-flowered. Scape 6–56 cm long, 2–2.5 mm diam.; internodes 3 or 4, rarely 1, lowest one (2.5–)5.5–15 cm long, highest one 5–21.5 cm long; scales 15–43 mm long, 3–4 mm diam., top acute, nerves c. 15. Rhachis to 42 cm long, 1.5–2 mm diam.; internodes 10–20(–30) mm long. *Bracts* patent, ovate, 6–13 by 4–8 mm; top acute to acuminate; nerves 3–5. Pedicel longitudinally grooved, 5–15 by 0.5–1.3 mm; ovary rather deeply longitudinally grooved, 4–7 by 0.8–1.5 mm. *Median sepal* somewhat incurvate, linear-lanceolate, (11.5–)13–19 by (2–)2.4–3.8 mm.; top acute; nerves 3, with few to many small transverse nerves. *Lateral sepals* broadly inserted on the column foot, (linear-)lanceolate, slightly falcate, 9–18.5

by 2.3–4.5 mm; top obtuse to acute; nerves 3, either without or with many small transverse nerves. *Petals* ovate-oblong, slightly falcate, (9–)10–16 by (3.3–)4–5.1 mm; top obtuse to acute; nerves (3–)5, with many small transverse nerves. *Lip* (7–)8–10 mm long. *Hypochilium* (4–)4.5–5 by (4.5–)5–7.5 mm; claw 1.8–2 by (1.5–)2.3–3 mm, on either side with one strong pleat, this fold curved upwards and shortly velvety hairy; front part on either side with an erect, obliquely semi-orbicular to ligulate, 2–2.5 by 2–3.3 mm big lateral lobe with a rounded top and an entire margin; lateral keels 2, starting 0.5–1 mm from the base of the lip, fleshy, up to 0.3–0.5 mm high, margin entire, but in the central 2.5–3 mm between the lateral lobes lowering and the margin double and more or less strongly undulating, ending on the base or up to about halfway the epichilium; median keel fleshy, starting near the base of the lip and there 0.4–0.7 mm high, continuing as a much lower ridge, between the lateral lobes again 0.4–0.6 mm high, the margin somewhat undulating, entire in the basal part, double or entire in the part between the lateral lobes, ending halfway between the lateral lobes of the hypochilium or on the basal half of the epichilium, 1–2 mm shorter to about as long as the lateral keels. *Epichilium* fleshy, in outline obovate to ligulate, (3.3–)4–5 by (3–)3.7–4.8 mm; top obtuse to slightly emarginate when flattened, its tip a blunt to acute point, lateral margins somewhat incurved. *Column* rather slender, upper part strongly curved forward, slightly swollen at the truncate top, (6–)7–9.5 by 0.8–1.5 mm when stretched, in front at the base with 2 large, semi-elliptic, 2.5–3.5 by 1–1.5 mm big keels which continue upwards on the column where they end and fuse between and just above the lateral wings, on the margin of the column laterally on either side of the keels with a narrow seam which is drawn out into a distinct, flat, ligulate, slightly falcate, forwards and downwards projecting, 0.5–1 by 0.2–0.5 mm big wing with a rounded top which in lateral view covers the top part of the keels continuing upwards as a narrow seam which is laterally of the base of the stigma drawn out into a small, triangular, c. 0.2 mm big point with an acute top; column foot 2–2.5 by 1–1.5 mm, the front on either side with a small, ligulate, fleshy, 0.4–0.7 by 0.4–1 mm big lobe, rarely this lobe absent, with a small, oblique, saccate, globular, blunt, shallowly cleft, 1–2 mm long, 1–2.5 by 0.8–1.5 mm wide spur with a narrow entrance. *Anther* c. 0.5 by 1–1.5 mm. Pollinia c. 0.5 by 0.5 mm. *Stigma* semi-orbicular, 0.8–1.5 by 0.8–1.5 mm, margin at the base laterally on either side with a small protruding point; rostellum an inconspicuous ridge 0.2–0.3 by 1–1.5 mm. *Fruit* not seen.

Collector's notes — Bracts green or pale yellow with green nerves. Sepals and petals (pale) yellow or greenish or whitish, with (red) purple veins and many transverse, more or less pale (red) purple spots except at the apex. Lip white with a short brown or purple streak at the base of the sidelobes, sidelobes white to more or less yellow; keels white or yellow, the lateral ones suffused purple at the base; epichilium white, spotted with deep lilac inside the margins, a large transverse dark lilac spot at its base but not on the keels. Column white, yellow or orange, spur on column foot once recorded yellow, anther bright yellow.

Distribution — Borneo: Sarawak (Bahagian Miri), Sabah (Bahagian Pedalaman, Pantai Barat); 8 collections (BM, CO, K, L, SING).

Habitat & Ecology — Terrestrial in montane rain forest, once recorded growing in moss in an open area in the forest, on stony clayey soil. Altitude 1300–2000 m. Fl. Feb.–June, Aug., Dec.

2. COLLABIUM

- Collabium* Blume, Bijdr. (1825) 357; J.J. Smith, Bull. Jard. Bot. Buitenzorg II, 8 (1912) 2; Schltr., Orch. (1914) 131; Notizbl. Berl.-Dahl. 9, 88 (1926) 586; J.J. Smith, Blumea 1 (1934) 202, 211; Schweinf. in Whitner (ed.), Orchids (1959) 518; Dressler & Dodson, Ann. Missouri Bot. Gard. 47 (1960) 40; Hawkes, Encycl. Cult. Orch. (1965) 124; Hatusima, Sci. Rep. Yokosuka City Mus. 13 (1967) 30; Liu & Su, Fl. Taiwan 6 (1978) 932; Seidenf., Opera Bot. 72 (1983) 22; Senghas in Schltr., Orch., ed. 3, I/A (1984) 840; Dressler, Phyl. Class. Orch. Fam. (1993) 212, 278; Chan et al., Orch. Borneo 1 (1994) 101. — Type species: *Collabium nebulosum* Blume.
- Chrysoglossum* (p.p.), A.C. Smith, J. Arnold Arbor. 36 (1955) 276; Kores, Allertonia 5 (1989) 65; Lewis & Cribb, Orch. Vanuatu (1989) 151; Orch. Solomon Isl. & Bougainville (1991) 298; Kores in A.C. Smith, Fl. Vitiensis Nova 5 (1991) 395.
- Collabiopsis* S.S. Ying, Col. Illust. Indig. Orch. Taiwan 1 (2) (1977) 112 (not seen; see note 2). — Type species: *Collabiopsis formosana* (Hayata) S.S. Ying.

Terrestrial, rarely epiphytical, sympodial herbs, glabrous except for minute hairs on the bracts. Roots filiform, not branching, more or less villous. Rhizome branching or not, creeping, more or less terete. Rhizome scales tubular, membranous, soon caducous, rarely persistent. *Pseudobulbs* alternately 1–6 bearing a leaf and 1 bearing an inflorescence, ascending, more or less clearly articulated at the junction with petiole or scape; inflorescence-bearing ones hardly different from the scape. Pseudobulb scales one per pseudobulb, tubular, membranous, generally soon caducous. Leaf one per pseudobulb, convolute, long or shortly petiolate. Petiole semi-orbicular, channelled; main nerves prominent. *Leaf blade* herbaceous. *Raceme* erect, with both scape and rhachis more or less elongating during anthesis, unbranched. Scape terete; scales tubular, membranous, persistent. *Bracts* persistent during anthesis. *Flowers* resupinate, turned to all sides, patent, more or less widely opening, either symmetric or asymmetric, with or without a torsion of the column. *Lateral sepals* inserted on the column foot. *Lip* not mobile, narrowly attached on the column foot, 3-lobed but in *C. chloranthum* entire and then with large, falcate lobes on the keels on the lip. *Hypochilium* more or less parallel to the column; claw with about parallel margins; front part on either side with a patent or erect lateral lobe, but in *C. chloranthum* without lateral lobes; lateral keels 2, starting at or near the base of the lip, towards the front increasingly becoming fleshy, widening and elevating into an erect, entire lobe or into a more or less oblique pyramid of which the outer margin is fused with the lateral margin of the hypochilium and which is in front hollow, keel continuing from the inner margin of this pyramid or lobe, entire, thin or fleshy; median keel absent or present, simple. *Epichilium* more or less recurved. *Column* with or without a counterclockwise torsion, semi-orbicular in section; in front laterally on either side with a seam which starts on the front margin of the opening of the spur, continuing along the sides of the column, each laterally of the stigma either or not drawn out into a distinct, flat wing; column foot with a saccate, cylindrical or laterally somewhat flattened, acute to obtuse, either or not shallowly cleft spur. *Anther* 2-celled. Pollinia 2, waxy, without appendages, obliquely conical with an obtuse top and a more or less hollow base. *Fruit* reflexed, fusiform, when young the perianth and column persistent, when mature only the column and back wall of the column foot persistent; jugae narrow, band-like, median more or less keeled; valvae rather narrow, very long elliptic, outside with a more or less pronounced keel, inside along the margin with an irregular row of scattered and grouped, slender unicellular hairs. Seeds fusiform, embryo about elliptic, very small.

Distribution — Southeast Asia: Burma, Vietnam (Tonkin, Langbian), China (S Yunnan, Hainan, Kwangtung, Kwangsi), Taiwan. Malesia: Malay Peninsula, Sumatra, Java, Borneo, Sulawesi, New Guinea. Pacific: Solomon Islands, New Hebrides, New Caledonia, Fiji Islands.

Habitat & Ecology — Terrestrial, rarely epiphytcal forest plants. Altitude 250–2700 m.

Notes — 1. In the descriptions of *Collabium nebulosum* and *C. simplex* reference is made to the right and left lateral sepal and petal. In this context, the flower is seen from above with the lip pointing towards the observer.

2. The publication by S.S. Ying in which the genus *Collabiopsis* was established came to our attention only after our manuscript was completed and so we do not know on what grounds *Collabium formosanum* and *C. uraiense* (which we consider conspecific) were excluded from *Collabium*. We do not consider such a step justified, however.

KEY TO THE SPECIES OF COLLABIUM

- 1a. Lip without lateral lobes, in outline entire, margins deeply double lacerate; elevated part of the keels c. 5 mm high **5. *C. chloranthum***
- b. Lip 3-lobed with distinct lateral lobes, margins entire or simple or double lacerate; elevated part of the keels less than 2 mm high 2
- 2a. Inflorescence over 35 cm long 3
- b. Inflorescence less than 35 cm long 5
- 3a. Pseudobulb and petiole together 11–26 cm long. Sepals and petals reflexed. Spur 4–8.5 mm long **8. *C. nebulosum***
- b. Pseudobulb and petiole together 1–9.5 cm long. Sepals and petals not reflexed. Spur 2–7.5 mm long 4
- 4a. Flowers less than 17 per inflorescence, rather laxly placed. Spur slender, conical-fusiform, 4.5–5 mm long, with more or less acute, almost entire top .. **3. *C. carinatum***
- b. Flowers 20–70 per inflorescence, rather densely placed. Spur sturdy, saccate, 2–3.5 mm long, with broadly rounded, emarginate top **10. *C. simplex***
- 5a. Rhizome part between two pseudobulbs almost always much longer than the length of the leaf blade. Rhizome scales long persistent. Leaf blade 2.7–4.5 cm long **9. *C. pumilum***
- b. Rhizome part between two pseudobulbs much shorter than the length of the leaf blade. Rhizome scales soon caducous. Leaf blade 5.5–17.8 cm long 6
- 6a. Each keel between the lateral lobes of the lip elevated into a solid, simple lobe ... 7
- b. Each keel between the lateral lobes of the lip elevated into an oblique pyramid which is in front hollow 10
- 7a. Column up to 6.5 mm long 8
- b. Column more than 9 mm long 9
- 8a. Spur slender, c. 3 by 1 mm, with an acute, not bilobed top **1. *C. acuticalcar***
- b. Spur sturdy, swollen, saccate, 2.5–5 by 2–3 mm, with a broadly rounded, more or less distinctly bilobed top **11. *C. vesicatum***
- 9a. Floral bracts ovate-oblong, 6–11 by 2–5.5 mm. Petals 2–2.5 mm wide. Epichilium wider than long; keels on the epichilium, beyond the elevated part, continuing as a distinct, c. 0.4 mm high ridge (sometimes drawn out into small ligulate lobes towards the top of the lip) **6. *C. delavayi***

- b. Floral bracts narrowly triangular to linear, 6–20 by 1–2 mm. Petals 1–1.8 mm wide. Epichilium longer than wide; keels on the epichilium, beyond the elevated part, continuing as a very low ridge **7. *C. formosanum***
- 10a. Pseudobulb and petiole together less than 2 cm long. Lip with triangular, acute side-lobes; the pyramids of the keels with an acute top **2. *C. bicameratum***
- b. Pseudobulb and petiole together more than 2.5 cm long. Lip with obliquely ligulate to almost semi-orbicular, rounded sidelobes; the pyramids of the keels provided with a keel-like ridge with an extended, obtuse to rounded top **11**
- 11a. Lateral lobes of the lip broadly sessile, broader than long, semi-ovate, in front not or hardly protruding, 1.5–3 mm long, base 4–5 mm wide. Column 5–7 mm long, together with the spur 9–16 mm long **4. *C. chinense***
- b. Lateral lobes of the lip rather narrowly sessile, longer than broad, obliquely ligulate, in front protruding, 2–2.8 mm long, base 1.5–2 mm wide. Column 3.5–4.5 mm long, together with the spur 6.5–9.5 mm long **11. *C. vesicatum***

1. *Collabium acuticalcar* W. Burgh & de Vogel, *spec. nov.* — Fig. 71

A Collabio nebuloso et *C. simplice* partibus vegetabilibus multo minore, columna relative longa gracili, inflorescentia pauciflora differt. — Typus: *Hagerup s.n.*, 1916/17 (C holo).

Note: For the use of the terms ‘left’ and ‘right’ see note 1 under the generic description.

Plant c. 13 cm high excluding the inflorescence. Roots 2 or 3 on each rhizome part between 2 pseudobulbs, to 5 cm long, 1–1.5 mm diam. Rhizome to 6 cm long, 1.5–2.5 mm diam. *Pseudobulbs* alternately c. 4 bearing a leaf and 1 bearing an inflorescence, c. 10 mm apart, cylindrical or somewhat angular, slender, when dried all finely longitudinally wrinkled, indistinctly articulated at the junction with petiole or scape; leaf-bearing ones tapering to the top, 1.3–2.8 cm long, 1.5–2 mm diam.; inflorescence-bearing ones cylindrical, c. 0.6 cm long, c. 1.5 mm diam. Petiole 1.2–2.4 cm by 1.5–2 mm. *Leaf blade* elliptic to ovate, 5.6–8.7 by 3.3–4.5 cm; top acuminate, base attenuate; main nerves 5. *Raceme* c. 8-flowered. Scape terete, c. 17.5 cm long, 2 mm diam.; internodes 3, about equal. Rhachis terete, to 3 cm long, c. 1 mm diam.; internodes 3–10 mm long. *Bracts* patent, lanceolate, 8–11 by 2–2.5 mm; top acute; nerves 3. *Flowers* rather regularly spaced along the rhachis; all flower parts with a torsion around the column. Pedicel shallowly grooved, 4–5 by 0.5 mm; ovary not different from the petiole, c. 3.5 by 0.7 mm. *Median sepal* lanceolate, 7–9 by c. 1.7 mm; top acute; nerves 3. *Lateral sepals* unequal in shape, the left one bent in a right angle, right one falcate, lanceolate, 7.5–8.5 by 1.5–2 mm; top acute, nerves 3. *Petals* slightly unequal in shape, slightly falcate, lanceolate, 7.5–8.5 by c. 1.8 mm; top acute; nerves 3. *Lip* c. 6.5 mm long. *Hypochilium* somewhat patent, c. 3.5 by 5.5 mm; claw c. 1.5 by 1 mm; lateral lobes patent, projecting in front, obliquely ligulate, unequal in size, 1.8–2 by c. 1.5 mm (the one on the right side smaller), with a rounded top and a somewhat irregular margin; lateral keels 2, between the lateral lobes of the lip turning into an erect, 1–1.5 mm long, 0.8–1 mm high ligulate lobe with a rounded top, each keel continuing as an entire, c. 0.2 mm high ridge, ending on the top half of the epichilium; median keel inconspicuous. *Epichilium* slightly recurved, in outline obovate, 3.5–4 by 2.8–3.2 mm; top acuminate; margins somewhat crenate. *Column* with a distinct clockwise torsion, c. 6.5 mm by 0.5 mm, at the top widened to 1.5 mm; seams

c. 0.2 mm wide, ending laterally of the stigma; column foot with a slender, cylindrical spur c. 3 mm long, 1 mm diam., with an acute top. *Anthers* 3, transversely elliptic, c. 0.5 by 0.8 mm; base emarginate; top obtuse, erose, consisting of a narrow band of tissue c. 0.2 by 0.7 mm. Pollinia c. 0.5 mm by 0.3 mm. *Stigmas* 3, indistinct, c. 0.2 by 0.5 mm, lateral ones much smaller; rostellums 3, fleshy, truncate, median one semi-transversely elliptic, c. 0.2 by 0.5 mm, lateral ones much smaller. *Fruit* not seen.

Collector's notes — None.

Distribution — Sumatra (Sumatera Utara), 1 collection (type).

Habitat & Ecology — Altitude 1500 m.

Note — This taxon is represented by one collection: *Hagerup s.n.* Only 3 flowers were available for study, which are aberrant in the column. The differences with the other species in *Collabium* are, however, sufficiently distinct to warrant the description of a new species. One open flower has the top of the column somewhat damaged; probably 3 anthers were present but all are missing. The second flower is just at anthesis, it has a column with three anthers: one terminal, and two laterally on either side of the stigma, each with 2 pollinia and a fleshy rostellum. The third flower is a bud just before anthesis, this has a column with one terminal anther, one lateral, somewhat smaller anther, and three rostellums. The flowers of *C. acuticalcar* have the torsion of the flower parts in common with *C. nebulosum* and *C. simplex*. It differs in the much smaller size of the vegetative parts, in the relatively long and slender column, and in the few-flowered inflorescence.

2. *Collabium bicameratum* (J.J. Smith) J.J. Wood — Fig. 72

Collabium bicameratum (J.J. Smith) J.J. Wood in Chan et al., Orch. Borneo 1 (1994) 101, fig. 18, plate 4B. — *Chrysoglossum bicameratum* J.J. Smith, Bull. Jard. Bot. Buitenzorg III, 11 (1931) 91; *ibid.*, Suppl. 3 (1949) pl. 155, 2; Masamune, En. Phan. Born. (1942) 138; Seidenf., Opera Bot. 72 (1983) 22; Senghas in Schltr., Orch., ed. 3, 1/A (1984) 844. — Type: *Endert 4351* (L. holo; BO iso).

Plant c. 10 cm high excluding the inflorescence. Roots 1 or 2 on each rhizome part between 2 pseudobulbs, to 10 cm long, c. 2 mm diam. Rhizome sometimes branching, to 13 cm long, 2–3 mm diam. Rhizome scales soon caducous, only remnants seen. *Pseudobulbs* alternately 2–5 bearing a leaf and 1 bearing an inflorescence, 15–20 mm apart, terete, tapering to conical, when dried all finely longitudinally wrinkled; leaf-bearing ones 9–12 mm long, 3–4 mm diam.; inflorescence-bearing ones c. 8 mm long, 3 mm diam. Pseudobulb scales of leaf-bearing pseudobulbs only remnants seen; of inflorescence-bearing pseudobulbs c. 6 mm long, 3 mm diam., with obtuse top, nerves c. 11. Petiole 3–5 by c. 2 mm. *Leaf blade* ovate to elliptic-oblong, 6.3–9.5 by 2.8–5 cm; top acute to acuminate; base attenuate to obtuse; main nerves 5, below prominent; small nerves many. *Raceme* 5–7-flowered. Scape 10–13 cm long, c. 2 mm diam.; internodes 2 (or 3), lower one 3.8–4.6 cm long, higher ones 3.9–7.5 cm long; scales about equal, 14–20 mm long, 2–5 mm diam., top acute, nerves c. 13. Rhachis terete, to 6 cm long, c. 1.5 mm diam.; internodes 5–13 mm long. *Bracts* patent, oblong, 5–14 by 2–7 mm; top acute; nerves 3–5. *Flowers* rather regularly spaced along the rhachis, most open at the same time, not widely opened. Pedicel star-shaped in section, 4–6 by 0.5–1 mm; ovary similar, 3.5–5.5 by 0.6–1.5 mm. *Median sepal* lanceolate, 10–12 by 2.5–4 mm; top obtuse to acute; nerves 5, midrib slightly prominent outside. *Lateral sepals* equal in size and shape, oblong-lanceolate, slightly falcate, 8–12 by 3–3.7 mm; top acute to acuminate; nerves 3 or 4, midrib slightly prominent

outside. *Petals* equal in size and shape, lanceolate, not falcate, 8–11 by 2.5–3.5 mm; top obtuse to acute; nerves 5, midrib slightly prominent to keel-like outside. *Lip* 8–11 mm long. *Hypochilium* 4.5–6 by 7–9 mm; claw 1–2.5 by 0.5–2 mm; lateral lobes erect, obliquely triangular, 1.7–2.2 by 2.3–3 mm, with an acute, triangular top and often a small triangular point near the base of the epichilium, margin entire; lateral keels 2, between the lateral lobes of the lip turning into a c. 1.5 mm long, c. 1.5 mm wide, c. 1 mm high pyramid which is in front hollow to a depth of c. 1 mm, with a somewhat extended, acute top, each keel continuing as an entire, thin, c. 0.4 mm high crest with an entire margin, ending about halfway or on the top half of the epichilium; median keel starting 3.5–4 mm from the base of the lip, thin, c. 0.4 mm high, margin entire, ending about halfway the epichilium. *Epichilium* recurved, in outline transversely elliptic, 3.5–4.5 by 5.5–8 mm; top margin broadly rounded, emarginate, denticulate, somewhat recurved. *Column* without torsion, upper part not curved forward, more or less swollen at the top, 3.5–5 by 0.8–1.5 mm; top obtuse, tip drawn out into an acute, c. 0.4 mm long point; seams 0.2–0.3 mm wide, each laterally of the stigma drawn out into a distinct, flat, forward projecting, obliquely triangular, acute, 0.6–1 by 0.8–1 mm big wing; column foot with a saccate, in section more or less reniform, laterally somewhat flattened, shallowly cleft spur, 2.5–3 mm long, 2–2.5 by 1 mm wide, with obtuse, more or less shallowly cleft top. *Anther* reniform, 0.7–1 by 1.2–1.4 mm; base emarginate; top semi-orbicular, tip an erect, triangular, acute, c. 0.2 mm long point. Pollinia c. 0.7 by 0.5 mm. *Stigma* triangular to about orbicular, c. 0.7 by 0.7 mm; rostellum about triangular, c. 0.5 by 0.7 mm, hardly covered by the anther. *Fruit* not seen.

Collector's notes — Leaves variegated. Sepals and petals pinkish violet; lip white with a large light yellow blotch. Column white.

Distribution — Borneo: Sarawak (Bahagian Miri); Kalimantan (Kalimantan Timur); 2 collections: *Endert 4351* (BO, L); *Nooteboom & Chai 02212* (L, SAR).

Habitat & Ecology — Primary forest plants, once recorded from a steep, narrow, mossy slope. Altitude 1600–1750 m. Fl. April, Oct.

3. *Collabium carinatum* de Vogel, *spec. nov.* — Fig. 73

A Collabio simplice inflorescentia laxiore pauciore florenti, calcari gracili subacuto 4.5–5 mm longo differt. — Typus: *Reeve 3425* (L holo; K iso, also CBG, E, LAE, NSW, not seen).

Plant 21–42 cm high excluding the inflorescence. Roots 1–5 on each rhizome part between 2 pseudobulbs, to 6 cm long, 1–2 mm diam. Rhizome not branching, fleshy, to 6 cm long, 3–5 mm diam. Rhizome scales soon caducous, only remnants seen. *Pseudobulbs* alternately 1–3 bearing a leaf and 1 bearing an inflorescence, c. 10 mm apart, articulated at the top, when dried finely longitudinally wrinkled; leaf-bearing ones somewhat quadrangular, slightly tapering to the top, 1.4–2.5 cm long, 2.5–5 mm diam.; inflorescence-bearing ones cylindrical, 2–2.5 cm long, 3–5 mm diam. Pseudobulb scales only remnants seen, probably 5–10.5 cm long. Petiole 3–7 cm by 2–4 mm. *Leaf blade* lanceolate, 12–40 by 4.3–10 cm; top acuminate; base attenuate; main nerves 5–7, below prominent, above somewhat prominent; small nerves many. *Raceme* 15–17-flowered. Scape 29–37.5 cm long, 2–4 mm diam.; internodes 3, lower one 7.5–9 cm long, higher ones 9.5–13 cm long; scales 24–63 mm long, 3–6 mm diam., top acute, nerves 11–21. Rhachis angular, to 14.5 cm long, 2–2.5 mm diam.; internodes 3–20 mm long. *Bracts*

reflexed, linear, 6–16 by 2.5–4 mm; top acute; nerves 3–5. *Flowers* rather laxly placed at irregular distances along the rhachis, many open at the same time, rather widely open. Pedicel hardly grooved, 4.5–7 by 0.7–1.3 mm; ovary somewhat longitudinally grooved, 8–9 by 1.3–1.5 mm. *Median sepal* lanceolate, 8.5–11 by 1.8–2.5 mm; top acute; nerves 3, midrib prominent outside. *Lateral sepals* hardly unequal, lanceolate, falcate, 9–12 by 2–2.5 mm; top acute; nerves 3, midrib prominent outside. *Petals* hardly different in shape, obovate-lanceolate, hardly falcate, 8.5–8.8 by 1.7–2 mm; top (obliquely) acute to rounded; nerves 3, midrib prominent outside. *Lip* 8.5–10 mm long. *Hypochilium* c. 5 by 5–8 mm; claw 2–3 by 0.8–2 mm; lateral lobes more or less erect, projecting in front, ligulate, 2–2.5 by 1–2 mm, with an obtuse to obliquely truncate top and an erose top margin; claw with 3 keels, the median one swollen; blade with 2 lateral keels, each of which between the lateral lobes of the lip turns into an oblique pyramid 1.2–2 mm long, 1–1.2 mm wide, c. 0.5 mm high which is hollow to a depth of 0.2–0.3 mm, each provided with a keel-like ridge with an extended, obtuse to rounded top, each keel beyond the pyramid continuing on the epichilium; beyond the pyramids with a median keel. *Epichilium* somewhat recurved, in outline broadly spatulate or rectangular, 4.5–5.5 by 4.5–6 mm; top obtuse to truncate to slightly emarginate, sometimes with acute tip; front margin erose, often somewhat incurvate; keels 3, high, plate-like, thin, erect, up to 0.5–0.8 mm high with entire, irregular margin, in front lowering and ending c. 1 mm from the top of the epichilium; between the lobes of the hypochilium somewhat fleshy, starting from this place with a high, plate-like, thin median keel up to 0.3–0.5 mm high with an irregular, on the basal half often double crested margin, which ends about 1.5 mm from the top of the epichilium. *Column* with a more or less slight counterclockwise torsion, upper part slightly curved forward, somewhat swollen at the truncate, obtuse-tipped top, 5–6 by 1–1.2 mm; seams c. 0.2 mm wide, ending laterally of the stigma and there not drawn out into triangular wings; column foot with a slender, conical spur 4.5–5 mm long, 1.2–2 mm wide, with a rather acute, hardly emarginate top. *Anther* reniform, c. 1 by 1.5 mm; top broadly rounded with irregular margin; base emarginate. Pollinia c. 0.6 by 0.4 mm. *Stigma* semi-elliptic, c. 1.5 by 0.8–1 mm; rostellum truncate, 0.4–0.6 by 0.6–1 mm. *Fruit* body ellipsoid, c. 2.5 by 0.6 mm, on top the column and the back wall of the spur of the column foot persistent; jugae c. 0.7 mm wide, median with a faint ridge; valvae up to c. 4 mm wide, outside with a low rounded keel, hairs inside along the margin up to 0.7 mm long. Seeds fusiform, up to 0.9 by 0.1 mm; embryo elliptic, c. 0.05 by 0.03 mm.

Collector's notes — Sepals and petals green, lip white, the spur once recorded yellow, column white. Leaves spotted dark green

Distribution — New Guinea: Papua New Guinea (Eastern Highlands, Enga Prov.), 3 collections: *Reeve* 703 (K; LAE not seen), 3425 (K, L; CBG, E, LAE and NSW not seen), 3494 (K, L; E, LAE and NSW not seen).

Habitat & Ecology — Terrestrial in secondary forest and along an overgrown logging track. Altitude 1650–2350 m. Fl. April, July, Aug.

4. *Collabium chinense* (Rolfe) Tang & Wang — Fig. 74

Collabium chinense (Rolfe) Tang & Wang in Anon., Icon. Corm. Sinic. 5 (1976) 684, fig. 8197 ('*chinensis*'); Fl. Hainan 4 (1977) 217, fig. 1101; Seidenf., Opera Bot. 72 (1983) 24, fig. 8; Senghas in Schltr., Orch., ed. 3, A/1 (1984) 843; Averyanov, Prelim. List Vietn. Orch. (A–L) (1988) 98; in Tzvelev et al., Vasc. Pl. Syn. Vietnam Fl. 1 (1990) 59; Su, Quart. J. Chinese For. 22 (2) (1989) 24, pl. 2; Seidenf.,

Opera Bot. 114 (1992) 323, pl. 20c. — *Nephelaphyllum chinense* Rolfe, Kew Bull. (1896) 194; Rolfe in Forbes & Hemsley, J. Linn. Soc. Bot. 36 (1903) 19; Dunn & Tutchner, Kew Bull. Add. Ser. 10 (1912) 263; Hu, Quart. J. Taiwan Mus. 27 (1974) 442. — *Tainia chinensis* (Rolfe) Gagnep., Bull. Mus. Hist. Nat. Paris sér. 2, 4 (1932) 706. — Type: *Hance 17733* (BM holo).

Chrysoglossum robinsonii Ridley, J. Fed. Mal. St. Mus. 6, 3 (1915) 157; Seidenf. & Smitinand, Orch. Thail. 4, 2 (1965) 751; Seidenf., Opera Bot. 72 (1983) 23; Senghas in Schltr., Orch., ed. 3, I/A (1984) 844. — Type: *Robinson s.n.* (K holo).

Tainia balansae Gagnep., Bull. Mus. Hist. Nat. Paris sér. 2, 4 (1932) 706. — *Collabium balansae* (Gagnep.) Tang & Wang, Acta Phytotax. Sin. 1, 1 (1951) 77; Seidenf., Contr. Orch. Camb., Laos, Vietnam (1975) 36; Senghas in Schltr., Orch., ed. 3, I/A (1984) 843. — Type: *Balansa 1998* (P holo).

Chrysoglossum sp. Cumberlege & Cumberlege, Nat. Hist. Bull. Siam Soc. 20, 3 (1963) 160, pl. 25.

Plant to 24 cm high excluding the inflorescence. Roots 1–3 on each rhizome part between 2 pseudobulbs, to 5 cm long, 1–2 mm diam. Rhizome not branching, to 15 cm long, c. 3 mm diam. Rhizome scales soon caducous, only remnants seen. *Pseudobulbs* alternately 1–6 bearing a leaf and 1 bearing an inflorescence, terete to quadrangular, slightly tapering to the top, slender, clearly articulated at the junction with petiole or scape, when dried all finely longitudinally wrinkled; leaf-bearing ones 15–60 mm apart, 2–4 cm long, 3–5 mm diam.; inflorescence-bearing ones 5–20 mm from the leaf-bearing ones, c. 1 cm long, 2 mm diam. Pseudobulb scales on leaf-bearing pseudobulbs 3.7–7 cm long, 3–5 mm diam., top acute, nerves c. 13; on inflorescence-bearing pseudobulbs 1.6–2 cm long, c. 3 mm diam., top acute, nerves c. 13. Petiole 1–1.5 cm by 2–3 mm. *Leaf blade* ovate to ovate-lanceolate, 10–18 by 3.2–8.5 cm; top acute to acuminate; base rounded, attenuate; main nerves 5–7, below prominent, above slightly prominent; small nerves many. *Raceme* 5–10-flowered. Scape 7.5–15 cm long, 1–1.5 mm diam.; internodes 2 or 3, lower one 1.8–5 cm long, higher one 4–11 cm long; scales 12–27 mm long, 2–3 mm diam., top acute to acuminate, nerves c. 11. Rhachis terete, to 10 cm long, 1–2 mm diam.; internodes 10–23 mm long. *Bracts* patent to reflexed, ovate-oblong, 12–18 by 5–6 mm; top acute; nerves 7. *Flowers* rather regularly spaced along the rhachis, several open at the same time, rather widely opened. Pedicel more or less star-shaped in section, 5–8 by 0.5–0.7 mm; ovary similar, 4–7 by c. 1 mm. *Median sepal* lanceolate to linear-lanceolate, 9–13.5 by 2–3 mm; top acute; nerves 3–5, not pronounced. *Lateral sepals* equal in size and shape, lanceolate, somewhat falcate, 8.5–15 by 2–4 mm; top acuminate; nerves 3 or 4, not pronounced. *Petals* equal in size and shape, lanceolate, slightly falcate, 8.5–13 by 2–3.3 mm; top acute to acuminate; nerves 3–5, not pronounced. *Lip* 9–13 mm long. *Hypochilium* 5.3–9 by 7–10 mm, claw 2–4 by 0.8–1.5 mm; lateral lobes patent, broadly sessile, more broad than long, semi-ovate, 1.5–3 by 4–5 mm, with a rounded top and an entire margin, in front not protruding, truncate; lateral keels 2, between the lateral lobes of the lip turning into a c. 1 mm high, 1.2–2 mm long, 1–2 mm wide pyramid which is in front hollow to a depth of 0.5–1 mm, provided with a keel-like ridge with an extended, obtuse to rounded top, each keel continuing as an entire, thin, gradually lowering crest with a somewhat undulating margin, from c. 1 mm before the base of the epichilium continuing as a c. 0.2 mm high ridge, ending on the top half of the epichilium; median keel starting 3.5–5 mm from the base, entire, thin, with a somewhat undulating margin, on the base of the epichilium c. 0.2 mm high, ending about halfway the epichilium, sometimes this keel hardly developed. *Epichilium* somewhat recurved, in outline transversely elliptic, 3.8–6.5 by 6–8.5 mm; top emarginate, tip rounded to acute; margins crenate. *Column* without torsion, slender, not curved forward, slightly swollen at the acute, sharp-tipped top, 5–7 by 0.8–1 mm; seams

0.2–0.4 mm wide, each laterally of the stigma drawn out into a distinct, flat forward projecting somewhat downward curved, triangular, obtuse to acute, 1–1.5 by 1–1.5 mm big wing; column foot with a saccate, swollen, cylindrical spur 4–7.5 mm long, 1.2–2.5 mm diam., with obtuse, more or less shallowly cleft top. *Anther* reniform, 0.5–1.3 by 1.2–2 mm; base emarginate; top emarginate. Pollinia 0.5–1.3 mm by 0.5–0.7 mm. *Stigma* about triangular, c. 1.2 by 1 mm; rostellum ligulate to semi-orbicular, 0.7–1 by c. 1 mm, partly covered by the anther. *Fruit* reflexed, body 2.7–3 by 0.8–1 mm, the column and back wall of the column foot persistent; jugae narrow, band-like, c. 10 mm wide, median keeled; the valvae up to c. 6 mm wide, outside with a pronounced keel, hairs inside along the margin up to 2.8 mm long. *Seeds* fusiform, up to 0.9 by c. 0.1 mm; embryo about elliptic, c. 0.05 by 0.03 mm.

Collector's notes — Sepals and petals (pale) green. Lip white with red or mauve veins on the lateral lobes.

Distribution — Thailand (Eastern and Peninsular), Vietnam (Kontum, Tonkin), China (Yunnan, Kwangtung, Hainan); 12 collections recorded, only 4 seen for the present study (K, L, P).

Habitat & Ecology — Terrestrial primary forest plants. Altitude 500–1000 m. Fl. Feb. to Aug.

5. *Collabium chloranthum* (Gagnep.) Seidenf. — Fig. 75

Collabium chloranthum (Gagnep.) Seidenf., Opera Bot. 72 (1983) 26, fig. 12. — *Calanthe chlorantha* Gagnep., Bull. Soc. Bot. Fr. 79 (1932) 162; Fl. Gén. Indo-Chine 6 (1933) 395. — *Chrysoglossum chloranthum* (Gagnep.) Tang & Wang, Acta Phytotax. Sin. 1, 1 (1951) 77; Seidenf., Contr. Orch. Camb., Laos, Vietnam (1975) 25; Ban & Huyen in Danh Luc (ed.), Thuc Vat Tay Nguyen (Florae Taynguyenensis Enum.) Orchidaceae (1983) 197; Averyanov, Prelim. List Vietn. Orch. (A–L) (1988) 99; in Tzvelev et al., Vasc. Pl. Syn. Vietn. Fl. 1 (1990) 59; Seidenf., Opera Bot. 114 (1992) 325, fig. 219. — Type: *Poilane 19731* (P holotype).

Plant c. 29 cm high excluding the inflorescence. Roots 1–3 on each rhizome part between 2 pseudobulbs, to 6 cm long, 2–3 mm diam. Rhizome not branching, to 4 cm long, 3–4 mm diam. Rhizome scales soon caducous, only remnants seen. *Pseudobulbs* alternately 1 bearing a leaf and 1 bearing an inflorescence, c. 10 mm apart, terete, slender, clearly articulated at the junction with petiole or scape, when dried all finely longitudinally wrinkled; leaf-bearing ones tapering to the top, 4–4.5 cm long, 5–6 mm diam.; inflorescence-bearing ones cylindrical, 0.8–1.2 cm long, 2–3 mm diam. Pseudobulb scales only remnants seen. Petiole 2–2.5 cm by c. 2 mm. *Leaf blade* lanceolate, 17–21 by 3.5–4.1 cm; top acute; base attenuate; main nerves 7, below prominent, above slightly prominent; small nerves many. *Raceme* c. 6-flowered. Scape 28–29 cm long, 1.5–2.5 mm diam.; internodes 3, lower one 1.5–4.5 cm long, middle one 8.5–10.5 cm long, highest one 14–18 cm long; scales about equal, 20–25 mm long, 2–3 mm diam., top not seen, nerves c. 13. Rhachis about triangular, incomplete in the only specimen, 1–1.5 mm diam.; internodes 15–20 mm long. *Bracts* reflexed, ovate-oblong, c. 9 by 3.5 mm; top acute; nerves 3, midrib with a low keel. *Flowers* rather regularly spaced along the rhachis, several open at the same time, widely opened. Pedicel star-shaped in section, c. 6 by 1 mm; ovary similar, c. 6 by 1.5 mm. *Median sepal* linear-lanceolate, c. 17 by 3.8 mm; top acute; nerves 3, not prominent. *Lateral sepals* unequal in size and shape, lanceolate, falcate, 14.5–15 by c. 4.5 mm; top acute; nerves 3–5, midrib outside with a low keel. *Petals* unequal in size and shape,

obovate-lanceolate, slightly falcate, c. 17 by 4.3–4.3 mm; top acute; nerves 5, midrib outside with a low keel. *Lip* in outline entire without lateral lobes, basal half parallel to the column, top half recurved, in outline obovate-oblong, c. 12 by 7 mm; top obtuse; margin of the basal 6 mm very finely ciliate, margin of the top half strongly double lacerate; lateral keels 2, entire, thin, c. 0.5 mm high, on c. 3 mm from the base turning into a large, patent, obliquely triangular, falcate, c. 5 by 3–3.5 mm big lobe with an acute top and scattered papillae, each keel continuing as a thin, c. 0.4 mm high crest with an irregularly denticulate margin, ending c. 2 mm from the top of the lip; median keel simple, low, with irregularly denticulate margin. *Column* without torsion, rather slender, upper part not curved forward, slightly swollen at the obtuse, blunt tipped top, c. 8 by 1 mm; seams c. 0.4 mm wide seam, starting on the front margin of the opening of the spur, continuing along the sides of the column, ending just above the stigma; column foot with a saccate, cylindrical spur c. 6 mm long, c. 2 mm diam., with obtuse, slightly cleft top. *Anther* and pollinia not seen. *Stigma* ligulate, c. 1.3 by 1 mm, with a callus along the lower margin; rostellum truncate, c. 0.5 by 1 mm. *Fruit* not seen.

Collector's notes — Flowers pale green, sepals reddish to the base. Lip white, pinkish to the top. Column yellowish white.

Distribution — Vietnam (Lam Dong). Only known from the type.

Habitat & Ecology — Montane forest plants. Altitude 2000 m. Fl. Oct. (only one record).

Note — This species differs from all other *Collabium* species in the absence of lateral lobes on the lip. A casual observer may easily mistake the large, falcate lobes of the keels on the lip for lateral lobes. On a label Gagnepain stated that he observed only 2 pollinia; unfortunately, the pollinia and the anther are missing from the type specimen. An accompanying sketch shows one free pollinium. Important other characters such as the pseudobulbs alternately bearing a leaf and an inflorescence, the spur formed by the column foot, the shape of the base of the lateral sepals and the claw of the lip, all suggest that this species belongs in *Collabium*.

6. *Collabium delavayi* (Gagnep.) Seidenf. — Fig. 76

Collabium delavayi (Gagnep.) Seidenf., Opera Bot. 72 (1983) 26, fig. 11. — *Tainia delavayi* Gagnep., Bull. Mus. Hist. Nat. Paris sér. 2, 4 (1932) 708; Hu, Quart. J. Taiw. Mus. 28 (1975) 167. — *Chrysoglossum delavayi* (Gagnep.) Tang & Wang, Act. Phytotax. Sin. 1, 1 (1951) 77; Hu, Quart. J. Taiw. Mus. 25 (1972) 216; Senghas in Schltr., Orch., ed. 3, I/A (1984) 844. — Type: *Delavay s.n.* (P holo). *Collabium formosanum* auct. non Hayata p.p.: Seidenf., Opera Bot. 72 (1983) 25, fig. 10c (specimen *To & Ts'ang* 12402); Opera Bot. 114 (1992) 324, p.p., fig. 218c.

Plant long creeping, to 13 cm high excluding the inflorescence. Roots 1–4 on each rhizome part between 2 pseudobulbs, to 6 cm long, 1–2 mm diam. Rhizome not branching, to 30 cm long, 1.5–2 mm diam. Rhizome scales rather long persistent, 8–18 mm long, 2–2.5 mm diam.; top obtuse to acute; nerves c. 15. *Pseudobulbs* alternately 1–3 bearing a leaf and 1 bearing an inflorescence, more or less clearly articulated at the top, when dried all finely longitudinally wrinkled; leaf-bearing ones 6.5–8 cm apart, somewhat angular in section, somewhat tapering to the top, 15–25 mm long, 1.5–2 mm diam.; inflorescence-bearing ones 15–20 mm from the leaf-bearing ones, cylindrical, 3–5 mm long, c. 2 mm diam. Pseudobulb scales on leaf-bearing pseudobulbs 2.2–3 cm long, 3–3.5 mm diam.,

top acute, nerves c. 15; on inflorescence-bearing pseudobulbs 1.4–2 cm long, 2.5–3 mm diam., top obtuse, nerves c. 15. Petiole 4–11 by 1–1.5 mm. *Leaf blade* ovate-oblong, 5.5–12 by 2.5–4.3 cm; top acute to acuminate; base attenuate to semi-orbicular; the main nerves 5, below prominent, above slightly prominent; small nerves many. *Raceme* 4–7-flowered. Scape 13–17 cm long, 1–1.5 mm diam.; internodes 2, lower one 3.5–9 cm long, higher one 7–10 cm long; scales 15–20 mm long, 1.5–2 mm diam., top obtuse, nerves c. 11. Rhachis somewhat angular, to 8 cm long, c. 1 mm diam.; internodes 12–30 mm long. *Bracts* patent, ovate-oblong, 6–11 by 2–5.5 mm; top acute; nerves 3–7. *Flowers* rather regularly spaced along the rhachis, most open at the same time, widely opened. Pedicel more or less star-shaped in section, 6–6.5 by c. 0.5 mm; ovary similar, 5–7 by 0.7–1 mm. *Median sepal* obovate-linear-lanceolate, 16–18.5 by 2–3 mm; top acute to acuminate; nerves 3, not prominent outside. *Lateral sepals* unequal in size and shape, one more falcate than the other, obovate-linear-lanceolate, 13–16.5 by 2–3 mm; top acuminate; nerves 3, not prominent outside. *Petals* about equal in size and shape, slightly falcate, obovate-linear-lanceolate, 12–16.5 by 2–2.5 mm; top acute to acuminate; nerves 3, not prominent outside. *Lip* 13–15.5 mm long. *Hypochilium* 7–10 by 9–10 mm; claw 4.5–5.5 by 1–2 mm; lateral lobes erect, somewhat falcate, semi-ovate, 6–7.5 by 2.5–4 mm, with an obtuse to acute, irregularly dentate to lacerate top, a somewhat undulating, more or less entire outer margin and a \pm straight inner margin; lateral keels 2, between the lateral lobes of the lip turning into an erect, inward curved, c. 2 mm long, 1.3–1.7 mm high ligulate lobe with a rounded top, each keel continuing as an entire, thin, c. 0.4 mm high crest with a somewhat undulating margin, ending about halfway or on the top half of the epichilium, and there either or not with several small, erect, narrowly ligulate projections up to c. 0.4 mm high; median keel starting from the fleshy part between the elevations of the keels as a low, fleshy, entire ridge which ends on the basal half or the top half of the epichilium, sometimes this ridge is to the top divided in ligulate projections. *Epichilium* somewhat recurved, in outline broadly obovate to transversely elliptic, 5.5–6 by 7–8 mm; top truncate to somewhat emarginate; margins dentate to lacerate and somewhat undulating; sometimes on the surface with some rows of small, erect, narrowly ligulate, up to 0.3 mm high lobes laterally of the keels. *Column* with a slight counterclockwise torsion, very slender, upper part somewhat curved forward, somewhat swollen at the truncate, acute-tipped top, 9–10.5 by 0.5–1 mm; seams 0.1–0.3 mm wide, each laterally of the base of the stigma drawn out into a distinct, flat forward projecting, triangular, acute, c. 0.5 by 0.3 mm big wing; column foot with a saccate, cylindrical spur 5–6.5 mm long, 1.5–2 mm diam., with an obtuse, shallowly cleft top. *Anther* reniform, 1–1.2 by 1.2–1.5 mm; top obtuse, either or not with a small acute tip; base emarginate. Pollinia 0.5–0.8 by 0.4–0.5 mm. *Stigma* ligulate, 1.2–1.5 by c. 1 mm; rostellum truncate, 0.2–0.4 by c. 1 mm, not covered by the anther. *Fruit* not seen.

Collector's notes — Flower colours recorded as: white with violet ends of tepals; yellowish, red lined; purple.

Distribution — China (Yunnan, Kwangtung, Kwangsi), 6 collections (AMES, E, K, NY, P, SING).

Habitat & Ecology — Primary forest plants, recorded growing along streams, in ravines, and on rocks. Altitude 700–750 m. Fl. June, Nov. (both once recorded).

Note — For a discussion of the differences of *Collabium delavayi* with the very closely related *C. formosanum*, see note 3 under that species.

7. *Collabium formosanum* Hayata — Fig. 79

Collabium formosanum Hayata, J. Coll. Sci. Imp. Univ. Tokyo 30, 1 (1911) 319; Schltr. in Fedde, Rep., Beih. 4 (1919) 183; Sasaki, Cat. Gov. Herb. (1930) 142; Hsieh, Quart. J. Taiw. Mus. 8 (1955) 228; Hu, Quart. J. Taiw. Mus. 26 (1973) 131; Lin, Nat. Orch. Taiwan 2 (1977) 96, fig. 98, phot. & col. phot.; Liu & Su, Fl. Taiwan 5 (1978) 932, fig. 1567; Seidenf., Opera Bot. 72 (1983) 25, p.p., fig. 10a, b; Senghas in Schltr., Orch., ed. 3, I/A (1984) 843, fig. 646; Averyanov, Prelim. List Vietn. Orch. (A–L) (1988) 99; in Tzvelev et al., Vasc. Pl. Syn. Vietnam Fl. 1 (1990) 59; Su, Quart. J. Chinese For. 22 (2) (1989) 24, pl. 3; Seidenf., Opera Bot. 114 (1992) 324, fig. 218a, b. — *Collabiopsis formosana* (Hayata) S.S. Ying, Col. Illust. Indig. Orch. Taiwan 1 (2) (1977) 112 (not seen). — Type: Kawakami & Mori 3181 (not seen, see note 1).

Collabium uraiense Fukuyama, Bot. Mag. Tokyo 48 (1934) 300; Hsieh, Quart. J. Taiw. Mus. 8 (1955) 228; Hu, Quart. J. Taiw. Mus. Hist. Nat. 26 (1973) 131. — *Collabiopsis uraiensis* (Fukuyama) S.S. Ying, Col. Illust. Indig. Orch. Taiwan 1 (2) (1977) 435 (not seen). — Type: Fukuyama 3977 (not seen, see note 2).

Tainia chapaensis Gagnep., Bull. Mus. Hist. Nat. Paris sér. 2, 4 (1932) 707; Fl. Gén. Indo-Chine 6, 3 (1932) 378. — *Chrysoglossum chapaense* (Gagnep.) Tang & Wang, Act. Phytotax. Sin. 1, 1 (1951) 77; Seidenf., Contr. Orch. Camb., Laos, Vietnam (1975) 25; Anon., Icon. Corm. Sinic. 5 (1976) 648, fig. 8198. — Syntypes: *Pételot 5148* (P lecto, here chosen; AMES iso), *5165* (P, not seen).

Plant to 22 cm high excluding the inflorescence. Roots 2–5 on each rhizome part between 2 pseudobulbs, to 10 cm long, 1–2 mm diam. Rhizome rarely branched, to 32 cm long, 2–3 mm diam. Rhizome scales usually long persistent, 13–35 mm long, 3–5 mm diam.; top acute; nerves c. 17. *Pseudobulbs* alternately 1–3 bearing a leaf and 1 bearing an inflorescence, terete, more or less clearly articulated at the junction with petiole or scape, when dried all rather smooth; leaf-bearing ones 40–130 mm apart, slightly tapering to the top, 2–5 cm long, 2–3 mm diam.; inflorescence-bearing ones 30–70 mm from the leaf-bearing one, cylindrical, 4–15 mm long, c. 3 mm diam. Pseudobulb scales on leaf-bearing pseudobulbs 3.8–5 cm long, 3–5 mm diam., top acuminate, nerves c. 17; on inflorescence-bearing pseudobulbs 1.5–2.5 cm long, 3.5–4 mm diam., top acute, nerves c. 17. Petiole 11–20 by 1.5–2 mm. *Leaf blade* (ovate-)oblong, 8–17 by 2.8–6 cm; top acuminate; base attenuate to somewhat semi-orbicular; main nerves 5, below prominent, above somewhat prominent; small nerves many. *Raceme* 3–11-flowered. Scape 10–23.5 cm long, c. 1.5 mm diam.; internodes 2 or 3, lower one 2.5–7 cm long, higher ones 3.5–10 cm long; scales 25–35 mm long, c. 3 mm diam. Rhachis terete, to 10 cm long, c. 1.5 mm diam.; internodes 6–22 mm long. *Bracts* narrowly triangular, 6–20 by 1–2 mm; top acute; nerves 7. *Flowers* rather regularly spaced along the rhachis, most open at the same time, rather widely opened. Pedicel \pm star-shaped in section, 5–7 by c. 0.5 mm; ovary similar, 5–6 by c. 1 mm. *Median sepal* obovate-linear-lanceolate, 16–18 by 1.3–2 mm; top acuminate, with inrolled margins; nerves 3–5, all slightly prominent outside. *Lateral sepals* unequal in size and shape, linear-lanceolate, somewhat falcate, 15–18 by 1.8–2.5 mm; top acuminate; nerves 3, midrib slightly prominent outside. *Petals* slightly unequal in size and shape, obovate-linear-lanceolate, slightly falcate, 15–18 by 1–1.8 mm; top acute to acuminate; nerves 3, midrib slightly prominent outside. *Lip* 13–16 mm long. *Hypochilium* 7–9.2 by 8–9 mm; claw 4–6 by 1–3 mm; lateral lobes obliquely semi-ovate, somewhat falcate, 7–7.5 by 3–4 mm, with an acute, dentate to lacerate top and a more or less entire, somewhat undulating outer margin, inner margin about straight; lateral keel 2, lateral lobes of the lip turning into an erect, inwards curved, 4–5 mm long, 1–1.8 mm high lobe with a rounded top, each keel continuing as a low, inconspicuous ridge with irregular to dentate margin

which ends on the basal half of the epichilium; median keel starting from the fleshy part between the elevated part of the keels as an inconspicuous, somewhat undulating ridge which ends on the basal half of the epichilium. *Epichilium* somewhat recurved, in outline obovate, 5–7 by 4.5–6 mm; top acute or acuminate to obtuse; side margins more or less entire, top margin irregular to lacerate. *Column* with a slight counterclockwise torsion, slender, upper part somewhat curved forward, somewhat swollen at the obtuse, sharp-tipped top, 9–10 by 0.5–0.7 mm; seams 0.1–0.2 mm wide, each just below the stigma drawn out into a distinct, flat, forward projecting, triangular, acute, 0.3–0.5 by 0.5–1 mm big lobe; column foot with a saccate, swollen, laterally somewhat flattened, in front somewhat indented spur 5–5.5 mm long, 2–2.5 by 0.7–1 mm wide with obtuse, more or less shallowly cleft top. *Anther* semi-orbicular, c. 0.6 by 0.8 mm; base emarginate; top semi-orbicular, tip with 1–3 small acute points. Pollinia not seen. *Stigma* ligulate, 1.3–2 by c. 1 mm; rostellum truncate, 0.3–0.5 by c. 1 mm, partly covered by the anther. *Fruit* not seen.

Collector's notes — Sepals and petals green, also recorded with red spots inside. Lip white or cream coloured; one record for red stripes or spots and one twisted to one side. Column purple (one record).

Distribution — Burma (North), Vietnam (Tonkin), Taiwan (Taipei, Nantou); 2 collections seen (K, P)

Habitat & Ecology — Terrestrial forest plants, recorded from laurel forest. Altitude 1350–1600 m; recorded down to 840 m by Tang & Wang, up to 2000 m by Liu & Su. Fl. Aug (4 records).

Notes — 1. No material from Taiwan could be studied for this revision. The description by Liu & Su agrees most with the one given above, and differs from that of the closely related *C. delavayi*. The drawing by Liu & Su (1978) is not very accurate.

2. The types of both *Collabium formosanum* and *C. uraiense* were not available for this revision. The latter species is regarded here as a synonym of *C. formosanum* on the authority of Lui & Su (1978). They describe and illustrate *C. formosanum* as having a hairy anther. However, all specimens studied for this revision have glabrous anthers.

3. *Collabium formosanum* is very closely related to *C. delavayi*. Differences found in this study are the following:

	<i>Collabium delavayi</i>	<i>Collabium formosanum</i>
Bracts	ovate-oblong, 6–11 by 2–5.5 mm	narrowly triangular, 6–20 by 1–2 mm
Petal width	2–2.5 mm	1–1.8 mm
Epichilium	wider than long	longer than wide
Epichilium	keels distinct, c. 0.4 mm high	indistinct low ridge

These characters, however slight they are, make a distinction between the two possible. More material is needed to decide whether these differences can be maintained. Seidenfaden (1983) kept the two separate although he was informed by Tang that in Peking they are believed to be conspecific.

8. *Collabium nebulosum* Blume — Fig. 78; Plate 7b

Collabium nebulosum Blume, Bijdr. (1825) 357; Lindley, Gen. & Sp. Orch. (1830) 96; Miq., Fl. Ind. Bat. 3 (1855) 678; Rchb. f., Bonplandia 5, 3 (1857) 58; Miq., Choix (1864) pl. 26; Ridley, Mat. Fl. Mal. Pen. 1 (1907) 112; Schltr., Orch. (1914) 132; Ridley, Fl. Mal. Pen. 4 (1924) 112; Burkill & Hend.,

Gard. Bull. Str. Settl. 3 (1925) 437; Senghas in Schltr., Orch., ed. 3, I/A (1984) 842, fig. 645. — *Chrysoglossum nebulosum* (Blume) J.J. Smith, Orch. Java (1905) 176; Orch. Java, Fig.-Atl. (1909) fig. 133; Koord., Exk. Fl. Java, Monocot. (1911) 367; J.J. Smith, Bull. Jard. Bot. Buitenzorg II, 8 (1912) 3; in Fedde, Rep. 32 (1933) 159; Backer & Bakh. f., Fl. Java (1968) 290; Comber, Orch. Java (1990) 372. — Type: *Blume 311* (L. holo)

Note: For the use of the terms 'left' and 'right' see note 1 under the generic description.

Plant 30 to 58 cm high excluding the inflorescence. Roots 3–8 on each rhizome part between 2 pseudobulbs, to 16 cm by 1.5–3 mm diam. Rhizome not branching, fleshy, to 20 cm long, 2–6 mm diam. Rhizome scales soon caducous, only remnants seen. *Pseudobulbs* alternately 1 or 2 bearing a leaf and 1 bearing an inflorescence, 15–30 mm apart, clearly articulated at the top, when dried finely longitudinally wrinkled; leaf-bearing ones more or less quadrangular in section, tapering to the top, 6.5–13 cm long, 2–5 mm diam.; inflorescence-bearing ones cylindrical, 0.5–2 cm long, 2–5 mm diam. Pseudobulb scales only remnants seen. Petiole 4.5–14 cm by 1.5–4 mm. *Leaf blade* oblong, 16.5–33 by 7.7–14 cm; top acuminate; base attenuate; main nerves 7–9, below prominent, above somewhat prominent; small nerves many. *Raceme* 22–70-flowered. Scape 44–60 cm long, 2–5 mm diam.; internodes 3 or 4, lowest one 7–16 cm long, higher ones 8–27 cm long; scales 2.5–4.8 cm long, 4–6 mm diam., top obtuse to acute, nerves c. 15. Rhachis terete, to 45 cm long, 2–4 mm diam.; internodes 1–20 mm long. *Bracts* more or less reflexed, linear, 9.5–22 by 1–3 mm; top acute; nerves 3. *Flowers* rather irregularly spaced in groups along the rhachis, many open at the same time, very widely open; all parts with a torsion around the column. Pedicel shallowly longitudinally grooved, 5–7 by c. 0.5 mm; ovary slightly more grooved, 4–5 by 0.6–1 mm. *Median sepal* reflexed, lanceolate, slightly falcate, 7–11.5 by 2–3 mm; top acuminate; nerves 3, midrib slightly prominent outside. *Lateral sepals* reflexed, unequal in shape, oblong, left one falcate, right one less so, 6–10 by 2.3–4 mm; top acuminate; nerves 3, midrib slightly prominent outside. *Petals* reflexed, unequal in size and shape, lanceolate, left one somewhat falcate, 6–9.5 by 1.8–3 mm, right one not falcate, 6–10 by 2–3.6 mm; top acute to acuminate; nerves 3, midrib slightly prominent outside. *Lip* 5.5–8.5 mm long. *Hypochilium* 3.2–5 by 6.5–10 mm; claw 1.5–3 by 0.7–1.5 mm; lateral lobes patent or somewhat recurved, ligulate, 2–4 by 1.2–3 mm, with an obtuse to semi-orbicular top and a somewhat lacerate to irregularly denticulate top margin; lateral keels 2, between the lateral lobes of the lip turning into an erect, 1–2 mm long, 1–1.8 mm high, ligulate, fleshy lobe with a rounded top, each keel continuing as a low ridge, ending about halfway or on the top half of the epichilium; median keel small, starting at the base of the lip, c. 0.3 mm high, entire, thin, continuing for 1–2 mm, between the lateral lobes of the lip dissolving in a fleshy patch, beyond that starting again, ending halfway the epichilium. *Epichilium* recurved to reflexed, in outline about transversely rectangular, 2.2–4.5 by 3–5.5 mm; top truncate, tip sometimes acuminate; top margin strongly lacerate and undulating, sometimes somewhat incurvate. *Column* with a strong counter-clockwise torsion of about 90 degrees, upper part hardly curved forward, slightly swollen at the acuminate or obtuse top, 3.5–5.3 by 0.5–0.8 mm; seams 0.2–0.3 mm wide, each laterally below the stigma drawn out into a small, flat, forward projecting, c. 0.3–0.5 by c. 0.5 mm big triangular wing with a rounded top; column foot with a conical-fusiform spur 4.2–8.5 mm long, 1.5–2 mm diam., with acute to acuminate top. *Anther* reniform to transversely elliptic, 0.5–0.8 by 0.8–1 mm; base emarginate; top obtuse to rounded, tip sometimes apiculate, top margin somewhat recurved. Pollinia 0.4–0.5 by 0.3–0.4 mm.

Stigma ligulate, 0.7–1 by 0.7–1 mm; rostellum obtuse, c. 0.2 by 0.7–1 mm, partly covered by the anther. *Fruit* only young ones seen, see note 2.

Collector's notes — Leaves (dark) green with darker green blotches, petiole sometimes violet or purplish. Scape and rhachis violet or purple, bracts (dark) purple. Sepals and petals greenish yellow or (light) green, the former once recorded slightly suffused red along the margin. Lip white, the claw and lobes of the lateral keels golden yellow, keels once recorded with a red streak. Column golden yellow, spur reddish, anther yellow.

Distribution — Sumatra (Sumatera Barat), 1 collection (BO). Java (Jawa Barat, Timur; in literature also reported from Jawa Tengah), 28 coll. (BO, K, L, NY, W).

Habitat & Ecology — Primary or secondary forest terrestrials, also recorded from boulders in a river. Altitude 650–2400 m, most records from 900–1100 m. Fl. Feb., May, July, most records from Sept. and Oct. In literature also recorded flowering in Aug. and Nov. to Dec.

Notes — 1. The specimen *Kuhl & van Hasselt 179* has a scale of the scape grown out and resembling a small leaf. Petiole 3–5.5 cm by c. 3 mm. *Leaf blade* oblong-lanceolate, 11–16 by 4–6 cm; top acuminate; base attenuate; main nerves 7.

2. During maturing of the young fruit the column foot turns to a right angle to the fruit body. One young fruit was fairly advanced in growth: fruit body fusiform, 25 by 3 mm, jugae 1 mm wide, valvae 1.5 mm wide; perianth and column persistent on top.

9. *Collabium pumilum* (J.J. Smith) Seidenf. — Fig. 79

Collabium pumilum (J.J. Smith) Seidenf., *Opera Bot.* 72 (1983) 22. — *Chrysoglossum pumilum* J.J. Smith, *Bot. Jahrb.* 65 (1933) 458; *Bull. Jard. Bot. Buitenzorg III*, Suppl. 3 (1949) pl. 155, 2; Senghas in *Schltr., Orch.*, ed. 3, I/A (1984) 844. — Type: *Kjellberg 1468* (S holotype; L iso).

Plant long creeping, to 7 cm high excluding the inflorescence. Roots 0–2 on each rhizome part between 2 pseudobulbs, to 2 cm long, c. 1 mm diam. Rhizome not branching, to 25 cm long, 0.5–2 mm diam. Rhizome scales long persistent, inflated, 7–18 mm long, 2–3 mm diam.; top obtuse; nerves c. 7. *Pseudobulbs* alternately 3–6 bearing a leaf and 1 bearing an inflorescence, 2–10 cm apart, slender, terete to about triangular in section, sometimes somewhat tapering, more or less clearly articulated at the junction with blade or scape, when dried all finely longitudinally wrinkled; leaf-bearing ones 7–13 mm long, 0.8–1 mm diam.; inflorescence-bearing ones 10–13 mm long, 0.8–1 mm diam. Pseudobulb scales on leaf-bearing pseudobulbs 1–1.9 cm long, 1.5–2 mm diam., top acute, nerves c. 7; on inflorescence-bearing pseudobulbs 1.2–1.8 cm long, 2–2.5 mm diam., top acute, nerves c. 10. Petiole 4–16 by 0.8–1 mm. *Leaf blade* oblong-ovate, 2.7–4.4 by 1.2–1.3 cm; top acuminate; base semi-orbicular to attenuate; main nerves 1–3, below prominent, above somewhat prominent; small nerves c. 10–15. *Raceme* 4–8-flowered. Scape 11–17.5 cm long, c. 2 mm diam.; internodes 2 (or 3), lower one 3.3–6.1 cm long, highest one 5.4–10 cm long; scales 10–25 mm long, 2–3 mm diam., with obtuse to acute top, nerves c. 10. Rhachis terete, to 4.5 cm long, c. 1 mm diam.; internodes 5–13 mm long. *Bracts* patent, ovate, 4–7.5 by 2.8–3.5 mm; top acute; nerves 3. *Flowers* rather regularly spaced along the rhachis, most open at the same time, rather widely opened. Pedicel somewhat longitudinally grooved, 4–9 by c. 0.5 mm; ovary longitudinally grooved, 3–4 by c. 0.8 mm. *Median sepal* lanceolate, 7–8 by 2–3.3 mm; top broadly acute to obtuse; nerves 3, midrib somewhat prominent outside. *Lateral sepals* slightly different in size and

shape, lanceolate, somewhat falcate, 6.5–9 by 2.3–3.3 mm; top acute to acuminate; nerves 3, midrib somewhat prominent outside. *Petals* equal in size and shape, oblong-lanceolate, 6.8–8.5 by 2–2.9 mm; top obtuse to acuminate; nerves 3, midrib somewhat prominent outside. *Lip* 7.5–9 mm long. *Hypochilium* 2.2–3 by 5–7 mm; claw 1–1.5 by 1–1.5 mm; lateral lobes patent, falcate, obliquely linear-lanceolate, 2.3–3.5 by 0.8–1.4 mm, with an acute top and an entire margin; lateral keels 2, between the lateral lobes of the lip turning into an erect, 0.7–1.5 mm long, 1–1.5 mm high incurvate ligulate lobe with a rounded top, each keel continuing as an entire, more or less fleshy, 0.2–0.3 mm high crest with a somewhat undulating margin, ending about halfway or on the top half of the epichilium; between the lobes of the keels somewhat fleshy, median keel either absent or starting from this place, 0.1–0.2 mm high, more or less fleshy, with an entire margin, ending about halfway or on the top half of the epichilium. *Epichilium* recurved, in outline spatulate, 5–6.5 by 3.5–4 mm; top truncate to emarginate when flattened, lateral margins entire, top margin more or less strongly dentate to lacerate, undulating; keels 2 or 3, continued from the hypochilium. *Column* with or without a slight counterclockwise torsion, upper part hardly curved forward, slightly swollen at the obtuse to truncate top, c. 4 by 0.8–1 mm; seams narrow, 0.2–0.4 mm wide, sometimes each laterally of the stigma drawn out into a small, flat, forward projecting, semi-orbicular, c. 1 by 0.5 mm big lobe; column foot with a saccate, laterally somewhat flattened, 2.5–4 mm long, 0.8–1.3 mm wide spur with a rounded, somewhat emarginate top. *Anther* reniform, 0.5–0.8 by 1–1.2 mm; base emarginate; top obtuse with a small triangular tip, slightly recurved. Pollinia c. 0.5 by 0.3 mm diam. *Stigma* ligulate, 0.7–1 by 0.5–1 mm; rostellum truncate, 0.3–0.5 by 0.8 mm. *Fruit* not seen.

Collector's notes — Leaves blue-green above, grey-green below. Bracts flushed purple. Sepals and petals white, sometimes with a faint purple line on the outside. Lip white, sometimes yellowish at the base, red or purple spotted at the top. Column yellowish or white, spur yellow.

Distribution — Celebes (Sulawesi Selatan), endemic, 3 collections: *Kjellberg 1469* (S, L); *Sands 416* (K, L); *van Steenis 10308* (BO, L).

Habitat & Ecology — Montane moss forest plants, terrestrial, once recorded rooting in thick moss. Altitude 2000–2700 m. Fl. May, June and Nov.

10. *Collabium simplex* Rchb. f. — Fig. 80

Collabium simplex Rchb. f., Gard. Chron. new ser. 15 (1881) 462; Ridley, J. Linn. Soc. Bot. 31 (1896) 285; Thistleton-Dyer, Kew Bull. Add. Ser. 4 (1900) 105; Ames in Merrill, Enum. Born. (1921) 143; Chan et al., Orch. Borneo 1 (1994) 103, fig. 19, pl. 4 C, D. — *Chrysoglossum simplex* (Rchb. f.) J.J. Smith, Orch. Java (1905) 177; Bull. Dep. Agr. Ind. Néerl. 13 (1907) 20; Orch. Java, Fig.-Atl. (1909) fig. 134; Koord., Exk. Fl. Java, Monocot. (1911) 367, 368; J.J. Smith, Bull. Jard. Bot. Buitenzorg II, 8 (1912) 3; Bull. Jard. Bot. Buitenzorg III, 9 (1928) 482; in Fedde, Rep. 32 (1933) 159; Masamune, En. Phan. Born. (1942) 138; Holtum, Orch. Malaya, ed. 3 (1964) 177; Backer & Bakh. f., Fl. Java (1968) 290; Senghas in Schltr., Orch., ed. 3, I/A (1984) 844; Comber, Orch. Java (1990) 372; Seidenf. & Wood, Orch. Penins. Malaysia & Sing. (1992) 533, fig. 241. — Syntypes: *Veitch & Sons* (Curtis) 288 (W lecto, here chosen); *Bull 592* (W pencil sketch). See note 1.

Note: For the use of the terms 'left' and 'right' see note 1 under the generic description.

Plant 24–40 cm high excluding the inflorescence. Roots 5–10 on each rhizome part between 2 pseudobulbs, to 15 cm long, c. 2 mm diam. Rhizome not branching, fleshy, to 10

cm long, 4–5 mm diam. Rhizome scales soon caducous, only remnants seen. *Pseudobulbs* alternately 1–3 bearing a leaf and 1 bearing an inflorescence, 5–15 mm apart, clearly articulated at the top, when dried finely longitudinally wrinkled; leaf-bearing ones somewhat quadrangular, tapering to the top, 1.5–3.2 cm long 4–7 mm diam.; inflorescence-bearing ones cylindrical, 0.8–1.5 cm long, 3–6 mm diam. Pseudobulb scales only remnants seen. Petiole 1.5–3.5 cm by 3–4 mm. *Leaf blade* lanceolate, (8.5–)21–37.5 by 6–15 cm; top acuminate; base attenuate; main nerves 7–9, below prominent, above somewhat prominent; small nerves many. *Raceme* 20–70-flowered. Scape 22–30 cm long, 2–4 mm diam.; internodes 2–4, lower one 4–6.5 cm long, higher ones 4–16 cm long; scales 20–50 mm long, 4–6 mm diam., top acute, nerves 20–30. Rhachis angular, to 28 cm long, 1–1.5 mm diam.; internodes 1–16 mm long. *Bracts* reflexed, linear, 6–20 by 1–2.5 mm; top acute; nerves 3. *Flowers* rather irregularly placed in groups along the rhachis, many open at the same time, widely open. Pedicel somewhat longitudinally grooved, 3–5 by 0.4–0.6 mm; ovary similar, 3–5 by 0.8–1.3 mm. *Median sepal* lanceolate, 8–10 by 1.5–2.7 mm; top acute; nerves 3–5, not prominent outside. *Lateral sepals* somewhat unequal, lanceolate, left one falcate, right one less so, 7.5–10 by 1.5–3 mm; top acute to somewhat acuminate; nerves (3–)5, not prominent outside. *Petals* slightly different in shape, lanceolate, left one somewhat falcate, right one not falcate, 7–9 by 1.5–2.7 mm; top acute to somewhat acuminate; nerves 3–5, not prominent outside. *Lip* 7–9 mm long. *Hypochilium* 3.5–4 by 5–7 mm; claw 2–3 by 0.7–1.3 mm; lateral lobes more or less erect, ligulate, 1.2–2.5 by 1–1.5 mm, with an obtuse to obliquely truncate top and an entire to slightly erose, somewhat undulating top margin; lateral keels 2, between the lateral lobes of the lip turning into an erect, 0.7–1.3 mm long, 1–1.5 mm high, ligulate to triangular, fleshy lobe with a rounded top, each keel continuing as an entire, rather fleshy, 0.2–0.4 mm high crest ending about halfway the epichilium; between the lobes of the keel somewhat fleshy, starting from this place with an inconspicuous, somewhat fleshy, entire median keel 0.2–0.3 mm high which ends about halfway the epichilium. *Epichilium* somewhat recurved, in outline obovate to almost orbicular or rectangular, 4–5 by 4–6 mm; top obtuse to slightly emarginate, sometimes with acute tip; front margin irregularly denticulate to lacerate and undulating, often somewhat incurvate. *Column* with a strong counterclockwise torsion, upper part more or less curved forward, somewhat swollen at the truncate, obtuse-tipped top, 3–4.5 by 0.5–1 mm; seams 0.2–0.3 mm wide, ending laterally of the stigma and there not drawn out into triangular wings; column foot with a sturdy, saccate spur 2–3.5 mm long, 0.8–1.7 mm wide, with a broadly rounded, more or less deeply emarginate top. *Anther* reniform, 0.5–0.7 by 0.7–1 mm; top broadly rounded, sometimes apiculate; base emarginate. Pollinia 0.4–0.5 by 0.3–0.4 mm. *Stigma* semi-orbicular to ligulate, 0.7–1 by 0.6–1 mm; rostellum truncate, c. 0.2 by 0.6–0.7 mm. *Fruit* not seen.

Collector's notes — Pseudobulbs purplish. Leaves when young violet, later on upper surface bright green with dark green rounded spots, lower surface (violetish) green with faint spots. Inflorescence, bracts, pedicels and ovaries violetish red to purplish. Sepals and petals (light) greenish (yellow), at the base and in the middle with a (reddish) violet blotch. Lip white, sometimes with violet, front part sometimes pale yellowish. Column white, more or less violet to the base; spur (pale) yellow.

Distribution — Malay Peninsula (Perak, Pahang), 2 coll. (E, SING). Sumatra (Sumatera Utara, Bengkulu), 4 coll. (BO, L). Java (Jawa Barat), 2 coll. (L). Borneo: Sabah (Bahagian Pantai Barat, Pedalaman); Kalimantan (Kalimantan Timur), 5 coll. (BO, K, W).

Habitat & Ecology — Forest plants. Altitude 900–1450 m. Fl. April, July, Sept., Nov.

Note — The type collections in W consist of 3 sheets. One sheet has a plant with a pseudobulb on which two rather small leaves are present, a detached young leaf, and an inflorescence with a label bearing the number 288. On a second sheet a coloured sketch of this plant is present. A third sheet contains a coloured sketch of the inflorescence and a flower analysis of this plant, annotated May 81, Borneo, *Curtis*. These elements all belong to the collection of Messrs. J. Veitch & Sons mentioned in the type description. The third sheet also contains a description of the plant in Reichenbach's handwriting, and a pencil sketch of a flower, a lip and a top of a column annotated '592 Bull feb. 81'. The Veitch & Sons collection is selected as the lectotype.

11. *Collabium vesicatum* (Rchb. f.) Schltr. — Fig. 81

Collabium vesicatum (Reichb. f.) Schltr. in Fedde, Rep., Beih. 1 (1911) 98; Senghas in Schltr., Orch., ed. 3, I/A (1984) 843. — *Chrysoglossum vesicatum* Rchb. f. in Seemann, Flora Vitiensis (1868) 304; Drake, Illus. Fl. Ins. Mar. Pac. (1892) 308 ('vesicarium'); Williams, Bot. Mus. Leaf. 5 (1938) 117; Parham, Trans. & Proc. Fiji Soc. 2 (1953) 31; A.C. Smith, J. Arnold Arbor. 36 (1955) 276; Parham, Pl. Fiji Isl. ed. 2 (1972) 380; Kores, Allertonia 5 (1989) 66; Lewis & Cribb, Orch. Solomon Isl. & Bougainv. (1991) 298; Kores in A.C. Smith, Fl. Vitiensis Nova 5 (1991) 395. — Type: *Seemann 611* (W holo; K iso).

Collabium papuanum (Schltr.) Schltr. in Fedde, Rep., Beih. 1 (1911) 98; Senghas in Schltr., Orch., ed. 3, I/A (1984) 843. — *Nephelaphyllum papuanum* Schltr. in K. Schum. & Lauterb., Nachtr. 2 (1905) 96; Schltr. in Fedde, Rep. 21 (1923) pl. 39 fig. 133. — *Chrysoglossum papuanum* (Schltr.) J.J. Smith, Bull. Dép. Agr. Ind. Néerl. 39 (1910) 7; Nova Guinea 8, 3 (1911) 527, pl. 77a; Bull. Jard. Bot. Buitenzorg II, 8 (1912) 3; Nova Guinea 12, 3 (1915) 196. — *Tainia papuana* (Schltr.) Gagnep., Bull. Mus. Hist. Nat. Paris sér. 2, 4 (1932) 706. — Type: *Schlechter 14630* (B holo, probably lost; BM lecto, here chosen; K iso).

Collabium aneityumense (Ames) Seidenf., Opera Bot. 72 (1983) 22 ('*aneitycumense*'). — *Chrysoglossum aneityumense* Ames, J. Arnold Arbor. 14 (1933) 105; Guillaumin, Ann. Mus. Col. Mars. 6, 6 (1948) 14; Bull. Soc. Bot. Fr. 103 (1956) 281; Senghas in Schltr., Orch., ed. 3, I/A (1984) 845. — Type: *Morrison s.n.* (K holo; AMES iso).

Plant terrestrial or epiphytic, 10–25 cm high excluding the inflorescence. Roots 2–4 on each rhizome part between 2 pseudobulbs, to 7.5 cm long, 1–2 mm diam. Rhizome rarely branching, to 7 cm long, 2–2.5 mm diam. Rhizome scales soon caducous, only remnants seen. *Pseudobulbs* alternately 1–3 bearing a leaf and 1 bearing an inflorescence, 1–6.5 cm apart, more or less clearly articulated at the junction with blade or scape, when dried all finely longitudinally wrinkled; leaf-bearing ones somewhat tapering to the top, 1–2.5 cm long, 1–3 mm diam.; inflorescence-bearing ones cylindrical, 5–10 mm long, 1–2 mm diam. Pseudobulb scales only remnants seen. Petiole 1–3 cm by 1.5–3 mm. *Leaf blade* ovate to oblong, 8.5–15.5 by 3.2–5.1 cm; top acute to acuminate; base attenuate; main nerves 5–7, below prominent, above slightly prominent; small nerves many. *Raceme* 4–8-flowered. Scape 6–14 cm long, 1–2 mm diam.; internodes 2–3, lower one 2–4.5 cm long, higher ones 2.2–6 cm long; scales 13–30 mm long, 2–4 mm diam., top acute to acuminate, nerves 11–15. Rhachis terete, to 8.5 cm long, 0.5–1.5 mm diam.; internodes 7–20 mm long. *Bracts* patent, sometimes reflexed, ovate to lanceolate, 9–15 by 3–6 mm; top acuminate; nerves 3–7. *Flowers* rather regularly spaced along the rhachis, several open at the same time, not widely opened. Pedicel star-shaped in section, 3–7 by 0.5–1 mm; the ovary similar, 4–7 by 0.8–2 mm. *Median sepal* lanceolate, c. 8–11 by 2–3.5 mm; top

acute to acuminate, somewhat incurvate; nerves 1–3, midrib somewhat prominent outside. *Lateral sepals* equal in size and shape, lanceolate-oblong, slightly falcate, 9.5–13.5 by 2–3.6 mm; top acute to acuminate; nerves 3, midrib somewhat prominent outside. *Petals* equal in size and shape, lanceolate, 8–11 by 2–3.5 mm; top acute to acuminate; nerves 1–5, midrib somewhat prominent outside. *Lip* 9.5–13.5 mm long. *Hypochilium* 4.5–6.5 by 6.7–9.5 mm; claw 2.5–3.5 by 1–2 mm; lateral lobes patent, obliquely ligulate to rarely broadly triangular, (1.5–)2–3.3 by 1.5–2(–3) mm, with a rounded to obliquely truncate to rounded top and an entire margin; lateral keels 2, between the bases of the lateral lobes of the lip turning into a c. 1 mm long, 0.3–1 mm wide, 1 mm high pyramid which is in front hollow to a depth of c. 0.3 mm, provided with a keel-like ridge with an extended, obtuse to rounded top (but sometimes this pyramid is less distinct), each keel continuing as a 0.2–0.4 mm high crest, sometimes halfway the epichilium somewhat elevated into a semi-orbicular, up to 0.6 mm high thin lobe, often partly with a double crest, further entire with a somewhat irregular margin, ending about halfway or on the top half of the epichilium; between the lobes of the keel somewhat fleshy, starting from this place with an entire, thin, c. 0.3 mm high median keel with an irregular, entire margin which ends on the epichilium just before the ends of the lateral keels. *Epichilium* slightly recurved, in outline broadly obovate, broadly spatulate to transversely elliptic, 4.5–8 by 6–9 mm; top somewhat emarginate to obtuse to acute, tip if present short, acute; margins somewhat denticulate and somewhat undulating. *Column* without torsion, upper part not or slightly curved forward, not swollen at the obtuse, irregularly dentate top, 3–4.5 by 1.5–2.5 mm; seams narrow to broad, 0.2–0.7 mm wide, each laterally of the stigma drawn out into a distinct, flat, forward projecting, narrowly to broadly triangular and acute, to broadly rounded, c. 1–1.5 by 0.5–2 mm big wing which is sometimes at the top provided with a downwards curved, up to 0.7 by 0.1 mm big apicula; column foot with a sturdy, swollen, saccate spur 2.5–5 mm long, 2–3.5 by 2–3 mm wide, with obtuse, more or less distinctly cleft top. *Anther* reniform, 0.6–1 by 1.3–1.5 mm; base emarginate; top obtuse to semi-orbicular, with a semi-orbicular to triangular, somewhat upwards curved tip. Pollinia c. 0.6 mm by 0.4 mm. *Stigma* ligulate to triangular, 1–2 by 0.7–1.5 mm; rostellum a narrow truncate ridge, 0.1–0.2 by c. 1 mm, not covered by the anther. *Fruit* not seen.

Collector's notes — Sepals and petals (yellowish) green to lemon yellow. Lip (twice recorded to be slightly twisted) and column white to yellowish, keels once recorded yellow. No scent (one record).

Distribution — New Guinea: Irian Jaya (Manokwari, Merauke); Papua New Guinea (Morobe Prov.); 5 collections (BM, BO, L, K, LAE). Solomon Islands (San Christobal), 1 coll. (K). Vanuatu (Aneityum), 1 coll. (K). Fiji (Taveuni), 1 coll. (K, W).

Habitat & Ecology — Terrestrial plants growing in humus in primary forest, one record stated as bedrock withered granite. The type of *Collabium vesicatum* is recorded to grow as an epiphyte. Altitude 200–1400 m. Fl. April, May–July, Nov.

Note — This species is rather variable in the shape of the seams of the column, which can be more or less abruptly narrowed lower on the column stalk, thus making the wings around the stigma more or less pronounced. These wings can in addition be broadly rounded, either or not provided with a small downwards curved apicula, to broadly or more or less narrowly triangular. Further there is some variation in the development of the pyramid formed by the keels between the bases of the lateral lobes. This can be distinctly developed, but in some specimens the side facing the lip margin is hardly developed and the pyramid

is almost reduced to a more or less erect lobe. The height of the keels beyond the pyramid varies, they can in addition be double crested or not. The lateral lobes of the lip vary in width and in the shape of the top. They are normally ligulate, but in the collection *Hunt RSS 2323* from San Christobal they are broadly triangular. These differences warrant no distinction of varieties or even species, since even among the eight collections studied intermediates are present.

3. DIGLYPHOSA

Diglyphosa Blume, Bijdr. (1825) 336; Benth., J. Linn. Soc. 18 (1881) 302; Schltr., Orch. (1914) 131; Notizbl. Berl.-Dahl. 9, 88 (1926) 586; Mansfeld, Flora 142 (1954) 75; Dressler & Dodson, Ann. Missouri Bot. Gard. 47 (1960) 40; Hatusima, Sci. Rep. Yokusuka City Mus. 13 (1967) 30; Dressler, The Orchids (1981) 213, 254; Seidenf., Opera Bot. 114 (1992) 325; Dressler, Phyl. Class. Orch. Fam. (1993) 212, 278. — *Diglyphis* Blume, Flora Javae 1 (1858) 138. — Type species: *Diglyphosa latifolia* Blume.

Terrestrial, sympodial herbs, glabrous except for minute hairs on the bracts. Roots filiform, not branching, somewhat villous. Rhizome creeping, more or less terete, not branching. Rhizome scales one per node, tubular, membranous; soon caducous or more or less persistent. *Pseudobulbs* alternately 1–4 bearing a leaf and 1 bearing an inflorescence, ascending, more or less clearly articulated at the junction with petiole or scape. Pseudobulb scales one per pseudobulb, tubular, membranous; more or less persistent. Leaf one per pseudobulb, convolute. Petiole semi-orbicular, channelled, main nerves prominent. *Raceme* with both scape and rachis elongating during anthesis, erect, branching in the largest plants. Scape terete; scales tubular, membranous, persistent. *Bracts* persistent during anthesis; on both sides with short, scattered hairs. *Flowers* resupinate, most open at the same time, turned to all sides, patent, rather widely open. *Lateral sepals* broadly inserted on the column foot, equal in size and shape. *Petals* equal in size and shape. *Lip* mobile, more or less fleshy, entire or 3-lobed, base semi-orbicular, distal part rather strongly recurved; lateral keels 2, starting at or near the base, and there 1.5–2.5 mm apart, fleshy, semi-orbicular, margin entire, converging towards the front, on the distal half continuing as low, either or not undulating, c. 0.2 mm high ridges 0.5–1 mm apart, which end near the top of the epichilium; small keels absent or 3 present near the top of the epichilium. *Column* erect, rather slender, upper part more or less clearly curved forward; laterally on either side with a narrow seam, starting at the front of the column foot, continuing upwards along the sides of the column, laterally of the stigma either or not drawn out; column foot simple, flat. Anther cordate, 2-celled. Pollinia 2, waxy, without appendages.

Distribution — Sikkim, India (Arunachal Pradesh), Vietnam (Dalat); in Malasia: Malay Peninsula, Sumatra, Java, Philippines, Sulawesi, Moluccas (Ceram), New Guinea.

Habitat & Ecology — Terrestrial plants in forest. Altitude 1000–1500 m.

KEY TO THE SPECIES OF DIGLYPHOSA

- 1a. Plant large, 35–90 cm high. Inflorescence not exceeding the leaf; raceme 30–80-flowered. Lip entire **2. *D. latifolia***
- b. Plant small, excluding the inflorescence 11–14 cm high. Inflorescence exceeding the leaf; raceme 8–10-flowered. Lip 3-lobed **1. *D. evrardii***

1. *Diglyphosa evrardii* (Gagnep.) Tang & Wang — Fig. 82

Diglyphosa evrardii (Gagnep.) Tang & Wang, Act. Phytotax. Sin. 1, 1 (1951) 77; Seidenf., Contr. Rev. Orch. Fl. Camb., Laos & Vietnam 5 (1975) 53; Ban & Huyen in Danh Luc (ed.), Thuc Vat Tay Nguyen (Florae Taynguyenensis Enum.) Orchidaceae (1983) 200; Senghas in Schltr., Orch., ed. 3, I/A (1984) 846; Averyanov, Prelim. List Vietn. Orch. (A–L) (1988) 160; in Tzvelev et al. (ed.), Vasc. Pl. Syn. Vietn. Fl. 1 (1990) 83; Seidenf., Opera Bot. 114 (1992) 326, fig. 220. — *Tainia evrardii* Gagnep., Bull. Mus. Hist. Nat. Paris sér. 2, 4 (1932) 709; Fl. Gén. Indo-Chine 6, 3 (1932) 377, fig. 33, 34; Hồ, Cây-Cỏ Miền Nam Việt-Nam ed. 2 (1972) 1034, fig. 5074. — Syntypes: *Dalat cult.* (Evrard) 1250 (P lecto, chosen by Seidenfaden); (Evrard) 254, 1943.

Plant to 14 cm high excluding the inflorescence. Roots 1 or 2 on each rhizome part between 2 pseudobulbs, to 5 cm long, 2–3 mm diam. Rhizome to 25 cm long, c. 2 mm diam. Rhizome scales rather long persistent, 7–17 mm long, 3–4 mm diam.; top minutely apiculate; nerves c. 13. *Pseudobulbs* alternately 2–4 bearing a leaf and 1 bearing an inflorescence, terete, slender, more or less clearly articulated at the junction with blade or scape, when dried all finely longitudinally wrinkled; leaf-bearing ones 4–4.8 mm apart, somewhat tapering to the top, 2.2–3.5 cm long, 2.5–3.5 mm diam.; inflorescence-bearing ones 1.5–3 cm from the leaf-bearing ones, cylindrical, 1.7–1.9 cm long, c. 1.5 mm diam. Pseudobulb scales on leaf-bearing pseudobulbs 3.4–3.8 mm long, 3–4 mm diam., top acute, nerves c. 15; on inflorescence-bearing pseudobulbs 2.2–2.4 cm long, 2.5–4 mm diam., top acute, nerves c. 15. Petiole 9–12 mm long, 1–1.5 mm diam. *Leaf blade* ovate, 6.2–8.3 by 2.7–3.7 cm; top acuminate; base obtuse; main nerves 1, below prominent; small nerves many, above and below somewhat prominent. *Raceme* with both scape and rachis elongating during anthesis, 8–10 flowered, unbranched. Scape terete, 11.5–12.9 cm long, c. 1.5 mm diam.; internodes 3, lower one 5.1–5.9 cm long, higher one 6.4–7 cm long; scales 1.5–2.1 mm long, c. 2 mm diam., top not seen, nerves c. 15. Rachis terete, to 8.5 cm long, 0.5–0.8 mm diam.; internodes 6.5–12 mm long. *Bracts* patent, ovate-lanceolate, 3.5–5 by 1.5–2 mm; top acuminate; nerves 3–5; on both sides with minute, scattered hairs. *Flowers* rather widely spaced, several open at the same time. Pedicel somewhat grooved, c. 3 by 0.6 mm; ovary similar, c. 3 by 1 mm. *Median sepal* linear-lanceolate, c. 8.1 by 1.3 mm; top acuminate; nerves 3, midrib slightly prominent outside. *Lateral sepals* broadly inserted on the column foot, narrowly triangular, somewhat falcate, c. 7 by 1.8 mm; top acute; nerves 3, not prominent. *Petals* linear-lanceolate, slightly falcate, 6.8–7.2 by 1.8–1.9 mm; top acute; nerves 3–5, not prominent. *Lip* mobile, somewhat fleshy, 3-lobed, c. 5.5 mm long. *Hypochilium* patent, c. 2 by 4 mm; base semi-orbicular, with laterally on either side a patent, obliquely narrowly triangular, falcate, c. 2 by 0.8 mm big lateral lobe with an acute top and an entire margin; lateral keels 2, fleshy, starting at the base, and there c. 1.5 mm apart, semi-orbicular, c. 2 mm long, c. 1 mm high, margin entire, keels somewhat converging towards the front, continuing c. 1 mm apart, each as a low, c. 0.2 mm high, undulating ridge, ending near the top of the epichilium. *Epichilium* recurved, in outline broadly spatulate, c. 3.5 by 4 mm; top truncate, tip obtuse; margins entire, somewhat undulating and towards the top somewhat incurvate; with 3 fleshy, c. 0.2 mm high, undulating ridges which alternate with the larger keels, ridges starting about half-way the epichilium, ending near the top. *Column* upper part somewhat curved forward, slightly towards the truncate crenate top, c. 4 by 1 mm; laterally on either side with a narrow, c. 0.2 mm wide seam, starting at the front of the column foot, continuing upwards along the sides of the column, laterally of the stigma drawn out into a triangular, c. 0.5 mm

high obtuse lobe; column foot simple, flat, c. 1.5 mm long, 0.5 mm wide, 0.2 mm high. *Anther* not seen. *Pollinia* not seen. *Stigma* triangular, c. 1 by 0.5 mm; rostellum an obtuse, c. 0.2 by 0.7 mm big ridge. *Fruit* not seen.

Collector's notes — Flower purple.

Distribution — Indochina.

Habitat & Ecology — Not known. Fl. Sept.

Note — The type description mentions 2 or 4 pollinia, and an anther "très surbaissée", which means "strongly incurvate". The only flower left on the plant did not have an anther or pollinia. The drawing in the Fl. Gén. Indo-China (fig. 33, 21 & 22) shows 2 ovoid pollinia.

2. *Diglyphosa latifolia* Blume — Fig. 83

Diglyphosa latifolia Blume, Bijdr. (1825) 337; Tab. & Platen 36 (1825) pl. 60; Lindley, Gen. & Sp. Orch. (1830) 62; Rchb. f., Bonplandia 5, 3 (1857) 58; Blume, Flora Javae (1858) pl. 55; Rchb. f., Xenia Orch. 1 (1858) 207, pl. 80; Engl. & Prantl, Nat. Pflanzenfam. 2, 6 (1888) 124; Kuntze, Rev. Gen. Pl. 2 (1891) 659; J.J. Smith, Orch. Java (1905) 171; Koord., Exk. Fl. Java, Monocot. (1911) 367; J.J. Smith, Bull. Jard. Bot. Buitenzorg II, 8 (1912) 1; Costantin, Atl. Orch. Cult. (1913) pl. 25 no. 25; Schltr., Orch. (1914) 131; Koord., Fl. Tjibodas (1919) 41; Ridley, Fl. Mal. Pen. 4 (1924) 112; Burkill & Hend., Gard. Bull. Str. Settl. 3 (1925) 43; J.J. Smith in Fedde, Rep. 32 (1933) 159; Schltr., Candollea 6 (1936) 442; Holttum, Orch. Malaya, ed. 3 (1964) 175; Backer & Bakh. f., Fl. Java (1968) 290; Steenis, Mount. Fl. Java (1972) pl. 39-3; Senghas in Schltr., Orch., ed. 3, I/A (1984) 846, fig. 649, 2; A.N. Rao, Orch. Soc. India 3 (1989) 47, fig. 1-11. — *Diglyphis latifolia* (Blume) Miq., Fl. Ind. Bat. 3 (1855) 654, 735; Blume, Flora Javae (1858) 138. — *Chrysoglossum latifolium* (Blume) Benth. & Hook. f., Gen. Pl. 3 (1883) 508. — Type: *Blume s.n.*, 1822 (L. holo).

Chrysoglossum macrophyllum King & Pantl., J. As. Soc. Beng. 63, 2 (1894) 335. — *Diglyphosa macrophylla* (King & Pantl.) King & Pantl., Ann. Roy. Bot. Gard. Calc. 8 (1898) 98, pl. 136; Schltr., Orch. (1915) 131; Pradhan, Indian Orch. 2 (1979) 238; Senghas in Schltr., Orch., ed. 3, I/A (1984) 846, fig. 649, 1. — Type: *Pantling 315* (see note 3); syn. nov.

Diglyphosa latifolia var. *celebica* Schltr. in Fedde, Rep. 10 (1911) 15; Orch. (1914) 131. — *Diglyphosa celebica* (Schltr.) Schltr., Orch. (1914) 131; Senghas in Schltr., Orch., ed. 3, I/A (1984) 846. — Type: *Schlechter 20720* (B holo, probably lost; lecto the description by Schlechter in Fedde, Rep. 10, 1911, 15); syn. nov.

Diglyphosa elmeri Ames in Elmer, Leafl. Philipp. Bot. (1912) 1555; Ames, Orch. 5 (1915) 48; Valmayor, Orchidiana Philipp. (1983) 185; Senghas in Schltr., Orch., ed. 3, I/A (1984) 846. — Type: *Elmer 11815* (AMES holo); syn. nov.

Plant to 90 cm high excluding the inflorescence. Roots 5–15 on each rhizome part between 2 pseudobulbs, to 17 cm long, 2–3 mm diam. Rhizome fleshy, to 25 cm long, 6–11 mm diam. Rhizome scales soon caducous, only remnants seen. *Pseudobulbs* alternately 1–3 bearing a leaf and 1 bearing an inflorescence, 15–50 mm apart, rather slender, more or less clearly articulated at the junction with petiole or scape, when dried all rather coarsely longitudinally wrinkled; leaf-bearing ones tapering to the top, quadrangular in section, 6.5–19 cm long, 7–11 mm diam.; inflorescence-bearing ones cylindrical, 1–2 cm long, 4–5 mm diam. Pseudobulb scales on leaf-bearing pseudobulbs c. 9 cm long, 7–8 mm diam., top acute, nerves c. 17; on inflorescence-bearing pseudobulbs 1.5–2.8 mm long, 6–8 mm diam, top acute to shortly acuminate, nerves c. 17; soon caducous. Petiole 8–33 cm by 2.5–5 mm. *Leaf blade* elliptic to lanceolate, 20–37 by 7.5–16.5 cm; top acute to acuminate; base attenuate; main nerves 5–8, below prominent, above slightly prominent; small nerves many. *Raceme* 30–80-flowered, branching in the largest plants. Scape 10–28 cm

long, 2–4 mm diam.; internodes (2–)3–4, lowest one 2.9–7.5 cm long, central one(s) 4.2–9.5 cm long, highest one 0.7–9 cm long; scales (10–)15–35 mm long, 4–8 mm diam., their top acute to acuminate, nerves c. 19. Rhachis somewhat triangular, to 18 cm long, 2–4 mm diam.; internodes 0.5–18 mm long. *Bracts* more or less reflexed, lanceolate, 6–13 by 1.7–2.6 mm; top acuminate; nerves 3. *Flowers* close together, most open at the same time. Pedicel star-shaped in section 5–8 by 0.5–0.6 mm; ovary star-shaped in section, 4–6 by 0.7–1 mm. *Median sepal* somewhat incurvate, lanceolate, 9–16.2 by 2–4 (–5) mm; top acuminate; nerves 5, midrib slightly prominent outside. *Lateral sepals* rather broadly inserted on the column foot, lanceolate, more or less strongly falcate, 6.5–13 by 2.3–4 mm; top acuminate; nerves 5, midrib slightly prominent outside. *Petals* ovate-lanceolate, somewhat falcate, 6.5–13.3 by 2.5–5.2 mm; top acuminate; nerves 5, midrib slightly prominent outside. *Lip* mobile, narrowly attached on the column foot, rather fleshy, patent, entire, in outline oblong to obovate and somewhat constricted in the middle, the distal part rather strongly recurved, 4.1–6 by 2–4 mm; base semi-orbicular; top obtuse, with a narrowly triangular, acute or obtuse, 0.1–0.4 mm long tip; margins entire, sometimes the lateral margins finely papillose; keels 2, fleshy, starting 1–1.5 mm from the base, and there 1.5–2.5 mm apart, semi-orbicular, 1.5–2 mm long, 0.5–1 mm high, margin entire, keels converging towards the front, each continuing 0.5–0.8 mm apart as a low, c. 0.2 mm high, entire, fleshy ridge, ending and more or less clearly fusing 0.5–1.5 mm from the top. *Column* upper part more or less clearly curved forward, slightly swollen at the obtuse, blunt-tipped top, 3.5–5.6 mm by 0.8–1.2 mm; laterally on either side with a narrow seam, 0.1–0.4 mm high, starting at the front of the column foot, continuing upwards along the sides of the column, ending laterally of the stigma; column foot simple, flat, 1–1.5 mm long, c. 1 mm wide, 0.3–0.5 mm high. *Anther* 2-celled, cordate, c. 1 by 1 mm; top acute and projecting upwards; base emarginate; lateral margins on either side with a sharp, c. 0.5 mm long, downwards projecting point; central part of connective somewhat cleft. Pollinia conical to ovoid, laterally somewhat flattened, 0.8–1 mm by 0.6–0.7 mm; top obtuse; base semi-orbicular. *Stigma* semi-orbicular, c. 0.8 by 0.8 mm; rostellum an inconspicuous, narrow ridge. *Fruit* not seen.

Collector's notes — Pseudobulb dark brown, petiole green, leaf pale green with darker blotches. Peduncle, bracts, ovary and pedicel purple. Sepals orange, flushed and veined with purple, petals somewhat paler. Lip orange, keels somewhat darker. Column yellow. Smell records: 'smells of chicken shit'; 'flower fetid'; 'pleasantly scented'.

Distribution — Sikkim, India (Arunachal Pradesh); in Malesia: Malay Peninsula, Sumatra, Java, Sulawesi, Philippines, Moluccas (Ceram), and New Guinea.

Habitat & Ecology — Terrestrial orchids growing in undisturbed forest. Altitude 1000–1500 m. Fl. Feb. to July (Sikkim, Malay Peninsula, Java, Sulawesi, New Guinea); Aug. and Sept. (Philippines); Nov. (Sumatra).

Notes — 1. *Diglyphosa latifolia* varies rather much in size. From Java the entire variability is known. *Diglyphosa celebica* applies to plants which fit well within this variation; *D. macrophylla* from Sikkim applies to large plants from the most northwestern part of the distribution area; cf. A.N. Rao (1989) "spotted populations of *Diglyphosa* with wide variations in the plant size and in colour of their scape and flowers." *Diglyphosa elmeri* applies to small plants from the Philippines.

2. According to the description of *D. elmeri* 'no calli' are present on the lip (Ames, 1912: 1556). The flower of the type specimen, however, has 2 distinct keels, exactly as *D. latifolia*.

3. The type of *Diglyphosa macrophylla* should be annotated as *Chrysoglossum macrophyllum*, as it was described as such by King and Pantling in 1896. In 1898 these authors transferred the species to *Diglyphosa*, stating *Pantling 315* as the only specimen, collected from exactly the same locality as the type. However, this plant is according to the label collected in May 1897. Maybe a mistake was made on the handwritten label; most probably *Pantling 315* is the type of *D. macrophylla*.

4. In the living state the pollinia may be attached to some adhesive matter or tissue (viscid disc?). This is not visible in dried material.

5. From the distribution area given above this species may be expected to occur also in Burma and Thailand.

6. The only specimen known from Ceram differs in having two erect, entire, low ridges between the distal parts of the keels on the lip. Otherwise it fits well within the variability of *Diglyphosa latifolia*. Until more material is known this specimen is tentatively placed in *Diglyphosa latifolia*. The deviating character has not been included in the description.

7. One plant from New Guinea which fits otherwise entirely in the variation of *Diglyphosa latifolia* deviates in having white flowers with a pinkish shading.

4. PILOPHYLLUM

Pilophyllum Schltr., Orchid., ed. 1 (1914) 131.

For literature, see under *Pilophyllum villosum*.

Terrestrial, sympodial herbs; all parts densely hairy except the inside of the bracts and the sepals and all other flower parts glabrous. Roots filiform, not branching, villous. Rhizome creeping, terete, not branching, fleshy. Rhizome scales soon caducous. *Pseudobulbs* alternately 1–4 bearing a leaf and 1 bearing an inflorescence, ascending, clearly articulated at the junction with petiole or scape. Pseudobulb scales soon caducous. Leaf one per pseudobulb, convolute; main nerves prominent; petiole short, semi-orbicular, channelled. *Raceme* with both scape and rhachis elongating during anthesis, erect, unbranched. Scape terete; internodes 3; scales tubular, membranous, persistent. Rhachis terete. *Bracts* persistent during anthesis. *Flowers* not resupinate, several open at the same time, turned to all sides, somewhat curved to the rhachis, very widely open. *Lateral sepals* broadly inserted on the column foot, equal in size and shape. *Petals* equal in size and shape, slightly falcate. *Lip* mobile, narrowly attached to the column foot, rather fleshy, 3-lobed. *Hypochilium* more or less parallel to the column; basal part concave with about parallel margins; in front with two conspicuous falcate lateral lobes; keels 2, fleshy and somewhat undulating, the distal 3 mm with double, not undulating margin, converging towards the front. *Column* erect, slender, upper part more or less clearly curved forward; median with a keel from the stielidia downwards; margins with a narrow seam which is on the top half of the column drawn out into a distinct, fleshy, ligulate, slightly falcate wing with a rounded, somewhat crenate top, upwards laterally of the stigma drawn out in a small, semi-orbicular lobe; column foot flat, laterally on either side with an about semi-orbicular, fleshy keel which is a continuation of the seams on the column, between these keels with a large, semi-orbicular, fleshy lobe which is a continuation of the median keel on the column. *Anther* 2-locular. Pollinia 2, waxy, without appendages. *Stigma* small, about triangular. Rostellum a narrow ridge. *Fruit* reflexed, ellipsoid; column persistent.

Distribution — Thailand (Peninsula), Malay Peninsula, Bangka, Mentawai Island, Java, Borneo, Philippines, Moluccas, New Guinea, Solomon Islands.

Habitat & Ecology — Terrestrial forest plants.

***Pilophyllum villosum* (Blume) Schltr. — Fig. 83; Plate 7d**

Pilophyllum villosum (Blume) Schltr., Orchid., ed. 1 (1914) 131; Valmayor, Ochidiana Philipp. (1983) 283; Senghas in Schltr., Orch., ed. 3, I/A (1984) 845, fig. 648; Comber, Orch. Java (1990) 379, col. phot.; Lewis & Cribb, Orch. Solomon Isl. & Bougainv. (1991) 229; Wood, Beaman & Beaman, Pl. Mt. Kinabalu Orch. (1993) 290, pl. 72 a. — *Chrysoglossum villosum* Blume, Bijdr. (1825) 338; Tab. & Platen 36 (1825) pl. 7; Lindley, Gen. & Sp. Orch. (1830) 14; de Vriese, Ill. Orch. Ind. Néerl. (1854) text & plate; Miq., Fl. Ind. Bat. 3 (1855) 626, 739; Blume, Flora Javae (1858) 137, pl. 47; Witte, Ann. Horticult. Bot. Pays-Bas 5 (1862) 9; Engl. & Prantl, Nat. Pflanzenfam. 2, 6 (1888) 124; Hook. f., Fl. Brit. India 5 (1890) 783; Ridley, J. Linn. Soc. Bot. 32 (1896) 315; J.J. Smith, Orch. Java (1905) 174; Schltr. in K. Schum. & Lauterb., Nachtr. 2 (1905) 97; Ridley, Mat. Fl. Mal. Pen. 1 (1907) 112; Ames, Philipp. J. Sc. 2, Bot. (1907) 316; Orch. 2 (1908) 67; J.J. Smith, Orch. Java, Fig.-Atl. (1909) fig. 131; Koord., Exk. Fl. Java, Monocot. (1911) 367; J.J. Smith, Bull. Jard. Bot. Buitenzorg II, 8 (1912) 3; Schltr., Orch. (1914) 131; Ames, Orch. 5 (1915) 48; Koord., Fl. Tjibodas (1919) 40; Ames in Merr., En. Born. (1921) 143; Ridley, Fl. Mal. Pen. 4 (1924) 111; Ames in Merr., Enum. Philipp. Flow. Pl. 1 (1925) 280; Burkill & Hend., Gard. Bull. Str. Settl. 3 (1925) 437; Hatusima, Mem. Fac. Agric. Kagosh. Un. 5 (1966) 63; Backer & Bakh. f., Fl. Java 3 (1968) 289; Senghas in Schltr., Orch., ed. 3, I/A (1984) 845; Seidenf. & Wood, Orch. Pen. Mal. Sing. (1992) 531, fig. 240 a-d; Dressler, Phyl. Class. Orch. Fam. (1993) 212, 278. — Type: *Blume s.n.*, probably lost; lectotype: Blume Tab. & Plat. 36 (1825) pl. 7, here proposed (see note 1).

Terrestrial, sympodial herbs, 19–30 cm high excluding the inflorescence; all parts densely yellowish-brown hairy, the inside of the bracts and the sepals and all other flower parts glabrous. Roots 2 or 3 on each rhizome part between 2 pseudobulbs, to 20 cm long, 1.5–2 mm diam. Rhizome to 13 cm long, 5–6 mm diam. Rhizome scales only remnants seen. *Pseudobulbs* alternating 1–4 bearing a leaf and 1 bearing an inflorescence, 5–15 mm apart; leaf-bearing ones somewhat tapering to the top, somewhat quadrangular, 3.5–5 cm long, c. 5 mm diam.; inflorescence-bearing ones cylindrical, 5–10 mm long, c. 5 mm diam.; when dried all rather coarsely longitudinally wrinkled. Pseudobulb scales only remnants seen. Leaf 1 per pseudobulb. Petiole semi-orbicular, channelled, 2–20 by c. 3. *Leaf blade* oblong to ovate-oblong, 16–24 by 7.5–12 cm; top acuminate; base attenuate to obtuse; main nerves 5, below prominent and with slightly longer hairs than the blade itself; small nerves many. *Raceme* erect. 15–25 flowered. Scape 24–42 cm long, 2–3 mm diam.; internodes 3, lower one shortest, 2.3–10 cm long, higher ones 6.5–17.5 cm long; scales 20–30 mm long, 3–5 mm diam., top acuminate, nerves c. 13. Rhachis to 9 cm long, c. 2 mm diam.; internodes 15–50 mm long. *Bracts* lanceolate, 16–25 by 4.5–8 mm; top acute to acuminate; nerves 3, alternating with 4 slightly lesser nerves; inner surface glabrous. *Flowers* not resupinate, rather widely spaced. Pedicel shallowly longitudinally grooved, 4–5 by 0.8–1 mm; ovary longitudinally grooved, 6–6.5 mm by 1–1.2 mm. *Median sepal* lanceolate, c. 14 by 3 mm; the top acute to somewhat acuminate and somewhat recurved; nerves 3, midrib somewhat prominent outside; inner surface glabrous. *Lateral sepals* broadly inserted on the column foot, equal in size and shape, oblong-lanceolate, falcate, 8.5–11 by 2.5–3 mm; top acuminate and somewhat recurved; nerves 1–3, midrib somewhat prominent outside; inner surface glabrous. *Petals* equal in size and shape, obovate-lanceolate, slightly falcate, 12–12.5 by c. 3 mm; top acuminate to cuspidate and somewhat recurved;

nerves 3, midrib prominent outside. *Lip* 3-lobed, c. 8.5 mm long. *Hypochilium* c. 5.5 by 5.5 mm base semi-orbicular, with the lateral margins somewhat folded and sometimes indistinctly papillose; front part on either side with a patent, obliquely ligulate, somewhat falcate, in the middle slightly constricted, c. 3 by 1.5 mm big lateral lobe with an acute to acuminate top and an entire margin; lateral keels 2, starting 1–2 mm from the base and there 2–3 mm apart, fleshy, erect, c. 1 mm high, margin entire and somewhat undulating in the basal part, in the distal c. 3 mm converging, the margin double and not undulating, ending c. 1 mm from the top of the epichilium, c. 0.4 mm apart. *Epichilium* recurved, in outline spatulate, c. 3 by 2.5–3 mm, claw c. 1.5 by 1–2 mm; top truncate to emarginate, tip truncate to acuminate; margin entire; with a small, erect, fleshy, c. 0.5 by 1 mm big lobe with a rounded top between the distal part of the lateral keels. *Column* semi-orbicular in section, base ovate in section, slightly swollen at the acute, slightly serrate top, 8–10 by c. 1 mm; median on the front of the column with a fleshy keel; on the margin of the column laterally on either side with a narrow seam which is on the top half of the column drawn out into a distinct, fleshy, ligulate, slightly falcate, in the middle somewhat constricted, forwards projecting, c. 3 by 0.5 mm big stelidium with a rounded, somewhat crenate top, continuing upwards as a narrow seam which is laterally of the stigma drawn out into a small, semi-orbicular, c. 0.5 mm big lobe; column foot not saccate, c. 2.5 mm long, c. 1 mm wide, 1–1.5 mm high, the front on either side with an about semi-orbicular, fleshy, c. 2 by 1 mm lateral, wing-like big keel which continues on the column, median with a large, semi-orbicular, fleshy, c. 1 by 1 mm big keel which continues on the column. *Anther* obovate, c. 1.5 by 1 mm; top truncate, with a triangular c. 0.2 mm long tip; base emarginate. Pollinia 2, conical, waxy, without appendages, 0.6–0.7 by 0.4–0.5 mm; top obtuse; base flat. *Stigma* about triangular, c. 0.8 by 0.8 mm; rostellum an inconspicuous, c. 0.2 by 0.8 mm big ridge. *Fruit* reflexed, ellipsoid; body 2.3–2.6 cm by 8–10 mm; column persistent.

Collector's notes — Flowers are orange with lemon and cream coloured centre. Buds golden.

Distribution — Malay Peninsula (Perak, Kelantan, Selangor), 1 collection (CAL, K), 2 other records by Quah (Seidenfaden & Wood, 1992). Java (Jawa Barat), 5 coll. (BO, L), according to Comber (1990) also fairly common in East Java. Borneo (Sabah), 8 coll. (AMES, B, BM, BO, E, K, L, NY). Philippines (Batan, Palawan, Mindoro), 4 coll. (AMES, K, NY, TI). Moluccas (Ceram), 1 coll. (K). New Guinea (West Sepik), no coll., recorded by Schlechter (1911). Solomon Islands (Guadalcanal, Malaita), 2 coll. (K). Judging from this distribution pattern the species may be expected to occur in Sumatra and Celebes.

Habitat & Ecology — Open places in the forest, once found on rocks in a riverbed. Altitude 1150–1650 m in Borneo, once found at 550 m in Java. Fl. May, June, Sept. to Jan.

Notes — 1. The type, a Blume collection, was not among the specimens studied; it should have been in Leiden but it is probably lost. There is a specimen in Leiden labelled '*Chrysoglossum villatum*' by Blume in 1841, which was collected on Mt Salak. As Blume in 1825 only cited material from Mt Gede, this is probably not the type. The plate in Blume, Tab. & Platen (1825) pl. 7 is here selected as the lectotype.

2. Some specimens from the Philippines are somewhat smaller and appear slightly less hairy than plants from other areas. The leaves are 9.5–15 by 4.6–7 cm; the vegetative parts are otherwise alike. These plants bear only fruits; on one fruit a column with wings was still present. Flowering material is needed to decide if these plants represent a different taxon.

EXCLUDED SPECIES

Collabium wrayi Hook. f. = *Thecostele alata* (Rchb. f.) Par. & Rchb. f.
Reduced to *Thecostele maculosa* Ridley (= *T. alata*) by Ridley.

Collabium annamense Gagnep. = *Thecostele alata* (Rchb. f.) Par & Rchb. f.

IDENTIFICATION LIST

C.a	=	<i>Collabium acuticalcar</i>	Ch.a	=	<i>Chrysoglossum assamicum</i>
C.b	=	<i>Collabium bicameratum</i>	Ch.e	=	<i>Chrysoglossum ensigerum</i>
C.c	=	<i>Collabium carinatum</i>	Ch.o	=	<i>Chrysoglossum ornatum</i>
C.chi	=	<i>Collabium chinense</i>	Ch.r	=	<i>Chrysoglossum reticulatum</i>
C.chlo	=	<i>Collabium chloranthum</i>			
C.d	=	<i>Collabium delavayi</i>			
C.f	=	<i>Collabium formosanum</i>	D.e	=	<i>Diglyphosa evrardii</i>
C.n	=	<i>Collabium nebulosum</i>	D.l	=	<i>Diglyphosa latifolia</i>
C.pu	=	<i>Collabium pumilum</i>			
C.s	=	<i>Collabium simplex</i>			
C.v	=	<i>Collabium vesicatum</i>	P.v	=	<i>Pilophyllum villosum</i>

(T) indicates a type specimen.

- Anderson 178: D.l — Anglade 588: Ch.o.
 Backer 6279, 7035: Ch.o; 9435: C.n; 10993, 12740: Ch.o; 13219: D.l — Bakhuizen van de Brink 936, 1010: C.n; 2616, 2868: D.l; 7736: P.v — Balansa 1998: C.chi — Bangham & Bangham 1123: Ch.e (T) — Barnes 2149: Ch.o — den Berger 535: Ch.o — Blatter & Halberg 26488: Ch.o — Blume 295: Ch.o (T); s.n. (K): Ch.o; s.n. (W, 5748): C.n; s.n., 1822: D.l (T); s.n., 1841: P.v — Bogor Cult. 4: D.l; VII, 1907: C.n; IV, 1908, VIII, 1908: P.v — Brass 5509: Ch.o — Bull or Veitch & Sons 288: C.s (T) — Bünnemeijer 4553: C.n.
 Carr 3116: P.v; 3314: Ch.r (T); 16604, 16696, 17237: Ch.o — Clarke 12314: Ch.o — Clemens & Clemens s.n., 1932: Ch.r; 30696, 50240, 51023: P.v — Comber 1319: D.l — Connell 14: C.n.: s.n., 1905/07: D.l — Corner s.n.: Ch.o — Cumberlege cult. 507, 1051: C.chi.
 Danser 6778: D.l — Darnton 482: P.v — Delavay s.n.: C.d (T) — Docters van Leeuwen-Reynvaan 2549: D.l — Dransfield 2050: C.n.
 Edaño 46: D.l — Elmer 11815: D.l — Endert 4351: C.b (T) — Everard im Thurm s.n., 1911: Ch.o — Evrard 1250: D.e (T) — Eyma s.n.: D.l.
 Gibbs 886: Ch.o — Gjellerup 1023: C.v — Glasnevin cult., 1901: C.n — Greenwood 366: Ch.o — Griffith 1233 or 1322: Ch.a.
 Hagerup s.n., 1916/17: C.a (T) — Hance 17733: C.chi (T) — Haniff, see SF series — Hansen 540: Ch.r — Hatusima & Sato 29060: P.v — Hochreutiner 796: Ch.o; 1141: D.l — Holtum, see SF series.
 Jacobson 923: C.s — Junghuhn 83: D.l; 6997: Ch.o.
 Kawakami & Mori 3490: Ch.o — Kerr 352: Ch.o; 445: C.chi; 535, 690: Ch.o — Kingdon Ward 12939: C.f — Kjellberg 1613: Ch.o — Kleinhoonte s.n.: Ch.o — Koorders 39060b: Ch.o; 41254b: C.n — Korthals 97: Ch.o — Kuhl & van Hasselt 179: C.n (T) — Kuntze 4691: C.n (p.p.).
 Lam 191: D.l — Lobb s.n.: Ch.o; s.n.: C.n — Lörzing 6150: C.s.
 Meijer 9539: Ch.o; 9556: D.l — de Meyier 73: D.l — Morrison s.n., 1896: C.v.
 NGF series 20155 (van Royen): C.v; 31952 (Ridsdale & Lavarack), 34167 (Woods): D.l — Nooteboom 968: Ch.r — Nooteboom & Chai 2212: C.b.
 O'Brien cult., 1911: C.n — van Ooststroom 13111: D.l.
 Pantling 83: Ch.o; 315: D.l — Pételot 5148: C.f (T of *Tainia chapaensis*) — Phillips & Collenette 89700: Ch.r — Poilane 18731: C.chlo (T); 28771: Ch.o — van der Pijl 126: D.l; 672: Ch.o.

Ramos 46345: P.v — Rant s.n., 1913: D.l — Reeve 703, 3425 (T), 3494: C.c — Reichenbach f. Orch. Herb. 35678: C.s — Ridley s.n.: C.s — Ridsdale & Lavarack, see NGF series — Robinson s.n., 1913: C.chi — von Römer 946: C.v — van Royen, see NGF series.

Sands 461: C.pu — Schiffner 1800: C.n — Schlechter 14630: C.v (T of *Collabium papuanum*); 15477: Ch.o — Seemann 611: C.v (T) — Sin 9591: C.d — Sinclair & Kiah, see SF series — A.C. Smith 746: Ch.o — SF series 9089 (Haniff), 12757 (Haniff), 38773 (Sinclair & Kiah): C.s; 31333 (Holtun): D.l — van Steenis 118: Ch.o; 2870: D.l; 5651: C.n; 6983: Ch.o; 10308: C.pu; 10457: C.n; 11770: D.l.

Tjibodas cult. 4: D.l — To & Ts'ang 12402: C.d.

de Voogd 1480: D.l.

Wilkes Expedition, Reichenbach f. Orch. Herb 45677: Ch.o — Winckel 226: C.n; 961, 2266: D.l — Woods, see NGF series.

Zollinger 680, 2846: D.l.