

## GENERIC AND SPECIES ACCOUNTS

### 1. VANILLA

Plum. ex Mill., Gard. Dict. Ed. 6. 1752.

*Scrambling or climbing vines or lianas* with thick adventitious roots emerging opposite the leaves, and fleshy, green, often branching stems leafy along their length. *Leaves* conduplicate, fleshy, well-developed and dorsi-ventrally flattened, or scale-like. *Inflorescence* lateral, short, densely few- to many-flowered; peduncle and rachis fleshy, green; bracts persistent or not, shorter than the pedicel and ovary. *Flowers* large, resupinate, fleshy, short-lived, often showy; pedicel and ovary green. *Sepals* and *petals* free, linear-lanceolate or linear-oblongate, acute. *Lip* free or with margins fused to column sides, porrect, three-lobed, often obscurely so, more or less enclosing the column, lacking a spur, with a callus of hairs or lacerate flaps. *Column* slender, elongate, lacking a foot, often hairy on lower surface; pollinia four, mealy. *Fruit* a dehiscent capsule or slightly dehiscent berry, often strongly fragrant.

A genus of about 107 species widely distributed in the New and Old World tropics. Two species are cultivated in the Pacific islands, especially in the Society Islands, and are occasionally found as escapes. A single species is grown in Tonga, the Cook Islands, and Niue (and is one of the two cultivated species in the Society Islands), and is occasionally found as an escape.

***Vanilla planifolia*** Andrews, Bot. Repos. 8: t. 538. 1808. Lectotype: cult. Greville (illustration cited here). For full synonymy, see Kores (1991).

*Climbing vine or liana* up to 15 m long. *Stem* circular in cross-section, 1–2 cm in diameter, green. *Leaves* oblong or oblong-elliptic, acute, 8–25 × 2–8 cm. *Inflorescence* lateral, densely many-flowered, 5–8 cm long. *Flowers* large, green, with a creamy-green lip. *Sepals* and *petals* linear-oblongate, 4–7 × 1–1.5 cm. *Lip* 3-lobed, 4–5 × 1.5–3 cm, with irregular dentate lateral margins; callus of several reflexed fimbriate plates in upper part of lip. *Column* 3–4 cm long, puberulous on lower surface. Fig. 17.

DISTRIBUTION. Native to Mexico and Central America. Widely cultivated around the tropics. Introduced to Tonga (Vava'u), the Cook Islands (Sykes, pers. comm.), and Niue, where it is established in the wild.

HABITAT. Uncommon in lowland to montane forest, especially in secondary forest, and sometimes in gardens.

COLLECTIONS. **Vava'u:** Whistler (sight record). **Rarotonga:** Sykes (sight record). **Niue:** Sykes CHR 150572; Yuncker 9856.

### 2. ERYTHRODES

Blume, Bijdr. Fl. Ned. Ind.: 410. 1825.

*Physurus* Rich., De Orchid. Eur.: 33 (1817) *nom. nud.*; Rich. ex Lindl., Gen. Sp. Orchid. Pl.: 501(1840).

Small to medium-sized *terrestrial herbs* with fleshy creeping rhizomes rooting at the nodes, and erect, leafy fertile shoots. *Leaves* not articulate, thin-textured. *Inflorescence* terminal, erect, racemose, many-flowered. *Flowers* small, not opening widely, resupinate. *Dorsal sepal* with the petals forming a hood over the column. *Lateral sepals* spreading. *Petals* entire, membranous, narrower than the sepals. *Lip* appressed to the column, entire or with a small apical recurved blade, prolonged at the base into a spur that projects

between the lateral sepals; spur entire or bilobed, short to long, with 2–4 sessile calli within. *Column* short; anther erect; pollinia two, sectile, clavate, attached by caudicles to a small viscidium; rostellum short, bilobed.

A genus of about 100 species widespread in the tropics of the New World, tropical Asia, and the Pacific region, but absent from Africa. Two species are reported from Tonga.

#### KEY TO SPECIES

1. Sepals 6–8 mm long, densely hairy; lip apex acute; leaves 5–10 cm long ..... 1. *E. oxyglossa*  
 1. Sepals 2.5–4 mm long, glabrous or sparsely hairy on outer surface; lip apex a small ovate, obtuse blade; leaves 3–5.5 cm long ..... 2. *E. purpurascens*

1. *Erythrodes oxyglossa* Schltr., Bot. Jahrb. Syst. 39: 53. 1906. Type: New Caledonia, *Schlechter 15749* (holotype B†).

*Erythrodes lilyana* (H. Fleischm. & Rech.) Schltr., Repert. Spec. Nov. Regni Veg. 9: 87. 1910.

*Physurus lilyanus* H. Fleischm. & Rech., Denkschr. Kaiserl. Akad. Wiss., Wien. Math.-Naturwiss. Kl. 85: 253, t. 1, fig. 3. 1910. Types: Samoa, *Rechinger 63, 1515, 1590* (all syntypes W!).

*Terrestrial herb* 25–40 cm in height. *Leaves* obliquely oblong-lanceolate to oblong-ovate, acuminate, 5–10 × 1.5–2.5 cm; petiole slender, 2.5–3.3 cm long. *Inflorescence* 12–27 cm long, many-flowered; peduncle pubescent in upper part; rachis pubescent; bracts lanceolate, 8–10 mm long, hairy. *Flowers* dull brownish white, pubescent on the outside of the sepals. *Sepals* lanceolate, 6–8 × 1.7–2.3 mm, densely hairy. *Petals* obliquely oblanceolate, acute, 5.5–7.5 × 1.5–1.7 mm. *Lip* 6–8.5 mm long, lanceolate to oblong-lanceolate, acute; spur bilobed at apex, 2.5–3.5 mm long, with 2 small glands within. *Column* 2.5–3.5 mm long. Fig. 18.

DISTRIBUTION. Tonga (Kao and Tofua). Also in New Caledonia, Fiji, and Samoa.

HABITAT. Uncommon in foothill to montane forest on ridges of volcanic islands; 300 to ca. 1000 m.

COLLECTIONS. **Kao:** *Buelow 621, 3004, 3197*. **Tofua:** *Buelow 439; Whistler 10602*.

2. *Erythrodes purpurascens* Schltr., K. Schum. & Lauterb., Fl. Schutzgeb. Südsee, Nachtr.: 88. 1905. Type: Papua New Guinea, Paub, *Schlechter 14616* (holotype B†).

*Cheirostylis* sp. *sensu* Yuncker, Bernice P. Bishop Mus. Bull. 184: 31. 1945.

*Terrestrial herb* up to 32 cm in height. *Leaves* obliquely ovate, acute, 3–5.5 × 1.5–2.2 cm. *Inflorescence* up to 28 cm long; bracts lanceolate, acuminate, 5–8 mm long. *Flowers* white within, brown on outside and with brown marks on lip, small, 4–6 mm long; pedicel and ovary 6–8 mm long, pubescent. *Sepals* elliptic-lanceolate, 2.5–4 × ca. 1 mm, glabrous or very sparsely pubescent on outer surface. *Petals* obliquely oblanceolate, acute, 2.5–3.5 × 0.7–0.8 mm. *Lip* subpandurate, 2.5–4.5 mm long, the apical lamina ovate, obtuse; spur 1.5–2.5 mm long, bilobed, usually with 2 small calli within. *Column* 2.5–3.5 mm long. Fig. 19.

DISTRIBUTION. Tonga (Kao and Tofua). Also in New Guinea, Fiji, and Samoa.

HABITAT. Uncommon among rocks and in small gullies in scrubby montane forest; 300–450 m.

COLLECTIONS. **Kao:** *Buelow 2940, 3005*. **Tofua:** *Buelow 469, 2541; Whistler 10603*.

NOTE. We have assigned these collections to *E. purpurascens* rather than to *E. parvula* Kores because the latter lacks calli on the lip.

## 3. GOODYERA

R. Br., Aiton & W.T.Aiton, Hortus Kew ed. 2, 5: 197. 1813.

*Terrestrial herbs* with creeping fleshy rhizomes rooting at the nodes, and erect, fleshy, leafy fertile shoots. *Leaves* thin-textured to fleshy, not articulated. *Inflorescence* terminal, racemose, few- to many-flowered. *Flowers* small, resupinate, usually tubular but never opening widely. *Dorsal sepal* and *petals* connivent into a hood over the column. *Lateral sepals* porrect, reflexed or spreading somewhat. *Lip* parallel to column, entire, deeply saccate at the base, with numerous thread-like calli within. *Column* short to long; anther erect, persistent; pollinia two, sectile, clavate, often deeply divided, attached by caudicles to a rather large viscidium; rostellum long, bilobed.

A genus of about 40 species found in both temperate and tropical parts of the Old and New Worlds, but not in Africa. A single species is reported from Tonga.

***Goodyera rubicunda*** (Blume) Lindl., Edward's Bot. Reg. 25: 61, misc. 92. 1839. Type: Java, *Blume s.n.* (holotype L!, isotype P!).

*Goodyera anomala* Schltr., Repert. Spec. Nov. Regni Veg. 9: 86. 1910. Type: Samoa, *Vaupel 405* (syntype B†).

*Goodyera biflora* sensu Kraenzl., Bot. Jarhb. Syst. 25: 600. 1898, non Hook. f.

*Goodyera grandis* (Blume) Blume, Fl. Javae ser. 2, 1, Orch.: 36. 1858.

*Goodyera rubens* Blume, Fl. Javae ser. 2, 1, Orch.: 36, t. 9. 1858)

*Goodyera rubicunda* (Blume) Lindl. var. *triandra* (Schltr.) N. Hallé, Fl. Nouv.-Caléd. 8: 532. 1977.

*Goodyera triandra* Schltr., Bull. Herb. Boissier II, 6: 298. 1906. Type: Vanuatu, *Morrison s.n.* (holotype B†, isotype AMES!).

*Goodyera waitziana* sensu H. Fleischm. & Rech., Denkschr. Kaiserl. Akad. Wiss., Wien. Math.-Naturwiss. Kl. 85: 254. 1910, non Blume.

*Neottia grandis* Blume, Bijdr. Fl. Ned. Ind.: 407. 1825.

*Neottia rubicunda* Blume, loc. cit.: 408. 1825.

*Terrestrial herb* up to 70 cm in height; rhizome creeping. *Leaves* obliquely elliptic to elliptic-lanceolate, acute or acuminate, 12–18 × 3.5–6 cm, long-petiolate, margins crisped-undulate. *Inflorescence* up to 40 cm long, pubescent. *Flowers* orangish, reddish brown or greenish pink, sometimes abnormal and triandrous. *Sepals* ovate or narrowly ovate, acute, 7–8.5 × 2.5–4 mm, densely pubescent. *Petals* clawed, obliquely ovate to subrhombic, acute, 7–7.5 × 2.5–3 mm. *Lip* entire, 6–7.5 mm long, saccate at base, recurved and ligulate at apex. *Column* 5–6.5 mm long. Fig. 20.

DISTRIBUTION. Tonga ('Eua). Also from southern Ryukyu Islands and Malaya throughout Malesia to northern Australia and eastwards to the Solomon Islands, Vanuatu, Fiji, and Samoa.

HABITAT. Uncommon in lowland and montane forest on volcanic soils; 250–300 m.

COLLECTIONS. 'Eua: *Buelow 2516; Hotta 5226, 5272; Hurlimann 260; Sykes 351, 412, 488; Whistler 6483, 12165; Wood 6846.*

NOTE. Plants with abnormal flowers having three anthers are sometimes found.

## 4. HETAERIA

Blume, Bijdr. Fl. Ned. Ind.: 409. 1825.

Small to medium-sized *terrestrial herbs* with fleshy creeping rhizomes rooting at the nodes, and erect, leafy

stems. *Leaves* simple, membranous, petiolate and sheathing at the base. *Inflorescence* terminal, racemose, few- to many-flowered, lax or dense. *Flowers* small, non-resupinate. *Dorsal sepal* entire, adnate to the membranous petals. *Lateral sepals* similar to the dorsal but oblique, enclosing the saccate lip-base. *Lip* more or less parallel to the column, entire, the base saccate, bearing two or more unstalked papillae or glands within, the apex small, concave, often contracted into a claw with a terminal, bilobed, transverse blade. *Column* short, with two parallel lamellae or keels on ventral surface; anther persistent, erect; pollinia two, sectile attached to a common viscidium; rostellum short, bilobed.

A genus of perhaps 70 species widespread from India throughout S.E. Asia and the Malay Archipelago to northern Australia and the S.W. Pacific islands. Also in Africa and Madagascar, and possibly the New World tropics. Two species are reported from Tonga, one of them also in Niue.

#### KEY TO SPECIES

1. Leaves elliptic to ovate-elliptic, 4–12 cm long, 2–4.5 cm wide; lip apex very small, not expanded into a transverse blade ..... 1. *H. oblongifolia*  
 1. Leaves narrowly elliptic to lanceolate, 10–22 cm long, 0.7–2.2 cm wide; lip apex expanded into a transversely bilobed blade ..... 2. *H. whitmeei*

1. *Hetaeria oblongifolia* Blume, Bijdr. Fl. Ned. Ind.: 410. 1825. Type: Java, *Blume s.n.* (holotype L!).  
*Aetheria oblongifolia* (Blume) Lindl., Gen. Sp. Orchid. Pl.: 491. 1840.  
*Goodyera discoidea* (Rchb. f.) Schltr., Bot. Jahrb. Syst. 39: 57. 1906.  
*Hetaeria discoidea* (Rchb. f.) Schltr., Repert. Spec. Nov. Regni Veg. 9: 89, in obs. 1910.  
*Hetaeria forcipata* Rchb. f., Linnaea 41: 62. 1877. Type: Fiji, *Roetzl s.n.* (holotype W!).  
*Hetaeria raymundii* Schltr., Bot. Jahrb. Syst. 56: 453. 1921. Type: Palau Islands, *Raymundus s.n.* (holotype B†).  
*Hetaeria samoensis* Rolfe, Bull. Misc. Inform. Kew 1898: 199. 1898. Type: Samoa, *Walter s.n.* (holotype CAM!, isotype K!).  
*Hetaeria similis* Schltr., Repert. Spec. Nov. Regni Veg. 9: 88. 1910. Type: Samoa, *Vaupel 657* (holotype B†, isotypes BISH!, K!).  
*Rhamphidia discoidea* Rchb. f., Linnaea 41: 59. 1877. Type: New Caledonia, *Vieillard 1311* (holotype P!, isotype BM!).  
*Rhamphidia tenuis* sensu H. Fleischm. & Rech., Denkschr. Kaiserl. Akad. Wiss., Wien. Math.-Naturwiss. Kl. 85: 254. 1910, non Lindl.

*Terrestrial herb* up to 50 cm in height. *Leaves* obliquely elliptic to ovate-elliptic, acute or abruptly acuminate, 4–12 × 2–4.5 cm; petiole 1.5–4 cm long. *Inflorescence* 10–30 cm long, many-flowered. *Flowers* small, white or creamy white; pedicel and ovary 5–7 mm long. *Dorsal sepal* ovate, subacute, 3–4 × 1.25–1.75 mm. *Lateral sepals* obliquely oblong-ovate, obtuse, 3–4 × 1–1.25 mm. *Petals* narrowly elliptic, obtuse, 3–3.5 × 0.7–1 mm. *Lip* saccate, 3–3.5 × 1 mm, mucronate at apex; calli papillate, 2 or 3 pairs. *Column* 1–1.5 mm long. Fig. 21.

DISTRIBUTION. Tonga ('Eua, Kao, Late, Niuafu'ou, and Tafahi) and Niue. Also widely distributed from the Philippines and Indonesia through New Guinea and Palau to the Solomon Islands, Santa Cruz Islands, Vanuatu, New Caledonia, Fiji, Samoa, and Australia.

HABITAT. Occasional in foothill to montane forest; 250–600 m.

COLLECTIONS. 'Eua: *Hotta 5517, 5557; Hurlimann 261, 262. Kao: Buelow 3190. Late: Buelow & Sykes 165. Niuafu'ou: Buelow 2258. Tafahi: Buelow 1199. Niue: Sykes 53, 358, 394; Whistler 10740.*

2. *Hetaeria whitmeei* Rchb. f., J. Bot. 15: 133. 1877. Type: Samoa, *Whitmee s.n.* (holotype K!, isotype W!).

*Adenostylis stricta* Rolfe, J. Linn. Soc., Bot. 39: 177. 1909. Type: Viti Levu, *Gibbs 667* (holotype BM!).

*Habenaria* sp. sensu Yuncker., B.P. Bishop Mus. Bull. 220: 87. 1959.

*Hetaeria francisii* Schltr., Repert. Spec. Nov. Regni Veg. 9: 161. 1911. Type: New Caledonia, *Franc 767* (holotype B†, isotype P!).

*Hetaeria polyphylla* Rchb. f., Otia Bot. Hamburg. (as *Etaeria*): 52. 1878 & *Xenia Orchid*. 3: 29. 1881. Type: Vanua Levu, *USEE s.n.* (holotype W!, isotype and photo AMES!).

*Zeuxine betchei* Schltr., Repert. Spec. Nov. Regni Veg. 9: 90. 1910. Type: Samoa, *Betche 57* (holotype B!, isotype MEL).

*Zeuxine sphaerocheila* H. Fleischm. & Rech., Denkschr. Kaiserl. Akad. Wiss., Wien. Math.-Naturwiss. Kl. 85: 251, t. 2, fig.6. 1910. Types: Samoa, *Rechinger 1663, 3710* (syntypes W!).

*Zeuxine triandra* M. Hotta, Acta Phytotax. Geobot. 19: 156. 1963. Type: Tonga, *Hotta 5332* (holotype KYO).

*Terrestrial herb* up to 60 cm in height. *Leaves* narrowly elliptic to lanceolate, acuminate, 10–22 × 0.7–2.2 cm; petiole 2–3.5 cm long. *Inflorescence* pubescent, 20–40 cm long, laxly many-flowered. *Flowers* brownish white without, creamy within. *Dorsal sepal* ovate, subacute, 4–5 mm long. *Lateral sepals* obliquely oblong-ovate, subacute, 4–5.5 × 2–2.5 mm. *Petals* oblong, rounded at apex, 4–4.5 × 0.7–1 mm. *Lip* 4.5–5.5 × 3–4 mm, saccate at the base with two lamellate, papillate calli within and longitudinally divided by a shallow groove externally; apical part transversely oblong, 1–1.5 × 1.5–2 mm. *Column* ca. 1.5 mm long. Fig. 22.

DISTRIBUTION. Tonga (\*Eua). Also in New Caledonia, Fiji, and Samoa.

HABITAT. Uncommon in lowland to montane forest that is often dominated by *Dysoxylum tongense*; 200–300 m.

COLLECTIONS. \*Eua: *Buelow 2507; Hotta 5332, 5334; Whistler 7421, 11703; Yuncker 15404.*

## 5. VRYDAGZYNEA

Blume, Fl. Javae ser. 2, 1, Orch.: 59. 1858.

Small *terrestrial herbs* with creeping fleshy rhizomes rooting at the nodes, and erect leafy stems. *Leaves* entire, alternate, petiolate, sheathing at the base, membranous. *Inflorescence* terminal, racemose, laxly to densely many-flowered. *Flowers* small, resupinate. *Dorsal sepal* entire, adnate to the petals and forming a hood over the column. *Lateral sepals* similar to the dorsal but oblique at the base. *Petals* entire, membranous. *Lip* more or less parallel to the column, entire, prominently spurred at the base, the spur projecting between the lateral sepals, entire or bilobed at apex, with two stalked glands within. *Column* very short; anther erect, persistent; pollinia two, sectile, clavate, attached to a common viscidium; rostellum relatively short, bilobed.

A small genus of perhaps 20 species in India, S.E. Asia, the Malay Archipelago, northern Australia, and the S.W. Pacific islands. A single species is reported from Tonga.

*Vrydagzynea vitiensis* Rchb. f., Otia Bot. Hamburg.: 51. 1878. Types: Samoa, *Wilkes s.n.* (syntype W!); Fiji, Ovalau, *Wilkes s.n.* (lectotype W!, isolectotype AMES!).

*Vrydagzynea whitmeei* Schltr., Bull. Herb. Boissier, II, 6: 296. 1906. Type: Samoa, *Whitmee s.n.* (holotype B†).

*Terrestrial herb* 8–25 cm in height. *Leaves* lanceolate or narrowly ovate, acute, 3.5–6 × 1.2–2 cm, green with a central white stripe; petiole 0.8–1.5 cm long. *Inflorescence* densely many-flowered, 2–7 cm long; rachis short, sparsely villose. *Flowers* greenish white to white; pedicel and ovary 5–9 mm long. *Dorsal sepal* oblong-ovate, subacute, 3–3.5 × 1–1.5 mm. *Lateral sepals* oblong, obtuse, oblique at the base, 3–3.5 × 1.5–2 mm. *Petals* falcately linear-oblong, obtuse, 2–2.5 × 1–1.5 mm. *Lip* ovate, blunt with incurved sides, 2–2.5 × 1–1.7 mm; spur conical, obscurely bilobed at apex, 2.5–3 mm long. *Column* 1.5–2 mm long. Fig. 23.

DISTRIBUTION. Tonga (Tafahi). Also in Vanuatu, Fiji, and Samoa.

HABITAT. Uncommon in foothill to montane forest; 250 to ca. 600 m.

COLLECTIONS. **Tafahi:** *Buelow* 1255, 1300; *Hurlimann* 442.

## 6. ZEUXINE

Lindl., Coll. Bot., app. no.18. 1826.

*Adenostylis* Blume, Bijdr. Fl. Ned. Ind.: 414. 1825.

*Monochilus* Wall. ex Lindl., Gen. Sp. Orchid. Pl.: 486. 1840.

Small to medium-sized *terrestrial herbs* with creeping fleshy rhizomes rooting at the nodes. *Stems* erect, leafy, fleshy. *Leaves* entire, alternate, petiolate, sheathing at the base, membranous. *Inflorescence* terminal, racemose, few- to many-flowered. *Flowers* small, resupinate. *Dorsal sepal* entire, adnate to the petals to form a hood over the column. *Lateral sepals* free, similar to dorsal sepal but oblique at base. *Lip* more or less adnate to front of column, entire, saccate or cymbiform at the base, with two small glands within; the middle clawed, the apex broadened into a transverse blade. *Column* short; anther dorsal, erect, persistent; pollinia two, sectile, attached to a common rather large viscidium; rostellum prominent, rather broad, deeply divided.

A large genus of perhaps 70 species widespread in the Old World tropics from Africa, Madagascar, and India eastward to China, S.E. Asia, the Malay Archipelago, and the Pacific islands. A single species is reported from Tonga.

*Zeuxine stenophylla* (Rchb. f.) Benth. & Hook. f. ex Drake, Ill. Fl. Ins. Pacif.: 312. 1892. Type: Samoa, Savai'i & Tutuila, *Wilkes s.n.* (syntypes W!).

*Adenostylis vitiensis* Rolfe, J. Linn. Soc., Bot. 39: 177. 1909. Type: Viti Levu, *Gibbs* 618 (holotype BM!, isotype K!).

*Monochilus stenophyllus* Rchb. f., Otia Bot. Hamburg.: 52. 1878; *Xenia* Orchid. 3: 29. 1881.

*Zeuxine vitiensis* (Rolfe) L.O. Williams, Bot. Mus. Leafl. 5: 112. 1938.

*Terrestrial herb* (or sometimes epiphytic) 18–35 cm in height. *Leaves* lanceolate, acute, 1.8–5 × 0.6–1.3 cm. *Inflorescence* laxly many-flowered; peduncle and rachis sparsely hairy; bracts lanceolate, acuminate, up to 8 mm long. *Flowers* white, sparsely hairy; pedicel and ovary 5–7 mm long, sparsely hairy. *Dorsal sepal* ovate, obtuse, 3–4 × 2–3 mm. *Lateral sepals* obliquely oblong-ovate, obtuse, 4–5 × 2–3 mm. *Petals* obliquely ovate, obtuse, 3–3.5 × 2–2.5 mm. *Lip* 3.5–4 × ca. 2 mm, recurved at apex; basal part bearing two recurved hook-like calli within; apical lamina transversely oblong, ca. 1 × 2–2.5 mm. *Column* 1.7–2 mm long. Fig. 24.

DISTRIBUTION. Tonga (Kao and Tafahi). Also found in Vanuatu, Fiji, and Samoa.

HABITAT. Uncommon on the ground or on the base of tree ferns in scrub forest; ca. 500 m.

COLLECTIONS. **Kao:** *Buelow* 2949, 3118. **Tafahi:** *Buelow* 1266.

## 7. SPIRANTHES

Rich., De Orchid. Eur.: 20, 28, 36. 1817.

Small to medium-sized *terrestrial herbs* with fasciculate fleshy roots. *Leaves* in a basal rosette or in lower part of stem. *Inflorescence* terminal, a spiralling raceme or spike of many small flowers, often pubescent or glandular. *Flowers* small, usually not opening widely, white, pink, or greenish. *Dorsal sepal* entire, adnate to the petals over the column. *Lateral sepals* similar but usually oblique at the base. *Petals* entire, membranous. *Lip* sessile or shortly clawed, entire or obscurely 3-lobed in apical part, hairy or glabrous on upper surface. *Column* rather short, lacking a foot; anther erect, dorsal; pollinia two, mealy, attached by a caudicle to a small viscidium; stigmas two, on each side under rostellum.

A genus of about 50 species, mostly in temperate North America and Central America, but with a few species in Europe and temperate Asia. A single species from the Himalayas and China into S.E. Asia, the Malay Archipelago, the S.W. Pacific islands, northern Australia, and eastward to Samoa (where it was recorded only recently; Cribb & Whistler 1999) and western Polynesia. The single species is reported from Tonga and Niue.

***Spiranthes sinensis*** (Pers.) Ames, Orchidaceae 2: 53. 1908. Type: China, collector not traced (holotype UPS!).

*Neottia sinensis* Pers., Syn. Pl. 2: 511. 1807.

*Spiranthes neocaledonica* Schltr., Bot. Jahrb. Syst. 39: 51. 1906. Type: New Caledonia, *Schlechter 15594* (holotype B†). For full synonymy, see Garay & Sweet. 1974.

*Terrestrial herb* 8–40 cm in height. *Leaves* mostly basal, oblong-elliptic to linear-lanceolate, grass-like, up to 10 × 1 cm. *Inflorescence* erect, spiralled, slender, laxly many-flowered; bracts ovate-lanceolate, 5–8 mm long, glabrous. *Flowers* white or pink with a white lip, apparently self-pollinating; pedicel and ovary up to 6 mm long. *Dorsal sepal* ovate, acute, 3.2–4 × 1–1.4 mm. *Lateral sepals* oblong-lanceolate, acute, 2.3–4.5 × ca. 1 mm. *Petals* oblong-lanceolate, rounded and erose at the apex, 2.8–4 × 0.7–1 mm. *Lip* oblong-ovate, rounded at the apex, slightly constricted and papillose in apical third, 4–5 × 2–2.5 mm, the apical margins undulate-crispate; calli basal, subglobose, fleshy. *Column* ca. 2 mm long. Fig. 25.

**DISTRIBUTION.** Tonga (Ha‘apai, Tofua, and Late) and Niue. Also widely distributed from mainland Asia, S.E. Asia, and the Malay Archipelago to New Guinea, the Solomon Islands, Vanuatu, Samoa, Australia, and New Caledonia.

**HABITAT.** Uncommon in open areas, especially open scrub; up to 300 m (higher elsewhere).

**COLLECTIONS.** **Ha‘apai:** *Yuncker 15775*. **Tofua:** *Buelow 2697; Hotta 4401; Whistler 10623*. **Late:** *Buelow & Sykes 68, 221*. **Niue:** *Sykes 440, 692; Whistler 10820*.

## 8. PERISTYLUS

Blume, Bijdr. Fl. Ned. Ind.: 404. 1825.

*Terrestrial herbs* growing from tubers or clustered thickened roots, with short or long, leafy stems. *Leaves* in a basal rosette or alternate along stem, entire, fleshy-membranous, not articulated. *Inflorescence* terminal, laxly to densely many-flowered, racemose. *Flowers* small, green or yellow-green, resupinate. *Dorsal sepal* entire, adnate to petals to form a hood over the column. *Lateral sepals* spreading, reflexed or erect. *Petals* membranous, entire. *Lip* connate at base with margins of the column, 3-lobed or entire, spurred at the base, rarely with a fleshy callus in the mouth of the spur. *Column* very short, erect; anther persistent, bilocular; pollinia two, clavate, each attached to a small viscidium; rostellum small; stigmas two, sessile, adnate to the base of the lip and auricles of the column.

A genus of about 70 species in tropical Asia, S.E. Asia, the Malay Archipelago, and S.W. Pacific islands. Two species are reported from Tonga and one from the Cook Islands.

#### KEY TO SPECIES

1. Spur of lip cylindrical, 5–7.5 mm long ..... 1. *P. tradescantifolius*  
 1. Spur of lip globular, ca. 2 mm long  
 2. Leaves clustered in middle of stem; sepals 3 mm long ..... 2. *P. novo-ebudarum*  
 2. Leaves well spaced along center part of stem; sepals 2 mm long or less ..... 3. *P. minimiflorus*

1. *Peristylus tradescantifolius* (Rchb. f.) Kores, *Allertonia* 5 (1): 12. 1989. Type: Ovalau, *Seemann 608* (holotype W!, isotype AMES!, K!).

*Habenaria cyrtostigma* Schltr., *Repert. Spec. Nov. Regni Veg.* 9: 83. 1910. Type: Samoa, *Rechinger 32*; Samoa, *Vaupel 584*; Samoa, *Rechinger 1146* (all syntypes B†).

*Habenaria papuana* Kraenzl., *Bot. Jahrb. Syst.* 18: 188. 1894. Type: New Guinea, *Hellwig 585* (holotype B†).

*Habenaria tradescantifolia* Rchb. f., *Seem., Fl. Vit.*: 293. 1868.

*Habenaria tradescantifolia* Rchb. f. var. *pinquior* H. Fleischm. & Rech., *Denkschr. Kaiserl. Akad. Wiss., Wien. Math.-Naturwiss. Kl.* 85: 250. 1910. Types: Samoa, ‘Upolu, *Rechinger 1146* (syntype BM!, W!), *1802* (syntype W!).

*Peristylus papuanus* (Kraenzl.) J.J. Sm., *Nova Guinea* 12: 3. 1913.

*Terrestrial herb* 30–65 cm in height. *Leaves* 7 or 8, scattered in upper half of stem, lanceolate, long-acuminate, 8–20 × 1–2.8 cm, subtended by 5 or 6 sheathing cataphylls. *Inflorescence* 19–55 cm long, laxly many-flowered; bracts 5–14 mm long. *Flowers* pale green or greenish white; pedicel and ovary 10–13 mm long. *Dorsal sepal* ovate, obtuse, 2.3–3.2 × 1.2–2 mm. *Lateral sepals* obliquely oblong-elliptic, obtuse, 2.5–3 × 1–1.5 mm. *Petals* obliquely ovate, obtuse, 2.5–3.3 × 1.5–2 mm. *Lip* 3-lobed, obscurely 3-ridged at base; side lobes linear-tapering, recurving towards apex, 4.2–5.5 mm long; midlobe triangular-ligulate, fleshy, 1.5–2 mm long; spur cylindrical-fusiform, slightly incurved, 5–7.5 mm long. *Column* ca. 1 mm long. Fig. 26.

DISTRIBUTION. Tonga (‘Eua, Kao, and Tofua). Also found on Fiji and Samoa.

HABITAT. Uncommon in lowland to montane forest; 200–1000 m.

COLLECTIONS. ‘Eua: ?*Buelow 2517*. Kao: *Buelow 2928, 2943*. Tofua: *Buelow 2734*.

2. *Peristylus novoebudarum* F. Muell., *Contr. Phytogr. New Hebrides*: 22. 1873. Type: Vanuatu, *Campbell s.n.* (holotype MEL).

*Terrestrial herb* up to 60 cm or more in height. *Leaves* clustered in middle of stem, lanceolate, acuminate, 10–17 × 1.5–2.5 cm; petiole 1–1.5 cm long. *Inflorescence* up to 30 cm long, subdensely many-flowered; bracts lanceolate, 1–1.5 cm long, equaling or longer than the flowers. *Flowers* pale greenish yellow to yellowish brown, small; pedicel and ovary ca. 0.8 cm long. *Dorsal sepal* ovate, obtuse, ca. 3 × 1.5 mm. *Lateral sepals* oblong-ovate, shortly mucronate, ca. 3 × 1–1.5 mm. *Petals* entire, obliquely ovate, obtuse, ca. 3.5 × 1 mm. *Lip* 3-lobed, with a horn-like callus at mouth of spur; side lobes spreading, linear-tapering, ca. 3 mm long; midlobe ligulate, obtuse, fleshy, ca. 2 mm long; spur globular, ca. 2 mm long. *Column* very short, ca. 1 mm long. No Fig. available.

DISTRIBUTION. Tonga (‘Eua, Kao, and Niuafou‘ou). Also in Vanuatu and New Caledonia.

HABITAT. Rare in lowland to montane and ridge-top forest; up to 800 m.

COLLECTIONS. ‘Eua: *Buelow 2517*. Kao: ?*Buelow 618*. Niuafou‘ou: *Buelow 2146*.



3. *Peristylus minimiflorus* (Kraenzl.) N. Hallé, Fl. Nouv.-Caléd. 8: 552. 1977. Type: New Caledonia, *Le Rat 98, pro parte* (holotype P!).

*Eulophia minimiflora* Kraenzl., Lecomte, Notul. Syst. (Paris) 4: 137. 1928, *pro parte*.

*Terrestrial herb* 35–45 cm or more in height. *Leaves* 6–8, scattered in central part of stem, lanceolate, acuminate, 6–8 × 1.4–2.1 cm; petiole 1–1.5 cm long. *Inflorescence* 22–25 cm long, subdensely many-flowered; bracts lanceolate, ca. 1 cm long. *Flowers* pale greenish yellow, small; pedicel and ovary ca. 0.8 cm long. *Dorsal sepal* ovate, obtuse, ca. 2 × 1 mm. *Lateral sepals* oblong-ovate, shortly mucronate, ca. 2 × 1 mm. *Petals* entire, obliquely ovate, obtuse, ca. 2 × 0.6 mm. *Lip* 3-lobed; side lobes obscure; midlobe ligulate, obtuse, fleshy, ca. 2 mm long; spur globular, ca. 1.5 mm long. *Column* very short, ca. 1 mm long. No Fig. available.

DISTRIBUTION. Cook Islands (Rarotonga and Miti‘aro). Also in New Caledonia.

HABITAT. Rare in lowland to montane and ridge-top forest; up to 800 m.

COLLECTIONS. **Rarotonga:** *Luttrell & McCormack 168A*. **Miti‘aro:** *Sykes 1035, 2384*.

#### 9. HABENARIA

Willd., Sp. Pl. 4: 44. 1805.

*Terrestrial herbs* growing from underground tubers, with erect leafy stems. *Leaves* in a basal rosette or borne on stem, entire, membranous, not articulated. *Inflorescence* terminal, few- to many-flowered, racemose. *Flowers* green, white, yellow, rarely red or orange, small to large, resupinate. *Dorsal sepal* entire, often adnate to the petals or the posterior petal lobes to form a hood over the column. *Lateral sepals* spreading to reflexed, entire. *Petals* entire or bilobed. *Lip* 3-lobed or 3-partite, rarely entire, spurred at base; side lobes spreading, sometimes further divided; midlobe usually pendent. *Column* erect, small to large; anther erect, persistent, bilocular; pollinia two, clavate, each attached to a small viscidium; rostellum 3-lobed, more or less triangular; stigmas two, stalked.

A genus of between 600 and 800 species, pantropical in distribution, but extending into warm temperate regions. A single species is reported from the Cook Islands.

*Habenaria amplifolia* Cheeseman, Trans. Linn. Soc. London, Bot. 6: 298. 1903. Type: Rarotonga, *Cheeseman s.n.* (holotype K!)

*Terrestrial herb* 75–160 cm in height. *Leaves* in central part of stem, elliptic-lanceolate to obovate, acuminate, 18–29 × 3.8–7 cm. *Inflorescence* subdensely many-flowered, up to 100 cm long; bracts lanceolate, acuminate, 13–18 mm long. *Flowers* green. *Dorsal sepal* ovate-elliptic, aristate, 12–13 × 4–5 mm. *Lateral sepals* obliquely ovate, aristate 11–12 × 3–3.5 mm. *Petals* bipartite; posterior lobe broadly linear-lanceolate, acuminate, 10–11 × 0.2–0.5 mm; anterior lobe falcate, much shorter than posterior lobe, linear, acuminate, incurved, 6–6.5 × 0.3–0.4 mm. *Lip* 3-lobed; side lobes incurved, linear-tapering, 6–7 mm long; midlobe longer than side lobes, linear, acute, ca. 10 × 1 mm; spur more or less straight or sinuous, longer than ovary, 25–30 mm long, filiform, inflated at apex. *Column* 2–2.5 mm long. Figs. 27, 67.

DISTRIBUTION. Rarotonga. Endemic to the island.

HABITAT. Locally common in shaded forested ravines in center of island; ca. 250 m.

COLLECTIONS. **Rarotonga:** *Cheeseman s.n.*; *Parks 22288*; *Sykes 1705, 2583*; *Whistler 5937*; *Wilder 792*.

#### 10. CORYMBORKIS

Thouars, Nouv. Bull. Sci. Soc. Philom. Paris 1: 318. 1809.

*Corymborchis* Blume, Fl. Javae ser. 2, 1, Orch.: 105. 1858–9.

*Corymbis* Thouars, Seem., Fl. Vit.: 295 (1868).

Large *terrestrial herbs* with woody, bamboo-like, erect leafy stems growing from short rhizomes, often forming clumps; roots fibrous, fasciculate. *Leaves* in upper half of stem, plicate, ovate, elliptic or lanceolate. *Inflorescence* axillary, simple or branching. *Flowers* not opening widely, resupinate. *Sepals* and *petals* free or shortly connate, linear-oblongate, subsimilar. *Lip* parallel to column, spatulate, recurved at apex, with two longitudinal callus ridges. *Column* elongate, slender, clavate, straight; pollinia two, granulose, with a slender terete stipe attached to a peltate viscidium; rostellum bilobed.

A pantropical genus of seven species, with one species found in Tonga.

***Corymborkis veratrifolia*** (Reinw.) Blume, Fl. Javae, ser. 2, 1, Orch.: 125 (1859). Type: Java, *Lobb 162* (neotype K!). For full synonymy, see Rasmussen (1977).

Large *terrestrial herb* with stems up to 1.2 m in height, leafy in apical half, often forming colonies. *Leaves* elliptic to lanceolate, acuminate, 20–32 × 4–9 cm, narrowed into a short petiole above the sheathing base. *Inflorescence* 1–several, up to 16 cm long, lateral from the leaf axils in upper part of stem, usually branching; bracts lanceolate, acuminate, 8–10 mm long. *Flowers* white or greenish white, narrow and tubular, not opening widely; pedicel and ovary up to 2 cm long. *Sepals* and *petals* similar, linear-oblongate, acute, 20–23 × 1.5–2 mm. *Lip* spatulate, 18–20 × 5–7 mm, claw linear, apical lamina suborbicular-ovate, shortly apiculate, margins crispate. *Column* 15–16 mm long. *Capsule* stalked. Fig. 28.

DISTRIBUTION. Tonga ('Eua and Tongatapu). Widely distributed from S.E. Asia and the Malay Archipelago to New Guinea, Australia, the Solomon Islands, Vanuatu, Fiji, and Samoa.

HABITAT. Occasional in lowland forest, less common in upper montane rainforest; ca. 20–650 m.

COLLECTIONS. 'Eua: *Hotta 5251, 5285, 5295; Hurlimann 253; Ives s.n.; Sykes 137, 623; Whistler 5982, 6474; Wood 6845; Yuncker 15467. Tongatapu: Buelow 51; Ilolahia 95; Palmer 125; Parks 15468, 15623.*

TONGAN NAME: 'Uto'uto.

## 11. NERVILIA

Commerson ex Gaudich., Voy. Uranie: 421. 1829.

Small to medium-sized *terrestrial herbs* growing from underground tubers. *Leaf* solitary, usually produced after the inflorescence has withered, ovate, lanceolate, elliptic, or heart-shaped, erect or borne parallel to the substrate, either appressed to the substrate or above it, glabrous to hairy, green or marked with purple on upper side, green or purple beneath. *Inflorescence* lateral, one- to several-flowered, erect, racemose. *Flowers* short-lived, resupinate. *Sepals* subsimilar, linear-lanceolate. *Petals* similar but shorter and membranous. *Lip* more or less embracing the column, entire to 3-lobed, bearing a lamellate or hairy callus, rarely spurred at base. *Column* clavate, elongate; anther incumbent, 2-celled; pollinia two, granulose, lacking caudicles; stigma below rostellum.

A genus of about 80 species in Africa, Madagascar, tropical Asia, the Malay Archipelago, Australia, and the S.W. Pacific islands. One species is reported from Tonga, the Cook Islands, and Niue.

***Nervilia concolor*** (Blume) Schltr., Bot. Jahrb. Syst. 45: 404. 1911. Type: Java, Mt. Salak, *Blume s.n.* (holo. L).

*Gastrodia* sp. *sensu* Kraenzl., Bot. Jahrb. Syst. 25: 599. 1898.

*Nervilia aragoana* Gaudich., Voy. Uranie: 422. 1829. Type: Mariana Islands, *Gaudichaud s.n.* (holotype P!).

*Pogonia concolor* Blume, Mus. Bot. 1: 32. 1825.



FIGURE 17. *Vanilla planifolia*.



FIGURE 18. *Erythrodes oxyglossa*. Tonga.



FIGURE 19. *Erythrodes purpurascens*. Tonga.



FIGURE 20. *Goodyera rubicunda*. Tonga.



FIGURE 21. *Hetaeria oblongifolia*. Niue.



FIGURE 22. *Hetaeria whitmeei*. Samoa.



FIGURE 23. *Vrydagzynea vitiensis*. Samoa.



FIGURE 24. *Zeuxine stenophylla*. Samoa.



FIGURE 25. *Spiranthes sinensis*. Samoa.



FIGURE 26. *Peristylus tradescantifolius*. Samoa.



FIGURE 27. *Habenaria amplifolia*. Cooks.



FIGURE 28. *Corymborkis veratrifolia*. Tonga.



FIGURE 29. *Nervilia concolor*. Tonga.



FIGURE 30. *Didymoplexis micradenia*. Rotuma.



FIGURE 31. *Calanthe hololeuca*. Tonga.



FIGURE 32. *Calanthe triplicata*. Samoa.

*Pogonia flabelliformis* Lindl., Gen. Sp. Orchid. Pl.: 415. 1840, *nom. illeg.* Type: Nepal, *Wallich 7400A* (holotype K!).

*Pogonia nervilia* Blume, Mus. Bot. 1.: 1849, 32 *nom. illeg.* based on the types of both above.

*Terrestrial stemless herb* arising from an underground tuber. *Leaf* erect, plicate, heart-shaped, acute, 12–15 × 14–18 cm, often marked with dark maroon on upper surface; petiole 15–30 cm long. *Inflorescence* laxly 5–15-flowered, up to 45 cm long; bracts linear to linear-lanceolate, 15–25 mm long. *Flowers* pendent or nodding, probably self-pollinating, white or greenish yellow with a white lip marked with rose or violet veins; pedicel and ovary 1–1.5 cm long. *Sepals* and *petals* linear-lanceolate, acute, 2–2.5 cm long. *Lip* 3-lobed near the apex, 2–2.4 cm long; side lobes small, erect, triangular; midlobe subovate, acute to obtuse, with undulate margins; callus puberulent in middle. *Column* clavate, ca. 7 mm long. Fig. 29.

**DISTRIBUTION.** Tonga (Tongatapu, Vava‘u, Niuatoputapu, Niuafu‘ou, and Tafahi), the Cook Islands (Atiu, Mangaia, Mauke, and Miti‘aro), and Niue. Also widely distributed from Asia and the Malay Archipelago to the Mariana Islands, New Guinea, the Solomon Islands, Vanuatu, New Caledonia, the Horn Islands, Samoa, the Society Islands, Fiji, and Australia.

**HABITAT.** Uncommon in lowland to montane forest; 10–500 m.

**COLLECTIONS.** **Tongatapu:** *USEE s.n.* **Vava‘u:** Whistler (sight record, 2002). **Niuafu‘ou:** *Buelow 1996, 2185, 2216; Whistler 6416.* **Niuatoputapu:** *Buelow 1141.* **Tafahi:** *Hurlimann 475; Whistler 6238.* **Atiu:** *Sykes 350; Whistler 5678.* **Mangaia:** *Whistler 5467.* **Mauke:** *Whistler 5541.* **Miti‘aro:** *Whistler 5268.* **Niue:** *Sykes 791, 820, 1038; Yuncker 10057.*

**COOK ISLANDS NAME:** Pia rau ta‘i, tamaru (Miti‘aro).

## 12. DIDYMOPLEXIS

Griffith, *Calcutta J. Nat. Hist.* 4: 383. 1843.

Small *saprophytic herbs* growing from a tuberous rhizome, with fleshy, glabrous, erect stems bearing a few cataphylls, but lacking chlorophyll and leaves. *Inflorescence* few-flowered, racemose. *Flowers* resupinate, small, lacking a spur. *Dorsal sepal* adnate to *petals* and forming a hood over the column. *Lateral sepals* free or fused to each other for at least part of length. *Lip* 3-lobed, attached to column-foot; callus of rows of papillae. *Column* free, elongate, with a short foot; anther declinate; pollinia two, sectile, lacking caudicles; rostellum short. *Capsule* with a stalk that elongates rapidly after pollination.

A small genus of about 20 species in tropical Africa, Madagascar, tropical Asia eastward to the Ryukyu Islands, the Malay Archipelago, Northern Australia, and the S.W. Pacific. A single species is reported from Tonga and Niue.

*Didymoplexis micradenia* (Rchb. f.) Hemsl., *J. Linn. Soc., Bot.* 20: 311. 1883. Type: Ovalau, *Seemann 610* (holotype W!, isotype K!).

*Didymoplexis minor* J.J. Sm., *Bull. Inst. Bot. Buitenzorg* 7: 1. 1900. Type: Java, *J.J. Smith 74* (holotype L!).

*Didymoplexis minor* subsp. *samoensis* H. Fleischm. & Rech., *Denkschr. Kaiserl. Akad. Wiss., Wien. Math.-Naturwiss. Kl.* 85: 251. 1910. Type: Samoa, *Rechinger 1641* (holotype W!).

*Didymoplexis neocaledonica* Schltr., *Bot. Jahrb. Syst.* 39: 50. 1906. Type: New Caledonia, *Schlechter 15748* (holotype B†).

*Didymoplexis pallens* sensu Sykes, *New Zealand Dept. Sci. Indust. Res. Bull.* 200: 258. 1970, non Griff.

*Didymoplexis samoensis* (H. Fleischm. & Rech.) Schltr., Repert. Spec. Nov. Regni Veg. 9: 85. 1910.

*Epiphanes micradenia* Rchb. f., Seem., Fl. Vit.: 295. 1868.

*Leucorchis micradenia* (Rchb. f.) Benth. & Hook. f. ex Drake, Ill. Fl. Ins. Pacif.: 313. 1892.

Leafless herb 7–10 cm in height, elongated in fruit up to 25 cm in height, with irregularly cylindrical-fusiform tubers up to 4 cm long and 0.8 cm in diameter; roots slender, filiform. *Inflorescence* erect, slender, up to 10 cm long, pinkish brown; peduncle bearing 2 or 3 short, sheathing cataphylls; bracts ovate-acuminate, 1–1.5 mm long. *Flowers* small, dull flesh-brown with a whitish lip; peduncle elongating rapidly after fertilization, 5–20 cm long. *Dorsal sepal* oblong-ovate, blunt, adnate to petals, forming a hood over column, 5.5–6.6 × 2.5–3.5 mm. *Lateral sepals* almost fused, oblong to oblong-lanceolate, obtuse, 5–6 × 1.5–2 mm. *Lip* oblong-cuneiform, weakly 3-lobed at apex, 5.5–6.5 × 2.5–3 mm; callus of 3 ridges of papillae. *Column* 4.5–5.5 mm long; foot 0.3–0.5 mm long. Fig. 30.

DISTRIBUTION. Tonga ('Eua, Tongatapu, Vava'u, Late, Niuatoputapu, and Tafahi) and Niue. Also in Vanuatu, New Caledonia, Fiji, and Samoa.

HABITAT. Uncommon in coastal to foothill forest; near sea level to 450 m.

COLLECTIONS. 'Eua: *Buelow 1738*. Tongatapu: *Lawrence 218*. Vava'u: *Buelow & Sykes 46*. Late: *Buelow & Sykes 72*. Niuatoputapu: *Buelow 1422*. Tafahi: *Buelow 1325*. Niue: *Sykes 387, 459; Whistler 10787, 10880*.

### 13. CALANTHE

R. Br., Ker Gawler, Bot. Reg. 7: sub t. 573. 1821.

Medium-sized to large *terrestrial herbs* (or rarely epiphytic) with a short to elongate rhizome. Erect *stems* pseudobulbous or obscurely so, several-noded, leafy along length. *Leaves* pleated, not or rarely articulated, often quite large. *Inflorescence* lateral, erect, many-flowered, racemose. *Flowers* resupinate, usually showy, turning blue-black when damaged and with age; bracts persistent or rarely caducous. *Sepals* free, spreading. *Petals* smaller than sepals, free, spreading. *Lip* entire or more commonly 3- or 4-lobed, connate at base to column, spurred at base; callus papillate, ridged or verrucose at base of lip; spur usually long, rarely short or absent. *Column* short, fleshy, connate with base of lip; anther decumbent; pollinia eight, clavate, waxy.

A genus of about 260 species widely distributed in Africa, Madagascar, tropical and east temperate Asia, Japan, Taiwan, S.E. Asia, the Malay Archipelago, W. and S.W. Pacific islands, and Australia, and a single species in tropical America. Two species are reported from Tonga.

#### KEY TO SPECIES

1. Lip 3-lobed, 6–7 mm long, lacking a basal callus; spur sigmoid, 12–14 mm long ..... **1. *C. hololeuca***  
 1. Lip 4-lobed; 13–20 mm long with a basal yellow to red callus; spur pendent to horizontal,  
 15–30 mm long ..... **2. *C. triplicata***

1. ***Calanthe hololeuca*** Rchb. f., Seem., Fl. Vit.: 298. 1868. Type: Viti Levu, *Seemann 607* (holotype K!, part of holotype W!).

*Calanthe neocaledonica* Rendle, J. Linn. Soc., Bot. 45: 251. 1921. Types: New Caledonia, *Compton 1409, 1609* (syntypes BM!).

*Calanthe vaupeliana* Kraenzl., Notizbl. Königl. Bot. Gart. Berlin 5: 111. 1909. Type: Samoa, *Vaupel 397* (holotype B!, isotype AMES!, K!).

Large *terrestrial herb* 50–90 cm in height. *Leaves* 6–8, lanceolate, acute or acuminate, 30–50 × 3–6.8 cm;



petiole 11–20 cm long. *Inflorescence* 27–65 cm long, subdensely many-flowered; peduncle terete, bearing several sheathing sterile bracts; rachis 6–15 cm long; bracts ovate-lanceolate, acute, 15–28 mm long, deciduous. *Flowers* white; pedicel and ovary 10–22 mm long. *Sepals* elliptic to oblong-ovate, acuminate or shortly apiculate, 11–14 × 4–6 mm. *Petals* elliptic to elliptic-obovate, acuminate, 10–13 × 4.5–8 mm. *Lip* 3-lobed, 6–7 × 4–5 mm, lacking a basal callus; side lobes upcurved, oblong, small; midlobe oblong-cuneate or oblong, truncate; spur cylindrical to slightly clavate, 12–14 mm long, slightly sigmoid at apex. *Column* ca. 3 mm long. Fig. 31.

**DISTRIBUTION.** Tonga (Kao and Tofua). Also from the Santa Cruz Islands, Vanuatu, New Caledonia, Fiji, Samoa, and the Horne Islands.

**HABITAT.** Common in foothill forest and on ridge tops; 350–400 m.

**COLLECTIONS.** **Kao:** *Buelow 2909; Hotta 4355.* **Tofua:** *Buelow 441, 2666.*

2. *Calanthe triplicata* (Willemet) Ames, Philipp. J. Sci., Bot. 2: 326. 1907. Type: Philippines, *Cuming 2064* (holotype BM!).

*Calanthe angraeciflora* Rchb. f., Linnaea 41: 75. 1877. Type: New Caledonia, *Deplanche 114* (holotype P!).

*Calanthe furcata* sensu Yuncker, Bernice P. Bishop Mus. Bull. 184: 32. 1945, non Batem. ex Lindl.

*Calanthe nephroglossa* Schltr., Repert. Spec. Nov. Regni Veg. 9: 99. 1911. Type: Samoa, *Vaupel 413* (holotype B†, isotype K!).

*Calanthe triplicata* var. *angraeciflora* (Rchb. f.) N. Hallé, Fl. Nouv.-Caléd. 8: 230. 1977. Type: As for *C. angraeciflora*. For a full synonymy, see Garay and Sweet. 1974.

*Calanthe veratrifolia* (Willd.) R. Br., Bot. Reg. 9: sub t. 573. 1821; Ker-Gawl., *op. cit.* 9: t. 720. 1823. *Limodorum veratrifolium* Willd., Sp. Pl. 4: 122. 1804, *nom. illeg.*

*Orchis triplicata* Willemet, Ann. Bot. (Usteri) 18: 52. 1796. Lectotype: Maluku, Amboinia, icon. in Rumphius, *Herb Amb.* 6: t. 52, f. 2.

Large *terrestrial herb* 60–125 cm in height. *Leaves* elliptic-lanceolate, acuminate, 40–75 × 4–9 cm; petiole 12–25 cm long. *Inflorescence* 60–125 cm long, laxly to subdensely many-flowered; peduncle pubescent, terete; rachis a quarter to half as long as peduncle; bracts lanceolate, acuminate. *Flowers* white with a whitish or yellow callus; pedicel and ovary 2–3 cm long. *Sepals* elliptic-obovate, abruptly acuminate, 12–20 × 6–9 mm. *Petals* elliptic-obovate or oblanceolate, acute, 10–18 × 4–7 mm. *Lip* 4-lobed, 13–20 × 11–14 mm; side lobes obliquely oblong-elliptic, rounded at apex; midlobe falcate, linear-oblong, spreading; callus of three short verrucose ridges at apex of column, yellow to red; spur filiform, 15–30 mm long, arcuate-dependent. *Column* 4–5 mm long. Fig. 32.

**DISTRIBUTION.** Tonga (Kao, Tofua, Niuafu‘ou, and Tafahi). Widely distributed from Madagascar, Asia, and S.E. Asia to the Malay Archipelago, New Guinea, the Solomon Islands, Vanuatu, New Caledonia, Fiji, Samoa, the Marquesas, Lord Howe Island, and Australia.

**HABITAT.** Occasional in forest on volcanic islands; near sea level to 1600 m (in Samoa). (Highest elevation in Tonga is just over 1000 m).

**COLLECTIONS.** **Kao:** *Buelow 613, 674.* **Tofua:** *Hotta 4355; Whistler 10598.* **Niuafu‘ou:** Whistler (sight record). **Tafahi:** *Buelow 1151, 1297; ?Hurlimann 412; Whistler 6239.*

#### 14. PHAIUS

Lour., Fl. Cochinch.: 517. 1790.

Large *terrestrial herbs* with short, stout rhizomes and stems pseudobulbous or elongate and cane-like, leafy. *Leaves* pleated, large, not articulated. *Inflorescence* few- to many-flowered, racemose, axillary. *Flowers* usually large and often showy, resupinate, turning blue-black when damaged or with age; bracts persistent.

*Sepals* and *petals* free, usually spreading, similar in shape and size. *Lip* shortly connate to column at the base, 3-lobed or entire, spurred at base, usually enclosing the column at the base; callus carinate. *Column* elongate, fleshy, lacking a foot or with a very short one; anther terminal; pollinia eight in two groups of four, clavate, waxy.

A genus of about 40 species in Africa, Madagascar, tropical Asia, the Malay Archipelago, and N.E. Australia eastward into the S.W. Pacific eastward to the Society Islands. One species naturalized in Hawai'i. One species is reported from Tonga, one from Tonga and the Cook Islands, and a third from Tonga, the Cook Islands, and Niue.

#### KEY TO SPECIES

1. Leaves borne in a cluster on pseudobulb; flowers somewhat nodding; sepals and petals chestnut with white backs; lip purple with a distinct spur, 6–8 mm long; bracts persistent ..... 1. *P. tankervilleae*
1. Leaves borne laterally on pseudobulb; flowers spreading, not colored as above; lip lacking a distinct spur; bracts caducous or persistent
  2. Flowers yellow with a whitish lip marked with purple and a yellow center; lip rhombic-elliptic with undulate apex; leaves borne along cylindrical pseudobulbs; lip with a short spur ..... 2. *P. robertsii*
  2. Flowers white, sometimes with a creamy lip; lip flabellate; stem elongate, non-pseudobulbous; lip lacking a spur ..... 3. *P. amboinensis*

1. *Phaius tankervilleae* (Banks ex L'Herit.) Blume, Mus. Bot. 2: 177. 1856; as *P. tankervilii*. Type: China, cult. Kew (holotype BM!). For full synonymy, see Hallé (1977) and Kores (1991).

Large *terrestrial herb* up to 2 m in height, with conical to ovoid pseudobulbs 2.5–6 × 2–5 cm. *Leaves* narrowly elliptic to elliptic-lanceolate, acuminate, up to 120 × 4–20 cm; petiole up to 25 cm long. *Inflorescence* erect, laxly 10–20-flowered, 60–200 cm long; bracts persistent, lanceolate, 3–5 cm long. *Flowers* large, showy, the sepals and petals white to pale purple on outer side, yellow to brown within; lip white or yellowish in throat, heavily marked with purple especially towards the apex; pedicel and ovary 2.5–5 cm long. *Sepals* lanceolate to oblanceolate, acuminate, 4.5–6.5 × 0.7–1.5 cm. *Petals* similar to sepals. *Lip* trumpet-shaped, broadly obovate and obscurely 3-lobed when flattened, apiculate, 4–5.5 cm long; spur slightly recurved, 0.6–0.8 cm long. *Column* slightly clavate, 1.5–2 cm long. Fig. 33.

DISTRIBUTION. Tonga ('Eua, Kao, Tofua, Vava'u, Late, Niuafu'ou, and Tafahi), the Cook Islands (Rarotonga and Mangaia), and Niue. Also widely distributed from Asia, S.E. Asia and the Malay Archipelago to New Guinea, New Caledonia, the Horne Islands, Fiji, and Australia. Probably a recent arrival in Polynesia and elsewhere in the Pacific islands.

HABITAT. Occasional in foothill to montane forest and in fernlands; 200–700 m.

COLLECTIONS. 'Eua: Parks 16255. Kao: Buelow 2813, 3181. Tofua: Hotta 4385, 4388; Whistler 10621. Vava'u: Crosby 248. Late: Buelow & Sykes 82, 222; Hotta 4799. Niuafu'ou: Buelow 2256. Tafahi: Buelow 1196, 1216; Whistler 6240. Rarotonga: Cheeseman 677; Philipson 10101; Sykes 2057, 2732; Whistler 5114; Wilder (published sight record). Mangaia: Sykes 576; Whistler 5452. Niue: Sykes 398, 473, 539, 600, 805.

2. *Phaius robertsii* F. Muell., S. Sci. Rec. 3: 263. 1883. Type: New Caledonia, *Layard s.n.* (holotype MEL!).

Large *terrestrial herb* up to 90 cm in height, with cylindrical pseudobulbs, 5–8-leaved along length in upper part. *Leaves* elliptic, acuminate, 11–26 × 4–8 cm, green. *Inflorescence* erect, 50–90 cm long, laxly several-

flowered; bracts persistent, 1.5–2.8 cm long. *Flowers* yellow, lip white with purple guide lines and yellowish in center; pedicel and ovary 1.4–2.5 cm long. *Sepals* lanceolate, acuminate, 2.3–2.5 × 0.4–0.5 cm; lateral sepals falcate. *Petals* similar to sepals. *Lip* connate for basal ca. 4 mm with the column, rhombic-orbicular, somewhat 3-lobed in front, 2.3–2.5 × 2–2.5 cm, apical margins undulate-crispate; spur very shortly conical, 1–2 mm long. *Column* hairy on ventral surface, ca. 1.5 cm long. Fig. 34.

DISTRIBUTION. Tonga (Tofua). Also in Vanuatu, New Caledonia, and Fiji.

HABITAT. Uncommon in montane forest on crater rims; 440–500 m.

COLLECTIONS. **Tofua:** *Buelow 2619; Whistler 10599.*

3. *Phaius amboinensis* Blume, Mus. Bot. 2: 180 (1852). Type: Ambon, *Zippelius s.n.* (lectotype, selected here, L!), .

*Phaius graeffei* Rchb. f., Seem., Fl. Vit.: 299. 1868, (repr. Xenia Orchid. 3: 30. 1881. Type: Samoa, *Graeffe s.n.* (holotype W!).

*Phaius terrestris* (L.) Ormerod (1998), Austral. Orchid Rev. 59: 14. 1994, excl. typ. et syn.

Large *terrestrial herb* up to 1 m in height with leafy, elongate, non-pseudobulbous stems up to 30 cm long. *Leaves* elliptic-lanceolate, acuminate, up to ca. 65 × 4–9 cm, petiolate. *Inflorescence* erect, axillary, 30–70 cm long, laxly 5–15-flowered; bracts obovate, 2.5–3.5 cm long, caducous. *Flowers* showy, white with a pale yellowish lip, turning blue when damaged, sometimes cleistogamous; pedicel and ovary 1.7–3 cm long. *Sepals* oblong-obovate, subacute, 2.8–3.5 × 1–1.3 cm. *Petals* oblanceolate, slightly falcate, rounded at apex, 2.8–3.3 × 0.7–0.8 cm. *Lip* embracing column, flabellate when flattened, 3-lobed at apex, 2.5–3 cm long and wide, lacking a spur, mealy-tomentose on the disc. *Column* clavate, 2–2.5 cm long. Fig. 35.

DISTRIBUTION. Tonga (Kao and Tafahi) and the Cook Islands (Rarotonga). Also in Indonesia (Ambon), New Guinea, Bougainville, the Solomon Islands, Vanuatu, Samoa, the Cook Islands, and Fiji.

HABITAT. Uncommon in lowland to montane forest; 50–800 m.

COLLECTIONS. **Kao:** *Buelow 722.* **Tafahi:** *Buelow 1161, 1196.* **Rarotonga:** *Sykes 1486; Wilder 846.*

NOTE. The misapplication of the name *Phaius terrestris* to this species is discussed by Garay (1997) in *Harvard Papers in Botany* 2,1: 47–49.

#### 15. SPATHOGLOTTIS

Blume, Bijdr. Fl. Ned. Ind. 1, 8: 400. 1825.

Medium-sized to large *terrestrial herbs*, with clustered, pseudobulbous stems hidden by leaf bases. *Leaves* several, suberect to spreading, pleated. *Inflorescence* basal, axillary, erect, laxly to densely several- to many-flowered; bracts persistent. *Flowers* showy, white, yellow, pink, or purple, often with a yellow callus on lip. *Sepals* subsimilar, free, spreading widely. *Petals* similar, often slightly smaller than the sepals. *Lip* 3-lobed at base, lacking a spur, with a callus; side lobes upcurved-erect, smaller than midlobe; midlobe linear, spatulate or obovate; callus between lateral lobes, entire or bilobed, glabrous or hairy. *Column* clavate, lacking a foot; pollinia eight, pear-shaped.

A genus of about 40 species widespread in tropical and subtropical Asia, S.E. Asia, the Malay Archipelago, New Guinea, the Philippines, N.E. Australia and the western Pacific islands. A single species, *Spathoglottis plicata*, has been found in Tonga, Niue, and the Cook Islands, and occurs as an escape in many parts of the tropics, including Hawai'i and Kenya.

*Spathoglottis plicata* Blume, Bijdr. Fl. Ned. Ind.: 401. 1825. Type: Java, *Blume s.n.* (holotype L!, isotype P!).

*Bletia angustifolia* Gaudich., Voy. Uranie: 421. 1829. Type: Moluccas, *Freycinet s.n.* (holotype P!).

*Spathoglottis angustifolia* (Gaudich.) Benth. & Hook. f., Gen. Pl. 3: 512. 1883.

*Spathoglottis daenikeri* Kraenzl., Vierteljahrsschr. Naturf. Ges. Zürich 74: 80. 1929. Type: New Caledonia, *Daeniker 1622* (holotype Z!).

*Spathoglottis pacifica* sensu Kraenzl., Bot. Jahrb. Syst. 25: 603. 1898; H. Fleischm. & Rech., Denkschr. Kaiserl. Akad. Wiss., Wien. Math.-Naturwiss. Kl. 85: 257 (1910); Christoph., Bernice P. Bishop Mus. Bull. 128: 66 (1935), non Rchb. f.

*Spathoglottis unguiculata* auct., non (Labill.) Rchb. f. 1868.

*Spathoglottis vieillardii* Rchb. f., Linnaea 41: 85. 1877. Type: New Caledonia, *Vieillard 1302* (holotype P!).

Large *terrestrial herb* up to 100 cm in height, with small ovoid pseudobulbs hidden by leaf bases. *Leaves* lanceolate to elliptic-lanceolate, acuminate, 40–90 × 2–6 cm, petiolate. *Inflorescence* erect, up to 1 m long, densely many-flowered; bracts elliptic-lanceolate, acuminate, 0.8–1.5 cm long. *Flowers* showy, purple, pink, or white with a yellow callus on the lip, pubescent on outer surface of sepals and petals; pedicel and ovary 3–5 cm long, densely shortly pubescent. *Sepals* elliptic to ovate, subacute to obtuse, 1.6–3 × 1–1.3 cm; laterals slightly oblique. *Petals* elliptic, obtuse, 2–3 × 1.3–1.8 cm. *Lip* 3-lobed at base, T-shaped when flattened; side lobes narrowly oblong, 0.7–0.8 cm long; midlobe spatulate, 1–1.3 cm long, auriculate at base, with a small callus on claw; callus between side lobes bilobulate, glabrous or sparsely hairy. *Column* clavate, incurved, 1.2–1.3 cm long. Fig. 36.

DISTRIBUTION. Tonga ('Eua, Tongatapu, Kao, Tofua, Vava'u, Late, Niuafu'ou, and Tafahi), the Cook Islands (Rarotonga), and Niue. Also widely distributed from Asia, S.E. Asia and the Malay Archipelago to New Guinea, the Solomon Islands, Vanuatu, New Caledonia, the Horne Islands, and Samoa. Naturalized in Hawai'i and the Marquesas Islands.

HABITAT. Occasional in disturbed places and open areas; near sea level to perhaps 1000 m.

COLLECTIONS. 'Eua: *Hotta 5248* (cf. 5243), 5333a; *Hurlimann 223*; *Lister s.n.*; *Sykes 511, 552, 553*; *Whistler 6472, 7422*; *Yuncker 15437*. Tongatapu: *USEE s.n.*, *Graeffe s.n.* Kao: *Yuncker 15929*. Tofua: *Hotta 4375, 4387*; *Scarth-Johnson 27*. Vava'u: *Crosby 247*. Late: *Buelow & Sykes 215*; *Hotta 4472, 4811*. Niuafu'ou: *Buelow 2070*; *Whistler 6430*. Tafahi: *Buelow 1185*; *Hurlimann 431*; *Whistler 6241*. Rarotonga: *Sykes 1548, 2008, 2512*; *Whistler 5104*. Niue: *Sykes 150584*; *Whistler 10753*; *Yuncker 9619*.

## 16. ACANTHEPHIPIUM

Blume, Bijdr. Fl. Ned. Ind. 353, t. 47. 1825.

Large *terrestrial herbs* with large green, ovoid-conical to conical-cylindrical clustered pseudobulbs. *Leaves* 2–3, suberect, plicate, slenderly petiolate. *Inflorescence* lateral from the base of the pseudobulbs, erect, 1–7-flowered, shorter than the leaves; bracts lanceolate, large. *Flowers* large, urn-shaped or campanulate, fleshy. *Dorsal sepal* free. *Lateral sepals* forming a distinct saccate mentum with the column-foot. *Petals* free but enclosed within the sepals. *Lip* saddle-shaped, 3-lobed, callose, lacking a spur, articulated to the column-foot. *Column* short, fleshy with a distinct foot; pollinia eight, clavate.

A genus of about 16 species in S.E. Asia, the Malaya Archipelago, the Philippines and S.W. Pacific islands. A single species is reported in Tonga.

*Acanthephippium splendidum* J.J. Sm., Natuurk. Tijdschr. Ned.-Indië 58: 360 (1898). Type: Hort. Bogor. 328c (holotype L!).

*Acanthephippium papuanum* Schltr., Repert. Spec. Nov. Regni Veg. Beih. 1: 371. 1912. Type from New Guinea.

*Terrestrial herb* up to 80 cm in height, with ovoid-conical to conical-cylindrical, 3-noded, green pseudobulbs 6–12 × 2.5–5 cm, 2–3-leafed. *Leaves* suberect, plicate, elliptic, acute, 25–45 × 10–15 cm; petiole slender, up to 25 cm long. *Inflorescence* erect, 1–7-flowered, 10–15 cm long; bracts lanceolate, up to 2.5 cm long. *Flowers* urn-shaped, sepals white to yellowish creamy, striped with pink or reddish, petals and lip pale yellow. *Dorsal sepal* oblong-lanceolate, 3.5–4 × 1–1.2 cm. *Lateral sepals* obliquely oblong-ovate, 3.5–4 × 1.2–1.5 cm; mentum sub-gibbose at apex, 0.7–1.4 cm long. *Petals* rhombic, obtuse, 3.1–3.9 × 1.6–2.2 cm. *Lip* 3-lobed, 1.5–1.8 × 1.2–1.6 cm; side lobes erect; midlobe oblong to oblong-spathulate; callus of 3–5 longitudinal keels. *Column* ca. 1.5 cm long, foot incurved, ca. 2.8 cm long. Fig. 37.

DISTRIBUTION. Tonga (Kao, Tofua, and Tafahi). Also in Sulawesi, New Guinea, the Solomon Islands, Vanuatu, Fiji, and New Caledonia (and newly discovered in Samoa).

HABITAT. Uncommon in lowland to foothill forests; 150–400 m.

COLLECTIONS. **Kao:** *Buelow 2956*. **Tofua:** *Buelow 2543, 2655*. **Tafahi:** *Buelow 1262; Hurlimann 439*.

#### 17. LIPARIS

L.C. Rich., *De Orchid. Eur.*: 21, 30, 38. 1817;

*Mém. Mus. Hist. Nat. Paris* 4: 43, 52, 60. 1818.

Small to medium-sized, *terrestrial, lithophytic, or epiphytic herbs* with short to long, leafy, pseudobulbous stems covered when young by sterile bracts. *Leaves* one to several, linear to ovate or elliptic, pleated or not, thin-textured to somewhat coriaceous. *Inflorescence* terminal, erect, racemose, few- to many-flowered. *Flowers* usually small, yellow, green, orange, or purple, often somewhat translucent, resupinate. *Sepals* free, spreading; laterals sometimes fused for part or all of length. *Petals* free, often linear and unlike sepals, often reflexed. *Lip* often strongly reflexed, ovate, oblong or flabellate, entire or lobed, usually with a basal callus, lacking a spur. *Column* incurved, clavate, elongate; pollinia four in two pairs.

A large cosmopolitan genus of some 350 species well represented in tropical Asia, the Malay Archipelago, the Philippines, New Guinea, Australia, and the S.W. Pacific islands, with three species in Tonga and one in the Cook Islands.

#### KEY TO SPECIES

- |  |                        |
|--|------------------------|
| 1. Leaf solitary, heart-shaped .....                                 | 1. <i>L. clypeolum</i> |
| 1. Leaves 2 or more, ovate to lanceolate or oblanceolate             |                        |
| 2. Blades ovate; flowers purple with a green column .....            | 2. <i>L. layardii</i>  |
| 2. Blades lanceolate or oblanceolate; flowers mostly yellowish green |                        |
| 3. Leaves 2, not distinctly plicate; articulate above base .....     | 3. <i>L. elegans</i>   |
| 3. Leaves 3 or more, distinctly plicate, not articulate .....        | 4. <i>L. disepala</i>  |

1. *Liparis clypeolum* (Forst. f.) Lindl., *Gen. Sp. Orchid. Pl.*: 23. 1830. Type: Tahiti, *Forster s.n.* (lectotype K!).

*Cymbidium clypeolum* (Forst. f.) Willd., *Sp. Pl.* 4: 22. 1804.

*Epidendrum clypeolum* Forst. f., *Fl. Ins. Austr.*: 61. 1786.

*Terrestrial herb* 15–25 cm in height, with one-leafed, approximate, ovoid-ellipsoidal pseudobulbs 2–3 × 1–1.5 cm. *Leaf* heart-shaped, acute, 7–18.5 × 6–13.5 cm, long-petiolate; petiole 5–9 cm long. *Inflorescence*

erect, densely 10–20-flowered, racemose to subcapitate; bracts linear-lanceolate, acuminate, 3–10 mm long. *Flowers* whitish; pedicel and ovary 17–23 mm long. *Dorsal sepal* lanceolate, subacute, ca. 10 mm long. *Lateral sepals* triangular-lanceolate, obtuse, ca. 10 mm long. *Petals* linear, subacute, ca. 10 mm long. *Lip* broadly obovate, apiculate, ca. 10 × 8 mm, with a serrulate margin; basal callus very small. *Column* a little dilated at the base, semi-terete above, ca. 4 mm long. Fig. 38.

DISTRIBUTION. Cook Islands (Rarotonga). Also in the Society and Marquesas Islands.

HABITAT. Rare in shaded mossy montane forest; 300–650 m.

COLLECTIONS. **Rarotonga:** *Cheeseman s.n.*, 676.

2. *Liparis layardii* F. Muell., S. Sci. Rec., n.s., 1: 1. 1885. Type: New Caledonia, *Layard s.n.* (holotype MEL!).

*Liparis mataanensis* J.J. Sm., Bull. Jard. Bot. Buitenzorg, II, 8: 56. 1912. Type: As for *L. stricta*.

*Liparis stricta* Schltr., Repert. Spec. Nov. Regni Veg. 9: 95. 1910. Type: Samoa, *Vaupel 134* (lectotype B†, isotype K!).

*Liparis* sp. 1 sensu Kraenzl., Bot. Jahrb. Syst. 25: 601. 1898.

*Terrestrial herb*, erect, up to 45 cm in height, with clustered, 2–3-leafed, cylindrical pseudobulbs up to 20 × 1 cm. *Leaves* ovate to ovate-elliptic, acute, 6.5–10 × 5–7 cm; petiole 2–3.5 cm long. *Inflorescence* laxly 8–15-flowered, 12–30 cm long; bracts 5–10 mm long. *Flowers* purple with a green column; pedicel and ovary 1–1.2 cm long, 6-angled. *Dorsal sepal* erect, oblong-lanceolate, acute, 7–12 × 2–2.5 mm. *Lateral sepals* reflexed, oblong to oblong-ovate, obtuse, 6.5–10 × 2.5–3 mm. *Petals* linear-ligulate, subacute, 6–12 × 0.75–1.25 mm. *Lip* recurved, flabellate to obovate, 6.5–10 × 5.5–7.5 mm, the margins weakly crenulate; callus bilobulate, basal. *Column* incurved at apex, 5–6 mm long. Fig. 39.

DISTRIBUTION. Tonga (Kao and Tofua). Also in the Solomon Islands, Vanuatu, New Caledonia, Samoa, and Fiji.

HABITAT. Occasional in montane forest; perhaps up to 1000 m in these islands.

COLLECTIONS. **Kao:** *Buelow 713; Whistler 10713*. **Tofua:** *Buelow 2547; Whistler 10600*.

3. *Liparis elegans* Lindl., Gen. Sp. Orchid. Pl.: 30. 1830. Type: Malaya, Penang, *Wallich s.n.* (holotype K!).

*Cestichis gracilis* (Hook. f.) Ames, Orchidaceae 2: 136. 1908.

*Leptorkis elegans* (Lindl.) Kuntze, Revis. Gen. Pl. 2: 671. 1891.

*Leptorkis gracilis* (Hook. f.) Kuntze, Revis. Gen. Pl. 2: 671. 1891.

*Liparis gracilis* Hook. f., Hooker's Icon. Pl. 21: t. 2011. 1889. Type: Malaya, Perak, *Wray s.n.* (holotype K!).

*Epiphytic herb* 15–35 cm in height, with slender pseudobulbs 1–3 × 0.8–1.5 cm, two-leafed towards the apex. *Leaves* suberect, linear-oblong-lanceolate, acute, 11–25 × 1.5–3 cm, articulate above base. *Inflorescence* 14–35 cm long, laxly many-flowered; rachis 5–15 cm long; bracts lanceolate, acuminate, 4–6 mm long. *Flowers* small, probably self-pollinating, pale yellowish green; pedicel and ovary 3–5 mm long. *Dorsal sepal* reflexed, oblong, obtuse, 3.5–4 × 1.2–1.7 mm. *Lateral sepals* reflexed, elliptic, obtuse, 3.5–4 × 1.2–2 mm. *Petals* linear, obtuse, 3.5–4 × 0.4–0.7 mm. *Lip* obscurely 3-lobed, 3.5–4 × 1.5–2 mm, geniculate in middle; side lobes erect, narrowly oblong; midlobe oblong or elliptic-oblong, retuse; callus basal, obscurely bilobed. *Column* incurved at apex, 2–5 mm long. Fig. 40.

DISTRIBUTION. Tonga (Kao, Tofua, and Tafahi). Also occurring from S.E. Asia into Malesia, and eastwards to the Solomon Islands, Vanuatu, New Caledonia, Samoa, and Fiji.

HABITAT. Occasional in coastal to montane forest; near sea level to 700 m.



FIGURE 33. *Phaius tankervilleae*. Tonga.



FIGURE 34. *Phaius robertsii*. Tonga.



FIGURE 35. *Phaius amboinensis*. Samoa.



FIGURE 36. *Spathoglottis plicata*. Tonga.



FIGURE 37. *Acanthephippium splendidum*. Samoa.



FIGURE 38. *Liparis clypeolum*. Marquesas.



FIGURE 39. *Liparis layardii*. Samoa.



FIGURE 40. *Liparis elegans*. Tonga.





FIGURE 41. *Liparis disepala*. Tonga.



FIGURE 42. *Crepidium resupinatum*. Cooks.



FIGURE 43. *Crepidium taurinum*. Samoa.



FIGURE 44. *Crepidium latisegmentum*. Eua.



FIGURE 45. *Crepidium brevidentatum*. Tonga.



FIGURE 46. *Crepidium reineckeanum*. Samoa.



FIGURE 47. *Oberonia equitans*. Cooks.



FIGURE 48. *Appendicula reflexa*. Tonga.

COLLECTIONS. **Kao:** *Buelow* 617, 2910; *Whistler* 10721. **Tofua:** *Buelow* 549, 2548, 2558; *Hotta* 4407; *Whistler* 10606. **Tafahi:** *Whistler* 6242.

4. *Liparis disepala* Rehb. f., *Linnaea* 41: 97. 1877. Types: New Caledonia, *Deplanche* 150, 355 (syntypes P); *Vieillard* 1320 (syntype P).

*Terrestrial herb* 20–48 cm in height, with ovoid pseudobulbs 1–3.5 × 0.6–2.5 cm. *Leaves* non-articulate, 4 or 5, suberect, lanceolate, clasping at base, 12–29 × 1–3.5 cm; petiole 4.5–9 cm long. *Inflorescence* a terminal, bracteate raceme 15–30 cm long, subdensely 6–30-flowered. *Flowers* green to greenish yellow with red to yellowish brown markings. *Dorsal sepal* oblong-lanceolate, 7–8 × 1.2–1.8 cm. *Lateral sepals* reflexed, ovate-falcate, 4.5–6 × 2–3 cm. *Petals* reflexed, linear-oblongate, 6–7 × 1–1.25 cm. *Lip* prominently arcuate, oblong-obovate, 3.5–5 × 3–4.5 cm, with entire margins, retuse at apex; callus transverse, obscurely trilobulate. *Column* slightly curved, 3–3.5 cm long. Fig. 41.

DISTRIBUTION. Tonga (‘Eua, Kao, Tofua, and Late). Also in New Caledonia and Fiji.

HABITAT. Occasional in fernlands; ca. 60 m.

COLLECTIONS. ‘**Eua:** *Hotta* 5246; *Sykes* 246, 334a; *Whistler* 7147, 7282, 7457; *Yuncker* 15446. **Kao:** *Whistler* 10691. **Tofua:** *Buelow* 437!, 2584; *Whistler* 10614. **Late:** *Hotta* 4800.

#### 18. CREPIDIUM

Blume, *Bijdr. Fl. Ned. Ind.* 387. 1825.

*Terrestrial or rarely epiphytic herbs* with hairy roots. *Stems* cylindrical to pseudobulbous, fleshy, leafy. *Leaves* several, thin-textured to fleshy, pleated, petiolate; petiole sheathing at base. *Inflorescence* apical, erect, racemose, laxly to densely few- to many-flowered. *Flowers* small, green, brown, yellow, pink, or purple, non-resupinate. *Dorsal sepal* spreading free. *Lateral sepals* free or fused, spreading. *Petals* often narrower than sepals, free, spreading. *Lip* erect, flat but sometimes concave at base, entire to lobed, auriculate at base, apical margins often toothed, lacking a spur, callus absent or obscurely ridged. *Column* very short, lacking a foot; pollinia 4, waxy, lacking appendages.

This genus has recently been resurrected as a segregate of *Malaxis* Sol. ex Sw. *Crepidium* comprises about 130 species found throughout the Old World tropics and subtropics. Three species are reported from Tonga, one from the Cook Islands, and one from Tonga, the Cook Islands, and Niue. The regional taxonomy is in urgent need of revision.

#### KEY TO SPECIES

1. Leaves 3–5, clustered more or less at base of plant; lip midlobe bifid; apical margins of side lobes strongly denticulate ..... 1. *C. resupinatum*
1. Leaves 3–7 or more arranged along the elongate erect stem; lip midlobe entire or emarginate; apical margins of side lobes entire to weakly denticulate
  2. Leaves narrowly ovate, twice as long as broad; flowers purple or pale yellow; lip longer than broad; side lobes acute but not toothed in front ..... 2. *C. taurinum*
  2. Leaves broadly ovate, less than twice as long as broad; flowers pale yellow; lip broader than long, entire or with the side lobes with several teeth along front margin
    3. Lip with apical margins entire ..... 3. *C. latisegmentum*
    3. Lip with toothed apical margins
      4. Apical teeth of lip rather obscure ..... 4. *C. brevidentatum*
      4. Apical teeth of lip strongly developed ..... 5. *C. reineckeanum*

1. *Crepidium resupinatum* (Forst. f.) Szlach., *Fragm. Florist. Geobot., Suppl. 3*: 131. 1995. Type: Tahiti, *Forster s.n.* (holotype BM!).

*Epidendrum resupinatum* Forst. f., *Fl. Ins. Austr. Prodr.*: 61. 1786.

*Malaxis resupinata* (Forst. f.) Kuntze, *Revis. Gen. Pl.* 2: 673. 1891.

*Microstylis resupinata* (Forst. f.) Drake, *Ill. Fl. Ins. Pacif.*: 305. 1892.

*Terrestrial plant* with decumbent or ascending terete stems 5–10 cm long, 3–5-leaved. *Leaves* erect or ascending, obliquely oblong-elliptic or ovate-elliptic, acuminate, 10–22 × 4.5–8 cm; petiole relatively stout, 6–10.5 cm long, somewhat dilated and sheathing at base. *Inflorescence* erect, 21–45 cm long, laxly many-flowered; peduncle weakly angular, 15–25 cm long; bracts lanceolate, acuminate, 2.5–5 mm long. *Flowers* maroon; pedicel and ovary ca. 6 mm long. *Dorsal sepal* oblong to oblong-elliptic, subacute, 3.5–4.5 × 1–1.5 mm. *Lateral sepals* falcate, oblong, obtuse, 3–4 mm long, ca. 1.5 mm. *Petals* slightly falcate, linear-ligulate, subacute, 3.5–4 × 0.7–0.8 mm wide. *Lip* more or less oblong-obovate, prominently auriculate at base, weakly 3-lobed in front, 5–6 × 4–5 mm; side lobes broadly rounded with several short teeth on front margin; midlobe small, semi-orbicular, acutely bilobed; callus horseshoe-shaped. *Column* 0.5–1 mm long. Fig. 42.

DISTRIBUTION. Tonga ('Eua, Tofua, Late, Niufo'ou, and Tafahi), the Cook Islands (Rarotonga and Mangaia), and Niue. Also widely distributed in the South Pacific, Vanuatu, Fiji, Samoa, and the Society Islands.

HABITAT. Common in lowland and montane forest; near sea level to 500 m.

COLLECTIONS. 'Eua: *Hotta 5508, 5559; Parks 16313; Sykes 320, 413; Whistler 7113, 7294; Yuncker 15575. Tofua: Buelow 482. Late: Hotta 4807. Niufo'ou: Buelow 2068, 2141; Whistler 6323. Tafahi: Buelow 1158, 1189; Whistler 6246. Rarotonga: Cheeseman s.n.; Luttrell 351, 357; Parks 22039, 22126; Philipson 10128, 10342; Seale s.n.; Sykes 75, 1462; Whistler 4041, 5045, 5197. Mangaia: Sykes 561; Whistler 5468. Niue: Sykes 397, 537, 629; Whistler 10741.*

2. *Crepidium taurinum* (Rchb. f.) Szlach., *Fragm. Florist. Geobot., Suppl. 3*: 132. 1995. Type: New Caledonia, *Deplanche s.n.* (holotype, W).

*Malaxis taurina* (Rchb. f.) Kuntze, *Revis. Gen. Pl.*: 573. 1891.

*Microstylis taurina* Rchb. f., *Linnaea* 41: 97. 1877.

*Terrestrial herb* with short erect stems 3–6 (–15 cm) long. *Leaves* 5–10, ovate, acute, 6–9 × 1.8–3.5 cm; petiole slender, up to 5 cm long, sheathing at the base. *Inflorescence* subdensely many-flowered; peduncle 11–15 cm long; bracts reflexed, linear, acuminate, 4–6 mm long. *Flowers* small, purple or rarely dull yellowish; pedicel and ovary 3–4 mm long. *Dorsal sepal* ovate, obtuse, ca. 3 × 2 mm. *Lateral sepals* oblong, obtuse, ca. 3 × 1.5 mm. *Petals* linear-oblong, obtuse, ca. 3 × 1 mm. *Lip* 3-lobed, ca. 4 × 3.5–4 mm; side lobes hatchet-shaped, acute in front; midlobe oblong-elliptic or tapering, emarginate. *Column* short. Fig. 43.

DISTRIBUTION. Tonga (Tafahi). Also in Vanuatu, New Caledonia, Samoa, and Fiji.

HABITAT. Rare, reported from a gully in montane forest; 500 m.

COLLECTIONS. **Tafahi:** *Buelow 1256.*

3. *Crepidium latisegmentum* (C. Schweinf.) M.A. Clem. & D.L. Jones, *Lasianthera* 1 (1): 37. 1996. Type: Fiji, *A.C. Smith 967* (holotype AMES!).

*Malaxis latisegmenta* C. Schweinf., *Bernice P. Bishop Mus. Bull.* 141: 22, fig. 7c. 1936. Type: Based on same type as *Crepidium latisegmentum*.

*Oberonia latisegmenta* (C. Schweinf.) Parham, *Trans. Proc. Fiji Soc.* 2: 27. 1953.

*Terrestrial herb* 12–30 cm in height with a creeping rhizome and erect stem 4.5–14 cm long. *Leaves* 3–7, ovate to ovate-elliptic, acute, 6–10.5 × 2.5–5.2 cm; petioles 2.5–7 cm long. *Inflorescence* subdensely many-flowered, 8.5–30 cm long; peduncle and rachis weakly costate; bracts lanceolate, acuminate, 5–11 mm long. *Flowers* greenish yellow to yellow. *Dorsal sepal* broadly elliptic to elliptic-ovate, 5–6 × 3–5 mm. *Lateral sepals* obliquely suborbicular-obovate, ca. 5 × 3.1–3.8 mm. *Petals* spatulate to elliptic-obovate, 4–5 × 1.8–2.5 mm. *Lip* cordate, 2.5–3.5 × 2.3–3 mm, prominently auriculate at base. *Column* 0.7–0.8 mm long. Fig. 44.

DISTRIBUTION. Tonga (Kao, Tofua, and possibly 'Eua). Also in Fiji, Vanuatu, and the Solomon Islands.

HABITAT. Uncommon in open foothill forest; 260–450 m.

COLLECTIONS. 'Eua: ?Wood 6836; Whistler 12166. Kao: Yuncker 15887. Tofua: Buelow 2719.

4. *Crepidium brevidentatum* (C. Schweinf.) M.A. Clem. & D.L. Jones, *Lasianthera* 1, 1: 35. 1996. Type: Fiji, A.C. Smith 1620 (holotype AMES!).

*Malaxis brevidentata* C. Schweinf., Bernice P. Bishop Mus. Bull. 141: 20, fig. 7a. 1936.

*Oberonia brevidentata* (C. Schweinf.) Parham, Trans. Proc. Fiji Soc. 2: 27. 1953.

*Terrestrial herb* 20–65 cm in height with a creeping rhizome and erect stem 4.5–10.4 cm long. *Leaves* 5–7, ovate to ovate-elliptic, acute, 6–13 × 2.1–4.8 cm; petioles 4–6.5 cm long. *Inflorescence* subdensely many-flowered, up to 25 cm long; peduncle and rachis weakly costate; bracts lanceolate, acuminate, 7–8 mm long. *Flowers* greenish white to white. *Dorsal sepal* elliptic-ovate, 3–3.5 × 2 mm. *Lateral sepals* obliquely elliptic-lanceolate, 3–3.5 × 2–2.2 mm. *Petals* oblanceolate to elliptic-lanceolate, 3–3.5 × 1.1–1.3 mm. *Lip* suborbicular in outline, 3–3.5 × ca. 3 mm, with subdeltoid auricles at base; side lobes weakly denticulate in front; midlobe obtuse or weakly denticulate at apex. *Column* 0.4–0.8 mm long. Fig. 45.

DISTRIBUTION. Tonga ('Eua, Kao, Tofua, and Late). Also in Fiji, Vanuatu, and the Solomon Islands.

HABITAT. Occasional in fernlands; 350–1000 m.

COLLECTIONS. 'Eua: Buelow 166; Sykes 351a; Whistler 5969; Wood 6836; Yuncker 15403. Kao: Buelow 650, 676, 2820; Whistler 10701; Yuncker 15887, 15910. Tofua: Buelow 440, 475, 2593; Hotta 4356; Whistler 10659. Late: Hotta 4807.

5. *Crepidium reineckeanum* (Kraenzl.) M.A. Clem. & D.L. Jones, *Lasianthera* 1(1): 3. 1996. Types: Samoa, Reinecke 311, 620 (syntype B†).

*Malaxis reineckeanum* (Kraenzl.) Kores, *Allertonia* 5 (1): 51. 1989.

*Malaxis whitmeei* (Rolfe) Kores, *Allertonia* 5 (1): 52. 1989.

*Microstylis reineckeanum* Kraenzl., Engler, Bot. Jahrb. Syst. 25: 600. 1898.

*Microstylis whitmeei* Rolfe, Bull. Misc. Inform. Kew 1922: 23. 1922. Type: Samoa, Whitmee s.n. (holotype K!).

*Terrestrial herb* with an elongate, erect stem up to 20 cm in height, leafy along its length, growing from an elongate fleshy stem. *Leaves* up to 12, distichous and twisted to lie in one plane, ovate, acute, 7–11 × 3–5 cm; petiole sheathing at base, up to 4 cm long. *Inflorescence* densely many-flowered, up to 30 cm long; bracts reflexed, linear, acuminate, 5–6 mm long. *Flowers* pale yellow, sometimes cleistogamous; pedicel and ovary ca. 5 mm long. *Dorsal sepal* oblong, obtuse, 3.5–4 × 1.5–1.8 mm. *Lateral sepals* similar to dorsal sepal. *Petals* oblong, obtuse, 2.5–3 × ca. 1 mm. *Lip* transversely reniform-suborbicular, obscurely 3-lobed, 4–4.5 × 5–6 mm; midlobe small, emarginate; side lobes rounded, shortly 3-toothed in front. *Column* short. Fig. 46.

DISTRIBUTION. Rarotonga. Also in Samoa and the Solomon Islands.

HABITAT. Rare in foothill to montane forest; 400–500 m.

COLLECTIONS. Rarotonga: Luttrell 356.

## 19. OBERONIA

Lindl., Gen. Sp. Orchid. Pl.: 15. 1830.

Small to large *epiphytic herbs* with short to long leafy stems, lacking pseudobulbs. *Leaves* iridiform, equitant, short to long, often fleshy, articulated or not at base, distichous, often imbricate at base. *Inflorescence* terminal, laxly to densely many-flowered, pubescent or glabrous. *Flowers* often in whorls, small, non-resupinate, flat. *Sepals* and *petals* free, spreading. *Lip* larger, sessile, entire or lobed, usually spreading, occasionally somewhat concave at base. *Column* short; anther terminal; pollinia four, waxy, cohering in two pairs.

A genus of some 150–200 species centered on tropical South and S.E. Asia and the Malay Archipelago, but extending to tropical Africa, Madagascar, the Mascarene Islands, the Philippines, New Guinea, Australia, and the S.W. Pacific islands eastward to Tahiti. A single species occurs in Tonga, Niue, and the Cook Islands.

***Oberonia equitans*** (Forst. f.) Mutel, Premier Mém. Orchid. Paris: 8. 1838. Type: Tahiti, *G. Forster 170* (holotype BM!, isotype P!).

*Cymbidium equitans* (Forst. f.) Sw., Nova Acta Regiae Soc. Sci. Upsal. 6: 72. 1799.

*Epidendrum equitans* Forst. f., Fl. Ins. Austr.: 60. 1786.

*Malaxis equitans* sensu Hallé, Fl. Nouv-Caléd. 8: 270, pro syn. 1977, non Blume.

*Malaxis glandulosa* (Lindl.) Rehb. f., Ann. Bot. Syst. 6: 215. 1861.

*Oberonia brevifolia* sensu Seem., Bonplandia 10: 153. 1861, non Lindl.

*Oberonia* aff. *diura* sensu Christoph., Bernice P. Bishop Mus. Bull. 128: 63. 1935, non Schltr. 1905.

*Oberonia flexuosa* Schltr., Engler, Bot. Jahrb. Syst. 39: 61. 1906. Type: New Caledonia, *Schlechter 15496* (holotype B†).

*Oberonia glandulosa* Lindl., Fol. Orchid.: 6. 1859. Type: Pacific islands, *Matthews 158* (holotype K, not traced).

*Oberonia palmicola* sensu Parham, Trans. Proc. Fiji Soc. 2: 27. 1953, non F. Muell.

Small *epiphytic herb* 14–21 cm in height, with elongate, flexuose stems up to 14 cm long and covered by imbricate leaf bases. *Leaves* in two rows, imbricate, iris-like, narrowly lanceolate-falcate, acute, 2–6 × 0.4–0.8 cm. *Inflorescence* cylindrical, up to 10 cm long, densely many-flowered, minutely pubescent; bracts subdeltoid, 1.5–2 mm long, erosulate. *Flowers* verticillate, greenish cream to cream-colored; ovary ca. 1.5 mm long, papillate. *Dorsal sepal* oblong, obtuse, ca. 1 mm long, sparsely papillate on outer surface. *Lateral sepals* similar. *Petals* oblong-ovate, acute to subacute, ca. 0.8 mm long. *Lip* subentire, subquadrate, obscurely bilobulate at apex, biauriculate at base, ca. 1 mm long. *Column* very short. Fig. 47.

**DISTRIBUTION.** Tonga ('Eua, Kao, Tofua, and Tongatapu), the Cook Islands (Mangaia and Rarotonga), and Niue. Also in the Solomon Islands, Vanuatu, New Caledonia, Fiji, Samoa, Tahiti, and the Tuamotus.

**HABITAT.** Occasional in lowland to montane forest; near sea level to 400 m.

**COLLECTIONS.** 'Eua: *Hotta 5364; Hurlimann 263; Parks 16237A; Sykes 489; Whistler 7125, 7482; Yuncker 15402.* Tongatapu: *Hotta 4026.* Kao: *Buelow 654, 655, 660; Whistler 10727.* Tofua: *Buelow 547, 2671.* Rarotonga: *Cheeseman 675, s.n.; Given 1439; Parks 22145, 22589; Philipson 10132, 10206, 10381; Sykes 1546, 1947, 2201; Whistler 4063, 5038; Wilder 8, 972.* Niue: *Sykes CHR 150564, 150565; Whistler 10739; Yuncker 9598.* Mangaia: *Sykes 564, 655; Whistler 5825.*

## 20. APPENDICULA

Blume, Bijdr. Fl. Ned. Ind.: 297. 1825.

Small to large *epiphytic or lithophytic herbs* with a short rhizome and leafy, clustered, unbranched (or rarely laxly branched near base) stems covered by persistent sheathing leaf bases. *Leaves* distichous, relatively thin-textured, ligulate to narrowly elliptic, often twisted at base to lie in one plane. *Inflorescence* terminal or axillary, simple to branched, short to long, few- to many-flowered. *Flowers* small, resupinate, white, greenish or yellow. *Dorsal sepal* free, erect. *Lateral sepals* united at base to column-foot to form a more or less saccate mentum. *Petals* free, smaller than sepals. *Lip* adnate to apex of column-foot, immobile, more or less entire or weakly 3-lobed, with a more or less horseshoe-shaped transverse callus. *Column* short with a prominent foot; pollinia six, waxy, clavate to pear-shaped.

A genus of about 100 species widespread in tropical Asia and S.E. Asia, the Malay Archipelago, New Guinea, the Philippines, and the S.W. Pacific islands eastward to New Caledonia and Samoa. A single species has been reported in Tonga.

*Appendicula reflexa* Blume, Bijdr. Fl. Ned. Ind. 301. 1825. Type: Java, *Blume s.n.* (holotype L!). For full synonymy, see Lewis & Cribb (1989).

*Epiphytic herb* with stems up to 60 cm long, concealed by persistent distichous sheaths. *Leaves* many, distichous, twisted at base to lie in one plane, oblong-lanceolate, 3.5–5 × 0.8–1.5 cm, bluntly bilobed at apex. *Inflorescence* lateral, opposite and shorter than the leaves, ca. 1 cm long, 2–4-flowered. *Flowers* small, white, turning yellowish with age. *Dorsal sepal* narrowly elliptic, obtuse, ca. 2.5 × 1.3 mm. *Lateral sepals* broadly triangular, ca. 3 × 2.5 mm; mentum blunt, ca. 3 mm long. *Petals* oblong-elliptic, obtuse, ca. 2 × 1 mm. *Lip* simple, ovate, obtuse, ca. 3 × 2 mm, slightly saccate at base; callus elliptic. *Column* and foot ca. 2.5 mm long. Fig. 48.

DISTRIBUTION. Tonga (Kao and Tofua). Also in New Guinea, New Caledonia, Fiji, Vanuatu, and the Solomon Islands.

HABITAT. Occasional in foothill to montane forest; 300–500 m.

COLLECTIONS. **Kao:** *Buelow 615; Whistler 10700; Yuncker 15897*. **Tofua:** *Buelow 438, 2549; Hotta 4411; Whistler 10607*.

## 21. PHREATIA

Lindl., Gen. Spec. Orchid. Pl.: 63. 1830.

Dwarf to medium-sized *epiphytic herbs*, with leafy, short to long or pseudobulbous stems. *Leaves* solitary to many, somewhat thin-textured to fleshy or leathery, articulate. *Inflorescence* basal or axillary, unbranched, racemose, laxly to densely many-flowered. *Flowers* resupinate, small or tiny, white, rarely pale green or pale yellow. *Dorsal sepal* free. *Lateral sepals* oblique, attached at base to column-foot to form a distinct mentum. *Petals* narrower than dorsal sepal, free. *Lip* adnate to column-foot, immobile, concave or saccate at base, usually with two small pit-like nectaries, the disc naked or papillate. *Column* short, with a foot; pollinia eight, borne on a small linear stipe attached to a small viscidium.

A genus of 100 or more species widespread in tropical Asia from India and Sri Lanka eastward to New Guinea, N.E. Australia, and the S.W. Pacific islands eastward to Tahiti. Two species occur in Tonga and Niue.

## KEY TO SPECIES

1. Leaves 11–30 × 1.2–2 cm; lip lacking a spur ..... 1. *P. micrantha*  
 1. Leaves 4–10.5 × 0.2–0.5 cm; lip with an obscurely saccate spur ..... 2. *P. matthewsii*

1. *Phreatia micrantha* (A. Rich.) Lindl., J. Proc. Linn. Soc., Bot. 3: 212. 1859. Type: Santa Cruz Islands, Vanikoro, *Lesson s.n.* (holotype P!).

*Eria sphaerocarpa* Rchb. f., Seem. Fl. Vit. 301. 1868. Type: Fiji, *Graeffe s.n.* (holotype W!).

*Oberonia micrantha* A. Rich., Voy. Astrolabe: 7, tab. 3. 1833.

*Phreatia collina* Schltr., Repert. Spec. Nov. Regni Veg. Beih. 1: 919. 1913. Type: New Guinea, *Schlechter 16438* (holotype B†), non J.J.Sm. (1911).

*Phreatia graeffei* Kraenzl., Engler Pflanzenr. Orch. Thelas. 26. 1911. Based on same type as *Eria sphaerocarpa* Rchb. f.

*Phreatia macrophylla* Schltr., Engler Bot. Jahrb. Syst. 39: 78. 1906. Type: New Caledonia, *Schlechter 15465* (holotype B†, isotype BM!, K!, P!, W!, Z).

*Phreatia robusta* R.S. Rogers, Trans. & Proc. Roy. Soc. South Australia 54: 3. 1930. Type: Australia, *A. Beck s.n.* (holotype AD).

*Phreatia samoensis* (Kraenzl.) Schltr., Repert. Spec. Nov. Regni Veg. 3: 320. 1907.

*Phreatia sarcothece* Schltr., Repert. Spec. Nov. Regni Veg. 9: 438. 1911. Type: Vanuatu, *Morrison s.n.* (holotype B†).

*Rhynchophreatia micrantha* (A. Rich.) N. Hallé, Fl. Nouv.-Caléd. 8: 341. 1977.

*Thelasis samoensis* Kraenzl., Engler, Bot. Jahrb. Syst. 25: 607. 1898. Type: Le Pua [Lepu'e?], *Reinecke 606* (syntype B†, isosyntype AMES!).

Medium-sized *epiphytic herb* with a very short stem. *Leaves* in a fan-shaped arrangement, 5–10, ligulate, unequally obtusely bilobed, 11–30 × 1.2–2.2 cm, articulated to broad, conduplicate, imbricate leaf bases 3–5 mm long. *Inflorescence* axillary, usually slightly longer than the leaves, cylindrical, subdensely many-flowered; peduncle twice as long as the rachis; bracts ovate, subulate, 2.5–4 mm long. *Flowers* tiny, white; pedicel and ovary 1.5–2 mm long. *Dorsal sepal* broadly ovate, obtuse, 1.2–1.5 × 1–1.5 mm. *Lateral sepals* oblique, broadly ovate, obtuse, 1–1.5 × 0.9–1.2 mm; mentum short, obtuse. *Petals* broadly ovate, subacute, 0.8–1.1 × 0.7–1 mm. *Lip* inflexed, subrhombic to broadly trullate, obtuse, 1–1.7 × 1.3–1.6 mm, lacking a spur. *Column* ca. 0.4 mm long; foot ca. 0.7 mm long. Fig. 49.

DISTRIBUTION. Tonga (Kao, Tofua, and Tafahi) and Niue. Also found from Micronesia, N. Australia, New Guinea, the Solomon Islands, Vanuatu, and New Caledonia eastwards to Samoa.

HABITAT. Occasional in forests on volcanic islands; near sea level to 300 m.

COLLECTIONS. **Kao:** *Buelow 3116, 3157, 3199; Yuncker 15902.* **Tofua:** *Hotta 4361, 4365; Scarth-Johnson 150.* **Niue:** *Sykes CHR 150573, 150574, 150575; Whistler 10767, 10842; Yuncker 9807, 10105.*

2. *Phreatia matthewsii* Rchb. f., Otia Bot. Hamburg.: 55. 1878. Type: Society Islands, *Matthews s.n.* (holotype W!).

*Eria myosurus* (Forst. f.) Rchb. f., Bonplandia 5: 54. 1857.

*Eria stachyurus* Rchb. f., Seem., Fl. Vit.: 301. 1868.

*Phreatia multiflora* sensu Kraenzl., Bot. Jahrb. Syst. 25: 607. 1898, non Lindl.

*Phreatia myosurus* (Forst. f.) Ames, Orchidaceae 2: 203. 1908, non (Rchb.f.) Lindl. (1859). Type: Society Islands, *Banks & Solander s.n.* (holotype BM!).



*Phreatia neocaledonica* Schltr., Bot. Jahrb. Syst. 39: 78. 1906. Types: New Caledonia, *Schlechter 14755, 15228* (syntype B†; isosyntypes BM, BO, K, P, Z).

*Phreatia reineckeii* Schltr., Fedde, Repert. Spec. Nov. Regni Veg. 9: 109. 1911. Type: Samoa, *Vaupel 658* (holotype B†; isotype K!).

*Phreatia upoluensis* Schltr., Repert. Spec. Nov. Regni Veg. 3: 319. 1907. Type: Samoa, *Betche 36* (holotype B†, isotype MEL).

*Phreatia yunckeri* L.O. Williams, Bernice P. Bishop Mus. Bull. 178: 42. 1943). Types: Niue, *Yuncker 9597, 9928* (syntypes AMES!).

Small *epiphytic herb* with a short stem 1–4 cm long. *Leaves* 6–10, in a fan-shaped arrangement, linear-ligulate, briefly obliquely unequally bilobed at apex, 4–10.5 cm × 2–5 mm, with articulated to sheathing, imbricate leaf bases. *Inflorescence* axillary, more or less as long as the leaves, 3–11 cm long, laxly many-flowered; peduncle about half as long as the rachis; bracts lanceolate, acuminate, 1.5–2 mm long. *Flowers* tiny, white; pedicel and ovary ca. 1 mm long. *Dorsal sepal* ovate, subacute, 0.8–1.2 × 0.6–0.8 mm. *Lateral sepals* obliquely ovate, acute, 1–1.5 × 0.9–1.2 mm; mentum subconical. *Petals* elliptic-ovate, acute, 0.8–1.2 × 0.6–0.8 mm. *Lip* clawed, with a transversely ovate, obtuse lamina 0.9–1.3 × 0.7–0.9 mm, obscurely saccate at base. *Column* short; foot ca. 0.3 mm long. Fig. 50.

DISTRIBUTION. Tonga (Tafahi) and Niue. Also in New Ireland, Bougainville, the Solomon Islands, Vanuatu, the Horne Islands, Fiji, Samoa, and the Society Islands.

HABITAT. Uncommon in lowland to montane forest; near sea level to 550 m.

COLLECTIONS. **Tafahi:** *Hurlimann 437, Buelow 1190, 1191; Whistler 6244. Niue:* *Sykes 110, CHR 150589, 150591, 150592; Whistler 10766, 10841; Yuncker 9597, 9928.*

## 22. DENDROBIUM

Sw., Nova Acta Regiae Soc. Sci. Upsal. ser. 2, 6: 82. 1799.

Small to large *epiphytic or lithophytic herbs* (or rarely terrestrial) with elongate, 1- to several-noded, slender and leafy or swollen stems, pseudobulbous, leafy towards apex. *Leaves* coriaceous to fleshy, flat, terete or bilaterally flattened, articulated at base; leaf base present or not. *Inflorescence* lateral or subterminal, axillary, one- to many-flowered, fasciculate, racemose, or paniculate. *Flowers* often showy and relatively large. *Dorsal sepal* free. *Lateral sepals* adnate to column-foot, forming a distinct mentum. *Petals* free, usually narrower than the sepals. *Lip* attached to apex of column-foot, mobile or articulated, entire to 3-lobed, lacking a spur, usually with a callus of ridges or appendages. *Column* short, with a short to long foot; pollinia four, waxy, lacking an appendage.

A large genus of perhaps 1000 or more species widespread in tropical and subtropical Asia, Malesia, the Philippines, Micronesia, N. and E. Australia, and the S.W. Pacific eastward to Tahiti and south to New Caledonia and New Zealand. Four species are reported from Tonga (one of them also in the Cook Islands) and one on Niue.

### KEY TO SPECIES

1. Flowers borne in pairs in sessile inflorescences along the stems and opposite the leaves
  2. Leaves 10–25 mm broad ..... 1. *D. dactyloides*
  2. Leaves 4–7 mm broad ..... 2. *D. biflorum*
1. Flowers not borne in sessile inflorescences opposite the leaves, usually three- or more-flowered
  2. Stems clavate and strongly bilaterally flattened ..... 3. *D. platygastrium*
  2. Stems terete, not clavate or bilaterally flattened

3. Mentum spur-like, longer than the dorsal sepal; flowers small, pale orange in dense clusters much shorter than the leaves ..... 4. *D. calcaratum*  
 3. Mentum chin-like, shorter than the dorsal sepal; flowers large, greenish yellow or yellow, in open, well-spaced racemes much longer than the leaves ..... 5. *D. tokai*

1. *Dendrobium dactylodes* Rehb.f., J. Bot. 15: 132 (1877). Type: Samoa, *Whitmee 46* (holotype W!, isotype K!, photo of holotype AMES!).

*Dendrobium cheesmanae* Guillaumin, Bull. Soc. Bot. France 103: 280. 1956. Type: Vanuatu, *Cheesman A22* (holotype BM!).

*Dendrobium everardii* Rolfe, Bull. Misc. Inform. Kew 1921: 55. 1921. Type: Viti Levu, *Im Thurn 326* (holotype K!).

*Dendrobium involutum* sensu Kraenzl., Bot. Jarhb. Syst. 25: 603. 1898, non Lindl.

*Dendrobium vaupelianum* Kraenzl., Notizbl. Königl. Bot. Gart. Berlin 5: 109. 1909. Type: Samoa, *Vaupel 286* (holotype B†, isotypes AMES!, K!).

*Dendrobium whitmeei* Kraenzl., Engler Pflanzenr. Orch. Mon. Dendr. 1.; 45: 189. 1910. Types: Samoa, *Whitmee s.n.* (syntype B!), *Betche 227* (syntype B!).

*Epiphytic herb* with clustered slender stems 25–140 cm long, leafy, many-noded. *Leaves* distichous, lanceolate, obliquely obtuse or subacute at apex, 3.5–8 × 1–2.5 cm, articulated to sheathing leaf bases, 5–10 mm long. *Inflorescence* lateral, 2-flowered, borne at nodes opposite leaves, 3–6 mm long; bracts small, scale-like. *Flowers* white to pale creamy white or tinged with pink, ephemeral; pedicel and ovary 7–13 mm long. *Dorsal sepal* linear-lanceolate, acute, 15–24 × 3–3.5 mm. *Lateral sepals* falcate, lanceolate, attenuate, acute, 13–28 × 6–10 mm; mentum inflexed, conical, 5–7 mm long. *Petals* linear-lanceolate, acute, 13–24 × 1–2 mm. *Lip* 3-lobed, recurved, 7–14 × 5–8 mm; side lobes erect, obliquely ovate, subacute to obtuse; midlobe ovate, attenuate, acuminate, sparsely papillate at apex of callus, the margins irregularly crenate-dentate below; callus with a prominently raised keel, verruculose in basal part, crenate in apical part. *Column* 3–3.5 mm long; foot 4.5–6 mm long. Section *Grastridium*. Fig. 51.

DISTRIBUTION. Tonga (Tafahi) and the Cook Islands (Rarotonga). Also found in Vanuatu, Fiji, Samoa, and the Cook Islands.

HABITAT. Common in coastal to cloud forest; near sea level to perhaps 600 m on these islands.

COLLECTIONS. **Tafahi:** *Buelow 1186, 1274; Hurlimann 463; Whistler 6243*. **Rarotonga:** *Cheesman A22; Given 1438; Luttrell 352; Parks 22132; Philipson 10149; Sykes 1547; Whistler 4058, 5783; Wilder 969*.

NOTE. Very close to *Dendrobium involutum* Lindl. from Tahiti and adjacent islands. Their relationship needs further exploration.

2. *Dendrobium biflorum* (Forst. f.) Sw., Nova Acta Regiae Soc. Sci. Upsal. Ser. 2, 6: 84. 1799. Type: Tahiti, *J. & G. Forster s.n.* (holotype BM!, isotype K!).

*Epidendrum biflorum* Forst. f., Fl. Ins. Austr.: 60 (1786).

*Erect or ascending epiphytic herb* with slender, reed-like, many-noded stems 35–160 cm long, 2–4 mm in diameter, leafy in upper part. *Leaves* distichous, linear-lanceolate, obliquely acute, 7–16 × 4–7 mm, articulated at base to tubular sheaths, 1–1.4 cm long. *Inflorescence* 2-flowered, borne at nodes opposite leaves; peduncle 3–7 mm long; bracts narrowly triangular, 1–1.5 mm long. *Flowers* ephemeral, white to pale yellow; pedicel and ovary 7–12 mm long. *Dorsal sepal* linear-lanceolate, filiform at apex, 28–32 × 1.5–2 mm. *Lateral sepals* obliquely linear-lanceolate, filiform at apex, 30–34 × 2–3 mm; mentum narrowly conical, 4–6.5 mm long. *Petals* linear-attenuate, filiform, 28–32 × 1–1.5 mm. *Lip* 3-lobed, recurved, 6–8 mm long, 3.5–4.5 mm wide;



FIGURE 49. *Phreatia micrantha*. Niue.



FIGURE 50. *Phreatia matthewsii*. Tahiti.



FIGURE 51. *Dendrobium dactyloides*. Samoa.



FIGURE 52. *Dendrobium biflorum*. Samoa.



FIGURE 53. *Dendrobium platygastrum*. Tonga.



FIGURE 54. *Dendrobium calcaratum*.



FIGURE 55. *Bulbophyllum rosticeps*. Tonga.



FIGURE 56. *Bulbophyllum distichobulbon*. Niue.



FIGURE 57. *Bulbophyllum longiflorum*. Cooks.



FIGURE 58. *Bulbophyllum longiscapum*. Samoa.



FIGURE 59. *Bulbophyllum pachyanthum*. Samoa.



FIGURE 60. *Taeniophyllum fasciola*. Cooks.



FIGURE 61. *Robiquetia tongaensis*. Tonga.



FIGURE 62. *Eulophia spectabilis*.



FIGURE 63. *Eulophia pulchra*. Tonga.



FIGURE 64. *Geodorum densiflorum*. Tonga.

side lobes obliquely narrowly triangular, acute, erose on margins; midlobe narrowly triangular, acute, 3–4 × 2–2.5 mm, irregularly fimbriate on lower margins; callus a longitudinal raised keel from base of lip merging into 3 rows of papillae on basal part of midlobe. *Column* 1.5–2 mm long; foot 4.5–6 mm long. Section *Grastridium*. Fig. 52.

**DISTRIBUTION.** Niue. Also in Bougainville, the Solomon Islands, the Santa Cruz Islands, Vanuatu, Fiji, Samoa, and the Society Islands.

**HABITAT.** Common in lowland to montane forest; near sea level to perhaps 200 m on Niue.

**COLLECTIONS.** **Niue:** *Sykes CHR 150563; Whistler 10750; Yuncker 9873.*

3. *Dendrobium platygastrium* Rchb.f., *Otia Bot. Hamburg.* 55. 1878. Type: Fiji, Vanua Levu, *USEE s.n.* (holotype W!, isotype AMES!).

*Dendrobium goldfinchii* sensu M. Hotta, non F. Muell. For full synonymy, see Kores (1991).

*Epiphytic herb* up to 30 cm in height with a short rhizome, clavate but bilaterally flattened pseudobulbs 10–25 × 1.8–3.5 cm, many-noded stems 3–6-leaved towards apex. *Leaves* lanceolate to elliptic-oblong, acute, 6–12 × 2–3.5 cm, articulated to persistent sheaths. *Inflorescence* laxly 2–4-flowered, up to 4 cm long; bracts ovate, 2–3 mm long. *Flowers* non-resupinate, white or white tinged with pink. *Dorsal sepal* ovate to elliptic-ovate, 12–13.5 × 6–7 mm. *Lateral sepals* obliquely ovate, 10–15.5 × 7–9 mm; mentum narrowly conical, 12–15 mm long. *Petals* obovate-oblong, 10–14 × 6–7 mm. *Lip* adnate to column-foot, broadly subrhombic, clawed, 16–23 × 7–10 mm; callus of 5 weakly undulate longitudinal ridges. *Column* ca. 3 mm long; foot 13–16 mm long. Section *Platygastrium*. Fig. 53.

**DISTRIBUTION.** Tonga (Kao and Tofua). Also in the Philippines, Borneo, the Solomon Islands, Vanuatu, New Caledonia, and Fiji.

**HABITAT.** Uncommon in coastal to montane forest; near sea level to 600 m.

**COLLECTIONS.** **Kao:** *Buelow 649, 712, 2823, 3158, 3198; Yuncker 15934.* **Tofua:** *Hotta 4406; Whistler 10618.*

4. *Dendrobium calcaratum* A. Rich., *Voy. Astrolabe* 2: 18. 1834. Type: Santa Cruz Islands, Vanikoro, *Lesson s.n.* (holotype P!, isotype W!).

*Dendrobium separatum* Ames, *J. Arnold Arb.* 13: 133. 1932. Type: Santa Cruz Islands, *Kajewski 503* (holotype AMES!).

*Dendrobium triviale* Kraenzl., *Bot. Jahrb. Syst.* 25: 604 (1898). Type: Samoa, *Reinecke 422* (holotype B†).

*Pedilonum separatum* (Ames) Rauschert, *Feddes Repert.* 94 (7–8): 463 (1983).

*Pedilonum triviale* (Kraenzl.) Rauschert, *loc.cit.* 464.

*Pendent epiphytic herb* with long, clustered, ribbed leafy stems up to 1.5 m long, yellow-green turning maroon with age. *Leaves* deciduous, distichous, coriaceous, ligulate or oblong-lanceolate, acute and unequally bilobed at apex, 9–16 × 1.3–1.7 cm. *Inflorescence* several, lateral, pendent, from nodes on leafless stems, densely 10–18-flowered; peduncle up to 2 cm long; bracts 2–4 mm long. *Flowers* pale apricot to orange, not opening widely; pedicel and ovary ca. 1 cm long. *Dorsal sepal* oblong, obtuse, 5–6 × ca. 3 mm. *Lateral sepals* obliquely oblong-ovate, obtuse, 14–15 × 3–4 mm; mentum cylindrical, obtuse, 7–8 mm long. *Petals* elliptic, obtuse, 5–6 × 2–3 mm, with erose margins. *Lip* obovate, obtuse, 9–10 × 3–4 mm with a lunate transverse callus in basal part. *Column* 2–3 mm long; foot ca. 8 mm long. Section *Pedilonum*. Fig. 54.

**DISTRIBUTION.** Tonga (Kao, Tofua, Late, Niuafou‘ou, and Niuatoputapu). Also in New Britain, the Solomon Islands, the Santa Cruz Islands, Vanuatu, Samoa, Tonga, and the Horne Islands.

HABITAT. Often common and abundant from mangrove to montane forest, also on lava fields; near sea level to 700 m.

COLLECTIONS. **Kao:** *Buelow 668*. **Tofua:** *Buelow 448, 2623; Hotta 4362, 4367, 4420*. **Late:** *Buelow & Sykes 110; Hotta 4720, 4792*. **Niuafou:** Whistler (sight record). **Niuatoputapu:** *Whistler 6182*.

5. *Dendrobium tokai* Rchb.f., *Hamburger Garten-Blumenzeitung* 21: 293. 1865. Type: Fiji, *Seemann 584* (lectotype W!; isolectotypes AMES!, BM!, K!, P!).

*Epiphytic herb* up to 80 cm or more in height, with clustered, leafy, cane-like stems arising from a short stout rhizome. *Leaves* many, distichous, coriaceous, elliptic or ovate-elliptic, obtuse or rounded at apex, 8.5–15 × 2.3–5 cm; sheaths tubular, 1–3 cm long. *Inflorescence* erect, laxly 8–20-flowered, 20–35 cm long; bracts ovate-triangular, acute, 1.5–3 mm long. *Flowers* greenish yellow or yellow with reddish stripes on lip, not opening widely; pedicel and ovary 2.5–3 cm long. *Dorsal sepal* narrowly oblong-lanceolate, acute, ca. 3–3.8 × 5 mm. *Lateral sepals* obliquely lanceolate, acute, 3.2–4 × 0.5–0.6 cm; mentum obliquely conical, 7–8 mm long. *Petals* narrowly oblong-obovate, acute, 3.2–4 × 0.4–0.6 mm, untwisted. *Lip* 3-lobed in apical half, 2.6–3.2 × 0.9–1.2 cm; side lobes narrowly oblong, erect, somewhat erose on front margins; midlobe ovate, acute, 1.5–1.8 × 1–1.3 cm, with an obscurely erose margin; callus of 3 longitudinal lamellae from base on basal half of midlobe, each raised into a flap at apex. *Column* 3–4 mm long; foot 6.5–7.5 mm long. Section *Spathulata*. No Fig. available.

DISTRIBUTION. Tonga ('Eua, Vava'u, Niuafou, Niuatoputapu, and Tafahi). Also in Fiji.

HABITAT. Occasional in littoral to lowland forest; near sea level to 80 m.

COLLECTIONS. 'Eua: *Lister s.n.* **Niuafou:** *Buelow 1934; Whistler 6432*. **Vava'u:** *Hotta 4997; Soakai 1043; Yuncker 16202*. **Niuatoputapu:** *Buelow 1075, 1114; Kirch 313*. **Tafahi:** *Buelow 1259, 1288; Hurlimann 462*.

### 23. BULBOPHYLLUM

Thouars, *Hist. Orchid.*: t. 3 sub u. 1822.

Small to large, *epiphytic or lithophytic herbs* (or very rarely terrestrial) with short- to long-creeping rhizomes and pseudobulbous stems (or pseudobulbs rarely almost absent), unifoliate (or sometimes bifoliate outside our region) at apex. *Leaf* coriaceous to chartaceous, rarely deciduous. *Inflorescence* solitary or fasciculate, lateral from base of pseudobulb or from rhizome, one- to many-flowered, racemose, subumbellate or subcapitate. *Flowers* small to relatively large and showy, sessile to long-pedicellate. *Dorsal sepal* free or rarely adnate to lateral sepals. *Lateral sepals* adnate to column-foot at base to form a more or less prominent mentum, free or partly connate above. *Petals* free, narrower than sepals. *Lip* articulate to column-foot, mobile, rarely not, entire to 3-lobed, often very fleshy and recurved, often ciliate or pubescent, usually with a callus. *Column* short, with a more or less prominent foot; pollinia two or four, waxy, usually coherent in two pairs.

A large genus of possibly 1500 species found throughout the tropics and subtropics, but best represented in S.E. Asia and Malesia. Six species are reported from the study area: three from Tonga only, one from Niue only, one from the Cook Islands, and one from both Tonga and Niue.

#### KEY TO SPECIES (excluding sp. No. 6)

1. Inflorescences one-flowered
  2. Pseudobulbs distant on a slender rhizome ..... 1. *B. rostriceps*
  2. Pseudobulbs distichously and proximally arranged ..... 2. *B. distichobulbum*
1. Inflorescence two or more-flowered



2. Flowers borne simultaneously in a subumbel; lateral sepals much longer than the dorsal sepal and fused in apical half ..... 3. *B. longiflorum*
2. Flowers borne in succession in an elongated raceme
3. Petals acuminate, ca. 2 mm long; lip with two erect, horn-like appendages near base ..... 4. *B. longiscapum*
3. Petals acute, 12–16 mm long; lip lacking horn-like appendages near base ..... 5. *B. pachyanthum*

1. *Bulbophyllum rostriceps* Rchb. f., *Otia Bot. Hamburg.* 55 (1878). Type: Fiji, *USEE s.n.* (holotype W!, isotype AMES!).

*Creeping epiphytic herb* with an elongate rhizome and cylindrical-ovoid pseudobulbs 1–1.8 cm long, 0.3–0.5 cm in diameter, borne 2.5–9.5 cm apart, unifoliate at apex. *Leaves* erect, elliptic-ligulate, obtuse, 2.6–5.6 × 0.6–1.3 cm, shortly petiolate. *Inflorescence* 2–5.5 cm long, bearing a solitary flower; scape filiform, up to 4.5 cm long; bract clasping, small, ovate-cucullate, ca. 1 mm long. *Flower* purple-maroon; pedicel and ovary ca. 8 mm long, ovary 6-angled. *Dorsal sepal* narrowly elliptic-ovate or ovate, acuminate, 4–5 × 1.5–2 mm. *Lateral sepals* oblong-ovate to ovate, oblique, acuminate, 4.5–5.5 × 2–2.4 mm. *Petals* obovate to elliptic-obovate, oblique, obtuse, 2–2.4 × 1.2–1.6 mm. *Lip* fleshy, porrect to slightly arcuate, oblong-ligulate, obtuse, 4–5.5 × 1.6–2.2 mm, glabrous or with a few scattered distal hairs; callus of two longitudinal ridges. *Column* ca. 1.8 mm long; stelidia attenuate to subulate; foot ca. 1 mm long. Section *Ephippium*. Fig. 55.

DISTRIBUTION. Tonga (Kao and Tofua). Also found in Vanuatu, Fiji, and Samoa.

HABITAT. Locally common in forests on volcanic islands; near sea level to 820 m.

COLLECTIONS. **Kao:** *Buelow 651; Whistler 10703; Yuncker 15903.* **Tofua:** *Buelow 473, 479; Hotta 4354, 4405; Scarth-Johnson 151; Whistler 10612.*

2. *Bulbophyllum distichobulbum* P.J. Cribb, *Kew Bull.* 50 (4): 787. 1995. Type: Samoa, Tutuila, *Whistler 3757* (holotype BISH!).

*Small epiphytic herb* with a short ascending rhizome and distichously arranged, proximate, subspherical, angular pseudobulbs 4–5 mm in diameter. *Leaves* coriaceous, elliptic or elliptic-obovate, obtuse to subacute, 2.1–4 × 1–1.5 cm. *Inflorescence* much longer than the leaf, one-flowered, glabrous; peduncle slender, filamentous, 5–5.5 cm long; bract sheathing, acute to acuminate, ca. 4 mm long. *Flower* yellow; pedicel and ovary 5–5.5 cm long. *Dorsal sepal* linear-lanceolate, acuminate, 11–14 × 1.5–2.1 mm. *Lateral sepals* obliquely lanceolate, acuminate, 14–14.5 × 2–2.5 mm. *Petals* transversely oblong, aristate at apex, ca. 3 × 1 mm. *Lip* fleshy, narrowly ellipsoidal, auriculate at base, rounded in front, ca. 4.5 × 1.5 mm, hairy; basal auricles erect; callus of two short ridges between auricles. *Column* ca. 2.5 mm long including ca. 1.5 mm long apical, aristate stelidia; foot swollen at base, ca. 1.5 mm long. Section *Micromonathe*. Fig. 56.

DISTRIBUTION. Niue. Also found in Samoa.

HABITAT. Occasional in limestone forest; ca. 10–70 m on this island.

COLLECTIONS. **Niue:** *Sykes 347, 769, 878; Whistler 10765, 10840; Yuncker 9808, 9923.*

NOTE. Closely related to the Fijian endemic species *B. aristopetalum* Kores, but having larger flowers and a longer inflorescence overtopping the leaf.

3. *Bulbophyllum longiflorum* Thouars, *Hist. Orchid.:* 98 (1822). Type: Mauritius, *Thouars s.n.* (holotype P!). For full synonymy, see Lewis & Cribb (1989).

*Creeping epiphytic herb* with a stout elongate rhizome bearing pseudobulbs at 5–6 cm intervals, these conical, 1.5–3.5 × 0.8–1.2 cm, one-leafed at apex. *Leaf* erect, oblong, obtuse, 9–16 × 2–3.5 cm; petiole 1.5–3

cm long. *Inflorescence* suberect to spreading, 4–9-flowered in a false umbel, 12–30 cm long. *Flowers* elongate, creamy to yellow, blotched with red to purple, lip yolk-yellow to purple. *Dorsal sepal* concave, ovate, apically with long cilia, ca.  $8 \times 4\text{--}5$  mm. *Lateral sepals* ligulate, fused in upper two-thirds,  $2.5\text{--}3 \times 0.4\text{--}0.6$  cm. *Petals* ovate, ciliate,  $0.6\text{--}0.9 \times 0.3\text{--}0.4$  cm. *Lip* fleshy, ligulate,  $4\text{--}5 \times 2.5\text{--}3$  mm, recurved. *Column* ca. 3 mm long with apical down-curved stelia; foot ca. 4 mm long. Section *Cirrhopetalum*. Fig. 57.

**DISTRIBUTION.** Cook Islands (Rarotonga). A widespread species from tropical Africa, Madagascar, and S.E. Asia eastward to the Society Islands.

**HABITAT.** Occasional in foothill to montane forest; elevation probably up to ca. 500 m or more.

**COLLECTIONS.** **Rarotonga:** *Cheeseman s.n.*; *Luttrell 353*; *Parks 22149, 22610*; *Philipson 10131*; *Sykes 1439, 1457, 1543, 2205*; *Whistler 4104, 5035, 5202*; Wilder (published sight record).

4. *Bulbophyllum longiscapum* Rolfe, Bull. Misc. Inform. Kew 1896: 45 (1896). Type: Fiji, cult. Kew, *Yeoward s.n.* (holotype K!).

*Bulbophyllum praealtum* Kraenzl., Notizbl. Königl. Bot. Gart. Berlin 5: 109 (1909). Type: Samoa, *Vaupel 322* (holotype B†, isotype K!).

*Creeping epiphytic herb* with an elongated rhizome 3–4.5 mm in diameter. Pseudobulbs widely spaced on rhizome, narrowly conical-ovoid,  $2\text{--}4.5 \times 0.8\text{--}1.8$  cm. *Leaf* oblong-elliptic, broadly acute,  $11.5\text{--}23 \times 2\text{--}3.5$  cm, petiolate. *Inflorescence* with several flowers produced in succession, erect-arcuate, racemose, 25–79 cm long; peduncle wiry, terete; rachis somewhat fractiflex; bracts broadly ovate, acuminate, 8–12 mm long. *Flowers* produced sequentially, white or greenish yellow marked with dull purple or red at base of segments; pedicel and ovary 10–15 mm long. *Dorsal sepal* lanceolate, acuminate,  $25\text{--}30 \times 5\text{--}5.5$  mm. *Lateral sepals* weakly spreading, obliquely lanceolate, attenuate, acute,  $30\text{--}35 \times 6.5\text{--}7.5$  mm. *Petals* broadly ovate, acuminate, briefly setiform at apex, ca.  $2 \times 1.5$  mm. *Lip* very fleshy, porrect, oblong-lanceolate, narrowly obtuse,  $26\text{--}32 \times 8\text{--}9$  mm; side margins revolute, crenate-undulate distally; callus of two prominently raised keels that coalesce in front. *Column* ca. 5 mm long; foot 7–8 mm long. Section *Dialeiphanthe*. Figs. 58, 68.

**DISTRIBUTION.** Tonga (Tafahi) and Niue. Also known from the Solomon Islands, Vanuatu, Fiji, Samoa, and Wallis Island.

**HABITAT.** Occasional in lowland to montane forest; near sea level to 500 m.

**COLLECTIONS.** **Tafahi:** *Buelow 1172, 1184*; *Hurlimann 416*; *Whistler 6245*. **Niue:** *Sykes CHR 150587, 150588*; *Whistler 10769*; *Yuncker 9806*.

5. *Bulbophyllum pachyanthum* Schltr., Bot. Jahrb. Syst. 39: 85 (1906). Type: New Caledonia, *Schlechter 15678* (holotype B†).

*Bulbophyllum longiscapum* sensu Parham, Trans. Proc. Fiji Soc. 2: pl. 11 (1953), non Rolfe.

*Bulbophyllum* sp. 2 sensu Yuncker, Bernice P. Bishop Mus. Bull. 184: 33 (1945).

*Large epiphytic herb* with a clustered or weakly spreading habit, somewhat elongated rhizome 4–6 mm in diameter, and closely spaced, obliquely ovoid pseudobulbs  $1.8\text{--}3.5 \times 1\text{--}1.7$  cm. *Leaf* oblong-elliptic, broadly acute,  $8\text{--}22 \times 3\text{--}5.2$  cm, narrowly petiolate at base. *Inflorescence* erect, racemose, 22–40 cm long, laxly 2–4-flowered; peduncle slender, terete, bearing 3 or 4 widely spaced sheaths along its length; rachis short; bracts broadly ovate, acuminate, 10–12 mm long. *Flowers* developing sequentially, green or greenish yellow spotted with purple, glabrous; pedicel and ovary 1.5–2.5 cm long. *Dorsal sepal* narrowly ovate, acuminate,  $2.2\text{--}2.8 \times 1.2\text{--}1.4$  cm, slightly thickened and carinate dorsally. *Lateral sepals* obliquely lanceolate, acute,  $3.3\text{--}3.8 \times 0.8\text{--}1.2$  cm, dorsally carinate. *Petals* obliquely ovate, acute,  $1.2\text{--}1.6 \times 0.8\text{--}0.9$  cm. *Lip* arcuate, fleshy,

oblong-lanceolate, subacute, 1.2–1.4 × ca. 0.5 cm, auriculate at base; calli 2, longitudinal, somewhat papillate. *Column* ca. 1 cm long, with setose stelia as long as the column; foot ca. 0.8 cm long. Section *Dialeipanthe*. Fig. 59.

DISTRIBUTION. Tonga (Kao and Tofua). Also from New Caledonia, Fiji, and Samoa.

HABITAT. Uncommon in lowland to montane forest; 200 to ca. 1000 m.

COLLECTIONS. **Kao:** *Buelow* 672. **Tofua:** *Buelow* 480, 580; *Hotta* 4412; *Scarth-Johnson* 151; *Whistler* 10641.

## 6. *Bulbophyllum* sp.

A sterile specimen at Kew (*Scarth-Johnston s.n.*) collected on Tofua in Tonga does not fit any of the above species, nor any other that we have seen from the S.W. Pacific islands. It has small clustered pseudobulbs each bearing an oblong, shortly petiolate, erect leaf. Vegetatively it is similar to *Bulbophyllum microrhombos* from the Solomon Islands, but its leaves are more oblong and of a slightly different shape. The specimen may belong to sect. *Hapalochilus* but it bears no flowers or even old inflorescences.

### 24. TAENIOPHYLLUM

Blume, *Bijdr. Fl. Ned. Ind.*: 355. 1825.

Small to tiny *acaulescent epiphytic herbs* with terete to strongly dorso-ventrally flattened, greenish photosynthetic roots and very short stems bearing scales. *Inflorescence* erect, short to long, unbranched; peduncle and rachis glabrous or hairy; rachis often fractiflex. *Flowers* small, distichous, ephemeral or lasting a few days, pale green, yellow, or white. *Sepals* and *petals* free or fused in basal part to form a distinct perianth tube, apical parts free. *Lip* immobile, entire or 3-lobed, simple or with a retrorse bristle-like apex, spurred at base, the mouth often partially or entirely covered by a hyaline septum. *Column* short, lacking a foot; pollinia four, waxy, obovoid to ellipsoidal, attached by a slender stipe to a large viscidium.

A large genus of about 170 species in subtropical and tropical Asia and S.E. Asia, Malesia, New Guinea, the Philippines, Micronesia, N.E. Australia, New Caledonia, and the S.W. Pacific islands eastward to the Austral Islands and Pitcairn, with one species in tropical Africa. A single species is reported from Tonga, the Cook Islands, and Niue.

*Taeniophyllum fasciola* (Forst. f.) Seem., *Bonplandia* 10: 153. 1862; *Rchb. f.*, Seem., *Fl. Vit.*: 296. 1868. Type: Tahiti, *G. Forster 172* (holotype BM!, isotype P!).

*Epidendrum fasciola* Forst.f., *Fl. Ins. Austr.*: 60, n. 320. 1786.

*Taeniophyllum asperulum* *Rchb.f.*, *Otia Bot. Hamburg.* 1: 53. 1878. Type: Society Islands, *Wilkes s.n.* (holotype W).

*Taeniophyllum decipiens* Schltr., *Repert. Spec. Nov. Regni Veg.* 9: 112. 1911. Type: Samoa, *Vaupel 278* (holotype B†; isotypes AMES!, B, BISH!, K!, W!).

*Taeniophyllum fasciola* var. *mutina* N. Hallé, *Fl. Nouv.-Caléd.* 8: 386, pl. 157. 1977. Type: New Caledonia, *McKee 29285* (holotype P!).

*Taeniophyllum parhamiae* L.O. Williams, *Bot. Mus. Leafl.* 7: 148. 1939. Type: Fiji, *Parham 3* (holotype AMES!).

*Taeniophyllum seemannii* *Rchb. f.*, Seem. *Fl. Vit.*: 296. 1868. Type: Fiji, *Seemann 593* (holotype W!, isotype L!).

*Small, leafless epiphytic herb* with long, flattened, spreading roots 10–30 × 2–5 mm. *Inflorescence* short, densely few-flowered; peduncle and rachis densely verruculose; rachis fractiflex, 1–4 cm long; bracts ovate, ca. 1 mm long. *Flowers* pale yellowish white, with darker yellow tips to the perianth segments; ovary glandular pubescent. *Sepals* free, ovate- to ovate-elliptic, subacute, 2.5–4 × 1–2 mm. *Petals* free, ligulate or elliptic-ligulate, subacute, 2.5–4 × 0.5–1 mm. *Lip* entire, concave, navicular, 1.5–2.2 mm long; spur perpendicular to lip, short, subcylindrical to conical, subacute to obtuse, 1–2 mm long. *Column* very short; pollinia four, ellipsoidal to obovoid. Fig. 60.

**DISTRIBUTION.** Tonga ('Eua, Tongatapu, Kao, Vava'u, Late, Niufo'ou, Niuatoputapu, and Tafahi), the Cook Islands (Rarotonga, Mangaia, Atiu, Mauke, and Miti'aro), and Niue. Also in the Mariana Islands (Guam), the Solomon Islands, Vanuatu, New Caledonia, Fiji, the Horne Islands, Tahiti, the Austral Islands, and Pitcairn Island.

**HABITAT.** Common in coastal to lowland forest; near sea level to 300 m.

**COLLECTIONS.** 'Eua: Palmer 133; Sykes 255, 700; Whistler 7212, 7373. **Tongatapu:** Buelow 143, 1788; Hotta 4035, 4113, 4282; Hurlimann 88; Parks 15642; Yuncker 15019, 15228, 16207. **Kao:** Buelow 719. **Vava'u:** Buelow 1473; Hotta 5691. **Late:** Buelow & Sykes 157; Hotta 4804. **Niufo'ou:** Buelow 1976; Whistler 6431. **Niuatoputapu:** Buelow 1358; Kirsch 309. **Tafahi:** Buelow 1251. **Rarotonga:** Cheeseman 679; Given 1437; Luttrell & McCormack 164, 165; Parks 22103; Philipson 10124; Sykes 918, 1565, 2182; Whistler 4065; Wilder 8507. **Mangaia:** Sykes 501; Whistler 5391. **Atiu:** Sykes 364; Whistler 5283. **Mauke:** Paulay 390; Sykes 2467; Whistler 5556. **Miti'aro:** Whistler 5917. **Niue:** Sykes 328; Whistler 10768; Yuncker 9596.

## 25. ROBIQUETIA

Gaudichaud, Voy. Uranie 426, t. 34 (1826).

*Epiphytic herbs* with stout, elongate, pendent stems. *Leaves* distichous, coriaceous, several. *Inflorescences* several, lateral, more or less clavate, thick, densely many-flowered, racemose. *Flowers* non-resupinate, more or less campanulate, small but often brightly colored, red, orange, or pink. *Sepals* and *petals* free, subsimilar. *Lip* very fleshy, entire or obscurely 3-lobed, spurred at the base; spur clavate. *Column* short; pollinia two, joined by a strap-shaped stipe to a common viscidium.

A genus of about 35 species in India, S.E. Asia, and the Malay Archipelago, east to the Philippines and the S.W. Pacific islands. A single species is found in Tonga.

***Robiquetia tongaensis*** P.J. Cribb & Ormerod, Kew Bull. 60, 4: 609. 2006. Type: Tonga, 'Eua, Whistler 7014 (holotype BISH!).

*Epiphytic herb* with a short stem up to 8 cm or more in length. *Leaves* thick, coriaceous-fleshy, oblong, bilobed at the tip, 9–23 × 2–3.5 cm, with undulate margins. *Inflorescence* of short, curved, axillary racemes up to 8 cm long, densely many-flowered; rachis rather fleshy; bracts small, triangular. *Flowers* more or less campanulate, white to dark pink with greenish sepal tips. *Sepals* oblong, subacute to obtuse, 4–5 × 2–3 mm. *Petals* oblong, obtuse, ca. 4.5 × 2.5 mm. *Lip* very fleshy, triangular, acute, ca. 4 × 2 mm, with upcurved sides; spur clavate, 4–5 mm long, geniculate at the base and parallel to the column. *Column* somewhat tapering from base, then abruptly clavate at apex, ca. 2.5 mm long; rostellum with two deflexed hatchet-shaped, apical wings acute in front; pollinia attached to a spatulate, convex, curved stipe and a single large cordate viscidium. *Capsule* cylindrical, ridged, ca. 2 cm long. Fig. 61.

**DISTRIBUTION.** Tonga ('Eua and Tongatapu). Endemic to Tonga.

**HABITAT.** Common in littoral to foothill forest, sometimes on *Tournefortia* and *Terminalia*; near sea level to 250 m.

COLLECTIONS. 'Eua: *Buelow* 1710, 1761; *Hotta* 5209, 5252, 5363, 5432; *Sykes* 392; *Whistler* 6002, 7104; *Yuncker* 15408, 15550, 15571. **Tongatapu:** *Buelow* 2291; *Hotta* 4018; *Parks* 15179, 15279.

## 26. TUBEROLABIUM

Yamamoto, *Bot. Mag. (Tokyo)* 38: 209. 1924.

Small *epiphytic herbs* with short unbranched stems bearing distichous coriaceous leaves. *Leaves* articulated to a sheathing base, ligulate to elliptic-ligulate. *Inflorescence* patent or pendulous, lateral, abbreviated, densely few-flowered. *Flowers* small, membranous. *Sepals* subsimilar, free. *Petals* smaller than sepals, free. *Lip* immobile, weakly 3-lobed, fleshy, somewhat concave, shortly spurred or saccate at base. *Column* lacking a column-foot; pollinia two, waxy, globose, attached by a common stipe to a large viscidium.

A small genus of about 12 species, widespread from India and S.E. Asia eastward to Taiwan, N.E. Australia, and the S.W. Pacific islands. A single species is found in the Cook Islands and Niue.

***Tuberolabium papuanum*** (Schltr.) J.J. Wood ex B.A. Lewis & P.J. Cribb, *Orchids Vanuatu*: 150. 1989. Types: New Guinea, *Schlechter* 17166, 18975 (syntypes B†).

*Saccolabium papuanum* Schltr., *Repert. Spec. Nov. Regni Veg. Beih.* 1: 978 (1913). For full synonymy, see Kores (1991).

*Trachoma papuanum* (Schltr.) M.A. Clem., J.J. Wood & D.L. Jones, *Austral. Orchid Res.* 145 (1989).

*Trachoma societatas* (J.W. Moore) N. Hallé, *Orchidophile (Asnières)* 40: 1481. 1980.

Small *epiphytic herb* 2–5 cm in height, with terete stems completely covered by distichous leaf sheaths. *Leaves* very fleshy, ligulate to elliptic-ligulate, often somewhat falcate, 2.6–6 × 0.9–1.6 cm; sheaths striate, inflated. *Inflorescence* subdensely few-flowered, 0.8–1.5 cm long; peduncle 1–2 mm long; bracts deltoid, ca. 1.5 mm long. *Flowers* pale yellow. *Dorsal sepal* oblong-ovate to oblong-elliptic, 4.5–5.5 × 1.5–2.2 mm. *Lateral sepals* obliquely oblong-ovate, 4.5–5.5 × 2.5–3 mm. *Petals* oblong-ligulate, 4–5 × 1.5–2.2 mm. *Lip* closely appressed to column, somewhat concave, bilaterally compressed, 3.5–4 mm long; side lobes erect, broader than long; midlobe porrect, transversely ovate, very fleshy; spur subcylindrical, ca. 1.5 mm long. *Column* 1.2–2 mm long. No Fig. available.

DISTRIBUTION. Cook Islands (Rarotonga) and Niue. Also in New Guinea, Queensland, the Solomon Islands, Fiji, the Australs, and the Society Islands.

HABITAT. Occasional in forest on upper terrace; ca. 65–600 m.

COLLECTIONS. **Rarotonga:** *Cheeseman s.n.*; *Sykes* 2200, 2208; *Whistler* 5036; Wilder (published sight record). **Niue:** *Sykes* 287, 698, 880, *CHR* 150580; *Yuncker* 9929.

## 27. EULOPHIA

R. Br. ex Lindl., *Bot. Reg.* 8: t. 686. 1823.

*Terrestrial herbs* with small several-noded pseudobulbs. *Leaves* 2–several, erect or suberect, pleated. *Inflorescence* erect, densely to laxly few- to many-flowered, racemose. *Flowers* medium-sized, to large, often showy. *Sepals* and *petals* subsimilar, free. *Lip* usually 3- or 4-lobed, rarely entire, spurred at base, callus usually present. *Column* short to elongate, with a short foot; pollinia four, attached by a short stipe to a sickle-shaped viscidium.

A large genus of about 250 species, widespread from Africa south of the Sahara, Madagascar to tropical Asia, the Malay Archipelago, N.E. Australia, and the S.W. Pacific. Two species are found in Tonga, one of them also in Niue.

## KEY TO SPECIES

1. Flowers more or less white; lip entire or very obscurely 3-lobed ..... 1. *E. spectabilis*  
 1. Flowers more or less greenish or yellowish, striped with purple on lip; lip 4-lobed ..... 2. *E. pulchra*

1. *Eulophia spectabilis* (Dennst.) Suresh, D.H. Nicholson et al., Interpret. Van Rheede's Hort. Malab.: 300. 1988.

*Eulophia nuda* Lindl., Gen. Sp. Orchid. Pl. 180. 1833.

*Wolfia spectabilis* Dennst., Schlüssel Hort. Malab.: 38 (1818). Based upon Rheede's Hort. Malabar.: 11: 71, t. 36. 1692. For full synonymy, see Suresh reference.

Medium-sized *terrestrial herb* up to 75 cm in height. *Leaves* erect, 2 or more, plicate, elliptic-lanceolate, acuminate, up to 44 × 3–3.5 cm. *Inflorescence* erect, 28–80 cm long, 2–10-flowered; peduncle and rachis stout, up to 5 mm diameter. *Flowers* showy, probably self-pollinating, white to greenish white; pedicels ca. 2.5 cm long. *Sepals* lanceolate, acute, 2.2–2.5 cm long. *Petals* ovate, acute, 1.8–2 cm long. *Lip* ovate to oblong, entire, 1.8–2 × ca. 1 cm; spur broad, flattened, 2–3 mm long, recurved. *Capsule* nodding, ribbed. *Column* stout, clavate, 9–11 mm long, winged near the base. Fig. 62.

DISTRIBUTION. Tonga (Kao and Tofua). Widespread from India and Sri Lanka eastward to the S.W. Pacific to Yap, Fiji, and Tonga.

HABITAT. Uncommon in forests; near sea level to 80 m.

COLLECTIONS. **Kao:** *Buelow 2829*. **Tofua:** *Buelow 469*. **Without exact locality:** *Lister s.n.?*

2. *Eulophia pulchra* (Thouars) Lindl., Gen. Sp. Orchid. Pl.: 182. 1833. Type: Mauritius, *Thouars s.n.* (holotype P).

*Eulophidium pulchrum* (Thouars) Summerh., Bull. Jard. Bot. État 27: 400. 1957. See Lewis & Cribb (1989) for other relevant synonymy.

Medium-sized *terrestrial herb* up to 50 cm in height. *Pseudobulbs* cylindrical, 6–10 cm long, 2–3-leafed-leaved at apex. *Leaves* suberect, broad, plicate, elliptic, acuminate, 18–28 × 4.5–7 cm; petiole articulated in middle, up to 10 cm long. *Inflorescence* a terminal raceme 40–75 cm long. *Flowers* green and yellow with red stripes on lip. *Sepals* ovate, 8–10 mm long. *Petals* narrower, 7–9 mm long. *Lip* 4-lobed with a small basal, bilobed callus; spur short, globular, ca. 3 mm long. Fig. 63.

DISTRIBUTION. Tonga (Kao, Vava'u, and Late) and Niue. Widespread from tropical Africa and Madagascar eastward to S.E. Asia, the Malay Archipelago, and the S.W. Pacific islands eastward to Niue.

HABITAT. Uncommon to rare in forests and open places; near sea level to ca. 200 m.

COLLECTIONS. **Kao:** *Buelow 2830*. **Vava'u:** *Whistler 6572*. **Late:** *Buelow & Sykes 71*. **Niue:** *Sykes 378, 747*.

## 28. GEODORUM

Jackson, Bot. Repos. 10: t. 626. 1811.

*Terrestrial herbs* with short subterranean rhizomes and erect, partially subterranean, one-noded pseudobulbs, leafy at apex. *Leaves* few, pleated, articulated, petiolate, deciduous. *Inflorescence* basal, racemose, crozier-shaped at anthesis but straightening and elongating after fruit set, laxly to densely few- to many-flowered; rachis much shorter than peduncle. *Flowers* often showy, medium-sized, non-resupinate. *Sepals* and *petals* free, dissimilar, more or less connivent. *Lip* sessile, continuous with column-foot, subentire, saccate or ventricose at

base, with or without a callus. *Column* short, broad, with a foot; pollinia two, waxy, sulcate, attached by a short stipe to a distinct viscidium.

A genus of perhaps 10 species in subtropical and tropical Asia and S.E. Asia, Malesia, New Guinea, the Philippines, Micronesia, N.E. Australia, the Solomon Islands, Vanuatu, New Caledonia, Fiji, Tonga, Niue, and Samoa. A single species is found in Tonga and Niue.

***Geodorum densiflorum*** (Lam.) Schltr., Repert. Spec. Nov. Regni Veg. Beih. 4: 259. 1919. Type: based on *Rheede*, Hort. Ind. Malabar. 11: 69, t. 35, (1692).

*Cymbidium pictum* R.Br., Prodr. Fl. Nov. Holl.: 331. 1810. Type: Australia, *R. Brown 5507* (holotype BM!).

*Geodorum furcatum* sensu Kraenzl., Bot. Jahrb. Syst. 25: 60. 1898, non Lindl.

*Geodorum neocaledonicum* Kraenzl., Vierteljahrsschr. Naturf. Ges. Zürich 74: 82. 1929. Type: New Caledonia, *Daeniker 1384* (holotype Z!).

*Geodorum pacificum* Rolfe, Bull. Misc. Inform. Kew 1908: 71. 1908. Types: Tonga, *Vava'u, Crosby 246* (syntype K!); Solomon Islands, *Woodford s.n.* (syntype K!).

*Geodorum pictum* (R. Br.) Lindl., Gen. Sp. Orchid. Pl.: 175 (1833).

*Geodorum tricarinatum* Schltr., Repert. Spec. Nov. Regni Veg. 9: 101. 1911. Type: Samoa, *Savai'i, Vaupel 285* (holotype B†), *nom. nov. pro G. furcatum* Kraenzl., non Lindl.

*Limodorum densiflorum* Lam., Encycl. 3: 516. 1792.

*Terrestrial herb* 20–50 cm in height, with clustered, subglobose pseudobulbs 1.3–2.6 cm in diameter covered by scarious sheaths when young. *Leaves* 2–5, ovate to elliptic-ovate, acute or acuminate, 18–40 × 4.5–7 cm; petiole sheath-like, 6–18 cm long; the lowermost 2 sheath-like, acute. *Inflorescence* more or less as long as leaves; peduncle erect; rachis recurved; bracts linear lanceolate, 1–1.3 cm long. *Flowers* pale pinkish white to pale purple with reddish marks and yellow blotches on lip; ovary 5–9 mm long. *Sepals* oblong-obovate, abruptly acuminate, 10–12 × 3–3.5 mm. *Petals* oblong to oblong-elliptic, obtuse to subacute, 9.5–11 × 3.5–4.5 mm. *Lip* cymbiform, slightly constricted in middle, weakly bilobed at apex, saccate at base, 11–13 × 10–12 mm; callus a small transverse ridge at base and warts or keels in front. *Column* ca. 3 mm long; foot ca. 3 mm long. Fig. 64.

**DISTRIBUTION.** Tonga (Tongatapu, Ha'apai, Kao, Tofua, Vava'u, Niuafu'ou, Niuatoputapu, and Late) and Niue. Also found in southern China, Burma, India, Ceylon, the southern Ryukyu Islands, New Guinea, northern Australia, the Bismarck Archipelago, the Solomon Islands, Vanuatu, New Caledonia, Fiji, and Samoa.

**HABITAT.** Uncommon in grassy areas, fern communities, and lowland forest; near sea level to 40 m.

**COLLECTIONS.** **Tongatapu:** *Hotta 4099; USEE s.n.; Yuncker 15295.* **Ha'apai:** *Buelow 296, 304; Hurlimann 260; Whistler 6649; Yuncker 15863.* **Kao:** *Buelow 731, 3112; Whistler 10692.* **Tofua:** *Buelow 528, 529, 2613.* **Vava'u:** *Buelow 1648; Crosby 246; Whistler 6008; Yuncker 16051.* **Late:** *Buelow & Sykes 159; Hotta 4810.* **Niuafu'ou:** *Buelow 2114, 2167, 2220.* **Niuatoputapu:** *Whistler 6168.* **Niue:** *Sykes CHR 150576; Yuncker 10098.*

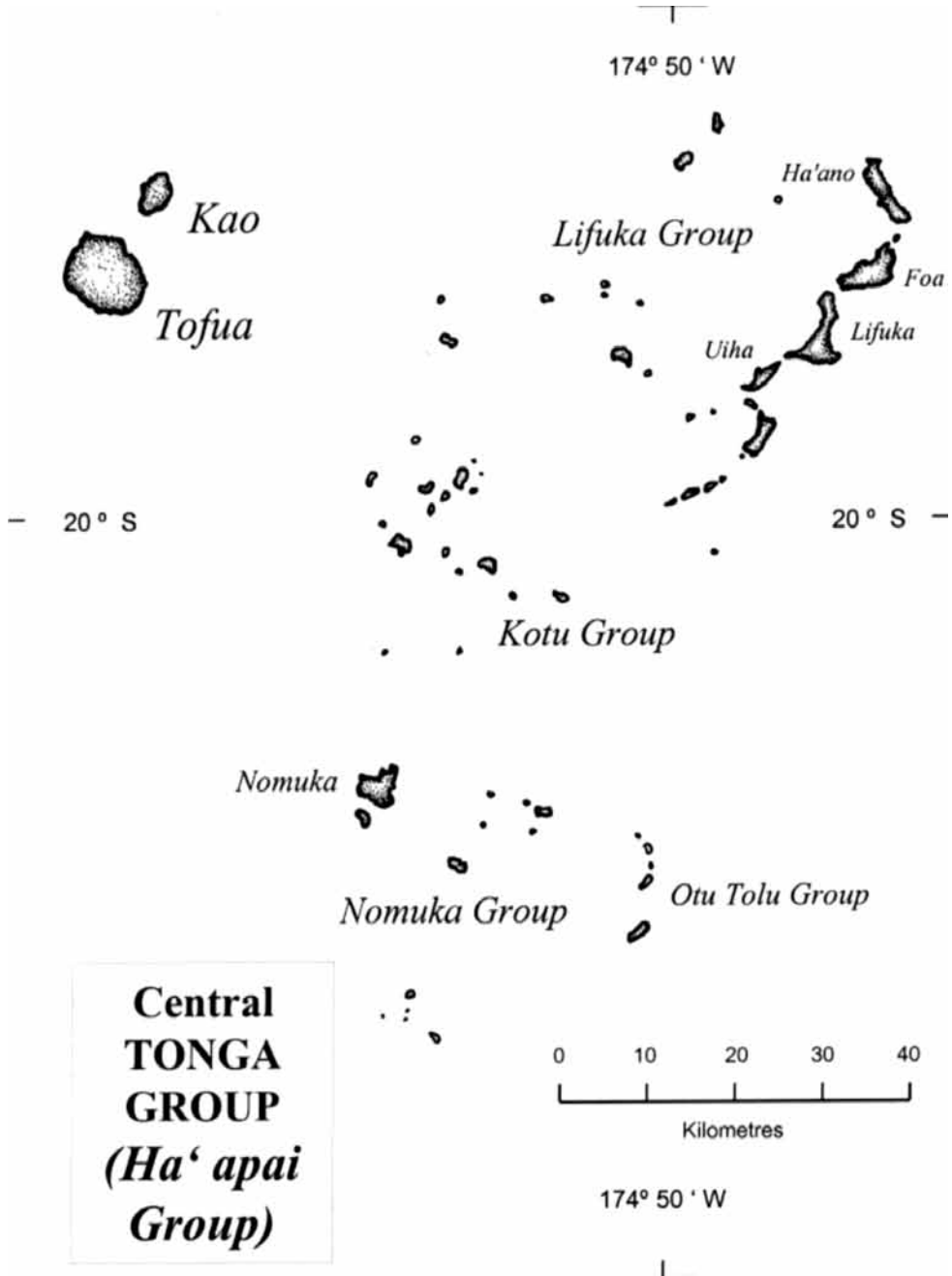


FIGURE 65. Map of central Tonga.



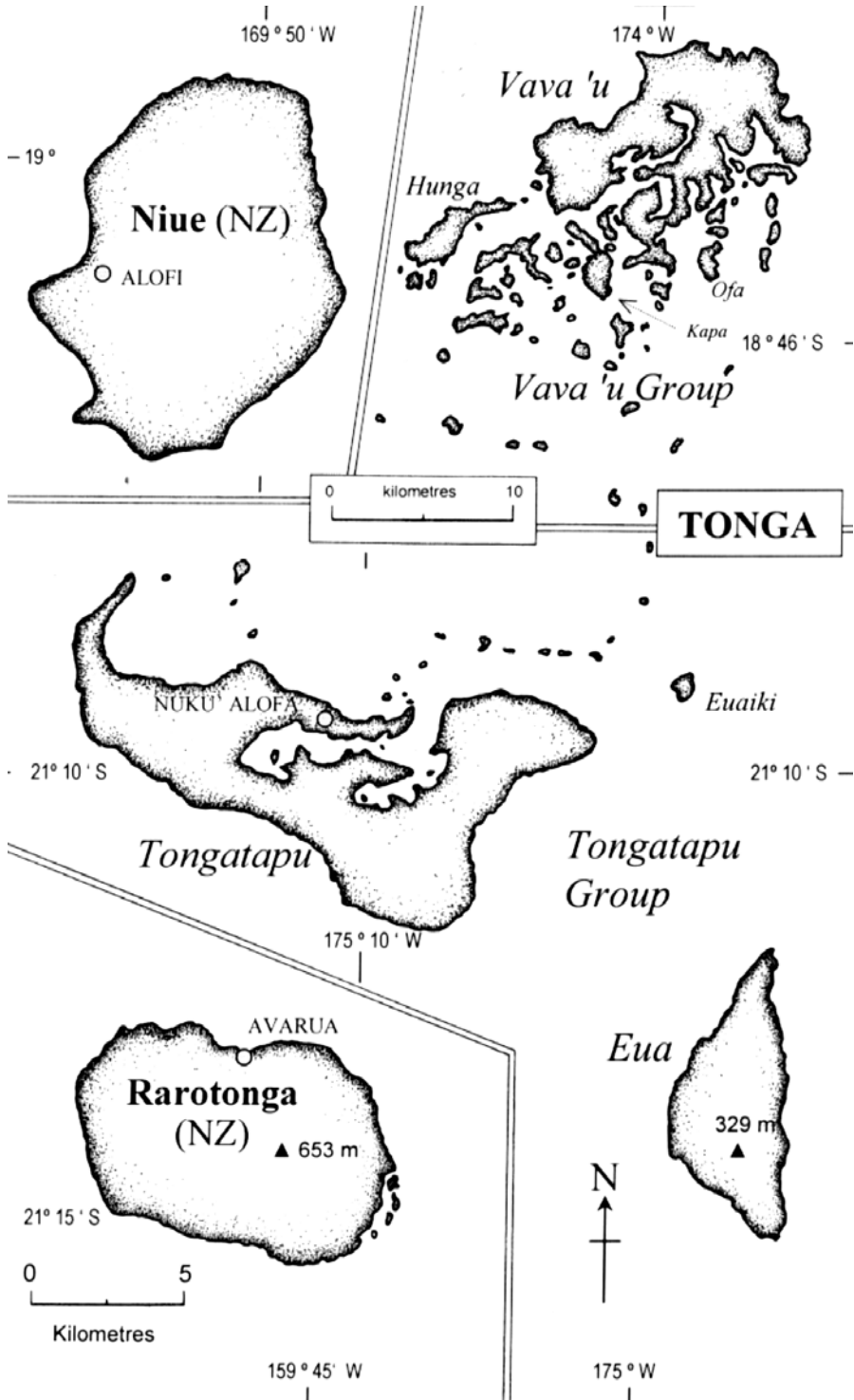


FIGURE 66. Map of Rarotonga, Tongatapu, Eua, Vava'u, and Niue.



FIGURE 67. *Habenaria amplifolia*. A – Plant habit. B – Flower from front. C – Flower from side. D – Column. E – Lateral sepal. F – Labellum without spur. G – Petal. H – Dorsal sepal. I – Column and ovary. J – Labellum with spur.

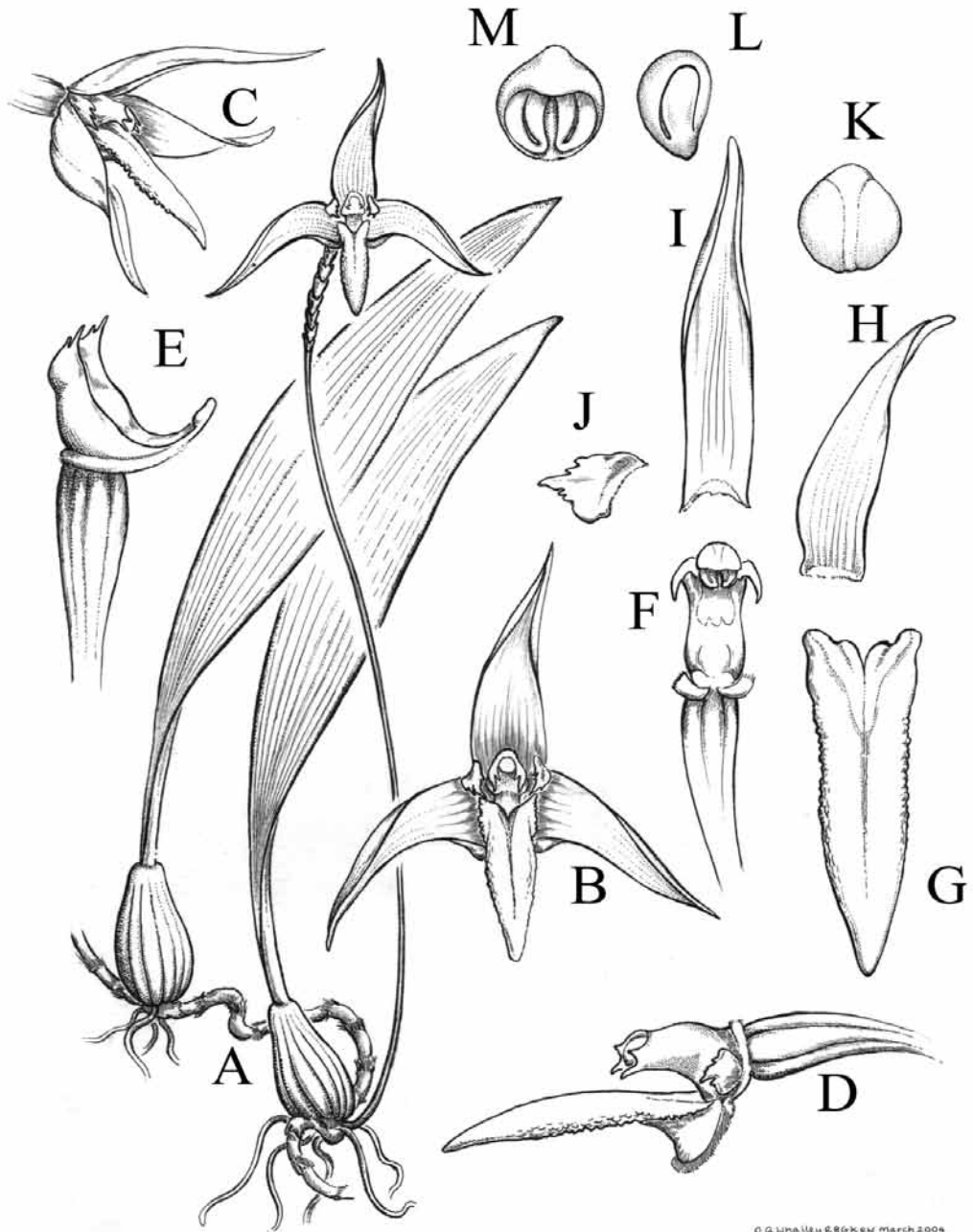


FIGURE 68. *Bulbophyllum longiscapum*. A – Plant habit. B – Flower from front. C – Flower from side. D – Flower with sepals removed, from side. E – Column and ovary with anther cap removed. F – Column and ovary from front. G – Labellum from above. H – Lateral sepal. I – Dorsal sepal. J – Petal. K – Top of anther cap. L – Pollinium from side. M – Anther cap (below) with pollinia in place.