

The orchids of Timor: checklist and conservation status

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A checklist of the Orchidaceae of Timor is presented, with emphasis on the eastern half of the island (East Timor), based on historical herbarium collections and recent botanical explorations. This list comprises 38 genera with 66 species, including 15 new genera and 32 new species records for this island. Moreover, four new species are described: *Bulbophyllum sundaicum*, *Habenaria ankylocentron*, *Habenaria cauda-porcelli*, and *Pterostylis timorensis*. Of these, we consider the finding of a new species of *Pterostylis* to be especially noteworthy, because this species seems to be more closely related to certain Australian members of the genus than to the Malesian ones, suggesting earlier contacts of Timor with Australia. Four new synonyms are proposed: *Calanthe veratrifolia* var. *timorensis* J.J.Sm. (*C. triplicata*), *Habenaria cornuta* Span. (*H. giriensis*), *H. grandis* Benth. ex Ridl. (*Peristylus goodyeroides*), and *H. mutica* Span. (*H. elongata*). The best represented genus is *Habenaria*, with 13 species, followed by *Dendrobium* with four, and *Bulbophyllum* with three. Because of insufficient or sterile material, it was not possible to identify, or describe as new, 20 different taxa. The conservation status of the ten endemic species, plus six possible new undescribed species and two non-endemic, but threatened, species, was assessed using the World Conservation Union (IUCN) criteria, and categories of threat were proposed. Seven endemic species are considered to be Critically Endangered, and two Endangered. One of the nonendemic species is considered to be Critically Endangered, and the other Endangered. The survival of some of these species might be less insecure if an effective application of Regulation project N.2000/19 on protected areas (UNTAET/REG/2000/19) was implemented and maintained, because most of these species were collected in areas considered for protection under this Regulation. Further studies are required, however, in order to complete our knowledge of the diversity and population dynamics of this interesting part of Timor's biodiversity. © 2008 The Linnean Society of London, *Botanical Journal of the Linnean Society*, 2008, 157, 197–215.

ADDITIONAL KEYWORDS: biodiversity – flora – Lesser Sunda Islands – Orchidaceae – South Malesia.

INTRODUCTION

The independence of East Timor has stimulated renewed scientific interest in the island of Timor. It has also raised a few questions: for example, to what extent has the 24 years of war and occupation affected the vegetation cover and its biodiversity. This paper constitutes the first contribution to answer this question as part of the objectives of the project, 'Contri-

bution to Flora Resources Management in East Timor', currently in progress at the Department of Biology of the University of Aveiro. Our account is based on data gathered from the literature, herbarium specimens, and new collections made during recent expeditions in the context of the above-mentioned project.

The Orchidaceae is one of the most diverse plant families with some 25 000 species (Hassler, 2001), and is of special conservation interest. All orchid species are included in Convention on International

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Trade in Endangered Species of Wild Fauna and Flora (CITES) (2005: Appendix I or II), and IUCN (2004) includes 150 orchid species.

The most important contribution to our knowledge of this family in Timor is a list by Ridley (1885), which includes 23 species, five of them new. There is no recent account of the family for the island, and a treatment for *Flora Malesiana* is not expected in the near future.

For these reasons, an annotated checklist of the Orchidaceae known to occur on Timor was prepared, also considering their conservation status and the question of their occurrence in the recently designated natural conservation areas [United Nations Transitional Authority in East Timor (UNTAET), 2000]. Because not all material could be completely identified, the exact number of orchid species occurring on Timor is still unknown, but there are at least 66 species in our checklist, and undoubtedly more remain to be discovered.

MATERIAL AND METHODS

The collections from Timor held at BM, COI, DNA, K, L, LISC, LISU, and Z were studied (abbreviations after Holmgren, Holmgren & Barnett, 1990). Recent collections kept at AVE and L (duplicates will shortly be offered to other herbaria, such as COI and LISC) were also examined.

The list of taxa includes basionyms, synonyms (limited for widespread taxa), and reference to types relevant for the area. New records for the area are preceded by an asterisk. Information on habit, habitat and ecology, distribution, conservation status, and vernacular names is also provided. The collections examined are cited, whereas those not seen but encountered in the literature are marked 'n.v.' Although this checklist is focused on the territory of East Timor, the collections and species known from West Timor (Indonesia) were also included because there are no significant ecological differences between the two areas. The original orthography of localities was generally respected and, in some cases, our interpretation is indicated in parentheses.

For the endemic taxa, categories of threat are proposed, applying the World Conservation Union (IUCN) Red List Category (IUCN, 2001). The assessments are based on herbarium specimens and the literature.

LIST OF TAXA

AERIDES LOUR.

Aerides timorana Miq., *Fl. Ind. Bat.* 3: 695 (1855) – Ridl. in *H.O.Forbes, Nat. Wand. East. Archip.* 518 (1885)

Aerides pallida Blume, *Rumphia*, 4: 53 (1849), *nom. illeg.* [not Roxb, not (Blume) Lindl.].

Habit: Probably epiphyte.

Habitat and ecology: Unknown.

Distribution: Endemic to Timor.

Collections: Timor: without further details, *Anonymous* 53 (holotype L!; isotype L!)

Conservation: Known only from the old type collection, collected before 1849 from an unspecified location, this endemic species might be extinct.

Proposed IUCN category: CR B1ab(i,ii,iii,iv). Although the island of Timor has an area of about 28 500 km² (Monk, Fretes & Reksodiharjo-Lilley, 1997), it is highly improbable that all subsequent collectors would have missed this species if it had an area of distribution greater than 100 km². Therefore, we estimate this area to be less than 100 km² (B1), it is known from a single (unspecified) location (a), and the available data indicate that a decline (b) in the extent of occurrence (i), area of occupancy (ii), quality of habitat (iii), and number of locations (iv) can be inferred for this species.

**Aerides odorata* Lour., *Fl. Cochinch.* 2: 525 (1790)

Habit: Epiphyte.

Habitat and ecology: On trees in savanna.

Distribution: India, southern China, and most of South-East Asia and Malesia, except New Guinea.

Collection: West Timor: Sao, Kapan, 10.i.1975. *Darnaedi* D613 (K!).

BULBOPHYLLUM THOUARS

**Bulbophyllum sundaicum* J.J. Verm. & Schuit., *sp. nov.* (Fig. 1)

A *Bulbophyllo* depresso King & Pantl. labelli lobis lateralibus margine anteriore lacerate fimbriato differt. Typus: *Paiva, Silveira & Sousa* T520 (holo AVE, iso L), from East Timor, Mt. Mundo Perdido, 16.ii.2005.

Description: Creeping epiphyte 1.5–3 cm high. Roots sprouting below the pseudobulb. Rhizome 1.2–1.5 mm in diameter, sections between pseudobulbs 0.9–1.5 cm long, bracts with few, barely persistent veins. Pseudobulbs 0.45–0.7 × 0.4–0.55 cm, distant, ovoid, somewhat oblique. Leaves: petiole 0.15–0.3 cm long; blade 1.3–2.2 × 0.6–0.8 cm, index (length/width) 2.2–3.6, elliptic(-ovate), finely acuminate. Inflorescence c. 1.2 cm long, one-flowered; peduncle c. 0.5 cm long, patent; non-floriferous bracts c. two, the longest c. 2 mm long; floral bract c. 2.2 mm long, tubular, acute. Flowers not fully opening. Sepals translucent very pale green towards the base, with a dark red spot along the mid-vein, green towards the tip, petals largely dark red, but with hyaline margins towards the base, lip dark red. Column white. Pedicel with

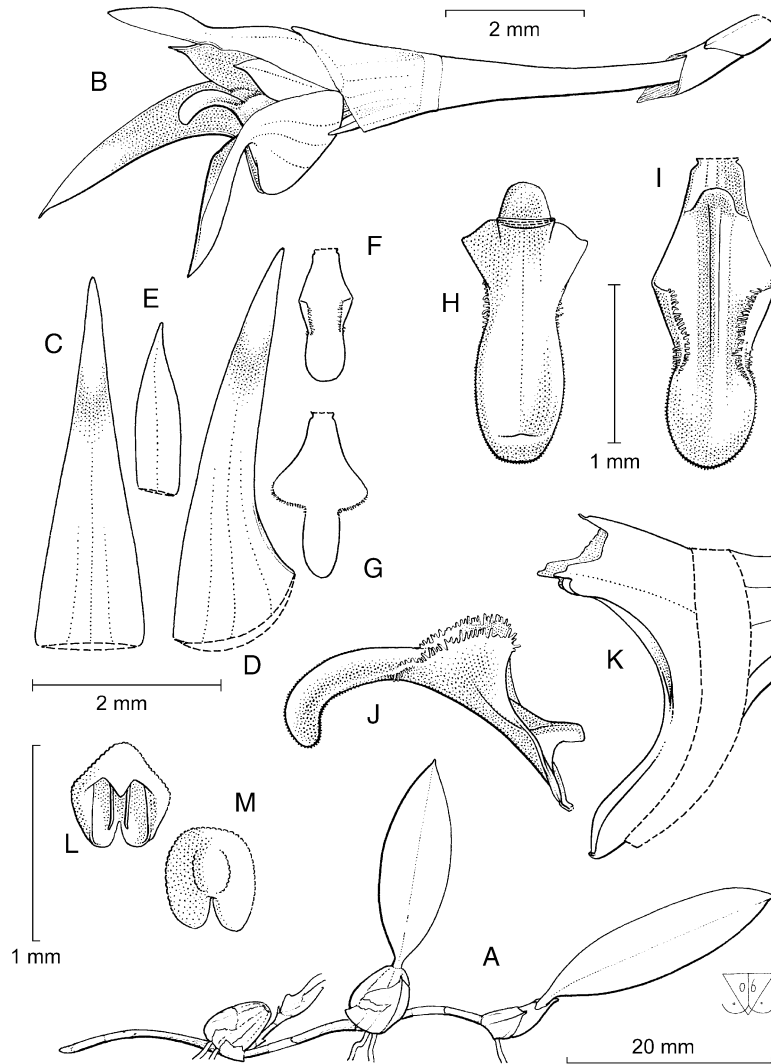


Figure 1. *Bulbophyllum sundaicum* J.J.Verm. & Schuit.: A, habit; B, flower; C, median sepal; D, lateral sepal; E, petal; F, lip; G, lip spread; H, lip, abaxial view; I, lip, adaxial view; J, lip, lateral view; K, column; L, anther, ventral side; M, anther, dorsal side. All drawn from Paiva, Silveira & Sousa T520 by J. J. Vermeulen.

ovary *c.* 1.5 mm long, basal node coinciding with the bract attachment. Median sepal 4.2–5.3 × 1.3–1.7 mm, index 3.1–3.3, ± porrect, triangular, acute, margins entire, base rather broadly attached; rather thin, thickened towards the tip, surface glabrous. Lateral sepals 4.8–6.2 × *c.* 2 mm, index 2.4–3.1, free, somewhat recurved, oblique; otherwise as the median sepal. Petals 2.5–2.6 × *c.* 0.8 mm, index 3.1–3.3, porrect, elliptic-ovate, acuminate, margins entire, base broadly attached; thin, surface glabrous. Lip *c.* 2 × 0.9 mm, index *c.* 2.2 (all without artificial spreading; when spread hastate, *c.* 2 × 1.4 mm), recurved, particularly towards the tip, general outline linguiform, three-lobed; mid-lobe ± elliptic, rounded, margins finely papillose, rather thick, adaxially with a distinct, obtuse, narrow median ridge starting near

the base as a retrorse, transverse, erect, triangular, rounded tooth, and continuing over about one-half of the total length of the lip, surface convex and finely papillose towards the tip, abaxially without a median ridge near the base, surface ± glabrous; side-lobes attached along the basal three-fifths of the length of the lip, antrorse, oblique, triangular, rounded, front margins finely fimbriate-lacerate, back margin entire; thin, surface glabrous. Column *c.* 1 mm long, stigma obovate, without keels inside, without teeth at its base, column foot slightly widened just above the ligament; stelia *c.* 0.3 mm long, triangular, acute, with a slight, deltoid, rounded tooth along the upper margin close to the tip, and a small, antrorse, semi-elliptic, rounded tooth along the lower margin slightly lower down; anther cap abaxially with a slight,

rounded crest, surface colliculate, front margin drawn out into a thin, triangular beak; pollinia not seen.

Habitat and ecology: Epiphytic on a small tree, shaded. Altitude 1280 m.

Distribution: Indonesia: Java [Gunung Ardjuno (Comber 1729, K!)]. East Timor.

Collections: East Timor: Viqueque, Mt. Mundo Perdido, 1280 m altitude, 16.ii.2005. *Paiva, Silveira & Sousa* T520 (AVE!, L!).

Notes: Most similar to *Bulbophyllum depressum* King & Pantl. (syn. *B. acutum* J.J. Sm.) in section *Hybochilus*; differs in the finely lacerate-fimbriate front margins of the lateral lobes of the lip.

Conservation: This species is known from only two collections, one from Java and the other from East Timor, where the conservation of its habitat, primary mountain forest, is crucial to safeguard its survival.

Proposed IUCN category: EN B1ab(i,ii,iii,iv). We estimate that the extent of occurrence of this species is less than 5000 km² (B1), it is known from less than five locations (a), and the available data indicate that a decline (b) in the extent of occurrence (i), area of occupancy (ii), quality of habitat (iii), and number of locations (iv) can be inferred for this species.

**Bulbophyllum cf. concinnum* Hook.f.

Habit: Epiphyte.

Habitat and ecology: In forest at about 1400 m.

Distribution: Thailand, Indochina, Peninsular Malaysia, Sumatra, Borneo, Timor.

Collections: West Timor: Bioba, west slope of Mount Timau, 1400 m altitude, 5.iii.1939, *Bloembergen* 3407 (K!, L!).

**Bulbophyllum sp. (section Aphanobulbon)*

Habit: Epiphyte.

Habitat and ecology: Montane forest at 1200–1470 m altitude.

Distribution: Not known.

Collections: East Timor: Mt. Mundo Perdido, c. 33 km south–south-west of Baucau, 28.ix.2006, *Pinto & Trainor* 100 (DNA, photo!).

**CADETIA* GAUDICH.

**Cadetia sp. (section Cadetia)*

Habit: Epiphyte.

Habitat and ecology: On primary, evergreen closed forest; clay soil over limestone; c. 600 m altitude.

Distribution: Not known.

Collections: East Timor: Mt. Paitxau Range, near Malahara, 2.iii.2006, *Cowie & Santana* 11201 (DNA, Photo!, fruiting).

CALADENIA R.BR.

Caladenia catenata (Sm.) Druce in *The Botanical Exchange Club & Society of the British Isles Report for 1916, Suppl. 2* (1917)

Arethusa catenata Sm., *Exot. Bot.* 2: 89, t. 104 (1804).

Caladenia javanica Bennett ex Ridl. in H.O.Forbes, *Nat. Wand. East. Archip.* 518 (1885).

Habit: Geophyte.

Habitat and ecology: Not recorded for Timor.

Distribution: Java, Sulawesi, Timor, Australia, and New Caledonia.

Collections: East Timor: Saluki, 22–26.iv.1883, *Forbes* 3516 (BM!).

CALANTHE R.BR.

Calanthe triplicata (Willemet) Ames, *Philipp. J. Sci., C 2:* 326 (1907)

Orchis triplicata Willemet, *Ann. Bot. (Usteri)* 18: 52 (1796).

Calanthe veratrifolia (Willd.) R.Br. ex Ker Gawl., *Bot. Reg.* 9: t. 720 (1823).

Calanthe veratrifolia var. *timorensis* J.J.Sm, *Repert. Spec. Nov. Regni Veg.* 36: 110 (1934), syn. nov.

Vernacular: Lietè.

Habit: Terrestrial herb.

Habitat and ecology: In Timor it has been collected in mixed moist forest from 900 to 1600 m.

Distribution: From Madagascar, India, Sri Lanka, tropical Asia, China, Japan, Malesia, Australia, Pacific Islands east to the Marquesas.

Collections: West Timor: Kapan, 900 m altitude, 14.iii.1939, *Bloembergen* 3475 (L!); loc. cit., 950 m altitude, 10.ii.1929, *Walsh* 900 (holotype *C. veratrifolia* var. *timorensis* J.J.Sm, L!); East Timor: Mt. Perdido (ascent of Ossu), 1600 m altitude, 23.xii.1953, *van Steenis* 18260 (BM!, LISC!, L!); Mt. Paitxau Range, near Malahara, 1.iii.2006, *Cowie* 11054 (DNA, photo!).

**COELOGYNE* LINDL.

**Coelogyne sp. (section Tomentosae)*

Habit: Probably epiphyte.

Habitat and ecology: In *Eucalyptus* savanna, c. 1200 m elevation.

Distribution: Not known.

Collections: West Timor: Fatu Monas, between Lelogama and Bioba, c. 1200 m, 11.vii.1981, *Kartawinata* 1716 (L!, sterile).

**CREPIDIUM* BLUME

**Crepidium* sp. A (section *Crepidium*)

Habit: Terrestrial.

Habitat and ecology: In montane forest.

Distribution: Not known.

Collections: East Timor: Viqueque, Mt. Mundo Perdido, 16.ii.2005, *Paiva, Silveira & Sousa* T548 (AVE!, L!).

Observations: In the vegetative parts, this resembles a large specimen of *C. ophrydis* (J.Koenig) M.A.Clem. & D.L.Jones; the flowers, however, are typical for section *Crepidium*.

**Crepidium* sp. B (section *Hololobos*)

Habit: Terrestrial.

Habitat and ecology: On limestone outcrops in primary closed montane forest, c. 600 m.

Distribution: Not known.

Collections: East Timor: Mt. Paitxau Range, near Malahara, 28.ii.2006, *Cowie* 11013 (CANB, DNA, L!).

Observations: The flowers are similar to those of *C. junghuhnii* (J.J.Sm.) Szlach., but the Timor specimen has much broader leaves than is usual for this species.

DENDROBIUM SW.

Dendrobium affine (Decne.) Steud., *Nomencl. Bot.*, ed. 2, 1: 489 (1840). – *Ridl. in H.O.Forbes, Natur. Wand. East. Archip.* 518 (1885)

Onychium affine Decne. in *Nouv. Ann. Mus. Par.* 3: 365 (1834) – Decne., *Herb. Timor. Descriptio*: 37 (1835).

Dendrobium urvillei Finet, *Bull. Soc. Bot. France* 50: 372 (1903).

Vappodes affinis (Decne.) M.A.Clem. & D.L.Jones, *Orchadian* 13: 492 (2002).

Habit: Epiphyte.

Habitat and ecology: Not recorded for Timor.

Distribution: Lesser Sunda Islands, Maluku, north Australia, New Guinea.

Collections: Timor: location unknown, 1801 or 1803, *Guichenot* s.n. (P); West Timor: Coupang, 1841, *Guillou* 40 & 41 (syntypes of *D. urvillei* Finet, P).

Conservation: Probably very rare in Timor, if not extinct.

Dendrobium calophyllum Rchb.f., *Xenia Orchid.* 2: 167 (1870). – *Ridl. in H.O.Forbes, Natur. Wand. East. Archip.* 518 (1885) – *P.J.Cribb in Kew Bull.* 41: 678 (1986)

Durabaculum calophyllum (Rchb.f.) M.A.Clem. & D.L.Jones, *Orchadian* 13: 487 (2002).

Habit: Epiphyte.

Habitat and ecology: Not recorded for Timor, c. 500 m elevation.

Distribution: ?Java (Kangean Arch.), Lesser Sunda Islands, and ?Maluku.

Collections: West Timor: Tubuleu – Bila, c. 500 m altitude, 26.viii.1968, *Kooy* 496 (L!).

**Dendrobium faciferum* J.J.Sm., *Bull. Dép. Agric. Indes Néerl.* 15: 10 (1908)

Ceraia facifera (J.J.Sm.) M.A.Clem., *Telopea* 10: 291 (2003).

Habit: Epiphyte on *Nauclea orientalis* trunk.

Habitat and ecology: In *Nauclea* woodland, on river floodplain and upper lake margin, at c. 350 m altitude.

Distribution: Lesser Sunda Islands, Sulawesi, Maluku.

Collections: East Timor: near Ira Siquero River, Mehara area, near Los Palos, 4.x.2005, *Cowie & Xavier* 10793 (DNA, photo!).

Dendrobium macrophyllum A.Rich. in *J.C.S. Dumont d'Urville, Voy. Astrolabe* 2: 22 (1834).

– *Ridl. in H.O.Forbes, Natur. Wand. East. Archip.* 518 (1885)

Sayeria macrophylla (A.Rich.) Rauschert, *Feddes Repert.* 94: 467 (1983).

Habit: Epiphyte.

Habitat and ecology: In primary forest up to c. 1280 m altitude.

Distribution: From Java to Samoa (not known from Australia).

Collections: East Timor: Kailakuk (prob. Cailaco), 26–28.iv.1883, *Forbes* 3761 (BM!, L!); Mt. Mundo Perdido, 1280 m altitude, 16.ii.2005, *Paiva, Silveira & Sousa* T553 (AVE!, L!); Mt. Paitxau Range, near Malahara, 1.iii.2006, *Cowie* 11042 (DNA, photo!).

**DIDYMOPLEXIS* GRIFF.

**Didymoplexis pallens* Griff., *Calcutta J. Nat. Hist.* 4: (383), fig. 17(b): 1–8 (1844)

Habit: Holomycotrophic terrestrial herb.

Habitat and ecology: Savanna woodland with bamboo, at c. 350 m elevation.

Distribution: India, South-East Asia, Malesia, Australia, east to Vanuatu.

Collections: East Timor: Lautem, Muapitine, c. 350 m altitude, 19.xii.1953, *van Steenis* 18178 (BM!, L!).

DIURIS SM.

Diuris fryana Ridl. in *H.O.Forbes, Nat. Wand. East. Archip.* 519 (1885)

Habit: Geophyte.

Habitat and ecology: Probably mountain grassland, c. 1000–2000 m above sea-level.

Distribution: Endemic to Timor.

Collections: East Timor: Kelehoko, near Erlura (prob. Orlora), 31.iii.1883, *Forbes* 3500 (BM!), 3508 (BM!, L not located, LISU!); Huato-Builico, undated (prob. 1962), *Cinatti* II.47 (LISC!); West Timor: Mt. Moetis, 1645 m a.s.l., 26.v.1929, *Walsh* 335 (BM!).

Conservation: As an endemic of the montane parts of Timor island, this species seems to deserve special conservation measures. Like *Pterostylis timorensis*, this is a species of Australian affinity.

Proposed IUCN category: EN B1ab(i,ii,iii,iv). Considering that the highest parts of the Timorese mountains occupy less than 5000 km², and that the species has not been found during a recent expedition to the Huato-Builico area conducted by some of the authors, we estimate that the extent of occurrence of this species is less than 5000 km² (B1), it is known from less than five locations (a), and the available data indicate that a decline (b) in the extent of occurrence (i), area of occupancy (ii), quality of habitat (iii), and number of locations (iv) can be inferred for this species.

**ERIA* LINDL.

Note: Molecular studies strongly suggest that the two species listed below do not belong to the genus *Eria* in the strict sense (Pridgeon *et al.*, 2005). However, we are not convinced, for reasons which lie outside the scope of this article, that the proposed disposition in the genera *Bryobium* and *Mycaranthes*, respectively, represents the best possible classification.

**Eria retusa* (Blume) *Rchb.f., Bonplandia* 5: 54 (1857)

Dendrolirium retusum Blume, *Bijdr.* 351 (1825).

Bryobium retusum (Blume) Y.P.Ng & P.J.Cribb, *Orchid Rev.* 113: 272 (2005).

Habit: Lithophyte.

Habitat and ecology: On naked limestone rocks on mountain summit at 1750 m; also epiphytic in

primary evergreen montane closed forest on limestone scree at 850 m altitude.

Distribution: Java, Borneo, Sulawesi, Timor, New Guinea, Christmas Island, Bima, Australia, Solomon Islands, New Caledonia.

Collections: East Timor: Viqueque, Mt. Perdido, ascent of Ossu, 23.xii.1953, *van Steenis* 18314 (L!, LISC!); Mt. Paitxau Range, near Malahara, 1.iii.2006, *Cowie* 11053 (DNA, L!).

**Eria oblitterata* (Blume) *Rchb.f., Bonplandia* 5: 55 (1857)

Mycaranthes oblitterata Blume, *Bijdr.* 353 (1825).

Habit: Epiphyte.

Habitat and ecology: In montane forest.

Distribution: Thailand, Indochina, Peninsular Malaysia, Sumatra, Java, Borneo, Bali, Timor.

Collections: East Timor: Viqueque, Mt. Mundo Perdido, c. 1280 m altitude, 16.ii.2005, *Paiva, Silveira & Sousa* T530a (AVE!).

EULOPHIA R.BR. EX LINDL.

Eulophia bicolor Blume, *Coll. Orchid.* 151 (1859)

Cyrtopodium bicolor (Blume) Ridl. in *Journ. Linn. Soc.* 21: 472 (1885).

Cyrtopera bicolor (Blume) Ridl. in *H.O.Forbes, Natur. Wand. East. Archip.* 518 (1885).

Habit: Terrestrial herb.

Habitat and ecology: Collected in East Timor on brown limestone soil at 350 m.

Distribution: Timor, Sulawesi.

Collections: Timor: without further data, *Zippelius* s.n. (holotype L!); East Timor: Baucau, 350 m, 17.xii.1954, *van Steenis* 18586 (L!).

FLICKINGERIA A.D.HAWKES

Flickingeria grandiflora (Blume) A.D.Hawkes in *Orch. Weekly* 2: 455 (1961)

Desmotrichum grandiflorum Blume, *Bijdr.* 331 (1825).

Dendrobium grandiflorum (Blume) Lindl., *Gen. Sp. Orchid. Pl.* 77 (1830), *nom. illeg.* (not H.B. & K., 1815; not Sw., 1829) – Ridl. in *H.O.Forbes, Natur. Wand. East. Archip.* 518 (1885).

Habit: Epiphyte.

Habitat and ecology: Montane forest.

Distribution: Java, Sumatra, and Timor.

Collections: East Timor: Samoro, Sobale Mount, iv–v.1883, *Forbes* 3820 (BM, n.v.).

Flickingeria sp.

Habit: Epiphyte.

Habitat: Not recorded.

Distribution: Not known.

Collections: East Timor: Baucau, Mate-Bian, 9.ix.1962, *Cinatti* iv.291 (L!, LISC!, both sterile).

Observations: Possibly *F. grandiflora*.

**GEODORUM* JACKS.

**Geodorum densiflorum* (Lam.) Schltr., *Repert. Spec. Nov. Regni Veg. Beih.* 4: 259 (1919)

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

Habit: Geophyte.

Habitat and ecology: Not recorded for Timor.

Distribution: South-East Asia, Malesia, Australia, east to Tonga and Niue.

Collections: Timor: without further data, Zippelius s.n. (L!); West Timor: Supul, 20.ii.1969, *Kooy* 645 (L!).

GOODYERA R.BR.

Goodyera bifida (Blume) Blume, *Coll. Orchid.* 40 (1858). – *Smith in Bull. Jard. Bot. Buitenzorg, sér.* 3, 14: 162 (1937)

Neottia bifida Blume, *Bijdr.* 408 (1825).

Habit: Terrestrial herb.

Habitat and ecology: Mountain summit, c. 2365 m.

Distribution: Peninsular Malaysia, Sumatra, Java, Borneo, Sulawesi, Flores, and Timor.

Collections: West Timor: highest top of G. Moetis, 26.v.1929, *Walsh* 340 (BM, BO, n.v.).

**GROSOURDYA* RCHB.F.

**Grosourdyia* sp.

Habit: Epiphyte.

Habitat and ecology: In primary, evergreen montane closed forest, at c. 830 m above sea-level.

Distribution: Unknown.

Collections: East Timor: Mt. Paitxau Range, near Malahara, 1.iii.2006, *Cowie* 11056 (DNA, photo!, specimen with small buds).

HABENARIA WILLD.

**Habenaria ankylocentron* Schuit. & J.J.Verm., *sp. nov.* (Fig. 2)

A *Habenariae* carinatae Span. calcare unciniformi differt. Typus: *Paiva, Silveira & Sousa* T514 (holo

AVE, iso L), from East Timor, Mt. Mundo Perdido, 16.ii.2005.

Description: Erect terrestrial herb c. 17 cm high. Subterranean tubers 2 at flowering time, narrowly oblongoid, 1.8 × 0.6 cm, tomentose to pilose. Roots few, apparently very short, tomentose. Stem (excluding inflorescence) very short; subterranean part 3.5 cm long, covered with c. three tubular sheaths, epigeal part abbreviated, two-leaved. Leaves 12.5–13.5 × 1.7–2.7 cm, basal, suberect, narrowly elliptic, attenuate towards the base, apex acuminate, glabrous, when dried membranous. Inflorescence c. eight-flowered; peduncle 8 cm long, near the middle with a foliaceous, sheathing scale 4.3 × 0.45 cm, just below the rachis with a much smaller bract-like scale; rachis 4.8 cm long. Floral bracts suberect-patent, a little shorter than the ovaries, narrowly triangular, acuminate, the lowermost bract 1.4 cm long, the upper ones progressively shorter. Flowers patent, quaquaversal, white. Median sepal 4.4 × 2.7 mm, erect, concave, ovate, obtuse, nerves 3. Lateral sepals 4.6 × 2.9 mm, reflexed, obliquely broadly ovate, obtuse, nerves 3. Petals 4.6 × 2.5 mm, entire, obliquely ligulate-elliptic, nerves 2. Lip spurred, three-lobed, 5.7 mm long excluding the spur, 9.8 mm wide across the tips of the lateral lobes, with a smooth, thick, rounded longitudinal keel extending from the mouth of the spur to near the tip of the mid-lobe, the lobes with minutely papillose margins; lateral lobes 4.5 × 2.2 mm, subpatent-deflexed, when flattened making an acute angle with the mid-lobe, obliquely narrowly rectangular, apex subtruncate; mid-lobe 3.9 × 1.9 mm, narrowly obovate, obtuse, apical margin slightly irregular; spur pointing backwards, basal part 7.1 mm long, 1.6 mm wide at the mouth, parallel with and distinctly shorter than the ovary, gradually narrowing towards the apex, terminal part 2.3 mm long, abruptly bent forwards, inflated, obliquely pyriform, obtuse, spur constricted between the two parts and with a slight obtuse apical projection formed by the continuation of the basal part. Column 2.2 × 3.2 mm, erect; auricles 1.3 mm long, narrowly cylindrical, finely verrucose; thecae widely separated, 0.9 mm long; anther channels very short; rostellum hood-like, rounded-triangular, slightly emarginate; stigmatic processes porrect, decurved at the apex, 1.5 mm long, obtuse. Ovary with pedicel to 1.5 cm long, terete, attenuate towards the apex; pedicel very short. Fruit not seen.

Habit: Geophyte.

Habitat and ecology: Found as a lithophyte, presumably rooting in soil deposits in crevices or on the rock face, on limestone.

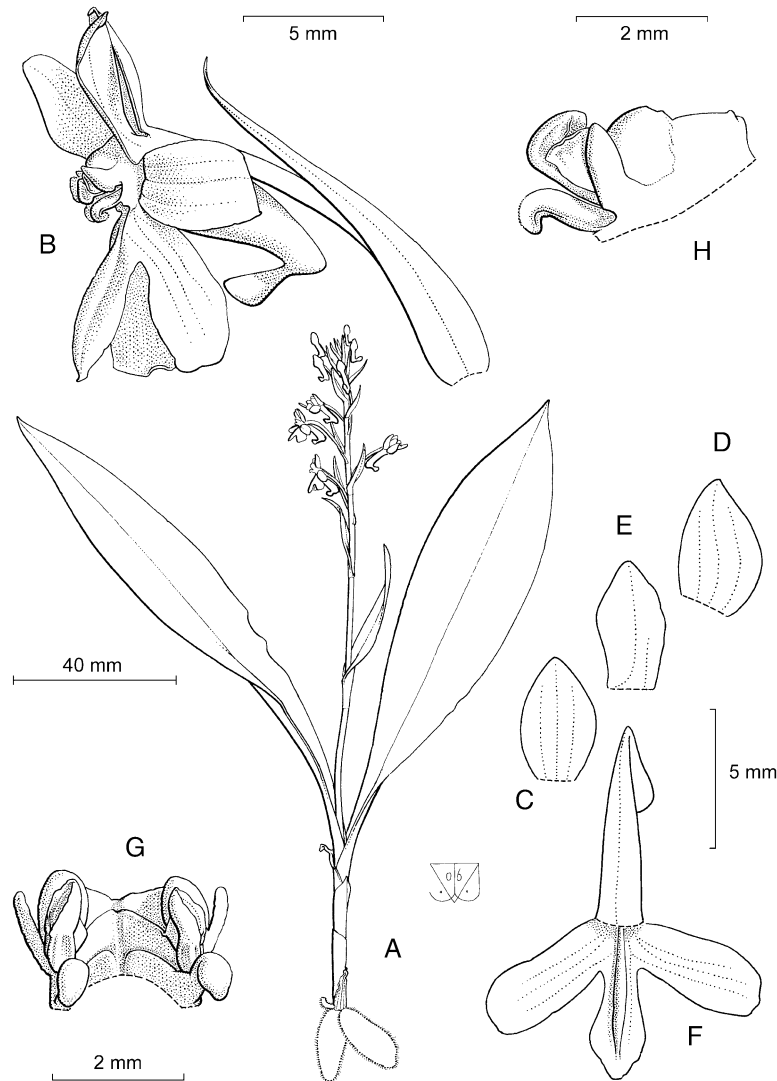


Figure 2. *Habenaria ankylocentron* Schuit. & J.J.Verm.: A, habit; B, flower; C, median sepal; D, lateral sepal; E, petal; F, lip; G, column, frontal view; H, column, lateral view. All drawn from Paiva, Silveira & Sousa T514 by J. J. Vermeulen.

Distribution: Endemic to East Timor. Only known from the type collection.

Collections: East Timor: Viqueque, Mt. Mundo Perdido, 16.ii.2005, Paiva, Silveira & Sousa T514 (AVE!, L!).

Observations: This species is very distinctive because of the remarkable hooked spur. The presence of a keel on the lip is also highly unusual in the genus (even in the subtribe), but in this character state, and indeed in most other respects, *H. ankylocentron* agrees with *H. carinata* Span. The latter has the slender clavate spur commonly observed in *Habenaria*.

Conservation: This recently discovered species seems to deserve special conservation measures because of its inferred rarity and its threatened habitat.

Proposed IUCN category: CR B1ab(i,ii,iii,iv). We estimate the extent of occurrence to be less than 100 km² (B1), it is known from a single location (a), and the available data indicate that a decline (b) in the extent of occurrence (i), area of occupancy (ii), quality of habitat (iii), and number of locations (iv) can be inferred for this species.

Habenaria carinata Span. in *Linnaea* 15: 478 (1841)

Habit: Geophyte.

Habitat and ecology: Not recorded for Timor.

Distribution: Lesser Sunda Islands (Timor, Flores, Lombok).

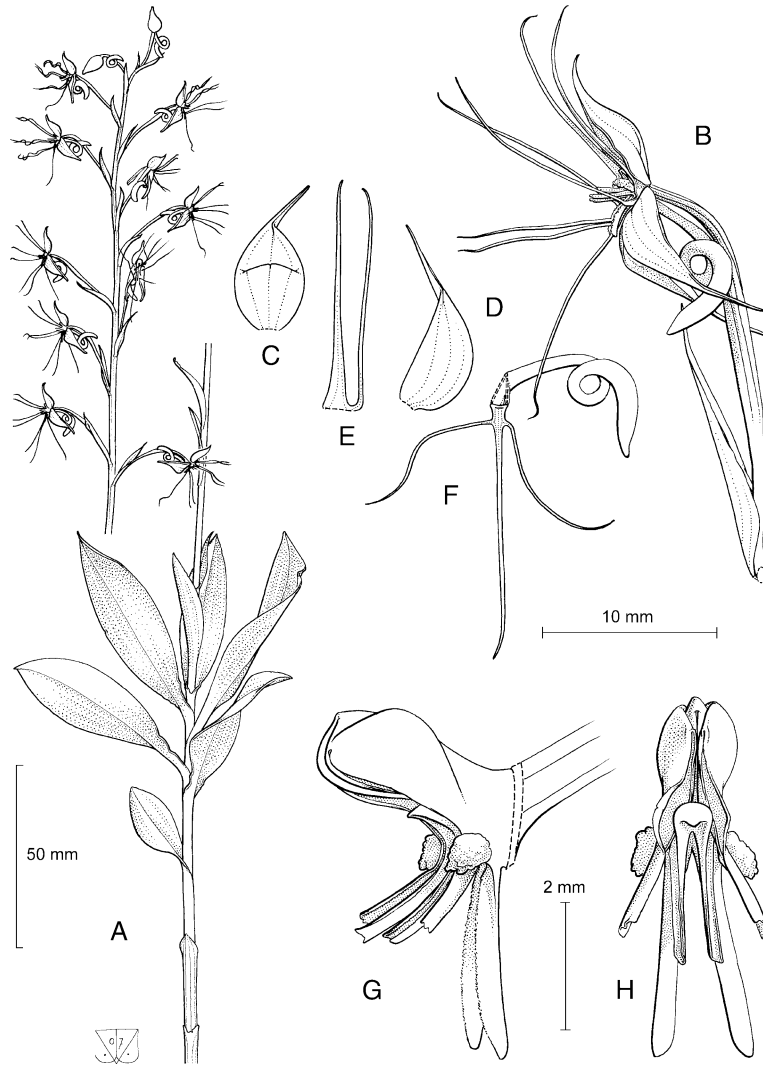


Figure 3. *Habenaria cauda-porcelli* Schuit. & J.J.Verm.: A, habit; B, flower; C, median sepal; D, lateral sepal; E, petal; F, lip; G, column, lateral view; H, column, frontal view. All drawn from *Kooy 178* by J. J. Vermeulen.

Collections: Timor: without further data, *Spanoghe* s.n. (holotype, L!; isotype L!).

Conservation: In Timor, only known from the type collection collected between 1831 and 1836; therefore, probably a very rare or even extinct taxon here.

Observations: Previously only recorded from the type collection. Specimens from Flores (*Schmutz 4741*, L!) and Lombok (*de Wilde & de Wilde-Duyffjes 21941*, L!) proved to belong to this species, and hence represent new records for these two islands. The Lombok collection is the only one with notes on colour and habitat. It is described as a white-flowered species growing on steep slopes on loamy soil near a river at 200 m elevation in a damp, shaded site.

**Habenaria cauda-porcelli* Schuit. & J.J.Verm., *sp. nov.* (Fig. 3)

A *Habenariae salaccensi* Blume petalae lobis subaequalibus, calcare distincte clavato in medio cum laqueo completo (*porcelli caudae similis*), antherae canalibus stigmatis lobis brevioribus differt. *Typus:* *Kooy 178* (holo L), from south-west Timor, Putain, 29.vi.1964.

Description: Erect terrestrial herb 26–34 cm high. Subterranean tubers and roots not seen. Stem (excluding inflorescence) somewhat elongated; subterranean part up to 9.5 cm long, covered with *c.* five tubular sheaths, epigeal part densely six- to seven-leaved, *c.* 5.5 cm long. Leaves 4.5–7 × 1.5–1.8 cm, patent-erect, elliptic, lowermost and uppermost leaf

much smaller, attenuate towards the base, margins finely undulate, apex acute, apiculate, glabrous, when dried membranous. Inflorescence rather laxly c. 12-flowered; peduncle 7.5–12 cm long, in the basal part with two sheathing, 3–4 cm long, foliaceous, acuminate scales, upwards with two or three much narrower bract-like scales; rachis 11–13 cm long. Floral bracts suberect-patent, somewhat shorter than the ovaries, narrowly triangular, acuminate-aristate, the lowermost bract 1.6 cm long, the upper ones progressively shorter. Flowers patent, quaquaversal, colours not recorded. Median sepal 5.9×4 mm, suberect, concave, broadly ovate, obtuse, apex drawn out in a 3.1 mm long subulate-filiform tip, nerves 3. Lateral sepals 6.5×3.3 mm, reflexed, obliquely ovate, obtuse, apex drawn out in a 4.4 mm long subulate-filiform tip, nerves 3. Petals 1.3 cm long, 2.3 mm wide at the base, bipartite, the segments almost equally long, filiform, straight, the dorsal segment widening towards the base. Lip spurred, three-lobed, 1.6 cm long excluding the spur, at the base with a 0.8 mm long claw; lateral lobes 9 mm long, filiform; mid-lobe 1.47 cm long, filiform; spur in natural position about 7 mm long, 1.1 mm wide in the thickest part, when straightened 1.7 cm long, pointing backwards, clavate, obtuse, with a complete 360° loop near the middle. Column 3.2×1.3 mm, suberect; auricles 0.8 mm long, irregular oblongoid, finely verrucose; thecae 1.8 mm long, close together; anther channels 1.9 mm long, much elongated, truncate, processes of the thecae slightly shorter, 1.8 mm long, divergent, not covering the anther channels, obliquely truncate; rostellum hood-like, rounded; stigmatic processes 3.5 mm long, pointing downwards, straight, obtuse, finely papillose-pubescent. Pedicel with ovary to 2.5 cm long, terete, attenuate towards the apex; pedicel slender. Fruit not seen.

Habit: Geophyte.

Habitat and ecology: Terrestrial in forest, locally common, altitude 200 m.

Distribution: Endemic to south-west Timor, Putain. Only known from the type collection.

Collections: West Timor: Putain, 29.vi.1964, Kooy 178 (L!).

Observations: This species is similar to *H. salaccensis* Blume. The latter is a much more robust plant with strongly unequal petal lobes, anther channels almost as long as the stigma lobes, and an almost straight, only slightly clavate spur. The curious loop in the spur induced us to apply the epithet '*cauda-porcelli*': piglet's tail.

Conservation: Known only from the type collection, this species seems to deserve special conservation measures because of its inferred rarity and its threatened habitat: forest at low altitudes, and thus subject to high human pressure.

Proposed IUCN category: CR B1ab(i,ii,iii,iv). We estimate the extent of occurrence to be less than 100 km² (B1), it is known from a single location (a), and the available data indicate that a decline (b) in the extent of occurrence (i), area of occupancy (ii), quality of habitat (iii), and number of locations (iv) can be inferred for this species.

Habenaria elongata R.Br., *Prodr.* 313 (1810)

Habenaria mutica Span. in *Linnaea* 15: 477 (1841), syn. nov. – J.J.Sm., *Bull. Jard. Bot. Buitenzorg*, sér. 3, 14: 160 (1937).

Habit: Geophyte.

Habitat and ecology: On limestone, 600–950 m.

Distribution: Timor, New Guinea, Australia.

Collections: Timor: without further data, *Spanoghe* s.n. (holotype L!; isotype L!); West Timor: Kapan, 6.i.1929, *Walsh* 31 (BM!); Manumuti, 600 m altitude, 2.iii.1969, *Kooy* 644 (L!).

Observations: *Kooy* 644 differs from the type of *H. mutica* in that the petals are provided with a small marginal tooth (as also occurs in specimens from Australia); in other respects, we did not find significant differences. *Habenaria elongata* is the oldest name for this entity.

Habenaria giriensis J.J.Sm., *Bull. Jard. Bot.*

Buitenzorg, sér. 3, 9: 28 (1927). – *Comber, Orchids*

Java: 63 (1990)

Habenaria cornuta Span., *Linnaea* 15: 478 (1841), *nom. illeg.* (not Lindl., 1836), syn. nov.

Habit: Geophyte.

Habitat and ecology: Not recorded for Timor.

Distribution: Java, Timor.

Collections: Timor: no further data, *Spanoghe* s.n. (holotype of *H. cornuta*, L!; isotype of *H. cornuta*, L!)

Observations: This is a member of the *H. digitata* Lindl. species complex, of which it may ultimately prove to be a synonym. Kraenzlin labelled the holotype specimen of *H. cornuta* Span. as *H. trinervia* Wight, which is now considered a synonym of *H. digitata*. *Spanoghe* wrongly described the lip as being five-lobed, evidently mistaking the lower lobe of the bipartite petals for a lobe of the lip.

Conservation: In Timor, only known from the type collection of *H. cornuta* Span. collected between 1831 and 1836; hence, it is probably a very rare or even extinct taxon here. Apparently also extinct in Java (*Comber*, 1990).

Proposed IUCN category: CR B1ab(i,ii,iii,iv). We estimate the extent of occurrence to be less than 100 km² (B1), it is severely fragmented (a), and the available data indicate that a decline (b) in the extent of occur-

rence (i), area of occupancy (ii), quality of habitat (iii), and number of locations (iv) can be inferred for this species.

**Habenaria malintana* (Blanco) Merr., *Sp.*

Blancoan. 112 (1918)

Thelymitra malintana Blanco, *Fl. Filip.* 642 (1837).

Kraenzlinorchis malintana (Blanco) Szalch., *Orchidee* 55: 58 (2004).

Habit: Geophyte.

Habitat and ecology: No data available for Timor.

Distribution: From east Himalaya to Hainan and Indochina, the Philippines, and East Timor.

Collection: East Timor: Fatumasse (prob. Fatu Masin), v.1896, *Newton* s.n. (K!).

**Habenaria multipartita* Blume ex Kraenzl., *Bot.*

Jahrb. Syst. 16: 194 (1892). – *Comber, Orchids*

Java: 62 (1990)

Kryptostoma multipartitum (Blume ex Kraenzl.)

Szlach. & Olszewski, *Fl. Cameroun* 34: 231 (1998).

Ochyrorchis multipartita (Blume ex Kraenzl.) Szlach., *Richardiana* 4: 55 (2004).

Habit: Geophyte.

Habitat and ecology: In mountain grassland.

Distribution: Java, Bali, Flores, Timor.

Collections: East Timor: Hato Builico-Maubisse.

11.ii.2005, *Paiva, Silveira & Sousa* T464 (AVE!, L!);

Hato Builico, *Tata-Mailau*, undated (prob. 1962),

Cinatti 46 (LISC!).

Conservation: Widespread in Java, but apparently very local in Timor.

**Habenaria cf. plantaginea* Lindl., *Gen. Sp. Orch.*

Pl. 323 (1835)

Plantaginorchis plantaginea (Lindl.) Szalch.,

Richardiana 4: 65 (2004).

Habit: Geophyte.

Habitat and ecology: Not recorded.

Distribution: Sri Lanka, India, Bhutan, ?Timor.

Collections: East Timor: location unknown, 1962/3,

Cinatti 119 (L!, LISC!).

Observations: The Timor specimens are so similar to collections from Sri Lanka and India studied by us that we hardly doubt that they are conspecific. The Timor material has slightly larger flowers with a somewhat longer spur than the specimens from the latter areas. This new record represents a remarkable

disjunction; it is unlikely that this conspicuous orchid has been overlooked in the area between Bhutan and Timor.

**Habenaria* sp. A (section *Plantaginea*)

Habit: Geophyte.

Habitat and ecology: Terrestrial in forest and under shrubs in open vegetation.

Distribution: So far only known from Timor.

Collections: West Timor: Tanèkè, c. 200 m altitude, 10.ii.1965, *Kooy* 155 (L!).

Observations: Clearly related to *H. carinata* Span., but the mid-lobe of the lip lacks a keel and is distinctly broader than the lateral lobes. See also *Habenaria* sp. B.

**Habenaria* sp. B (section *Plantaginea*)

Habit: Geophyte.

Habitat and ecology: Not recorded., at 700 m elevation.

Distribution: So far only known from Timor.

Collections: West Timor: Fatumnasi (prob. Falumasin), 27.iii.1965, *Kooy* 169 (L!).

Observations: Very similar to *Habenaria* sp. A, only differing in the larger flowers. More material is needed to assess the variability of these plants before we dare to describe them as new.

**Habenaria* sp. C (section *Plantaginea*)

Habit: Geophyte.

Habitat and ecology: Not recorded.

Distribution: Undetermined.

Collections: Timor: location unknown, iv.1803, *Brown* s.n. (BM!).

**Habenaria* sp. D (section *Salaccenses*)

Habit: Tuber geophyte.

Habitat: Not recorded.

Distribution: So far only known from Timor.

Collection: Timor: Turskain (prob. Turisca), 3–6.iv.1883, *Forbes* 3521a (BM!).

Habenaria viridiflora Span. in *Linnaea* 15: 478

(1841), *nom. illeg.* [not (Rottler ex Sw.) *R.Br. ex Spreng.*, 1826]

Habit: Geophyte.

Habitat and ecology: Not recorded.

Collections: Timor: without further details, Spanoghe s.n. (holotype apparently lost).

Observations: Judging from the protologue, this is probably a species of *Peristylus*.

HERMINIUM L.

Herminium lanceum (Thunb. ex Sw.) J. Vuyk in *Blumea* 11: 228 (1961)

Ophrys lancea Thunb. ex Sw., Kongl. Vetensk. Acad. Handl. 21: 223 (1800).

Herminium angustifolium (Lindl.) Benth. & Hook.f. – Ridl. in H.O.Forbes, *Natur. Wand. East. Archip.* 519 (1885); von Malm in *Fedde Repert.* 34: 267 (1934).

Habit: Geophyte.

Habitat and ecology: No data available for Timor.

Distribution: Known from Kashmir and the Himalayas, north to Japan, and throughout South-East Asia to New Guinea.

Collections: East Timor: Turskain (prob. Turiscail), iv.1883, *Forbes* 3561 (BM!, L!), 3521 (BM!), 3515 (BM!, L!); Samoro, Sobale mount, iv–v.1883, *Forbes* 3823 (BM!); Fatumasse (prob. Fatu Masin), v.1896, *Newton* s.n. (K!).

*HETAERIA BLUME

**Hetaeria oblongifolia* Blume, *Bijdr.* 410 (1825)

Habit: Terrestrial.

Habitat and ecology: In semi-evergreen closed forest on clay soil over limestone, occasional. Elevation 400 m.

Distribution: Thailand, Indochina, Malesia, Australia, Solomon Islands, east to Samoa.

Collections: East Timor: Mehara area, near Los Palos, 3.x.2005, *Cowie & Xavier* 10722 (CANB, DNA, L!).

LIPARIS RICH.

Liparis aurita Ridl. in H.O.Forbes, *Nat. Wand. East. Archip.* 518 (1885)

Platystyliparis aurita (Ridl) Marg., *Richardiana* 7 (2007) 38.

Habit: Probably epiphyte.

Habitat and ecology: Not recorded.

Distribution: Endemic to East Timor. But see 'Observation'.

Collections: East Timor: Bibičuçu (prob. Bubususu), 6–22.iv.1883, *Forbes* 3714 (holotype BM!; isotypes L!, LISU!); loc. cit., 1882–3, *Forbes* 4007 (BM!).

Observation: This member of section *Platystylis* was recorded for Thailand by Seidenfaden (1976: 86, fig. 59) who, at the same time, expressed some doubts about his identification. Seidenfaden's figure certainly looks very similar to a flower from an isotype speci-

men of *Liparis aurita* that we examined. Apart from the differences already noted by Seidenfaden, we observed that *Liparis aurita* has two distinctly lamellate keels in the basal part of the lip, the configuration of which looks rather different in Seidenfaden's drawing after the Thai material. A comparison of fresh material would be most helpful. There can be little doubt that, even if the Thai and Timor specimens are not conspecific, they are at least sister species.

Conservation: Collected twice, but in the same locality and by the same collector in the 19th century; it is probably extinct.

Proposed IUCN category: CR B1ab(i,ii,iii,iv). We estimate the extent of occurrence to be less than 100 km² (B1), it is known from a single location (a), and the available data indicate that a decline (b) in the extent of occurrence (i), area of occupancy (ii), quality of habitat (iii), and number of locations (iv) can be inferred for this species.

Liparis gibbosa Finet, *Bull. Soc. Bot. France* 55: 842 (1908)

Liparis disticha auct non Lindl. Decne., *Nouv. Ann. Mus. Par.* 3: 366 (1834); Ridl. in H.O.Forbes, *Natur. Wand. East. Archip.* 518 (1885).

Habit: Probably epiphyte.

Habitat and ecology: Not recorded.

Distribution: Indochina to New Caledonia.

Collections: Timor: without further details, *Riedlé & Guichenot* s.n. (P, n.v.).

LUISIA GAUDICH.

Luisia unguiculata J.J.Sm., *Bull. Jard. Bot. Buitenzorg, sér. 3, 8:* 65 (1926)

Habit: Epiphyte.

Habitat and ecology: Not recorded.

Distribution: Endemic to West Timor.

Collections: West Timor: Hort. Bog. cult., 1924, *Anonymous* (BO, n.v.).

Conservation: Known only from the type specimen.

Observations: This taxon may be conspecific with *L. confusa* Rchb.f. from Sulawesi and Maluku.

Conservation: Until new material is collected and its taxonomy re-evaluated, this taxon should not be assessed for conservation.

Luisia sp.

Habit: Epiphyte.

Habitat and ecology: In a small patch of forest, c. 900 m altitude.

Distribution: Not known.

Collections: East Timor: Ainaro, 22.i.2004, *Paiva & Silveira* T134 (AVE!, L!, sterile).
Observations: Possibly *L. unguiculata*.

MICROTIS R. BR.

Microtis unifolia (G.Forst.) Rchb.f., *Beitr. Syst. Pflanzenk.* 62 (1871)
Ophrys unifolia G.Forst., *Fl. Ins. Austral.* 59 (1786).
Microtis parviflora R.Br., *Prodr.* 321 (1810) – Ridley in H.O.Forbes, *Natur. Wand. East. Archip.* 518 (1885).

Habit: Geophyte.
Habitat and ecology: On mountain grassland.
Distribution: From south China and Japan to south-west Pacific.
Collections: East Timor: Turskain (Turiscas), iv.1883, Forbes 3563 (BM!); Huato-Builico, 1800 m altitude, 4.i.1933, *Steenis* 18370 (LISC!)

*NERVILIA COMM. EX GAUDICH.

**Nervilia aragoana* Gaud., in *Freye., Voy. Bot.* 422, t. 35 (1829)

Habit: Geophyte.
Habitat and ecology: Collected once in Timor, in forest, at c. 600 m altitude.
Distribution: From India to China, throughout South-East Asia to Australia, and east to many of the Pacific Islands.
Collections: West Timor: Oeneu, c. 600 m altitude, 14.i.1969, *Kooy* 606 (L!).

OBERONIA LINDL.

Oberonia glandulifera Ridl. in H.O.Forbes, *Nat. Wand. East. Archip.* 518 (1885)

Habit: Epiphyte.
Habitat and ecology: Not recorded.
Distribution: Endemic to East Timor.
Collections: East Timor: Bibiquçu (prob. Bubususu), iv.1883, *Forbes* 3591 (holotype BM!)
Conservation: Known only from the type specimen collected in the 19th century; this species is probably extinct.
Proposed IUCN category: CR B1ab(i,ii,iii,iv). We estimate the extent of occurrence to be less than 100 km² (B1), it is known from a single location (a), and the available data indicate that a decline (b) in the extent of occurrence (i), area of occupancy (ii), quality of habitat (iii), and number of locations (iv) can be inferred for this species.

**Oberonia* sp. A

Habit: Epiphyte.
Habitat and ecology: Montane forest, at c. 1200–1470 m above sea-level.
Distribution: Not known.
Collections: East Timor: Mt. Mundo Perdido, c. 33 km south–south-west of Baucau, 28.ix.2006, *Pinto & Trainor* 67 (DNA, photo!, fruiting).

Observations: This is clearly not *Oberonia glandulifera*, as the latter is stemless, whereas the present material, unfortunately without flowers, is of a species with short but distinct stems.

PECTEILIS RAF.

Pecteilis susannae (L.) Raf.; *Fl. Tellur.* 2: 38 (1836, published 1837)

Orchis susannae L., *Sp. Pl.* 939 (1753).
Habenaria susannae (L.) R.Br.Ridl. – H.O.Forbes, *Natur. Wand. East. Archip.* 519 (1885).

Habit: Geophyte.
Habitat and ecology: Usually in grassland or scrub, where the climate is strongly seasonal and fires are common in the dry season, from sea-level up to 2750 m.
Distribution: India, south China, and all over South-East Asia to Timor.
Collections: East Timor: Fatunaba hills, 19.xii.1882–30.iii.1883, *Forbes* 3437 (BM, L!); undated, *Castro* s.n. (LISU!); Ainaro – Hato-Udo, Raibere. 23.i.2004, *Paiva & Silveira* T157 (AVE!, L!); c. Monte Laritame, 16.ii.2005, *Paiva, Silveira & Sousa* T557 (AVE!). West Timor: Soé, 838 m, 6.ii.1929, *Walsh* 30 (Z!); Supul, 26.ii.1969, *Kooy* 643 (L!).

PERISTYLUS BLUME

Peristylus goodyeroides (D. Don) Lindl., *Gen. Spec. Orch. Pl.* 299 (1835)

Habenaria goodyeroides D. Don, *Prodr. Fl. Nep.* 25 (1825).

Habenaria grandis Benth. ex Ridl. in H.O.Forbes, *Nat. Wand. East. Archip.* 519 (1885), syn. nov.

Habit: Geophyte.
Habitat and ecology: In grassland, usually on rocky terrain, from sea-level to 1750 m.
Distribution: From India and China throughout South-East Asia to New Guinea.
Collections: East Timor: Fatunaba hills, 19.xii.1882–30.iii.1883, *Forbes* 3442 (type of *H. grandis*; holotype BM!, isotype L!); Fato-Maria, c. Ainaro. 22.i.2004, *Paiva & Silveira* T137 (AVE!); Aileu-Dili, near Dili, 11.ii.2005 *Paiva, Silveira & Sousa* T480 (AVE!, L!); Aileu, 6.i.1954, *Steenis* 18481 (BM!); Mt. Mundo

Perdido, 16.ii.2005, *Paiva, Silveira & Sousa* T508 (AVE!, L!). West Timor: Kapan, 6.i.1929, *Walsh* 27 (BM!).

Peristylus timorensis (Ridl.) J.J.Wood & Ormerod, *Orchid Rev.* 106: 239 (1998)

Habenaria timorensis Ridl. in H.O.Forbes, *Nat. Wand. East. Archip.* 519 (1885).

Habit: Geophyte.

Habitat and ecology: On rocky ground.

Distribution: Endemic to East Timor.

Collections: East Timor: Turskain (Turiscai), 3–6.iv.1883, *Forbes* 3520 (holotype BM!).

Conservation: This is another species known only from the type specimen collected in the 19th century. *Proposed IUCN category:* CR B1ab(i,ii,iii,iv). We estimate the extent of occurrence to be less than 100 km² (B1), it is known from a single location (a), and the available data indicate that a decline (b) in the extent of occurrence (i), area of occupancy (ii), quality of habitat (iii), and number of locations (iv) can be inferred for this species.

**PHOLIDOTA* LINDL. EX HOOK.

**Pholidota carnea* (Blume) Lindl., *Gen. Sp. Orch.*

Pl. 37 (1830) var. *carnea*

Crinonia carnea Blume, *Bijdr.* 339 (1825).

Habit: Epiphyte.

Habitat and ecology: In moist forests, at 600–1740 m altitude.

Distribution: Peninsular Malaysia, Sumatra, Java, Timor, Borneo, and the Philippines.

Collections: East Timor: location unknown, 1962/3, *Cinatti* 293 (L!); Mt. Mundo Perdido, c. 33 km south-south-west of Baucau, 28.ix. 2006, *Pinto & Trainor* 91 (DNA, photo!).

PLATANATHERA RICH.

Platanthera angustata (Blume) Lindl., *Gen. Sp.*

Orchid. Pl. 290 (1835)

Mecosa angustata Blume, *Bijdr.* 404 (1825).

Habenaria sp. aff. *angustata* (Blume) Kuntze, *Rev. Gen. Pl.* 664 (1891) – Ridl. in H.O.Forbes, *Natur. Wand. East. Archip.* 519 (1885) ('*Habenaria* aff. *angustata* Blume').

Habit: Geophyte.

Habitat and ecology: On mountains, from 1500 to 2870 m altitude.

Distribution: From Japan, to Thailand, Vietnam, Peninsular Malaysia, throughout Indonesia to New Guinea and some of the Pacific Islands.

Collections: Unknown.

Observations: Not having seen a specimen, we cannot be sure about the correctness of Ridley's qualified record for Timor, although this species is known from the Lesser Sunda Islands. By listing '*Habenaria* aff. *angustata* Blume', Ridley implicitly proposed the combination *Habenaria angustata* based on *Mecosa angustata* Blume, but we believe the combination should nevertheless be attributed to Kuntze who made the transfer explicitly 6 years later.

**POLYSTACHYA* HOOK.

**Polystachya concreta* (Jacq.) Garay & Sweet, *Orquideologia* 9(3): 206 (1974)

Epidendrum concretum Jacq., *Enum. Syst. Pl.* 30 (1760).

Polystachya flavescens (Blume) J.J.Sm., *Orch. Java:* 284 (1905).

Habit: Epiphyte.

Habitat and ecology: In moist forest from 50 to 1400 m altitude.

Distribution: Sub-cosmopolitan in moist tropical climates.

Collections: East Timor: Viqueque, Mt. Mundo Perdido, c. 1280 m altitude, 16.ii.2005, *Paiva, Silveira & Sousa* T530b (AVE!); West Timor: Soe, 762 m altitude, 10.ii.1929, *Walsh* 86 (BM!).

**PTEROSTYLIS* R.BR.

**Pterostylis timorensis* Schuit. & J.J.Verm.

sp. nov. (Fig. 4)

A Pterostylidi depauperata F.M.Bailey foliis distincte petiolatis, sepalo mediano apice libero multo brevior, labello multo angustiore, floribus maioribus inprimis rubrobrunneis longitudinaliter albe striatis differt. Typus: *Paiva, Silveira & Sousa* T521 (holo AVE; iso L), from East Timor, Mt. Mundo Perdido, 16.ii.2005.

Description: Plant solitary, apparently not forming offsets. Tuber 9 × 6 mm, ovoid; roots c. 1 mm in diameter, very sparse. Subterranean stem 7–10 cm long, in the upper 2–4 cm enveloped in cataphylls, in the lower part covered with trichomes. Leaves 3–4, petiolate, more or less arranged in a basal rosette, patent, bright light green; petiole 0.5–1.3 cm long; blade 2.5–4 × 0.9–2.2 cm, broadly elliptic-oblong, with finely undulate margins, apex abruptly acute-acuminate. Inflorescence 5.5–8.5 cm long, erect, glabrous, one-flowered; peduncle scales 1.2–2.4 × 0.3–0.9 cm, two or three, bract-like, narrowly ovate, acuminate. Floral bract 1–1.5 × 0.2–0.3 cm, narrowly ovate, acuminate. Flower c. 2.5 cm long, erect; median sepal white with red-brown margins and red-brown median stripe, lateral

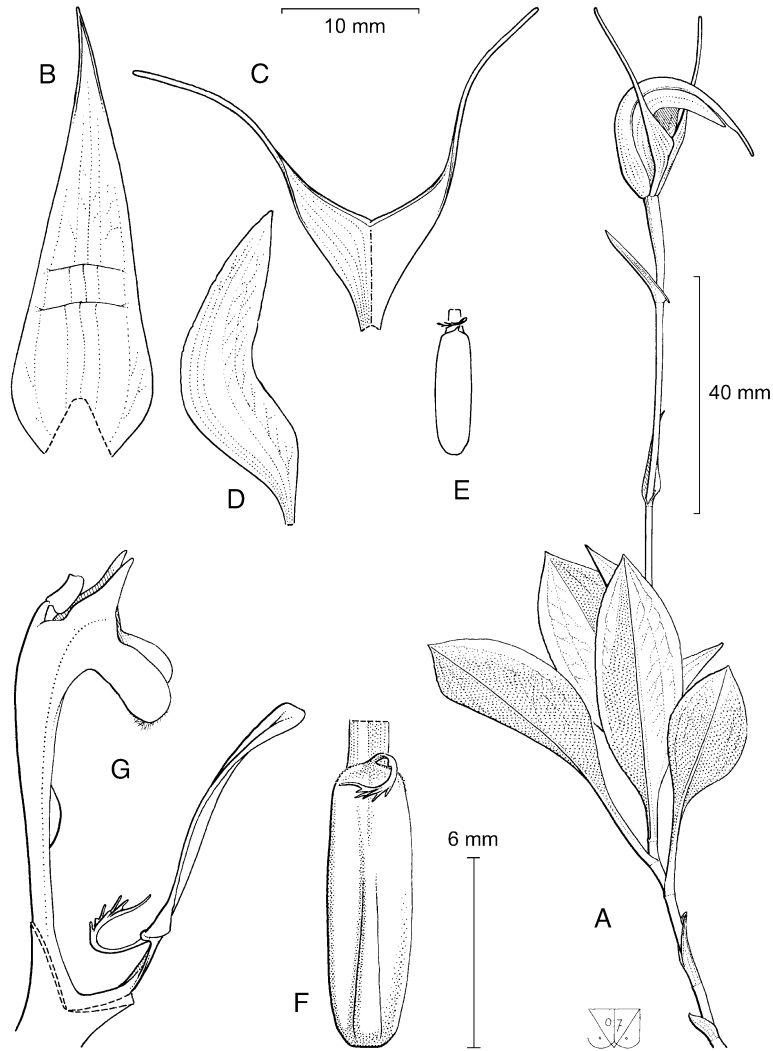


Figure 4. *Pterostylis timorensis* Schuit. & J.J.Verm.: A, habit; B, median sepal; C, lateral sepals; D, petal; E, lip; F, lip; G, column and lip, lateral view. All drawn from Paiva, Silveira & Sousa T521 by J. J. Vermeulen.

sepals red-brown, grading to light green at the base, petals white with broad red-brown band along the exterior margin and an olive-green and brownish band along the interior margin, lip red-brown, pale greenish at the base, column red-brown, the upper lobe of the column wings and the margin of the clinandrium white, anther green, pollinia light yellow. Pedicel with ovary 12 mm long, glabrous, terete. Median sepal 34×10.4 mm, in natural position strongly concave, forming a helmet-like structure together with the petals, the basal half erect, the apical half incurved-horizontal, narrowly ovate-triangular when flattened, acuminate; tip projecting beyond the petals 8.4 mm long, almost filiform because of the involute margins. Lateral sepals 26.5 mm long, the basal 13 mm obliquely narrowly triangular, the apical 13.5 mm filiform, erect, connate along their interior margins for

8.3 mm. Petals narrowly oblong-elliptic, strongly falcate, subacute. Lip clawed, erect, entirely concealed by the sepals; claw *c.* 2 mm long, rectangular; blade 9.5×5.4 mm, narrowly oblong, rounded-truncate; in the apical half with a broad, rounded keel; basal appendage 3.8 mm long, filiform, with a few subulate hairs in the apical part. Column 12.6 mm long, erect, almost straight; apical wings large, bilobed, the lower lobe 2.9 mm long, rounded-rectangular, slightly falcate, somewhat pubescent along the adaxial margin near the apex, the upper lobe 2.6 mm long, narrowly triangular, almost subulate; stigma 2 mm long, located just below the middle of the column. Anther cap 1.3 mm long, saddle-shaped. Fruit not seen.

Habit: Geophyte.

Habitat and ecology: Terrestrial in montane forest, at *c.* 1280 m altitude.

Distribution: Endemic to East Timor.

Collections: East Timor: Mt. Mundo Perdido, 16.ii.2005, Paiva, Silveira & Sousa T521 (AVE!, L!).

Observations: With its prominently keeled, broadly rounded, almost truncate lip, which remains entirely concealed in the flower, as well as its slender-tipped median sepal, this species bears some resemblance to the Australian *Pterostylis depauperata* F.M.Bailey [syn. *Crangonorchis depauperata* (F.M.Bailey) D.L.Jones & M.A.Clem.]. *Pterostylis timorensis* differs from *Pterostylis depauperata* in the distinctly petiolate leaves that are not pressed against the soil, the much shorter free tip of the median sepal, the much narrower lip, and the larger flowers with different colours (white and lime-green in *Pterostylis depauperata*). The fact that this new species appears to be more closely allied to some Australian species of *Pterostylis* than to the few Malesian ones, which occur in New Guinea and the Moluccas, provides some support for the theory that the Lesser Sunda Islands, especially Timor, have in the past acted as a bridge between Malesia and Australia (van Steenis, 1979). Description based on dried material and photographs of the type collection.

Conservation: This recently discovered species seems to deserve special conservation measures because of its inferred rarity and its threatened habitat: montane forest.

Proposed IUCN category: CR B1ab(i,ii,iii,iv). We estimate the extent of occurrence to be less than 100 km² (B1), it is known from a single location (a), and the available data indicate that a decline (b) in the extent of occurrence (i), area of occupancy (ii), quality of habitat (iii), and number of locations (iv) can be inferred for this species.

SPATHOGLOTTIS BLUME

**Spathoglottis cf. aurea* Lindl. In *Journ. Hort. Soc.* 5: 34 (1850)

Habit: Pseudobulb geophyte.

Habitat and ecology: Not recorded.

Collections: West Timor: Kimbana, 200 m altitude, 2.i.1965, Kooy 166 (L!, sterile).

Observations: With yellow flowers according to the collector, but these are missing from the fragmentary specimen cited.

Spathoglottis plicata Bl., *Bijdr.* 401, t. 76 (1825) – Ridl. in *H.O.Forbes, Natur. Wand. East. Archip.* 518 (1885)

Habit: Geophyte.

Habitat and ecology: In grassland and open roadside vegetation, from near sea-level up to 1600 m.

Distribution: South-East Asia to New Guinea, Australia, and the Pacific Islands.

Collections: East Timor: Turskain (Turiscai), sides of stream Maukuda, iv.1883, *Forbes* 3504 (BM!); Samoro (prob. Samora), iv.1883, *Forbes* 3923 (BM!); Mt. Perdido, ascent of Ossu, 23.xii.1953, *Steenis* 18244 (BM!, L!, LISC!); Ainaro, 22.i.2004, Paiva & Silveira T131 (AVE!, L!); location unknown, 1962–63, *Cinatti* 87 (L!, LISC!). West Timor: Naukae, 23.xii.1964, *Kooy* 159 (L!).

SPIRANTHES RICH.

Spiranthes sinensis (Pers) Ames, *Orch.* 2: 53 (1908)

Neottia sinensis Pers., *Syn. Pl.* 2: 510 (1807).

Spiranthes australis (R.Br.) Lindl. in *Bot. Reg.* 10: sub t. 823 (1824) – Ridl. in *H.O.Forbes, Natur. Wand. East. Archip.* 518 (1885).

Habit: Geophyte.

Habitat and ecology: In grassland, from 20 to 1750 m altitude.

Distribution: From India eastwards to China, Japan, and Siberia and south to Australia and New Zealand.

Collections: East Timor: Samoro (prob. Samora), Sobale Mount, 28.iv–3.v.1883, *Forbes* 3824, 3825, 3862 (BM!); Fatumasse (prob. Fatu Masin), v.1896, *Newton* s.n. (K!); West Timor: Bioba, 4.iii.1939, *Bloembergen* 3359 (L!).

THELYMITRA J.FORST. & G.FORST.

Thelymitra forbesii Ridl. in *H.O.Forbes, Nat. Wand. East. Archip.* 518 (1885)

Habit: Geophyte.

Habitat and ecology: Probably in montane grassland.

Distribution: Endemic to East Timor.

Collections: E. Timor: Fatete (prob. Hatete), 31.iii.1883, *Forbes* 3509 (holotype, BM!); location unknown, undated, *Forbes* 3517 (B M); Huato-Builico, Tata-Mailau, undated (prob. 1962), *Cinatti* II.24 (LISC!).

Conservation: Known only from the above-mentioned two specimens, probably collected in the same mountain area.

Proposed IUCN category: EN B1ab(i,ii,iii,iv). We estimate that the extent of occurrence of this species is less than 5000 km² (B1), it is known from less than five locations (a), and the available data indicate that a decline (b) in the extent of occurrence (i), area of occupancy (ii), quality of habitat (iii), and number of locations (iv) can be inferred for this species.

**THRIXSPERMUM* BLUME

Thrixspermum sp. A (section *Dendrocolla*)
Sarcanthus timorensis Decne., *Nouv. Ann. Mus. Par.*
 3: 365 (1834) – Ridley in *H.O.Forbes, Natur. Wand.*
East. Archip. 518 (1885).

Habit: Probably epiphyte.
Habitat and ecology: Not recorded.
Distribution: East Timor.
Collections: Not indicated.
Observations: The vague and possibly erroneous description by Decaisne suggests a species of *Thrixspermum*. The description of the vegetative parts fits *Thrixspermum subulatum*, a characteristic species which occurs in Timor, very well. It is certainly not a *Cleisostoma*, of which *Sarcanthus* is now a synonym.

**Thrixspermum* sp. B (section *Dendrocolla*)

Habit: Epiphyte.
Habitat and ecology: In old secondary deciduous closed forest to c. 15 m tall, open area amongst limestone outcrops, c. 430 m above sea-level.
Distribution: Not known.
Collections: East Timor: Ira Malaru, near Los Palos, 6.xi.2005, *Cowie & Xavier* 10848 (DNA, photo!).
Observations: A species in the alliance of *Thrixspermum trichoglottis* (Hook.f.) Kuntze.

**Thrixspermum subulatum* (Blume) *Rchb.f., Xenia*
Orchid. 2: 122 (1868)
Dendrocolla subulata Blume, *Bijdr.* 291 (1825).

Habit: Epiphyte.
Habitat and ecology: Collected at 750 m altitude in Timor.
Distribution: Taiwan, Thailand, Malesia (not in Borneo or New Guinea).
Collections: East Timor: Malahara, 4.xi.2005, *Cowie* s.n. (DNA, photo!); West Timor: Babaauw (prob. Babauk), undated, *Teysmann.* s.n. (L!); Supul 21.ii.1969, *Kooy* 639 (L!).

**TRICHOGLOTTIS* BLUME

**Trichoglottis* cf. *koordersii* Rolfe, *Bull. Misc. Inform. Kew* 1899: 130 (1899)

Habit: Epiphyte.
Habitat and ecology: Unspecified.
Distribution: Sulawesi to Maluku, and now also possibly Timor.

Collections: East Timor: Mt. Paitxau Range, 1.iii.2006, *Cowie* s.n. (DNA, photo!); Malahara, 25.x.2006, *Pinto* s.n. (DNA, photo!).

**TRICHOTOSIA* BLUME

**Trichotosia* sp. A

Habit: Epiphyte.
Habitat and ecology: In moist montane forest.
Distribution: Not known.
Collections: East Timor: Mt. Mundo Perdido, c. 1280 m altitude, 16.ii.2005, *Paiva, Silveira & Sousa* T532 (AVE!, L!).
Observations: Possibly an undescribed species.

TROPIDIA LINDL.

Tropidia curculigoides Lindl., *Gen. Spec. Orch. Pl.* 497 (1840) – Ridley in *H.O.Forbes, Natur. Wand. East. Archip.* 518 (1885)

Habit: Terrestrial herb.
Habitat and ecology: No data available for Timor.
Distribution: India, Burma, Thailand, Cambodia, Vietnam, Taiwan, Peninsular Malaysia, Sumatra, Java, Borneo, Timor, and Australia.
Collections: East Timor: Kailakuk (prob. Cailaco), iv.1883, *Forbes* 3795 (BM!).

VANDA JONES EX R.BR.

Vanda insignis Blume, *Rumphia* 4: 49 (1849)
Vanda tricolor auct. non Lindl. Ridley in *H.O.Forbes, Natur. Wand. East. Archip.* 518 (1885).

Habit: Epiphyte.
Habitat and ecology: On *Tamarindus*; in deciduous vine thicket along seasonal creek; c. 20 m above sea-level (*Cowie* 11375).
Distribution: Lesser Sunda Islands.
Collections: Timor: without further details, *Anonymous* (prob. Zippelius) s.n. (holotype, L!); location unavailable, 15.iii.1929, *Walsh* 154 (BM); East Timor: without further details, *Castro* s.n. (LISU!); Kailakuk (prob. Cailaco), iv.1883, *Forbes* 3794 (BM!); c. 4 km west-north-west of Laleia, 11.i.2006, *Cowie* 11375 (DNA, photo!, flowers incomplete, identification somewhat uncertain).

DIVERSITY AND CONSERVATION

Based on literature records and on the results of two expeditions conducted by the Portuguese team in East Timor, during January 2004 and February 2005, we estimate that about 2000 species of vascular plants occur on the island of Timor. It is not possible to give an exact number because many of these

Table 1. Distribution of the threatened orchids known to occur in Timor and their conservation assessment

Taxon	Distribution	Proposed IUCN category
<i>Aerides timorana</i>	Endemic to Timor (location unknown)	CR B1ab(i,ii,iii,iv)
<i>Bulbophyllum sundaicum</i>	Known only from one specimen from Java and one from East Timor	EN B1ab(i,ii,iii,iv)
<i>Crepidium</i> sp. A	Possibly a new endemic species	*
<i>Crepidium</i> sp. B	Possibly a new endemic species	*
<i>Diuris fryana</i>	Endemic to Timor (West and East)	EN B1ab(i,ii,iii,iv)
<i>Habenaria ankylocentron</i>	Endemic to East Timor	CR B1ab(i,ii,iii,iv)
<i>Habenaria cauda-porcelli</i>	Endemic to West Timor	CR B1ab(i,ii,iii,iv)
<i>Habenaria giriensis</i>	Known from Java and Timor, probably extinct in both places	CR B1ab(i,ii,iii,iv)
<i>Habenaria</i> sp. A	Endemic to West Timor. Threatened?	*
<i>Habenaria</i> sp. B	Endemic to West Timor. Threatened?	*
<i>Habenaria</i> sp. C	Endemic to Timor. Threatened?	*
<i>Liparis aurita</i>	Endemic to East Timor	CR B1ab(i,ii,iii,iv)
<i>Luisia unguiculata</i>	Endemic to West Timor. Threatened?	*
<i>Oberonia glandulifera</i>	Endemic to East Timor	CR B1ab(i,ii,iii,iv)
<i>Peristylus timorensis</i>	Endemic to East Timor	CR B1ab(i,ii,iii,iv)
<i>Pterostylis timorensis</i>	Endemic to East Timor	CR B1ab(i,ii,iii,iv)
<i>Thelymitra forbesii</i>	Endemic to East Timor	EN B1ab(i,ii,iii,iv)
<i>Trichotosia</i> sp.	Possibly a new endemic species	*

*Needs further taxonomic study before conservation assessment.

records are based on old references that require a critical revision. Moreover, as was revealed by this study, there are still many undetermined and unpublished specimens in various herbaria.

Using similarly provisional numbers, we can state that the largest flowering plant family on the island is the Poaceae with *c.* 11% of the species, closely followed by the Fabaceae with *c.* 8%. The Asteraceae, Convolvulaceae, Cyperaceae, Euphorbiaceae, Orchidaceae, and Rubiaceae account, together, for *c.* 20% of the species, with *c.* 3% each. These numbers will probably require modification as the flora becomes better known.

With regard to the Orchidaceae, this account contains 66 species, including 15 genera and 32 fully identified species that have never before been cited for Timor. Of these, four species new to science are described here for the first time. Amongst the unidentified species, six are also possibly new species; they were not described because of the poor quality of the available material. This list will probably increase because 14 additional collections could not be fully identified (marked with 'sp.' and 'cf.'). and some of these might also prove to be new species.

We are unable to provide a reliable estimate of the total percentage of endemic plants in Timor, but, for the orchids, we can now say that it averages 15% (ten species) of the total diversity of the family on the whole island (66 species). Seven of these species are known only from East Timor (see Table 1).

All of these endemic species are known only from one to three specimens, thus deserving special attention for conservation. According to the present data, at least 11 species of Orchidaceae should be considered under threat in Timor using IUCN (2001) criteria (Table 1): eight as critically endangered and three as endangered. This list includes nine endemics and two that are also known from Java, although very rare or even extinct in both areas. Six probable new undescribed species were also included in Table 1, because they seem to be very rare and threatened; however, they cannot be assessed using IUCN (2001) criteria until more material is collected to allow a complete taxonomic evaluation. The status of *Luisia unguiculata* was also not assessed because recently collected sterile material may represent this species.

These results should be considered with care because of the lack of reliable population and distribution data. However, because the territory of East Timor has been subject to high human pressure (agriculture, deforestation, fire regimes, war, etc.), we believe that it is appropriate to highlight the need to conduct further botanical and ecological research here by calling attention to these potentially threatened orchid species.

In the meantime, efforts must be taken to preserve some areas of Timorese territory. The most important areas for conservation in East Timor, with respect to orchids, seem to be the higher parts of the mountains

and associated forests, and, in particular, Mt. Tata-Mailau and other surrounding high-altitude areas, the summit of Mt. Fatu Masin, and Mt. Mundo Perdido and its forests. These areas were considered for Regulation project N.2000/19 on protected areas (UNTAET/REG/2000/19); this Regulation also protects other lower altitude forests, which might very well act as important refuges of biodiversity if effective conservation can be achieved.

As a final remark, we should note that, because the focus of this work was mostly on East Timor, and because of the temporary closure of Herbarium Bogoriense (BO, moving to new facilities) during the course of this study, it is highly probable that it is incomplete with regard to West Timor. The information on recent collections provided by the Northern Territory Herbarium (DNA) also proves that further botanical exploration of East Timor is still needed, and may well reveal additional species new to science and lead to a better knowledge of those already recorded.

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