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**THE ORCHIDS OF VIETNAM ILLUSTRATED SURVEY.
Part 3. SUBFAMILY EPIDENDROIDEAE
(primitive tribes – *Neottieae*, *Vanilleae*, *Gastrodieae*, *Nervilieae*)**

**ИЛЛЮСТРИРОВАННЫЙ ОБЗОР ОРХИДНЫХ ВЬЕТНАМА.
Часть 3. ПОДСЕМ. EPIDENDROIDEAE
(примитивные трибы – *Neottieae*, *Vanilleae*, *Gastrodieae*, *Nervilieae*)**

Summary. The article continues serial publication of illustrated critical taxonomical survey of orchids in the flora of Vietnam. This part of the monograph includes taxonomical treatment of so-called primitive tribes (*Neottieae*, *Vanilleae*, *Gastrodieae*, *Nervilieae*) of the largest subfamily *Epidendroideae* (17 genera and 41 species in Vietnam); besides, some corrections and additions to first and second parts of the monograph are included. Identification keys, valid name, necessary synonyms, type material citation, short description, data on ecology and distribution, as well as a list of studied voucher specimens for each species are provided. Mentioned species are illustrated with original line drawings and color photographs. Two new nomenclature combinations are proposed, namely *Cyrtosia faberi* (Rolfe) Aver., and *C. falconeri* (Hook. f.) Aver. A new genus *Miguelia* Aver. with 2 species – *M. somai* (Hayata) Aver. and *M. annamica* (Gagnep.) Aver. is established. Description of a new species – *Peristylus tenuicallus* Ormerod. discovered by P. Ormerod on the base of his studies of AMES Herbarium is also presented.

Key words: Orchidaceae, flora of Vietnam, keys for identification.

Аннотация. Статья продолжает публикацию серийного издания иллюстрированного критического таксономического обзора орхидных (Orchidaceae) флоры Вьетнама. Третья часть монографии включает предисловие и стандартную таксономическую обработку наиболее примитивных триб (*Neottieae*, *Vanilleae*, *Gastrodieae*, *Nervilieae*), объединяемых в подсемейство *Epidendroideae* и насчитывающих во флоре страны 17 родов и 41 вид. Для всех признаваемых видов приводятся законное название, наиболее важные синонимы, цитирование аутентичного материала, краткое описание, данные по экологии и распространению, а также список изученных образцов. Все виды иллюстрированы черно-белыми рисунками и цветными фотографиями. Для 2 таксонов в работе предложены новые номенклатурные комбинации – *Cyrtosia faberi* (Rolfe) Aver. и *C. falconeri* (Hook. f.) Aver. В качестве нового для науки описывается род *Miguelia* Aver., включающий два вида – *M. somai* (Hayata) Aver. и *M. annamica* (Gagnep.) Aver. В публикацию также включено описание нового вида – *Peristylus tenuicallus* Ormerod., открытого недавно Полом Омеродом на основании изучения гербарных коллекций Эймса (AMES).

Ключевые слова: орхидные, флора Вьетнама, ключи для определения.

PREFACE

The article continues serial publication of illustrated critical taxonomical survey of orchids in the flora of Vietnam (Averyanov, 2008, 2010). The third part of this monograph includes taxonomical treatment of so-called primitive tribes – *Neottieae*, *Vanilleae*, *Gastrodieae* and *Nervilieae* of the largest subfamily – *Epidendroideae* with totally 17 genera and 41 species, as well as some novelties that represent modern additions to the first and second parts of the monograph. As in earlier publications, illustrated survey is presented here in form of standard

taxonomic treatment, which includes identification keys for all mentioned taxa and their short characterization. Correct name (with standard taxonomic reference), type, data about volume and distribution is reported for each taxonomic group. Data for each genus also include short description, total number of species and number of species in the flora of Vietnam (figures in brackets), as well as genus distribution.

Presented data for each species include:

– valid name, most significant synonyms and citation of most important recent monographs and illustrations;

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- available data about type;
- short description;
- available data on ecology, elevation of observed habitats, phenology, frequency of occurrence in the nature with approximate estimation of species status according to IUCN categories for the territory of Vietnam;
- general distribution and distribution in Vietnam (in brackets are mentioned in alphabetical order provinces where species was reported from);
- list of studied verified specimens and index of their host herbaria;
- when necessary short notices on species taxonomy, biology, ecology, phenology or variation are also provided;
- line drawings and color photographs accompany in the book each species reported for the flora; collecting numbers of plants used as a model for illustration are cited on drawings or in notices to photographs.

Text of labels is maximally abbreviated whenever being cited. It usually includes only province name, district name, collectors name and collecting number, or if necessary date of collection. Largest recent collections are abbreviated and designated as series with following prefixes:

CBL – Cao Bang Limestone – collections on program of U.S.A. National Geographic Society “*Limestone Flora of Cao Bang Province of northern Vietnam*” (years 1998-1999, # 6300-98) with principal investigator Dr. Nguyen Tien Hiep;

CPC – collections made in expeditions managed by the Center for Plant Conservation (mainly Dr. Nguyen Tien Hiep, Prof. Leonid V. Averyanov and Prof. Phan Ke Loc);

CPNP – collections in Cuc Phuong national park (commonly without indication of collectors);

DDS – Prof. D.D. Soejarto – collections according to International Cooperative Biodiversity Groups program with this person as principal investigator;

DKH – Dr. D.K. Harder – collections according to expeditions with this person as a principal investigator;

HAL – Dr. Nguyen Tien Hiep, Prof. Leonid V. Averyanov, Prof. Phan Ke Loc – collections in collaborative explorations of these persons;

HLF – Henry Luce Foundation, collections of different collectors according to Vietnam Botanical Conservation Program supported from Henry Luce Foundation;

LX-VN – collections of Soviet (Liên Xô) – Viet Name Expedition (commonly without exact indication of collectors);

NMC – collections of staff member of Cuc Phuong national park – Mr. Nguyen Manh Cuong on the territory of the national park;

NTH – Dr. Nguyen Tien Hiep – collections in expeditions with this person as principal investigator;

P – Prof. Phan Ke Loc – collections in expeditions with this person as principal investigator;

VA – Vietnam-American Series – collections of international group with Dr. N.T. Hiep as principal investigator;

VH – Vietnamese Highlands – collections on program of U.S.A. National Geographic Society “*Flora of Highlands of South Vietnam*” (years 1993–2001, # 5094-93, 5803-96, 6383-98) with principal investigator Prof. Leonid V. Averyanov.

Modern administrative divisions of Vietnam with names of administrative units used in the text, as well as terminology list and terms explanation were presented in the first part of this monograph (Averyanov, 2008).

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Henry Luce Foundation. Vietnam Botanical Conservation Program in Vietnam. 1999–2008. “*Preliminary updated checklist of orchids (Orchidaceae) of Ba Be National Park*”, 2002; “*Preliminary updated checklist of orchids (Orchidaceae) of Bach Ma National Park*”, 2003; “*Preliminary updated checklist of orchids (Orchidaceae) of Nui Chua National Park*”, 2004; “*Preliminary updated checklist of orchids (Orchidaceae) of Bu Gia Map National Park*”, 2005; “*Preliminary Survey of the Flora and Vegetation of Bi Doup – Nui Ba National Park*”, 2005; “*Preliminary Survey of the Flora and Vegetation of Da Krong Nature Reserve and allied areas*”, 2006; “*Flora and vegetation of Pu Nat national park and allied areas*”, March 2007; “*Flora and vegetation of Thuong Lo Municipality and allied*

areas (Thua Thien – Hue Province)”, April 2007; “*Survey of the flora at Yok Don national park*”, March 2008; “*Survey of the flora at Lo Go – Xa Mat national park*”, December 2008.

American Orchid Society. “*Exploration of endangered Vietnamese Paphiopedilums*”, years 1996–1997; “*Exploration of endangered calcium dependent orchid flora in inaccessible rocky limestone areas of the North Vietnam*”, 1999–2000; “*Population studies of endemic Paphiopedilum species in northern Vietnam*”, 2001–2002; “*Discovery of endemic orchid flora in remote limestone areas of Northern Vietnam*”, 2003–2005; “*Exploration of Vietnamese orchid flora in regions allied to Laos territory*”, 2008–2009; “*Assessment of orchid endemism in NW. Vietnam with special attention to Paphiopedilum canhui*”, 2011–2012.

Fauna & Flora International (Vietnam Program). “*The distribution of Paphiopedilum vietnamense and its current status in the wild*”, 2000; “*Community-based Conservation of the Hoang Lien Mountain Ecosystem, Vietnam, Flora and vegetation survey of Van Ban district, Lao Cai province of northern Vietnam*”, 2002; “*Preliminary survey of orchids and gymnosperms in Trung Khanh district, Cao Bang province northern Vietnam*”, 2004.

Fauna & Flora International Vietnam Conservation Support Program of the Ministry of Agriculture and Rural Development, Vietnam. “*Pu Luong – Cuc Phuong Limestone Landscape Conservation Project, Preliminary botanical survey of primary vegetation in Pu Luong nature reserve*”, 2003.

Fauna & Flora International (Vietnam Program) & Counterpart International. “*Preliminary survey of Orchids (Orchidaceae) in Phong Nha – Ke Bang National Park*”, 2005.

WWF Indochina Programme. Green Corridor Project in Thua Thien – Hue Province, VN 085301. “*Lowland flora and vegetation. Preliminary survey*”, 2005.

Basic Research program in Life Sciences of Viet Nam, # 611001. “*Threatened conifers and cycads of Vietnam*”, 2000–2002.

The Rufford Small Grant Foundation. “*Assessment of distribution and natural status of Paphiopedilum canhui, Vietnam*”, 2010–2011.

Chicago Zoological Society, Chicago Board of Trade Endangered Species Fund. “*Assessment of current natural status of critically endangered species – Paphiopedilum canhui for its conservation*”, 2010–2011.

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SUBFAMILY 5 EPIDENDROIDEAE LINDL.,

1821, Collect. Bot. App. Epidendreae. – Subfam. *Malaxidoideae* Burnett, 1835, Outlines Bot.: 461 (sub “*Malaxidae*”). – Subfam. *Arethusoideae* Endl., 1837, Gen. Pl.: 216 (sub “*Arethuseae*”).

Type: *Epidendrum* L.

220(–60) genera and 10 000(–480) species. Tropical, subtropical and temperate regions of the World, boreal zone of Northern Hemisphere.

Group of primitive tribes (*Neottieae*, *Vanilleae*, *Gastrodieae*, *Neottieae*).

Trib. 5.1. *Neottieae* Lindl.,

1821, Collect. Bot. App. – Trib. *Epipactieae* Endl., 1830, Fl. Poson.: 163 (sub “*Epipactideae*”). – Trib. *Listereae* Endl., 1842, Mant. Bot. Suppl. 2: 19 (sub “*Listeridae*”). – Trib. *Limodoreae* Nees, 1845, Gen. Pl. Monocot. 8, tab. 15 (sub “*Limodorinae*”). – Subtrib. *Limodorinae* Benth., 1881, Journ. Linn. Soc. London (Bot.) 18: 288 (sub “*Limodoreae*”). – Sub-

trib. *Cephalantherinae* Pfitz., 1887, Entw. Nat. Anord. Orch.: 98 (sub “*Cephalanthereae*”). – Subtrib. *Epipactidinae* M. Schulze, 1894, Orch. Deutsch.: 8 (sub “*Epipactideae*”).

Subtrib. 5.1.1 *Limodorinae* Benth.,

1881, Journ. Linn. Soc. Bot. 18: 288.

Type: *Limodorum* Boehm.

3(2) genera and 30–40(7) species. Temperate, subtropical and tropical regions of the World.

Epipactis Zinn.,

1757, Cat. Pl. Gott.: 85, nom. cons.; Seidenf., 1978, Dansk Bot. Ark. 32, 2: 116–117; id., 1992, Opera Bot. 114: 21–22; Aver., 1994, Ident. Guide Vietnam. Orch.: 24; P.H. Ho, 2000, Ill. Fl. Vietnam 3: 780; Su Horng-Jye, 2000, Fl. Taiwan 5: 858–861; Pearce et Cribb, 2002, Orch. Bhutan: 42–47; Aver. et Averyanova, 2003, Updated Checklist Orch. Viet.: 32; Newman et al, 2007, Checkl. Vasc. Pl. Lao PDR: 267; Schuiteman et al., 2008, Nord. Journ. Bot. 26: 289; Chen Sing-chi et al., 2009, Fl. China, 25: 179–183.

Type: *E. helleborine* (L.) Crantz (*Serapias helleborine* L.).

Terrestrial or lithophytic herbs with underground rhizome, erect leafy stems and terminal few- to many-flowered, more or less secund raceme. Leaves plicate, sessile, sheathing at the base. Flowers medium-sized, resupinate, rare not resupinate. Sepals and petals free, lip with different callosities, divided into, concave hypochile and flat elongate or circular epichile. Column short. Pollinia 2, mealy, normally with viscidium, without caudicles and stipe.

25–30(2) species. N. Africa, Eurasia, N. America.

Key to species

1. Riparian plants of swampy stream valleys, 35–120 cm tall; leaves numerous, narrowly ovate; sepals 1.2–1.5 cm long, yellow-green with purple-brown margin; epichile narrowly obovate, straight along margin **1. *E. atromarginata***
- Plants of dry rocky limestone, 15–25 cm tall; leaves 2–3, ovate; sepals less than 1 cm long, purple; epichile circular, undulate along margin **2. *E. alata***

1. *E. atromarginata* Seidenf.,

1992, Opera Bot. 114: 22, 23, 461, fig. 5, pl. 1c; Aver., 1994, Identif. Guide. Vietnam. Orch.: 24; P.H. Ho, 2000, Ill. Fl. Vietnam 3: 780, fig. 10883; Aver. et Averyanova, 2003, Updated Checklist Orch. Viet.: 32. – *E. flava* auct. non Seidenf.: P.H. Ho, 2000, l.c.: 780, fig. 10884.

Described from S. Vietnam (“Prov. Gialai-Kontum. Kon Ha Nung”). **Type** (“15.05.1985 LX-

VN 1975”) – HN (holotype), LE (isotype).

Riparian or swampy herb 35–120 cm tall with creeping stout rhizome. Stem erect, glabrous, with numerous narrowly ovate, acuminate leaves. Raceme secund, pubescent, usually with 5–12 resupinate, well opening flowers 2 cm across. Sepals and petals yellow-green with purple-brown margin, subsimilar, ovate, acute, 12–15 mm long, densely white pubescent outside. Lip light reddish-brown

with yellow-green base and center, 14 mm long, divided into hypochile and epichile. Hypochile concave, with ovate side lobes striped with dark purple-brown nerves, disc with broad hemispheric warty callus. Epichile narrowly obovate, finely rugose, curved, with callus-like umbo at center. Column light green, 6 mm tall, erect, stout, with massive stigma and large forward protruding green anther cap. **Fig. 1; 5 a, b.**

Ecology. Wet alluvial banks and riparian rocks along streams and small rivers in shady broad-leaved forests. 400–700 m. Fl. March-May. Very rare (CR).

Distribution. Vietnam (Gia Lai, Quang Tri). Laos?

Studied specimens. Gia Lai, Kon Ha Nung, *LX-VN 1975* (HN, LE); Gia Lai, Konplong, *LX-VN 2275* (HN, LE); Quang Tri, Da Krong, *HLF 5757* (HN), *HLF 6139* (HN), *HLF 6181* (HN, LE).

Notes. Critically endangered species of low-land stream valleys.

2. *E. alata* Aver. et Efimov,

2006, Rheedea, 16, 1: 4–6, fig. 3 d-g; Chen Sing-chi et al., 2009, Fl. China, 25: 182.

Described from Vietnam (“Ha Giang Prov., Meo Vac Distr., Sung Tra Municipality...”). **Type** (“11 December 2005 *HAL 8513*”) – HN (holotype), LE (isotype).

Terrestrial herb 15–25 cm tall with short rhizome. Stem erect, glabrous, with 2–3 distant, ovate, leaves. Raceme, sparsely pubescent, with 2–5 distant, not resupinate, campanulate, purple-violet flowers 1 cm across. Sepals and petals subsimilar, ovate, acute, 8–10 mm long, outside sparsely pubescent. Lip purple-violet with yellow center, 10 mm long, divided into hypochile, mesochile and epichile.

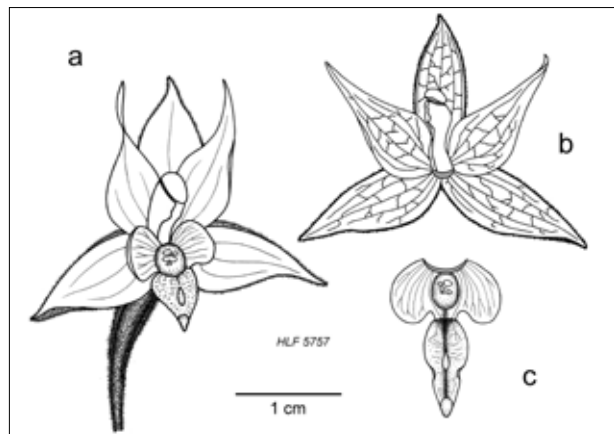


Fig. 1. *Epipactis atromarginata* (HLF 5757): a – flower, b – flattened sepals and petals, c – flattened lip.

Hypochile concave, with triangular side lobes, disc with numerous small deep brown warts. Mesochile elongate, 3.5 mm long, 2 mm wide, with two broad fleshy low keels. Epichile circular, 3.5 mm across, finely undulate and folded along the margin. Column white, 5–7 mm tall, broadening from narrow stalk into massive apex covered with forward pendent anther cap; stigma 3 mm long, 4 mm wide, with prominent rectangular, forward directed side lobes. **Fig. 2; 5 c, d; 6.**

Ecology. Coniferous forests with *Tsuga chinensis* on rocky limestone. 1000–1200 m. Fl. November – December. Very rare (CR).

Distribution. Vietnam (Ha Giang). S. China (SE. Yunnan).

Studied specimens. Type only.

Notes. Critically endangered species of primary limestone coniferous forests. Brown papillae on honey-yellow disc of hypochile strikingly resemble insect larvae that probably have certain role in pollinators attraction.

Aphyllorchis Blume,

1825, Bijdr. 6, fig. 77; id. 1849, Mus. Bot. Lugd. 18: 30, emend.; Gagnep., 1934, Fl. Gen. Indo-Chine 6, 5: 577–580; Seidenf., 1978, Dansk Bot. Ark. 32, 2: 118–122; id., 1992, Opera Bot. 114: 24–25; Comber, 1990, Orch. Java: 50–51; id., Orch. Sumatra: 118–121; Seidenf., Wood, 1992, Orch. Malay. Sing.: 44–45; Aver., 1994, Ident. Guide Vietnam. Orch.: 24–25; P.H. Ho, 2000, Ill. Fl. Vietnam 3: 779; Su Horng-Jye, 2000, Fl. Taiwan 5: 749–751; Pearce et Cribb, 2002, Orch. Bhutan: 36–37; Aver. et Averyanova, 2003, Updated Checklist Orch. Viet.: 11; Newman et al, 2007, Checkl. Vasc. Pl. Lao PDR: 253; Schuiteman et al., 2008, Nord. Journ. Bot. 26: 364; Chen Sing-chi, Gale, 2009, Fl. China, 25: 177–179. – *Sinorchis* S.C. Chen, 1978, Acta Phytotax. Sin. 16, 4: 82.

Type: *A. pallida* Blume.

Achlorophyllous leafless terrestrial herbs with short erect rhizome, few spreading thick roots, erect stem and terminal inflorescence of few- to many resupinate flowers. Sepals and petals subsimilar, free, more or less spreading. Lip with distinct short, concave, narrow hypochile to which more or less 3-lobed epichile is joined. Column long, slender, with erect apical anther. Column foot absent. Pollinia 2, powdery.

15(5) species. Mainland tropical and subtropical Asia, Indonesia, Philippines, Australia, New Guinea.

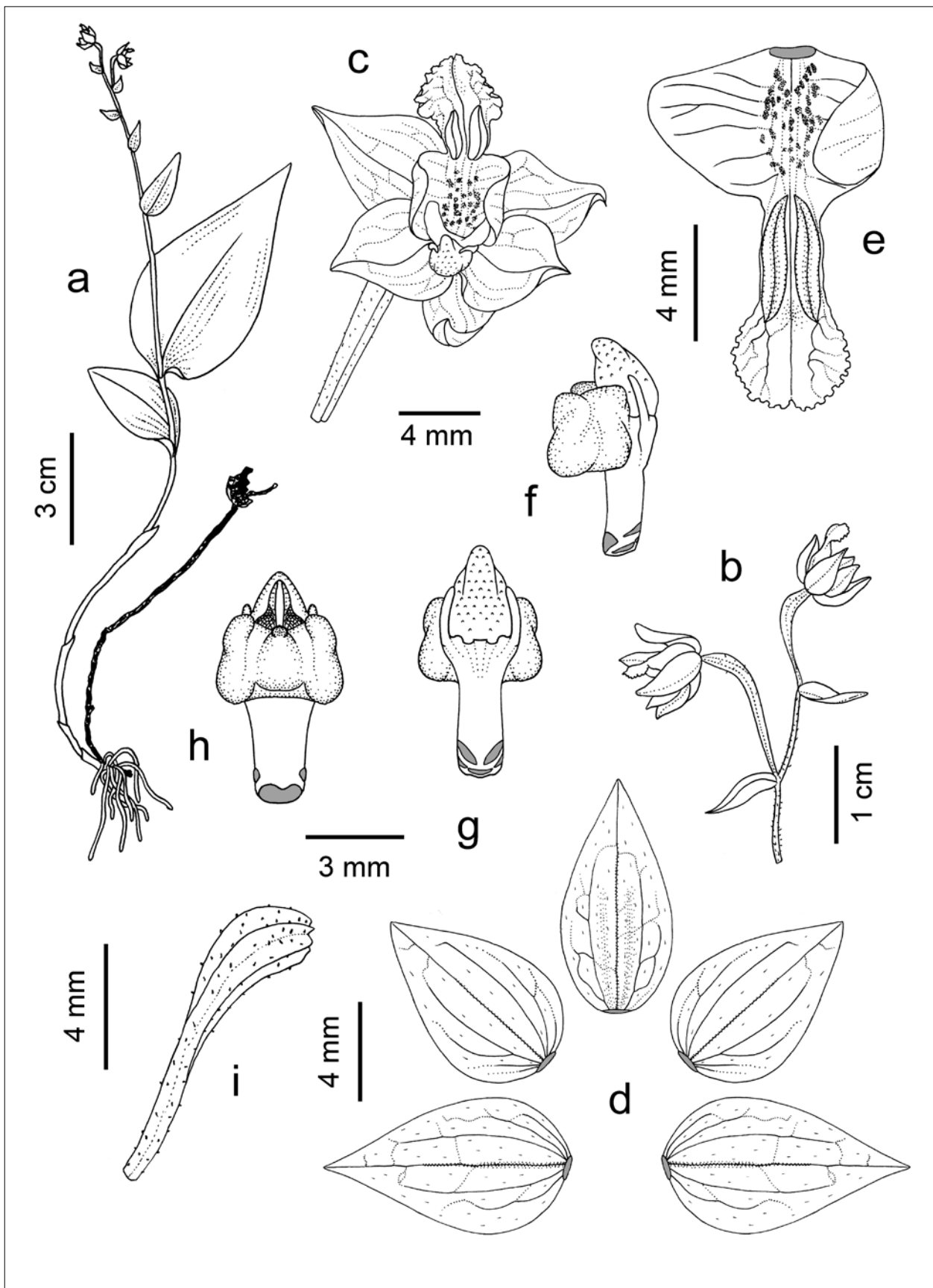


Fig. 2. *Epipactis alata* (HAL 8513, type): a – flowering plant, b – inflorescence, c – flower, d – flattened sepals and petals, e – flattened lip, f–h – side, ventral and dorsal views of the column, i – pedicel and ovary.

Key to species

1. Petals and lip subsimilar; flowers sub-actinomorphic; lip simple, oblong to elliptic, without ornamentation, not divided into hypochile and epichile **1. *A. simplex***
- Flowers distinctly zygomorphic; lip very different from petals, distinctly divided into hypochile and epichile, with spongia-like inflations on its surface 2
2. Stem rather slender, 15–50 cm tall; sepals not caudate, less than 1.5 cm long 3
- Stem stout, up to 1.5 m tall; sepals caudate, longer than 1.5 cm 4
3. Stem commonly 15–30 cm tall; flowers white, less than 8 mm across; sepals 4–5 mm long; epichile rough flat **2. *A. pallida***
- Stem commonly 30–50 cm tall; flowers yellow, more than 8 mm across; sepals 8–10 mm long; epichile with fat, finely warty margin **3. *A. montana***
4. Midlobe of epichile narrowly cuneate, acuminate to linear-subulate, often finely warty along margin, less than 2 mm wide **4. *A. evrardii***
- Midlobe of epichile ovate to narrowly-ovate, 4–7 mm wide, papillose, with fat sponge-like, warty margin, long caudate at apex **5. *A. annamensis***

1. *A. simplex* Tang et F.T. Wang,

1951, Acta Phytotax. Sin. 1: 67. – *Sinorchis simplex* (Tang et F.T. Wang) S.C. Chen, 1978, Acta Phytotax. Sin. 16, 4: 83.

Described from S. China (“North-east Kwangtung: Mei Hsien, Yin-na-shan, steep rocky slope, flower white, ...”). **Type** (“Aug. 4–31, 1932 W.T. Tsang no. 21504”) – PE?

Stem erect, slender, light yellow-brownish, sometime with violet tint, 25–35 cm tall, with several short sheaths and many-flowered, lax inflorescence 10–15 cm long, with 10–12 campanulate, not widely opened flowers. Floral bracts triangular-cuneate, to 1 cm long, down reflexed. Pedicel and ovary 1.8–2.2 cm long, with sparse glandular hairs. Sepals and petals dull yellow, with purple streaks, subsimilar, narrowly elliptic, 8–10 mm long, acute to obtuse, sepals fleshy and keeled in apical half. Lip light yellow, oblanceolate, elongate, simple, in shape and size similar to petals, 9–10 mm long, 2–2.5 mm wide, thin, without ornamentation. Column 9–11 mm long, bended at the middle, widened to the apex, apically from both sides with 2 large curved staminodes and erect ligulate rostellum as tall as or taller than operculum. Stigma subterminal. **Fig. 3; 5 e, f.**

Ecology. Primary evergreen broadleaved forests with short bamboo on alluvial limestone slopes. 1100–1200 m. Fl. October – November. Very rare (DD).

Distribution. Vietnam (Hoa Binh). S. China (E. Guangdong).

Studied specimens. Hoa Binh, Tan Lac, Ngoc Son – Ngo Luong nature reserve, CPC 775 (CPC Herbarium, LE).

Notes. This species superficially resembles just a peloric sub-actinomorphic form of *A. montana*. Meanwhile, its column with curious large

curved staminodia and erect prominent ligulate rostellum is very characteristic that was also mentioned earlier (Chen Sing-chi, Gale, 2009a). Most probably, this plant represents fairly distinct species, which needs further study. Unfortunately, it is very rare and highly endangered.

2. *A. pallida* Blume,

1825, Bijdr., tab. 16, fig. 77; Seidenf., 1978, Dansk Bot. Ark. 32, 2: 118, 120, fig. 74; Comber, 1990, Orch. Java: 51, fig.; id., 2001, Orch. Sumatra: 120, fig.; Seidenf., Wood, 1992, Orch. Malay. Sing.: 44, fig. 12a-d.

Described from Java (“Salak”). **Type** – ?

Stem erect, slender, silvery-white with sparse violet streaks, 15–30 cm tall, with several dark brownish short sheaths and few-flowered inflorescence 2–6 cm long. Floral bracts ovate to broadly-cuneate, 3–4 mm long. Pedicel and ovary silvery white with dark violet streaks, 5–12 mm long. Flowers white, not widely opening. Sepals and petals subsimilar, ovate, obtuse, 4–5 mm long, white, sometimes with yellowish tint, with dark violet marks. Lip shorter than tepals. Hypochile with erect, triangular side lobes. Epichile hinged at the apex of hypochile, triangular, with 2 indistinct broad side lobes and small fleshy, obtuse midlobe. Column white, 2.5–3 mm long. **Fig. 4 a-c; 5 g, h.**

Ecology. Primary mixed and coniferous forests on deep silicate soils. 800–1500 m. Fl. August – October. Very rare (VU).

Distribution. Vietnam (Dak Lak, Lam Dong). Thailand, Malacca, Sumatra, Java, Kalimantan, Philippines.

Studied specimens. Dak Lak, Chu Yang Sin mt., HLF 5423 (HN, LE); Lam Dong, Lac Duong, Hon Giao Ridge, HLF 5328a, HLF 5344 (HN, LE).

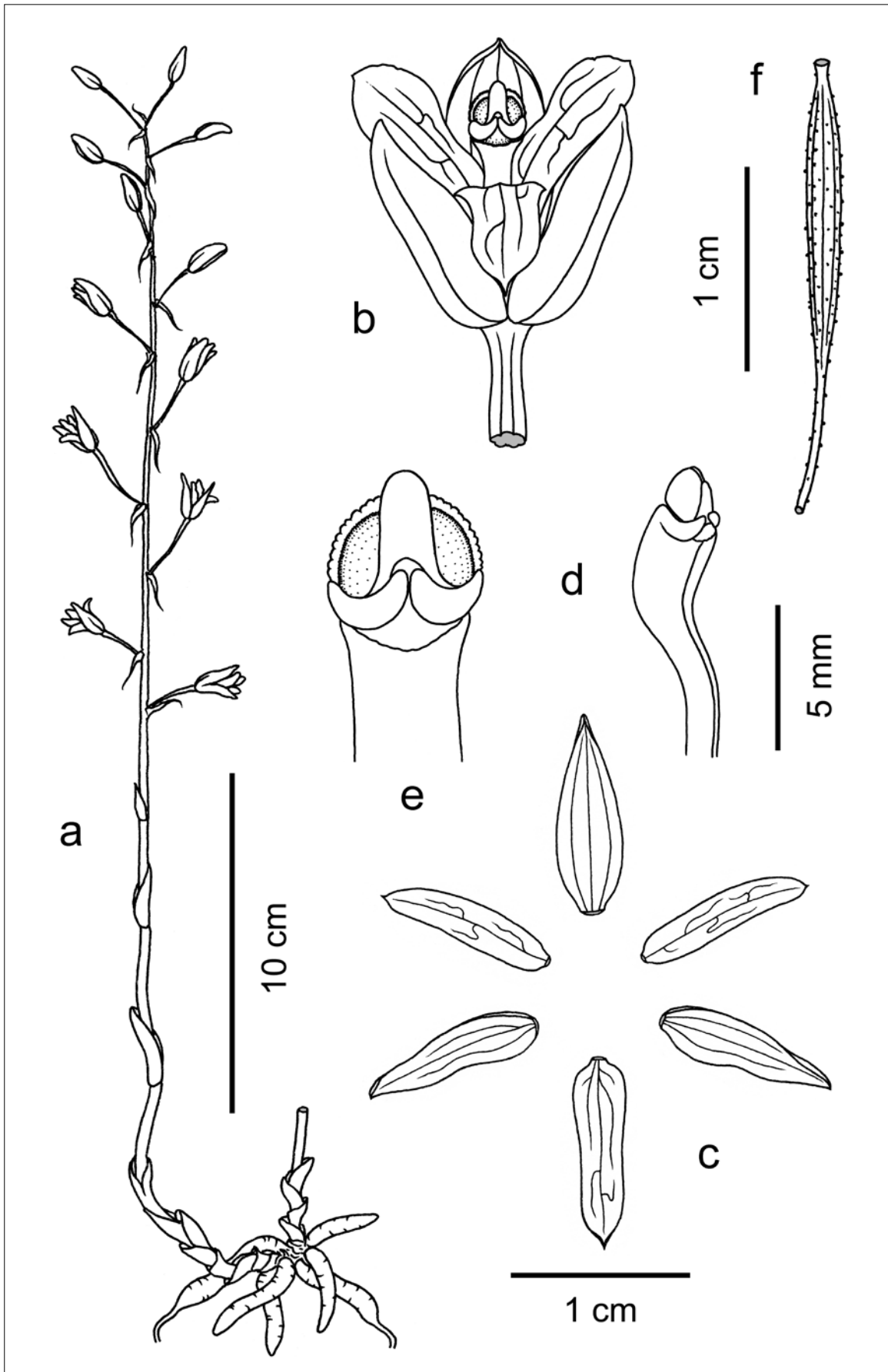


Fig. 3. *Aphyllorchis simplex* (CPC 775): a – flowering plant, b – flower, c – flattened sepals, petals and lip, d – column, side view, e – column apex, frontal view, f – pedicel and ovary.

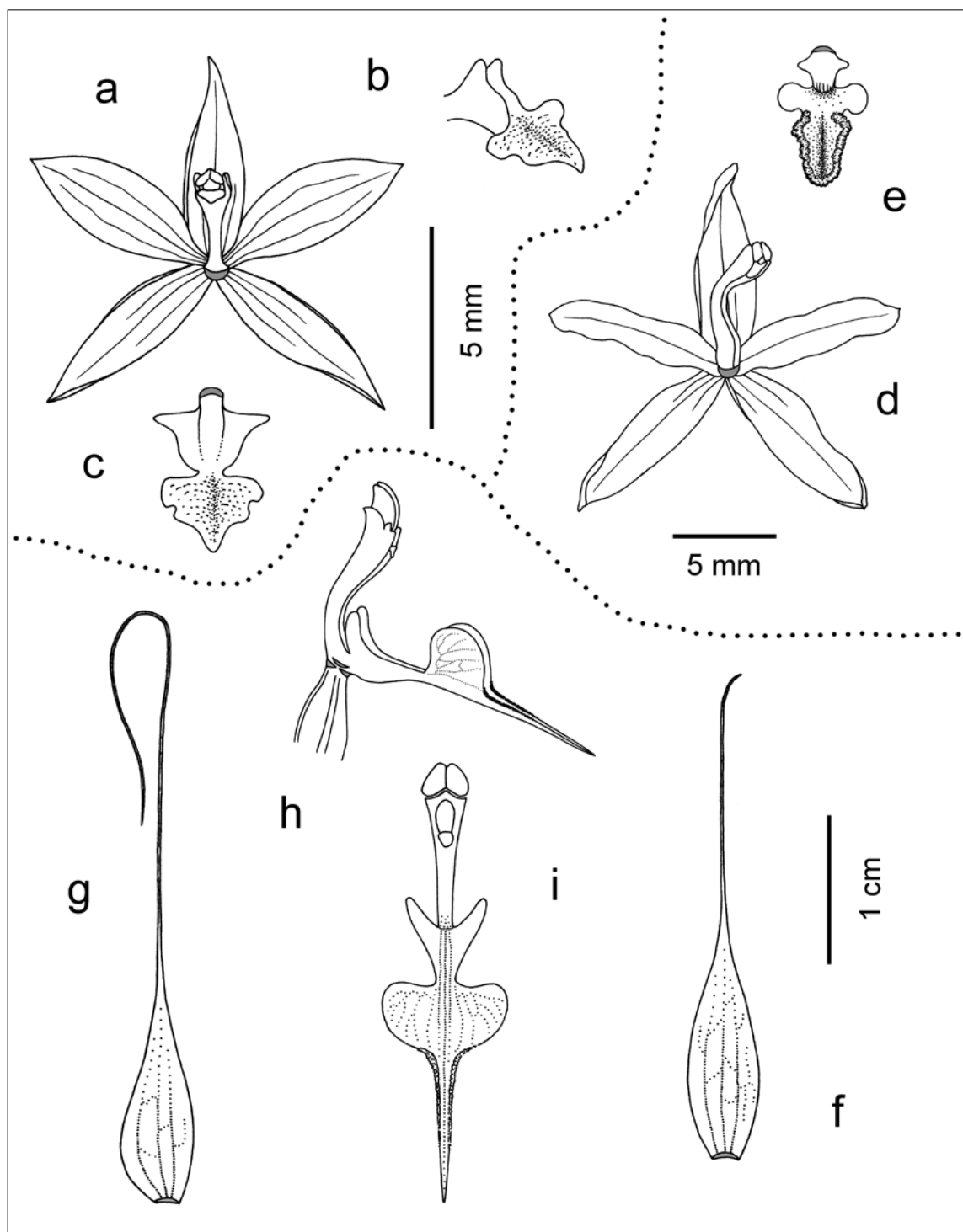


Fig. 4. *Aphyllorchis pallida* (HLF 5328a): a – column and flattened sepals and petals, b – lip, side view, c – flattened lip; *A. montana* (HAL 2992): d – column and flattened sepals and petals, e – flattened lip; *A. evrardii* (VH 2328): f – median sepal, g – lateral sepal, h – column and lip, side view; i – column and flattened lip, frontal view.

3. *A. montana* Reichenb. f.,

1877, Linnaea 41: 57; Garay, Sweet, 1974, Orch. Ryukyu Isl.: 45, 46, fig. 2; Seidenf., 1978, Dansk Bot. Ark. 32, 2: 121, 122, fig. 75; id., 1992, Orch. Indochina: 25; Seidenf., Wood, 1992, Orch. Malay. Sing.: 45, fig. 12 e-o; Aver., 1994, Identif. Guide. Vietnam. Orch.: 24; P.H. Ho, 2000, Ill. Fl. Vietnam 3: 779, fig. 10882; Su Horng-Jye, 2000, Fl.

Taiwan 5: 750, fig. 318; Comber, 2001, Orch. Sumatra: 119, fig.; Pearce et Cribb, 2002, Orch. Bhutan: 37, fig. 7 k-s; Aver. et Averyanova, 2003, Updated Checklist Orch. Viet.: 11.

Described from Sri Lanka (“Ambagumowa District”). **Lectotype** (“*Thwaites CP 3189*”) – K.

Stem erect, slender, yellow-brownish to nearly white, 30–50 cm tall, with several short

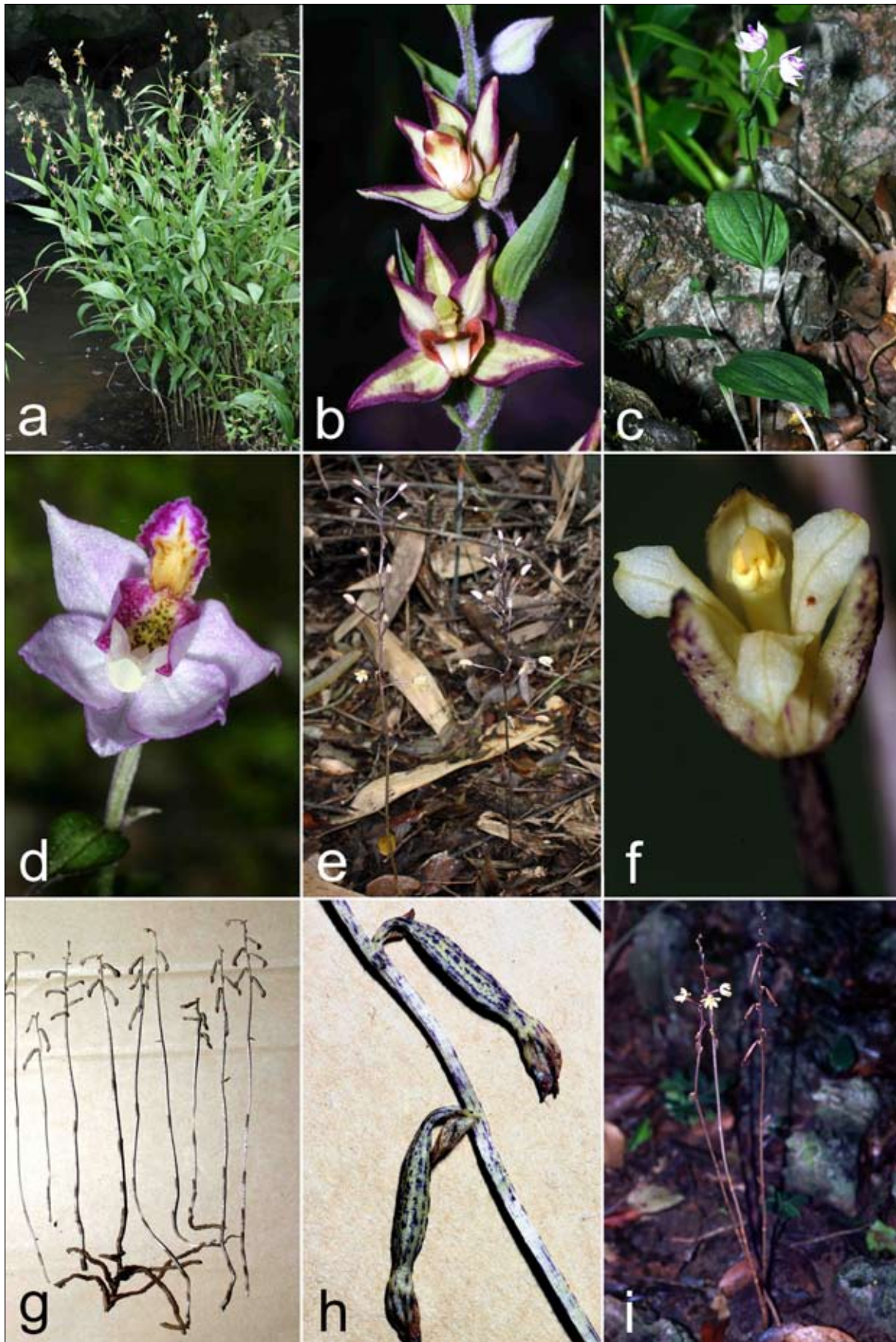


Fig. 5. *Epipactis atromarginata*: a, b (HLF 6181); *E. alata*: c, d (HAL 8513, type); *Aphyllorchis simplex*: e, f (CPC 775); *A. pallida*: g, h (HLF 5328a); *A. montana*: i (HAL 2992).

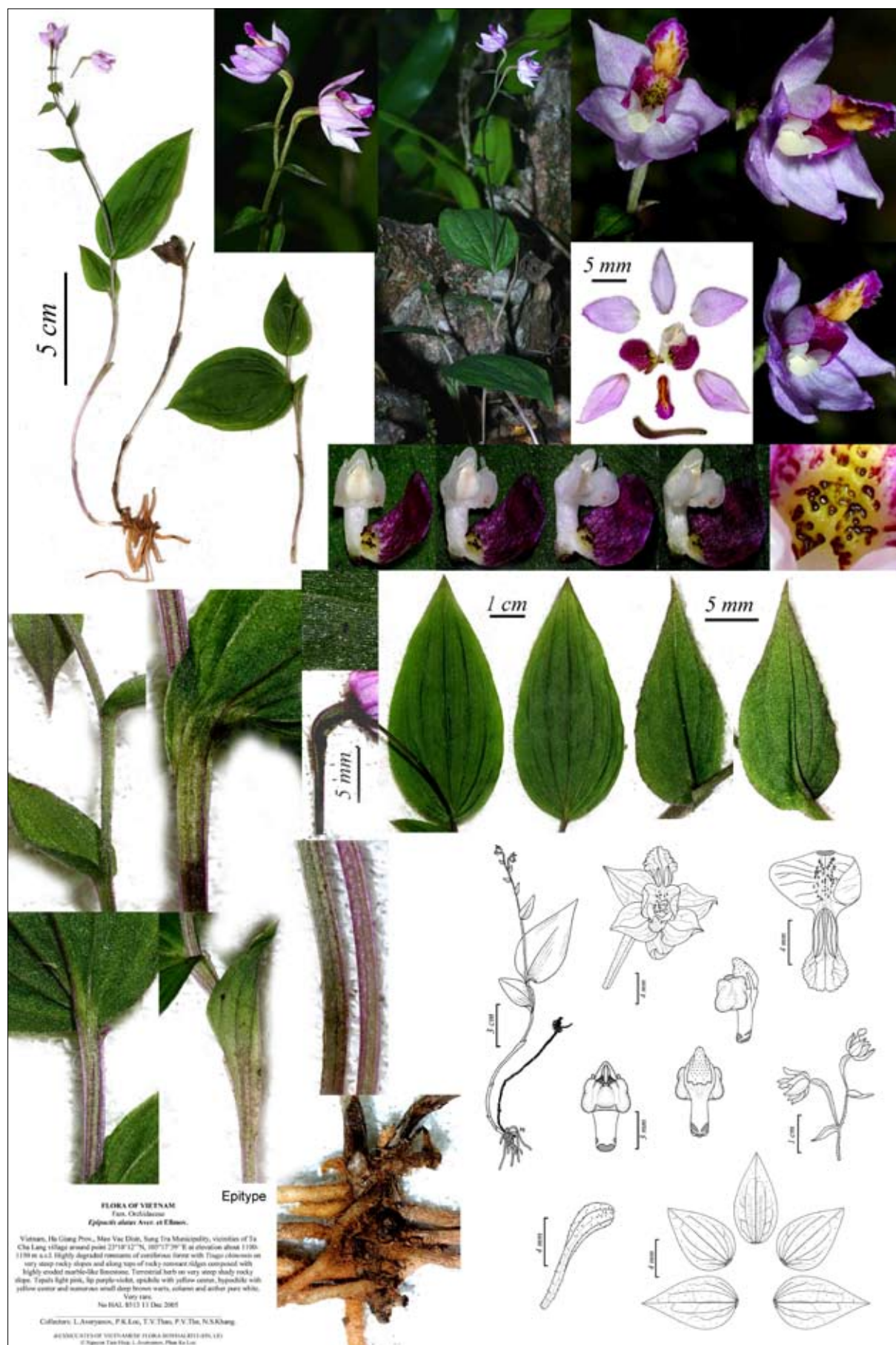


Fig. 6. Digital herbarium specimen of *Epipactis alata* (Averyanov L. HAL 8513, epitype).

sheaths and few- to many-flowered inflorescence 5–15 cm long. Floral bracts linear-cuneate, to 1.5 cm long, reflexed. Pedicel and ovary 1.5–2 cm long, elongated after anthesis. Sepals and petals, dull yellow, sometimes with purple tint, subsimilar, elliptic, 8–10 mm long, sepals fleshy and keeled in apical half. Lip yellow to yellow-brownish, with white spots. Hypochile with erect, triangular, acute lobes. Epichile triangular-ovate, 6–8 mm long, with indistinct erect roundish side lobes; midlobe fleshy, rugose, concave, obtuse, with fat finely warty margin. Column 1 cm long, bended at the middle, widened to the apex. **Fig. 4 e d; 5 i; 23 a.**

Ecology. Broadleaved forests on deep limestone and silicate soils. 350–800 m. Fl. September – October. Rare (VU).

Distribution. Vietnam (Kien Giang, Ninh Tuan, Thanh Hoa, Vung Tau). Mainland tropical Asia, Hainan, Taiwan, Kalimantan, Philippines.

Studied specimens. Cana, Phanrang, *Poilaene s.n.*; Krong Pha, *Hayata 949* (P); Thanh Hoa, Ba Thuoc, *HAL 2992* (HN, LE); Kien Giang, Phu Quoc, a. 2007 *N.V. Khoi, s.n.* (LE – photo); Pulo Condor, *Harmand s.n.*

4. *A. evrardii* Gagnep.,

1931, Bull. Mus. Hist. Nat. (Paris) 2 ser. 3, 7: 680; Seidenf., 1978, Dansk Bot. Ark. 32, 2: 118, 120, fig. 73; id., 1992, Orch. Indochina: 24, 25, fig. 7; Aver., 1994, Identif. Guide. Vietnam. Orch.: 24; P.H. Ho, 2000, Ill. Fl. Vietnam 3: 779, fig. 10881; Aver. et Averyanova, 2003, Updated Checklist Orch. Viet.: 11.

Described from Vietnam (“Annam: Dalat”).

Type (“*F. Evrard, N 1846*”) – P.

Stem brownish-yellow, with violet stripes, stout, erect, up to 1.2 m tall, with broad sheaths and many-flowered inflorescence up to 30 cm long. Floral bracts narrowly-cuneate, acuminate, 3–4 cm long. Pedicel and ovary 3.5–4 cm long, elongated after flowering. Sepals and petals subsimilar, light yellowish, with 3 violet nerves, narrowly ovate to lanceolate, 2–4.5 cm long, attenuate to long caudate apex. Hypochile, fused with base to column, side lobes narrow, erect, falcate, 2–3 mm long, roundish at the apex. Epichile 3-lobed, 1.4–1.6 cm long; side lobes, erect, hemicircular; midlobe narrowly-cuneate, acuminate, 9–11 mm long, with fat, finely papillose margin. Column slender, broadening to the apex, 9–11 mm long. Anther large, mitre-form, oblique. **Fig. 4 f-i.**

Ecology. Primary broadleaved montane forests on deep silicate soils. 1200–1700 m. Fl. No-

vember – January. Very rare (CR).

Distribution. Vietnam (Gia Lai, Lam Dong). Thailand, Laos.

Studied specimens. Benon Da Treu, *Tixier 27* (P); Dalat, *Evrard 1846* (P); Kon Tum, Dak Gley, *VH 2328* (HN, LE); Manline, *Tixier* drawing (P).

5. *A. annamensis* Aver.,

1996, Bot. Journ. (St. Petersburg), 81(10): 82, fig. 6; Aver. et Averyanova, 2003, Updated Checklist Orch. Viet.: 11.

Described from Vietnam (“Prov. Kon Tum, Distr. Dak Gley, about 7–8 km to the S. of Dak Gley town on Dak Poko River near Dak Tung village”).

Type (“3 December 1995 *VH 2221*”) – HN (holotype), AAU, LE, MO, P (isotypes).

Stem brownish-yellow, often with violet marks, stout, erect, up to 1.5 m tall, with broad sheaths and many-flowered inflorescence up to 30 cm long. Floral bracts linear-cuneate, 3–4 cm long. Pedicel and ovary 3.5–4 cm long, after flowering elongating. Sepals and petals subsimilar, white to light yellowish, with 3 violet nerves, narrowly ovate to lanceolate, 1.8–4 cm long, attenuate to long caudate apex. Hypochile white to light yellowish, fused with broad base to column, side lobes narrow, erect, falcate, 3–4 mm long. Epichile 3-lobed, chestnut-brown with white marks, 1.4–1.6 cm long, moveably articulated to apex of hypochile; side lobes dull violet, erect, broadly-rounded; midlobe triangular-ovate, 8–12 mm long, papillose, with fat warty margin, long caudate. Column pale yellow-green with violet tint, slender, 1–1.4 cm long. Anther yellow. **Fig. 7; 23 b, c.**

Ecology. Primary broadleaved forests on silicate deep soils. 800–2000 m. Fl. November – February. Rare (EN).

Distribution. Vietnam (Dak Nong, Kon Tum, Nghe An). Endemic.

Studied specimens. Dak Nong, Dak Glong, Ta Dung mt., *HLF 5617* (HN, LE); Nghe An, Quy Chau, Phu Lon peak *HLF 3102* (HN, LE).

Subtrib. 5.1.2 *Neottiinae* Reichenb. f.,

in Seem., 1868, Fl. Vit.: 293.

Type: *Neottia* Guett.

3(1) genera and 70–100(1) species. Europe, boreal, temperate and subtropical regions of mainland Asia.

Listera R. Br.,

1813, in Ait. et Ait. f. Hortus Kew. ed. 2, 5: 201, nom. cons.; Gagnep., 1934, Fl. Gen. Indo-

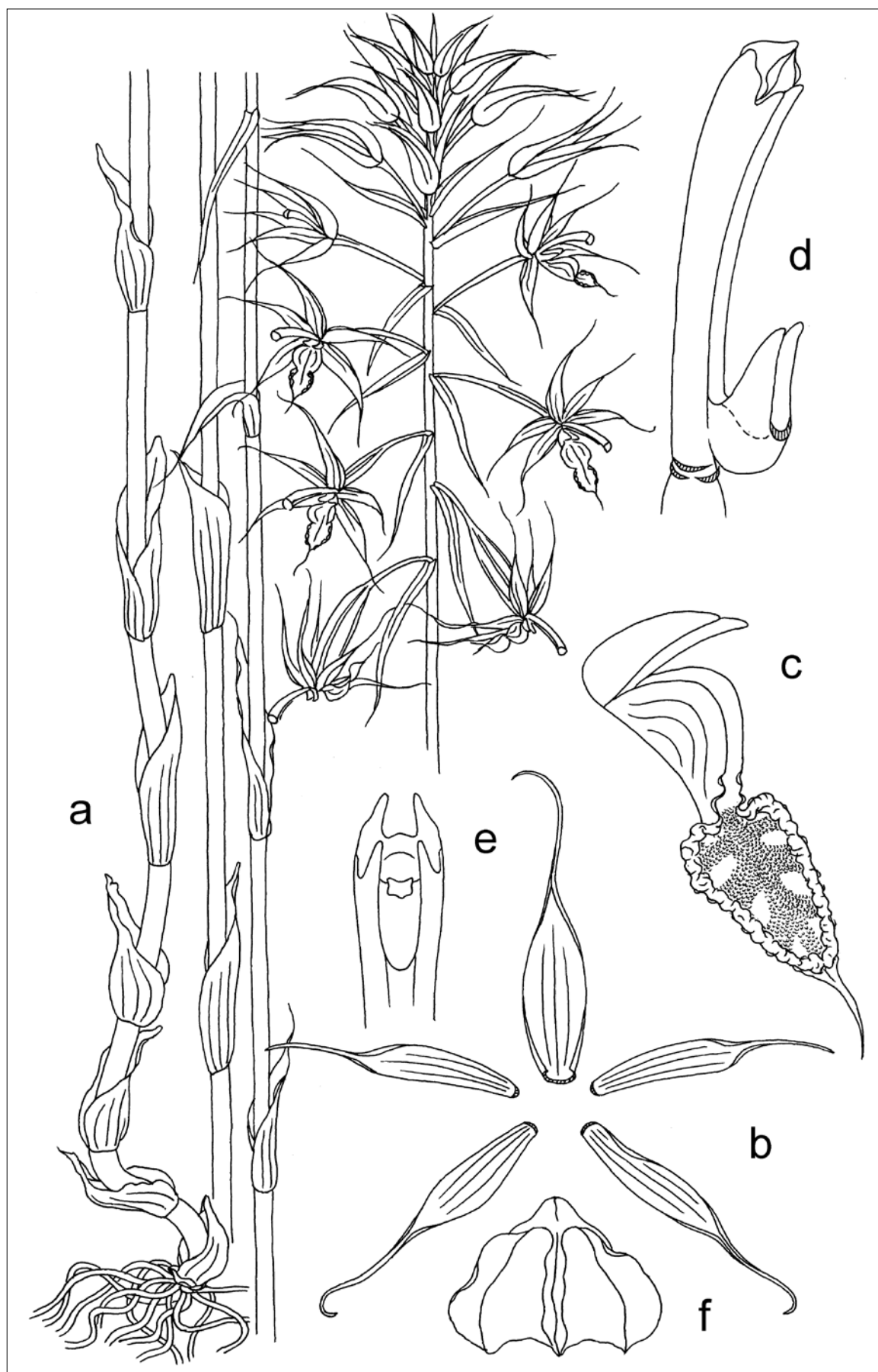


Fig. 7. *Aphyllorchis annamensis* (VH 2221, type): a – flowering plant, b – flattened sepals and petals, c – lip, side view, d – column, side view, e – column apex, frontal view, f – operculum, view from below.

Chine 6, 4: 575–576; Seidenf., 1992, Opera Bot. 114: 26; Aver., 1994, Ident. Guide Vietnam. Orch.: 26–27; P.H. Ho, 2000, Ill. Fl. Vietnam 3: 783; Su Horng-Jye, 2000, Fl. Taiwan 5: 952–959; Pearce et Cribb, 2002, Orch. Bhutan: 47–53; Aver. et Averyanova, 2003, Updated Checklist Orch. Viet.: 43. – *Neottia* Guett., 1754, Hist. Acad. Roy. Sci. Mem. Math. Phys. (Paris, 4°) 1750: 374, nom. cons., p.p.: Chen Sing-chi, Gale, Cribb 2009, Fl. China, 25: 184–195.

Type: *L. ovata* (L.) R. Br. (*Ophrys ovata* L.).

Terrestrial sympodial herbs with thin underground rhizome, 2-leaved slender stem and terminal few- to many-flowered inflorescence. Leaves sub opposite at the middle of stem, sessile, plicate. Flowers small, resupinate. Sepals and petals free. Lip without spur, not mobile, usually 2-lobed. Column short. Pollinia 2, powdery, each with small viscidium.

20(1) species. Eurasia, N. America.

***L. latilabra* Evrard ex Gagnep.,**

1931, Bull. Mus. Hist. Nat. (Paris) 2 ser. 3, 7: 683; Gagnep., 1934, Fl. Gen. Indo-Chine 6, 4: 576, fig. 15, 16; Seidenf., 1992, Orch. Indochina: 26, fig. 8; Aver., 1994, Identif. Guide. Vietnam. Orch.: 26; P.H. Ho, 2000, Ill. Fl. Vietnam 3: 783, fig. 10896; Aver. et Averyanova, 2003, Updated Checklist Orch. Viet.: 43.

Described from S. Vietnam (“Annam: Dalat”). **Type** (“Evrard, N 1251”) – P.

Stem slender, erect, 10–25 cm tall. Leaves 2 (rarely 3), triangular-cordate, 2–4 cm long and wide, acute, finely undulate along margin. Inflorescence few flowered, 2–10 cm long. Floral bracts cuneate, 1–1.5 mm long. Pedicel and ovary 5–12 mm long, sparsely pubescent. Flowers 3–8, dull purple-green, 6–8 mm across. Sepals and petals 3 mm long; sepals narrowly ovate, acute; petals narrowly lanceolate, obtuse. Lip 7 mm long, oblong-pandurate, with semicircular auricles at the base, fat green midvein and 2 triangular-falcate acute lobules at the apex. Column very short, knob-like. Fruit ovate capsule 5–6 mm long. **Fig. 8; 23 d.**

Ecology. Wet mossy spring-water places along streams in broadleaved and mixed forests on silicate soils. 1000–1500 m. Fl. September – October. Very rare (CR).

Distribution. Vietnam (Lam Dong, Thua Thien-Hue). Endemic.

Studied specimens. Dalat, *Evrard 1371* (P); Thua Thien-Hue, Bach Ma national park, *HLF 1298*, *HLF 1355* (HN, LE).

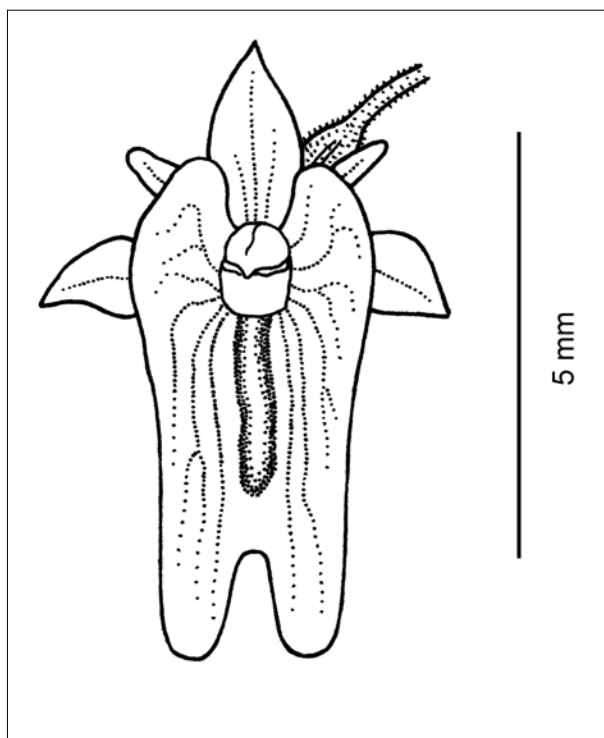


Fig. 8. *Listera latilabra* (Eberhard, 1257, type): flower, frontal view.

Trib. 5.2. Vanilleae Blume,

1835, Rumphia 1: 196.

Subtrib. 5.2.1. Galeolineae Garay,

1986, Bot. Mus. Leaflet. Harv. Univ. 30, 4: 233.

Type: *Galeola* Lour.

3(3) genera and 30(8) species. Tropical and subtropical regions of the World.

***Erythrorchis* Blume,**

1837, Rumphia, 1: 200, t. 70; Comber, 1990, Orch. Java: 72–73; id., 2001, Orch. Sumatra: 127–128; Seidenf., 1992, Opera Bot. 114: 73; Seidenf., Wood, 1992, Orch. Malay. Sing.: 130–132; Aver., 1994, Ident. Guide Vietnam. Orch.: 79; P.H. Ho, 2000, Ill. Fl. Vietnam 3: 792; Su Horng-Jye, 2000, Fl. Taiwan 5: 872–874; Aver. et Averyanova, 2003, Updated Checklist Orch. Viet.: 35; Newman et al, 2007, Checkl. Vasc. Pl. Lao PDR: 268; Schuiteman et al., 2008, Nord. Journ. Bot. 26: 292; Chen Sing-chi, Gale, Cribb, 2009, Fl. China, 25: 171. – *Galeola* Lour., p.p.: Gagnep., 1934, Fl. Gen. Indo-Chine 6, 5: 630–636.

Type: *E. altissima* (Blume) Blume (*Cyrtosia altissima* Blume).

Achlorophyllous leafless vines. Stem climbing, dull reddish-brown or yellowish-brown, cylindric, flexuous, much branched, glabrous, with roots and scales at nodes. Inflorescence terminal or lateral raceme or panicle, dense, many-flowered;

rachis and flower glabrous; floral bracts small, persistent. Flowers resupinate, not fully opening. Sepals and petals often connivent; lip nearly unlobed, broad, with stout and thick longitudinal median ridge and apical papillose cushion. Column erect, slightly curved, with very short foot, tapering into median ridge of lip; anther subterminal; pollinia 2, granular-mealy, without caudicle or viscidium; stigma concave, large; rostellum small. Fruit dry, dehiscent, long cylindric capsule. Seeds with stout testa and broad surrounding wing.

3(1) species. Tropical Asia to islands of W. Pacific.

***E. altissima* (Blume) Blume,**

1837, Rumphia, 1: 200; Gagnep., 1934, Fl. Gen. Indochine, 6, 5: 632, fig. 61, 2–8; Comber, 1990, Orch. Java: 73, fig.; id., 2001, Orch. Sumatra: 128, fig.; Seidenf., Wood, 1992, Orch. Malay. Sing.: 132, fig. 54 a, b; Su Horng-Jye, 2000, Fl. Taiwan 5: 873, fig. 371. – *Cyrtosia altissima* Blume, 1825, Bijdr.: 396. – *Galeola altissima* (Blume) Reichenb. f., 1865, Xenia Orch. 2: 77; Seidenf., 1978, Dansk Bot. Ark. 32, 2: 137, fig. 85; Aver., 1988, Prelim. List Vietnam. Orch. 1: 198; Gagnep., 1934, Fl. Gen. Indo-Chine 6, 5: 635, fig. 61, 2–8. – *G. ochobiensis* Hayata, 1916, Icon. Pl. Formos. 6: 87. – *Erythrorchis ochobiensis* (Hayata) Garay, 1986, Bot. Mus. Leaflet. Harv. Univ. 30, 4: 234; Seidenf., 1992, Opera Bot. 114: 73; Seidenf., Wood, 1992, Orch. Malay. Sing.: 132, fig. 54 c–e; Aver., 1994, Ident. Guide Vietnam. Orch.: 79; P.H. Ho, 2000, Ill. Fl. Vietnam 3: 792, fig. 10930; Aver., Averyanova, 2003, Updated Checkl. Orch. Vietnam: 35.

Described from Java (“in montibus Seribu”).

Type (“*Blume*”) – L.

Stem yellowish-pink, reddish-brown or olive-brown, climbing, cylindric, slender, to 10 m long, with many curved and twisted branches, with short scales at slightly inflated nodes. Inflorescence large, many-flowered raceme, with branched slender, glabrous rachis. Floral bracts persistent, triangular, 2–3 mm long. Pedicel and ovary erect, glabrous, 6–10 mm long. Flowers whitish-yellow, slightly tinged with brown, often not opening widely. Sepals narrowly obovate, 10–14 mm long 3–5 mm wide, glabrous. Petals oblanceolate, slightly narrower than sepals. Lip slightly tinged with violet or brown, broadly obovate, concave, as long as sepals, apex indistinctly 3-lobed, irregularly undulate and plicate; disc with stout thick median hairy longitudinal ridge

from base to middle, at the apex with papillose cushion; surface of lip side lobes with numerous fine indistinct transversal folds. Column erect, 5–7 mm tall. Capsule dull reddish-brown to gray, narrowly cylindric, 10–22 cm long, 5–10 mm wide. Seeds with large, flat, surrounding wing about 1 mm wide, wing cleft on one side. **Fig. 9; 23 e–g.**

Ecology. Primary and secondary broad-leaved, evergreen, shady forests on soils derived from silicate rocks at elev. 50–1000 m a.s.l. Fl. April – May. Rare (EN).

Distribution. Vietnam (Danang, Dong Nai, Hai Phong, Hanoi, Kien Giang, Ninh Thuan, Phu Khanh, Quang Binh, Quang Nam, Quang Tri, Thua Thien-Hue). NE. India, Myanmar, Japan, Taiwan, Hainan, Thailand, Laos, Cambodia, Malaysia, Indonesia, Philippines.

Studied specimens. Hanoi, Bavi, *Balansa 2018* (LE, P); Dong Nai, Muxohay, *Pierre 61* (P); Hai Phong, Cat Ba, *Nong Van Tiep NVT 3089*, (LE, UHN); Kien Giang, Phu Quoc, *Godefroy, 961* (P); Phu Khanh, Nhatrang, *Poilane 6247* (K, P), *Poilane 6414* (P); Quangnam-Danang, Phuoc Son, Lang Ha, *LX-VN s.n.* 16.07.1986 (LE), Quang Binh, Le Thuy, *HAL 11440* (HN, LE); Quang Binh, Quang Ninh, *HAL 11571* (HN, LE); Quang Tri, Da Krong, Da Krong Nature Reserve *HLF 6214* (HN, LE), d-EXSICCATES OF VIETNAMESE FLORA 0062/*HLF 6214*; Ninh Thuan, Ninh Hai, Nui Chua national park *HLF 4416* (HN, LE), *HLF 4603* (HN, LE).

Notes. Northern race of this species distributed in Japan, Taiwan and Hainan sometimes treated as a distinct species – *Erythrorchis ochobiensis* with very narrow, filiform fruits. Vietnamese specimens have more or less intermediate fruit morphology.

***Cyrtosia* Blume,**

1825, Bijdr. 6, fig. 6; id., 1825, ibid., 8: 396; Comber, 1990, Orch. Java: 72; id., Orch. Sumatra: 126–127; Seidenf., 1992, Opera Bot. 114: 73; Seidenf., Wood, 1992, Orch. Malay. Sing.: 127–128; Aver., 1994, Ident. Guide Vietnam. Orch.: 77; P.H. Ho, 2000, Ill. Fl. Vietnam 3: 793; Su Horng-Jye, 2000, Fl. Taiwan 5: 835–839; Aver. et Averyanova, 2003, Updated Checklist Orch. Viet.: 25; Newman et al., 2007, Checkl. Vasc. Pl. Lao PDR: 261; Schuitman et al., 2008, Nord. Journ. Bot. 26: 279; Chen Sing-chi, Cribb, 2009, Fl. China, 25: 168–170. – *Galeola* Lour., p.p.: Gagnep., 1934, Fl. Gen. Indo-Chine 6, 5: 630–636.

Lectotype: *C. javanica* Blume.

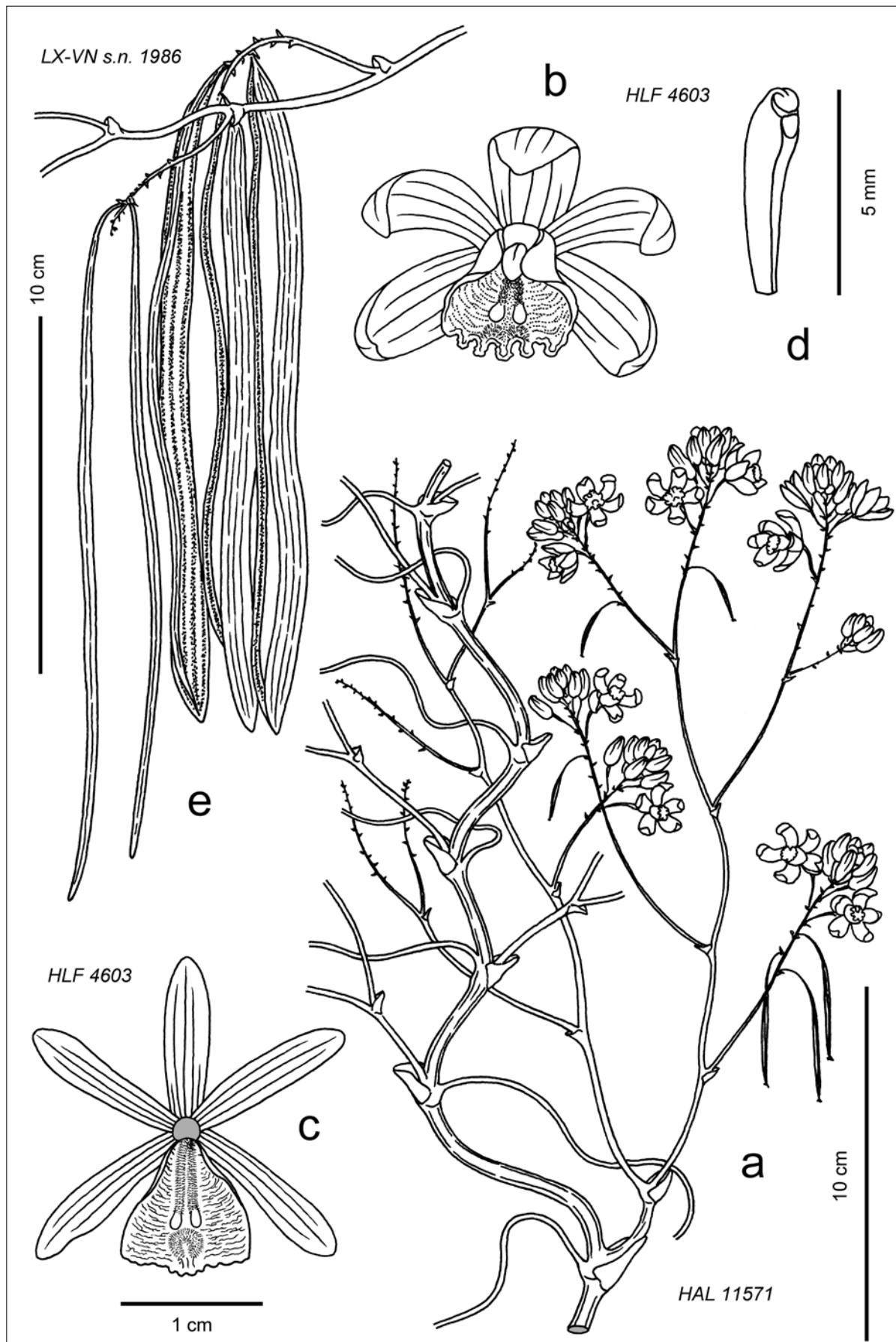


Fig. 9. *Erythrorchis altissima*: a – flowering plant (HAL 11571), b – flower, c – flattened sepals, petals and lip, d – column, side view (HLF 4603), e – fruits and portion of fruiting stem (Averyanov, LX-VN s.n., 1986).

Achlorophyllous leafless terrestrial herbs with erect stem, stout rhizome bearing woody or fleshy, tuber-like roots. Stem simple or branched, dull pink to yellowish-brown, fleshy, with scales at nodes. Inflorescence terminal or lateral raceme or panicle, few- to many-flowered, shortly hairy, floral bracts persistent. Flowers commonly not widely opening, campanulate, or subcampanulate. Sepals and petals connivent or not; sepals often more or less hairy outside; petals glabrous. Lip unlobed, spurless, lip base embracing column. Column footless slightly curved or straight, stout, broadening to the apex; anther terminal; pollinia 2, granular-mealy,

without caudicle or viscidium. Fruit fleshy cylindrical indehiscent berry. Seeds with stout testa, wingless or with a narrow surrounding wing.

10(6) species. Mainland tropical and subtropical Asia, Japan, Taiwan, Hainan, Indonesia.

Notes. The genus closely allies to *Galeola* Lour., which species differ in climbing vine habit, aerial roots at nodes and drying dehiscent fruit that is rather capsule than berry. All members of the genus have ephemeral inflorescences and flowers, hence they easily overlooked in field surveys and collecting.

Key to species

1. Stem commonly much shorter than 1.2 m, less than 5 mm in diam. at the base; inflorescence simple or hardly branching; rachis less than 15 cm long, lateral racemes less than 2(3) cm long; flowers less than 2 cm across 2
- Stem 1.5–3.5 m tall, more than 5 mm in diam. at the base; inflorescence much branching; rachis much longer than 15 cm long, lateral racemes usually longer than 2 cm; flowers larger than 2 cm across 4
2. Stem (15)20–120 cm tall; flowers more or less widely opening, sepals and petals more or less thin, recurved; lip very fleshy, with 2 large massive glabrous callosities at the center; column with large broad, ear-like, lateral wings at apex **1. *C. integra***
- Stem to 15(20) cm tall; flowers hardly opening, campanulate, sepals fleshy, not recurved; lip not too much fleshy, with no callosity inside, or with 2 small finger-like erected glabrous processes at the center; column with no large prominent wings at apex 3
3. Inflorescence branching; lip hairy inside and finely ciliate along rather thin apical margin; disc with 2 small finger-like erected glabrous processes **2. *C. nana***
- Inflorescence not branching; lip glabrous or slightly mealy pubescent to the apex, not ciliate along fleshy apical rim; disc with no callosities **3. *C. javanica***
4. Lip oblong, hardly concave, not cup-like; disc with strong nerves covered with warty, lamellate or crenate appendages; floral bracts outside sparsely hairy or glabrous; column 8–10 mm tall **4. *C. faberi***
- Lip almost round, strongly concave, cup-like; disc densely haired with long papillae; floral bracts outside densely hairy; column 2–3 mm tall 5
5. Inflorescence narrow, usually composed with unbranched racemes less than 3.5 cm long; sepals less than 2 cm long, with distinct massive wavy keel or roughly grooved outside; lip with small erect glabrous plate near the base, without constriction or fold at the base; anther strongly papillose **5. *C. lindleyana***
- Inflorescence broad, many branched, with branches to 35 cm long; sepals 2.5–3 cm long, outside more or less smooth, without distinct keel; lip with small transversal fold forming a sac at the base, distinctly constricted between the sac and lip blade; anther short papillose or nearly glabrous **6. *C. falconeri***

1. *C. integra* (Rolfe ex Downie) Garay, 1986, Bot. Mus. Leaflet. 30, 4: 232; Seidenf., 1992, Orch. Indochina: 73; Aver. et Averyanova, 2003, Updated Checklist Orch. Viet.: 25; Newman et al., 2007, Checkl. Vasc. Pl. Lao PDR: 261. – *Galeola integra* Rolfe ex Downie, 1925, Kew Bull. 1925: 409; Seidenf., 1978, Dansk Bot. Ark. 32, 2: 130, 131, fig. 80; P.H. Ho, 2000, Ill. Fl. Vietnam 3: 793, fig. 10931.

Described from NW. Thailand (“Doi Suthep 900 m”). **Type** (“Kerr 304”) – C, K.

Stems dull red, pink-brown to yellowish-brown, to 1(1.2) m tall, arising by 1–4 from short,

rigid vertical rhizome, clustered with fleshy, cylindrical or clavate roots. Inflorescence branching or not, each raceme few- to many-flowered. Floral bracts triangular, acute, persistent, to 3 mm long. Pedicel and ovary pinkish, 1–1.5 cm long, mealy-pubescent. Flowers broadly opening, sepals and petals subsimilar, 1.2–1.8 cm long, median sepal and petals brown, brown-yellow to olive-green, lateral sepals broader, in halves brown and yellow. Sepals mealy pubescent outside; dorsal sepal, narrowly ovate, 4–5 mm wide, concave; lateral sepals, ovate, 5–8 mm wide. Petals narrowly ovate, 4–5 mm wide. Lip yellow, often with whitish center, fleshy, concave, subor-

bicular, hairy inside, particularly to the apex, with 2 low thick, glabrous keels at the center. Column white, slightly curved, broadening to apex, 6–8 mm tall, at apex with broad, ear-like, lateral wings finely denticulate along margin. Fruits cylindric, light brown-yellow to brown-purple, to 7 cm long. **Fig. 10; 23 h, i.**

Ecology. Primary and secondary broadleaved and mixed evergreen rather open forests (often with bamboo) on any kind of soils at elev. 800–1500 m a.s.l. Fl. April – May (June). Very rare (VU).

Distribution. Vietnam (Bac Kan, Ha Giang, Thua Thien-Hue). Thailand, Laos.

Studied specimens. Bac Kan, Cho Don, HAL 4874 (HN, LE); Ha Giang, Quan Ba, HAL 1510 (HN, LE); Thua Thien-Hue, Phu Loc, Bach Ma national park, HLF 934 (HN, LE).

2. *C. nana* (Rolfe ex Downie) Garay,

1986, Bot. Mus. Leaflet. 30: 233. – *Galeola nana* Rolfe ex Downie, 1925, Kew Bull. 1925: 409; Seidenf. 1978, Dansk Bot. Ark. 32, 2: 132, fig. 81.

Described from NW. Thailand (“Doi Suthep”). **Type** (“Kerr 313”) – K.

Stem fleshy, erect, white with yellow or reddish tint, to 15 cm tall, glabrous or apically with sparse, mealy hairs; nodes with lanceolate scales; internodes usually 1–3 cm. Rhizome slender, rigid, woody, to 10 cm long, fascicled with numerous tuber-like, short, fleshy, clavate roots, 4–9 cm long and 0.5–1.2 cm in diam. Inflorescence erect, rigid, on stalk 2–5 cm, elongating slowly and producing flowers in succession, branching or not; raceme few- to many-flowered, rusty mealy-pubescent; floral bracts persistent, triangular, acute, 1–2 mm long, rusty pubescent outside. Pedicel and ovary 8–10 mm long, rusty haired. Flowers hardly opening, pale yellow, lip with indistinct orange-red longitudinal stripes. Sepals fleshy, elliptic, 1–1.8 cm long, 0.9 cm wide, concave, outside mealy pubescent. Petals, slightly narrower, thin. Lip concave, cup-like, broadly ovate, entire, 1–1.4 cm long, hairy inside, margin sometime finely undulate and erose-ciliate, disk at the center with 2 small pyramidal glabrous finger-like erected glabrous processes. Column slender, to 7 mm tall, slightly dilated to the apex, without conspicuous wing. Fruit oblong-elliptic to cylindric pink-purple berry, 3–6 cm long, 0.8–1 cm in diam. **Fig. 11; 24 a, b.**

Ecology. Primary and secondary evergreen broadleaved shady lowland valley forest in limestone areas at elev. about 250 m a.s.l. Fl. April – June. Very rare (VU).

Distribution. Vietnam (Nghe An, Ninh Binh, Thanh Hoa, Quang Binh). Thailand, SW. China.

Studied collections. Ninh Binh and Thanh Hoa, Cuc Phuong national park, *Dinh kinh 181–264*; CPNP 5147 (Cuc Phuong national park Herbarium); N.M. Cuong et al., NMC 1665 (Cuc Phuong national park Herbarium, LE); Thanh Hoa, Thach Thanh, HAL 2896 (LE); Nghe An, Tuong Duong, HLF 6674 (HN, LE), HLF 7055 (HN, LE); Quang Binh, Minh Hoa, VH 4677a (LE).

Notes. Very rare relictual element of primary warm-temperate lowland limestone tropical forests. In northwestern Thailand and southwestern China it was reported from elevations 500–1400 m a.s.l.

3. *C. javanica* Blume,

1825, Bijdr. 6, fig. 6; id., 1825, ibid., 8: 396; Comber, 1990, Orch. Java: 73, fig.; id., 2001, Orch. Sumatra: 126, fig.; Seidenf., 1992, Orch. Indochina: 73; Seidenf., Wood, 1992, Orch. Malay. Sing.: 128, fig. 52; Aver., 1994, Ident. Guide Vietnam. Orch.: 77; P.H. Ho, 2000, Ill. Fl. Vietnam 3: 793, fig. 10933; Su Horng-Jye, 2000, Fl. Taiwan 5: 838, fig. 354; Aver. et Averyanova, 2003, Updated Checklist Orch. Viet.: 25; Shih-Wen Chung, 2008, Orch. Taiwan, 1: 121, fig. – *Galeola javanica* (Blume) Benth. et Hook.f., 1883, Cen. Pl. 3: 590; J.J. Smith, 1908, Fl. Buitenzorg 6, 2, fig. 46; Seidenf., 1978, Dansk Bot. Ark. 32, 2: 130, fig. 79; Jayaweera, 1981, Fl. Ceylon 2: 339, fig. 149; Aver., 1988, Prelim. List Vietnam. Orch. 1: 199.

Described from Java (“montium Javae insulae”). **Syntypes** (Herb. numbers 9023222253, 9023222254, 9023222256) – L.

Stems yellowish or pink-yellow, to 20 cm tall, often arising by 1–3 from short, rigid vertical rhizome 6–8 cm long, covered with more or less imbricate yellowish-brown persistent glabrous scales. Roots numerous, fleshy, tuber-like, cylindric or clavate, 5–8 cm long, 8–12 mm in diam. Inflorescence racemose, few- to many-flowered. Floral bracts triangular, small. Pedicel and ovary 1–1.5 cm long, mealy pubescent. Flowers not fully opening, yellowish to yellow-orange. Sepals subsimilar, fleshy, mealy pubescent outside, narrowly ovate, 1–1.4 cm long, 4–6 mm wide, concave. Petals thin, narrowly ovate, as long as sepals. Lip, 8–12 mm long, yellowish at the base, whitish to the apex, suborbicular, with thickened apex, glabrous or slightly mealy pubescent in apical part. Column clavate, to 6 mm tall, with erose-dentate wings at apex. Fruits cylindric, dull pinkish-brown, to 6 cm long. **Fig. 12.**

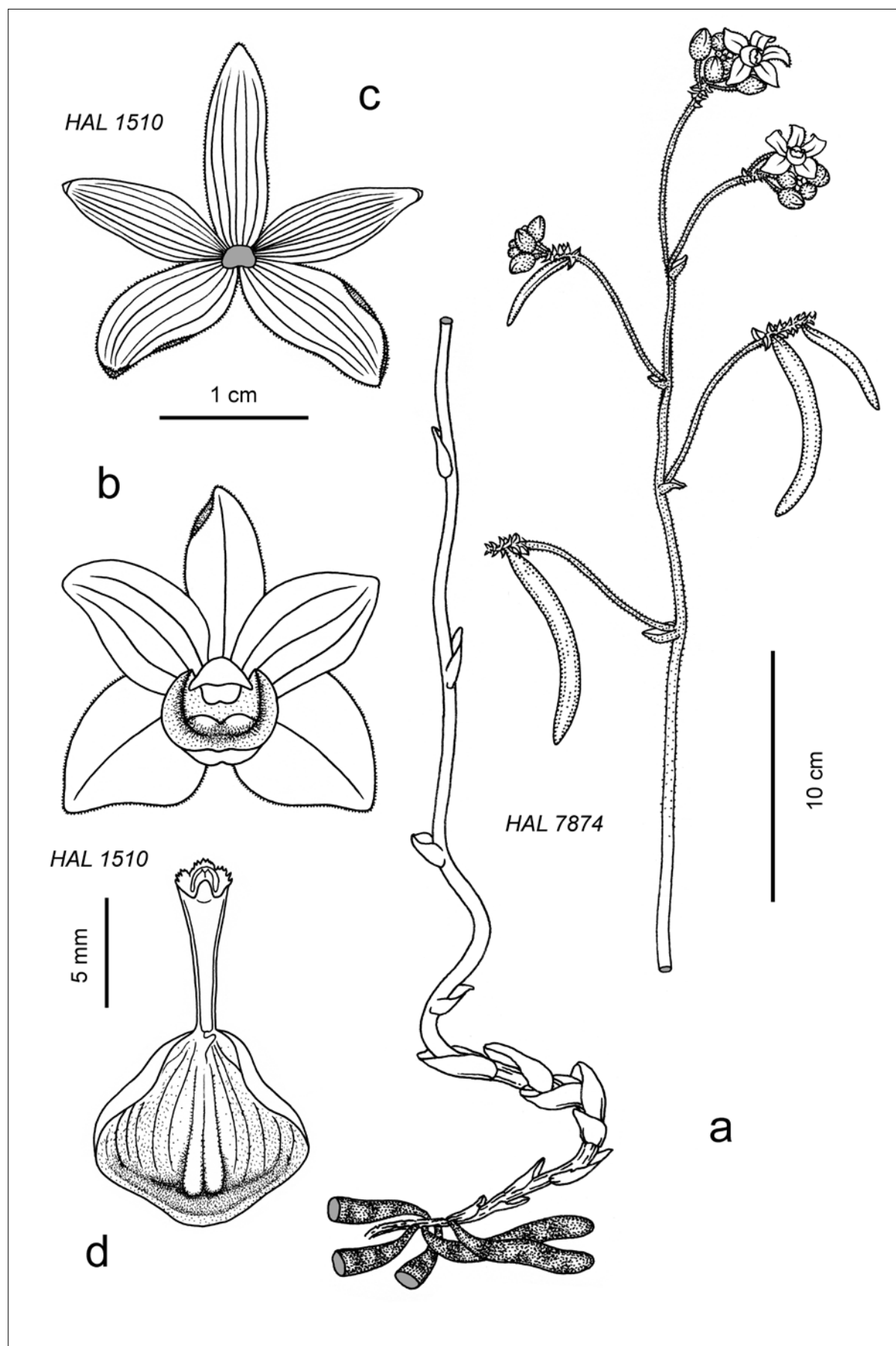


Fig. 10. *Cyrtosia integra*: a – flowering and fruiting plant (HAL 7874), b – flower, c – flattened sepals and petals, d – column and reflexed, flattened lip, frontal view (HAL 1510).

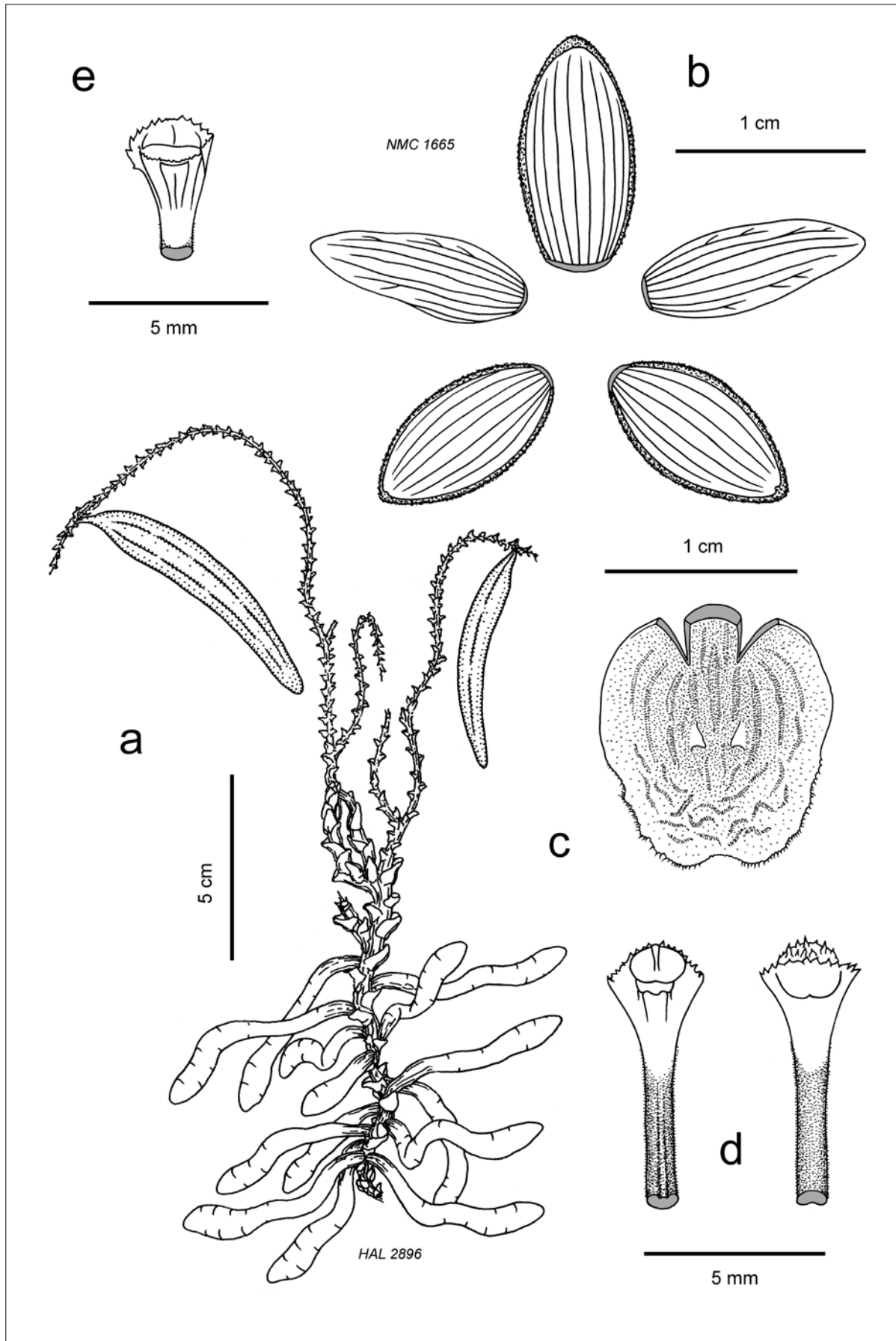


Fig. 11. *Cyrtosia nana*: a – fruiting plant (HAL 2896), b – flattened sepals and petals, c – flattened lip, d – column, ventral and dorsal view, e – column apex without operculum (NMC 1665).

Ecology. Primary and secondary old broad-leaved evergreen shady forests (sometimes with bamboo) on any kind of soils at elev. 300–1500 m a.s.l. Fl. March – May (June). Very rare (VU).

Distribution. Vietnam (Cao Bang, Ha Noi, Hoa Binh, Quang Binh). Sri Lanka, NE. India, Thailand, Taiwan, Philippines, Malacca Peninsula, Java, Sumatra, Kalimantan.

Studied specimens. Hanoi, Mt. Bavi, *Baslansa* 2015 (P); Cao Bang, Tra Linh, *NTH 2111a* (HN, LE); Hoa Binh, Mai Chau, *NTH 2111* (HN); Quang Binh, Quang Ninh, *HAL 11515* (HN).

Notes. Forms with several wings at each lateral side of column apex were described from Thailand as *Cyrtosia plurialata* Seidenf. (1995, Opera Bot., 124: 13). Such plants closely ally to variable *C. javanica* and may represent its marginal form.

4. *C. faberi* (Rolfe) Aver.,

comb. nov. – *Galeola faberi* Rolfe, 1896, Kew Bull. 1896: 200; Chen Sing-chi, Tsi Zhanhuo, Luo Yibo, 1990, Nat. Orch. China: 226, fig.; Jin Xiaohua, Zhao Xiaodong, Shi Xiaochun, 2000, Nat Orch. Gaoligongshan Mount.: 251, fig. – *G. shweliensis* W.W. Smith, 1921, Not. Roy. Bot. Gard. Edinb. 13: 204.

Described from S. China (“China: Sichuan: Mt. Omei, 7000 ft.”). **Type** (“*Faber s.n.*”) – K.

Stem dull reddish-brown, to 3 m tall, in lower part glabrous, upper part hardly sparsely rusty hairy, with several distant ovate to lanceolate scales 2–4 cm long. Rhizome 2–3 cm in diam., covered by broad triangular scales. Panicle composed of terminal and lateral often branching racemes 5–25 cm long, many-flowered; peduncle and rachis sparsely shortly tomentose; sterile bracts at base of racemes narrowly ovate, 1–2 cm long, glabrous; floral bracts ovate-triangular, 1–4 mm long, often vertical to rachis, dorsally glabrous or hardly sparsely rusty tomentose. Pedicel and ovary 1–2 cm long, rusty tomentose. Flowers dull pale yellow, 2.5–3.5 cm in diam., lip sometimes laterally with reddish stripes. Sepals similar, narrowly elliptic to broadly lanceolate, 2–3 cm long, 5–8 mm wide, sparsely very shortly rusty tomentose outside. Petals oblong, as long as sepals, 6–10 mm wide, finely irregularly denticulate along margin. Lip entire, obovate to oblong, 1.6–2.2 cm long, 1–1.2 cm wide, inside with many thick veins densely covered with warty, lamellate or crenate appendages, basal part concave, loosely embracing column, margin finely irregularly incised and undulate. Column clavate, erect, nearly straight, 8–10 mm tall; anther cap finely papillose. Fruit red to red-brownish, cylindric berry. **Fig. 13.**

Ecology. Humid primary and secondary broad-leaved evergreen rather open forests (sometimes with bamboo) on silicate soils commonly in small depressions rich in humus accumulations at elev. 1900–2000 m a.s.l. Fl. May – June. Fruits September – October. Very rare (VU).

Distribution. Vietnam (Lao Cai). Nepal, Bhutan, N. India, China, Sumatra.

Studied collections. Lao Cai, Sa Pa, *DKH 5992* (HN, LE, MO), *NTH 2650* (HN, LE).

Notes. This species as well as *C. lindleyana* and *C. falconery* are spectacular giant highland plants with unforgettable handsome appearance and very large, banana-like, fleshy and juicy, brightly red or purple fruits. Unfortunately, flowering period of these species is fairly ephemeral, hence they are poorly presented in botanical collections.

5. *C. lindleyana* Hook. f. et J. Thomson,

1855, Ill. Himal. Pl., tab. 22. – *Galeola lindleyana* (Hook. f. et J. Thomson) Rehb.f., 1865, Xenia Orchid. 2: 78; King et Pantl., 1898, Ann. Roy. Bot. Gard. Calcutta, 8: 264, tab. 352; Chen Sing-chi, Tsi Zhanhuo, Luo Yibo, 1990, Nat. Orch. China: 227, fig.; Jin Xiaohua, Zhao Xiaodong, Shi Xiaochun, 2000, Nat Orch. Gaoligongshan Mount.: 252, fig.; Comber, 2001, Orch. Sumatra: 129, fig.; Pearce et Cribb, 2002, Orch. Bhutan: 66, fig. 14, a-o, pl. 4; Shih-Wen Chung, 2008, Orch. Taiwan, 1: 168, fig. – *Galeola matsudai* Hayata, 1920, Icon. Pl. Formos. 9: 114. – *Galeola kwangsiensis* Hand.-Mazz., 1936, Sinensia, 7: 620.

Described from NE. India (“India, Khasia”).

Type (“*Hooker 357*”) – K (holotype).

Stem usually not branched, dull reddish-brown, 2–4 m tall, rusty hairy to glabrous with age, nodes with broadly ovate spaced scales. Rhizome horizontal, woody, 2–3 cm in diam., with sparse broad ovate scales at nodes. Panicle composed of terminal and lateral racemes; lateral raceme commonly less than 3.5 cm long, few- to 10-flowered, usually very shortly pedunculate. Sterile bracts at base of raceme triangular to broadly ovate, 1–2.5 cm, densely rusty pubescent. Floral bracts broadly ovate, 5–10 mm long, outside densely rusty pubescent. Pedicel and ovary 1–2 cm long, densely rusty pubescent. Flowers brightly yellow, whitish-furry outside, 2.5–3.5 cm in diam., lip sometimes with red hairs. Sepals subsimilar, ovate to elliptic, 1.4–2 cm long, 9–11 mm wide, outside densely rusty tomentose, median sepal outside roughly grooved, lateral sepals with massive keel. Petals broadly obovate to suborbicular, as long as sepals, 1–1.4 cm wide, erose

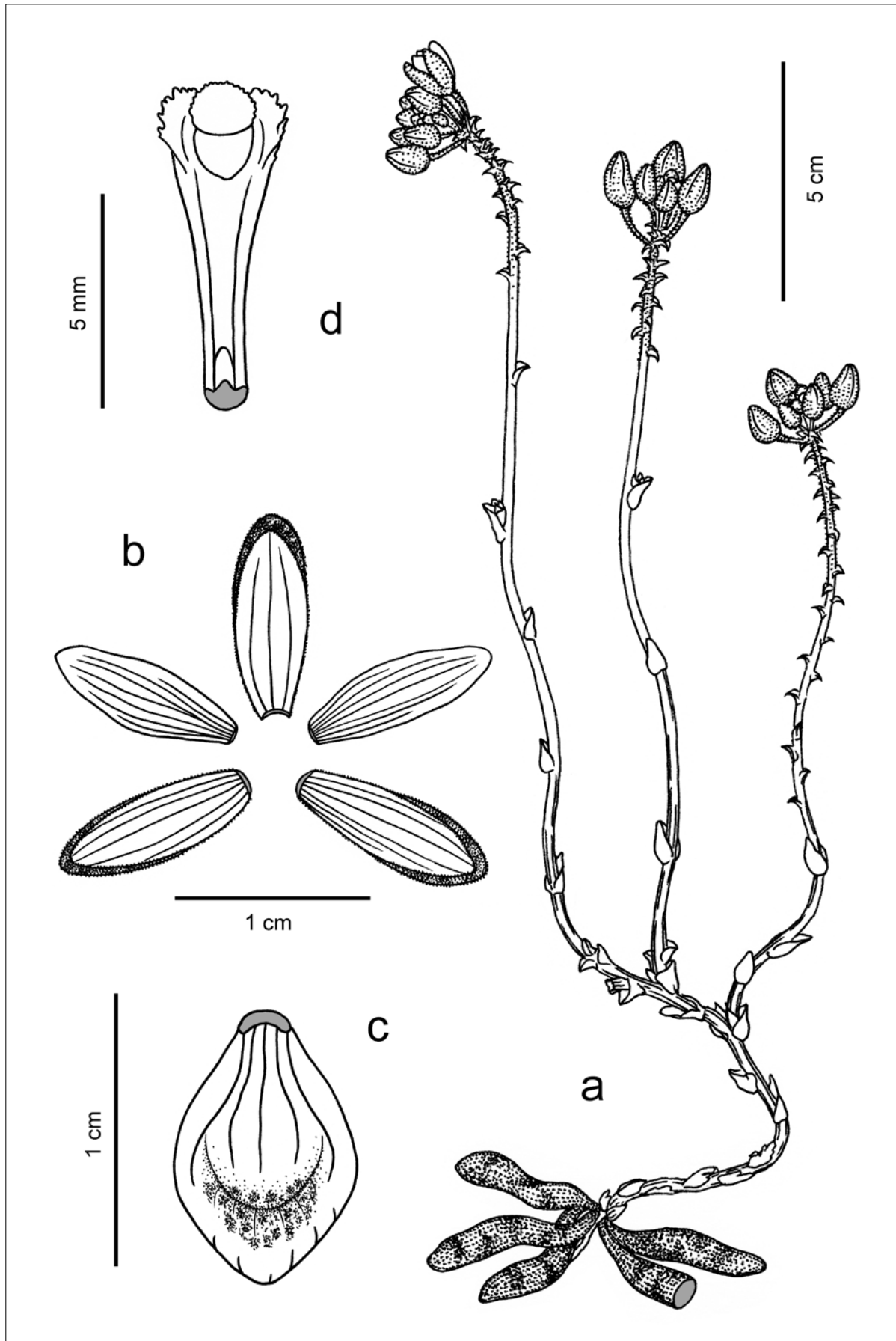


Fig. 12. *Cyrtosia javanica* (NTH 8111a): a – flowering plant, b – flattened sepals and petals, c – lip, d – column, frontal view.

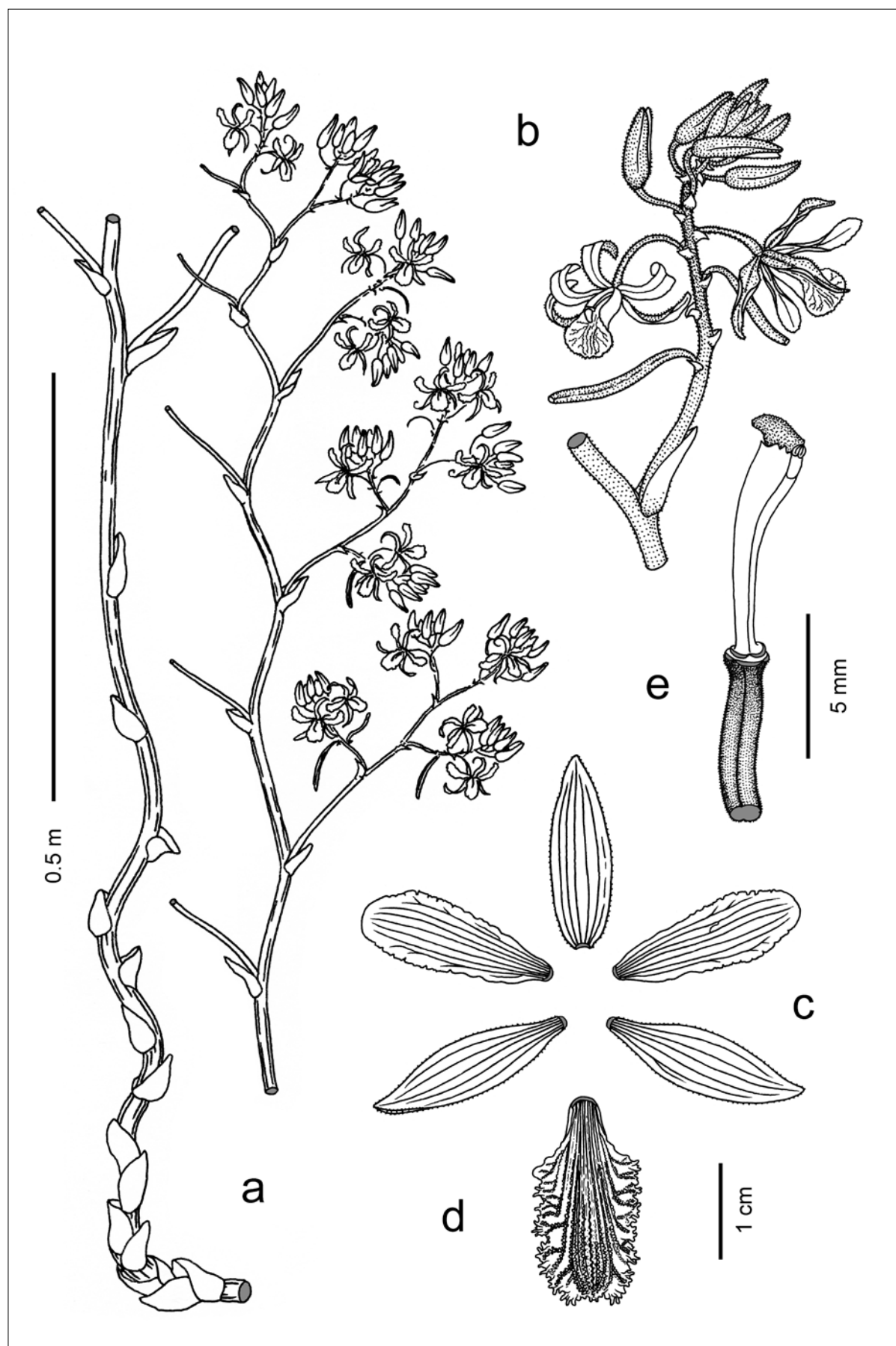


Fig. 13. *Cyrtosia faberi* (NTH 2650): a – flowering plant, b – inflorescence branch, c – flattened sepals and petals, d – flattened lip, e – ovary and column, side view.

or finely toothed along margin. Lip entire, concave, cup-shaped, broadly ovate or orbicular, about 1.2 cm in diam., densely papillose, shortly fimbriate along margin, with small glabrous vertical plate near base. Column yellow, stout, erect, straight, 2–3 mm tall, at the base with 2 tufts of long papillae; anther cap reddish-orange, haired with long papillae. Fruit pale brown to red, cylindric to subtrigonal in section, 8–18 cm long, 1.7–2.4 cm in diam. Seeds brown, 1–1.5 mm in diam., with narrow encircled wing.

Fig. 14.

Ecology. Humid primary and secondary broad-leaved evergreen rather open forests (sometime with bamboo) on silicate soils commonly in small depressions rich in humus accumulations at elev. 1000–2200 m a.s.l. Fl. May – June. Very rare (VU).

Distribution. Vietnam (Ha Giang, Lao Cai). Nepal, Bhutan, NE. India, China, Taiwan, Sumatra.

Studied collections. Ha Giang, Yen Minh, *CBL 2090* (HN, LE); Lao Cai, Than Uyen, *NTH 2867* (HN, LE).

Notes. All available specimens from Vietnam differ from the type and other Himalayan plants in sepals that have distinctly incise to irregularly denticulate margin. In this connection, Vietnamese (as well as, probably, Chinese) plants certainly represent taxonomically different eastern race of the species.

6. *C. falconeri* (Hook. f.) Aver.,

comb. nov. – *Galeola falconeri* Hook. f., 1890, Fl. Brit. India 6: 88; King et Pantl., 1898, Ann. Roy. Bot. Gard. Calcutta, 8: 265, tab. 353; Su Horng-Jye, 2000, Fl. Taiwan 5: 883, fig. 376; Pearce et Cribb, 2002, Orch. Bhutan: 64, fig. 14, p-t, pl. 4; Shih-Wen Chung, 2008, Orch. Taiwan, 1: 167, fig. – *G. kuhlii* auct. non (Reichenb. f.) Reichenb. f.: Liu et Su, 1978, Fl. Taiwan, 5: 996.

Described from NE. India (“India, Garhwal”, “India, Sikkim”). **Syntypes** (“icon. *Falconer s.n.*”, “*Thomson s.n.*”) – K.

Stem dull brownish to reddish, to 3.5 m tall, in lower part almost glabrous, upper part sparsely and shortly rusty hairy, with several distant ovate or lanceolate scales 2–4 cm long. Rhizome 3–5 cm in diam., covered by large, broad, triangular scales. Panicle composed of terminal and lateral often branching racemes; racemes 5–35 cm; peduncle and rachis shortly tomentose. Floral bracts triangular, 1–3 mm, often nearly at right angle to rachis, outside rusty tomentose. Pedicel and ovary 1.5–3 cm long, densely rusty tomentose. Flowers bright yellow, 4–5 cm in diam. Sepals elliptic-oblong, 2.2–

3 cm long, 1–1.5 cm wide, densely rusty tomentose and smooth outside. Petals as long as sepals, slightly narrower. Lip entire, concave, cup-shaped, broadly ovate or orbicular, about 2 cm in diam., inside densely papillose, margin finely fimbriate, basal part loosely embracing column, near base with transversal fold forming small sac. Column stout, erect, slightly curved forward, 2–3 mm tall, at the base with 2 tufts of long papillae; anther cap papillose or nearly glabrous. Fruit red to purple, oblong, cylindric, (18)20–25 cm long, to 3 cm in diam., with finely verruculose surface. Seeds dark brown, 1.5–2 mm in diam., with narrow encircled wing. **Fig. 15; 24 c, d.**

Ecology. Humid primary and secondary broad-leaved evergreen rather open forests (sometime with bamboo) on silicate soils commonly in small depressions rich in humus accumulations at elev. 1500–2200 m a.s.l. Fl. May – June. Very rare (VU).

Distribution. Vietnam (Son La, Lai Chau, Lao Cai). Bhutan, NE. India, China, Thailand.

Studied collections. Son La, Thuan Chau, *HAL 9653* (HN, LE); Lai Chau, Tam Duong, *HAL 10260* (HN); Lao Cai, Van Ban, *HAL 2133* (HN), *HAL 2467* (HN, LE); Lao Cai, Sa Pa, s.n. (photo – LE).

Notes. Chen Sing-chi and Phillip Cribb consider specimens from China in their treatment for “Flora of China” (2009) as different from Himalayan plants, which have slightly 3-lobed lip and petals denticulate along margins. Vietnamese plants may belong to the same – “Chinese” form.

***Galeola* Lour.,**

1790, Fl. Cochinchin.: 520; Gagnep., 1934, Fl. Gen. Indo-Chine 6, 5: 630–636; Seidenf., 1978, Dansk Bot. Ark. 32, 2: 129–137; id., 1992, Opera Bot. 114: 73–74; Comber, 1990, Orch. Java: 73; id., 2001, Orch. Sumatra: 128–130; Seidenf., Wood, 1992, Orch. Malay. Sing.: 129–130; Aver., 1994, Ident. Guide Vietnam. Orch.: 78; P.H. Ho, 2000, Ill. Fl. Vietnam 3: 793; Su Horng-Jye, 2000, Taiwan, 45,3: 242–246; id., 2000, Fl. Taiwan 5: 882–884; Pearce et Cribb, 2002, Orch. Bhutan: 63–67; Aver. et Averyanova, 2003, Updated Checklist Orch. Viet.: 36; Chen Sing-chi, Cribb, 2009, Fl. China, 25: 168–169.

Lectotype: *G. nudifolia* Lour.

Achlorophyllous, reddish-brown or yellow-brown terrestrial, fleshy, leafless, climbing vines with persistent scales and aerial roots at nodes and rigid, woody rhizome. Raceme or panicle terminal and lateral, with many flowers. Rachis pubescent, floral bracts persistent. Flowers not widely opening,

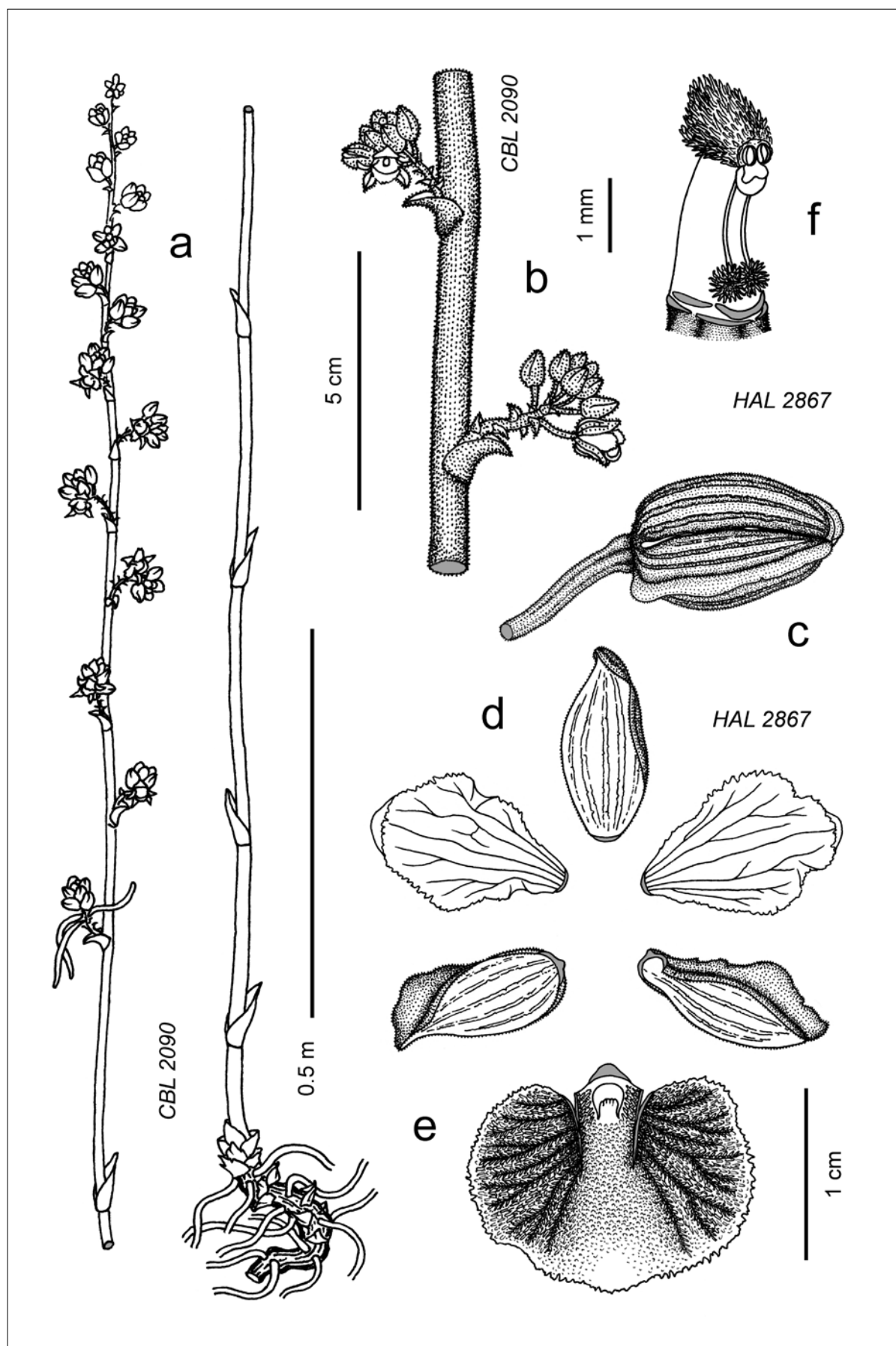


Fig. 14. *Cyrtosia lindleyana*: a – flowering plant, b – portion of inflorescence (CBL 2090), c – flower bud, d – flattened sepals and petals, e – flattened and partially dissected lip, f – column, side view (HAL 2867).

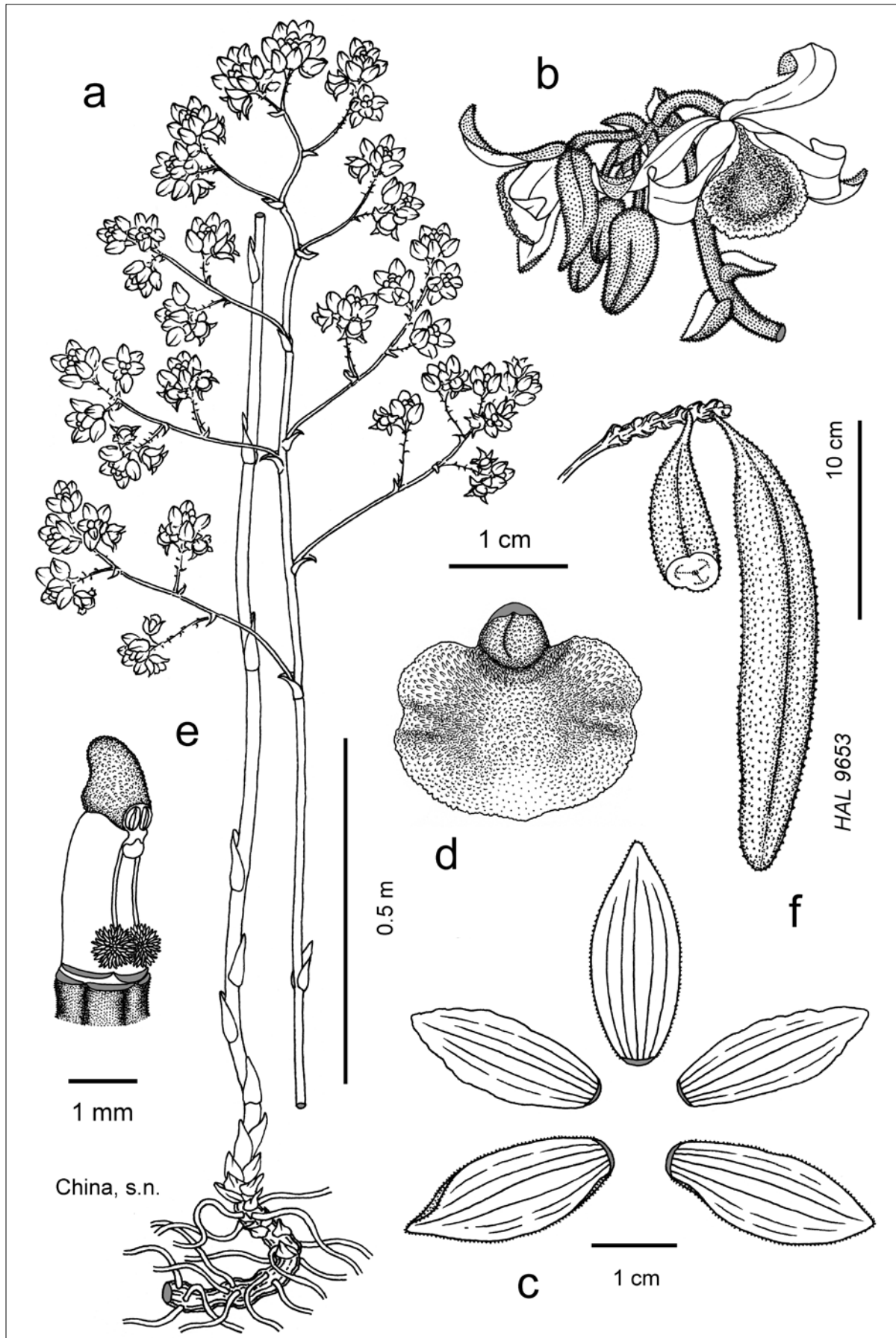


Fig. 15. *Cyrtosia falconeri*: a – flowering plant, b – branchlet of inflorescence, c – flattened sepals and petals, d – flattened lip, e – column, side view (*China s.n.*), f – fruits, and apical portion of inflorescence axis (*HAL 9653*).

campanulate, yellow, sometimes tinged with red. Sepals and petals free, subsimilar. Sepals outside hairy. Petals slightly smaller than sepals, glabrous. Lip entire, concave, cup-shaped, embracing column, disc with longitudinal ridge or callus. Column short and stout, strongly forward curved, without column foot. Anther very large. Pollinia 2, cleft, mealy, without caudicle or viscidium. Stigma large, deeply concave; rostellum short and wide. Fruit dry, pod-like, dehiscent capsule. Seeds with stout testa and broad surrounding wing.

5(1) species. Tropical and subtropical Asia to New Guinea and N. Australia.

***G. nudifolia* Lour.,**

1790, Fl. Cochinchin.: 521; Seidenf., 1978, Dansk Bot. Ark. 32, 2: 135, fig. 83; id., 1992, Opera Bot. 114: 74; Seidenf., Wood, 1992, Orch. Malay. Sing.: 129, fig. 53; Aver., 1994, Ident. Guide Vietnam. Orch.: 78; P.H. Ho, 2000, Ill. Fl. Vietnam 3: 793, fig. 10932; Aver. et Averyanova, 2003, Updated Checkl. Orch. Vietnam: 36. – *Galeola hydra* Reichenb. f., 1865, Xen. Orch. 2: 77; Gagnep., 1934, Fl. Gen. Indo-Chine 6, 5: 634; King et Pantl., 1898, Ann. Bot. Gard. Calcutta, 8, tab. 351; J.J. Smith, 1908, Fl. Buitenzorg 6, 2, fig. 45. – *Erythrorchis kuhlîi* Reichenb. f., 1865, Xen. Orch. 2: 78, tab. 119. – *Galeola kuhlîi* (Reichenb. f.) Reichenb. f., 1865, Xen. Orch. 2: 78; P.H. Ho, 1972, Illustr. Fl. South Vietnam 2: 1013, fig. 5014; Liu et Su, 1978, Fl. Taiwan 5: 997, fig. 1596.

Described from S. Vietnam (“in sylvis Cochinchinae”). **Type** (“*Loureiro*”) – BM.

Climbing vine to 15 m long, stem 0.5–2 cm in diameter, rooting at nodes, with thick, very rigid, woody rhizome and triangular reddish scales 0.5–6 cm long. Inflorescence branching, with branches 15–50 cm long, laxly bearing many flowers, flowering in succession, 2–3 open in a time near growing tips, all young parts rusty hairy. Pedicel and ovary 8–20 mm long. Floral bracts fleshy, triangular, acute, 9–12 mm long. Flowers not open widely, 1.5–2.5 cm across, yellow, lip with orange-red veins inside. Sepals and petals subsimilar, elliptic, 1.2–2.2 cm long, 0.6–1.2 cm wide, blunt to obtuse, lateral sepals broader and slightly oblique; petals more thin in texture, often undulate along upper margin. Lip almost round, entire, 1–1.6 cm across, strongly concave, hairy, erose-fimbriate along margin, with somewhat pointed apex and erect short callus near base. Column 4–5 mm tall, strongly curved forwards. Fruit cylindric, dry, dehiscent capsule, to 15 cm long and 2.5 cm in diam., seeds shortly winged, 2 mm in diam. **Fig. 16; 24 e, f.**

Ecology. Primary and secondary broad-leaved evergreen forests, often on steep slopes in places of humus accumulations on any kind of soils, but preferably in region with silicate subsoil rocks, at elev. 100–800(1000) m a.s.l. Fl. March – July. Rare (VU).

Distribution. Vietnam (Ha Tinh, Hoa Binh, Ninh Binh, Quang Binh, Quang Tri, Thanh Hoa, Thua Thien-Hue). Bhutan, Myanmar, NE. India, S. China, Taiwan, Hainan, Thailand, Laos, Cambodia, Vietnam, Malacca Peninsula, Indonesia, Philippines.

Studied specimens. Ha Tinh, Huong Son, HAL 5000 (HN, LE); Hoa Binh, Ha Son Binh, Luong Son, Lam Son, P-6193 (HNU, LE); Ninh Binh and Thanh Hoa, Cuc Phuong national park, 7 June 1971, Vu Van Dung 2\48, CPNP 5115; sine date, Dinh Kinh 181-26a; sine date, Vu van Dung 181-26 (Cuc Phuong national park Herbarium); Quang Binh, Bo Trach, Phong Nha-Ke Bang national park, HAL 6240 (HN, LE); Quang Binh, Le Thuy, HAL 11439 (HN, LE); Quang Tri, Da Krong, Da Krong nature reserve, HLF 5758 (HN, LE), HLF 6118 (HN, LE), HLF 6213 (HN, LE); d-EXSICCATES OF VIETNAMESE FLORA 0060/HLF 6213; Quang Tri, Huong Hoa, HLF 6534 (HN, LE); Thanh Hoa, Ba Thuoc, HAL 954 (HN); Thua Thien-Hue, Huong Thuy, HAL 8160 (HN, LE); Thua Thien-Hue, Nam Dong, HAL 6792 (HN, LE).

Notes. Widespread, but rather uncommon species of lowland, submontane and montane woods, occurring sometime in quite open places in areas of forest cutting, particularly in wet places among logging decaying timber.

Closely related species – *G. cathcartii* Hook. f. differs from *G. nudifolia* in narrow, lanceolate sepals and in cuneate base of the lip. This species reported from NE. India and Thailand quite may be found in eastern regions of Vietnam.

Subtrib. 5.2.2. *Vanillinae* Lindl.,

1840, Gen. Sp. Orch. Pl.: 429 (sub “*Vanilleae*”).

Type: *Vanilla* Mill.

6(2) genera and 110(5) species. Tropical regions of the World.

***Vanilla* Plum. ex Mill.,**

1754, Gard. Dict. Abr. 4, 3; Gagnep., 1934, Fl. Gen. Indo-Chine, 6, 5: 580–583; Seidenf., 1978, Dansk Bot. Ark. 32, 2: 138–146; id., 1992, Opera Bot. 114: 71–72; Comber, 1990, Orch. Java: 74–76; id., 2001, Orch. Sumatra: 130–132; Seidenf., Wood, 1992, Orch. Malay. Sing.: 124–127; Aver., 1994,

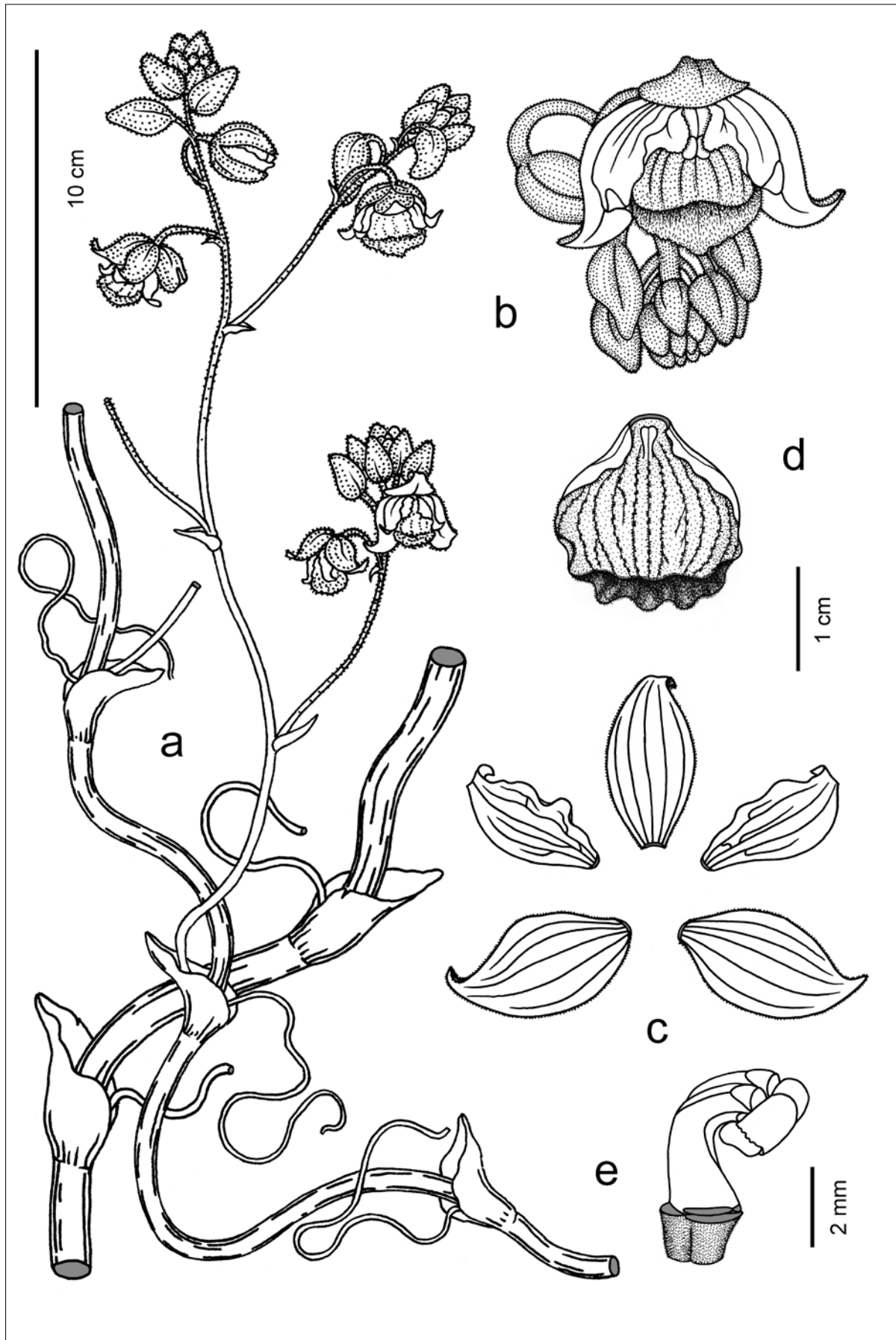


Fig. 16. *Galeola nudifolia* (HLF 6213): a – flowering plant, b – branchlet of inflorescence, c – flattened sepals and petals, d – flattened lip, e – column, side view.

Ident. Guide Vietnam. Orch.: 75–77; P.H. Ho, 2000, Ill. Fl. Vietnam, 3: 791–792; Su Horng-Jye, 2000, Fl. Taiwan 5: 1063; Aver. et Averyanova, 2003, Updated Checklist Orch. Viet.: 60; Newman et al., 2007, Checkl. Vasc. Pl. Lao PDR: 283; Schuiteman et al., 2008, Nord. Journ. Bot. 26: 314–315; Chen Sing-chi, Cribb, 2009, Fl. China, 25: 167–168; Soto, Cribb, 2010, Lankesteriana 9, 3: 355–398.

Lectotype: *V. mexicana* Mill.

Climbing epiphytic or lithophytic herbaceous succulent vines to 20 m long. Stem fleshy, green, with succulent leaves or leafless, with aerial roots at nodes. Leaves sessile or shortly petiolate, sometimes reduced to dull brownish scales. Inflorescence – axillary raceme with few to many spirally arranged flowers. Scape naked or with few spirally arranged, triangular or leaf-like bracts. Floral bracts small, commonly broadly triangular, obtuse, much shorter than ovary. Flowers resupinate, widely

opening, often with abscission layer between ovary and perianth. Sepals and petals similar, free, spreading. Lip spurless, joined to lateral sides of column, sometimes almost to top of column, more or less trumpet-shaped, free apical part broadening, entire or 3-lobed, disk often with scarious, papillate or hairy appendages. Column long, slender, slightly curved. Anther apical, pointing downward; pollinia 2 or 4, mealy or granular, without caudicle or viscidium; rostellum often broad. Fruit cylindric, fleshy, often indehiscent. Seeds with stout testa, brown to black, wingless.

110(3) species. Tropical regions of the World.

Note. Taxonomy of the genus is very difficult and complicated because of all its species being rarely found in flowers. In this treatment, I follow mainly the concept of Soto Arenas and Cribb (2010).

Key to species

1. Stem leafless, or with small scales at nodes **1. *V. aphylla***
- Stem with normal, broad, green leaves **2**
2. Inflorescence 1–3 cm long, few-flowered; lip glabrous or with few small scattered papillae at apex; sepals and lip 4–5 cm long **2. *V. yersiniana***
- Inflorescence 3–14 cm long, many-flowered; lip with fimbriate papillae near apex; sepals and lip 3.8–4.5 cm long **3. *V. siamensis***

1. *V. aphylla* Blume,

1825, Bijdr. Fl. Ned. Ind. 8: 422; J.J. Smith, 1908, Fl. Buitenzorg, 6, 2, fig. 43; Seidenf., 1978, Dansk Bot. Ark. 32, 2: 142, fig. 90; id., 1992, Opera Bot. 114: 72; Comber, 1990, Orch. Java: 75, fig.; Seidenf., Wood, 1992, Orch. Malay. Sing.: 127, fig. 51 f; Aver., 1994, Identif. Guide. Vietnam. Orch.: 77; P.H. Ho, 2000, Ill. Fl. Vietnam, 3: 791, fig. 10926; Aver. et Averyanova, 2003, Updated Checklist Orch. Viet.: 60; Soto, Cribb, 2010, Lankesteriana 9, 3: 368. – *V. parishii* Reichenb. f., 1866, Otia Bot. Hamburg 1: 39.

Described from Java (“Sadjram Provinciae Bantam... Nusae Kambangae insulae”). **Type** (“Blume, 1719”) – L.

Epiphytic or lithophytic creeping vine to 12 m long. Stem succulent, aphyllous, with internodes 5–8 cm long. Leaves reduced to small triangular green scales 5–10 mm long. Inflorescence very short, 1–3 flowered. Floral bracts small, broadly-triangular, obtuse. Tepals pale greenish, narrowly ovate to ovate, to 3 cm long, 8–10 mm wide, obtuse. Lip joined to column almost to the anther, 2.2–2.6 cm long, apically 3-lobed; side lobes erect, rounded, with crisped reflexed edges, pale green; median lobe

1 cm long, rounded, with reflexed slightly toothed edges, almost entirely covered with pale pinkish hairs about 2 mm long. **Fig. 17; 24 g, h.**

Ecology. Primary and secondary broad-leaved evergreen and deciduous dry forests, open dry secondary shrubs, rocky outcrops in semiarid areas on any kind of soils at elevation from sea level to 400 m a.s.l. Fl. May – July. Rare (VU).

Distribution. Vietnam (Dac Lac, Dong Nai, Kien Giang, Lam Dong, Ninh Thuan, Phu Khanh, Tay Ninh). Myanmar, Thailand, Laos, Malacca Peninsula, Java.

Studied specimens. Dac Lac, Buon Don, Yok Don national park, *HLF 7175* (HN, LE); Kien Giang, Phu Quoc, photo (LE); Ninh Thuan, Ninh Hai, Nui Chua national park, *HLF 3223* (HN, photo LE); Tay Ninh, Tan Bien, Lo Go-Xa Mat national park, *HLF 7450* (HN), *HLF 7592* (HN), *HLF 7677* (HN), *HLF 7736* (HN); Ninh Hoa, *Sigaldi, 318* (P); Suai Dan, Nhatrang, *Vidal 4866* (P); Mt. Dinh, Baria, *Pierre 6565* (P, K), *d’Alleizette 6974* (L); Nam Cat Tien, *Tam* s.n.

2. *V. yersiniana* Guillaumin et Sigaldi,

1964, Bull. Mus. Hist. Nat. Ser. 2, 36: 162;

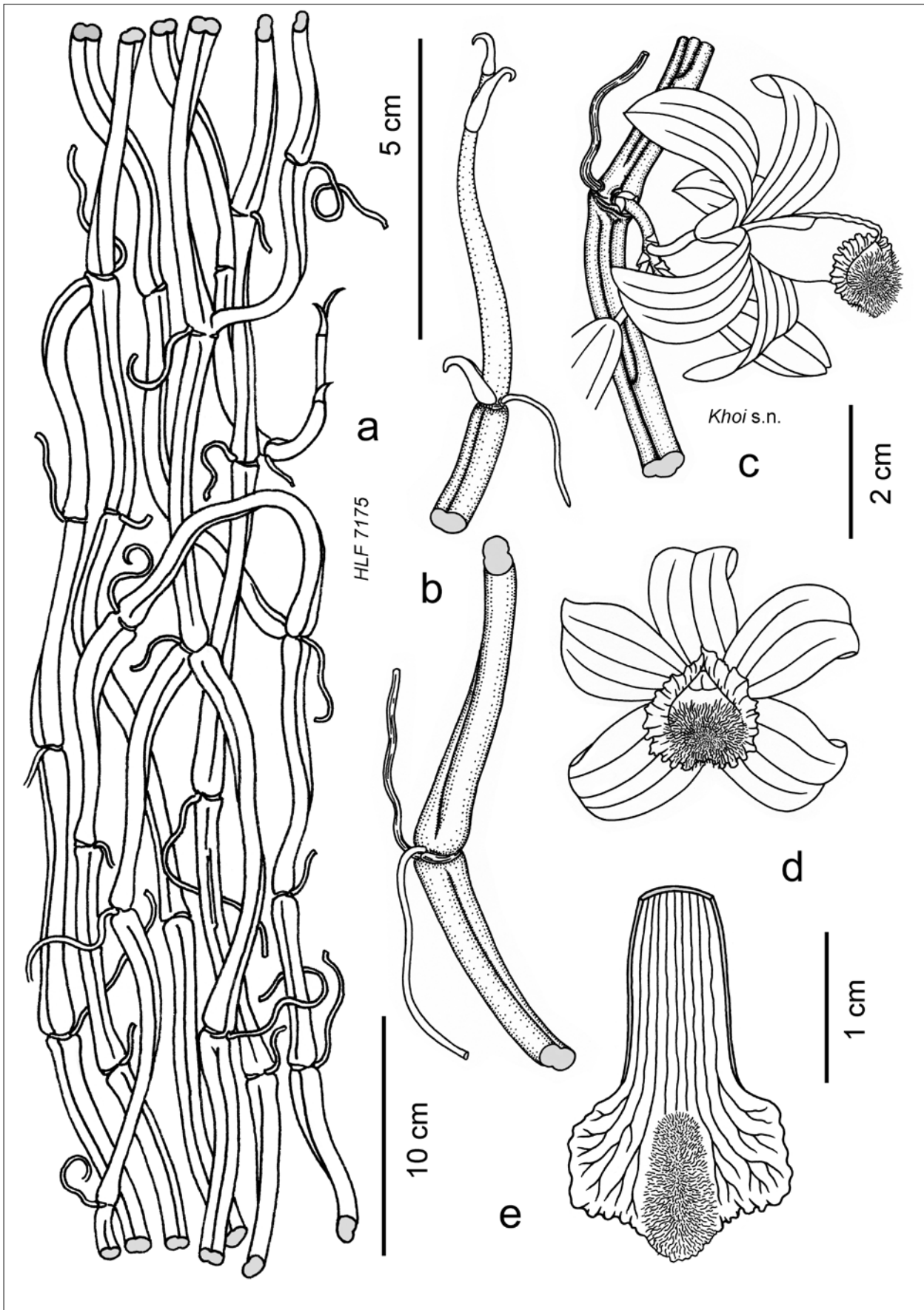


Fig. 17. *Vanilla aphylla*: a – mature plant, b – portions of mature stem (HLF 7175), c – inflorescence, d – flower, e – flattened lip (Khoi, s.n.).

Soto, Cribb, 2010, Lankesteriana 9, 3: 397. – *V. albida* auct. non Blume, 1823: Seidenf., 1978, Dansk Bot. Ark. 32, 2: 141, p.p., fig. 87; id., 1992, Opera Bot. 114: 72, p.p.; Seidenf., Wood, 1992, Orch. Malay. Sing.: 127, p.p., fig. 51, d, e, pl. 5 d; Aver., 1994, Ident. Guide Vietnam. Orch.: 76; P.H. Ho, 2000, Ill. Fl. Vietnam, 3: 791, fig. 10927; Aver. et Averyanova, 2003, Updated Checklist Orch. Viet.: 60. – *V. sumatranensis* auct. non J.J. Smith: Seidenf., 1972, Bot. Tidsskr. 67, 1–2: 96, p.p., fig. 18.

Described from southern Vietnam (“Sur la piste Yersin du Hon Ba a Duoi Dau (Nhatrang) et plante a Duoi Dau pepiniere”). **Syntypes** (26 mars 1963, *de Sigaldi 362, de Sigaldi 309*) – P.

Epiphytic creeping vine. Leaves broadly lanceolate to narrowly ovate, 12–14 cm long, 3.5–5 cm wide. Inflorescence 1–3 cm long, few-flowered. Flowers white with greenish tint, 6–8 cm across. Floral bracts broadly-triangular, rounded, 2 mm long. Sepals and petals 4–5 cm long and about 1 cm wide, petals little smaller. Lip 4–4.5 cm long, at the base forms narrow tube, joined to column, trumpet-shaped, about 2 cm across the mouth, apex glabrous or hardly sparsely papillose, disc at the center with bundle of broad, fan-shaped, toothed scarious scales. Column about 4 cm tall. Fruit to 8 cm long. **Fig. 18.**

Ecology. Primary and secondary evergreen lowland forests on silicate soils. Fl. March – April. Very rare (DD).

Distribution. Vietnam (Khanh Hoa). Thailand.

Notes. *Vanilla yersiniana* is known from Vietnam by alone type collection until now. This rare species very close to Indonesian *V. albida* Blume (reported from Java and Sumatra), from which it differs in more or less attenuate leaves, whitish flowers and in scarcely developed papillae on lip apex.

3. *V. siamensis* Rolfe ex Downie,

1925, Kew Bull. 10: 410; Seidenf., 1978, Dansk Bot. Ark. 32, 2: 138, fig. 86; Chen Sing-chi, Tsi Zhanhuo, Luo Yibo, 1990, Nat. Orch. China: 411, fig.; Soto, Cribb, 2010, Lankesteriana 9, 3: 393. – *V. pierrei* Gagnep., 1931, Bull. Mus. Hist. Nat. (Paris), 2 ser. 3, 7: 686; Gagnep., 1934, Fl. Gen. Indochine, 6, 5: 582, fig. 55, 10–13 (12 – sphalm.); Seidenf., 1992, Opera Bot. 114: 72; Aver., 1994, Identif. Guide. Vietnam. Orch.: 76; P.H. Ho, 2000, Ill. Fl. Vietnam, 3: 792, fig. 10929; Aver. et Averyanova, 2003, Updated Checklist Orch. Viet.: 60.

Described from northern Thailand (“Thailand, Doi Sutep, 690 m”). **Type** (“Kerr 95”) – K (holotype), C, P (isotypes).

Epiphytic or lithophytic creeping vine to 12 m long. Stem fleshy, with long internodes and loosely arranged, fleshy leaves. Leaves elliptic, 14–25 cm long, 6–8 cm wide, acuminate; shortly petiolate, petiole broad, 1.5–2.5 cm long. Inflorescence 7–14 cm long, many and dense flowered. Floral bracts triangular ovate, 2–8 mm long, fleshy. Pedicel and ovary to 2 cm long. Flowers opening successively. Sepals and petals yellowish green to nearly white, oblong or narrowly ovate, 3.8–4.5 cm long, about 1–1.3 cm wide, obtuse. Lip rhombic-obovate, about 4 cm long, adnate to column, trumpet-shaped, indistinctly 3-lobed. Lateral lobes embracing column; median lobe undulate at margin, with bunch of fat papillae at apex; disk at center with several subquadrate, densely imbricate, scarious scales ciliate at margin. Column 2–2.6 cm long, hairy at front. Fruits odorless. **Fig. 19.**

Ecology. Primary and secondary evergreen forests on silicate soils at elev. 800–1200 m a.s.l. Fl. April – May. Fruits July – Sept. Very rare (DD).

Distribution. Vietnam (Binh Dinh). Thailand, SW. China, Cambodia.

Studied specimens. Mt. Binh Dinh, *Pierre* s.n. (P).

Notes. In Vietnam the species is known by the single collection until now. Its identification remains questionable. New material is needed for additional study that can reconfirm occurrence of this rare species in the country if it is not yet completely extinct.

Miguelia Aver.,

gen. nov. – *Vanilla* Plum. ex Mill., 1754, Gard. Dict. Abr. 4, 3 p.p.; Gagnep., 1934, Fl. Gen. Indo-Chine, 6, 5: 580–583; Seidenf., 1978, Dansk Bot. Ark. 32, 2: 138–146; id., 1992, Opera Bot. 114: 71–72; Aver., 1994, Ident. Guide Vietnam. Orch.: 75–77; P.H. Ho, 2000, Ill. Fl. Vietnam, 3: 791–792; Su Horng-Jye, 2000, Fl. Taiwan 5: 1063; Aver. et Averyanova, 2003, Updated Checklist Orch. Viet.: 60–61; Newman et al, 2007, Checkl. Vasc. Pl. Lao PDR: 283; Schuitman et al., 2008, Nord. Journ. Bot. 26: 314–315; Chen Sing-chi, Cribb, 2009, Fl. China, 25: 167–168. – “*Vanilla annamica* group”: Soto, Cribb, 2010, Lankesteriana 9, 3: 359.

Type: *M. somai* (Hayata) Aver. (*Vanilla somai* Hayata).

Inflorescentia axillaris paniculata, ramis lateralibus 1–2 cymis secundis bifloris paucis (solitariis) et floribus apicalibus ferentibus, interdum ad cymam axillarem bifloram unam reducta. Inflorescentiae bracteae biflorae: geminae, suboppositae, conchoideae, apice rotundatae, aliusmodi alternan-

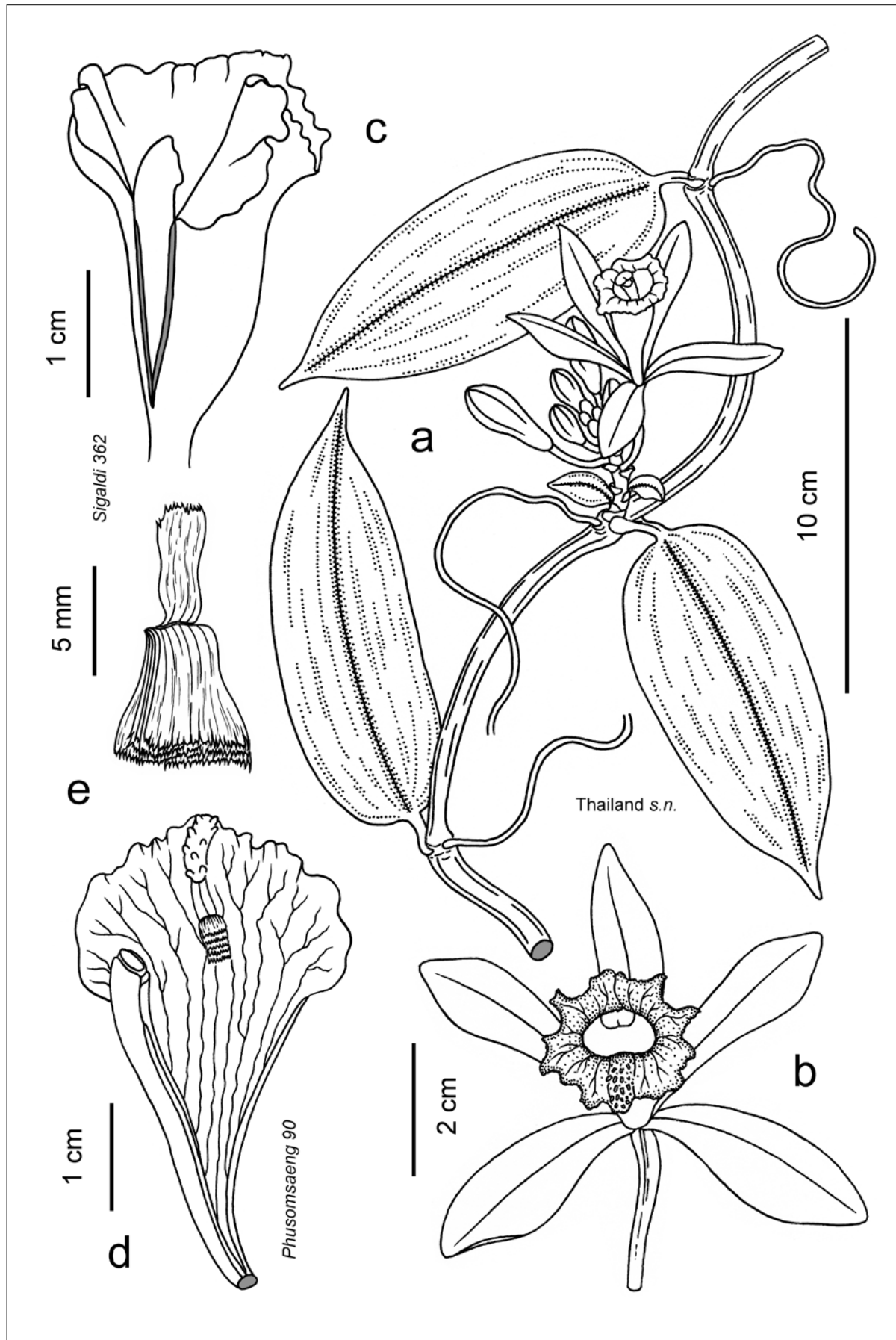


Fig. 18. *Vanilla yersiniana*: a – flowering plant, b – flower (Thailand s.n.), c – partially dissected lip, side view (Sigaldi, 362, type), d – partially dissected, flattened lip, e – scales at the lip center (Phusomsaeng 90).

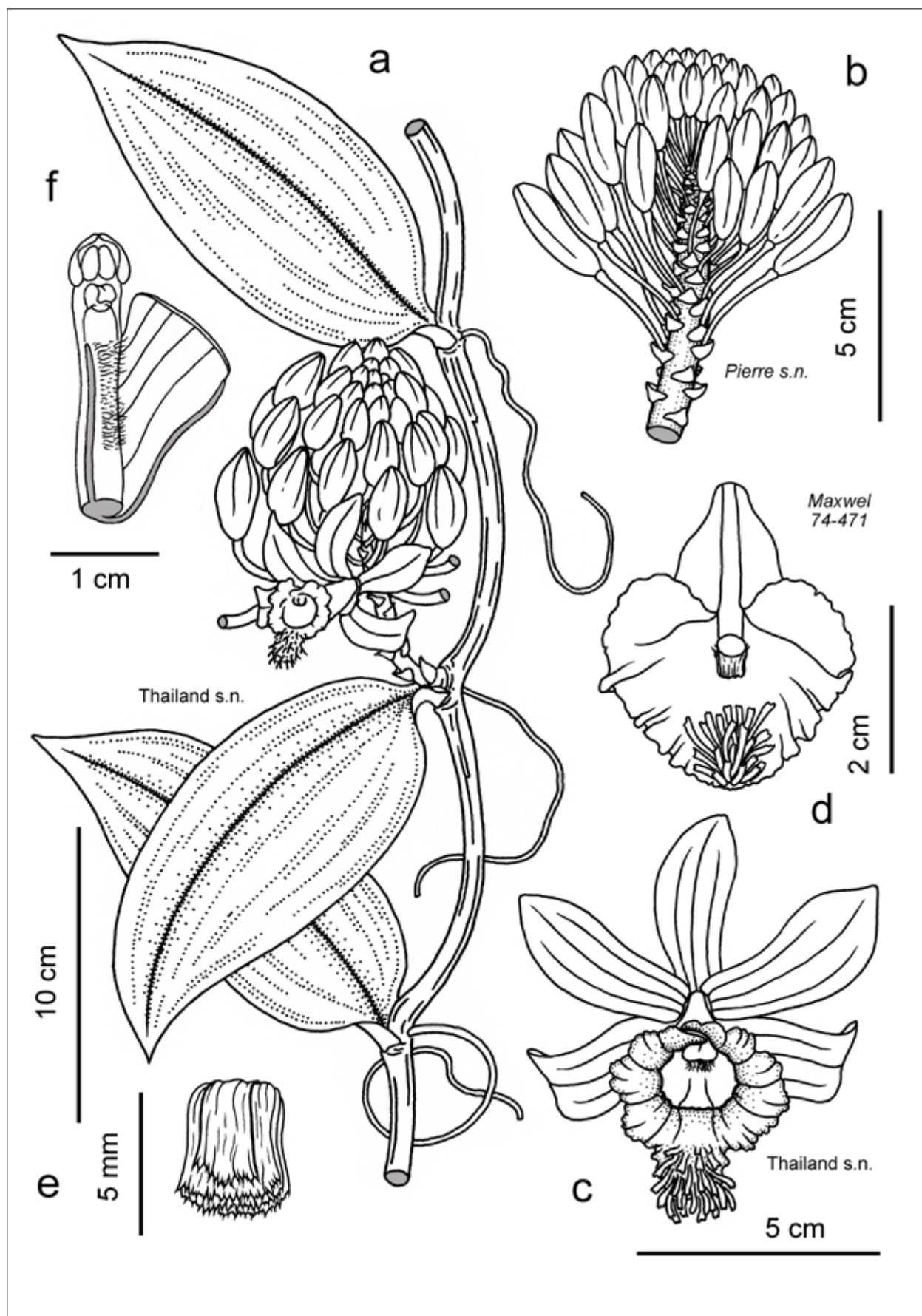


Fig. 19. *Vanilla siamensis*: a – flowering plant (Thailand s.n.), b – inflorescence (Pierre s.n.), c – flower (Thailand, s.n.), d – flattened lip, e – scales at the lip center, f – column, side view (Maxwel 74-471).

tes, triangulares, acutae. Bracteeae geminae conchoideae initio basi connatae, capsulam compressam inflorescentiam juvenilim amplectentim formantes.

Climbing epiphytic or lithophytic herbaceous succulent vines to 20 m long. Stem fleshy, green, with succulent leaves and aerial roots at nodes. Leaves shortly petiolate. Inflorescence – axillary panicle, with one or two secondary secund axes bearing one to several biflorous, secund cymes and sometimes few solitary apical flowers; not rare inflorescence reduced to the single 2-flowered axillary cyme. Inflorescence bracts of two different types. First are “internodal” bracts, rigid, paired, subopposite, ovate, concave, rounded at apex, shell-like; at early stage each couple joined from the base with their margins forming flattened capsule that embraces juvenile inflorescence spire. Such bracts placed in leaf axil and at internodes of inflorescence secondary axis, below offshoot of each individual cyme. Bracts of second type (“nodal” bracts) of usual appearance are not paired, triangular, conduplicate, acute, placed at node of axis, nearly opposite to offshoot of each individual cyme. Floral bracts rather small, triangular or broadly triangular, acute, similar to “nodal” inflorescence bracts, but much smaller. Flowers resupinate, widely opening, with abscission layer between ovary and perianth. Sepals and petals similar, free, spreading. Lip spurless, joined to lateral sides of column almost to top of column, trumpet-shaped, free apex broadening, entire or indistinctly 3-lobed, densely haired with long fat clavate papillae; disk at center with scarious, densely imbricate, recurved, lamellate scales and 2–4 short low lamellate, lateral keels. Column erect, slender, slightly curved. Anther apical; pollinia mealy or granular, without caudicle or viscidium; rostellum broad. Fruit obscurely triangular in section, fleshy, hardly dehiscent. Seeds with stout black testa, wingless. **Fig. 20.**

2–3(2) species. SE. China, Taiwan, Laos, Vietnam.

Etymology. Generic name is dedicated to

the memory of the genus monographer, Dr. Miguel Angel Soto Arenas, who was tragically murdered in Mexico at the peak of his bright botanic activity.

Note. The genus has close relation to *Vanilla*, from which strikingly differs in the inflorescence structure, inflorescence bracts and the carinate disk of the lip. The differences are shortly outlined in the identification key presented below (see also fig. 20).

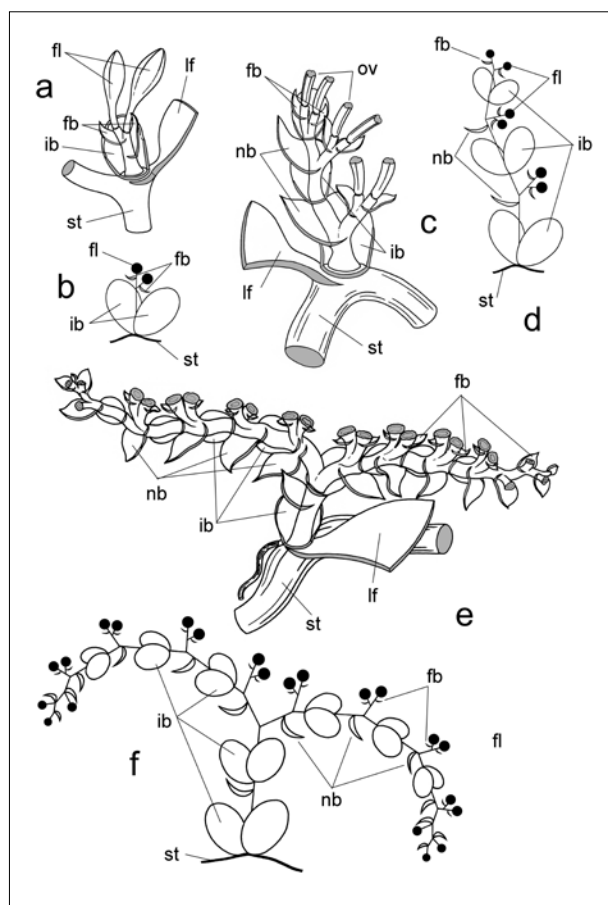


Fig. 20. Schematic drawings and graphic schemes of inflorescence in species of *Miguelia*: a–d (*M. somai*), e, f (*M. annamica*). Bracts on inflorescence drawings are cut in a section parallel to axis. Explanations of abbreviations on figures: st – stem; lf – leaf; ov – ovary; fl – flower; ib – “internodal” bracts; nb – “nodal” bracts; fb – floral bracts.

1. Scape at the base naked with no shell-like, subopposite bracts embracing axis; inflorescence – raceme with few to many spirally arranged flowers; scape naked or with few triangular, or leaf-like bracts ***Vanilla***
- Scape at the base with 2 subopposite, rigid, concave, shell-like bracts embracing axis (in early stage bracts joined with their margins forming compressed lens-like capsule that contains juvenile inflorescence spire); inflorescence – panicle with 1 or 2 axes bearing one to several biflorous cymes (occasionally inflorescence reduced to alone biflorous axillary cyme); inflorescence bracts of two different types – paired, subopposite, shell-like, rounded at apex and alternative, triangular, acute ***Miguelia***

Key to species

1. Inflorescence monochasial, with 1 secondary axis, less than 1(3) cm long, with 1–2(4) biflorous secund cymes; flowers in inflorescence commonly open simultaneously; lip broadest at apex, inside with pink or reddish tint **1. *M. somai***

- Inflorescence commonly dichasial, with 2 secondary axes, much longer than 1 cm, each axis with several biflorous cymes and 1–3 solitary apical flowers, flowers in inflorescence opens in succession; lip broadest at the middle, white tinged with green **2. *M. annamica***

1. *M. somai* (Hayata) Aver.,

comb. nov. – *Vanilla somai* Hayata, 1916, Icon. Pl. Formos. 6: 88, tab. 14; Soto, Cribb, 2010, Lankesteriana 9, 3: 368. – *V. griffithii* Reichenb. f. var. *formosana* Ito, 1911, Icon. Pl. Japan. 1, 4: 1, tab. 1. – *V. ronoensis* Hayata, 1920, Icon. Pl. Formosan. 9: 114. – *V. shenzhenica* Z.J. Liu et S.C. Chen, 2007, Acta Phytotax. Sin. 45: 301, fig. 1. – *V. annamica* auct. non Gagnep.: Aver., 1988, Bot. Journ. (Leningrad), 73, 3: 427, 429, fig. 6; id., 1994, Identif. Guide. Vietnam. Orch.: 76, fig. 3; P.H. Ho, 2000, Ill. Fl. Vietnam, 3: 792, fig. 10928; Aver. et Averyanova, 2003, Updated Checklist Orch. Viet.: 60. p.p. – *V. albida* auct., non Blume: Su Horng-Jye, 2000, Fl. Taiwan 5: 1065, fig. 457; Shih-Wen Chung, 2008, Orch. Taiwan 2: 203, photos.

Described from Taiwan (“Taiwan, between Urai and Agisku ...”). **Type** (“May 1916, *Hayata s.n.*”) – TL.

Epiphytic or lithophytic creeping vine to 15 m long. Stem internodes 5–10 cm long. Leaves shortly petiolate, narrowly ovate to elliptic-lanceolate, acuminate, 10–30 cm long, 4–9 cm wide, fleshy. Inflorescence monochasial (very rare dichasial), secund, 1–2(3) cm long, with 1–2 (very rare with 3–4) 2-flowered secund cymes, flowers simultaneously opening in each cyme. Inflorescence “internodal” bracts oval, rigid, rounded at apex, concave, 0.8–2 cm long, 0.5–1 cm wide; “nodal” bracts triangular, acute. Floral bracts triangular, 0.7–1 cm long. Pedicel and ovary 2–3 cm long. Flowers 4–5 cm in diam., white or white with yellowish or greenish tint, lip pink or reddish inside. Sepals and petals similar, spreading, slightly recurved, broadly oblanceolate, 2–3 cm long, 5–8 mm wide, obtuse. Lip 2.5–3 cm long, connate for about 4/5 its length with sides of column forming a trumpet-shaped tube. Lip apex entire or indistinctly 3-lobed; lateral lobes large, broad, margins crisped and irregularly incised; median lobe suborbicular, fleshy, with many fat papillae 1.5–2 mm long; disk at center with many dense, scarious, incumbent, imbricate, overlapping scales and with 2 short low lateral keels. Column slender, glabrous, straight, 2–2.5 cm long, at the apex with 2 small dent-like wings. Anther hemispheric, about 3 mm in diam. Stigma transversely slit-like; rostellum square, curved downwards and covering stigma. Fruit cylindric, 7–10 cm long, obscurely 3-ridged, dehiscent. **Fig. 20 a-d; 21; 24 a; 27 a, b.**

Ecology. Primary and secondary evergreen broad-leaved, mixed and coniferous forests, as well as secondary shrubs on any kind of soils (but more common on rocky limestone, particularly on steep rocky slopes and cliffs) at elev. 300–1400 m a.s.l. Fl. April – June. Occasional (VU).

Distribution. Vietnam (Bac Kan, Cao Bang, Ha Giang, Hoa Binh, Lang Son, Lao Cai, Ninh Binh, Quang Binh, Son La, Thai Nguyen, Thanh Hoa). S. China, Taiwan.

Studied specimens. Bac Kan, Cho Don, *HAL 4858* (HN, LE); Bac Kan, Na Ri, *NTH 3711* (HN); Cao Bang, Bao Lac, *CBL 306* (HN), *CBL 1481* (HN, LE), *CBL 1585* (HN, LE); Cao Bang, Thach An, *CBL 961* (HN); Ha Giang, Bac Me, *HAL 6575* (HN, LE); Ha Giang, Meo Vac, *CBL 1866* (HN), *HAL 8499* (HN); Ha Giang, Quan Ba, *CPC 156* (HN, LE); Ha Nam Ninh, Cuc Phuong, *X. Bong 146* (LE); Lang Son, Huu Lien, Huu Lien protected area, *DKH 4186* (HN, LE), *NTH 3257* (HN, LE); Lao Cai, Van Ban, *HAL 2296* (HN); Quang Binh, Bo Trach, *HAL 6144* (HN), *HAL 6330* (HN); Quang Binh, Minh Hoa, *HAL 5880* (HN), *HAL 12217* (HN, LE); Quang Binh, Quang Ninh, *HAL 11524* (HN); Son La, Quynh Nhai, *HAL 11296* (HN); Son La, Yen Chau, *HAL 9485* (HN, LE); Thai Nguyen, Dong Hy, *HAL 61* (HN, LE); Thanh Hoa, Ba Thuoc, Pu Luong protected area, *HAL 1097* (HN), *HAL 3071* (HN), *HAL 3254* (HN); Thanh Hoa, Quan Hoa, *HAL 3925* (HN).

Notes. Some collections cited here are presented by sterile specimens, which identification needs confirmation. Meanwhile, it is obviously certain, that *M. somai* is most common species of the genus in northern Vietnam, particularly in limestone areas.

Vigorous plants with 4-flowered inflorescence and large flowers were described from S. China as *Vanilla shenzhenica*. I see no specific difference in floral morphology of this novelty.

2. *M. annamica* (Gagnep.) Aver.,

comb. nov. – *Vanilla annamica* Gagnep., 1931, Bull. Mus. Hist. Nat. (Paris), 2 ser. 3, 7: 686; id., 1934, Fl. Gen. Indochine, 6, 5: 584, fig. 56, 1; Lang et Tsi, 1976, Icon. Corm. Sinic. 5: 651, fig. 8132; Seidenf., 1992, Opera Bot. 114: 72; Aver. et Averyanova, 2003, Updated Checklist Orch. Viet.: 60; Soto, Cribb, 2010, Lankesteriana 9, 3: 368.

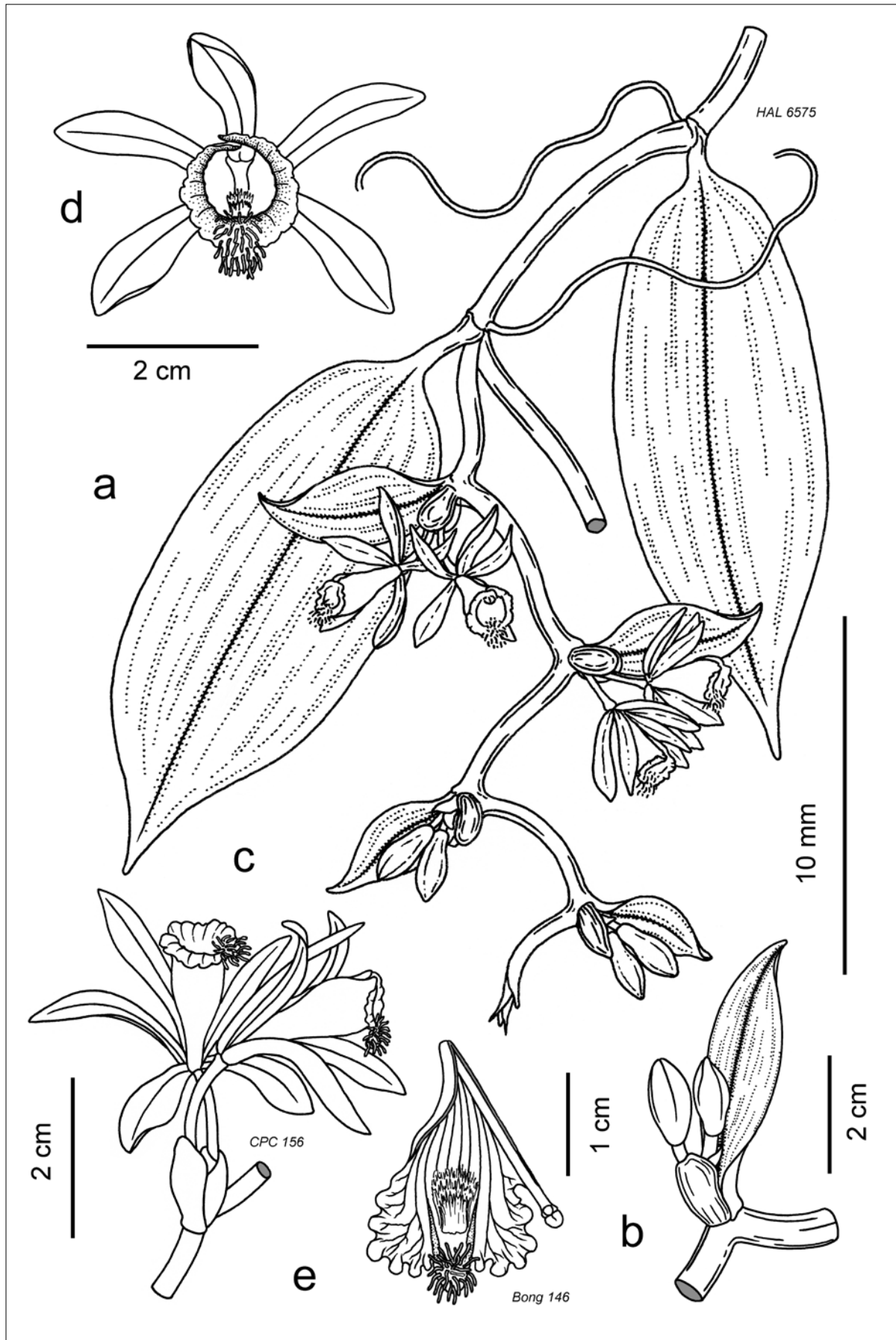


Fig. 21. *Miguelia somai*: a – flowering plant, b – inflorescence with flower buds (HAL 6575), c – inflorescence with open flowers, d – flower (CPC 156), e – partially dissected and flattened lip (Bong 146).

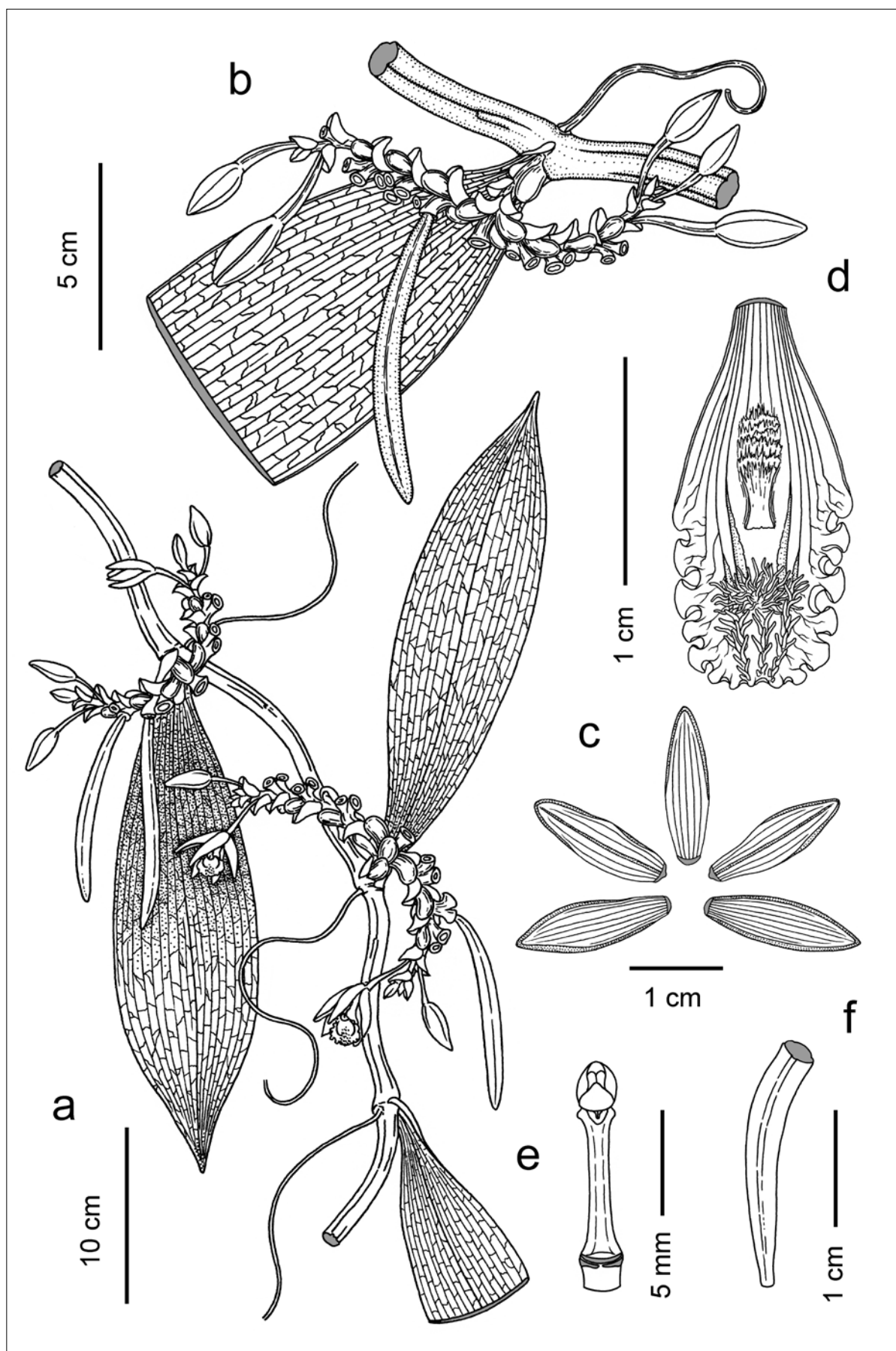


Fig. 22. *Miguelia annamica* (VH 3519): a – portion of flowering stem, b – inflorescence, c – flattened sepals and petals, d – partially dissected and flattened lip, e – column, frontal view, f – pedicel and ovary.

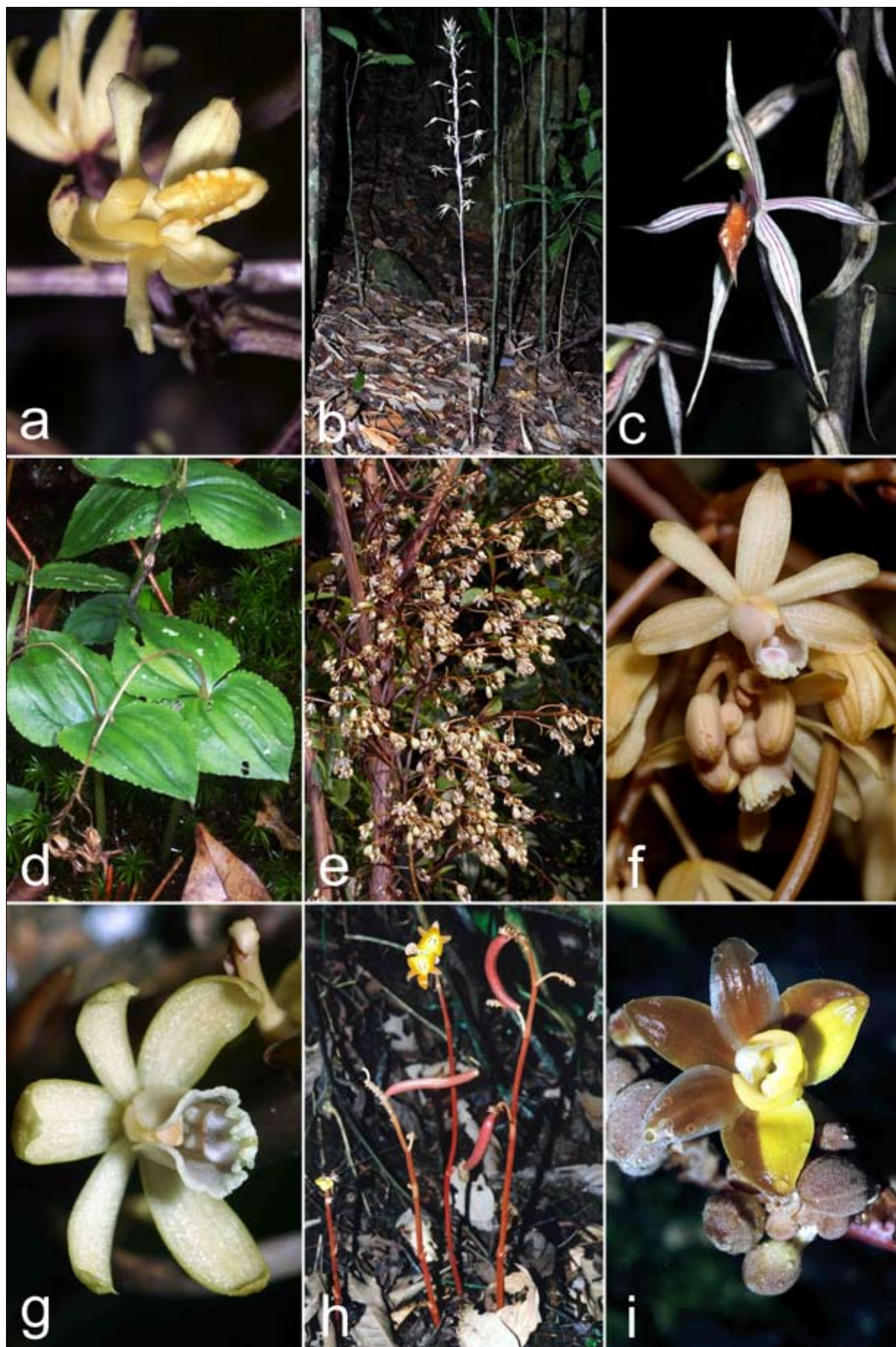


Fig. 23. *Aphyllorchis montana*: a (HAL 2992); *A. annamensis*: b, c (HLF 5617); *Listera latilabra*: d (HLF 1355); *Erythrorchis altissima*: e (HLF 6214), f (HAL 11571), g (HLF 6214); *Cyrtosia integra*: h (HAL 4874), i (HAL 1510).

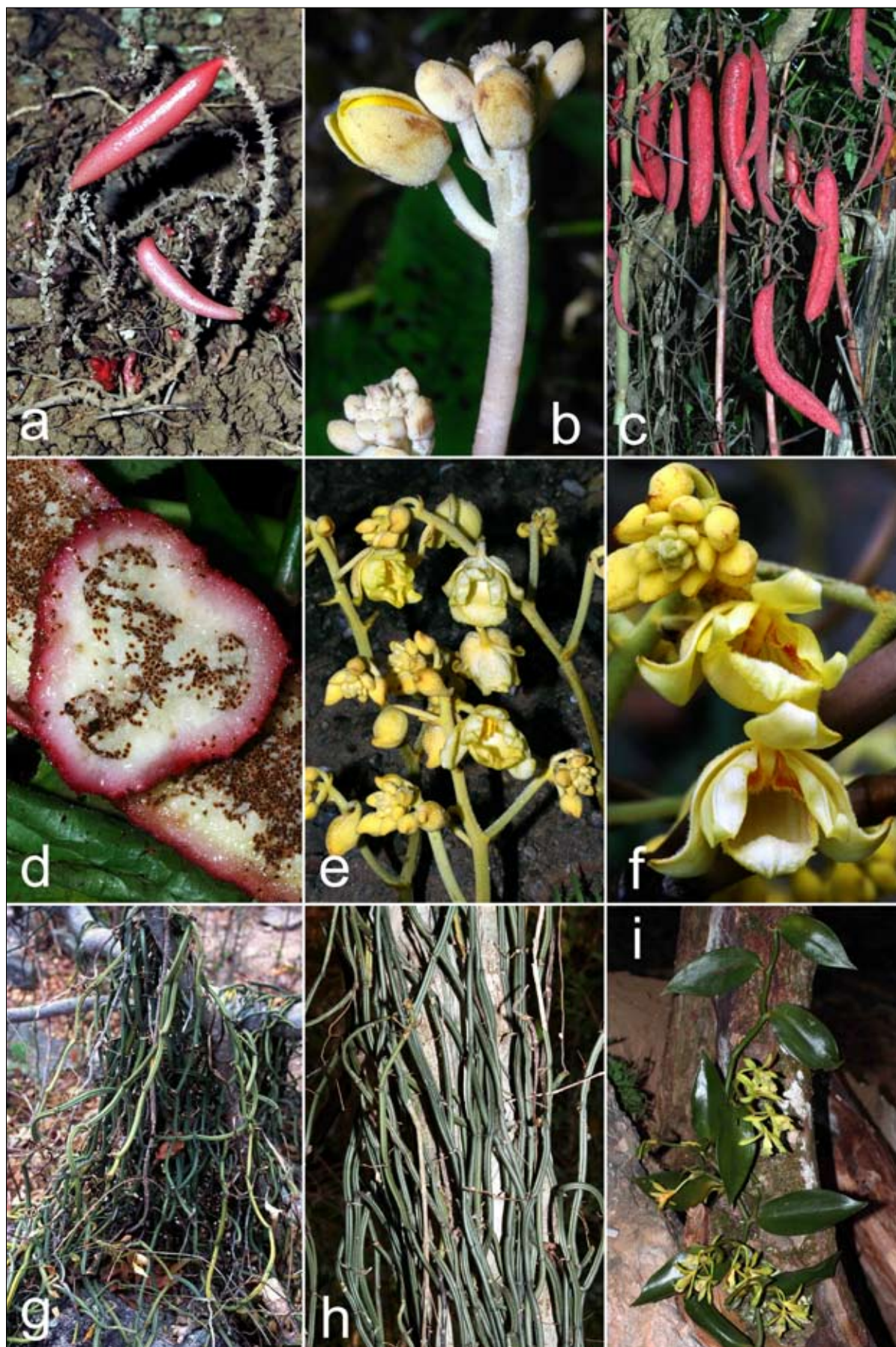


Fig. 24. *Cyrtosia nana*: a (HAL 2896), b (HLF 6674); *Cyrtosia falconeri*: c, d (HAL 9653); *Galeola nudifolia*: e, f (HLF 6213); *Vanilla aphylla*: g (HLF 3223), h (HLF 7175); *Miguelia somai*: i (CPC 156).

Described from southern Vietnam (“Annam: col de Mangiang, prov. Quinhon, ...; Lang-bian, entre B’dle et Dankia; ...; Lang-bian, ...; prov. de Binh-Thuan, Djiring, ...”). **Syntypes** (“*Poilane 17973, 18635; Jacquel 622; Magnein 82*”) – P.

Epiphytic or lithophytic creeping vine to 20 m long. Stem about 1 cm in diam., with internodes 6–15 cm long and slightly swollen nodes. Leaves shortly petiolate or subsessile, elliptic, 15–30 cm long, 5–10 cm wide, fleshy. Inflorescence dichasial or occasionally monochasial, each axis secund, (4)5–20 cm long, with (3)4–10 2-flowered secund cymes and 1–3 solitary apical flowers; flowers opening in succession. Inflorescence “internodal” bracts oval, rigid, rounded at apex, concave, 1–1.5 cm long, 5–7 mm wide; “nodal” bracts triangular, acute. Floral bracts broadly triangular, 1–5 mm long, obtuse to acute. Pedicel and ovary 2.5–3 cm long. Flowers white, tinged with greenish. Sepals and petals broadly oblanceolate, 2–3 cm long, 5–7 mm wide. Lip 2–2.5 cm long, 1–1.5 cm wide, connate with column on 3/4 of its length forming trumpet-shaped tube. Lip apex entire or indistinctly 3-lobed; lateral lobes broad, margins crisped and irregularly incised; apex of median lobe somewhat obtuse, fleshy, with many fat papillae 1.5–2 mm long; disk at center with many dense, scarious, incumbent, imbricate, overlapping scales and with 2–4 short lateral lamellate, shallowly incised keels. Column slender, glabrous, straight, 1–2 cm long. **Fig. 20 e; 22.**

Ecology. Primary and secondary broad-leaved and mixed evergreen forests, commonly on steep slopes and cliffs composed with silicate rocks at elev. 1000–1400 m a.s.l. Fl. February – April. Rare (EN).

Distribution. Vietnam (Binh Dinh, Binh Thuan, Lam Dong, Ninh Thuan, Thua Thien Hue). S. China, Laos.

Studied specimens. Ninh Thuan, Ninh Son, *VH 3519* (HN, LE); Thua Thien Hue, Phu Loc, Bach Ma national park, *HLF 1333* (HN, LE).

Notes. Basic structure of *M. annamica* flowers is similar to the previous species. Main differences are indicated in the key to species. Dichasial inflorescence with 2 axes bearing many biflorous cymes is characteristic for this rare species. Our previous record of *M. annamica* (Aver., 1988, Bot. Journ. (Leningrad), 73, 3: 427, 429, fig. 6; id., 1994,

Identif. Guide. Vietnam. Orch.: 76, fig. 3) belongs to *M. somai*.

Subtrib. 5.2.3. Lecanorchidinae Dressler, 1979, Selbyana 5, 2: 205.

Type: *Lecanorchis* Blume.

2(1) genera and 30–40(2) species. Tropical regions of the world with largest diversity in SE. Asia and Australia.

***Lecanorchis* Blume,**

1858, Mus. Bot. 2: 188; Seidenf., 1978, Dansk Bot. Ark. 32, 2: 125–128; Hashimoto, 1990, Ann. Tsukuba Bot. Gard. 9: 1–40; Comber, 1990, Orch. Java: 76–77; id., 2001, Orch. Sumatra: 133–134; Seidenf., Wood, 1992, Orch. Malay. Sing.: 132–134; Su Horng-Jye, 2000, Fl. Taiwan, 5: 932–936; Pearce et Cribb, 2002, Orch. Bhutan: 67–68; Aver. et Averyanova, 2003, Updated Checklist Orch. Viet.: 41; Chen Sing-chi, Cribb, 2009, Fl. China, 25: 171–172.

Lectotype: *L. japonica* Blume.

Terrestrial achlorophyllous leafless herbs with slender, erect or ascending, rigid, branching rhizome. Stems erect, usually black or dark brown, slender, usually simple, with sparse small scale-like sheaths. Inflorescence terminal, branching or not, with partial few-flowered spikes. Floral bracts small, triangular, membranous. Flowers resupinate, yellowish to dull brownish, with small toothed calyculus below perianth. Sepals and petals free, sub-similar. Lip base with canaliculate claw connate to lateral sides of column forming a short tube, rarely free, not spurred; upper part of lip entire or 3-lobed; disk often hairy or papillose. Column footless, more or less slender, slightly broadening toward apex, slightly curved. Anther terminal; pollinia 2, granular-mealy, without caudicle and viscidium; rostellum short. Fruit erect, cylindric capsule.

20(2) species. Tropical and subtropical Asia to islands of Pacific.

Note: All species of this genus are unattractive plants with bleak ephemeral flowers easily overlooked in botanical collecting and very poorly represented in available collections. It is highly probable that in Vietnam may be found more species than yet reported.

Key to species

1. Stem 12–30 cm tall; rhizome 2–3 mm thick; sepals less than 12 mm long; lip side lobes obtuse to acute; fruit 1.8–2.4 cm long **1. *L. vietnamica***
- Stem 20–50 cm tall; rhizome 4–6 mm thick; sepals longer than 12 mm; lip side lobes round at apex; fruit 2.5–4.5 cm long **2. *L. malaccensis***

1. *L. vietnamica* Aver.,

2005, Rheede, 15, 2: 92, fig. 7, 8, f-i.

Described from central Vietnam ("Thua Thien-Hue Prov., A Luoi Distr., A Roang Municipality, Tra Lenh Forestry Department station, around point 16°04'38"N, 107°29'10"E., at elev. 700–800 m, on tops of ridge"). **Type** ("20 April 2005, L. Averyanov, P.K. Loc, N.T. Vinh etc., HAL 7247") – HN (holo), LE (iso).

Rhizome vertical, gray-brown, 2–3 mm thick. Stem slender, dark brown-purple to nearly black, 12–30 cm tall, 0.5–1 mm thick, with many small distant bracts and few thick gray-brown roots at the base. Inflorescence simple or branching, with lax terminal few-flowered spikes, rachis zigzag. Floral bracts very small, ovate, obtuse, glabrous. Ovary cylindrical, 8–12 mm long, yellowish or pinkish. Calyculus short, campanulate, 0.5–1 mm long, 1.5 mm across, with irregular, erose dentate margin. Flowers sessile, hardly opening, campanulate. Sepals and petals subsimilar, light brown, yellowish to nearly white, oblong-spatulate, with 3 indistinct veins, 8–11 mm long, 1.8–3 mm wide. Lip 8–11 mm long, 5–8 mm wide, adnate at the base to lateral sides of column and forming inflated sac-like nectary; lip blade 3-lobed; side lobes erect, triangular-cuneate to broadly-falcate, acute, 1.5–2.5 mm long, 1–1.8 mm wide, median lobe turned down at right angle, oblong or obovate, 2–3 mm long, 2.2–3 mm wide, usually longer than wide, rounded at apex, densely covered with long, flexuose, white to lilac-pinkish hairs. Column straight, 5–6 mm tall, 1–1.5 mm wide, stigma in form of fleshy ovate finely papillose lamella reflexed forward; anther cup hemispheric, about 1 mm across. Fruit cylindrical to narrowly-ellipsoid black capsule, 1.8–2.4 cm long, about 3 mm wide. **Fig. 25 a-f; 27 c-e; 28.**

Ecology. Primary closed, broad-leaved, evergreen, forests on silicate soils, commonly along ridge edges and on mountain tops, at elev. 300–1600 m a.s.l. Fl. February – May. Rare (VU).

Distribution. Vietnam (Khanh Hoa, Kon Tum, Lam Dong, Lao Cai, Nghe An, Quang Nam, Thua Thien-Hue). Endemic.

Studied specimens. Khanh Hoa, Khanh Son, *VH 4156a* (HN; LE); Kon Tum, Dak Gley, *VH 2237* (HN; LE); Lam Dong, Lac Duong, *VH 3780* (HN; LE); Lao Cai, Van Ban, *HAL 2715* (HN; LE); Nghe An, Tuong Duong, *HLF 6670* (HN; LE); Quang Nam, Phuoc Son, *HAL 11988* (HN; LE); Thua Thien-Hue, Nam Dong, *HAL 6982* (HN; LE); d-EXSICCATES OF VIETNAMESE FLORA 0014/*HAL 7247*.

Note: The species differs from the most similar *L. malaccensis* Ridl. and *L. japonica* Blume in much smaller flowers, inflated sac-like base of the lip and its broadly cuneate, acute side lobes.

2. *L. malaccensis* Ridl.,

1893, Trans. Linn. Soc. London, Bot. 3, 9: 371; Seidenf., 1978, Dansk Bot. Ark. 32, 2: 126, fig. 77; Comber, 2001, Orch. Sumatra: 133; Seidenf., Wood, 1992, Orch. Malay. Sing.: 134, fig. 55 f, g. – *L. javanica* auct. non Blume: Aver. et Averyanova, 2003, Updated Checklist Orch. Viet.: 41.

Described from central Malacca Peninsula ("Tahan Woods"). **Type** ("Ridley s.n.") – ?

Rhizome vertical or ascending, dull brown, 4–6 mm thick. Stem slender, dull brownish, later nearly black, 20–50 cm tall, 1–2 mm thick, with few distant bracts and many thick brownish roots at the base. Inflorescence simple, with lax terminal few-flowered spikes, rachis rather straight. Floral bracts small, triangular, acute, glabrous. Ovary cylindrical, 2–4 cm long, nearly black. Calyculus short, campanulate, about 1 mm long, 2–3 mm across, with irregular, erose dentate margin. Flowers odorless, sessile, hardly opening, campanulate. Sepals and petals subsimilar, light pale purple-brown or pinkish, broadly lanceolate, with 3–5 veins, 15–17 mm long, 2–3.5 mm wide, petals slightly broader. Lip as long as sepals, the base joined to sides of column on 2–3 mm forming narrow tube, widening gradually to 3-lobed apex 5–7 mm wide from tip to tip of side lobes when flattened, side lobes brownish, triangular, almost rounded at apex, median lobe rounded, 3–4 mm long, yellow, densely haired with white flexuose hairs. Column pure white, straight, 10–11 mm tall, 1–1.5 mm wide, stigma concave, round, finely papillose; anther cup subquadrate, about 1 mm tall. Fruit cylindrical to narrowly-ellipsoid black or dark brown capsule, 2.5–4.5 cm long, about 4 mm wide. **Fig. 25 g, h; 27 f, g.**

Ecology. Primary and secondary, rather dry, broad-leaved and mixed, evergreen forests on shale and granite, commonly along ridge edges and on mountain tops, at elev. 700–2000 m a.s.l. Fl. March – April. Very rare (EN).

Distribution. Vietnam (Dak Nong, Kon Tum). Thailand, Malacca Peninsula, Sumatra.

Studied specimens. Dak Nong, Dak Glong, Ta Dung Nature Reserve, *HLF 5521* (HN, LE); Kon-tum, W slope of Ngoc Linh mt, *VH 1300* (HN; LE).

Trib. 5.3. *Gastrodieae* Lindl.,

1821, Collect. Bot. App.

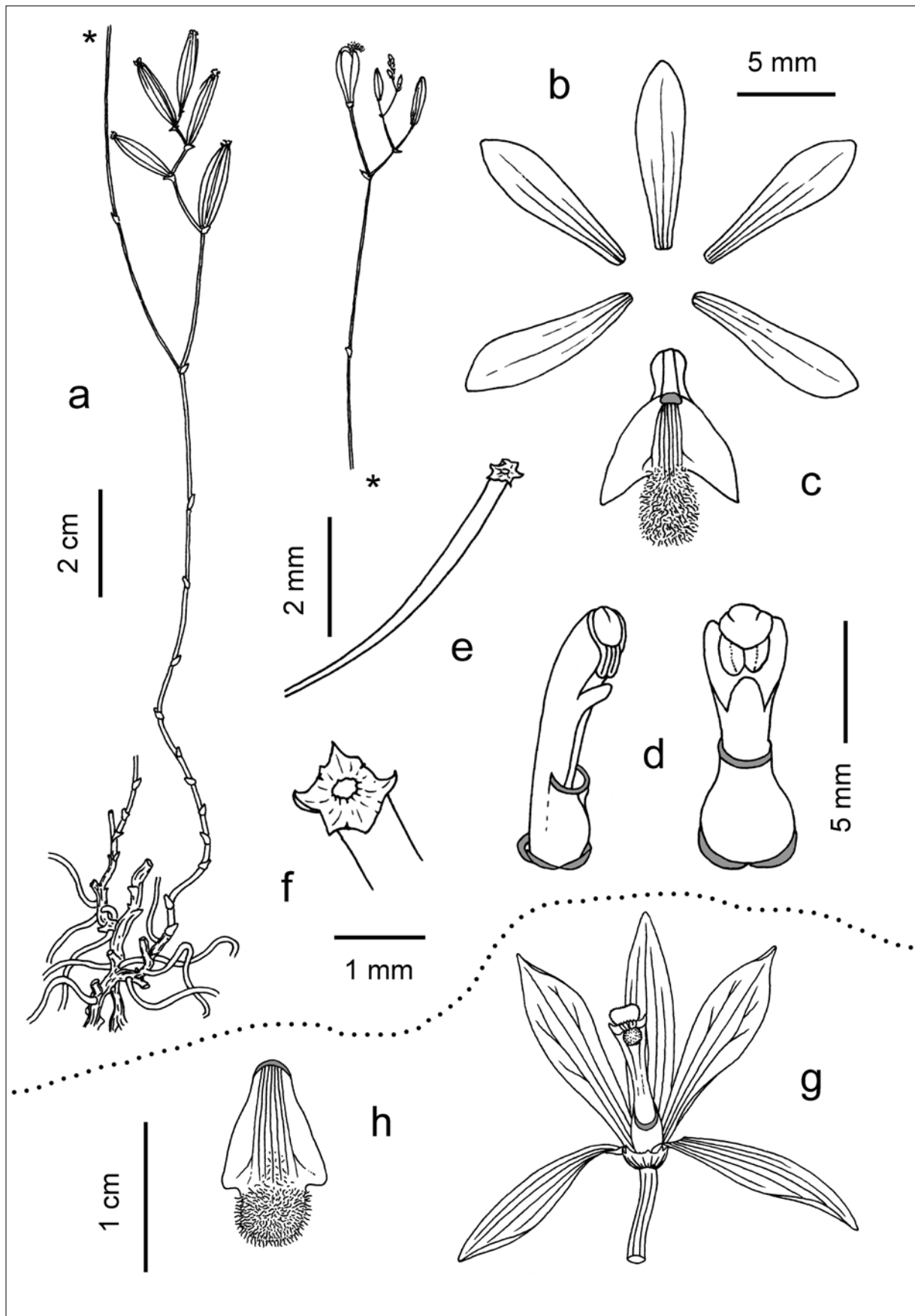


Fig. 25. *Lecanorchis vietnamica* (HAL 7247, type): a – flowering and fruiting plant, b – flattened sepals and petals, c – flattened lip, d – column, side and frontal view, e – pedicel and ovary, f – apex of ovary with cuniculus; *L. malaccensis* (VH 1300): g – flower with flattened sepals and petals, with removed lip, h – flattened lip.

Subtrib. 5.3.1. *Gastrodiinae* Lindl.,

1840, Gen. Sp. Orch. Pl.: 383.

Type: *Gastrodia* R. Br.

7(5) genera and 70–90(11) species. Tropical regions of the world with largest diversity in SE. Asia and Australia.

***Didymoplexiella* Garay,**

1954, Arch. Jard. Bot. Rio de Janeiro 13: 33; Seidenf., 1978, Dansk Bot. Ark. 32, 2: 175–176; Seidenf., Wood, 1992, Orch. Malay. Sing.: 137–139; Su Horng-Jye, 2000, Fl. Taiwan 5: 849–851; Comber, 2001, Orch. Sumatra: 111–112; Aver. et Averyanova, 2003, Updated Checklist Orch. Viet.: 31; Chen Sing-chi, Gale, Cribb, 2009, Fl. China, 25: 206. – *Leucolea* Ridley, 1891, Journ. Linn. Soc., Bot. 28: 340, non (DC.) Benth., 1837.

Type: *Didymoplexiella ornata* (Ridl.) Garay (*Laucolea ornata* Ridl.).

Terrestrial achlorophyllous leafless tuberiferous herbs. Tubers horizontal or inclined, cylindrical-fusiform, with few small sparse adpressed scales at the base. Stem simple, erect, slender, with few thin roots at the base, small distant bracts and terminal simple racemose inflorescence of 1 to many flowers. Inflorescence rachis elongated after flowering. Flowers resupinate, widely opening to sub-campanulate, 2-labiate, ephemeral. Sepals and petals all joined near their base, dorsal sepal connate to petals for 1/2–2/3 of their length forming a porrect hood; lateral sepals united basally for half way, deflexed or weakly spreading. Lip adnate with column at base, free from sepals and petals, not spurred, apex entire or 3-lobed; disk papillose, with a 2-lobed gland. Column erect, elongate, footless, widening to the apex, with 2 slender, downwards curved, hook-like subulate stelia more than half of column length on either side of stigma; anther terminal, with 4 mealy pollinia in 2 pairs, each pair with viscidium, with no caudicles, operculum with long filament; rostellum erect, transverse, small; stigma broad, placed directly below rostellum. Capsule erect, fusiform.

10(1) species. Mainland tropical SE. Asia, Ryukyu Islands, Malacca Peninsula, Indonesia.

***D. denticulata* Aver.,**

2010, Taiwania, 55, 2: 92, fig. 1, 3; 4. – *D. siamensis* auct. non (Rolfe) Seidenf.: Aver. et Averyanova, 2003, Updated Checklist Orch. Viet.: 31.

Described from central Vietnam (“Quang Binh province, Le Thuy district, Kim Thuy municipality, around Lang Ho village at 16°59’31”N 106°38’31”E, ... slopes of Khe Nuoc Trong Ri-

ver ...”). **Type** (9 April 2008, *L. Averyanov, P.K. Loc, N.T. Vinh et al.*, HAL 11443) – HN (holotype), LE (isotype). **Epitype** – d-EXSICCATES OF VIETNAMESE FLORA 0129/HAL 11443.

Terrestrial herb. Stem (5)10–25(35) cm tall, 1–1.5 mm thick, olive-brownish to dull gray-brownish or nearly black, with 1–3 small distant triangular bracts and many-flowered inflorescence. Tubers longitudinally wrinkled, 2–12 cm long, to 0.8 cm in diameter. Inflorescence with many buds densely arranged at the apex. Floral bracts triangular, 1–1.2 mm long and broad. Flowers 1 day lasting, opening in succession one by one. Inflorescence rachis elongate after flowering to 12 cm long. Pedicel and ovary at flowering, suberect, 6–9 mm long. Flowers very fragrant, widely opening to sub-campanulate, 10–15 mm across. Sepals and petals pink, lilac, violet or bluish with brownish tint, occasionally almost pure white, sub-similar in shape, obovate, 6–9 mm long, 2.5–4 mm wide, with obtuse to roundish apex; median sepal slightly longer. Lip light violet with white apex, 5–7 mm long, 2.5–3 mm wide, narrowly obovate, widening from narrow base, 3-lobed, with fleshy triangular, slightly emarginate callus near the apex; side-lobes broadly rounded, with down deflexed irregularly denticulate margins; median lobe bluntly rectangular or sub-quadrate, slightly emarginate and usually irregularly denticulate. Column 3–5 mm tall, footless, operculum hemispheric, slightly flattened, finely papillose. Fruit unknown. **Fig. 26; 27 h, i; 35.**

Ecology. Terrestrial ephemeroïd herb. Shady broad-leaved evergreen primary and secondary lowland and submontane forests (often with bamboo) on any kind of soils at elev. 150–1000 m a.s.l. Fl. March – April. Rare (LR).

Distribution. Vietnam (Nghe An, Quang Binh, Quang Tri, Tuyen Quang). Laos (Bolikhamxai, Khammouan).

Studied specimens. Nghe An, Tuong Duong, HLF 6672 (HN, LE); Quang Binh, Le Thuy, HAL 11443 (HN, LE); Quang Binh, Minh Hoa, HAL 11676 (HN, LE); Quang Binh, Quang Ninh, HAL 11521 (HN, LE); Quang Tri, Da Krong, HLF 6216 (HN, LE), d-EXSICCATES OF VIETNAMESE FLORA 0061a/HLF 6216; Quang Tri, Huong Hoa HLF 6263 (HN, LE), d-EXSICCATES OF VIETNAMESE FLORA 0061b/HLF 6263; Tuyen Quang, Na Hang, HAL 218 (HN, LE).

Notes. Species name refers finely dentate margin of the lip. It may be close to *D. ornata* and *D. siamensis* found in western Malesia and Thailand, but distinctly differ from both these species

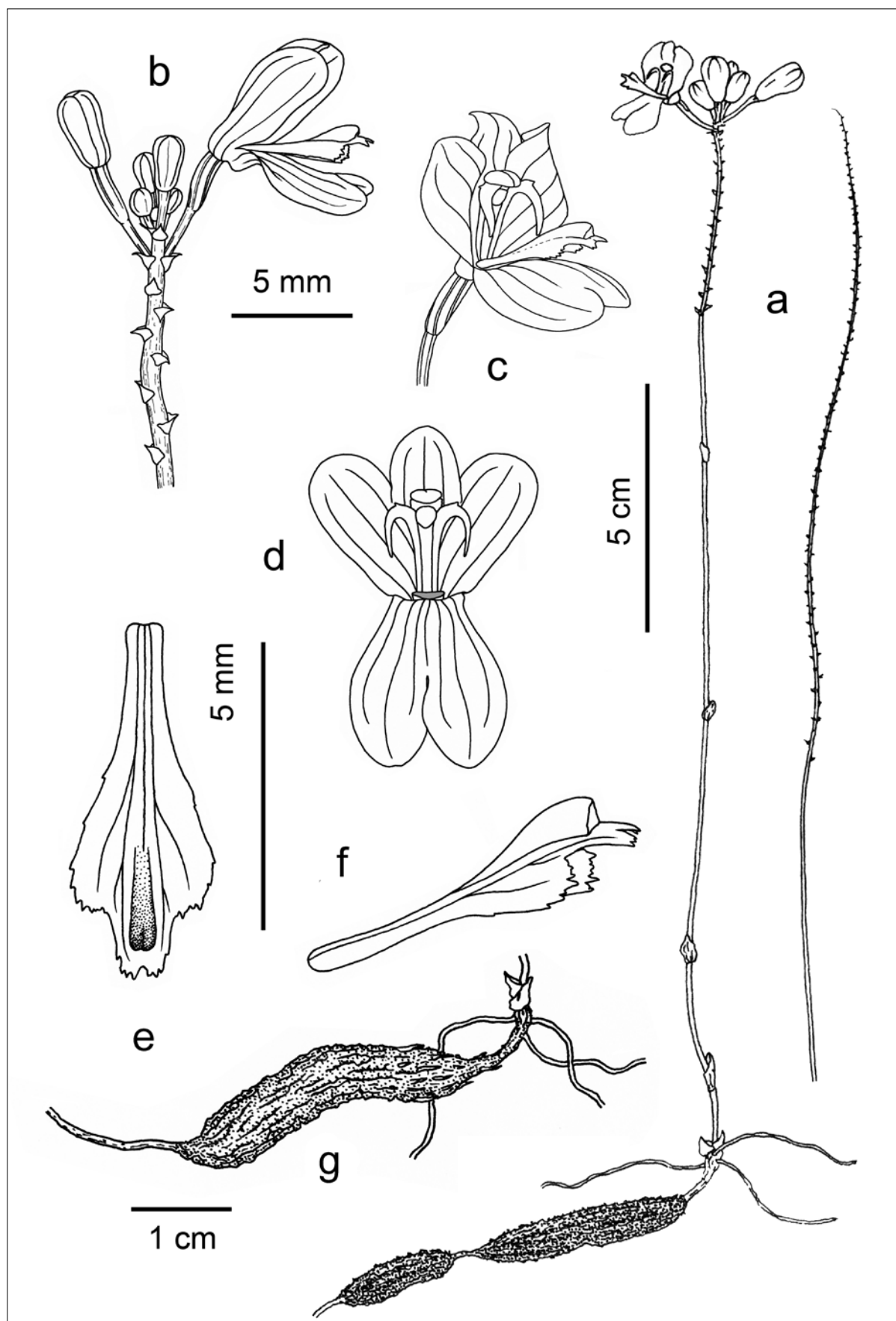


Fig. 26. *Didymoplexiella denticulata* (HAL 11443, type): a – flowering plant and old inflorescence, b – apex of inflorescence, c – flower, half side view, d – column and flattened sepals and petals, e – flattened lip, f – lip, side view, g – tuber.

in low, broad, denticulate lip side lobes. I think all specimens that I have seen from Vietnam belong to this species. It's flowers, however, are very delicate hence lip may be actually analyzed morphology only in fresh material. In dry and even liquid fixed flowers, very thin lip margins usually decurved down and adjoin densely to lower lip surface. As a result, lip sides look straight (not denticulate) and even unlobed exactly resembling lip of *D. siamensis*. It is quite possible that plants from Hainan, Taiwan and Japan reported under this name actually belong to *D. denticulata*.

Didymoplexiella denticulata in some areas of its distribution was observed growing just along Vietnam-Laotian border, in fact on eastern border of Bolikhamxai and Khammouan provinces, why Laos is included here in species distribution area.

Didymoplexiopsis Seidenf.,

1997, Contrib. Orch. Fl. Thailand 13: 13; Aver. et Averyanova, 2003, Updated Checklist Orch. Viet.: 31; Chen Sing-chi, Gale, Cribb, 2009, Fl. China, 25: 207.

Type: *D. khiriwongensis* Seidenf.

Terrestrial achlorophyllous leafless tuberiferous herbs. Tubers horizontal or inclined, cylindrical-fusiform, verrucose. Stem simple, erect, slender, with few thin roots and few small distant bracts at the base. Inflorescence terminal, simple, racemose, few-flowered, with small triangular acute floral bracts. Flowers not resupinate, widely opening, opening in succession, white, 2-labiate, ephemeral. Sepals and petals subsimilar, elliptic-ovate, all spreading; dorsal sepal and petals joined together at the base on 1/3, free of lateral sepals. Lateral sepals united for about 1/2 of their length. Lip free from sepals and petals, not spurred, moveably articulated with column foot apex, broadly rectangular, with broad incurved wing-like side lobes and truncate, slightly emarginate to erose-dentate apex. Lip ventral surface with massive prismatic curved warty callus at the base and with transversal obscurely dentate fold at the middle; dorsal surface with rounded finely verrucose yellow callus. Column with long column foot, erect, widening to apex, with 2 slender, curved downwards, hook-like subulate stelidia as long as column on either side of stigma; anther terminal, broad, with 4 mealy pollinia in 2 pairs, operculum with short filament; rostellum erect, massive, fleshy, transverse; stigma broad, placed directly below rostellum.

Monotypic genus endemic to Indochina and SE. China.

***D. khiriwongensis* Seidenf.,**

1997, Contrib. Orch. Fl. Thailand 13: 13,

fig. 2; Aver. et Averyanova, 2003, Updated Checklist Orch. Viet.: 31. – *Didymoplexiella hainanensis* X.H. Jin et S.C. Chen, 2004, Novon, 14: 176, fig. 1.

Described from southern Thailand ("Khao Luang, Nakorn Sritammarat 800–1000 m"). **Type** ("*Suksathan 1001*") – C (holo, iso).

Stem dark grey to dull yellowish-brown, 5–15 cm tall, with 2 or 3 dull brownish bracts. Tubers fusiform, 5–6 cm long, 3–10 mm wide. Rachis 5–10 mm long, with few flowers; floral bracts triangular, acute, 1.5–2 mm long. Flowers white, finely fragrant, lip below with yellow-orange spot. Pedicel and ovary 0.5–1.5 cm long, dark brown. Dorsal sepal and petals ovate to narrowly ovate, 7–13 mm long, 3–5 mm wide, obtuse; lateral sepals ovate, 10–13 mm long, 4 mm wide, obtuse. Lip moveable joined with column foot apex, broadly rectangular, 5–6 mm long, 11–12 mm wide, indistinctly 3-lobulate, margin of side lobes erose-denticulate, midlobe slightly emarginate; massive callus at the base of lip covered by numerous small olive-grey warts, center of lip often with few fibrous cirri. Column 2.5–3 mm tall, as long as incurved hook-like stelidia; column foot incurved, 4–5 mm long. Pollinia light pinkish.

Fig. 29; 36 a-c.

Ecology. Primary and secondary closed broad-leaved and mixed evergreen forests on any kind of soils at elev. Fl. 100–1600 m a.s.l. March – May (July). Rare (VU).

Distribution. Vietnam (Ha Tinh, Khanh Hoa, Quang Binh, Quang Tri, Thua Thien-Hue). Thailand, SE. China (Hainan).

Studied specimens. Ha Tinh, Huong Son, HAL 5040 (HN, LE), HAL 5153 (HN, LE), HAL 5262 (HN, LE), HAL 5341 (HN, LE), Khanh Hoa, NE slope of Bi Dup mountain, VH 1441 (HN, LE), Quang Binh, Minh Hoa, VH 4650 (HN, LE), Quang Binh, Quang Ninh, HAL 11885 (HN, LE), Quang Tri, Huong Hoa, HLF 5875 (HN, LE), Thua Thien-Hue, A Luoi, HAL 7246 (HN, LE), d-EXSICCATES OF VIETNAMESE FLORA 0015/HAL 7246 (HN, LE), HAL 7890 (HN, LE), HAL 7944 (HN, LE), Thua Thien-Hue, Huong Thuy, HAL 8177 (HN, LE), Thua Thien Hue, Bach Ma HLF 1397 (HN, LE), Thua Thien Hue, Xuan Loc, HLF 1829 (HN, LE).

Notes. Each flower in inflorescence commonly lasts only during few morning hours, hence this species is easily overlooked in field studies.

***Didymoplexis* Griff.,**

1844, Calcutta Journal Nat. Hist., 4: 383; Seidenf., 1978, Dansk Bot. Ark. 32, 2: 177–178; Comber, 1990, Orch. Java: 81–83; id., 2001, Orch.

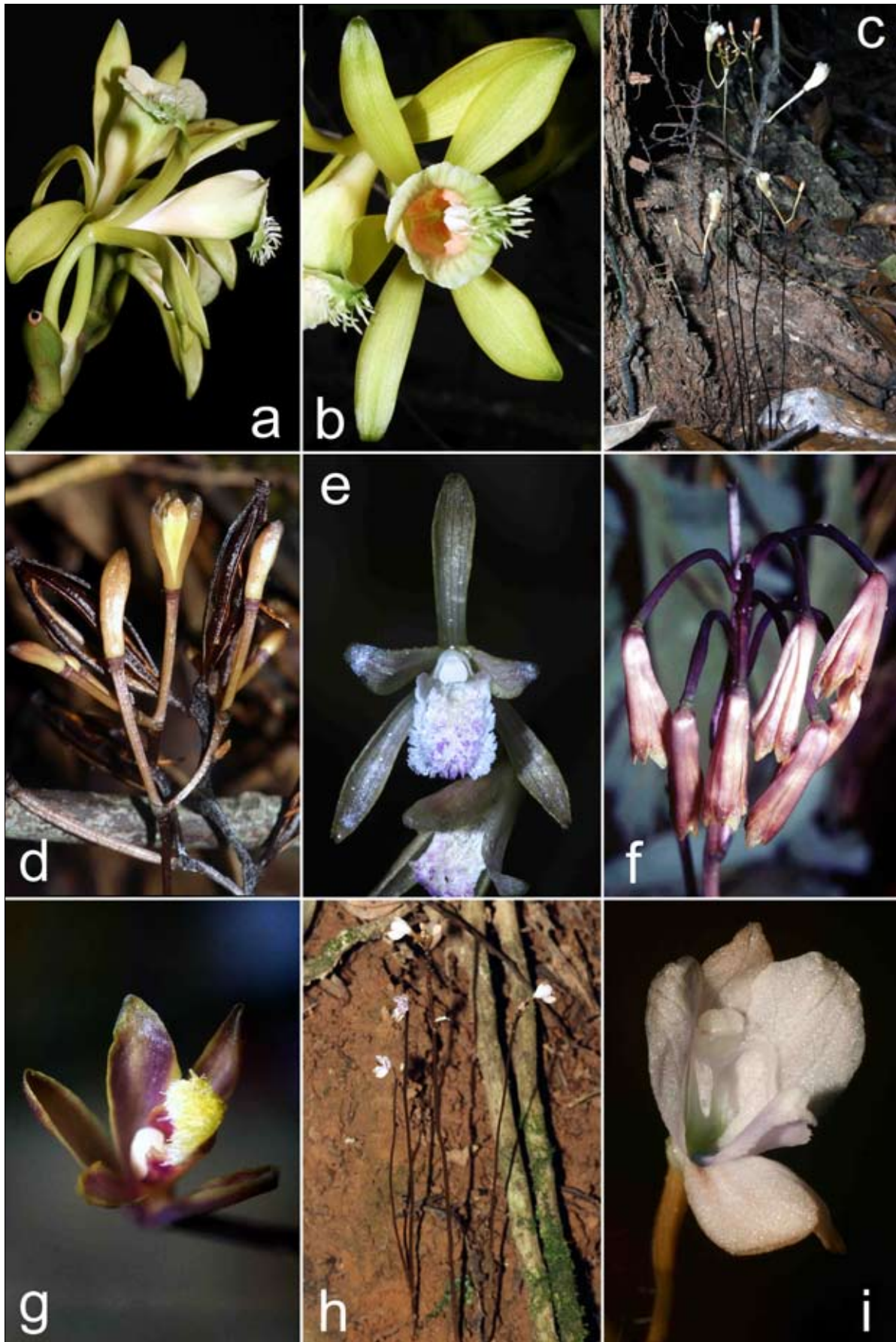


Fig. 27. *Miguelia somai*: a, b (CPC 156); *Lecanorchis vietnamica*: c, e (HAL 7247, type), d (HAL 6982); *L. malaccensis*: f, g (VH 1300); *Didymoplexiella denticulata*: h (HAL 11443, type), i – (HAL 11521).

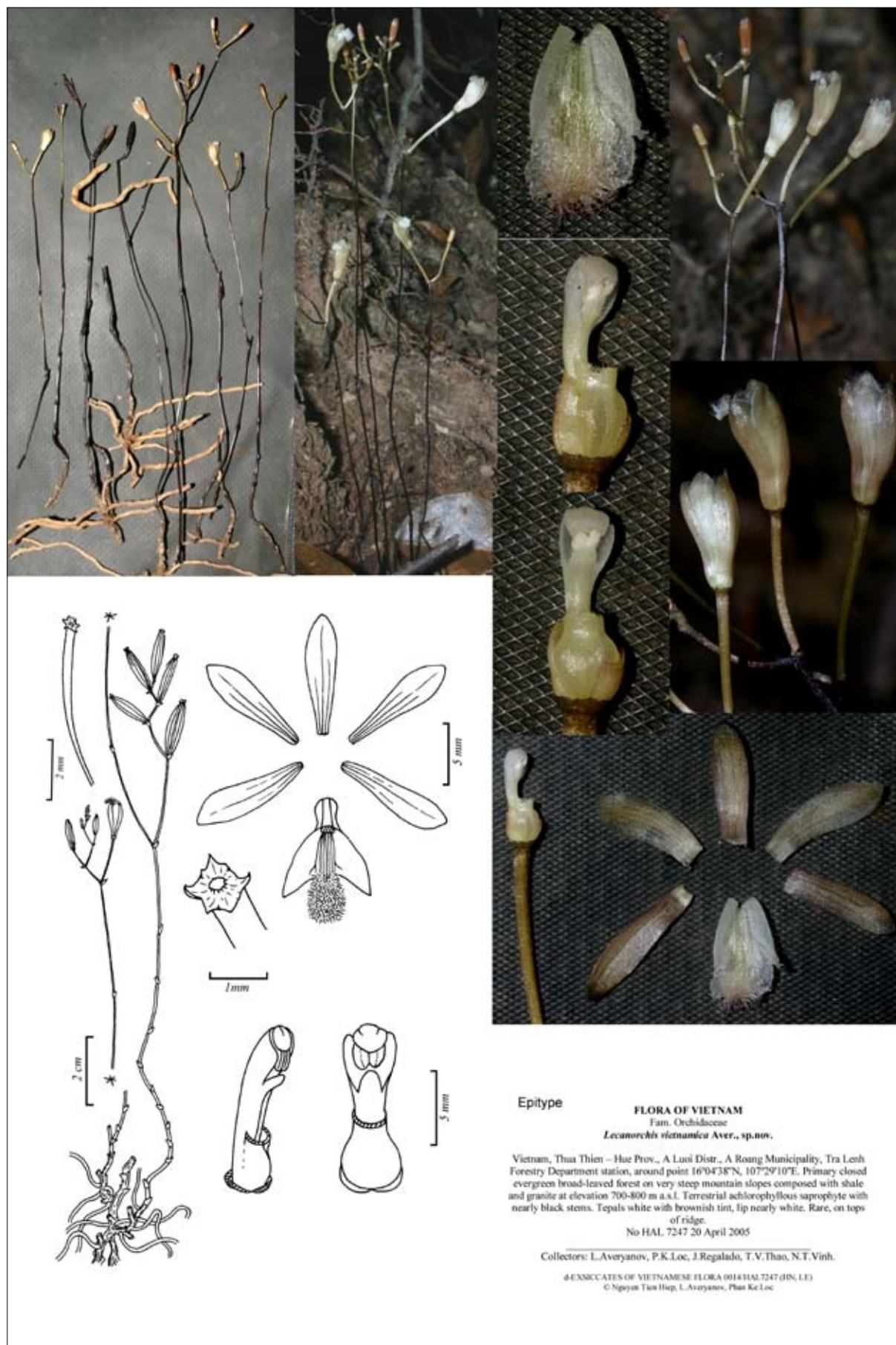


Fig. 28. Digital herbarium specimen of *Lecanorchis vietnamica* (Averyanov L. HAL 7247, epitype).

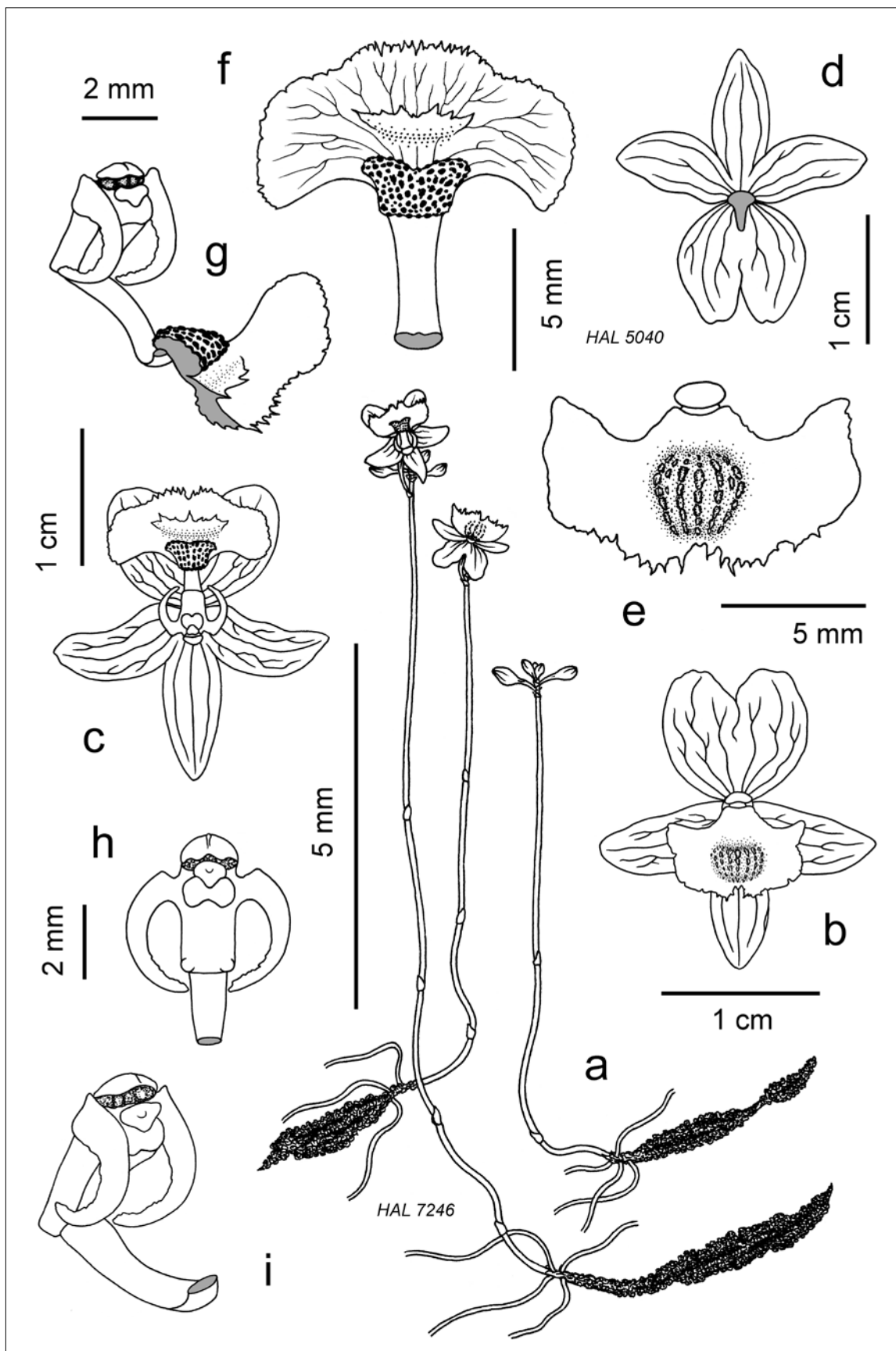


Fig. 29. *Didymoplexiopsis khiriwongensis*: a – flowering plant, b – flower at the beginning of anthesis (HAL 7246), c – flower with lip up-turned during anthesis, d – flattened sepals and petals, e – lip from below (dorsal surface), f – lip from above (ventral surface), g – column half-side view and sagittal lip section, h, i – column, frontal and half-side views. (HAL 5040).

Sumatra: 112–113; Seidenf., Wood, 1992, Orch. Malay. Sing.: 139; Su Horng-Jye, 2000, Fl. Taiwan 5: 851–854; Pearce et Cribb, 2002, Orch. Bhutan: 28–30; Aver. et Averyanova, 2003, Updated Checklist Orch. Viet.: 31; Chen Sing-chi, Gale, Cribb, 2009, Fl. China, 25: 205–206. – *Leucorchis* Blume, 1849, Mus. Bot. Lugd. 1, 2: 31, non E. Meyer, 1839.

Type: *D. pallens* Griff.

Terrestrial achlorophyllous leafless tuberiferous herbs. Tubers horizontal or inclined, cylindrical-fusiform. Stem simple, erect, with few thin roots and 1–3 small sheaths near base, glabrous. Inflorescence racemose with 1 to many flowers, rachis with small broadly triangular, acute persistent floral bracts. Flowers resupinate, subcampanulate, 2-labiate, ephemeral, white to pale yellowish-brown. Sepals and petals all joined near their base, dorsal sepal connate to petals for 1/2 or more of their length forming a porrect hood; lateral sepals united basally for more than 1/2 of their length, deflexed distally. Lip adnate with column foot at base, free from se-

pals and petals, not spurred, entire or indistinctly 3-lobed; disk commonly papillose, with 1 or more basal glands. Column erect, elongate, with distinct column foot, widening to the apex, with 2 wings at apex, forming short, tooth-like stelidia; anther terminal with 4 mealy pollinia in 2 pairs, each pair with viscidium, with no caudicles, operculum with short filament; rostellum erect, fleshy, transverse; stigma broad, placed directly below rostellum. Capsule erect, fusiform; pedicel usually erect, elongates after anthesis to 20–30 cm, dull pinkish, hollow.

20(3) species: SW. Africa, Madagascar, Tropical and subtropical mainland Asia, Ryukyu Islands, Malay Archipelago to New Guinea, tropical Australia, islands of SW Pacific Ocean.

All species of the genus have very short flowering period due to which they are easily overlooked in field studies. Study of delicate flower structure and identification may be correctly fulfilled actually only on the base of fresh and liquid preserved material.

Key to species

1. Lip moveably articulated with column foot apex, at the base with large prismatic callus covered by numerous small olive-brown warts, at the center with yellow-orange spot; flowers widely opening; pedicels in fruits pendent, not much elongated **3. *D. vietnamica***
- Lip adnate to column foot, not moveable; without massive callus at the base but sometimes with papillose rugosity along midvein; without distinct yellow-orange spot at the center; flowers not widely opening, campanulate; pedicels in fruits erect, much elongated, to 10–30 cm **2**
2. Flowers mainly 1.5–2.2 cm across, tepals (6)8–12 mm long; lip broadly triangular-orbulate, more than 6 mm wide, straight or slightly undulate along apical margin; column foot about 2 mm long ... **1. *D. pallens***
- Flowers mainly less than 1.5 cm across, tepals 6–8 mm long; lip obovate or obdeltoid, less than 5 mm wide, finely denticulate along apical margin; column foot less than 1 mm long **2. *D. micradenia***

1. *D. pallens* Griff.,

1844, Calcutta Journal Nat. Hist., 4: 383; id., 1845, ibid., 5, pl. 17; King, Pantl., 1898, Ann. Roy. Bot. Gard. Calcutta, 8, tab. 346; Garay, Sweet, 1974, Orch. Ryukyu Isl.: 51, 62, fig. 3, g, h; Seidenf., 1978, Dansk Bot. Ark. 32, 2: 178, fig. 110; Comber, 1990, Orch. Java: 83, fig.; id., 2001, Orch. Sumatra: 113, fig.; Seidenf., Wood, 1992, Orch. Malay. Sing.: 138, fig. b-e; Su Horng-Jye, 2000, Fl. Taiwan, 5: 853, fig. 361; Pearce et Cribb, 2002, Orch. Bhutan: 30, fig. 4; Aver., Averyanova, 2003, Updated Checklist Orch. Viet.: 31. – *Leucorchis sylvatica* Blume, 1849, Mus. Bot. 1, 2: 31. – *Apetalon minutum* Wight, 1851, Icon. Pl. Ind. Orient. 5, tab. 1758. – *Didymoplexis subcampanulata* Hayata, 1912, Icon. Pl. Formos. 2: 136. – *D. brevipes* Ohwi, 1937, Acta Phytotax. Geobot. 6: 238. – *D. sylvatica* (Blume) Garay, 1995, Opera Bot. 124: 15.

Described from India (“Calcutta, Serampore”). **Type** (“Griffith”) – K (CAL, BR)?

Stem pale brown to dull pinkish or reddish brown, 5–20 cm tall, at the base with 3–5 sheaths and few to many wiry roots, often with small globose thickenings. Rachis elongates in fruits to 3 cm long, few to many-flowered, lax to subdense; floral bracts ovate, acute, to 2 mm long. Flowers opening in succession, white, campanulate; pedicel and ovary erect, brown, 0.7–1.2 cm; pedicel elongate in fruit to 15–30 cm long. Dorsal sepal and petals 6–12 mm, united for more than 1/2 of their length; free portion ovate triangular, shallowly 3-lobed, each lobe ovate-deltoid, obtuse. Lateral sepals to 12 mm long, connate to half-way, and with petals for 1/3 of their length; free portion 2-lobed, each lobe ovate, obtuse, reflexed. Lip broadly obovate, 5–7 mm long, 8–12 mm wide, erose-crenate, lateral margins erect or incurved, apex truncate; disk with dense row

of warty papillae along midvein. Column slightly curved, widened to apex, 4 mm long, with 2 oblong wings. Column foot slightly curved, 2–3 mm long. Anther hemispaeric. Capsule cylindric-fusiform, 2–4 cm long. **Fig. 30.**

Ecology. Primary and secondary closed broad-leaved evergreen forests on any kind of soils at elev. 30–1600 m a.s.l. Fl. April – May. Very rare (DD).

Distribution. Vietnam (Bac Kan, Dak Nong, Hoa Binh, Lam Dong, Lao Cai, Nge An, Ninh Binh, Thua Thien-Hue). Tropical and subtropical mainland Asia, Ryukyu Islands, Malay Archipelago to New Guinea.

Studied specimens. Bac Kan, Na Ri, *HAL 4960* (HN, LE); Dak Nong, Dak Glong, Ta Dung nature reserve, *HLF 5606* (HN, LE); Hoa Binh, Da Bac, *HAL 517* (HN, LE); Lam Dong, Lac Duong, *VH 3781* (HN, LE); Lao Cai, Van Ban, *HAL 2713* (HN, LE); Nghe An, Tuong Duong, *HLF 6671* (HN, LE); Ninh Binh, Cuc Phuong national park, 1 April 1997, *Henk van der Werff et al. 14201* (HN, LE); Thua Thien-Hue, Phu Loc, Bach Ma national park, *HLF 1391a* (HN, LE).

Notes. All studied specimens were collected in fruits, hence occurrence of this species in Vietnam still needs confirmation.

2. *D. micradenia* (Reichenb. f.) Hemsl.,

1883, Journ. Linn. Soc. Bot. 20: 311; Tien-Chuan, Shih-Wen Chung, 2007, Taiwan, 52, 4: 360, fig. 2, 3. – *Epiphanes micradenia* Reichenb. f., 1868, Seem. Fl. Vit.: 295. – *Didymoplexis minor* J.J. Smith, 1900, Bull. Inst. Bot. Buitenzorg 7: 1; id., 1908, Orch. Java. Atlas, fig. 53; Comber, 1990, Orch. Java: 83.

Described from Fiji ("*Ovalau, Fiji*"). **Type** ("*Seemann 610*") – W (holo), K (iso).

Stem pale brown to whitish, erect, 5–15 cm high, 1.5–2 mm in diam., glabrous, with 3–5 scarious scales. Tubers pale brown, fusiform or moniliform, 1–5 cm long, 4–7 mm thick. Roots few, arising from the base of stem. Raceme 2–5 cm, with 8–15 flowers; floral bracts ovate, 1.5 mm long, acuminate. Pedicel and ovary 4–6 mm long, glabrous. Flowers whitish, tinged with pale red, campanulate. Sepals and petals connate at base into floral tube. Dorsal sepal 6–8 mm long, connate with petal for 1/2 to 2/3 of their length, petals shorter. Lateral sepals 5–7 mm long, connate for 2/3 to 4/5 of their length, whole structure united with petals to about 1/3 of its length, free apex reflexed, 2-lobed, lobules sub-orbicular. Lip white, obovate to obdeltoid, 4–6 mm long, erect on both sides, 4–5 mm wide when flat-

tened, base cuneate, apex obtuse, finely irregular denticulate along apical margin, disc with longitudinal raised keel of pale brownish warty papillae. Column white, clavate, about 5 mm long, apex with 2 truncate rhombic wings, base with short foot, less than 1 mm long. Anther oval or hemispheric, about 0.8 mm long, white; pollinia white, connected by broad viscidium detached from rostellum. Capsules cylindrical, 1.8–2.2 cm long, triangular in cross section; pedicels elongate to 10–25 cm long in fruit, about 2 mm in diam., fleshy. **Fig. 31.**

Ecology. Primary and secondary shady evergreen forests at elev. 100–300 m a.s.l. Fl. March – May. Very rare (DD).

Distribution. Vietnam (reported from center of the country). Taiwan, Java, New Caledonia, islands of SW. Pacific (Samoa, Vanuatu, Fiji, Tonga, Niue, Palau).

Notes. Species was reported for central Vietnam without citation of voucher specimens (Tien-Chuan, Shih-Wen Chung, 2007). We have not seen any material of this species from Vietnam. *Didymoplexis micradenia* morphologically close to *D. pallens*, but differs in distinctly smaller flowers, very short column foot and in obdeltoid lip that has irregularly denticulate margin.

3. *D. vietnamica* Ormerod,

2000, Oasis, 1, 4: 15; Aver., Averyanova, 2003, Updated Checkl. Orch. Vietnam: 31.

Described from northern Vietnam, Ninh Binh province ("*Cuc Phuong*"). **Type** ("*3-04-1997, B. Gray 7146*") – QRS (holo).

Stem dark grey to dull purple (in fruit) 5–25 cm tall, with 1–3 bracts and few densely arranged flowers opening in succession. Scape elongate during anthesis to 4–5 cm. Floral bracts ovate, acute, 1–1.5 mm long, 1 mm wide. Pedicel and ovary erect, 9–12 mm long. Flowers odorless, widely opening, broadly campanulate, 1.5–2.2 cm across, white, lip with yellow-orange center on both surfaces. Sepals and petals subsimilar, ovate, 10–12 mm long, about 7 mm wide, with obtuse to roundish apex, petals slightly smaller. Dorsal sepal connate to petals for 1/2–2/3 of their length; lateral sepals similarly united to about 2/3 from the base; petals and lateral sepals united for 1/4 to 1/3 of their length forming broad shallow tube. Lip moveably articulated with column foot apex, subquadrate, 7–10 mm long and broad, with broad, raised lateral sides and broad, truncate, slightly emarginate apex. Ventral lip surface with massive prismatic, curved, warty callus at the base and with finely verrucose callosity at the center of dorsal lip surface. Column erect, slightly

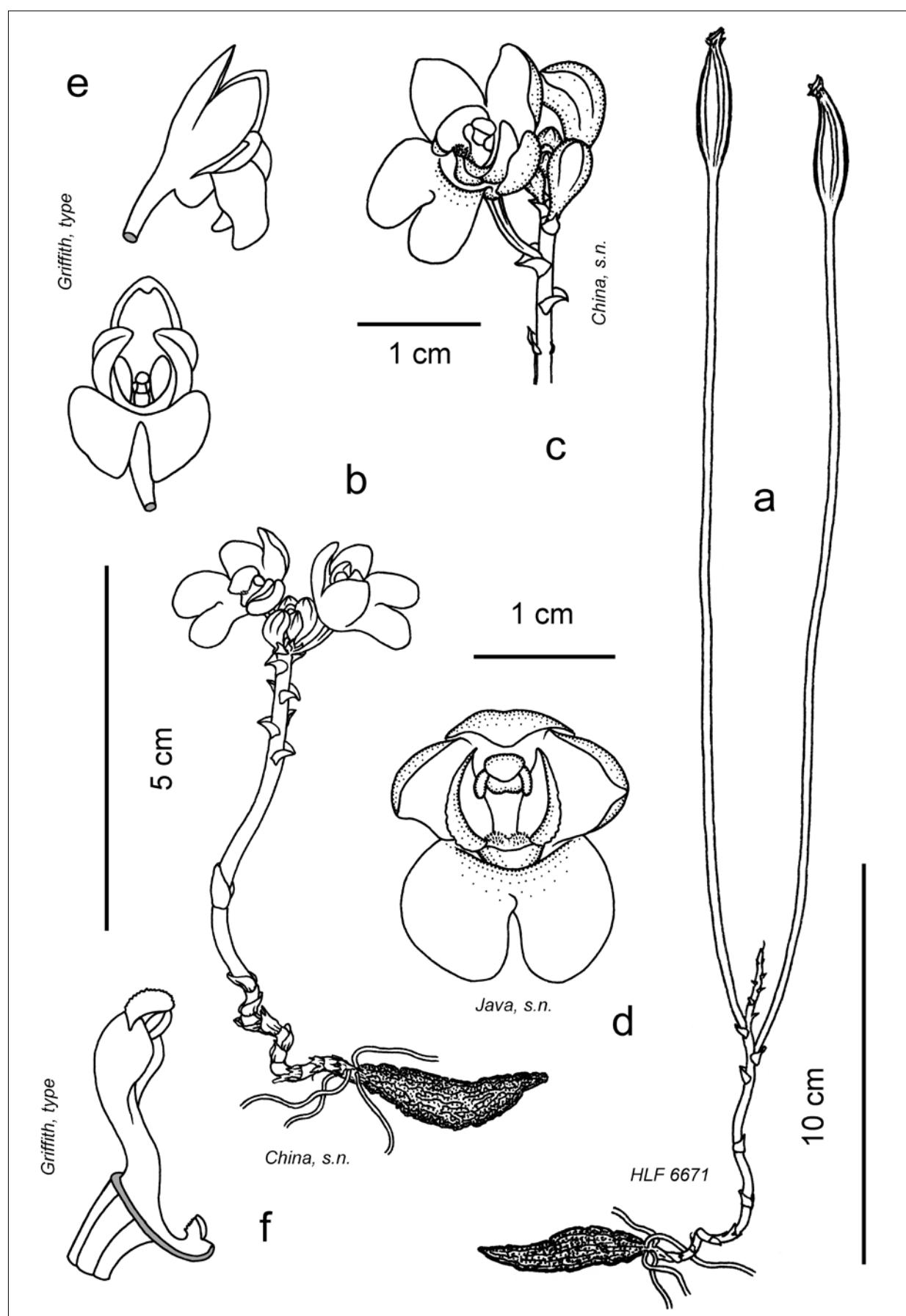


Fig. 30. *Didymoplexis pallens*: a – fruiting plant (HLF 6671), b – flowering plant, c – inflorescence (China s.n.), d – flower, frontal view (Java s.n.), e, f – flower and column (copy of type Griffith drawing).

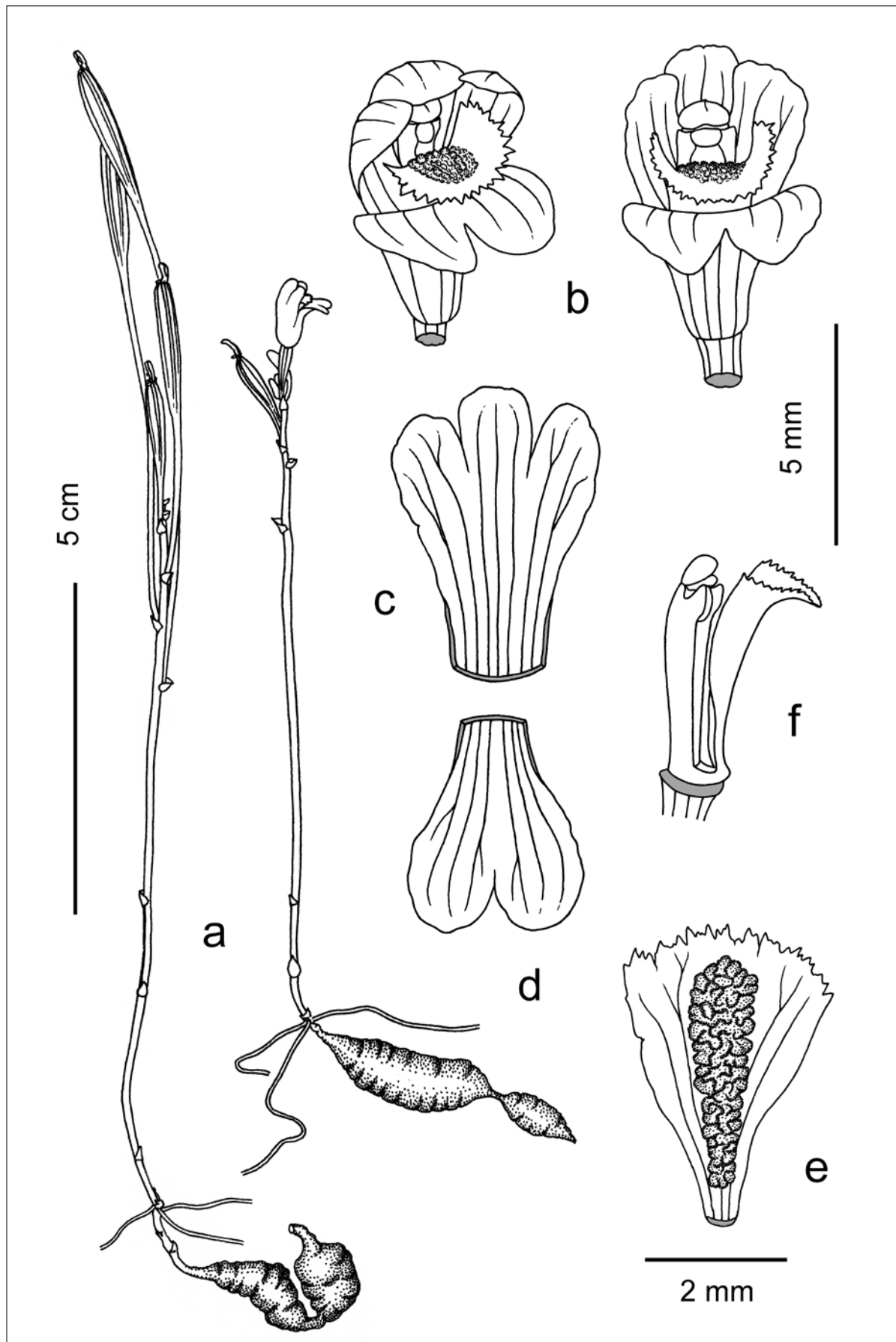


Fig. 31. *Didymoplexis micradenia* (Taiwan, s.n.): a – flowering and fruiting plant, b – flowers, c – flattened median sepal and petals, d – flattened sepals, e – flattened lip, f – column and lip, side view.

curved and widened to apex, 4–6 mm long, with 2 large, falcate, down directed acute hook-like stelidia 3 mm long, on both sides of stigma; column foot about 1 mm long. Fruit cylindric pendent capsule, 1.8–2.2 cm long. **Fig. 32; 36 d-f.**

Ecology. Primary and secondary closed evergreen forests on limestone at elev. 300–600 m a.s.l. Fl. March – April. Very rare (EN).

Distribution. Vietnam (Nghe An, Ninh Binh). Endemic.

Studied specimens. Nghe An, Tuong Duong, *HLF 6673* (HN, LE), d-EXSICCATES OF VIETNAMESE FLORA 0092/*HLF 6673*.

Notes. Very rare endemic of Vietnam. It has rather isolated taxonomical position in the genus having subulate hook-like stelidia, moveable lip, large massive, warty, prismatic callus at the base of the lip and pendant pedicels, not elongated in fruits. According to these features it certainly closely allied to *Didymoplexiopsis* Seidenf. This highly endangered species is typical relictual element of primary warm-loving lowland tropical limestone forests.

Yuania Maxim.,

1872, Bull. Acad. Imp. Sci. Petersburg, ser. 3, 18: 68; Su Horng-Jye, 2000, Fl. Taiwan 5: 1070–1073; Pearce et Cribb, 2002, Orch. Bhutan: 244–246; Aver. et Averyanova, 2003, Updated Checklist Orch. Viet.: 61; Chen Sing-chi, Gale, Cribb, 2009, Fl. China, 25: 210–211.

Type: *Y. japonica* Maxim.

Terrestrial leafless achlorophyllous glabrous herbs. Rhizome coralloid, fleshy, branched, with many small scales, lacking roots. Stem erect, stout, fleshy, with distant broad cucullate bracts, leafless, yellowish- or pinkish-white. Inflorescence terminal, racemose, with 1 to few loose flowers. Floral bracts often prominent. Flowers yellowish to pink or white, fleshy, subcampanulate, pedicellate. Sepals and petals free, similar, connivent, ovate, concave. Lip oblong, concave, adnate to short column foot, slipper-shaped or saccate, spurred or not. Column erect, broad, winged, with short column foot at base. Anther terminal, acuminate. Pollinia 4, in 2 pairs, granular-farinaceous, sectile, attached without caudicles directly to a common viscidium. Stigma large, concave; rostellum inconspicuous.

3(1) species. Bhutan, NE. India, China, Taiwan, Japan.

***Y. prainii* King et Pantl.,**

1898, Ann. Roy. Bot. Gard. Calcutta, 8: 175, tab. 237; Pearce et Cribb, 2002, Orch. Bhutan: 246,

fig. 57; Aver. et Averyanova, 2003, Updated Checklist Orch. Viet.: 61.

Described from NE. India (“India, Sikkim, Choongthang (Chunthang)...”, “Naga Hills ...”). **Syntypes** (“*Pantling 469*”) – BM, CAL, K, (“*Prain 15*”) – CAL, K.

Stem pinkish-white, 7–20 cm tall, covered with distant broadly ovate, loose, whitish scales. Inflorescence with 1–4 lax flowers. Floral bracts ovate to broadly ovate, fleshy, 7–9 mm long, 3–5 mm wide, white to pink, concave, clasping pedicel. Flowers odorless, erect, white with purple tint, sepals in apical part pink, lip white with many small deep purple dots. Pedicel and ovary white to pink or purple, cylindric, 2–4 cm long, elongating after flowering. Sepals and petals subsimilar, concave, ovate to broadly ovate, 1.5–1.8 cm long, 0.8–1.4 cm wide, petals distinctly wide to almost round. Lip entire, concave, slipper-shaped, spurless, 1.5–1.8 cm long, 0.8–1 cm wide. Column white, short, stout, 7–9 mm tall, with lateral wings at apex, and inconspicuous foot. Anther cap beaked, light yellowish. Fruit fusiform, 5–6 cm long. **Fig. 33; 36 g, h.**

Ecology. Primary evergreen broadleaved humid forests on silicate soils at elev. 1300–1500 m a.s.l. Fl. April – May. Very rare (EN).

Distribution. Vietnam (Ha Giang). NE. India, Bhutan.

Studied specimens. Ha Giang, Yen Minh, *CBL 2091* (HN, LE).

Gastrodia R. Br.,

1810, Prodr. Fl. Nov. Holl.: 330; Seidenf., 1978, Dansk Bot. Ark. 32, 2: 179–181; id., 1992, Opera Bot. 114: 75; Comber, 1990, Orch. Java: 84–85; id., 2001, Orch. Sumatra: 114–115; Seidenf., Wood, 1992, Orch. Malay. Sing.: 139–141; Aver., 1994, Ident. Guide Vietnam. Orch.: 82–83; Su Horng-Jye, 2000, Fl. Taiwan 5: 890–896; P.H. Ho, 2000, Ill. Fl. Vietnam 3: 795; Pearce et Cribb, 2002, Orch. Bhutan: 30–33; Aver. et Averyanova, 2003, Updated Checklist Orch. Viet.: 37; Schuiteman et al., 2008, Nord. Journ. Bot. 26: 293; Chen Sing-chi, Cribb, 2009, Fl. China, 25: 201–205.

Type: *G. sesamoides* R. Br.

Terrestrial, achlorophyllous, leafless, tuberiferous herbs. Tubers underground, many noded, fleshy, spherical to fusiform, sometimes tuberculate or slightly coralloid, covered with early decaying scales. Floriferous stem erect, with few to many tubular or scale-like sheaths, glabrous, pale yellowish-brown. Inflorescence terminal, few- to many-flowered lax raceme. Flowers campanulate or tubular,

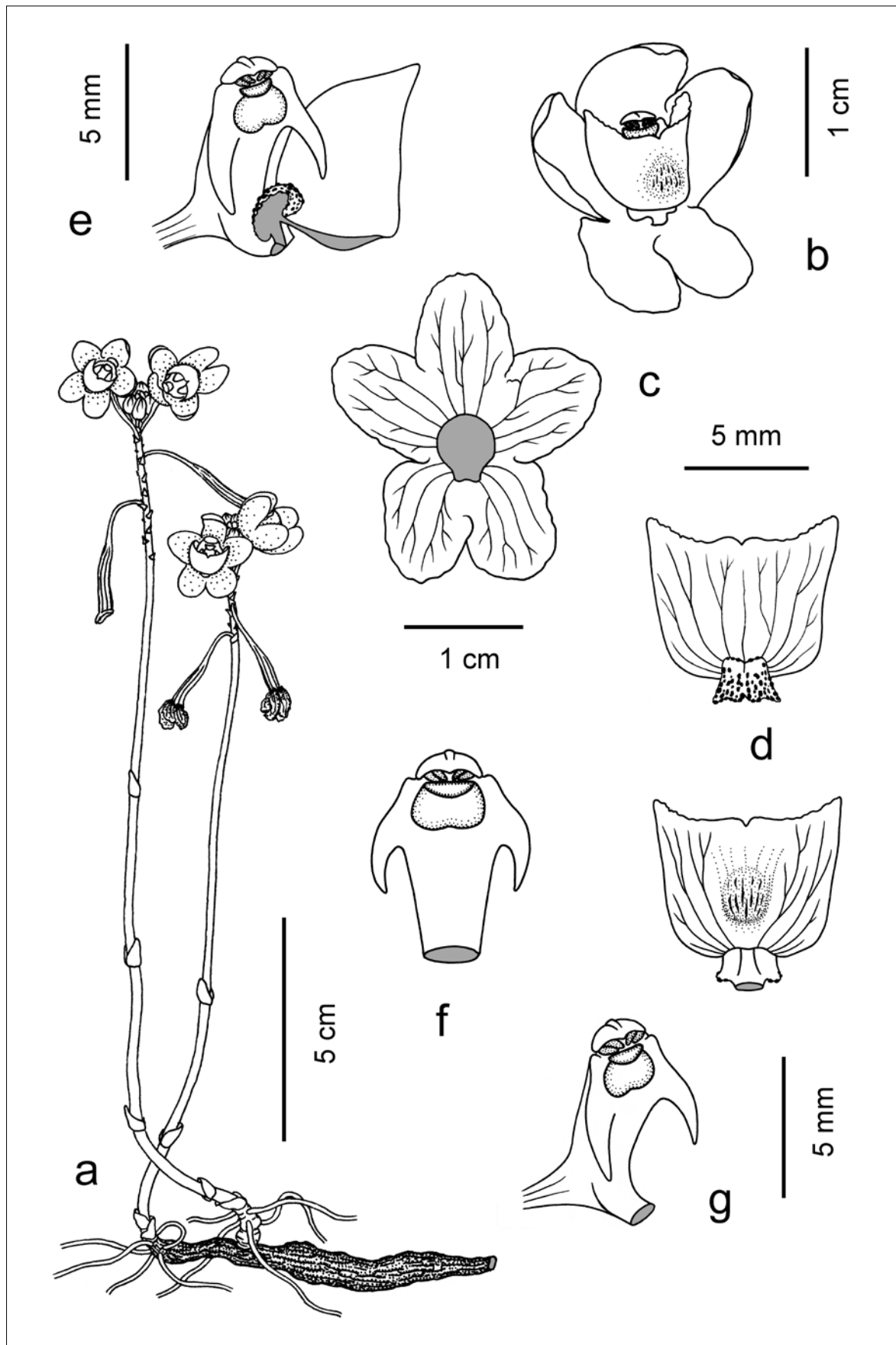


Fig. 32. *Didymoplexis vietnamica* (HLF 6673): a – flowering plant, b – flower, half-side view, c – flattened sepals and petals, d – lip from above (ventral surface) and from below (dorsal surface), e – column half-side view and sagittal lip section, f, g – column, frontal and half-side views.

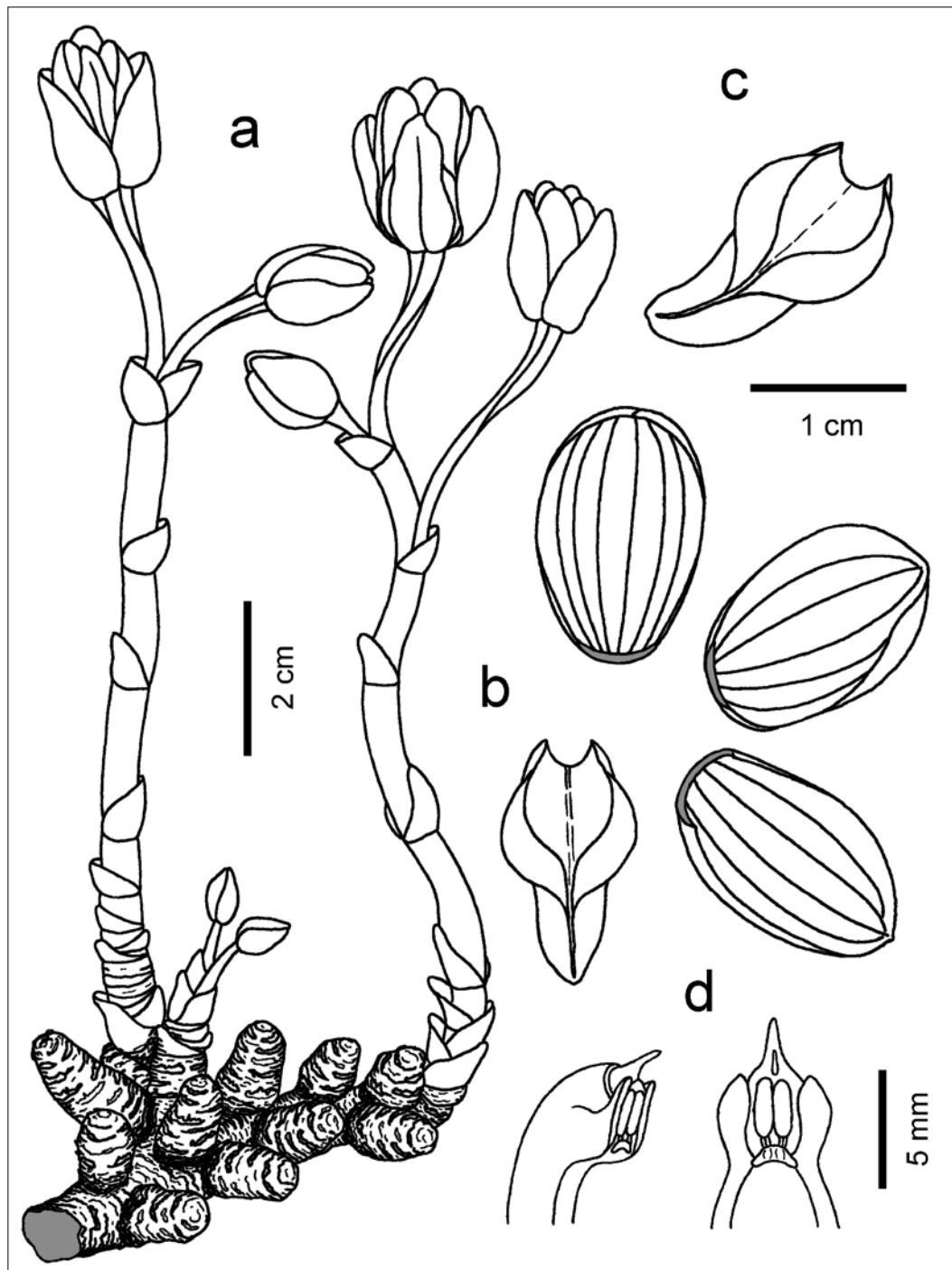


Fig. 33. *Yoania prainii* (CBL 2091): a – flowering and fruiting plant, b – flattened sepals, petal and lip, c – lip, half side view, d – column, side and frontal views.

resupinate or not, pink, yellowish, olive-greenish to brown; lip often lighter, sometimes with orange marks. Pedicel and ovary usually elongating in fruit. Sepals and petals united into perianth tube, with only apices free; sometimes with deep sinus between lateral sepals. Outer surface of perianth tube often verrucose. Petals much smaller than sepals. Lip usually small, enclosed within perianth tube, adnate to apex of small column foot, entire or 3-lobed, often clawed at base, with 2 globose calli at base. Column

straight, elongate, more or less distinctly winged toward apex. Anther terminal, large; pollinia 2, granular, usually composed of friable massulae, without caudicles; stigma convex, placed at the base of column. Capsule erect, elongating with age.

50(5) species. Tropical Africa, Madagascar, Mascarene Islands, tropical, subtropical and temperate E. Asia to Pacific islands, Australia, with highest diversity in southeast mainland Asia and Taiwan.

Key to species

1. Stem less than 5 cm tall; rachis shorter than 1 cm, flowers densely arranged in almost umbellate raceme **1. *G. theana***
- Stem longer than 5 cm, rachis longer than 1 cm, flowers distant in more or less lax raceme 2
2. Stem 6–18 cm tall; flowers 7–8 mm long, opening in succession one by one, short lasting; lip obovate to almost circular, broadening to the apex, little shorter and distinctly broader than sepals **2. *G. tonkinensis***
- Stem 16–60 cm tall; flowers 8–25 mm long, opening more or less simultaneously, long lasting; lip narrowly ovate to oblong, narrowing to the apex, much shorter and distinctly narrower than sepals 3
3. Flowers 8–14 mm long **3. *G. punctata***
- Flowers 16–25 mm long 4
4. Inflorescence 2–3 flowered; flowers broadly campanulate, 1.6–1.7 cm long; ovary round in section **4. *G. taiensis***
- Inflorescence commonly bears more than 3 flowers; flowers urceolate, almost tubular, 2–2.5 cm long; ovary triangular in section **5. *G. major***

1. *G. theana* Aver.,

2005, Rheede, 15, 2: 90, fig. 6, 8 c-e.

Described from central Vietnam ("Vietnam, Thu Thien-Hue Prov., Nam Dong Distr., Huong Son Municipality, around point 16°09'58"N, 107°36'07"). Type ("31 March 2005, L. Averyanov, P.K. Loc, P.V. The, A. Averyanova, N.T. Vinh, HAL 7165") – HN (holotype), LE (isotype).

Tubers cylindrical, finely irregularly verrucose, hairy, 2–4 cm long, 4–8 mm in diam. Stem erect, fleshy, straight or flexuose, white to yellowish-brown, 2.5–5 cm tall, 2–4 mm thick, with 2–3 ovate, obtuse bracts, 3–5 mm long, 2–4 mm wide, with many small imbricate triangular acute scales and with few slender roots at the base. Inflorescence dense raceme with 3–8 close flowers. Floral bracts yellowish-brown, ovate, 2–5 mm long. Pedicel and ovary 3–5 mm long, ovary 2–2.5 mm thick. Flowers tubular, hardly opening, fleshy; sepals with fleshy incurved tips, roughly verrucose outside, with irregularly warty dorsal ridge-like keel. Sepals white to pinkish-brown, oblong-ovate, 8–15 mm long, 3.5–5 mm wide, obtuse, connate with petals on about 9/10; lateral sepals connate each other on 1/4–1/3 from the base. Petals pink, thin, oblong, 1–1.3 cm long, 3–4 mm wide; free parts of petals fleshy, very small, sometimes hardly visible, shorter than sepals, narrowly-triangular, 0.4–0.8 mm long, 0.2–0.3 mm wide. Lip green with red apex and base; 5 nerved, 3.5–4 mm long, 2.5–3 mm wide, entire, finely denticulate along margin, flat, cordate, attenuate to blunt of acute apex; disc with thick short keel-like median callus near lip apex and 2 white spherical calli at suddenly narrowing lip base. Column white, straight, 4–4.5 mm tall, 1.4–1.6 mm wide, with long narrow stelia, at the base with very short column foot. Anther cap hemispheric, 0.6–0.7 mm across; stigma round convex, placed at the base of column. **Fig. 34; 36 i; 43.**

Ecology. Primary broadleaved evergreen lowland, shady forests on shale and sandstone at elev. 300–400 m a.s.l. Fl. March – April. Very rare (EN).

Distribution. Vietnam (Thua Thien-Hue). Endemic.

Studied specimens. Species is known till now by type collection only.

Notes. The species superficially similar to *G. verrucosa* Blume recorded from Japan, Malacca, Sumatra and Java, but distinctly differs in very small, hardly visible narrowly-triangular free part of petals and cordate base of lip. This rare, probably strictly endemic plant is typical element of the aboriginal warm-lowing lowland flora of central part of Vietnam.

2. *G. tonkinensis* Aver. et Averyanova,

2006, Komarovia, 4: 13, fig. 7.

Described from northern Vietnam ("N Vietnam, Ha Tinh Prov., Huang Son Distr., Son Hong municipality, around the point 18°34'06"N, 105°11'40"E..."). **Type** ("9 May 2004, Phan Ke Loc, L. Averyanov, Pham Van The, Nguyen Tien Vinh HAL 5263") – HN (holotype), LE (isotype).

Tubers irregularly verrucose, cylindrical, 2–5 cm long, 3–5 mm thick. Stem slender, straight or slightly flexuose, white to light gray-brown, 6–18 cm tall, 0.8–1 mm thick, with 1–2 distant, ovate, obtuse bracts, 2.5–3 mm long, at the base with few close small brown scales and few slender roots. Rachis with (4)6–8(10) flowers. Floral bracts light brown, ovate, acute, 1.5–2.5 mm long, 1–1.5 mm wide. Pedicel and ovary 8–10 mm long, 0.6–0.8 mm thick. Flowers urceolate, hardly opening, light brown with darker nerves, sparsely warty outside. Sepals and petals oblong, with 1 distinct vein and fleshy obtuse tips. Sepals subsimilar, 7–8 mm long, 1.2–1.5 mm wide; median sepal connate with petals for about

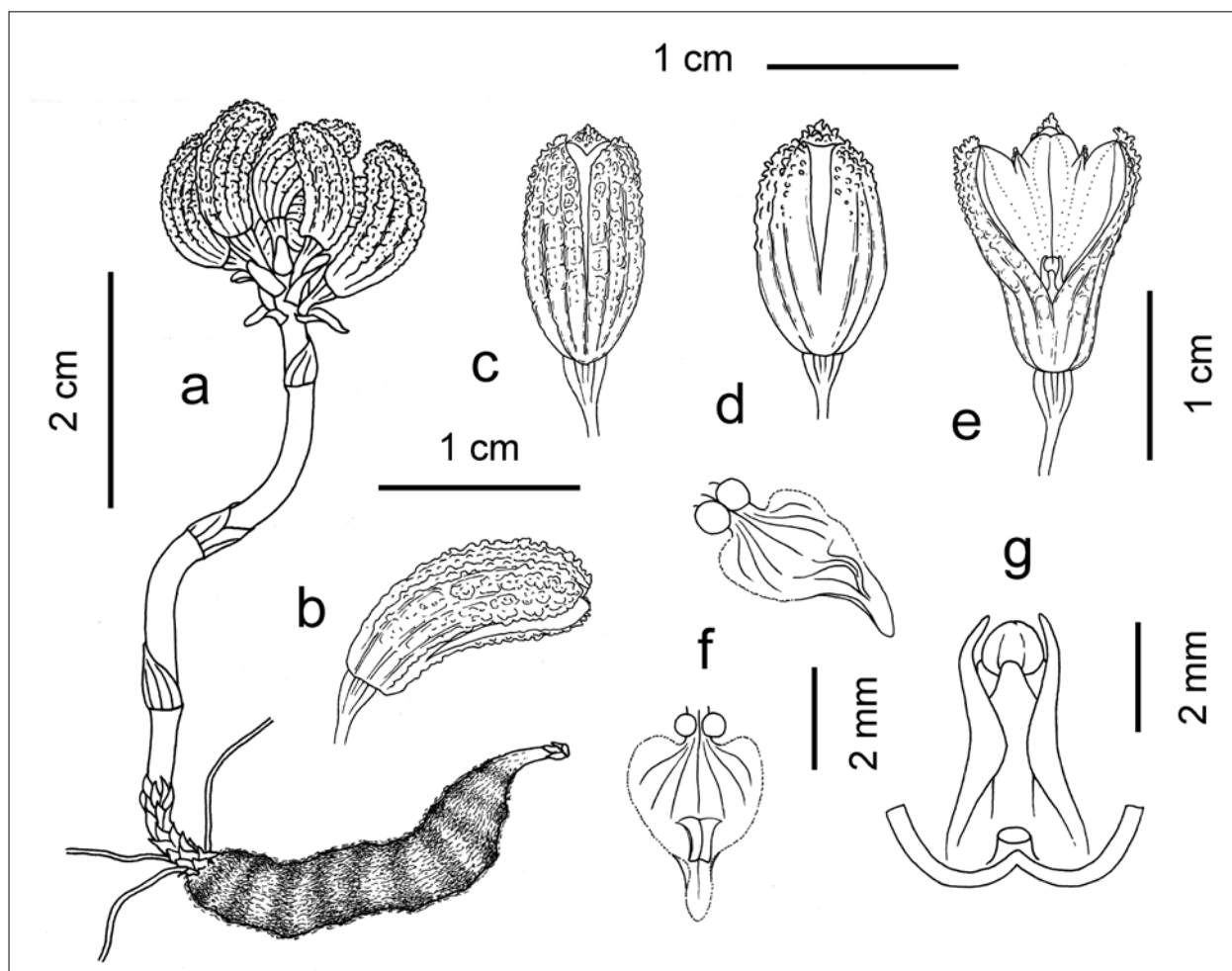


Fig. 34. *Gastrodia theana* (HAL 7165, type): a – flowering plant, b–d – flower, side view and view from below, e – artificially half opened flower with partially dissected lateral sepals, f – lip, side and frontal views, g – column, frontal view.

4/5; lateral sepals connate with each other for 4/5 and with petals for 1/5 of their length from the base. Petals little shorter than sepals, 6–6.5 mm long, 1.2–1.5 mm wide. Lip 5-nerved, concave, broadly obovate or almost circular, truncate, about 3.5 mm long, 4.5 mm wide, slightly irregularly crenulate along the margin, with thickened median band ending in narrowly-triangular acute fleshy mid-lobe; lip blade narrowing to the base into short flat claw, 2 mm long, 0.5 mm wide, with 2 lamellate erect calli, 0.5 mm tall at the base. Column narrow, straight, 4–4.5 mm tall, 0.8–1 mm wide, with narrow lateral wings in the apical part, with short column foot. Anther cap hemispheric, about 0.8 mm across. **Fig. 37; 44 a, b.**

Ecology. Primary broadleaved evergreen lowland dry forests on shale at elev. 300–400 m a.s.l. Fl. April – June. Very rare (EN).

Distribution. Vietnam (Ha Tinh, Hoa Binh). Laos?

Studied specimens. Hoa Binh, Da Bac, HAL 329 (HN, LE).

Notes. From all species of the genus known in SE. Asia, *G. tonkinensis* differs in broadly ovate, almost circular truncate and narrowly triangular acute fleshy median lobe, as well as in lateral sepals, which are connate with petals for less than half (from the base). The species may be related to *G. abscondita* J.J. Sm. and *G. verrucosa* Blume described from Java. This plant is probably endemic to low hilly area on the border of Vietnam and Laos in limits of North Indochinese floristic province. It was discovered on Vietnamese territory very close to the border and may be certainly found in Laos.

3. *G. punctata* Aver.,

2006, Rheedia, 16, 1: 7, fig. 6, 7 c-d.

Described from southern Vietnam (“VIETNAM, Lam Dong Prov., Lac Duong Distr., Da Chais Municipality, territory of Bi Doup – Nui Ba National Park, around point 12°06’44’N, 108°39’27’’E... Western slope of Bi Doup mt.”). **Type** (“15 October 2005, L. Averyanov, P.K. Loc, J. Regalado et al., HLF 5237a”) – HN (holotype), LE (isotype).

Tubers cylindrical, 2–3 cm long, 5–8 mm thick, grey-brown, hairy, covered with small scales. Stem 15–35 cm tall, 2–3 mm thick, soft, dark brown, with 3–4 broad, ovate, obtuse, bracts, upper bract usually much longer, to 4 cm long, at the base with few, weak, roots. Rachis 4–8 cm long, with 4–10 lax flowers. Floral bracts black, cuneate-falcate, acute, 2–3 mm long. Pedicel and ovary 3–5 mm long, ovary 2–2.5 mm thick, shortly cylindric, dark brown. Flowers urceolate, hardly opening, fleshy. Sepals brown, with numerous large white spots, oblong-ovate, 8–14 mm long, 2.5–4 mm wide, with fleshy, obtuse tips, connate with petals for more than 3/4 of their length; lateral sepals connate mutually for about 2/3. Petals thin, connate to sepal tube on about 3/4 of their length, its free part 1.5–2 mm long, 0.8–1.2 mm wide, ovate, acute, narrowing to the base. Lip narrowly ovate, flat, 5.5–6.5 mm long, 3–3.5 mm wide, entire, obtuse, with 2 spherical calli at the base, finely undulate toward apex, disc with 2 low fleshy keels at basal part and 2 similar keels toward the apex. Column 5.5–6 mm tall, 3.5–4 mm wide, straight, flat, very thin, distinctly broadening at the middle, at apex with narrowly triangular, acute stolidia, at the base with fleshy falcate stigma and ovate thickening lying along median vein. Anther cap hemispheric, about 0.8–1 mm across. **Fig. 38; 44 c, d.**

Ecology. Primary and secondary evergreen broad-leaved shady forests on shale and granite at elev. 1800–2000 m a.s.l. Fl. October – November. Very rare (VU).

Distribution. Vietnam (Lam Dong). Endemic.

Studied specimens. Species is known till now by type collection only.

Note: The species is probably close to *G. dyeriana* King et Pantl. reported from Bhutan, Nepal and NE. India, but differs in dark, olive-brown silvery-white spotted flowers, in 4 keels on the lip and in prominent falcate stigma at the base of column.

4. *G. taiensis* Tuyama,

1941, Journ. Jap. Bot. 17, 10: 579, fig. 1 a, b; Seidenf., 1992, Opera Bot. 114: 74, fig. 38; Aver., 1994, Ident. Guide Vietnam. Orch.: 82; Aver. et Averyanova, 2003, Updated Checklist Orch. Viet.: 37; P.H. Ho, 2000, Ill. Fl. Vietnam, 3: 795, fig. 10940 (sub *Gastrodia* “*taliense*”).

Described from northwestern Vietnam (“Chapa”). **Type** (“*Hayata* s.n., June 23 1913”) – TI?

Tuber fusiform, about 1.5 cm long and 5 cm in diam., pubescent, with small scales. Stem erect, fleshy, glabrous, 16–29 cm tall, 0.7–1.2 mm in diam., with 2–3 slender roots at the base and few

distant tabular scale-like sheaths. Rachis 1.1.5 cm long, with 2–3 flowers. Floral bracts membranaceous, broadly lanceolate to narrowly obovate, acuminate, 3.5–4 mm long, 2 mm wide. Pedicel suberect, 4.5–5.5 mm long. Ovary narrowly obovoid, 2 mm long, 1.2 mm in diam. Flowers campanulate, light yellowish to almost white; sepals and petals connate to about 4/5 of their length forming broad tube 1.1–1.2 cm in diam., free tips broadly triangular to oblong, obtuse. Sepals 1.6–1.7 cm long, 5–6.5 mm wide, free tips about 3.5 mm long, 5 mm wide. Petals little shorter, 1.3–1.4 cm long with free tips 2.5–3 mm long, 2–4 mm wide. Lip narrowly ovate to oblong, slightly recurved, 5–6 mm long, 2.5–2.8 mm wide, cuspidate with narrowing apex, in apical part along median vein with short ridge-like papillose callus, at the base with 2 small hemispheric bosses. Column clavate, 5.5–6 mm long, 1.3 mm wide. **Fig. 39.**

Ecology. Primary broad-leaved evergreen shady forests on silicate soils at elev. 1500–1600 m a.s.l. Fl. June. Very rare (EN).

Distribution. Vietnam (Lao Cai). Endemic.

Studied specimens. Species is known till now by type collection only.

Note: Insufficiently known endemic species recorded from type collection only. Diagnosis and figure 39 are copied from original description. Author in his description said “This species is nearest to *G. dyeriana* King et Pantl., but the flowers are larger and the lip is different in shape”.

5. *G. major* Aver.,

2006, Rheede, 16, 1: 7, fig. 3 h, 5, 7 a-b.

Described from southern Vietnam (“VIETNAM, Dak Lak Prov., Krong Bong Distr., Hoa Son Municipality, vic. of Krong Kmar river, territory of Chu Yang Sin national park, NE slopes of Chu Yang Sin mt. system at elev. 700–900 m., around point 12°27'55"N, 108°19'00"E...”). **Type** (“28 October 2005, L. Averyanov, T.V. Thao, N.T. Vinh, HLF 5444”) – HN (holotype), LE (isotype).

Tubers cylindrical, 5–8 cm long, 1.5–3 cm in diam., hairy, with many acuminate scales. Stem rigid, straight, olive-brown, 25–60 cm tall, 3–6 mm thick, with 5–8 broad, ovate, obtuse distant bracts 0.5–2 mm long, and few close, imbricate, narrowly-triangular acute scales at the base, without roots. Raceme 4–15 cm long, with 4–10 flowers. Floral bracts cuneate, 1–1.5 cm long. Pedicel and ovary 1.5–2 cm long, ovary 3–3.5 mm in diam., triangular in section. Flowers urceolate, fleshy, with honey fragrance; flower tube outside olive-brownish, fine-



Fig. 35. Digital herbarium specimen of *Didymoplexiella denticulata* (Averyanov L. HAL 11443, epitype).

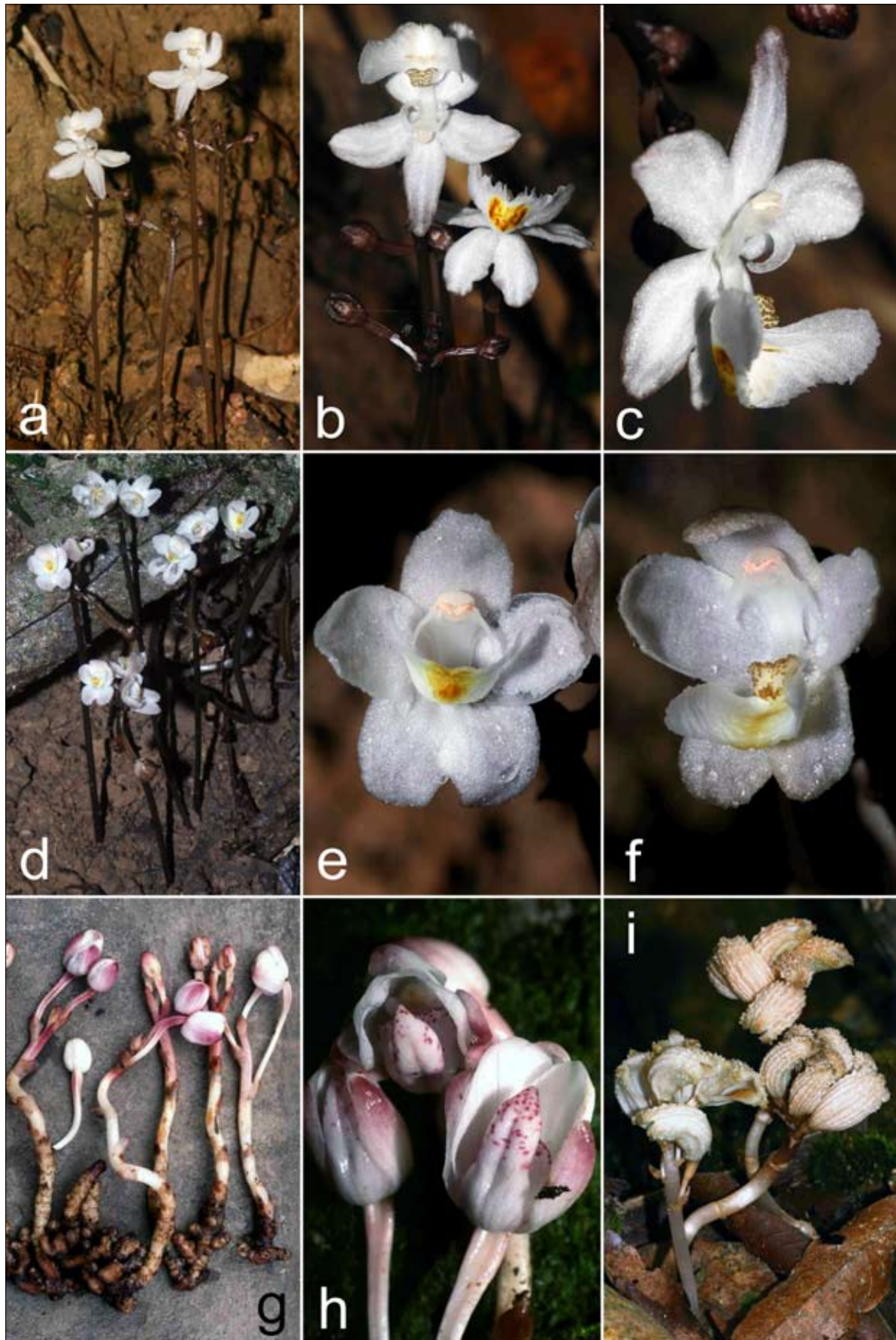


Fig. 36. *Didymoplexiopsis khiriwongensis*: a-c (HAL 7246); *Didymoplexis vietnamica*: d-f (HLF 6673); *Yonia prainii* (CBL 2091); *Gastrodia theana* (HAL 7165, type).

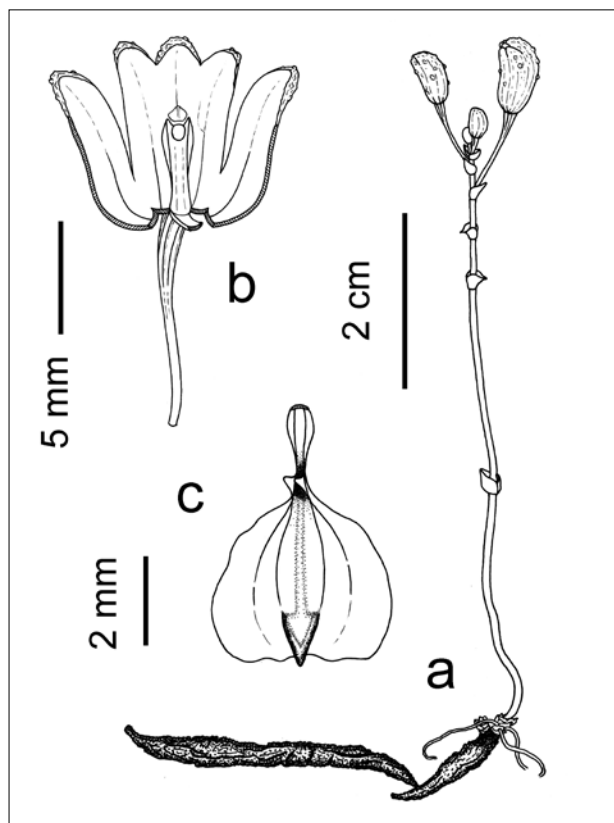


Fig. 37. *Gastrodia tonkinensis* (HAL 5263, type): a – flowering plant, b – dissected flattened flower, c – flattened lip.

ly rugose, with numerous small, white warts. Sepals olive-brown outside, white or pinkish inside, similar, oblong-ovate, 2–2.5 cm long, 5–7 mm wide, fleshy, connate from base for about 3/4 of their length, free apices obtuse, irregularly crenulate and wavy along margin. Petals thin, yellow-orange, connate to sepal tube for about 4/5 of their length, free apices 4–5 mm long, 3–3.5 mm wide, triangular-cordate, acute. Lip white, entire, 7–11 mm long, 4–5.5 mm wide, circular to ovate with attenuate, obtuse, recurved, brightly orange, fleshy apex, with 2 ovate calli at the base; disc 5-veined with 2 low fleshy keels united toward the apex into thick fleshy rectangular callus. Column 9–11 mm tall, 3.5–4 mm wide, straight, fleshy, white, light greenish at the base, with orange-brown, wing-like, straight, narrow stelidia on lateral sides at the apex. Anther cap white, hemispheric, 1.8–2.2 mm across; stigma round, fleshy at the base of column. Capsule erect, cylindric, finely tuberculate, elongating to 6 cm long. **Fig. 40; 44 e, f; 50.**

Ecology. Secondary evergreen broad-leaved, shady forests with bamboo on granite at elev. 700–900 m a.s.l. Fl. October – November. Very rare (VU).

Distribution. Vietnam (Dak Lac). Endemic.

Studied specimens. Species is known till now by type collection only.

Subtrib. 5.3.2. *Epipoginae* Schltr.,

1926, Notizbl. Bot. Gart. Berlin, 9: 571 (sub “*Epipogoneae*”). – Trib. *Epipogieae* Parl., 1858, Fl. Ital. 3: 388 (sub “*Epipogoneae*”).

Type: *Epipogium* J.G. Gmel. ex Borkh.

2(2) genera and 4(2) species. Europe, tropical Africa, temperate, subtropical and tropical Asia, NE. Australia.

Stereosandra Blume,

1856, Mus. Bot. 2, 9–12: 176; Seidenf., 1978, Dansk Bot. Ark. 32, 2: 173–174; Comber, 1990, Orch. Java: 86–87; id., 2001, Orch. Sumatra: 118; Seidenf., Wood, 1992, Orch. Malay. Sing.: 142–143; Su Horng-Jye, 2000, Fl. Taiwan 5: 1036–1039; Pearce et Cribb, 2002, Orch. Bhutan: 582; Aver. et Averyanova, 2003, Updated Checklist Orch. Viet.: 56; Chen Sing-chi, Gale, Cribb, 2009, Fl. China, 25: 207.

Type: *S. javanica* Blume

Terrestrial leafless, achlorophyllous delicate herbs with ovoid to oblong tuberculate fleshy underground tubers. Stem erect, glabrous, slender, with few, distant, lanceolate scarious bracts, white with violet tint. Inflorescence terminal raceme with few to many ephemeral flowers. Floral bracts cuneate-lanceolate, membranous. Flowers pendulous, resupinate, not opening widely, white with violet tips of tepals. Ovary ovoid. Sepals and petals free, similar, lanceolate, connivent. Lip similar to petals, entire, concave, with incurved margins, ecalose, with small spherical glands at base, not spurred. Column short, stout, fleshy, without column foot. Anther cap large, erect, fleshy, on broad filament arising from dorsal side of column; pollinia 2, granular, with slender common caudicle and attached to small common viscidium. Stigma at the apex of column, entire or slightly lobed, continuous with rostellum. Capsule pendulous, ovoid to ellipsoid, maturing rapidly.

One species. SE. Asia to Pacific Islands.

S. javanica Blume,

1856, Mus. Bot. 2, 9–12: 176; Seidenf., 1978, Dansk Bot. Ark. 32, 2: 173, fig. 107; Comber, 1990, Orch. Java: 86, fig.; Seidenf., Wood, 1992, Orch. Malay. Sing.: 143, fig. 60; Su Horng-Jye, 2000, Fl. Taiwan 5: 1038, fig. 444; Aver. et Averyanova, 2003, Updated Checklist Orch. Viet.: 56; Shih-Wen Chung, 2008, Orch. Taiwan 2: 177, photos.

Described from Java (“Bantam”). Type (“*Hasselt s.n.*”) – L.

Stem white, often with violet streaks, 15–30 cm tall, with 2–4 distant, lanceolate to narrowly cuneate scarious scales and several yellowish papy-

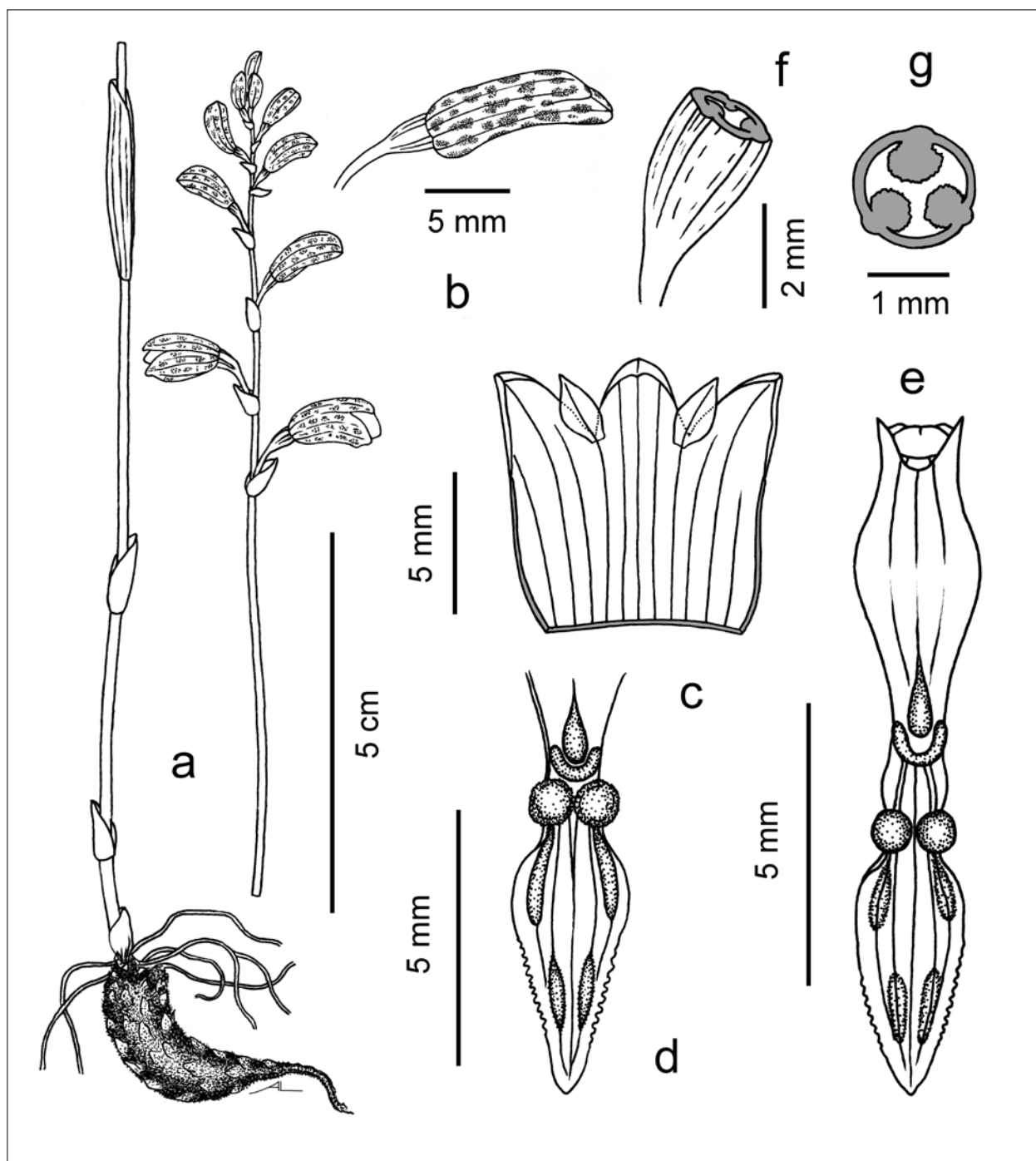


Fig. 38. *Gastrodia punctata* (HAL 5237a, type): a – flowering plant, b – flower bud, c – dissected flattened flower tube, d – flattened lip, e – column and lip, f, g – section of ovary.

raceous bracts clustered at the base. Tuber spherical to ovoid, 1–2 cm long. Rachis slender, few to many-flowered. Floral bracts erect, narrowly cuneate, acute, 3–10 mm long, less than 1 mm wide, shorter than ovary. Flowers not widely opening, pendulous, white, all tepals deep violet to the apex. Pedicel and ovary about 1 cm long. Sepals and petals connivent, similar, lanceolate, 5–9 mm long, 1–2 mm wide, with acute diverging tips. Lip lanceolate, acute, as long as

sepals, little wider, concave, with incurved margins and 2 small wart-like calli at base. Column white, short, about 2 mm tall. Anther on broad filament, erect, cucullate, about 2 mm tall. Stigma terminal. Capsule white with dirty purple-violet streaks, pendulous, ellipsoid to 1.5 cm long. **Fig. 41; 44 g, h.**

Ecology. Primary shady broad-leaved evergreen forests on silicate soils at elev. 700–800 m a.s.l. Very rare. Fl. April – May (EN).

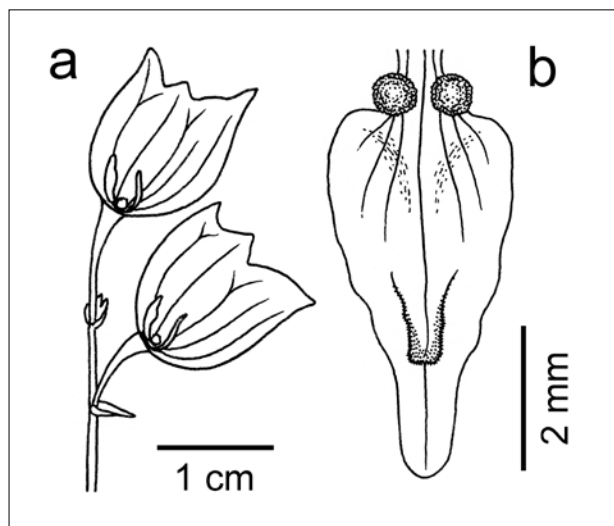


Fig. 39. *Gastrodia taiensis* (Hayata, s.n., type): a – inflorescence with sagittal section of flowers, b – flattened lip.

Distribution. Vietnam (Thua Thien-Hue). NE. India, S. China, Taiwan, Japan, Thailand, Malacca Peninsula, Indonesia, New Guinea, Philippines, Pacific islands.

Studied collections. Thua Thien-Hue, A Luoi, HAL 7380 (HN, LE); d-EXSICCATES OF VIETNAMESE FLORA 0019/ HAL7380.

Notes. Widespread but very rare element of primary forests with intact soils rich in humus.

***Epipogium* J.G. Gmel. ex Borkh.,**

1792, Tentam. Disp. Pl. German.: 139; Seidenf., 1978, Dansk Bot. Ark. 32, 2: 171–172; id., 1992, Opera Bot. 114: 75–76; Comber, 1990, Orch. Java: 86; id., 2001, Orch. Sumatra: 116–117; Seidenf., Wood, 1992, Orch. Malay. Sing.: 141–142; Aver., 1994, Ident. Guide Vietnam. Orch.: 83; P.H. Ho, 2000, Ill. Fl. Vietnam, 3: 795; Su Horng-Jye, 2000, Fl. Taiwan 5: 861–863; Pearce et Cribb, 2002, Orch. Bhutan: 33–36; Aver. et Averyanova, 2003, Updated Checklist Orch. Viet.: 32; Newman et al, 2007, Checkl. Vasc. Pl. Lao PDR: 267; Schuiteman et al., 2008, Nord. Journ. Bot. 26: 289; Chen Sing-chi, Gale, Cribb, 2009, Fl. China, 25: 207–208. – *Epipogum* Rich., 1817, Mem. Mus. Nat. Hist. Nat. 4: 36. – *Galera* Blume, 1825, Bijdr.: 415. – *Epipogon* C. Patze et al., 1850, Fl. Prov. Preussens: 93; Gagnep., 1934, Fl. Gen. Indo-Chine 6, 5: 585–586.

Type: *E. aphyllum* Sw.

Terrestrial leafless, achlorophyllous herbs with spherical, ovoid or coralloid underground fleshy tubers. Stem erect, glabrous, fleshy, with short, scale-like sheathing scarious bracts at nodes, white or pale yellowish. Inflorescence terminal raceme

with few to many ephemeral flowers. Floral bracts ovate-lanceolate, membranous. Flowers pendulous, resupinate or not, white or yellowish, often with violet or purple markings. Ovary subspherical. Sepals and petals free, similar, lanceolate. Lip ovate to broadly ovate, concave, spurred at base, entire or 3-lobed; disk papillose, sometimes with longitudinal ridges or lamellae; spur broad, obtuse, shortly saccate to elongate, straight or slightly curved. Column short, fleshy, with no column foot. Anther erect; pollinia 2, each deeply cleft, clavate, farinaceous, each with a slender caudicle attached to viscidium. Stigma placed at base of column; rostellum broad, sometimes reduced and obscure. Capsule ovoid to ellipsoid, usually maturing rapidly.

3(1). Europe, tropical Africa, temperate, subtropical and tropical Asia, NE. Australia.

***E. roseum* (D. Don) Lindl.,**

1857, Journ. Linn. Soc. London (Bot.), 1: 177; Aver. 1988, Prelim. List Vietnam. Orch. 1: 166; id., 1994, Ident. Guide Vietnam. Orch.: 83; Seidenf., 1978, Dansk Bot. Ark. 32, 2: 171–172, fig. 106; id., 1992, Opera Bot. 114: 76; Comber, 1990, Orch. Java: 86, fig.; id., 2001, Orch. Sumatra: 116, figs.; Seidenf., Wood, 1992, Orch. Malay. Sing.: 141, fig. 59; P.H. Ho, 2000, Ill. Fl. Vietnam, 3: 795, fig. 10941; Pearce et Cribb, 2002, Orch. Bhutan: 34, fig. 6; Aver. et Averyanova, 2003, Updated Checklist Orch. Viet.: 32. – *Limodorum roseum* D. Don, 1825, Prodr. Fl. Nepal.: 30. – *Galera nutans* Blume, 1825, Bijdr. 6, fig. 3; id., 1825, ibid., 8: 416. – *Podanthera pallida* Wight, 1852, Icon. Pl. Ind. Orient. 5, tab. 1759. – *Epipogon nutans* Rchb., 1857, Bonpl., 1857: 36; Gagnep., 1934, Fl. Gen. Indo-Chine 6, 5: 585, fig. 56, 2–5; King et Pantl., 1898, Ann. Roy. Bot. Gard. Calcutta, 8: 253, tab. 335.

Described from Nepal (“in Nepalia”). **Type** (“Wallich s.n.”) – BM.

Stem white to yellowish, 10–45 cm tall, with few distant amplexicaule, white, scarious sheaths to 1.5 cm long, with terminal, few to many-flowered loose raceme. Tuber spherical or ovoid to 5 cm long and 2 cm in diam., many noded. Rachis to 15 cm long, sometimes pendulous toward apex; Floral bracts membranaceous, hyaline, ovate to lanceolate, to 12 mm long. Flowers white to light yellowish, resupinate, pendulous, widely opening, white, often with fine purple spots on lip. Pedicel 3–6 mm long; ovary ovoid to almost spherical, 4–6 mm long. Sepals and petals weakly spreading, lanceolate, 8–11 mm long, with 3 veins, acute. Lip white to yellowish, often with fine purple marks, entire, ovate,

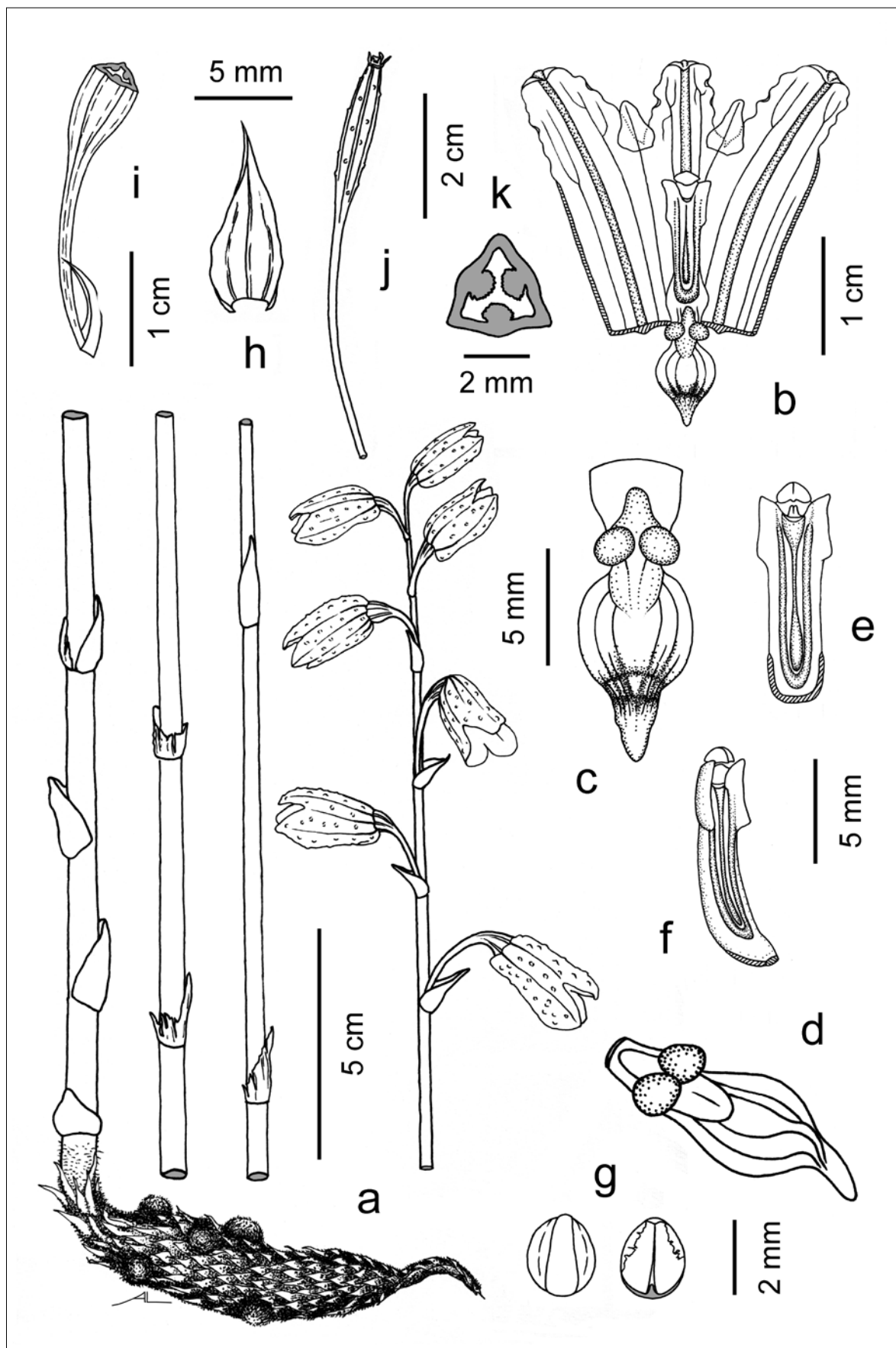


Fig. 40. *Gastrodia major* (HAL 5444, type): a – flowering plant, b – dissected flower with flattened tepals, c – flattened lip, d – lip, side view, e, f – column, side and frontal view, g – operculum, view from below and from above, h – floral bract, i – section of ovary and floral bract, j – pedicel and ovary, k – ovary cross section.

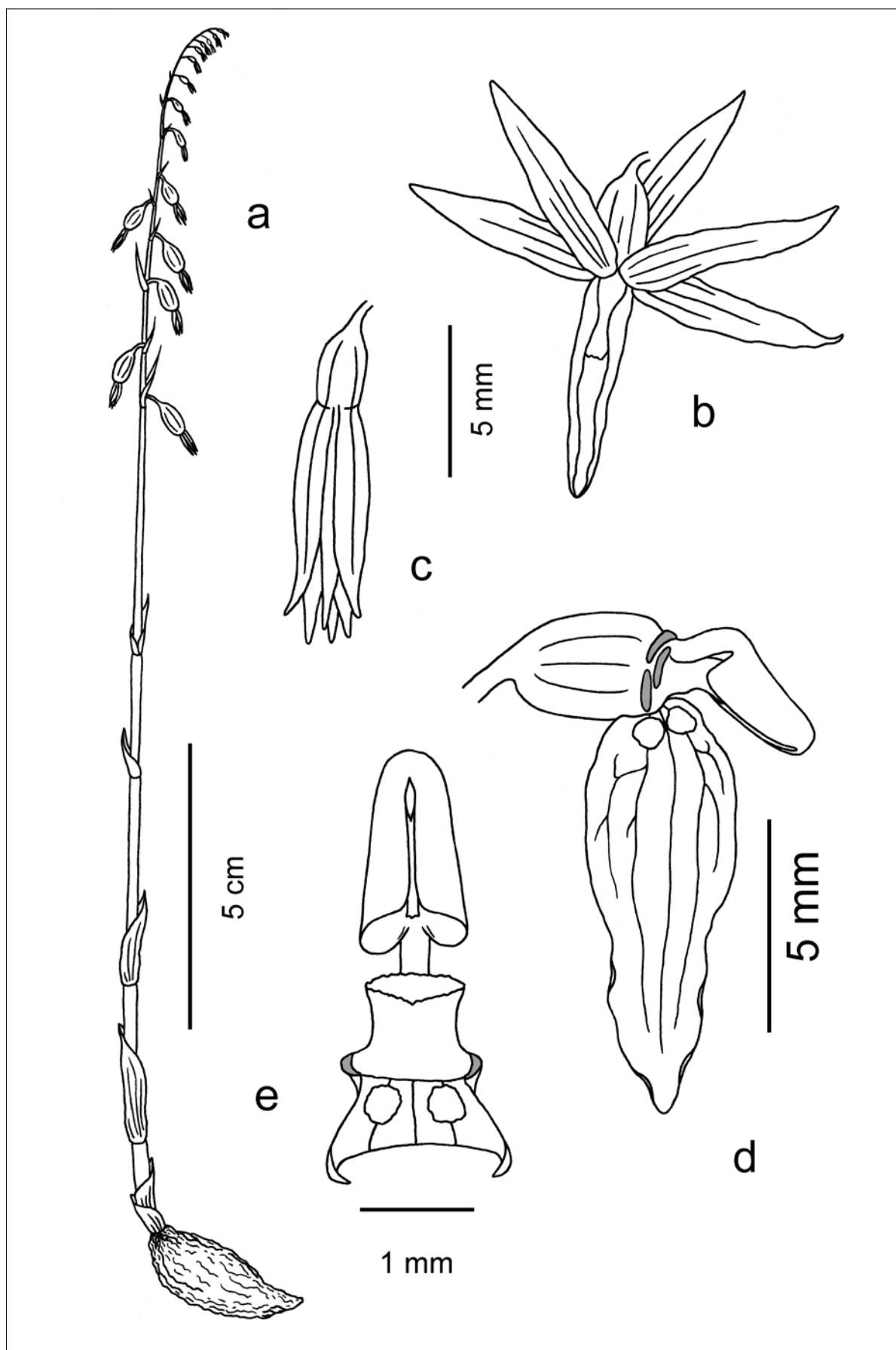


Fig. 41. *Stereosandra javanica* (HAL 7380): a – flowering plant, b – flower with reflexed sepals and petals, c – intact flower, d – column and lip, e – column, frontal view.

often with hardly attenuate apex, concave, 8–12 mm long, 7–8 mm wide, spurred, in apical part finely erose-denticulate; disk with 2 longitudinal sparsely papillose stripes; spur nearly parallel to ovary, cylindric, 3–4 mm long, equal or little shorter than ovary, apex slightly bifid. Column gibbose, 2.5–3.5 mm tall; anther cap curved or subglobose, attenuate. Capsule ovoid or obovoid, 5–7 mm in diam. **Fig. 42; 44 i; 51 a.**

Ecology. Primary humid shady broad-leaved or mixed evergreen forests on any kind of soils at elev. 300–1700 m a.s.l., commonly in small depressions with rich humus accumulations. Rare. Fl. March – June (VU).

Distribution. Vietnam (Bac Kan, Cao Bang, Ha Tinh, Lai Chau, Lam Dong, Nghe An, Quang Binh, Quang Tri, Thua Thien-Hue). Tropical areas of Africa and Asia, NE. Australia.

Studied collections. Da Tan La and Man-line, Dalat, *Tixier s.n.* (P); Bac Kan, Cho Don, *HAL 4827* (HN, LE); Bac Kan, Na Ri, *HAL 5404* (HN, LE); Cao Bang, Tra Linh, *VH 4861* (HN, LE); Ha Tinh, Huong Son, *HAL 5214* (HN, LE); Lai Chau, Sin Ho, *NTH 2786* (HN, LE); Nghe An, Tuong Duong, *HLF 6674a* (HN, LE); Quang Binh, Minh Hoa, *HAL 11806* (HN, LE); d-EXSICCATES OF VIETNAMESE FLORA 0139/*HAL 11806*; Quang Tri, Huong Hoa, *HLF 6291* (HN, LE), *HLF 5760* (HN, LE); Thua Thien-Hue, Phu Loc, Bach Ma National Park, *HLF 1830* (HN, LE).

Notes. Widespread, but rather rare element of primary forests with intact soils rich in humus. Peloric forms of this species with subactinomorphic flowers having spurless lanceolate lip similar to petals were observed in Quang Tri Province (Huong Hoa, *HLF 6291*, *HLF 5760*).

Trib. 5.4. Nervilieae (Schltr.) Dressler, 1990, *Lindleyana* 5, 2: 124.

Subtrib. 5.4.1. Nerviliinae Schltr., 1926, *Notizbl. Bot. Gard. Berlin*, 9: 571.

Type: *Nervilia* Gaudich.

1 genus and 80(5) species. Tropical areas of Africa and Asia.

***Nervilia* Gaudich.,**

1827, in Freycinet, *Voyage Uranie Physicien. Bot.*, tab. 35; id., 1829, *ibid.*: 421, nom. conserv.; Seidenf., 1978, *Dansk Bot. Ark.* 32, 2: 147–170; id.,

1992, *Opera Bot.* 114: 74–75; Comber, 1990, *Orch. Java*: 77–81; id., 2001, *Orch. Sumatra*: 121–126; Seidenf., Wood, 1992, *Orch. Malay. Sing.*: 134–137; Aver., 1994, *Ident. Guide Vietnam. Orch.*: 80–82; P.H. Ho, 2000, *Ill. Fl. Vietnam*, 3: 793–794; Su Horng-Jye, 2000, *Fl. Taiwan* 5: 976–981; Pearce et Cribb, 2002, *Orch. Bhutan*: 56–63; Aver. et Averyanova, 2003, *Updated Checklist Orch. Viet.*: 45–46; Newman et al, 2007, *Checkl. Vasc. Pl. Lao PDR*: 274–275; Schuiteman et al., 2008, *Nord. Journ. Bot.* 26: 257–316; Chen Sing-chi, Gale, 2009, *Fl. China*, 25: 197–201. – *Pogonia* Andrews, 1801, *Bot. Rep.*, tab. 212, p.p.: Gagnep., 1934, *Fl. Gen. Indo-Chine*, 6, 5: 629–630.

Type: *N. aragoana* Gaudich.

80(5) species. Tropical areas of Africa, Asia, Australia and Pacific islands.

Terrestrial tuberiferous herbs. Tubers underground, globose or ovoid, white, fleshy, of several nodes, with a few short roots at nodes or rootless, often bearing few lateral runners during vegetation. Runners produce new tubers at apex. Floriferous stem and leaf arise from apex of tuber in succession. Leaf erect, petiolate, solitary, usually developing after anthesis, cordate, orbicular, reniform, or elliptic, with cordate base, palmately veined, plicate, membranous or fleshy, glabrous or pubescent. Inflorescence hysteranthous, erect, terminal, glabrous, 1- to many-flowered; peduncle with 1 to several tubular sheaths. Floral bracts, lanceolate, acute, green to scarious. Flowers erect or pendent, resupinate or not, opening widely or not. Pedicel usually becoming erect and elongating in fruit in 1-flowered species. Sepals and petals free, similar, narrowly ovate to lanceolate. Lip entire or 3-lobed, base spurless or spurred, disc often hairy. Column elongate, clavate, slender, wingless. Anther terminal, usually ovoid. Pollinia 2, cleft, granular, sectile; caudicle absent; viscidium reduced or prominent; rostellum broad, entire, sometimes absent; stigma orbicular or oblong.

Notes. Species of this genus usually develop flowers and leaves at different times hence it is not always easy to match the leaves with the flowers, particularly in herbarium collections. As a result, taxonomy of this group remains complicated. Flowers of all species are ephemeral and often overlooked during field surveys. It is quite possible that in Vietnam more species can be found than were reported till now.

Key to species

1. Leaves present during anthesis, plant blossoms having fully developed leaves; leaves more or less fleshy, dark green; flowers 5–6 cm in diam., sepals white, longer than 25 mm 1. *N. marutana*

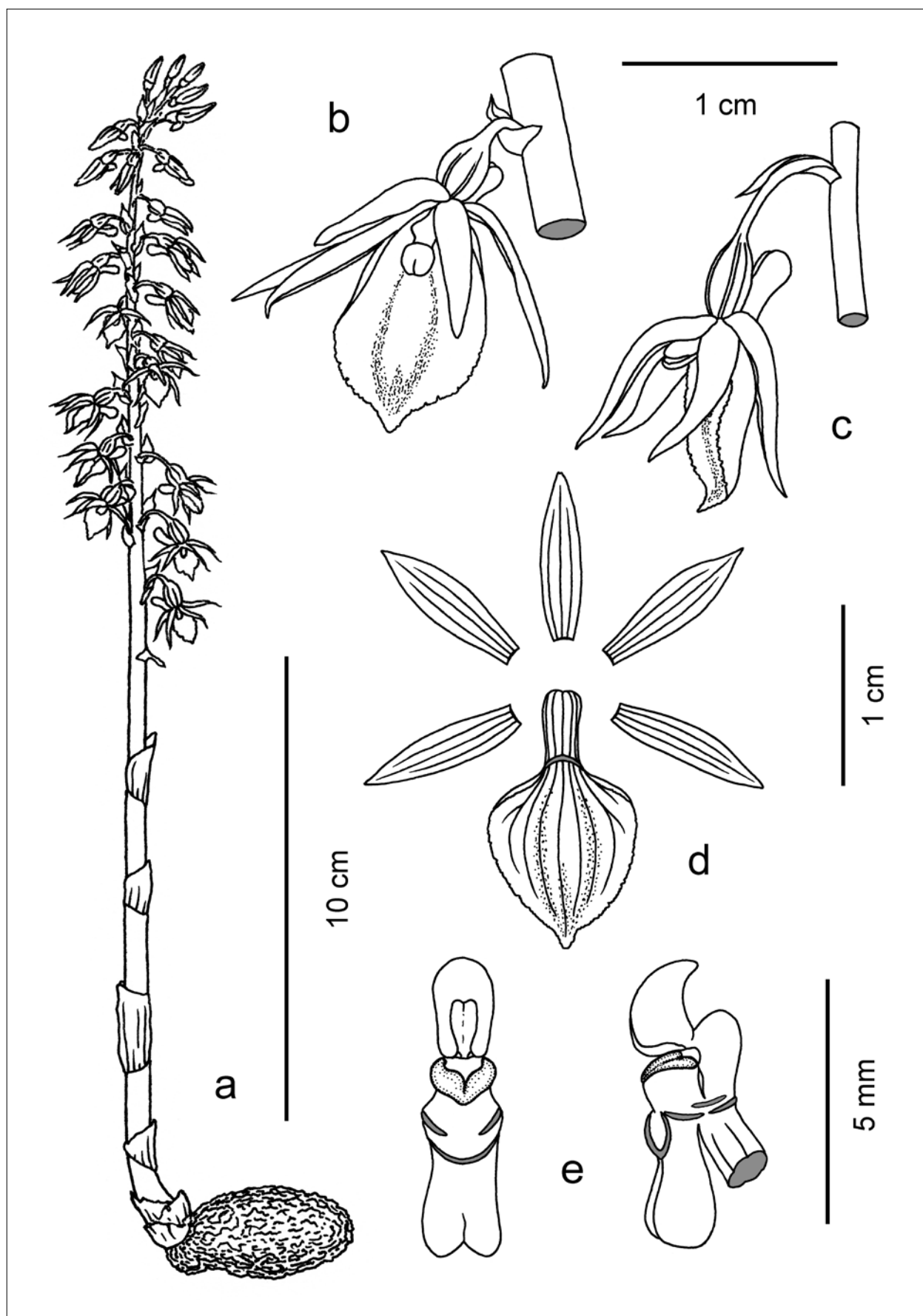


Fig. 42. *Epipogium roseum* (HAL 5214): a – flowering plant, b, c – flower, half side and side views, d – flattened sepals, petals and lip, e – column and spur, frontal and side views.

- Leaves develop after flowering and completely die before next flower formation, plant blossoms without leaves; leaves thin, not fleshy, usually light green, sometimes with dirty purple blotches or velvety dark green to brown; flowers less than 5 cm in diam., sepals yellowish, greenish to brown, less than 25 mm long 2
- 2. Inflorescence 1-flowered; leaves shallowly crenulate-polygonal, 1–5 cm across, commonly with 5 main veins 3
- Inflorescence with 2 or many flowers; leaves indistinctly irregular crenulate or more or less straight along margin, more than 5 cm across, with numerous main veins 4
- 3. Flowers erect, widely opening; lip apex irregularly lacerate or fimbriate; leaves 2–5 cm across, slightly fleshy, sparsely setulose above **2. *N. crociformis***
- Flowers nodding, not widely opening; lip apex with entire, glabrous margin; leaves 1–2.5 cm across, membranaceous, glabrous **3. *N. gracilis***
- 4. Inflorescence normally 2-flowered, 5–15 cm tall; lip glabrous; leaves velvety dark green to dark purple-brown, setulose above, particularly along veins and along leaf margin; petiole 2–5 cm tall **4. *N. plicata***
- Inflorescence normally with more than 2 flowers, 15–40 cm tall; lip hairy along median vein and at apex; leaves grassy green, sometimes with large irregular dirty purple blotches, glabrous; petiole 5–20 cm tall **5. *N. aragoana***

1. *N. muratana* S.W. Gale et S.K. Wu,

2008, Makinoa, n. ser., 7: 81. – *N. macroglossa* auct. non (Hook. f.) Schltr., 1911: Aver. et Averyanova, 2003, Updated Checklist Orch. Viet.: 45.

Described from S. Yunnan (“China, Yunnan, Hekou County, Kuzhudong, alt. 200–500m a.s.l. ...”). **Type** (“1 March 1994, S.K. Wu, Y.P. Yang, J. Murata & T. Kawahara 870”) – KUN.

Tuber whitish, subglobose, 5–10 mm in diam., 3–5-noded. Leaves dark green, slightly fleshy, cordate, 4–8 cm across, broadly indistinctly crenulate, glabrous, with 5–7 main veins, apex acute to shortly acuminate; leaf of single plant long living, commonly remains during flowering. Petiole erect, 3–6 cm, long, with 1–2 short, broad, tubular, scarious sheaths near base. Inflorescence 6.5–10 cm tall, 1-flowered; peduncle with 2 tubular acuminate sheaths 1–2 cm long. Floral bracts broadly lanceolate, acuminate, 6–7 mm long. Flower suberect, later nodding, resupinate, widely opening, 5–6 cm in diam. Pedicel and ovary light yellow-brownish, 7–9 mm long. Sepals and petals similar, pure white, tepals sometime with finest brownish marks outside, lanceolate, acuminate, slightly recurved, 28–32 mm long, 3–4 mm wide, petals little shorter. Lip white with irregular pinkish purple blotches on median lobe, narrowly obovate, 2.4–2.6 cm long, 8–12 mm wide, spurless, 3-lobed near middle; lateral lobes rounded, erect, loosely embracing column; median lobe ovate to triangular-cordate or almost round, 10–12 mm long, 9–12 mm, acute or almost rounded, slightly reflexed; disk with shortly haired thickened median band. Column clavate, erect, white, 10–12 mm tall, finely hairy along lateral sides; stigma round; rostellum transversely elliptic, large. **Fig. 45; 51 b, c.**

Ecology. Primary broad-leaved and coniferous humid shady forests on rocky limestone at elev. 700–1200 m a.s.l. Fl. March – April. Very rare (EN).

Distribution. Vietnam (Hoa Binh, Nghe An, Quang Binh). S. China (S. Yunnan).

Studied specimens. Hoa Binh, Mai Chau, HAL 883 (HN, LE); Nghe An, Tuong Duong, HLF 6879 (HN); Quang Binh, Bo Trach, HAL 6191 (HN); Quang Binh, Minh Hoa, HAL 12510 (HN, LE).

Notes. Species closely related to “*E. Himalayan*” *Nervilia macroglossa*, from which differs in shorter and much broader lip, distinctly haired along median vein. Vietnamese plants commonly keep leaves during anthesis that is rare feature among species of the genus. On the territory of China this rare species was reported from elevations 200–500 m that is much lower than in Vietnam.

2. *N. crociformis* (Zoll. et Moritz) Seidenf., 1978, Dansk. Bot. Ark. 32, 2: 151, fig. 92; Aver. et Averyanova, 2003, Updated Checklist Orch. Viet.: 45; Shih-Wen Chung, 2008, Orch. Taiwan 2: 107, photos. – *Bolborchis crociformis* Zoll. et Moritz, 1846, in Moritz, Syst. Verz.: 89. – *Pogonia prainiana* King et Pantl., 1896, Journ. As. Soc. Bengal, 65, 2: 129; King et Pantl., 1898, Ann. Bot. Gard. Calcutta, 8, tab. 355. – *Pogonia crispata* Blume, 1849, Mus. Bot. 1, 2: 32; Gagnep., 1934, Fl. Gen. Indo-Chine, 6, 5: 629. – *Nervilia crispata* (Blume) Schltr. ex K. Schum. et Lauterb., 1900, Fl. Schutzgeb. Sudsee: 240; P.H. Ho, 2000, Ill. Fl. Vietnam, 3: 793, fig. 10935. – *N. prainiana* (King et Pantl.) Seidenf., 1978, Dansk Bot. Ark. 32, 2: 149, fig. 91; Aver., 1994, Ident. Guide Vietnam. Orch.: 82; P.H. Ho, 2000, l.c.: 794, fig. 10939; Seidenf., 1992, Opera Bot. 114: 74.

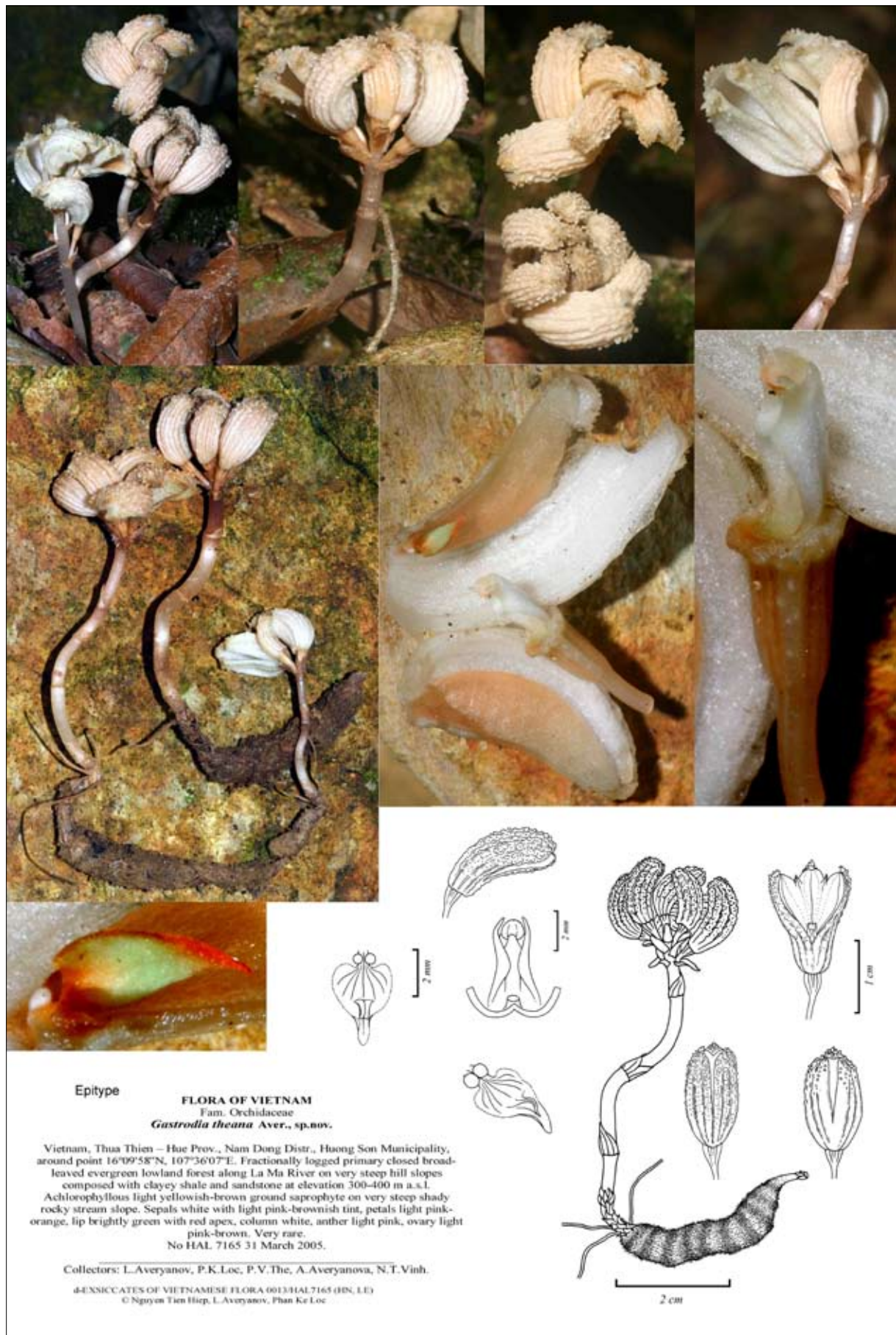


Fig. 43. Digital herbarium specimen of *Gastrodia theana* (HAL 7165, epitype).

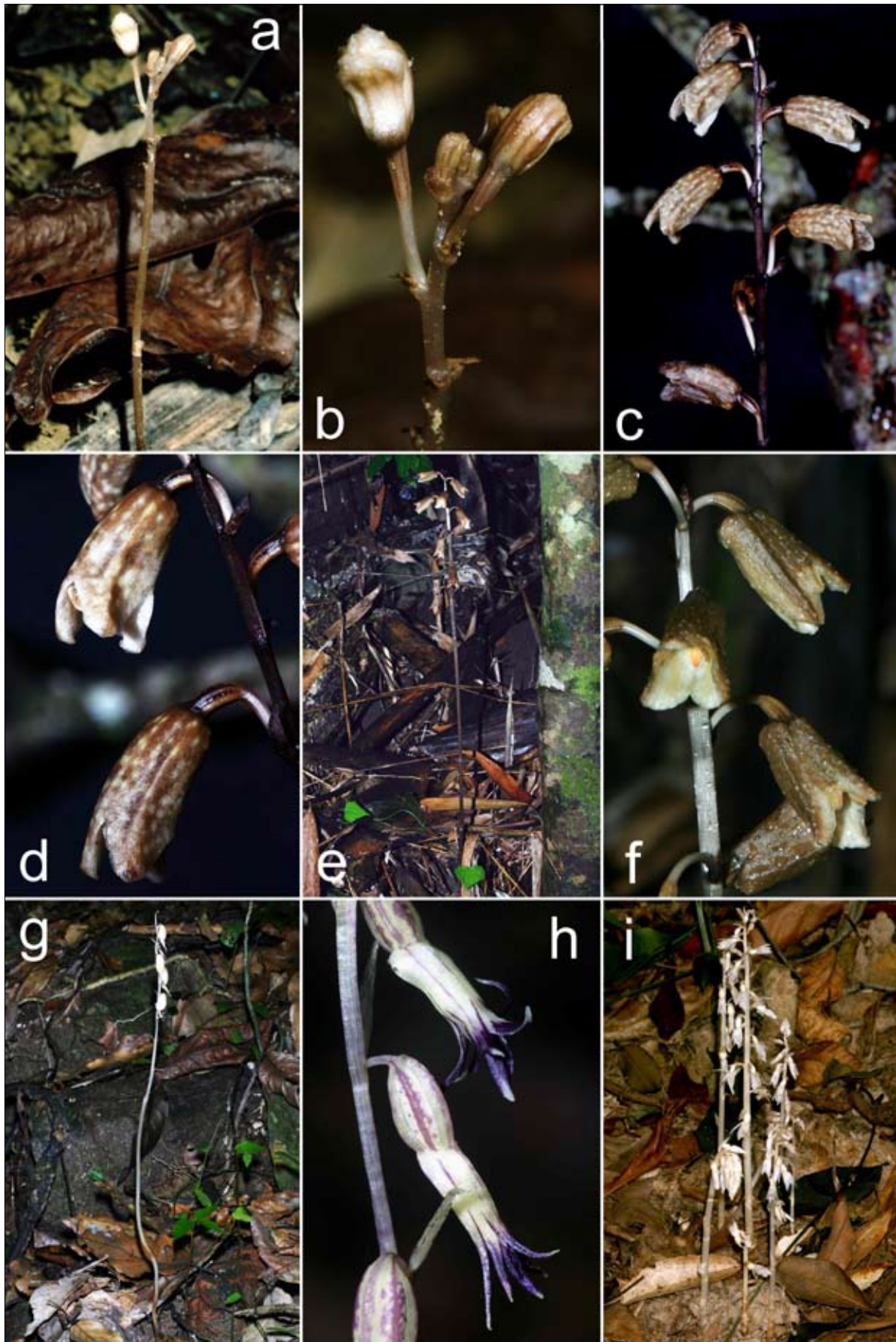


Fig. 44. *Gastrodia tonkinensis*: a, b (HAL 5263, type); *G. punctata*: c, d (HAL 5237a, type); *G. major*: e, f (HAL 5444, type); *Stereosandra javanica*: g, h (HAL 7380); *Epipogium roseum*: i (HAL 11806).

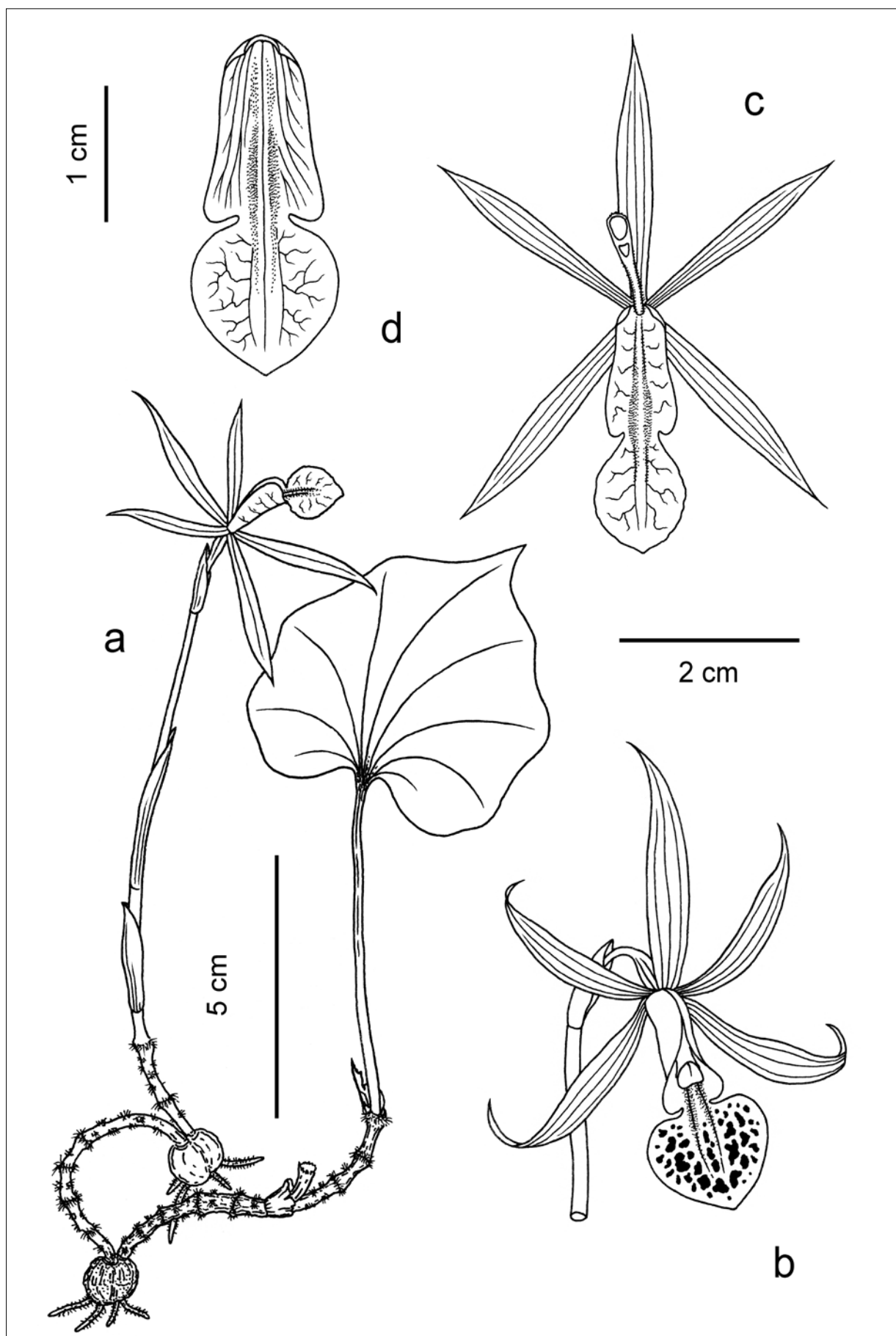


Fig. 45. *Nervilia muratana* (HAL 883): a – flowering plant, b – flower, c – flattened flower, d – flattened lip.

Described from Java (“Indonesia, Java, Tjikoya”). **Type** (“Zollinger 762”) – W (holotype), LE (isotype).

Tuber whitish, subglobose to ovoid, about 1 cm in diam. Leaves pale green, shallowly crenulate-polygonal, cordate at the base, 2–5 cm across, slightly fleshy, sparsely setulose above, commonly with 7 main prominent veins, often slightly undulate along margin. Petiole erect, 2–3(5) cm long. Inflorescence erect, (1)3–6 cm tall, 1-flowered; peduncle with 2–4 tubular scarious sheaths. Floral bract small, ovate to lanceolate, acute. Flower erect, not resupinate, widely opening, 18–25 mm in diam. Sepals and petals light green, lanceolate, 10–12 mm long, 1–2 mm wide, acute to acuminate, petals little shorter and narrower. Lip with strongly reflexed epichile, white, with green tint toward the base, sometimes with yellowish spot at center, rhombic, 12–13 mm long, 6–8 mm wide when flattened, spurless, entire or 3-lobed, lateral margins erect, loosely embracing column; apical margin irregularly lacinate or fimbriate; disk with low papillose ridge coming from lip base to apex. Column clavate, 6–8 mm tall, stigma suborbicular. **Fig. 46.**

Ecology. Secondary grasslands, grassy habitats among secondary shrubs, open areas after forest logging, particularly in wet places at elev. 600–1500 m a.s.l. Fl. May – June. Very rare (DD).

Distribution. Vietnam (Da Nang, Gia Lai, Lam Dong). Africa, mainland tropical Asia, Taiwan, Philippines, Indonesia, New Guinea, Australia.

Studied specimens. Gia Lai Kontum, Chupa, *LX-VN 2145* (LE, HN); Lam Dong, Duc Trong, *Nguyen Thi Nhan 839* (LE, HN); Tourane, Danang, *Gaudichaud* s.n. (?)

Notes. Widespread and very variable species, particularly in shape and ornamentation of the lip. Despite its wide distribution this species is obviously very rare in Vietnam.

3. *N. gracilis* Aver.,

2011, *Taiwania* 56, 1: 50, fig. 1–2. – *N. infundibulifolia* auct. non Blatt. et McCann, 1932 p.p.: Seidenf., 1978, *Dansk Bot. Ark.* 32, 2: 153, fig. 94; P.H. Ho, 2000, *Ill. Fl. Vietnam*, 3: 794, fig. 10937. – *N. punctata* auct non (Blume) Makino: Aver. et Averyanova, 2003, *Updated Checklist Orch. Viet.*: 46.

Described from northern Vietnam (“N. Vietnam, Cao Bang Prov., Nguyen Binh Distr., Ca Thanh Municipality (22°44’N 105°50’E) ...”). **Type** (“13 April 1999 *P.K. Loc, P.H. Hoang, L. Averyanov, CBL 1279*”) – HN (holotype), LE (isotype).

Tuber white, subglobose, 5–10 mm across.

Leaves light green, very thin, membranaceous, cordate in outline, obscurely 5–7-angled, 1–2.5 cm across, with 5–7 main veins, glabrous, base deeply cordate, obtuse. Petiole erect, 2–4 cm long, with 1 acute, tubular sheath near base. Inflorescence erect, slender, 5–12 cm tall, 1-flowered (very rare 2-flowered). Scape filiform, elongating in fruit to 20 cm long, white to light brownish, occasionally with purple flecks, with 1–2 tubular, scarious, light yellowish-brown, acute sheaths 0.5–1.5 cm long. Floral bracts very small, acute, ovate-triangular to lanceolate, 2–4 mm long. Flower at right angle to scape, resupinate, not widely opening, 1–1.5 cm across. Pedicel and ovary brown to greenish-brown, occasionally with purple flecks, 4–5 mm long, ovary ovoid, 2–3 mm long. Sepals and petals similar, yellowish-brown to greenish-brown, with purple-brown streaks and flecks, obtuse to acute, lanceolate, 10–20 mm long, 2–3 mm wide, petals little shorter and narrower. Lip white, with purple-magenta spots and blotches on reflexed at right angle epichile, oblong, as long as sepals or little longer, 12–18 mm long, about 3 mm wide at the base, widening to the apex, spurless, 3-lobed near middle; lateral lobes erect, obtuse to acute, oblique-triangular or almost round, loosely embracing column; median lobe rhomboid, obovate or broadly lanceolate, 7–12 mm long, 3–7 mm wide, acute, obtuse to almost round at apex; disk glabrous or finely papillose, at the center with 2 short, glabrous keels 0.5 mm tall, coming along lateral veins. Column clavate, erect, white, 5–7 mm tall, glabrous; clinandrium broad funnel-like, anther terminal, anther cap ovoid, white, at the base with prominent membranaceous lateral ears; stigma subquadrate; rostellum large, prominent, in form of erect plate. Capsule erect, fusiform, 8–11 mm long, 2–3 mm in diam., very early ripening. **Fig. 47; 51 d.**

Ecology. Primary broad-leaved, mixed and coniferous humid shady evergreen forests on rocky limestone at elev. 900–1400 m a.s.l. Fl. March – April. Fruits May – June. Very rare (EN).

Distribution. Vietnam (Cao Bang, Ha Giang).

Studied specimens. Cao Bang, Nguyen Binh, *CBL 1279* (HN, LE); Ha Giang, Quan Ba, *CPC 174* (HN), *HAL 1498* (HN, LE), *DKH 4803* (HN, LE), *DKH 5034* (HN, LE).

Notes. The plant belongs to the complex of miniature closely related 1-flowered species with small flowers, which includes “Himalayan” group (*N. falcata* (King et Prantl.) Schltr., *N. infundibulifolia* Blatt. et McCann, *N. khasiana* (King et Prantl.) Schltr., *N. mackinnonii* (Duthie) Schltr.) distributed

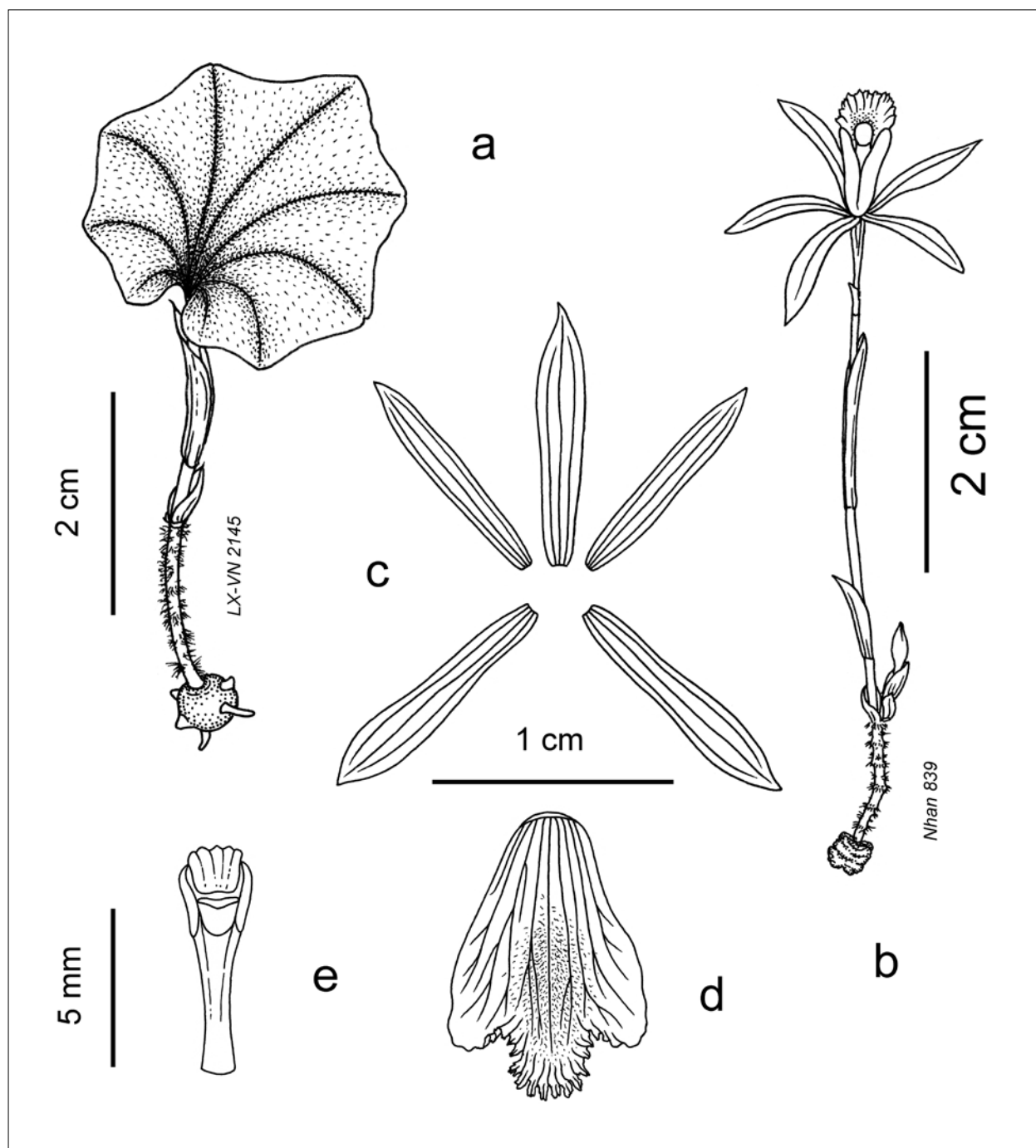


Fig. 46. *Nervilia crociformis*: a – mature plant with leaf (LX-VN 2145), b – flowering plant, c – flattened sepals and petals, d – flattened lip, e – column, frontal view (Nhan, 839).

mainly through Himalayas, “East Asian” group (*N. lanyuensis* S.S. Ying, *N. nipponica* Makino, *N. taiwaniana* S.S. Ying) recorded from Japan and Taiwan and “Indochinese Malesian” group (*N. calcicola* Kerr, *N. punctata* (Blume) Makino spreading from Laos and Thailand to Sumatra, Java and Kalimantan. Though *N. gracilis* fairly variable in form of lip, it differs from all mentioned species in 2 small but distinct straight lamellate keels at the center of the disk and in small, very thin, membranaceous leaves. This species obviously demonstrates

strict endemism very typical for local aboriginal floras of rocky limestone widely spreading in northern Vietnam and southern China. Undescribed plant from Yunnan mentioned in notes to *N. taiwaniana* in “Flora of China” (Chen Sing-chi, Gale, 2009b) may also belong here.

Nervilia gracilis has probably closest relations to *N. calcicola* described from Laos. Latter species differs in flat glabrous disk of the lip. It can be also found in future on territories of Vietnam allied to Laotian border.

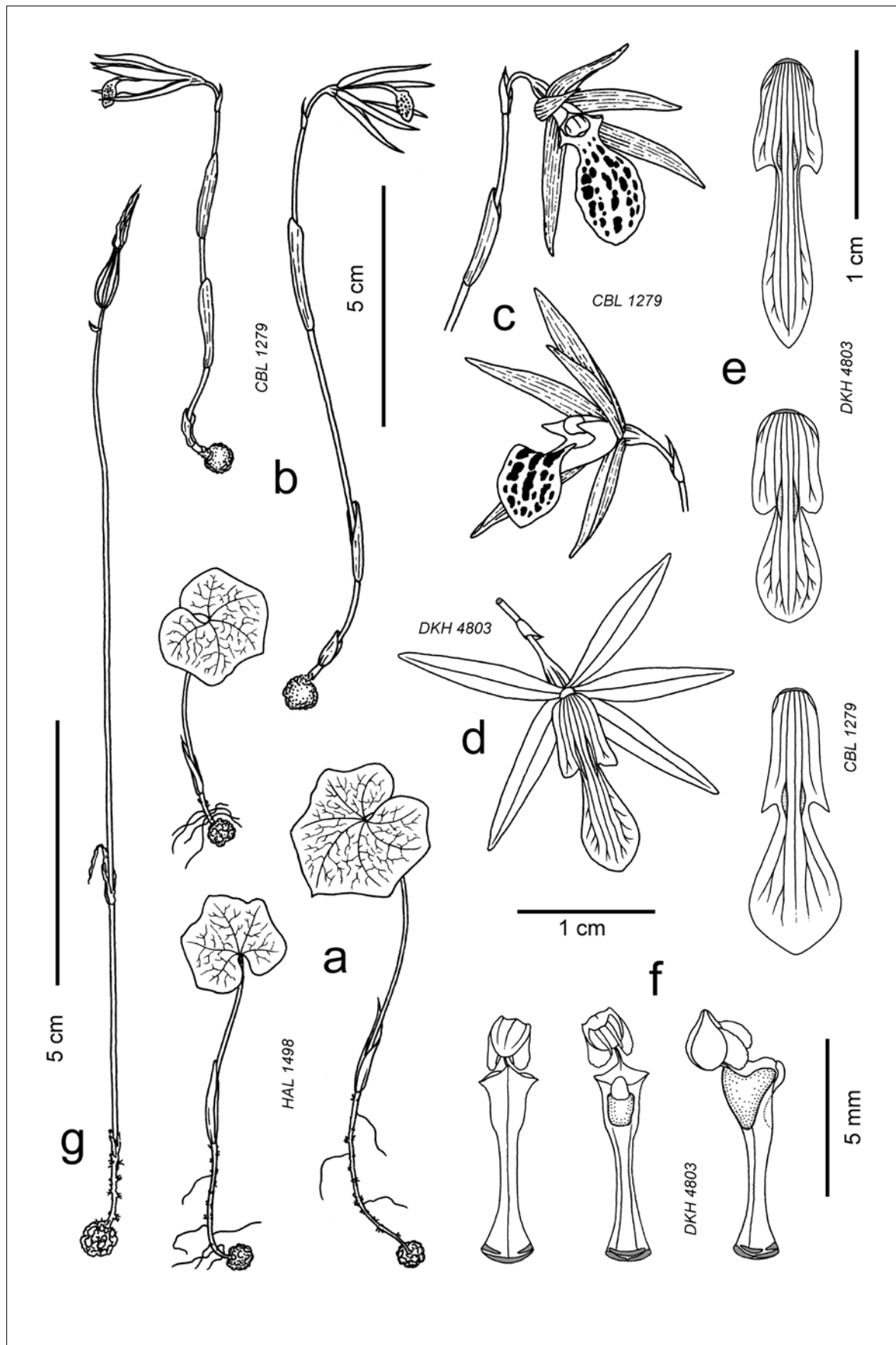


Fig. 47. *Nervilia gracilis*: a – mature plants with leaves (HAL 1498), b – flowering plants (CBL 1279), c – flowers (CBL 1279), d – flower with flattened tepals (DKH 4803), e – morphological variants of lip (CBL 1279, DKH 4803), f – column, dorsal, ventral and side views (DKH 4803), g – fruiting plant ((HAL 1498).

4. *N. plicata* (Andrews) Schltr.,

1911, Bot. Jahrb. Syst. 45: 403; Seidenf., 1978, Dansk Bot. Ark. 32, 2: 156, fig. 100; id., 1992, Opera Bot. 114: 75; Comber, 1990, Orch. Java: 79, 80, figs.; Chen Sing-chi, Tsi Zhanhuo, Luo Yibo, 1990, Nat. Orch. China: 297, fig.; Seidenf., Wood, 1992, Orch. Malay. Sing.: 137, fig. 56 f-h; Aver., 1994, Ident. Guide Vietnam. Orch.: 81; Su Horng-Jye, 2000, Fl. Taiwan 5: 980, fig. 416; P.H. Ho, 2000, Ill. Fl. Vietnam, 3: 794, fig. 10938; Comber, 2001, Orch. Sumatra: 123, fig.; Aver. et Averyanova, 2003, Updated Checklist Orch. Viet.: 45; Shih-Wen Chung, 2008, Orch. Taiwan 2: 111, photos. – *Arethusa plicata* Andrews, 1803, Bot. Repos., tab. 321. – *Cor-dula discolor* Blume, 1825, Bijdr.: 417. – *Pogonia plicata* (Andrews) Lindl., 1840, Gen. Sp. Orch. Pl.: 415; King et Pantl., 1898, Ann. Bot. Gard. Calcutta, 8, tab. 358. – *Pogonia discolor* (Blume) Blume, 1849, Mus. Bot. 1: 32; id., 1858, Coll. Orch. Arch. Ind. Jap., tab. 57; Hook. f., 1874, Bot. Mag., tab. 6125; J.J. Smith, 1908, Fl. Buitenzorg 6, 2, fig. 33. – *Pogonia biflora* Wight, 1851, Icon. Pl. India Orient. 5, 1, tab. 1758, 2. – *Pogonia pulchella* Hook. f., 1885, Bot. Mag. 111, tab. 6851.

Described from E. India (“from the East-Indies”). **Type** (“E. Indes, cult. *A.B. Lambert*”) – K.

Tuber spherical or ovoid, 1–1.5 cm in diam. Leaves almost orbicular with broad cordate base, with almost round or obtuse apex, 7.5–11 cm long, 8–14 cm wide, dark green to dark brown-purple, sometimes with darker blotches, many veined, pubescent, particularly along veins. Petiole erect, 2–5 cm long. Inflorescence 5–15 cm tall, 2(1)-flowered; peduncle with 2–3 tubular sheaths. Floral bracts cuneate, acuminate, 3–5 mm long, about 1 mm wide. Flowers nodding, resupinate, widely opening. Pedicel and ovary 5–8 mm long, ridged. Sepals and petals similar, light pale brownish-yellow, lanceolate, acute, 2–3.5 cm long, 4–5 mm wide, petals little shorter. Lip white, light yellowish-brown to light purple-violet, with yellow median stripe and light purple-red venation on sides, entire, oblong-ovate, 1.5–2 cm long, 1–1.4 cm wide, spurless, loosely embracing column at the base; lip apex almost round or slightly emarginate; disk glabrous, with median ridge running from base to apex. Column white, 8–12 mm long, clavate; anther cap terminal, subquadrate, stigma suborbicular. **Fig. 48; 51 e, f.**

Ecology. Primary and secondary evergreen forests on any kind of soils at elev. 300–700 m a.s.l. Fl. March – May. Rare (VU).

Distribution. Vietnam (Binh Phuoc, Dak Lak, Thanh Hoa). Mainland tropical Asia, Philip-

pines, Indonesia, New Guinea, N. Australia.

Studied specimens. Binh Phuoc, Phuoc Long, *HLF 4940* (HN, LE); Dak Lak, Krong Bong, *HLF 5485* (HN); Thanh Hoa, Quan Hoa, *HAL 3555* (HN, LE), *HAL 3927* (HN); Cochinchina sine loc., *Pierre 7* (P).

Notes. Widespread and very variable species particularly in shape, ornamentation and color of the lip, as well as in leaf color and size. A number of forms have been recognized as distinct species by some early authors.

5. *N. aragoana* Gaudich.,

1827, in Freycinet, Voyage Uranie Physicien. Bot., tab. 35; id., 1829, *ibid.*: 422; Seidenf., 1978, Dansk Bot. Ark. 32, 2: 164, fig. 103; id., 1992, Opera Bot. 114: 74; Comber, 1990, Orch. Java: 81, fig.; Chen Sing-chi, Tsi Zhanhuo, Luo Yibo, 1990, Nat. Orch. China: 27, fig.; Seidenf., Wood, 1992, Orch. Malay. Sing.: 137, fig. 56 i-k; Aver., 1994, Ident. Guide Vietnam. Orch.: 81; Su Horng-Jye, 2000, Fl. Taiwan 5: 976, fig. 415; P.H. Ho, 2000, Ill. Fl. Vietnam, 3: 793, fig. 10934; Comber, 2001, Orch. Sumatra: 122, fig.; Aver. et Averyanova, 2003, Updated Checklist Orch. Viet.: 45; Shih-Wen Chung, 2008, Orch. Taiwan 2: 105, 106, photos. – *Pogonia carinata* Lindl., 1840, Gen. Sp. Orch. Pl.: 414; Hook. f., 1895, Ann. Bot. Gard. Calcutta, 5, tab. 94. – *Pogonia flabelliformis* Lindl., 1840, l.c.: 415; J.J. Smith, 1908, Fl. Buitenzorg, 6, 2, fig. 36; Gagnep., 1934, Fl. Gen. Indo-Chine, 6, 5: 630, fig. 60, 15, 16; 61, 1. – *Pogonia nervilia* Blume, 1849, Mus. Bot. Lugd. Bat. 1: 32; id., 1858, Coll. Orch. Arch. Ind. Jap.: 154, tab. 56, 2. – *Pogonia gracilis* Blume, 1858, l.c.: 155, tab. 57, 3. – *Pogonia scottii* Reichenb. f., 1872, Flora, 55: 276; Hook. f., 1895, l.c. 5, tab. 93; King et Pantl., 1898, Ann. Bot. Gard. Calcutta, 8, tab. 360. – *Pogonia fordii* Hance, 1885, Journ. Bot. 23: 247. – *Nervilia fordii* (Hance) Schltr., 1911, Bot. Jahrb. Syst. 45: 403; Seidenf., 1978, l.c.: 163, fig. 101; P.H. Ho, 2000, l.c.: 794, fig. 10936; Aver. et Averyanova, 2003, l.c.: 45.

Described from Mariana Islands (“in insulis Mariannis (Guam)”). **Type** (“*Gaudichaud-Beaupre s.n.*”) – P (holotype).

Tubers spherical or ovoid, 1–2 cm in diam. Leaves green, sometimes with dirty purple blotches, broadly cordate, 5–12 cm long, 6–15 cm wide, glabrous, many veined, acute to shortly acuminate, shallowly crenate and undulate along margin. Petiole 5–20 cm long, usually with 1 or 2 short tubular sheaths near base. Inflorescences developed and died before leaf formation, 15–40 cm, few- to

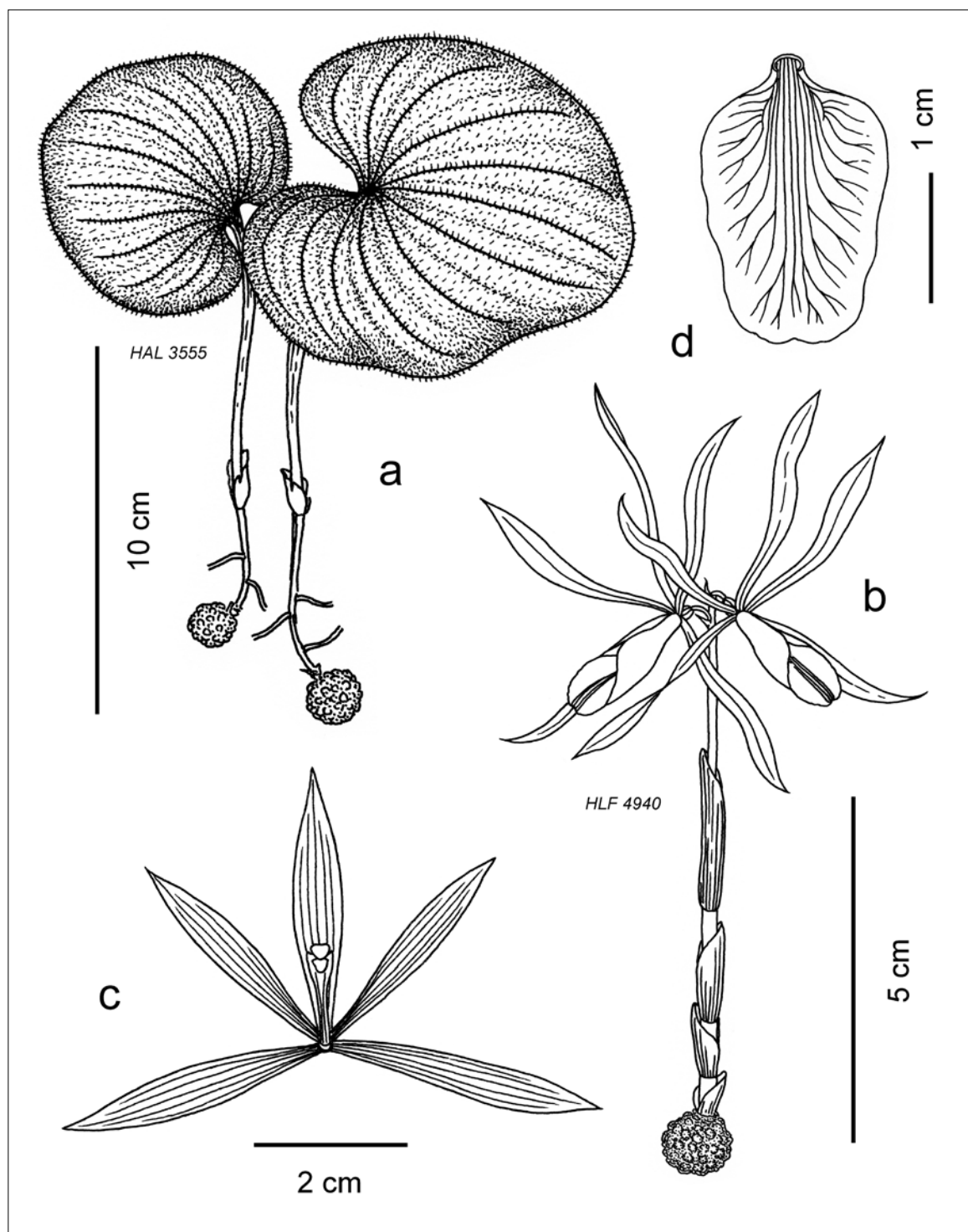


Fig. 48. *Nervilia plicata*: a – mature plants with leaves (HAL 3555), b – flowering plant, c – flattened sepals and petals, d – flattened lip (HLF 4940).

many-flowered; peduncle with 2–4 tubular sheaths. Floral bracts reflexed, narrowly lanceolate, 1–2 cm long, 1–1.5 mm wide, longer than ovary. Flowers pendent, resupinate, usually not much widely opening. Pedicel and ovary 7–13 mm long, ridged. Sepals and petals similar, greenish, lanceolate, acute, 1.5–2.2 cm long, 2.5–4 mm wide. Lip pale green to white, often with purplish venation, and 2 purple-

violet side blotches at apex, ovate-oblong, obovate, or rhombic, 1–1.4 cm long, 5–7 mm wide, spurless, 3-lobed above middle; lateral lobes small, erect, triangular, acute, loosely embracing column; median lobe round, ovate or ovate-triangular, obtuse; disk hairy along veins and at apex. Column white, 6–10 mm tall. **Fig. 49; 51 g-i.**

Ecology. Primary and secondary forests of

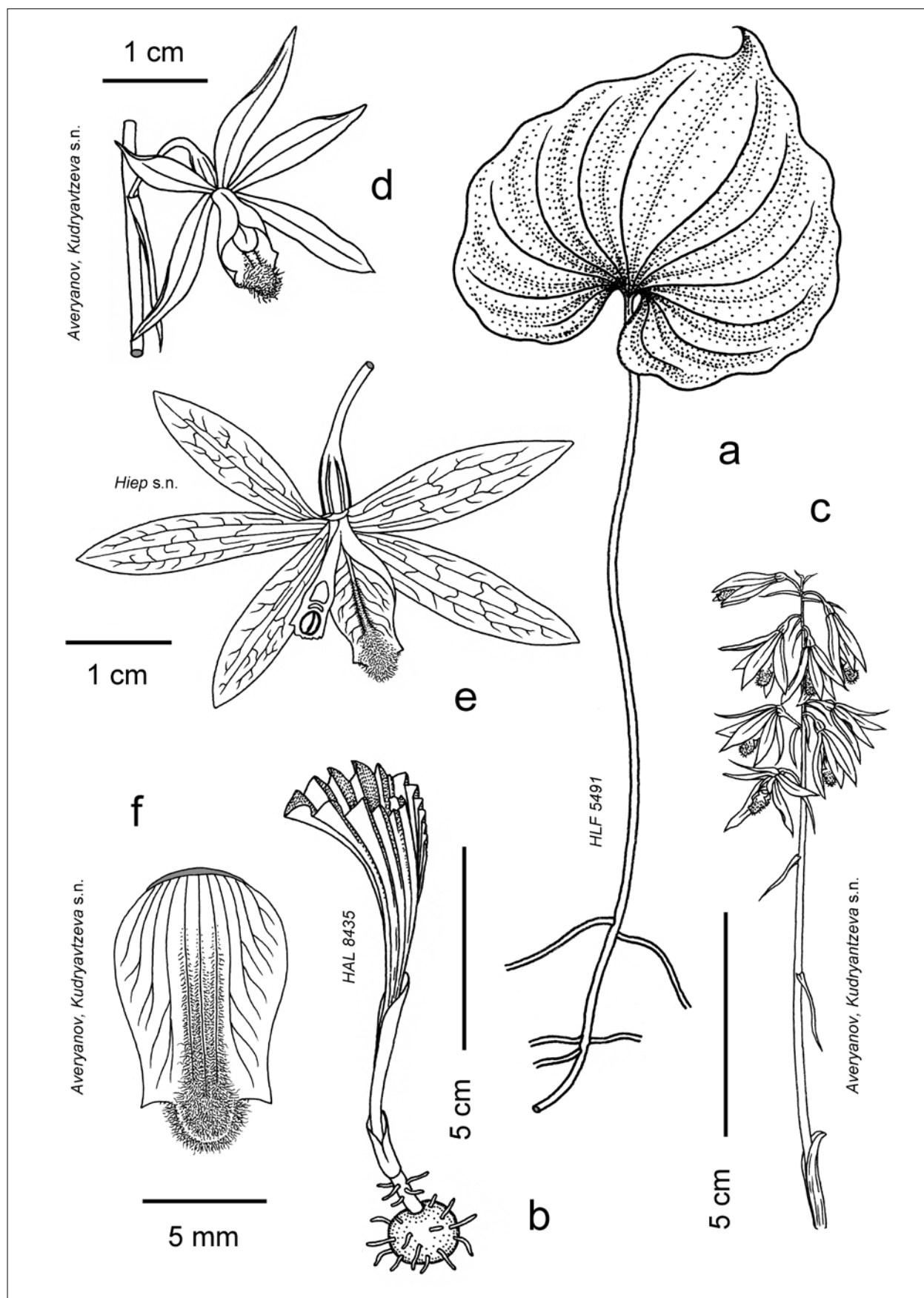


Fig. 49. *Nervilia aragoana*: a, b – mature plants with leaves (*HAL 8435*, *HLF 5491*), c – flowering plant, d – flower (*Averyanov, Kudryavtzeva, s.n.*), e – flattened flower (*Hiep, s.n.*), f – flattened lip (*Averyanov, Kudryavtzeva, s.n.*).



Fig. 50. Digital herbarium specimen of *Gastrodia major* (HAL 5444, epitype).

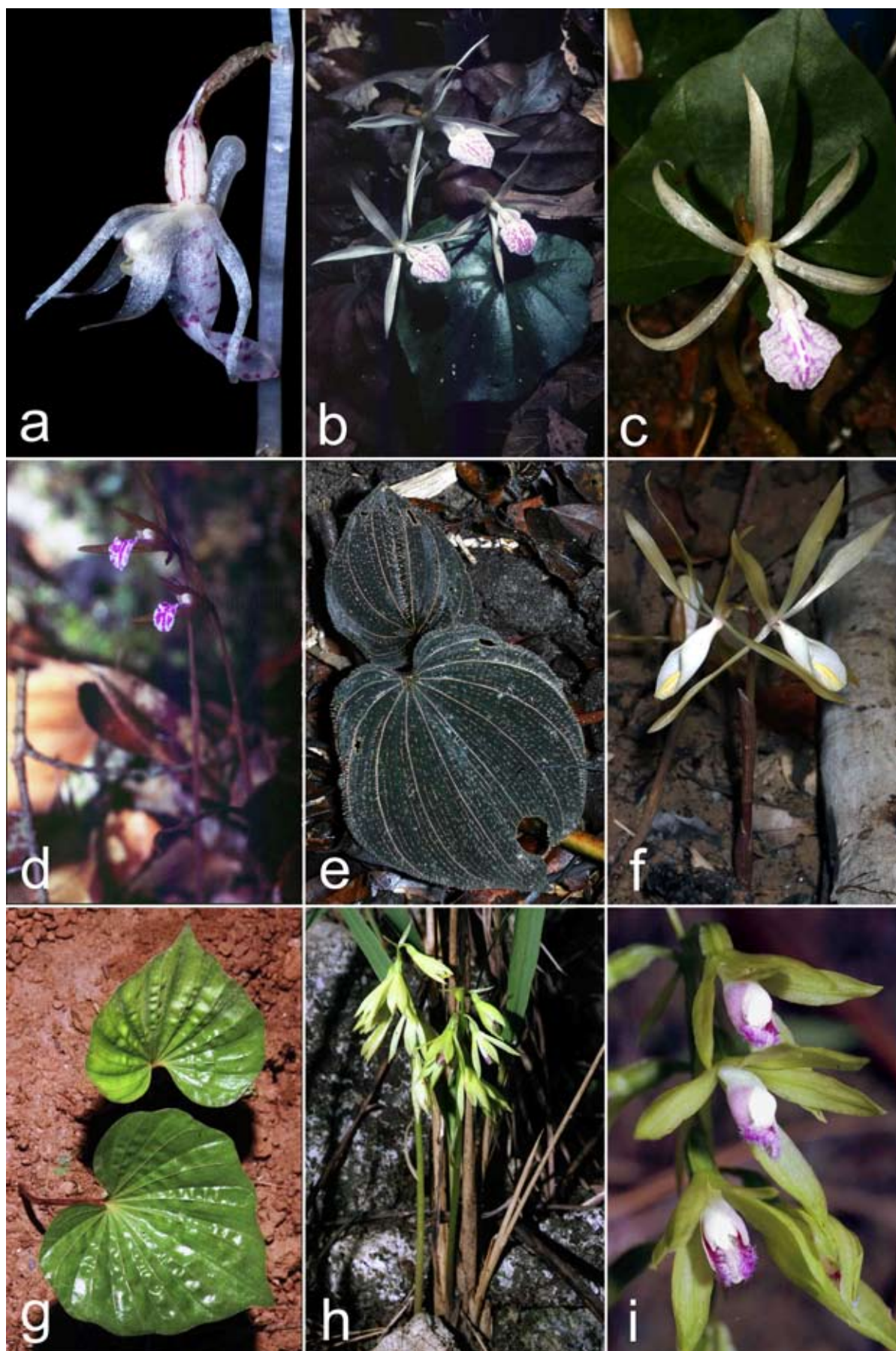


Fig. 51. *Epipogium roseum*: a (HLF 6674a); *Nervilia muratana*: b (HAL 883), c (HAL 12510); *N. gracilis*: d (CBL 1279); *N. plicata*: e (HLF 5485), f (HLF 4940); *N. aragoana*: g (HAL 1702), h, i (HAL 1580).

any kind, woodlands, open secondary shrubs, secondary grasslands, pastures and timber plantations, often in wet shady places, occasionally as lithophyte on steep rocky slopes, on any kind of soils at elev. 15–1700 m a.s.l.. Fl. March – May (June). Not rare (LR).

Distribution. Vietnam (Ba Ria – Vung Tau, Bac Can, Cao Bang, Dak Lac, Dak Lak, Dong Nai, Ha Giang, Hoa Binh, Lang Son, Ninh Binh, Quang Binh, Son La, Tay Ninh, Thai Nguyen, Thanh Hoa). Mainland tropical and subtropical Asia, Philippines, Indonesia, Australia, Pacific islands.

Studied specimens. Bac Can, Ngon Son, *VH 4991* (NH, LE); Cao Bang, Trung Khanh, *HAL 5443* (NH, LE); Cuc Phuong n.p., *Hiep s.n.*, 4 April 2004 (LE); Dak Lak, Krong Bong, *VH 6053* (HN), *HLF 5487* (NH, LE), *HLF 5491* (NH, LE); Dak Nong, Dak Glong, *HLF 5612* (HN); Ha Giang, Quan Ba, *HAL 1580* (HN); Hoa Binh, Luong Son, *NOT-2945* (LE, UHN); Lang Son, Huu Lung, *PVT 561* (HN, photo LE); Ninh Binh, Nho Quan, Cuc Phuong National Park, *HAL 1702a* (HN); Quang Binh, Minh Hoa, *HAL 5995* (HN); Son La, Moc Chau, *NTH 2926* (NH, LE); Thai Nguyen, Vo Nhai, *NTH 3801* (HN); Thanh Hoa, Ba Thuoc, *HAL 1100* (NH, LE), *HAL 2936* (HN), *HAL 3507* (HN); Thanh Hoa, Quan

Hoa, *HAL 12906* (HN), *HAL 3637* (HN), *HAL 3738* (HN); Vungtau-Condau, Bay Canh Island, *Averyanov, Kudryavtzeva s.n.*, 30 April 1993 (LE); Nui Bara, Bienhoa, *Poillane s.n.* (P?), Cay Cong, Cochinchina, *Pierre s.n.* (P).

Notes. Species is fairly common in Vietnam; it can easily inhabit secondary habitats and can be certainly found in all provinces of the country.

It is widespread and extremely variable species particularly in lip shape, ornamentation, hairiness and color, as well as in leaf color and size. Some forms of this taxon have been recognized as distinct species by early authors. After study of Vietnamese material I could not eventually separate *Nervilia fordii* described from southern China (“Kwangtung: Lofaushan, *Ford, Hance Herb. 22301*”) from variable *N. aragoana*. Dense hairiness of the lip apex was generally accepted by some authors as main feature for *N. fordii*. However, hairiness of the lip in observed material varies very widely and hardly may be accepted as a feature for separation of mentioned species.

Local people in some areas of Vietnam widely crop tubers of *Nervilia aragoana* for medicinal purposes and for sale as traditional oriental drug.

SUPPLEMENT

Supplement includes taxonomic novelties that appeared after publication of first and second parts of the monograph and logically belong to already published treatments. They are listed below as follows:

***Goodyera rubicunda* (Blume) Lindl.,**

1839, Bot. Reg. 25: 61, misc. 92; Seidenf., Wood, 1992, Orch. Malay. Sing.: 59, 60, fig. 20 a-c; Comber, 2001, Orch. Sumatra: 55, 53, fig.; Chen Sing-chi et al., 2009, Fl. China, 25: 50. – *Neottia rubicunda* Blume, 1825, Bijdr.: 408. – *N. grandis* Blume, 1825, l.c.: 407. – *Goodyera grandis* (Blume) Blume, 1858, Coll. Orchid.: 43; Comber, 1990, Orch. Java: 29, fig.; Leou, 2000, Fl. Taiwan 5: 905. – *G. fumata* auct. non Thwaites, p.p.: Seidenf., 1978, Dansk Bot. Ark. 32, 2: 21, fig. 7; Seidenf. 1992, Opera Bot. 114: 28; Aver. 1994, Identif. Guide Vietnam. Orch.: 36; P.H. Ho, 2000, Ill. Fl. Vietnam 3: 781, f. 10889; Aver. et Averyanova, 2003, Updated Checklist Orch. Viet.: 37; Aver., 2008, Orch. Viet. Ill. Survey 1: 120, fig. 33 l; 36 f.

Described from Java (“Java, Mt. Salak and Mt. Gede, ...”). **Syntypes** (“*C.L. Blume s.n.*”) – L, P.

Ecology. Humid shady broad-leaved forests, commonly in wet places. 150–250 m. Fl. July. Rare (LR).

Distribution. Vietnam (Ninh Binh). NE. India, SW. China, Taiwan, Japan, Philippines, Malacca Peninsular, Indonesia, New Guinea, NE. Australia, New Caledonia and Pacific islands.

Studied specimens. Ninh Binh Prov., Cuc Phuong national park, near park headquarters, 180–220 m, 18 July 1995, *T.B. Croat & Nguyen Van Dzu 78009* (GH).

Note. Up to now, we have alone record of this species in Vietnam (Ormerod, 2009). Differences of *Goodyera rubicunda* and *G. fumata* many time recorded in Indochina (Averyanov, 2008) remain very unclear. Both species, probably, can be distinguished by shape of epichile: – “ligulate, recurved” in *G. rubicunda*, and “caudate, revolute” in *G. fumata* (Leou, 2000). However, according to our observation epichile of the lip in *G. fumata* continues elongation and scrolling during anthesis becoming from “ligulate, recurved” just “caudate, revolute” (**Fig. 54 b-f**). Linear, rather “caudate” epichile is typical for “ripe” flowers of *Allochilus eberhardtii* Gagnep., 1932, Bull. Mus. Hist. Nat. 2 ser. 4: 591; id., 1934, Fl. Gen. Indo-Chine 6, 4: 564, fig. 53, 2–9 described from Bac Kan province of N. Vietnam. P. Ormerod distinguishes *G. rubicunda* by

its long anther and rostellum over one third of column length (pers. comm.).

***Cheirostylis octodactyla* Ames,**

1907, Philipp. J. Sci., C 2: 314. – *C. inabai* Hayata, 1914, Ic. Pl. Formos. 4: 108, fig. 56; Aver., 2008, Orch. Viet. Ill. Survey 1: 106, fig. 29 f-i. – *C. oligantha* Masam. et Fukuy., 1940, Trans. Nat. Hist. Soc. Taiwan 30: 241. – *C. pingbianensis* K.L. Lang, 1996, Acta Phytotax. Sin. 34, 6: 635. – *C. phamhoangii* N.T. Tich, 2001, Orch. Vietnam, 1: 197, nom. inval.

Described from Philippines (“Philippines – Mindoro, Mt. Halcon, 2500 m ...”). **Type** (“22 November 1906, *Merrill 5834*”) – AMES.

Distribution. Vietnam (Lam Dong), S. China, Taiwan, Philippines.

Note. Studies of P. Ormerod (2002) revealed identity of “Philippine” and “mainland” plants that lead to use of correct valid name for “Vietnamese” specimens. New concept essentially expands known distribution area and illustrates close floristic connections between Philippine and floras of Eastern Indochina.

***Cheirostylis spathulata* J.J. Smith,**

1927, Bull. Jard. Bot. Buitenzorg, 3 Ser. 9: 32; Aver., 2008, Orch. Viet. Ill. Survey 1: 114, fig. 33 g; 36 b. – *C. didymacantha* Seidenf., 1978, Dansk Bot. Ark. 32: 75.

Distribution. Vietnam (probably extinct). Myanmar, Thailand, Java (extinct), Kalimantan.

Note. Species was recorded for Myanmar on the base of P. Ormerod studies, who also added the name *C. didymacantha* to synonymy of the spesies (pers. comm.).

***Hetaeria youngsayei* Ormerod,**

2004, Oasis Suppl. 3: 7. – *H. nitida* auct. non Ridl.: S.Y. Hu, 1977, Gen. Orch. Hong Kong: 49–51, fig. 21; Seidenf., 1978, Dansk. Bot. Ark. 32, 2: 103, p.p.; Barretto, Youngsaye, 1980, Hong Kong Orch.: 64; Aver., 2008, Orch. Viet. Ill. Survey 1: 131, fig. 35 f, g; 37 h, i.

Described from E. China (“China – Hong Kong, Mt. Gough, ...”). **Type** (“... coll. Walden, cult. Barretto 5-04-1973, *S.Y. Hu 13233*”) – K (holotype).

Distribution: Vietnam (Ha Giang, Quang Tri), Thailand, SE. China (Hong Kong).

Studied specimens. Ha Giang, Quan Ba, Bat Dai Son mt., *NTH 5420G* (HN, LE); Quang Tri, Da Krong Nature Reserve, *HLF 6255*, HN, LE, d-EXSIC-CATES OF VIETNAMESE FLORA 0065/*HLF6255*.

Note. P. Ormerod expects that plants from SE. China and Vietnam previously reported as *H. nitida* belongs actually to his species *H. youngsayei* closely related to Indonesian *H. obliqua* Blume, whereas true *H. nitida* Ridl. is conspecific with *H. oblongifolia* Blume (P. Ormerod, 2004; pers. comm.).

***Odontochilus tortus* King et Pantl.,**

1896, Journ. As. Soc. Bengal 2, Nat. Hist. 65: 125; Aver., 2008, Orch. Viet. Ill. Survey 1: 144, fig. 39 l-n. – *O. repens* Downie, 1925, Bull. Misc. Inform. Kew 1925: 413. – *Anoectochilus densiflorus* Mansf., 1930, Repert. Spec. Nov. Regni Veg. 27: 294. – *A. inabai* Hayata, 1914, Icon. Pl. Formos. 4: 102, pl. 14. – *Odontochilus inabai* (Hayata) T.P. Lin, 1975, Nat. Orch. Taiwan: 216; Aver., 2008, l.c.: 146, fig. 39 o; 43 g.

Distribution. Vietnam (Hoa Binh, Ninh Binh). Bhutan, N. India, S. China, Taiwan.

Studied specimens. Ninh Binh, Cuc Phuong national park, HAL 1670 (HN, LE); Hoa Binh, Mai Chau, HAL 9002 (HN).

Note. Reassessment of *Odontochilus tortus* related species (P. Ormerod, pers. comm.) adds to its synonymy the names *O. repens*, *Anoectochilus densiflorus* and *A. inabai* regarded earlier as separate species.

***Peristylus tenuicallus* Ormerod., sp. nov.**

Described from N. Vietnam (Vietnam: Chapa, 1500 m, ...). **Type** (“...July 1928, *A. Petelot 5160*”) – AMES (right hand plant).

Species nova subsimilis P. chapaensis (Gagnep.) Seidenf. sed floribus subduplo minoribus, calcar brevioribus (1.1–1.2 vs. 2 mm) et labello trilobatis (non integris) differt.

Slender terrestrial herb about 13 cm tall. Tubers narrowly obovoid, pubescent, 8 mm long, 3.5 mm in diam. Roots fleshy, pubescent. Stem erect, terete, glabrous, with 3 leaves apically, about 7 cm long, 1.5 mm in diam. Leaves ovate to narrowly ovate, 2.5–3.5 cm long, 1.1–1.9 cm wide, acute. Inflorescence glabrous, slender, erect, 6 cm long; peduncle ebracteate, 2.7 cm long. Rachis 3.2 cm long, with 7 lax flowers. Floral bracts narrowly ovate to triangular cuneate, 4–9 mm long, to 3 mm wide, shorter or almost as long as ovary, acute. Pedicellate ovary glabrous, erect, cylindric-fusiform, 5–6 mm long. Flowers resupinate, sepals and petals with 1 vein. Median sepal ovate, subacute, about 1.9 mm long, 1.1 mm wide. Lateral sepals obliquely oblong from a shortly clawed base, subacute to obtuse, about 2 mm long, 0.75 mm wide. Petals obliquely ovate from a shortly clawed base, about 1.8 mm

long, 1 mm wide, obtuse, basal claw and lower margin broadly connate to column. Lip spurred, cymbiform, 3-lobed, joined to column for 0.5–0.6 mm, medially with an erect, laterally compressed, thin, obtuse callus; epichile ovate, subacute, concave, about 1 mm long and wide; lateral lobes erect, triangular, subacute, about 0.2 mm long; spur obovoid to almost globose, obtuse, 1–1.2 mm in diam. Column erect, about 1.1 mm tall, with prominent cylindrical, forward directed stigma arms 0.5 mm long. Fl. June – July. **Fig. 52.**

Etymology. Species name refers unusual callus at the center of lip.

Ecology. Most probably type specimen was collected in montane broad-leaved forest on granite at elev. about 1500 m a.s.l. typical for Chapa town area.

Distribution. Vietnam (Lao Cai). Endemic.

Studied specimens. Known only by type collection.

Notes. The holotype of this species is mounted on the right hand side of an isotype sheet of *Habenaria keiskeioides* Gagnep. at AMES.

Erect cylindrical callus rising at the center of the lip represent unique feature unknown in any another species of the genus. Generic placement of this unusual plant needs further studies of newly collected fresh material.

***Rhomboda lanceolata* (Lindl.) Ormerod,**

1995, Orchadian, 11: 329; Aver., 2008, Orch. Viet. Ill. Survey 1: 149, fig. 41 a. – *Odontochilus hatusimanus* Ohwi et T. Koyama, 1957, Bull. Nat. Sci. Mus. Tokyo n.s., 4: 272.

Note. Most widespread species in the genus. According to P. Ormerod, specimens from Vietnam (Lam Dong, N.T. Tich s.n., a. 1994) were housed at BRI. He also added the name *Odontochilus hatusimanus* to synonymy of this species on the base of own studies (pers. comm.).

***Rhomboda tokioi* (Fukuyama) Ormerod,**

1998, Austral. Orchid Rev. 63, 4: 11; Aver., 2008, Orch. Viet. Ill. Survey 1: 149, fig. 40 m-n; 44 a. – *Hetaeria tokioi* Fukuyama, 1934, Bot. Mag. (Tokyo) 48: 434. – *Goodyera pogonorrhyncha* Hand.-Mazz., 1937, Beih. Bot. Centralbl. 56B: 473. – *Hetaeria cristata* var. *tokioi* (Fukuyama) Ying, 1977, Col. Ill. Indigen. Otch. Taiwan 2: 468. – *Rhomboda pogonorrhyncha* (Hand.-Mazz.) Ormerod, 1995, Orchadian 11: 331. – *Hetaeria cristata* auct non Blume: Garay, Sweet, 1974, Orch. Ryukyu Isl.: 91; Lin, 1975, Nat. Orch. Taiwan 1: 204, fig., pl. 127–129; Leou, 2000, Fl. Taiwan 5: 926, 927, fig. 394. –

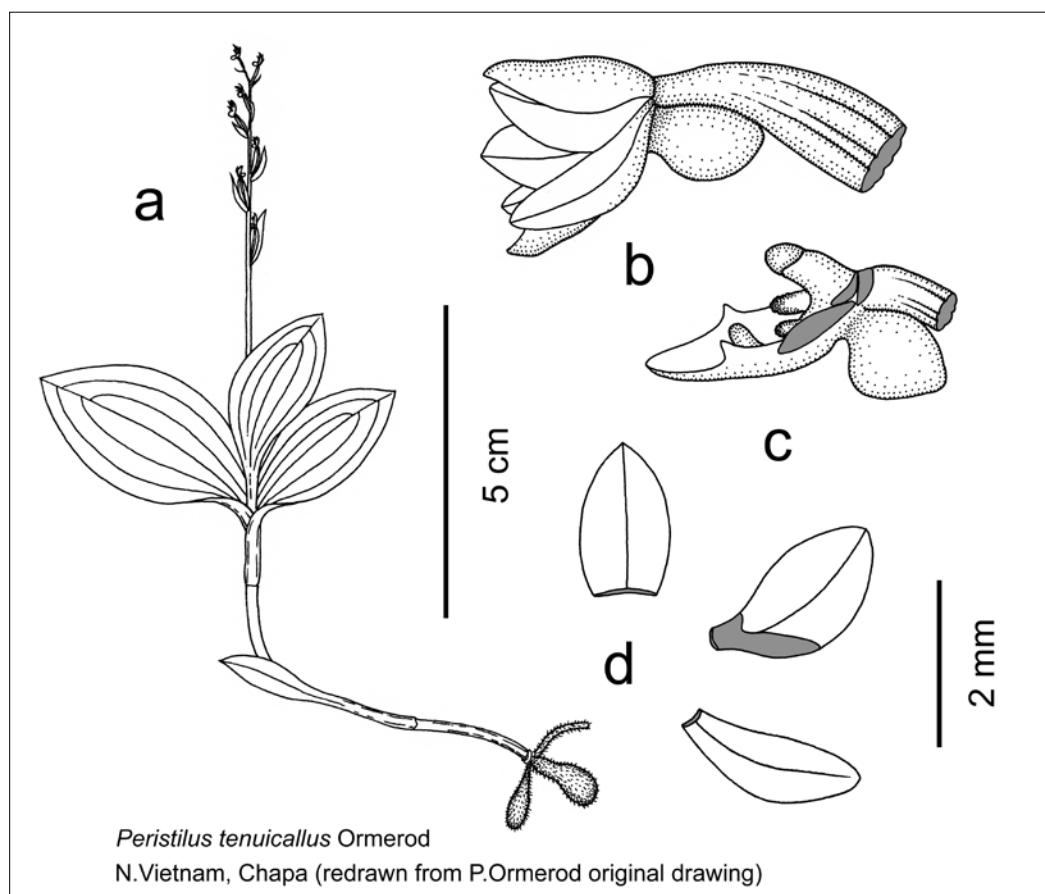


Fig. 52. *Peristylus tenuicallus* (A. Petelot 5160, type): a – flowering plant, b – flower, side view, c – flower with removed sepals and petals, side view, d – flattened sepals and petal.

Hetaeria pauciflora auct. non Ridl.: Seidenf., 1992, Orch. Indochina: 39; Aver., 1994, Identif. Guide. Vietnam. Orch.: 33. – *Rhomboda pauciflora* auct. non (Ridl.) Ormerod: Aver. et Averyanova, 2003, Updated Checklist Orch. Viet.: 54.

Described from Taiwan (“Taiwan – Taikohu Praef., near Urai”). **Type** (09-1932, *Suzuki-Tokio 4128*) – TI.

Terrestrial creeping herb. Floriferous stem ascending, (8)15–25 cm tall, with (2)3–5 petiolate leaves approximated at the middle part. Leaves oblique-ovate, (2)4–9 cm long, (1)2–4 cm wide, acute, velvety dark green to greenish-brown, with white median stripe. Inflorescence scape 2–3 cm long, finely sparsely pubescent, with 1–2 cuneate, pinkish hyaline bracts. Rachis to 8 cm long, finely pubescent with numerous not resupinate, hardly opening flowers. Ovary cylindric, slightly curved, erect, sparsely finely pubescent or glabrous, 6–8 mm long, more or less adpressed to the rachis. Floral bracts finely sparsely pubescent and ciliate along margin, cuneate, acuminate, as long as, or slightly longer than ovary, dull pinkish, hyaline. Sepals olive-pink to greenish brown, free, sparsely finely pubescent, ovate, acute, 4–6 mm long, 2.5–3.5 mm

wide, with 1 vein. Petals white, strongly oblique, almost half-circular, with 1 vein, acute, as long and as wide as sepals. Lip white, ovate, concave, as long as sepals, 2.5–3 mm wide, with attenuate acute (sometimes broadening or almost circular) recurved apex 1–1.5 mm long; ventrally at the center, with 2 semi-circular, closely allied longitudinal keels 1.5–2 mm long arising along median vein, and with 2 shortly stalked flat obovate or obtriangular glands at the base; dorsally with 2 distant lateral keels 3–4 mm long. Column erect, dilated to the apex, 2.5–3.5 mm tall, with 2 large broad, wings at front, bifid rostellum and 2 lateral finely papillose not touching stigmas. Anther broadly ovate, bifid, acuminate, viscidium oval, placed at front at the apex of column. Fruits unknown. **Fig. 53; 54 a.**

Ecology. Humid broad-leaved shady forests on silicate soils. 400–1300 m. Fl. June – August. Rare (DD).

Distribution. Vietnam (Ha Tinh, Phu Tho). Japan, SE. China, Hainan, Taiwan.

Studied specimens. Ha Tinh, Huong Son, HAL 5216 (LE); Vietnam, sine loc., 1985, *Averyanova et al., LX-VN s.n.* (LE); Phu Tho, Tan Son, HAL 12783a (HN, LE), HAL 12813a (HN, LE).

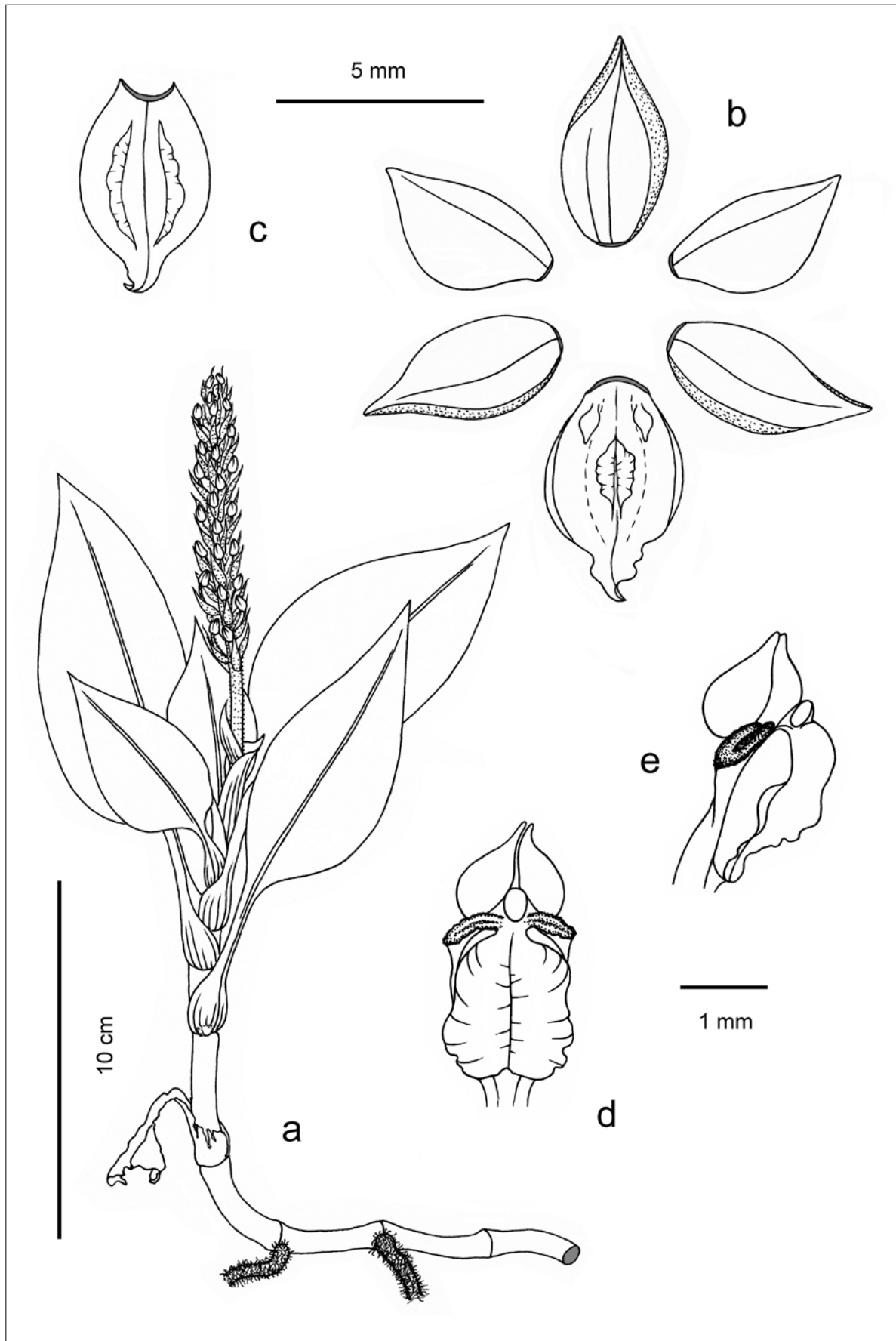


Fig. 53. *Rhomboda tokioi* (HAL 12783a): a – flowering plant, b – flattened sepals, petals and lip, c – lip, dorsal view, d, e – column, frontal and half-side views.



Fig. 54. *Rhomboda tokioi* (HAL 12783a): a; *Goodyera fumata* (LX-VN 1811): b – portion of inflorescence, c – flower, frontal view, d-f – elongation and scrolling of epichile during anthesis.

Note. New materials collected recently in N. Vietnam make possible to essentially improve description of this rare, earlier obscure species, as well as prepare its drawing based on morphological analysis of fresh flowers. Some available specimens from Vietnam differ from the type in glabrous ovary and sepals and may represent separate variety. According to the limits, synonymy and distribution of this species we follow P. Ormerod (2002) as an eminent expert in this group.

Actually, the species is very close to *Rhomboda cristata* (Blume) Ormerod (*Hetaeria cristata* Blume), *R. pauciflora* (Ridl.) Ormerod (*Hetaeria pauciflora* Ridl.) and *R. abbreviata* (Lindl.) Ormerod (*Hetaeria abbreviata* Lindl.), with which it should be compared on the base of more collected materials. It also looks very similar with *Rhomboda yakusimensis* (Masam.) Ormerod (*Zeuxine yakusimensis* Masam.) regarded as rare local Japanese endemic.

***Zeuxine bidupensis* Aver.,**

2006, Rheedea, 16, 1: 12, fig. 7 g, h; 9. – *Z. goodyeroides* auct non Lindl., p.p.: Aver., 2008, Orch. Viet. Ill. Survey 1: 153, fig. 41, g-k; 44, c.

Described from S. Vietnam (“Lam Dong Prov., Lac Duong Distr., Da Chais Municipality, territory of Bi Doup – Nui Ba national park, around point 12°08’17”N 108°40’47”E, at about 1600 m. ...”). **Type** (“19 October 2005, T.T.T. Trang, T.V. Thao, N.T. Vinh, HLF 5319”) – HN (holotype), LE (isotype).

Ecology. Wet broad-leaved and coniferous closed forests on silicate soils. 1500–1900 m. Fl. November – January. Rare (VU).

Distribution. Vietnam (Lam Dong). Endemic.

Studied specimens. Known only by type collection.

Note. P. Ormerod (pers. comm.) regards this species as well defined from *Z. goodyeroides*. It differs from last species in subquadrate shape of

glands in the lip, 2 fleshy swellings at junction of hypochile and epichile and in long rostellum processes, much longer than in *Z. goodyeroides*. The species is probably local endemic of Central Highlands of the southern Vietnam. Specimens from Lai Chau province need more studies and could belong to true *Z. goodyeroides*.

***Zeuxine membranacea* Lindl.,**

1840, Gen. Sp. Orchid. Pl.: 486; Pearce et Cribb, 2002, Orch. Bhutan: 113. – *Z. godefroyi* Reichenb. f., 1878, Oti Bot. Hamburg.: 34. – *Z. evrardii* Gagnep., 1931, Bull. Mus. Natl. Hist. Nat. II, 3: 326. – *Z. debrajiana* Sud. Chowdhury, 1996, Indian Forester 122: 87. – *Z. strateumatica* auct. non (L.) Schltr., p.p.: Seidenf., 1978, Dansk Bot. Ark. 32, 2: 80, fig. 48; id., 1992, Opera Bot. 114: 37; Aver., 1994, Identif. Guide Vietnam. Orch.: 38; Aver. et Averyanova, 2003, Updated Checklist Orch. Viet.: 61; Aver., 2008, Orch. Viet. Ill. Survey 1: 153, fig. 41 c-f.

Described from Bhutan without precise locality. **Type** (“Griffith 16”) – K.

Distribution. Vietnam (Lam Dong). Bhutan, NE. India, E. China (Hong Kong), Myanmar, Thailand, Cambodia.

Studied specimens. S. Vietnam, Dalat, Reserve of Camly, 24-10-1920, *Evrard 276* (P).

Note. At least the cited collection from Vietnam (*Evrard 276*) belongs to this species (P. Ormerod pers. comm.), which differs from the closely related *Z. strateumatica* in the following characters: “the plant is generally taller, the petals are not adnate to the dorsal sepal, the shape and texture of the lip is distinct and the ovary is papillose or pubescent rather than glabrous” (Pierce, Cribb, 2002). On the other hand, *Z. bonii* Gagnep., described from N. Vietnam (Cao Bang province) is conspecific with *Z. strateumatica* (L.) Schltr.

***Zeuxine tonkinensis* Gagnep.,**

1931, Bull. Mus. Natl. Hist. Nat. 2. s. 3, 7: 328. – *Z. parvifolia* auct. non (Ridl.) Seidenf., p.p.: Aver. 1994, Identif. Guide Vietnam. Orch.: 37; Aver. et Averyanova, 2003, Updated Checklist Orch. Viet.: 61; Aver., 2008, Orch. Viet. Ill. Survey 1: 155, fig. 41 p; 44, f.

Described from N. Vietnam (“Pl. du Tonkin ... Forêts du Mont-Bavi, vers 400 metr. ...”). **Type** (“27 mars 1887, *B. Balansa 2002*”) – P.

Distribution. Vietnam, Hong Kong.

Note. P. Ormerod (pers. comm.) suspects that most specimens from N. Vietnam belong to this species, which differs from true *Z. parviflora* in small wings on the column and in cornute glands on hypochile. I should agree with his opinion that complex of plants around *Z. parviflora* s.l. in Indochina needs further studies.

LITERATURE

Averyanov L. The orchids of Vietnam. Illustrated survey. Part 1. Subfamilies *Apostasioideae*, *Cypripedioideae* and *Spiranthoideae* // Turczaninowia, 2008. – Vol. 11, № 1. – P. 5–168.

Averyanov L. The orchids of Vietnam. Illustrated survey. Part 2. Subfamily *Orchidoideae* // Turczaninowia, 2010. – Vol. 13, № 2. – P. 5–98.

Chen Sing-chi, P.J. Cribb. *Galeola* Lour. // Flora of China. Vol. 25. – Beijing-St. Louis, Missouri Botanical Garden Press, 2009. – P. 169–170.

Chen Sing-chi, S.W. Gale. *Aphyllorchis* Blume // Flora of China. Vol. 25. – Beijing-St. Louis, Missouri Botanical Garden Press, 2009a. – P. 177–179.

Chen Sing-chi, S.W. Gale. *Nervilia* Commerson ex Gaudichaud. // Flora of China. Vol. 25. – Beijing-St. Louis, Missouri Botanical Garden Press, 2009b. – P. 197–201.

Leou Chong-Sheng. *Goodyera* R. Br. // Flora of Taiwan. Vol. 5. – Taipei: National Taiwan University, 2000. – P. 898–914.

Ormerod P. Some brief notes on Taiwanese Orchids 1 // Taiwan, 2002. – Vol. 47, № 4. – P. 239–245.

Ormerod P. Notulae Goodyerinae 1 // Oasis, 2004. – Vol. 3. – P. 3–19.

Ormerod P. Notulae Goodyerinae 4 // Taiwan, 2009. – Vol. 54, № 1. – P. 45–51.

Pierce N.R., P.J. Cribb. Flora of Bhutan // The Orchids of Bhutan. – Royal Bot. Gard. Edinburgh. Royal Government of Bhutan, 2002. – Vol. 3, part 3. – 643 p.

Soto Arenas M.A., P. Cribb. A new infrageneric classification and synopsis of the genus *Vanilla* Plum. ex Mill. (Orchidaceae, *Vanillinae*) // Lankesteriana, 2010. – Vol. 9, № 3. – P. 355–398.

Tien-Chuan, Shih-Wen Chung. *Didymoplexis micradenia*: a newly recorded orchid (Orchidaceae) in Taiwan // Taiwan, 2007. – Vol. 52, № 4. – P. 360–364.