



## New Orchids (Orchidaceae: Epidendroideae and Vandoideae) in the Flora of Vietnam

Leonid V. AVERYANOV<sup>1,\*</sup>, Van Canh NGUYEN<sup>2</sup>, Hoang Tuan NGUYEN<sup>3</sup>, Ba Vuong TRUONG<sup>4</sup>, Phi Tam NGUYEN<sup>5</sup>, Sinh Khang NGUYEN<sup>6</sup>, Tatiana V. MAISAK<sup>1</sup>, Hiep Tien NGUYEN<sup>7</sup>, Duc Nam BUT<sup>8</sup>, Xuan Canh CHU<sup>9</sup>

1. Komarov Botanical Institute of the Russian Academy of Sciences, Prof. Popov Street 2, 197376, St. Petersburg, Russia.
  2. Center of scientific research and practice, Thu Dau Mot University, No. 6 Tran Van On Street, Phu Hoa ward, Thu Dau Mot city, Binh Duong province, Vietnam; nguyenvanvanh@gmail.com
  3. 15 Le Thanh Tong, Hoan Kiem, Hanoi University of Pharmacy, Hanoi, Vietnam; tuand150@yahoo.com
  4. Institute of Tropical Biology, Dept. of Biological resources, Vietnam Academy of Science and Technology, 85 Tran Quoc Toan St., Distr. 3, Ho Chi Minh City, Vietnam; bavuong2019@yahoo.com
  5. Viet Nam Post and Telecommunications Group – VNPT Lam Dong, 8 Tran Phu Street, Da Lat City, Lam Dong Province, Vietnam; phitam77@gmail.com
  6. Institute of Ecology and Biological Resources, Vietnam Academy of Science and Technology, 18 Hoang Quoc Viet Road, Nghia Do, Cau Giay, Hanoi, Vietnam; khangnguyensinh@yahoo.com
  7. Center for Plant Conservation, no. 25/32, lane 89, Lac Long Quan, Nghia Do, Cau Giay District, Ha Noi, Vietnam; centerforplantconservation@gmail.com
  8. Thach That General Hospital, 84 street, Kim Quan commune, Thach That district, Hanoi, Vietnam; dr.buiducnam@gmail.com
  9. 292 Thanh Nhan Street, Hai Ba Trung district, Hanoi, Vietnam; cxcanh@gmail.com
- \*Corresponding author's e-mails: av\_leonid@mail.ru or av\_leonid@yahoo.com

(Manuscript received 5 April 2018; accepted 21 June 2018; online published 10 July 2018)

**ABSTRACT:** The paper continues our recent publication of new original data on orchid diversity in Vietnam (Averyanov *et al.*, 2018a-c) obtained in 2016–2017. It includes data on 5 orchid species new for science (*Calanthe nguyenthinhii* Aver., *Dendrobium truongcuongii* Aver. & Canh, *Gastrodia khangii* Aver., *Nephelaphyllum thaovayae* Aver. & Canh and *Podochilus truongtamii* Aver. & Vuong) and 15 species, new for the flora of Vietnam (*Calanthe ceciliae*, *Dendrobium eriiflorum*, *D. griffithianum*, *D. hekouense*, *D. minusculum*, *D. stuposum*, *D. xichouense*, *Eria lancifolia*, *E. xanthocheila*, *Geodorum terrestre*, *Liparis condylobulbon*, *L. tenuis*, *Luisia teres*, *Pomatocalpa maculosum*, *Porpax ustulata*). Annotated species list includes the valid name, synonyms, type, citations of relevant taxonomic regional publications, data on ecology, phenology and distribution, estimated IUCN Red List status, studied specimens, brief taxonomic notes, and illustrations for each recorded species. Lectotypes for two species, *Liparis tenuis*, and *Dendrobium exsculptum* are proposed. When the new data presented in this paper are included, the documented orchid flora of Vietnam reaches at least 1243 species.

**KEY WORDS:** Flora of Vietnam, Indochina, New species, Orchidaceae, Plant geography, Plant taxonomy, Nature protection.

### INTRODUCTION

This paper continues our recent publications of new original data on orchid diversity in Vietnam (Averyanov *et al.*, 2018a-c) obtained in the field studies mostly during years 2016–2017 since last our publications (Averyanov *et al.*, 2016a-d, 2017a, b; Averyanov and Maisak, 2017a, b; Nguyen and Averyanov, 2017). Like previous papers, it summarizes the results of joint efforts of professional botanists and orchid enthusiasts on studies of Vietnamese native orchids from subfamilies Epidendroideae and Vandoideae leading to the discovery of 5 species new for science, namely *Calanthe nguyenthinhii* Aver., *Dendrobium truongcuongii* Aver. & Canh, *Gastrodia khangii* Aver., *Nephelaphyllum thaovayae* Aver. & Canh and *Podochilus truongtamii* Aver. & Vuong. Additionally, fifteen species are reported and documented here as a new for the flora of Vietnam. These species are: *Calanthe ceciliae* Rchb.f.,

*Dendrobium eriiflorum* Griff., *D. griffithianum* Lindl., *D. hekouense* Z.J. Liu et L.J. Chen, *D. minusculum* Aver., *D. stuposum* Lindl., *D. xichouense* S.J. Cheng et Z.Z. Tang, *Eria lancifolia* Hook.f., *E. xanthocheila* Ridl., *Geodorum terrestre* (L.) Garay, *Liparis condylobulbon* Rchb.f., *L. tenuis* Downie, *Luisia teres* (Thunb.) Blume, *Pomatocalpa maculosum* (Lindl.) J.J. Sm. and *Porpax ustulata* (E.C. Parish et Rchb.f.) Rolfe. When the new data presented in this paper are included, the documented orchid flora of Vietnam reaches at least 1243 species. Valid name, synonyms, type, citations of relevant taxonomic regional publications, data on ecology, phenology and distribution, estimated IUCN Red List status and studied specimens as well as brief taxonomic and biological notes are provided for each studied species. Lectotypes for two species, *Liparis tenuis*, and *Dendrobium exsculptum* are proposed.

An illustrated annotated list of all studied species arranged in alphabetical order is presented below.



## MATERIALS AND METHODS

Materials used in present studies were collected mainly during years 2016–2017. Some previously collected herbarium specimens and living samples also provided significant additional information of the current investigation. Fresh plants, as well as flowers and inflorescences from living plants, were fixed and stored in 60–65% ethanol. Measurements of the floral parts for descriptions were taken on both herbarium and liquid-fixed materials. In describing of quantitative characters, infrequent extreme values (i.e. rarely occurring minimal and maximal values) of a variation range are parenthesized before and after the normal variation range. Detailed analytical photos of plant parts compiled into plates referred to here as “digital plates” or “digital epitypes” were made from the living plants prior to preparation of the appropriate herbarium specimens. Taxa distribution in Vietnam is indicated in the text by mentioning concerned provinces according to the official administrative country division (Viet Nam Administrative Atlas, 2007). The online version of the IUCN Red List of Threatened Species (2017) was used for estimation of preliminary species conservation status. Place of the housing of cited specimens is indicated by accepted acronyms or respected Herbaria. The studied taxa are listed below in alphabetical order.

## TAXONOMIC TREATMENT

### List of new orchids in the flora of Vietnam

*Calanthe ceciliae* Rehb.f., 1883, Gard. Chron. n.s. 19, 1: 432; Seidenfaden, 1975, Dansk Bot. Ark. 29, 2: 19, fig. 5; Comber, 1990, Orch. Java: 95, fig.; id., 2001, Orch. Sumatra: 271, fig.; Seidenfaden, Wood, 1992, Orch. Pennins. Malaysia Singapore: 169, fig. 72b-c.; Kurzweil, 2010, Adansonia, ser. 3, 32, 1: 84; Clayton, Cribb, 2013, Gen. *Calanthe*: 250, pl. 35E-G.

#### Fig. 1

Described from Malayan Peninsula (“Most probably this *Calanthe*, from the Malayan peninsular..., Messrs. H. Low & Co. ...”). **Type** (“cult. Low”) – W-RCHB 2196 (holotype).

**Habitat, phenology and conservation status.** Terrestrial rosulate herb. Primary and secondary evergreen broad-leaved submontane forests, commonly in shady wet, sometimes flooded places. 700–800 m. Fl. August–November. Not common. Estimated IUCN Red List status – DD.

**Distribution.** Vietnam: Dak Lak (Chu Yang Sinh Mountains) and Lam Dong (Bao Loc town area) provinces, northern Vietnam (with no exact location). Myanmar, Peninsular Thailand, Peninsular Malaysia, Sumatra, Java.

**Notes.** It is one more new addition of the typical

Malasian species to the orchid flora of Vietnam. It shows remarkable geographical variation in its flowers color. Plants with pink-purple flowers are most common in Java and Sumatra (Comber, 1990, 2001). White flowers tinged with violet are typical for the plants in Malay Peninsular (Seidenfaden and Wood, 1992; Clayton and Cribb, 2013). According to available collections and observations, the flowers in Vietnam are pure white with light yellow callosity at the lip base. Specimens from Vietnam also differ from Malasian plants in spreading, obtriangular, truncate lip side lobes (vs. side lobes somewhat forward directed, ovate with roundish apex) and small median lobe much narrower than side lobes with almost entire margin (vs. median lobe distinctly wider than side lobes, finely denticulate along margin). Studied Vietnamese plants certainly represent distinct geographical race, but the identification of its taxonomical rank needs further studies and analysis of more material.

**Studied specimens.** Southern Vietnam, Lam Dong province, Bao Loc town, Loc Chau commune, Ba Mountain. Shady and wet, sometimes flooded place on the hillside. 700–800 m a.s.l. 15 August 2017, *Nguyen Hoang Tuan, Nguyen Van Thien, Nguyen Huy Hau, s.n.* (LE). Plate – d-EXSICCATES OF VIETNAMESE FLORA 0291/*Nguyen Hoang Tuan et al., s.n. 15.08.2017* (Fig. 1). Southern Vietnam, Dak Lak province, Chu Yang Sinh Mountains, cult. N.V. Canh, herbarium specimen prepared from cultivated plants 19 October 2017, *Nguyen Van Canh, L. Averyanov AL 320* (LE, LE – photo). Northern Vietnam, with no exact location, cult. *Nguyen Minh Duc*, herbarium specimen prepared from cultivated plants 25 October 2017, *L. Averyanov, T. Maisak AL 400* (LE, LE – photo).

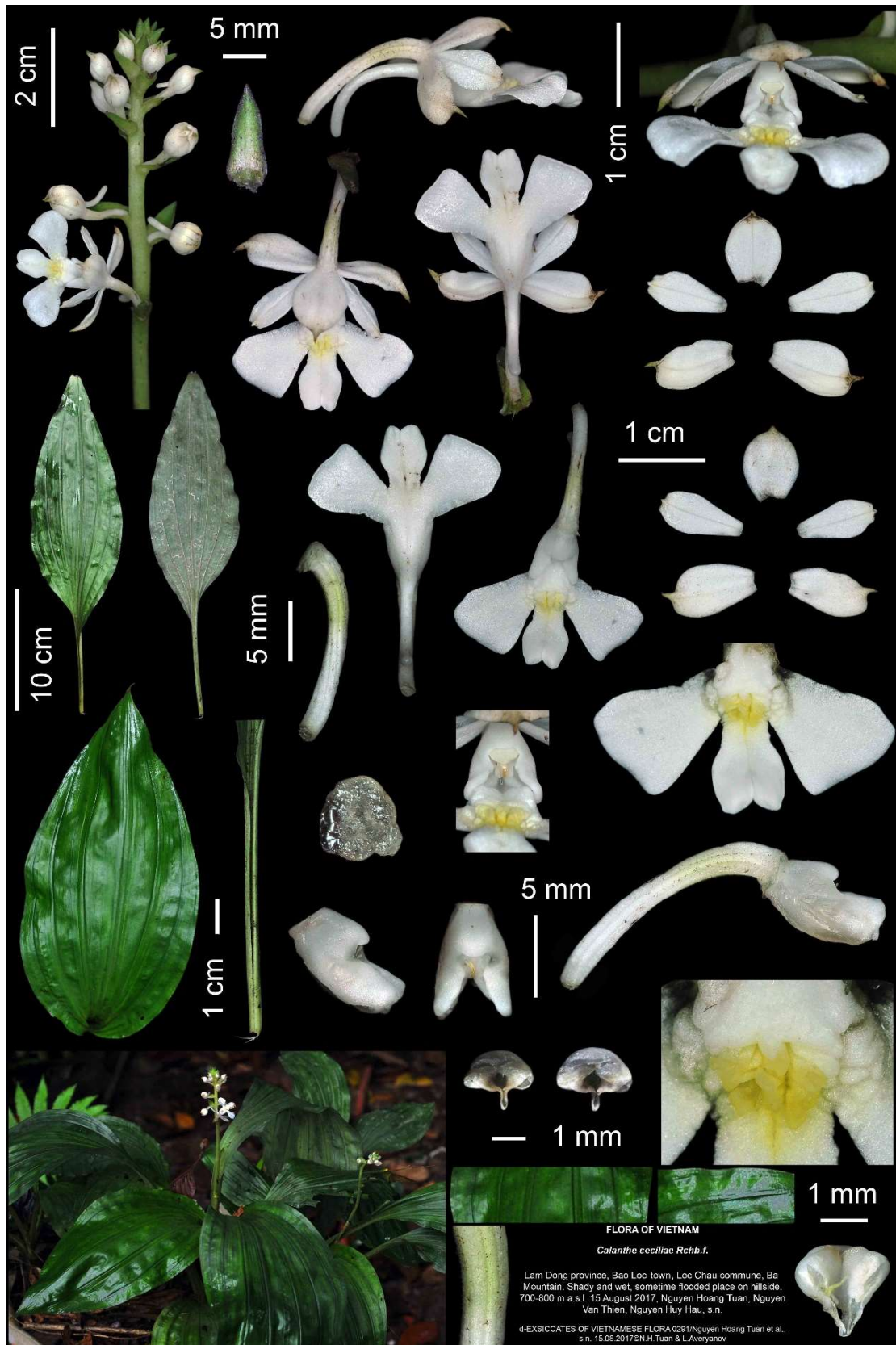
### *Calanthe nguyenthinhii* Aver., sp. nov.

#### Fig. 2

Described from southern Vietnam. **Type** (“16 October 2017, *Nguyen Phi Tam, L. Averyanov, T. Maisak, AL 287*”) – LE (holotype), was prepared from the flowering plant cultivated in Dalat Town by Nguyen Phi Tam. The living plant was collected in Lam Dong province, Lac Duong district, Da Chais municipality, Bidoup Mountains, an evergreen forest at elevation 1600 m a.s.l., 21 January 2017 by *Nguyen Van Thinh, sine n.* Digital epitype – d-EXSICCATES OF VIETNAMESE FLORA 0297/*AL 287* (Fig. 2).

**Etymology.** The specific epithet refers the name of the plant discoverer, Nguyen Van Thinh, orchid explorer and grower from Dalat town, Lam Dong province.

**Description.** Terrestrial herb with few erect abbreviated stems densely clustering on the short rhizome. Rhizome plagiotropic, epigeous, very short, insignificant. Stems (1)3–6(8), dull green, touching each other, erect, slightly swelling, narrowly conoid, (1.5)2–2.5(3) cm long, (0.6)0.8–1(1.2) cm in diameter, covered by light green broadening leaf bases or their whitish fibrous remnant. Leaves (3)4–6(7), subglabrous above, finely puberulent below, sessile, imbricate, with narrowing petiole-like basal part, broadening and sheathing at the base; petiole-like basal parts light green,



**Fig. 1.** New orchids in the flora of Vietnam. *Calanthe ceciliae* H. Low ex Rchb.f. Plate – d-EXSICCATES OF VIETNAMESE FLORA 0291/Nguyen Hoang Tuan *et al.*, s.n. 15.08.2017. All photos by Nguyen Hoang Tuan, design and correction by L. Averyanov.



channeled, (2)3–8(10) cm long, (2)3–4(6) mm wide (being flattened), broadening at the base into short overlapping sheath embracing stem; leaf blade dark velvety green, ovate elliptic, (8)12–20(24) cm long, (3)4–6(8) cm wide, plicate, wavy along margin, acute to acuminate at the apex. Inflorescence arising from the apical part of stem, erect, dense raceme, (60)70–110(120) cm tall; peduncle light green, soft densely puberulent, (45)60–100(110) cm long, with (3)5–6(8) distant, narrowly ovate to narrowly triangular acuminate herbaceous sterile bracts, diminishing from the base of peduncle toward the apex, (1)2–5(7) cm long, (3)4–10(14) mm wide; rachis puberulent, (4)5–8(9) cm long, with many, spirally arranged flowers forming dense cylindric raceme (2)2.2–2.8(3) cm in diameter. Floral bracts persistent, puberulent, horizontally directed, olive-green, later dull brownish, ovate to narrowly triangular, acute to shortly acuminate, (2.5)3–6(7) mm long, (1.4)1.6–3(4) mm wide. Pedicel and ovary light green, straight to slightly downcurved, (8)9–12(13) mm long, hairy by many scurfy dark brownish short hairs; pedicel cylindric (2.5)3–4(4.5) mm long, 0.8–1 mm in diameter; ovary obconic, (5.5)6–7(7.5) mm long, 1.5–2 mm in diam., shallowly grooved, obscurely 3-angled in section. Flowers widely opening, (1)1.2–1.4(1.5) cm across; sepals and petals strongly recurved coming almost parallel to ovary, light pale green; lip down spreading, pure white with bright yellow central callus. Sepals thin, subsimilar, almost flat, hairy with short dark brownish scurfy hairs, ovate, (6.5)7–8(8.5) cm long, (4.8)5–5.5(5.8) mm wide, acute to shortly apiculate at apex, lateral sepals slightly oblique. Petals as long as sepals, twice narrower than sepals, narrowly obovate, (2.4)2.6–2.8(3), acute. Lip spurred, 3-lobed, massively fused with the column wings, being flattened broadly ovate in outline, (9.5)10–12(12.5) mm long, (11)12–14(14.5) cm wide, glabrous; side lobes oblique broadly ovate, flat, laterally spreading, obtuse or obscurely dentate at apex, (5.5)6(6.5) mm long and wide; median lobe narrowly obovate, deeply 2-lobulate, down spreading, flat or slightly convex, (7.2)7.5–8(8.2) mm long, (5.5)6(6.5) mm wide, lobules separated by deep sinus, narrowly obovate, (5.8)6(6.2) mm long, finely irregularly denticulate at rounded or somewhat truncate apex; disc at the lip base with large 3-lobed yellow callus and allied numerous, fleshy, bright yellow, finger-like irregular protuberances; spur light pale green, narrowly cylindric, obtuse, straight to slightly curved, (13.5)14–15(15.5) mm long, 1–1.2 mm in diameter, sparsely shortly hairy outside, with dense long white hairs inside near throat. Column pure white, stout, fleshy, broadening from narrow base, massively fused by lateral wings to the lip, truncate at apex, (3.2)3.5–4(4.2) mm tall, 3.4–3.6 wide, rostellum 2-lobed. Anther cup white, apical, hemispheric, (1.1)1.2–1.3(1.4) mm across, with short, forward-directed beak. Pollinia 8, light gray to dull

yellowish, clavate, 1–1.1 mm long, on small common viscidium. Fruit unknown.

**Habitat, phenology and conservation status.** Terrestrial perennial herb with clustering much abbreviate erect stems. Primary and secondary evergreen broad-leaved montane forest on granite. 1600 m. Fl. September–October. Very rare. Estimated IUCN Red List status – DD.

**Distribution.** Vietnam: Lam Dong province (Lac Duong district, Bidoup Mountains). Endemic.

**Notes.** New species belongs to a group of related species from the sect. *Calanthe* with large, well developed subradical leaves, erect abbreviated stem and long, erect subapical inflorescence bearing short terminal raceme. In Vietnam, this group includes such widespread and common species as *C. argenteostriata* C.Z. Tang et S.J. Cheng, *C. herbacea* Lindl., *C. leonidii* P.J. Cribb et D.A. Clayton, *C. odora* Griff. and *C. triplicata* (Willemet) Ames (Clayton and Cribb, 2013). Among them, our plant has the closest relation to *C. triplicata* and *C. leonidii*, but strikingly differs in proportionally very long inflorescence, much dense raceme (vs. raceme subdense or lax), short pedicel and ovary 0.8–1.3 cm long (vs. 2.5–4 cm long), smaller flowers with sepals 6.5–8.5 mm and lip 9.5–12.5 mm long (vs. sepals 10–12 mm and lip 12–18 mm long), shorter spur 13–15 cm long (vs. about 2 cm long), lobules of median lip lobe straight, down directed, parallel each other (vs. lobules of median lip lobe strongly divergent) and in prominent 3-lobed callus and numerous, fat brightly yellow protuberances on lip disc near the lip base (disc more or less warty or tuberculate, but with no prominent 3-lobed callus and numerous finger-like papillae). Most probably, new species is local endemic with very limited distribution in western mountain slopes of Bidoup Mountains.

***Dendrobium eriiflorum*** Griff., 1851, Not. Pl. Asiat. 3: 316; id., 1851, Icon. Pl. Asiat. 3, pl. 307; Pearce, Cribb, 2002, Orch. Bhutan: 419, pl. 23.

#### Fig. 3A & B

Described from northeastern India (“Khasyah Mountains. Assam Herb. 230. In Ceraso, Myrung: November 9th, 1835”). **Type** – K000943903 (holotype).

**Habitat, phenology and conservation status.** Trunk and branch clustering epiphyte. Primary broad-leaved evergreen forests on karstic rocky limestone, commonly on tops of remnant hills and mountains. 1100–1300 m. Fl. September–October. Rare. Estimated IUCN Red List status – DD.

**Distribution.** Vietnam: Son La province (Moc Chau district). Nepal, Bhutan, N. India, Myanmar.

**Notes.** This discovery represents one more Himalayan species in the flora of northern Vietnam. Its discovered location extends the known area of this species on 800 km in SEE direction. Vietnamese plants



**Fig. 2.** New orchids in the flora of Vietnam. *Calanthe nguyenthinhii* Aver. Digital epitype – d-EXSICCATES OF VIETNAMESE FLORA 0297/AL 287. All photos, design and correction by L. Averyanov.

Herbarium specimen prepared from flowering plant cultivated in Dalat City private garden of Mr. Nguyen Phi Tam in 16 October 2017 by N.P. Tam, L. Averyanov, T. Matsak, AL 287. Plant was collected in the wild in Lam Dong province, Lac Duong district, Da Chais municipality, Bidoup Mountains, evergreen forest at elevation 1600 m a.s.l., 21 January 2017 by Mr. Nguyen Van Thinh, sine n. d-EXSICCATES OF VIETNAMESE FLORA 0297/AL287 © L.Averyanov.



differ from the type in yellowish tepals and purple-violet lip. These color forms desire for cultivation as a miniature ornamental plant (Fig. 3A, B).

**Studied specimen.** Northern Vietnam, Son La province, Moc Chau district, Chieng Son commune, about 1 km to NE from Chieng Son village, around point 20°46'02.0"N 104°37'03.1"E, remnants of primary broad-leaved evergreen forest on tops of hills composed with karstic highly eroded yellow-white limestone at elevation 1150–1250 m a.s.l., clustering epiphyte on tall mossy trees, 27 September 2016, *L. Averyanov et al.*, CPC 8053 (LE).

***Dendrobium griffithianum*** Lindl., 1835, Bot. Reg. 21, tab. 1756.

Described from Myanmar (“Hab. in Regno Burmano supra arbores, ...”). **Syntypes** (“Wm. Griffith 1834”) – K000894344, K000894407.

**Habitat, phenology and conservation status.** Trunk and branch epiphyte. Primary humid broad-leaved evergreen and mixed forests on rocky karstic limestone. 1100–1170 m. Fl. July. Rare. Estimated IUCN Red List status – DD.

**Distribution.** Vietnam: Ha Giang (Bac Me district) and Tuyen Quang (Na Hang district) provinces. NE. India, Myanmar, Thailand.

**Notes.** This discovery represents one more East-Himalayan species in the flora of northern Vietnam. Its discovered location extends the known area of this species on about 500 km in E direction. Miniature ornamental species desirable for ornamental horticulture.

**Studied specimen.** Northern Vietnam, border area between Phiang Luong municipality (Ha Giang province, Bac Me district) and Sinh Long municipality (Tuyen Quang province, Na Hang district), primary broad-leaved humid evergreen and mixed forest on very steep slopes and along rocky ridge composed with solid crystalline highly eroded limestone at elevation 1100–1170 m a.s.l. around point 22°38'24.3"N 105°20'21.3"E, epiphyte on the old mossy tree, not common, 14 November 2014, *L. Averyanov et al.*, CPC 7431a / TM 1130 (LE).

***Dendrobium hekouense*** Z.J. Liu & L.J. Chen, 2011, Ann. Bot. Fennici. 48: 87, fig. 1, 2; Zhou *et al.*, 2016, Phytotaxa 276: 48.

### Fig. 3C

Described from southern China, SE. Yunnan (“China. Yunnan, Hekou, growing on tree trunk, alt. 1000 m, ...”). **Type** (“... 23.VIII.2008 Z.J. Liu 4093”) – NOCC (holotype).

**Habitat, phenology and conservation status.** No ecology information in Vietnam. Fl. in cultivation in July–August. Very rare. Estimated IUCN Red List status – DD.

**Distribution.** Vietnam: Ha Giang province (Bac Quang district). S. China (SE. Yunnan).

**Notes.** Unfortunately, discoverer of Vietnamese population did not provide any information about the species ecology in Vietnam. In one known location in China, it grew as a trunk epiphyte mostly on Fagaceae trees (species of *Castanopsis*, *Lithocarpus*, and *Quercus*), in primary evergreen, broad-leaved limestone

submontane subtropical forests at elevations 1000–2000 m a.s.l. The flowering period is from August to September, in the middle of the rainy season (Liu and Chen, 2011). Discovered species is a typical local endemic of the South Chinese floristic province accepted in the regional floristic regionalization (Averyanov *et al.*, 2003a, b). This is very attractive miniature plant highly desirable for ornamental horticulture. Specimens discovered in Vietnam look identical with plants from the Chinese type population (Fig. 3c). Authors of the species place it into section *Dendrobium*. To our opinion floral morphology of this species better fits with sect. *Breviflores* Hook.f.

**Studied specimen.** Northern Vietnam, Ha Giang province, Bac Quang district, 7 July 2017, *Nguyen Hoang Tuan*, HNU 021787 (HNU, LE).

***Dendrobium minusculum*** Aver., 2016, Turczaninowia 19, 3: 26, fig. 5, 6.

### Fig. 3D & E

Described from NE. Laos (“Xiangkhouang province, Peak district, Oran village, primary and secondary broad-leaved evergreen dry forest on shale-sandstone slopes and along ridge edge at elevation 1750–1850 m a.s.l., clustering epiphyte on the tall tree, rare”). **Type** (“2 April 2015, *Nguyen Tien Hiep*, *L. Averyanov*, *Nguyen Sinh Khang*, *Nguyen Quang Hieu*, *T. Maisak*, *Pheng Phengsintham*, LA-VN 925”) – LE (holotype), HNL, FOF (isotypes).

**Habitat, phenology and conservation status.** Brunch and canopy clustering epiphyte. Primary broad-leaved evergreen forests on silicate rocks. Fl. September–October. Very rare. Estimated IUCN Red List status – DD.

**Distribution.** Vietnam: Kon Tum province (Ngoc Linh Mountains). NE. Laos.

**Notes.** This is typical endemic of eastern Indochina occurring in highlands of Laos and Vietnam.

**Studied specimen.** S. Vietnam, Kon Tum province, Ngoc Linh Mountains, *Nguyen Van Canh*, s.n., herbarium voucher specimen prepared in 12 October 2016, *Nguyen Van Canh*, *L. Averyanov*, *T. Maisak*, AL 251a (LE).

***Dendrobium stuposum*** Lindl., 1838, Bot. Reg. 24 (Misc.): 52; Seidenfaden, 1985, Opera Bot. 83: 93, fig. 54; Pearce, Cribb, 2002, Orch. Bhutan: 416; Chen *et al.*, 2009, Fl. China 25: 389; Zhou *et al.*, 2016, Phytotaxa 276: 50.

### Fig. 3F

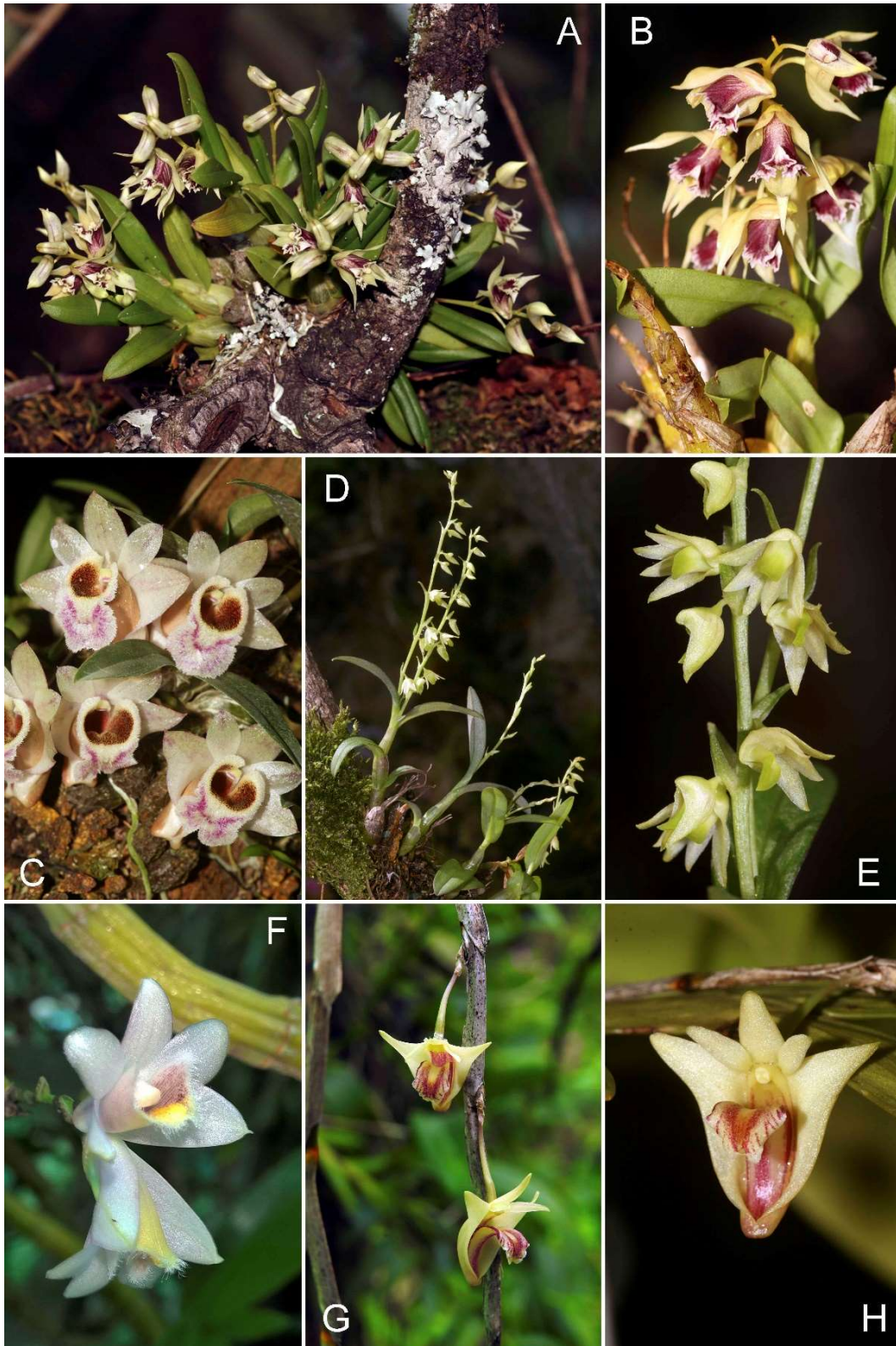
Described from India (“A native of India ...”). **Type** (“India, cult. *Loddiges s.n.*”) – K-LINDL.

= *Dendrobium exsculptum* Teijsmann et Binnendijk, 1862, Natuurk. Tijdschr. Ned.-Indië 24: 316.

Described from Java (“Habit. in sylvis mont. Pantjar prope Bogor, ins. Javae”). **Lectotype** – Ic. (“*Dendrobium exsculptum* T. et B.”) – L2096147, designated here.

= *Dendrobium flavidulum* Ridl. ex Hook.f., 1890, Fl. Brit. India 6: 185. Described from Singapore (“Singapore; at Kranji, in Mangrove swamps ...”). **Type** (“*Ridley*”) – BM000038253.

= *Dendrobium pristinum* Ames, 1915, Orchidaceae 5: 133.



**Fig. 3.** New orchids in the flora of Vietnam. **A, B** – *Dendrobium eriiflorum* Griff. (L. Averyanov *et al.*, CPC 8053). **C** – *Dendrobium hekouense* Z.J. Liu & L.J. Chen (plants from the type population). **D, E** – *Dendrobium minusculum* Aver. (Nguyen Van Canh, L. Averyanov, T. Maisak, AL 251a). **F** – *Dendrobium stuposum* Lindl. (Nguyen Van Canh, s.dt, s.n.). **G, H** – *Dendrobium truongcuongii* Aver. & Canh (type, Nguyen Van Canh, L. Averyanov, T. Maisak, AL 339). Photos by L. Averyanov (A–E, H) and Nguyen Van Canh (F, G), design and correction by L. Averyanov.



Described from the Philippines ("Luzon, Rizal Province, Maximo Ramos Bur. Sci. 3041. Flowered at Manila, August 19, 1907"). **Type** ("Aug. 19, 1907 *Maximo Ramos*") – HUH (00090287).

= *Dendrobium spegidoglossum* Rchb.f., 1854, Bonplandia 2: 88; Comber, 1990, Orch. Java: 235; id., 2001, Orch. Sumatra: 636; Seidenfaden, Wood, 1992, Orch. Penins. Malaysia Singapore: 393, fig. 177a-d; Seidenfaden, 1985, Opera Bot. 83: 93, fig. 55.

Described from NE. India ("... Ostindien ..."). **Type** – W?

**Habitat, phenology and conservation status.** Trunk and branch epiphyte. Primary broad-leaved evergreen forests on any kind of parental rocks. Fl. June–July. Rare. Estimated IUCN Red List status – DD.

**Distribution.** Vietnam: Son La (sine loc.), Ha Giang (Bac Quang district), Dac Lak (sine loc.) and Lam Dong (Da Nhim and Lac Duong districts) provinces. Bhutan, NE. India, Myanmar, S. China (S. Yunnan), Thailand, Indonesia, Philippines.

**Notes.** This is not a much surprising discovery of quite widespread species overlooked in botanical inventories in Vietnam for a long time due to its small, rather unattractive flowers.

**Studied specimens.** Northern Vietnam, Son La province, 2016, *Vo Van Cong, s.n.*, herbarium specimen prepared from cultivated plants in 13 October 2016, *L. Averyanov, T. Maisak, AL 254* (LE). Northern Vietnam, Ha Giang province, Bac Quang district, evergreen forest, epiphyte at elevations 1200–1400 m a.s.l., 23 June 2017, *Bui Duc Nam & Nguyen Hoang Tuan, s.n.* (photo – LE). Southern Vietnam, Dac Lak area, *Nguyen Van Canh, s.d., s.n.* (LE – photo). Southern Vietnam, Lam Dong province, Da Nhim – Lac Duong, 18 June 2017, *Nguyen Phi Tam s.n.* (LE).

***Dendrobium truongcuongii* Aver. & Canh, sp. nov.**

**Figs. 3G, H & 4**

Described from southern Vietnam. **Type** ("19 October 2017, *Nguyen Van Canh, L. Averyanov, T. Maisak, AL 339*") – LE (holotype), prepared from the plant collected on 20 August 2017 in Bidoup Mountains, Lam Dong province, and cultivated privately in Buon Ma Thuot town by *Nguyen Van Canh, s.n.*

**Etymology.** Species epithet refers the name of the plant discoverer, officer of Bidoup Nui Ba National Park, Truong Quang Cuong.

**Description.** Clustering branch epiphyte. Stem yellowish, clustering on short rhizome, erect and arching, slender, not swelling, laterally compressed, to (30)40–60(70) cm long, 3–4 mm in diam., unbranched, many-nodal, leafy in basal half, becoming leafless (or with rudimentary leaves) in upper part, internodes slightly widening toward apex, (1)1.5–2(2.5) cm long. Leaves sessile, rigid, leathery, laterally compressed, distichous, ascending, slightly overlapping or alternate, oblique narrowly triangular, acute, (1.5)2–2.5(3) cm long, (3)4–5(7) mm wide, base dilated into sheaths as long as leaf, embracing stem. Inflorescences lateral, arising from nodes on leafless, apical half of stem, 1-flowered; peduncle (1.5)2–2.5(3) mm long. Floral bracts papyraceous, triangular, 0.5–1 mm long. Pedicel and ovary light green, slightly curved, (8)10–11(12) mm long. Flowers widely opening, 8–10 mm across, white

with yellowish green tint, lip and column foot heavily speckled with purple, column yellowish-white, anther white. Median sepal narrowly ovate, obtuse, (6.8)7–7.5(7.7) mm long, (2.4)2.6–2.8(3) mm wide. Lateral sepals broadly oblique triangular, acute, as long as median sepal, (9.5)10–11(11.5) mm wide at base, connate laterally to column foot, distally connate each other forming short mentum 0.8–1 mm long, 2 mm broad. Petals oblong broadly lanceolate, little shorter and narrower than dorsal sepal, obtuse to blunt. Lip simple, movably joined to column foot apex, long clawed, strongly recurved, narrowly obdeltoid, (13.5)14–15(15.5) mm long, broadening to truncate or shallowly emarginate apex, (4.5)5(5.5) mm wide, apex margin strongly recurved to revolute; disk with no particular ornamentation. Column erect, very short and broad, 0.8–1 mm tall, 1.8–2 wide; column foot as broad as column, down directed, slightly curved, (9)10(11) mm long; anther cap oblate, slightly toothed at front. Fruit unknown.

**Habitat, phenology and conservation status.** Densely clustering branch epiphyte. Primary and secondary evergreen broad-leaved montane forest on granite. Fl. September–November. Rare. Estimated IUCN Red List status – DD.

**Distribution.** Vietnam: Lam Dong province (Bidoup Mountains). Endemic.

**Notes.** Our plant belongs to *D. sect. Aporum* (Blume) Blume and superficially looks close to *D. spatella* Rchb.f., widely distributed in mainland southeast Asia and very common in Vietnam. Meanwhile, it distinctly differs in larger flower, 8–10 mm across (vs. 6–7 mm across), sepals 6.8–7.7 mm long (vs. 3–5 mm long), lip long clawed, narrowly oblong obdeltoid, 13.5–15.5 mm long (vs. lip short-clawed, almost rhomboid, 4–5 mm long) and also in much longer column foot 9–11 mm long (vs. 2–2.5 mm long). The described plant also well differs from all other species of its section hitherto recorded in Indochina. However, it shows somewhat resemblance with *D. bilobulatum* Seidenf. and *D. terminale* C.S.P. Parish et Rchb.f. and theoretically may be a natural hybrid of any of these species and *D. spatella*.

***Dendrobium xichouense* S.J. Cheng & Z.Z. Tang, 1984, Acta Bot. Yunnan. 6: 280, fig. 1; Chen et al., 2009, Fl. China 25: 384; Zhou et al., 2016, Phytotaxa 276: 51.**

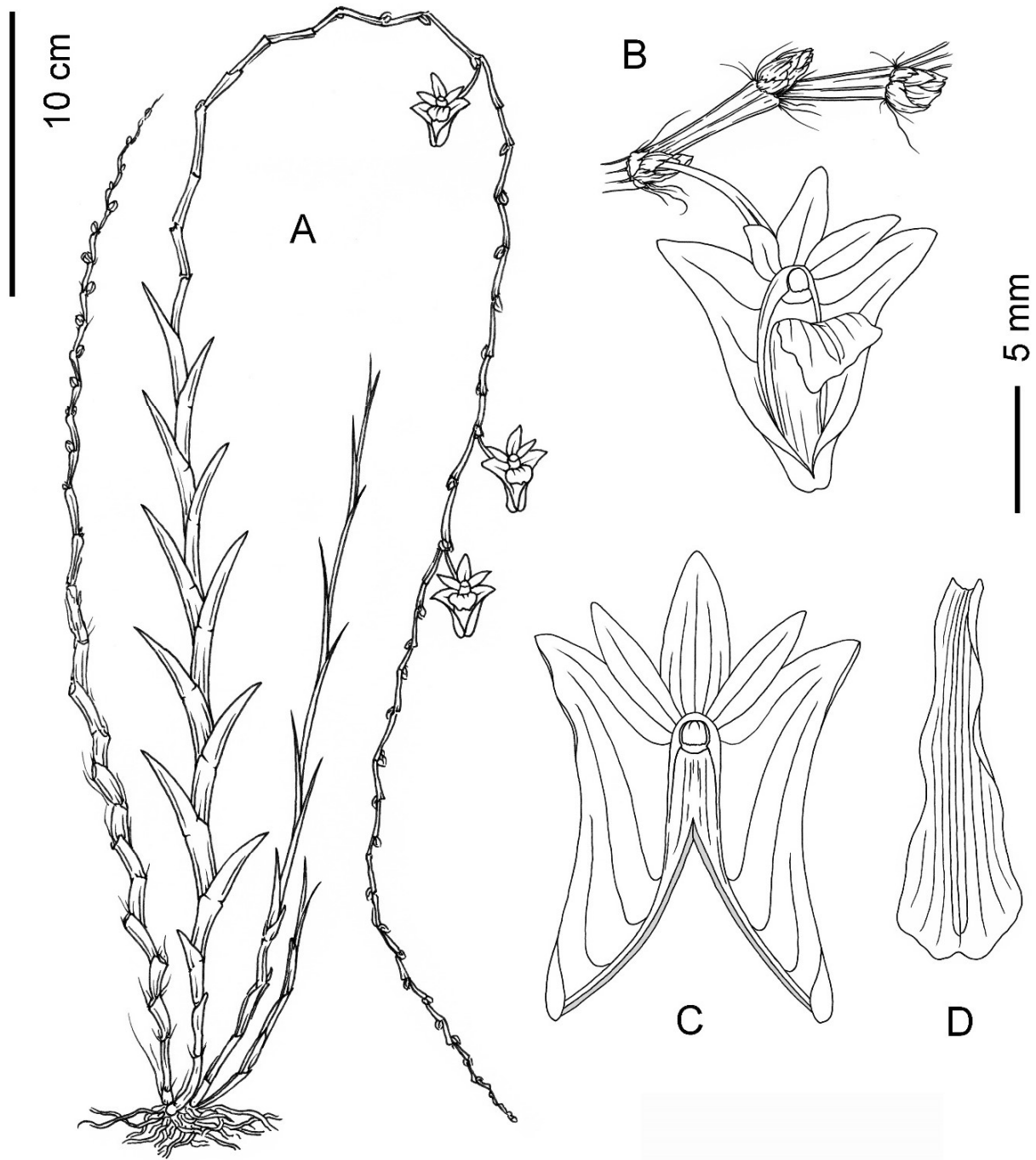
**Fig. 5A & B**

Described from southeastern Yunnan ("Yunnan: Xichou, Fadou Commune, Donzuncao, alt. c. 1900 m, on trees in the forest on lime-stone mountain, 20 VII 1982, *R.Z. Zhou 821192*"). **Type** – IBSC?

**Habitat, phenology and conservation status.** No information in Vietnam. Fl. in cultivation in September–October. Rare. Estimated IUCN Red List status – DD.

**Distribution.** Vietnam: Cao Bang province (sine





**Fig. 4.** New orchids in the flora of Vietnam. *Dendrobium truongcuongii* Aver. & Canh. **A**-Flowering plant. **B**- Apical portion of stem with flower. **C**- Flattened flowers with dissected mentum and removed lip, frontal view. **D**-Flattened lip, frontal view. All drawn from the type (AL 339) by L. Averyanov.



loc.). S. China (SE. Yunnan).

**Notes.** This species regarded earlier as a local endemic of SE. Yunnan, in fact, is very close to widespread, very variable *Dendrobium moniliforme* (L.) Sw. and may be regarded as its variety. This point of view is strongly supported by visual morphology and available data of molecular cladistics (Xiang *et al.*, 2013). Its type material probably lost (Chen *et al.*, 2009). Any information on species ecology in Vietnam is not yet available. In one location known in China, the plant grows as a trunk epiphyte in limestone broad-leaved evergreen mountain forests at an elevation about 1900 m a.s.l. (Chen *et al.*, 2009).

**Studied specimens.** **Northern Vietnam**, Hanoi area, wild-collected plant originated from the street market, 16 September 2016, *Nguyen Hoang Tuan, s.n.* (LE – photos). **Northern Vietnam**, Hanoi area, wild-collected plant originated from the street market, 16 September 2016, *Nguyen Phong, AL 213* (LE – photos). **Northern Vietnam**, Cao Bang province with no exact locality, 13 October 2016, *Vo Van Cong, L. Averyanov, T. Maisak, AL 252* (LE, LE – photos). The species also recorded as a medicinal plant occurring in Cao Bang province, Nguyen Binh district (Vu Nong and Tinh Tuc communes) and Bao Lac district (Khanh Xuan commune) with no citing of any voucher collections in some online resources (Nguyen, 2017).

*Eria lancifolia* Hook.f., 1890, Fl. Brit. India 5: 804, id., 1891, Icon. Pl. 21, tab. 2075.

#### Fig. 6

Described from Peninsular Malaysia (“Perak; at low elevations, *King’s Collector*”). **Type** (“Perak, 300–500 ft. July 1885 *King’s Collector 7927*”) – K000364361.

**Habitat, phenology and conservation status.** Clustering sympodial epiphyte and lithophyte. Primary evergreen broad-leaved lowland forests. 500–550 m. Fl. August–September. Very rare. Estimated IUCN Red List status – DD.

**Distribution.** Vietnam: Kien Giang province (Phu Quoc Island). Southern Thailand, Peninsular Malaysia.

**Notes.** This is very rare, insufficiently known species for many years was regarded as a local endemic of the middle part of Malay Peninsula. Its present discovery in Phu Quoc Island of southern Vietnam distant at about 600 km to the NNE direction crossing Siam Gulf. It demonstrates well connections of the flora of Malay Peninsular and the coastal mountain flora of southern Vietnam.

**Studied specimen.** **Southern Vietnam**, Kien Giang province, Phu Quoc Island, Phu Quoc National Park, Nui Chua Mountain, evergreen forest at elevation 500–520 m a.s.l., epiphyte and lithophyte, 23 August 2017, *Truong Ba Vuong s.n.*, voucher herbarium specimen prepared in 16 October 2017, *L. Averyanov, T. Maisak, AL 394* (LE). Plate – d-EXSICCATES OF VIETNAMESE FLORA 0300/AL 394 (Fig. 6).

*Eria xanthocheila* Ridl., 1907, Mat. Fl. Malay. Penins. 1: 102; Seidenfaden, 1982, Opera Bot. 62: 119, fig. 72, pl. 9a; Comber, 1990, Orch. Java: 179, fig., id., 2001, Orch. Sumatra: 488, fig.; Seidenfaden, Wood, 1992, Orch. Penins. Malaysia Singapore: 303, fig. 131f, g, pl. 19a; Wood, Cribb, 1994, Checklist Orch. Borneo: 219.

#### Fig. 7

Described from Peninsular Malaysia (“Selangor: near Klang (Ridley 10272). Endemic”). **Type** (“Ridley, H.N. 10272”) – SING0048275.

**Habitat, phenology and conservation status.** Clustering sympodial epiphyte and lithophyte. Primary evergreen broad-leaved lowland forests. 500–550 m. Fl. August–September. Very rare. Estimated IUCN Red List status – DD.

**Distribution.** Vietnam: Kien Giang province (Phu Quoc Island). Peninsular Myanmar, Peninsular Thailand, Malaysia, Sumatra, Java, Borneo, Philippines.

**Notes.** This is one another species having the wide distribution in eastern Malesia and found in Vietnam at first. Like previous species, it illustrates the fairly close connection of coastal montane floras of southeastern Indochina with the true flora of eastern Malesia.

**Studied specimen.** **Southern Vietnam**, Kien Giang province, Phu Quoc Island, epiphyte or lithophyte among mosses, under an evergreen forest of Nui Chua mountain, on the territory of Phu Quoc National Park, at elevation 500–520 m a.s.l., uncommon, 28 August 2017, *Le Minh Dung, Truong Ba Vuong s.n.* voucher herbarium specimen prepared on 16 October 2017, *L. Averyanov, T. Maisak, AL 395* (LE). Plate – d-EXSICCATES OF VIETNAMESE FLORA 0301/AL 395 (Fig. 7).

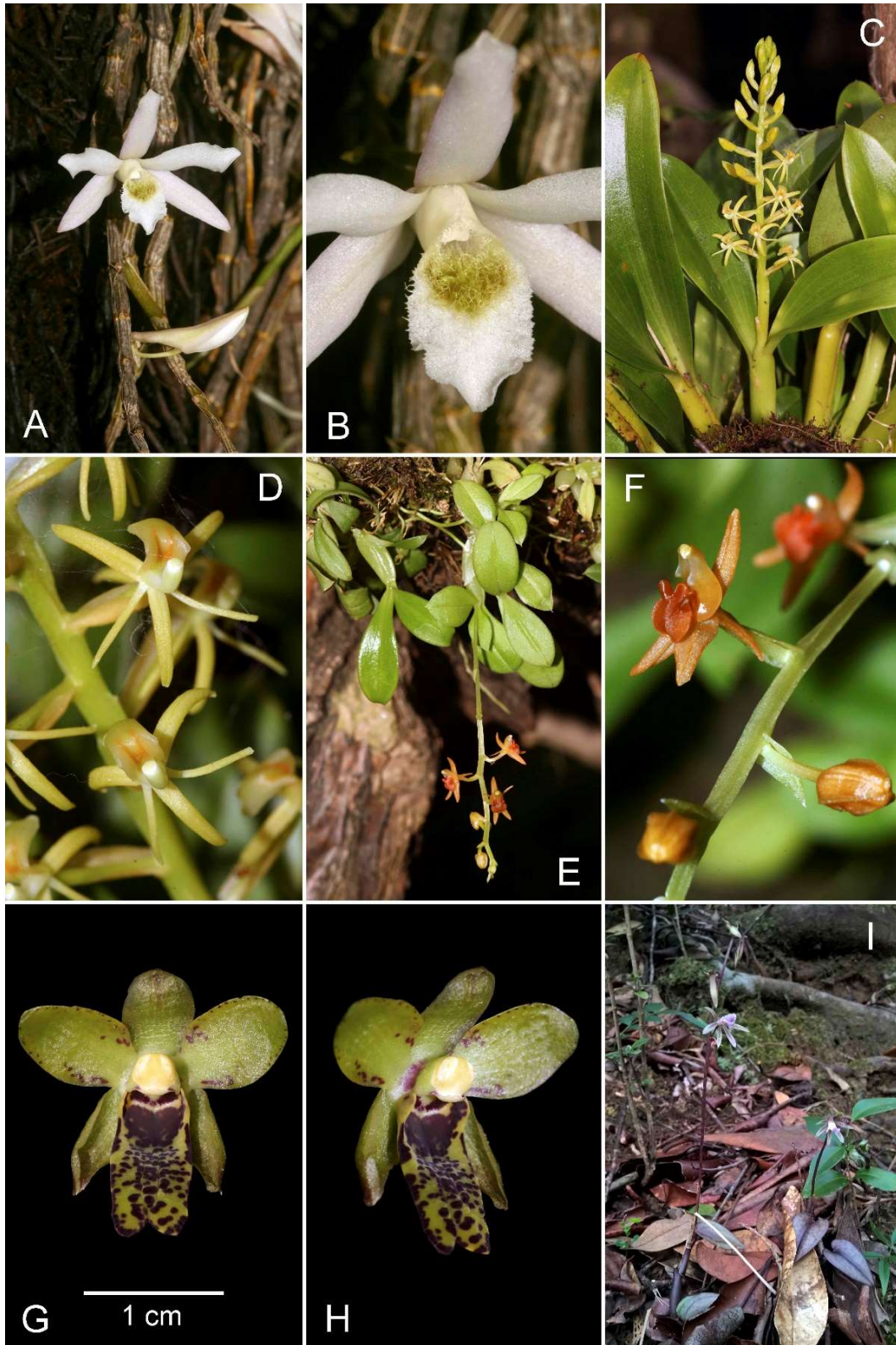
#### *Gastrodia khangii* Aver., *sp. nov.*

#### Fig. 8

Described from northern Vietnam. **Type** (“Vietnam, Son La province, Van Ho district, Van Ho commune, Hua Tat village, around point 20°46′21.7N 104°47′47.5E, dense bamboo forest on alluvial slope of remnant mountain composed with highly eroded karstic light gray marble-like limestone at elevation about 1100 m a.s.l., terrestrial achlorophyllous mycotrophic tuberiferous herb, flowers dark brown, lip and column wings red, column itself, anther and lip calli white, rare, 2 October 2016, *L. Averyanov, Nguyen Tien Hiep, Nguyen Sinh Khang, Chuong Quang Ngan, T. Maisak, Nguyen Thanh Son, CPC 8240*”) – LE (holotype), Herbarium of the Center for Plant Conservation (isotype). Digital epitype – d-EXSICCATES OF VIETNAMESE FLORA 0264/CPC 8240 (Fig. 8).

**Etymology.** The species is named in honor of its discoverer, Dr. Nguyen Sinh Khang.

**Description.** Terrestrial tuberiferous leafless achlorophyllous mycotrophic perennial herb. Tubers more or less plagiotropic, cylindrical to fusiform, (2)3–5(6) cm long, (0.5)0.6–1(1.2) cm in diam., fleshy, pale brown, rootless, hairy, covered with many small triangular, acute, thin, papyraceous scales. Stem erect, fleshy, glabrous, soft, straight or slightly flexuose, white to light yellowish-brown, (4.5)5–8(10) cm tall, (3.5)4–5(6) mm thick, with (3)4–7(8) distant, tubular, scarious, obtuse bracts, 5–7 mm long densely adpressed to the stem, rootless at the base. Inflorescence terminal subdense raceme with (2)3–8(9) close flowers; rachis fleshy, straight, (0.8)1–4.5(5.5) cm long. Floral bracts white to



**Fig. 5.** New orchids in the flora of Vietnam. **A, B** – *Dendrobium xichouense* S.J. Cheng & Z.Z. Tang (Vo Van Cong, L. Averyanov, T. Maisak, AL 252). **C, D** – *Liparis condylobulbon* Rchb.f. (Nghiem Xuan Son, L. Averyanov, T. Maisak, AL 302). **E, F** – *Liparis tenuis* Downie (L. Averyanov *et al.*, CPC 7581b/TM 1183). **G, H** – *Luisia teres* (Thunb.) Blume (L. Averyanov *et al.*, CPC 7504 / TM 1185a). **I** – *Nephelaphyllum thaovya*e Aver. & Canh (type, Nguyen Van Canh, AL 330). Photos by L. Averyanov (**A-H**) and Nguyen Van Canh (**I**), design and correction by L. Averyanov.



Fig. 6. New orchids in the flora of Vietnam. *Eria lancifolia* Hook.f. Plate – EXSICCATES OF VIETNAMESE FLORA 0300/AL 394. All photos by Truong Ba Vuong, design and correction by L. Averyanov.



**Fig. 7.** New orchids in the flora of Vietnam. *Eria xanthocheila* Ridl. Plate – d-EXSICCATES OF VIETNAMESE FLORA 0301/AL 395. All photos by Truong Ba Vuong, design and correction by L. Averyanov.



Fig. 8. New orchids in the flora of Vietnam. *Gastrodia khangii* Aver. Digital epitype – d-EXSICCATES OF VIETNAMESE FLORA 0264/CPC 8240. All photos, design and correction by L. Averyanov.



light yellowish-brown, triangular-ovate, acute, (4)5–9(11) mm long, 1.5–2 mm wide. Pedicel and ovary during anthesis (1.2)1.4–1.8(2) cm long, ovary obconoid, (3.5)4–6(6.5) mm in diam. at apex, light brownish, longitudinally ribbed; pedicel in fruit erect, terete, white to light pink-brownish, elongate to 6–8(10) cm long, (2)2.5–3.5(4) mm in diam. Flowers bell-shaped, nodding, not widely opening, fleshy, glossy, dark brown; tepals connate on 2/3 forming broad verruculose perianth tube (1.6)1.8–2(2.2) cm long, (0.8)1–1.2(1.3) cm broad, slightly flattened from adaxial side. Sepals subsimilar, oblong ovate, (1.6)1.8–2(2.2) cm long, (0.7)0.8–0.9(1) cm wide, free apex triangular, very fleshy, verruculose, straight to slightly incurved, (5)6–7.5(8.5) mm long and broad. Petals light brown, thin, broadly ovate, almost flat, (2.6)2.8–3.2(3.4) mm long and wide, twice shorter than free sepal apices. Lip entire, flat, orange-brown with red base, narrowly triangular deltoid, adnate to the apex of short column foot, (10)11–12(13) mm long, (5.2)5.5–6(6.2) mm wide, white hairy on flanges, with roundish, straight or recurved apex; disc at the base with 2 massive, irregularly lobed, glossy white calli 2–3 mm across, in apical half with white keel rising apically. Column dorsally dull brownish, white at front, stout, slightly curved, (10.5)11–12(12.5) mm tall, (1.7)1.8–2(2.1) mm wide, with thin broad red lateral wings; apex simple with no stelia; stigma at column base, ovate, convex, yellow-brown, 1.4–1.6 mm across; column very short, 2–3 mm long, at straight angle to column base. Anther cup white, hemispheric, about 0.7–0.8 mm across. Pollinia 2, granular-farinaceous, with no caudicles. Fruits cylindrical, straight or slightly curved, light brownish erect capsule (2)2.5–3(3.5) cm long, (4.5)5–6(7) mm in diam., finely longitudinally ribbed.

**Habitat, phenology and conservation status.**

Terrestrial achlorophyllous tuberiferous herb. Old shady secondary bamboo forests on alluvial slopes of remnant karstic limestone mountains, commonly in small depressions with soils rich in humus. 1100 m. Fl. September–October. Very rare. Estimated IUCN Red List status – DD.

**Distribution.** Vietnam: Son La province (Van Ho district). Endemic.

**Notes.** Species belongs to the group of dwarf unattractive species with rather small, dark brown, finely verruculose, campanulate flowers often hardly visible among leaf litter. This group in Southeast Asia includes such similar, more or less related species as *Gastrodia abscondita* J.J. Sm. (Java), *G. appendiculata* C.S. Leou et N.J. Chung (Taiwan), *G. confusa* Honda et Tuyama (Korea, Ryukyu Islands, Taiwan), *G. confusoides* T.C. Hsu *et al.* (Taiwan), *G. crispa* J.J. Sm. (Java), *G. fontinalis* T.P. Lin (Taiwan), *G. nipponica* (Honda) Tuyama (Japan), *G. shimizuana* Tuyama (Ryukyu Islands, Taiwan), *G. theana* Aver. (Vietnam) and *G. verrucosa* Blume confirmed for Java, Sumatra (Ong,

2015). From all these species our plant distinctly differs in narrowly triangular lip long hairy on flanges, very large, irregularly lobed lip calli, and simple flat alate column with no apical stelia. From *Gastrodia pubilabiata* Sawa (Sawa, 1980) and *G. shimizuana* Tuyama (Chung and Hsu, 2006; Suetsugu *et al.*, 2012) distributed mainly in Japan and Taiwan (Asian species of the genus with a similarly pubescent lip) new species differs in the narrow lip, simple column, connivent (newer recurved) perianth lobes and verruculose perianth tube. Like almost all mentioned species, our plant inhabits secondary humid shady bamboo forests and has pedicels much elongated during fruit formation.

***Geodorum terrestre* (L.) Garay, 1997, Harvard Pap. Bot. 2: 47. – *Epidendrum terrestre* L., 1759, Syst. Nat. ed. 10 2: 1246.**

**Fig. 9**

Described from Java (“Rumph. amb. 6. t. 52. f. I.”). **Type** – LINN 1062.19

= *Geodorum citrinum* Jacks., 1811, Bot. Repos. 10, tab. 626; Seidenfaden, 1983, Opera Bot. 83: 55, fig. 28, pl. 2c; Wood, Seidenfaden, 1992, Orch. Penins. Malaysia Singapore: 545, fig. 247, f-i.

Described from Malay Peninsula (“... discovered in Pulo-Pinang, or Prince of Wales’s Island...”). **Type** – (herbarium hardly exist).

**Habitat, phenology and conservation status.**

Terrestrial tuberiferous herb. Lowland open secondary evergreen broad-leaved forest, woodlands, and scrub on alluvial soils. 400 m. Fl. March–May, October–November. Rare. Estimated IUCN Red List status – LC.

**Distribution.** Vietnam: Dak Lak province (Buon Don district). NE. India, Bangladesh, Myanmar, Thailand, Malaysia, Sunda Islands, the Philippines, New Guinea, northern Australia, tropical Pacific islands.

**Notes.** The discovery of this species in Vietnam is not too surprising as it has very broad distribution in tropical Asia.

**Studied specimen.**

**Southern Vietnam,** Dak Lak province, Buon Don district, Yok Don National Park, Dipterocarp forests at an elevation about 400 m a.s.l., 24 April 2017, *Chu Xuan Canh, Nguyen Van Canh, Nguyen Hoang Tuan, s.n.* (LE). Plate – d-EXSICCATES OF VIETNAMESE FLORA 0285/*Chu Xuan Canh, Nguyen Van Canh, Nguyen Hoang Tuan, s.n.* (Fig. 9). **Northern Vietnam,** sine loc., herbarium prepared from wild collected plants cultivated in Hanoi by *Nguyen Minh Duc*, 25 October 2017, *L. Averyanov, T. Maisak, AL 402* (LE.)

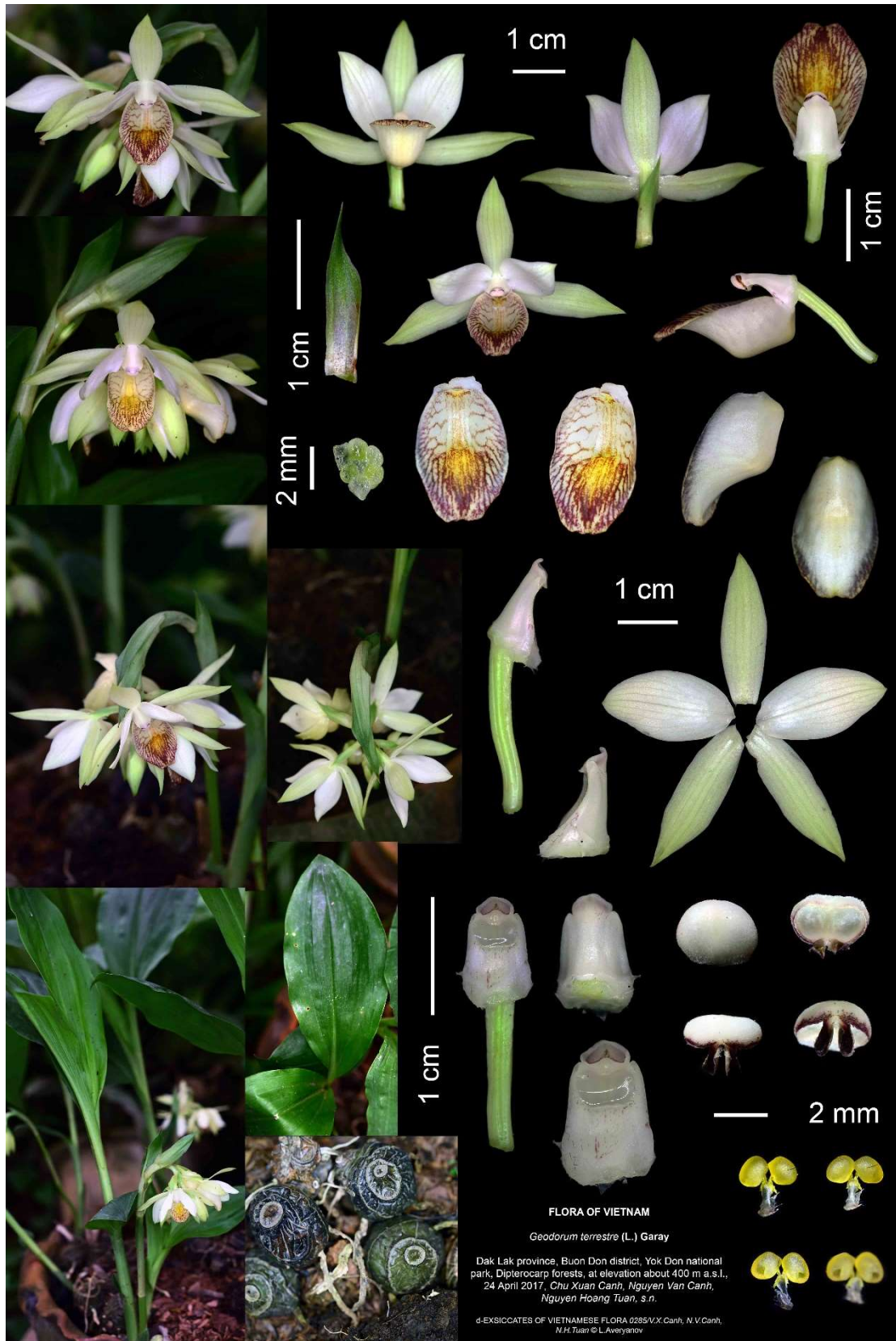
***Liparis condylobulbon* Rchb.f., 1862, Hamburger Garten-Blumenzeitung 18: 34; Seidenfaden, 1976, Dansk Bot. Arkiv 31, 1: 70, fig. 44; Comber, 1990, Orch. Java: 140, fig.; id., 2001, Orch. Sumatra: 152, fig.; Wood, Cribb, 1994, Checklist Orch. Borneo: 92; Chen *et al.*, 2009, Fl. China 25: 224; Zhou *et al.*, 2016, Phytotaxa 276: 83; Lin *et al.*, 2016, Taiwania 61, 2: 105.**

**Fig. 5C & D**

Described from Java (“Java”). **Type** (“Feb. 1862, *Schiller s.n.*”) – W (Herb. *Reichenbach 46205*).

**Habitat, phenology and conservation status.**

Clustering trunk and branch epiphyte, or lithophyte. Rather open submontane evergreen broad-leaved and coniferous forests at elevations 1200–1400 m. Fl.



**Fig. 9.** New orchids in the flora of Vietnam. *Geodorum terrestre* (L.) Garay. Plate – d-EXSICCATES OF VIETNAMESE FLORA 0285/Chu Xuan Canh, Nguyen Van Canh, Nguyen Hoang Tuan, s.n. All photos by Nguyen Hoang Tuan, design and correction by L. Averyanov.





September–November. Very rare. Estimated IUCN Red List status – DD.

**Distribution.** Vietnam: Lam Dong province (Dalat town area). Myanmar, Thailand, Taiwan, Indonesia, New Guinea, Moluccas, Sulawesi, Philippines, Solomon Islands, Australia, New Caledonia, tropical Pacific Islands.

**Notes.** This is the first, but a not surprising record of the species very common in southwestern Indochina and Malaysia. In Vietnam, this species according to available data is very rare. This species was also found in Taiwan (Lin, 1976, Lin *et al.*, 2016).

**Studied specimen.** Southern Vietnam, Lam Dong province, Prenn waterfall, 17 October 2017, *Nghiem Xuan Son, L. Averyanov, T. Maisak, AL 302* (LE).

***Liparis tenuis*** Downie, 1925, Bull. Misc. Inform. Kew 1925: 372; Seidenfaden, 1976, Dansk. Bot. Ark. 31, 1: 94, fig. 64. **Fig. 5E & F**

Described from northwestern Thailand (“Doi Suthep 3200 ft.”). **Type** (“*Kerr 250*”) –K000596220 (lectotype, proposed here), K000596221 (isolecotype).

– *Liparis tenuis* auct. non Downie: Aver., Averyanova, 2005, Turczaninowia 8, 1: 76, tab. 2a (= *L. filiformis* Aver., 2013, Turczaninowia 16, 1: 102, Fig. 52k-n); Aver. *et al.*, 2016, Turczaninowia 19, 2: 42, fig. 4I; 5A-C (= *L. delicatula* Hook. f.).

**Habitat, phenology and conservation status.** Primary broad-leaved, mixed and coniferous evergreen humid forest on rocky crystalline karstic limestone. 1500–1550 m. Fl. in culture February–June. Very rare. IUCN Red List status – DD.

**Distribution.** Vietnam: Cao Bang province (Bao Lac district). NW. Thailand.

**Notes.** For a long time, this miniature species was regarded as a local endemic of Doi Suthep Mountains at northwestern Thailand. Discovered population in northern Vietnam expands known area of this species about 1000 km to the northeastern direction. Some specimens identified earlier as *L. tenuis* (Averyanov and Averyanova, 2005, Averyanov *et al.*, 2016) belong in fact to *L. filiformis* Aver. and *L. delicatula* Hook.f.

**Studied specimen.** Northern Vietnam, Cao Bang province, Bao Lac district, Hong An municipality, Mi Lung village, primary broad-leaved and mixed humid evergreen forest (with *Podocarpus*, *Pinus*, *Fokienia*, and *Tsuga*) on very steep slopes and along rocky ridge composed with solid crystalline highly eroded limestone at elevation 1500–1550 m a.s.l. around point 22°49′15.4″N 105°49′53″E, canopy epiphyte on mossy tree on shady, humid slope, Rare, 21 November 2014, fl. 10 May 2016 and 1 March 2017, *L. Averyanov, Nguyen Tien Hiep, Nguyen Sinh Khang, T. Maisak, L. Osinovetz, CPC 7581b/TM 1183* (LE).

***Luisia teres*** (Thunb.) Blume, 1849, Rumphia 4: 50; Chen *et al.*, 2009, Fl. China 25: 489; Zhou *et al.*, 2016, Phytotaxa 276: 87; Lin *et al.*, 2016, Taiwania 61, 2: 108. – *Epidendrum teres* Thunb. in J.A. Murray, 1784, Syst. Veg., ed. 14: 818. **Fig. 5G, H.**

Described from Japan (“Thunb. Jap. Mfpt. M.”). **Type** (“*E. Japonia*. Thunberg”) – UPS-THUNB 21386.

**Habitat, phenology and conservation status.** Trunk and branch epiphyte. Primary broad-leaved and mixed humid evergreen forest on rocky crystalline karstic limestone. 1500–1550 m a.s.l. Fl. in culture February–March. Occasional. Estimated IUCN Red List status – DD.

**Distribution.** Vietnam province: Cao Bang (Bao Lac district). Korea, southern mainland China (Guangxi, Guizhou, Sichuan, Yunnan), Taiwan, Japan.

**Notes.** This is not much surprising discovery slightly expanding known area of the species distribution to southern direction.

**Studied specimen.** Northern Vietnam, Cao Bang province, Bao Lac district, Hong An municipality, Mi Lung village, primary broad-leaved and mixed humid evergreen forest on very steep slopes and along rocky ridge composed with solid crystalline highly eroded limestone at elevation 1500–1550 m a.s.l. around point 22°50′01.3″N 105°50′05.7″E, epiphyte, occasional, 20 November 2014, *L. Averyanov, Nguyen Tien Hiep, Nguyen Sinh Khang, T. Maisak, L. Osinovetz, CPC 7504 / TM 1185a*, fl. on 7 March 2018 (LE).

***Nephelaphyllum thaovya*** Aver. & Canh, *sp. nov.*

**Figs. 5I; 10A, B & 11**

Described from southern Vietnam. **Type** (“Dak Lak province, M Drak district, Chu Mu Mountain, evergreen broad-leaved forest on granite rocks at elevation 1000–1200 m a.s.l., common, flowers whitish, lip with purple marks, 10 August 2017, *Nguyen Van Canh, AL 330*”) – LE (holotype).

**Etymology.** Distinguished orchid explorer from Ban Me Thuot town of southern Vietnam, Nguyen Van Canh discovered this species named it after his beloved daughter, Thao Vy.

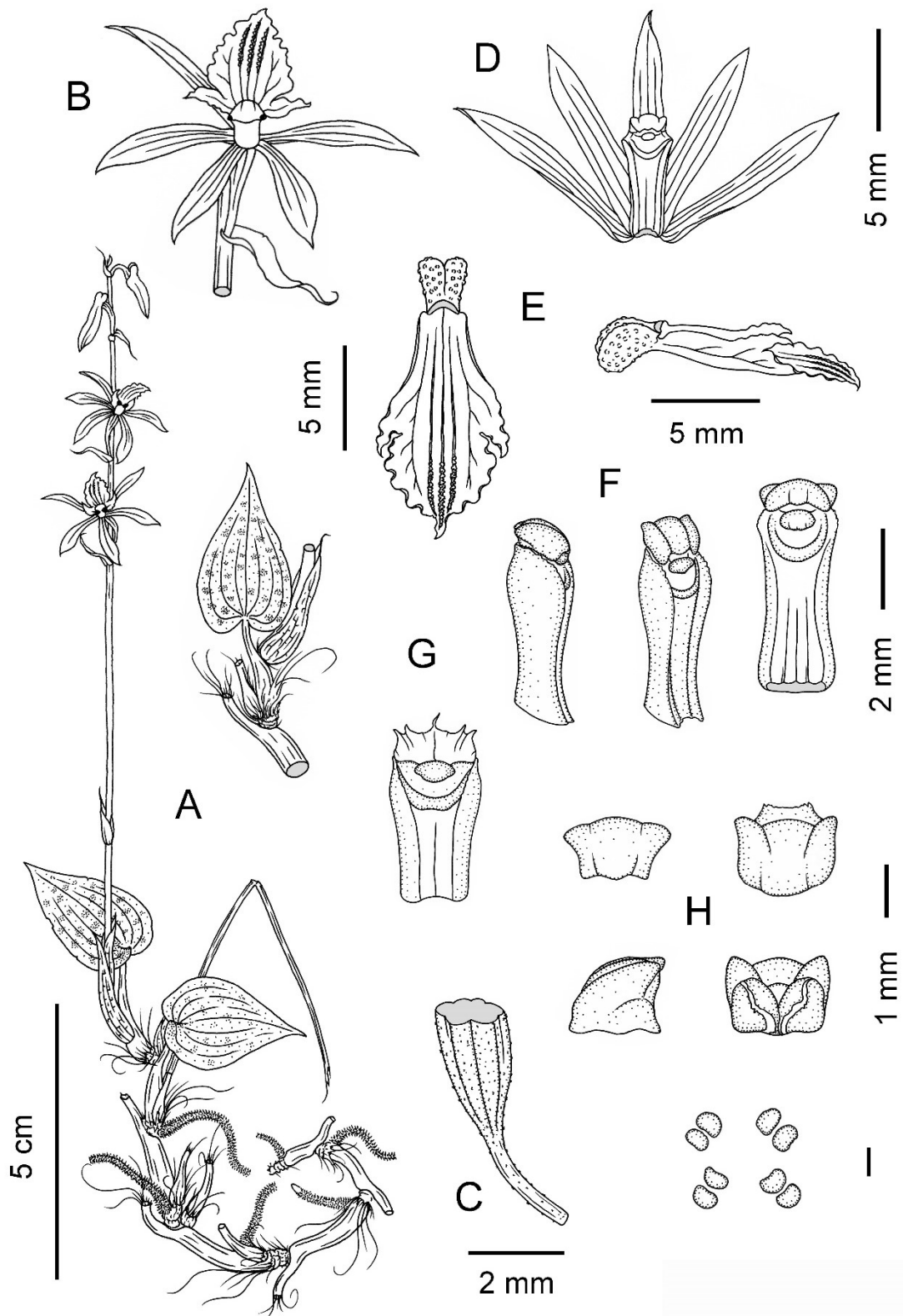
**Description.** Small terrestrial herb with the short creeping rhizome-like stem. Stem flexuose, (4)6–10(12) cm long, composed with several cylindrical or fusiform, oblique pseudobulbs sympodially arising from the oblique apical part of each other. Pseudobulbs 1-leaved, dull violet to pale brownish-violet, fleshy, smooth, ascending, (1.2)1.5–2.5(2.8) cm long, (2.5)3–4(5) mm in diameter, with narrowing oblique petiole-like apical part, young covered by scarious-papyraceous sheath, old naked with few fibrous remains and 1(2) villous roots at the base. Leaves sessile, joined to apex of petiole-like apical part of pseudobulb, which is terete, fleshy, erect to oblique, (4.5)5–7(7.5) mm long, 1–1.2 mm in diameter; leaf blade narrowly cordate, (2)2.5–3(3.5) cm long, (1.2)1.5–1.7(2) cm wide, somewhat fleshy, pale gray-violet, mottled with darker, unclear, dull violet spots, with prominent median vein, acute, straight along the margin. Inflorescence arising from pseudobulb apex, sheathed at the base, erect slender raceme, apically with (1)2–4(5) spirally arranged, lax flowers; peduncle thin, glabrous, (5)6–8(10) cm long, dull purple-violet to pale purple-brownish, with (1)2–3(4) persistent, membranous, well distant, narrowly triangular, acute, sterile bracts; rachis (0.8)1–4(4.5) cm long, straight, purple-violet.



Fig. 10. New orchids in the flora of Vietnam. **A, B** – *Nephelaphyllum thaovya* Aver. & Canh (type, *Nguyen Van Canh*, AL 330). **C, D** – *Porpax ustulata* (E.C. Parish & Rchb.f.) Rolfe (*Nguyen Van Canh* s.n.). All photos by Nguyen Van Canh, design and correction by L. Averyanov.

Floral bracts horizontally directed, yellowish membranous to papyraceous, narrowly triangular acuminate, (4.5)5–7(10) mm long 1–1.5 mm wide. Pedicel and ovary (3.5)4–5(6) mm long, hairy with sparse scurfy dirty-brownish short hairs, pedicel (2.2)2.5–3(3.2) mm long terete, 0.25–0.3 mm in diameter, ovary obconoid, (1.6)1.8–2(2.2) mm long, (0.9)1–1.2(1.3) mm in diameter, longitudinally grooved. Flowers not resupinate, widely opening, (1.4)1.6–1.8(2) cm across. Sepals and petals subsimilar, dull yellowish, with 3 pale violet veins, spreading, broadly lanceolate, (8)9–10(11) mm long,

(1.7)1.8–2(2.1) mm wide, acute to shortly apiculate, with sparse scurfy hairs on adaxial surface. Lip immobile, broadly attached to column base, almost parallel to column, 3-lobed, finely hairy in basal part, shortly spurred; lip blade white with 3 purple-violet nerves and few purple marks on sides, flat or slightly concave, rather straight, narrowly obovate in outline, (9.5)10–11(11.5) mm long, (5.5)6–6.5(7) mm wide, wavy or crispy along the margin; side lobes triangular falcate, erect, forward directed acute to acuminate, 2–3 mm long; median lobe broadly ovate, (3.8)4–4.2(4.4) mm long and wide, acute to apiculate,



**Fig. 11.** New orchids in the flora of Vietnam. *Nephelaphyllum thaovyaе* Aver. **A** – Flowering plant and leaf with pseudobulbs. **B** – Intact flower with floral bract. **C** – Pedicel and ovary. **D** – Flattened flower, with lip removed. **E** – Lip, frontal and side views. **F** – Intact column, side, half side and frontal views. **G** – Column apex with operculum and pollinia removed, frontal view. **H** – Operculum, frontal view, view from above, side view and view from below. **I** – Full set of pollinia. All drawn from the type – AL 330 by L. Averyanov.



with 3 low parallel, verruculose keels in apical half; disk flat, with no ornamentation; spur pale olive-brownish with violet tint, saccate, slightly flattened, (1.8)2–2.2(2.3) mm long, 1.4–1.6 mm in diameter, with 2 hemispheric lobes at apex, finely verruculose. Column white, erect, simple, (3.4)3.5–3.8(4) mm tall, (0.9)1–1.2(1.3) mm wide, finely crenulate at apical sides, footless. Operculum white to very light yellowish, subquadrate, at front truncate, 2-locular, (1.1)1.2–1.4(1.5) mm tall, long and wide, slightly flattened, with 2 low lateral conical deep purple horns at apex. Pollinia 8 in 4 groups of 2, rather soft, with no caudicles, stipe, or viscidium. Fruits unknown.

**Habitat, phenology and conservation status.** Creeping terrestrial herb. Evergreen broad-leaved humid forests on granite. 1000–1200 m a.s.l. Fl. July–August. Very rare. Estimated IUCN Red List status – DD.

**Distribution.** Vietnam: Dak Lak province (M'Drak district, Chu Mu Mountain). Endemic.

**Notes.** New species differs well from its known congeners in broad flat or slightly concave lip having no prominent keels or any other ornamentations. In general habit, our plant solely resembles Himalayan *N. cordifolium* (Lindl.) Bl., but distinctly different in many features, including pedicel and ovary hairy with scurfy hairs (vs. glabrous pedicel and ovary), lip pure white with 3 purple-violet nerves (vs. lip uniformly pale yellow), lip margin wavy or crispy (vs. entire, straight lip margin), prominent falcate lip side lobes (vs. rudimentary, triangular, tooth-like side lobes), broadly ovate, apiculate median lip lobe with 3 hardly visible low finely verruculose keels (vs. broadly rectangular, emarginate median lobe with 3 lamellate, dent-like, tall keels) and finely verruculose spur (vs. spur with smooth surface).

***Podochilus truongtamii* Aver. & Vuong, sp. nov.**

**Fig. 12 & 13.**

Described from southern Vietnam. **Type** (“Khanh Hoa Province, Hon Ba Nature Reserve, Hon Ba Mountain, evergreen broad-leaved humid submontane forest around point 12°07.232'N, 108°58.377'E, at elevation about 900 m, lithophytic herb in rather open place, 13 June 2017, *Truong Ba Vuong, Mang Van Lam, BV 285 / AL 391*”) – VNM (holotype), LE (isotype). Digital epitype – d-EXSICCATES OF VIETNAMESE FLORA 0305/BV 285 / AL 391 (Fig. 12).

**Etymology.** Species discoverer, Truong Ba Vuong named his plant after his father, Truong Quang Tam.

**Description.** Perennial clustering lithophytic herb. Stems few to many, (5)6–11(14) cm long, commonly pendulous, slender, rigid, rather straight, simple, leafy throughout, covered by sheathing leaf bases, often densely tufted on the short insignificant plagiotropic rhizome. Leaves numerous, distichous, lying in one plane, rigid, coriaceous, sessile, joined, sheathing at base, elliptic, (7)8–10(12) mm long, (1.8)2–2.4(2.8) mm wide, with the prominent median vein, obtuse. Inflorescence

terminal, comparably with related species rather long, (3)5–8(10) flowered, raceme. Scape and rachis (2)2.5–3(3.5) mm long, light greenish to almost white; scape at the base with several greenish conduplicate rudimentary acute leaves, apically with small broad almost scarious bracts. Floral bracts light greenish to white or light pink, broadly triangular, conduplicate, acute, persistent, (1.2)1.5–1.8(2) mm long, (0.4)0.5–0.8(1) mm wide. Pedicel and ovary white to light greenish, cylindrical, slightly curved, (1.8)2–2.2(2.4) mm long, (0.4)0.5–0.6(0.8) mm in diam. Flowers opening in succession, Tepals and lip white with light pink-purple apex, not widely opening, (2)2.2–2.4(2.5) mm across. Sepals fleshy, subsimilar, narrowly ovate, (2.4)2.8–3(3.2) mm long, (0.7)0.8–1(1.1) mm wide; lateral sepals oblique, adnate with their flesh base with very short base of the column, forming no distinct mentum. Petals not much fleshy, narrowly ovate, much shorter than sepals, forward directed. Lip fleshy, spurless, entire, shortly cymbiform, slightly recurved, being flattened narrowly elliptic, (2)2.1–2.2(2.5) mm long, (0.7)0.8–0.9(1) mm wide, simple, at the base with erect fleshy, finely tuberculate, transversal wall divided into two equal lobes by deep sinus; joined to column foot apex. Column shortly cylindrical, (0.8)0.9–1(1.1) mm tall and wide, with prominent fleshy lateral wings and narrow forward directed foot; rostellum in form of thin plate, bifurcate at apex; stigma large, concave; anther cap obscurely triangular 0.35–0.45 mm long, at front obtuse. Pollinarium 0.35 mm long, with narrowly ellipsoid viscidium. Fruits unknown.

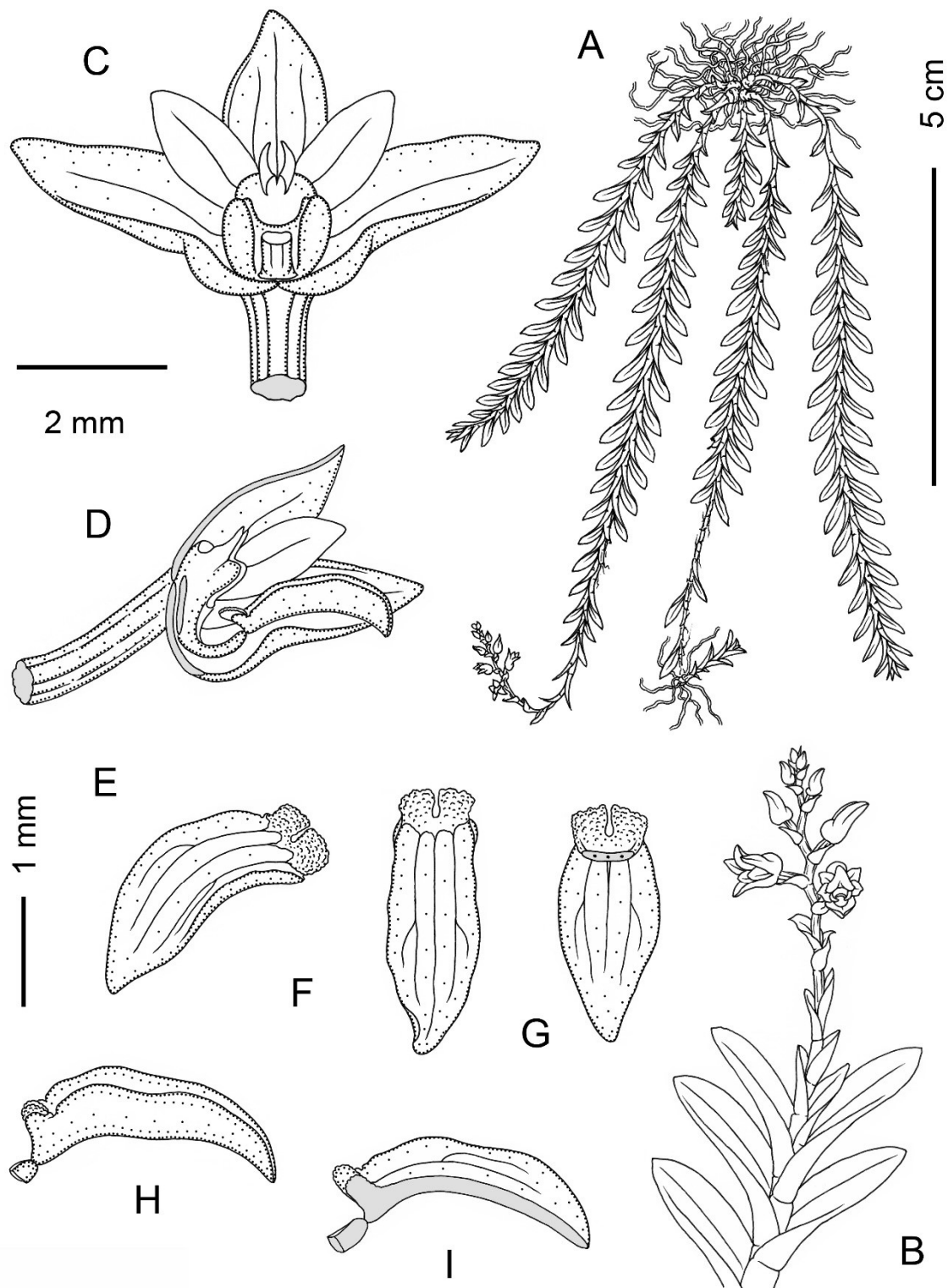
**Habitat, phenology and conservation status.** Clustering lithophytic herb. Primary humid broad-leaved evergreen submontane forests on granite. 900 m. Fl. June–July. Not common. Estimated IUCN Red List status – DD.

**Distribution.** Vietnam: Khanh Hoa province (Hon Ba Mountains). Endemic.

**Notes.** New species in its vegetative habit and ecology resembles *Podochilus banaensis* Ormerod, *P. khasianus* Hook.f. (= *P. intermedius* Aver.) and *P. microphyllus* Lindl., widely distributed in eastern Indochina including Vietnam. In its floral morphology it is probably most close to *P. khasianus*, but well differs in much longer inflorescence to 3.5 cm long with scape longer than rachis (vs. inflorescence 5–6 mm long, with scape much shorter than rachis, when rachis looks almost sessile), in the lip with erect fleshy wall at the base (vs. lip at the base flat, with two acute plain lateral lobes, with no fleshy erect wall) and long forward directed column foot, longer than lip breadth (vs. very short column foot, much shorter than lip base). It is noteworthy, that new species was found in the same geographic area as recently described local endemic, *P. rotundipetala* Aver. et Vuong. (Averyanov *et al.*, 2016d). Both species, however, have no close relation and grow



**Fig. 12.** New orchids in the flora of Vietnam. *Podochilus truongtamii* Aver. & Vuong. Digital epitype – EXSICCATES OF VIETNAMESE FLORA 0305/BV 285 / AL 391. All photos by Truong Ba Vuong, design and correction by L. Averyanov.



**Fig. 13.** New orchids in the flora of Vietnam. *Podochilus trungtamii* Aver. & Vuong. **A** – flowering plant. **B** – apical part of shoot with inflorescence. **C** – flattened flower with lip removed, frontal views. **D** – flower and ovary, with sepal and petal removed, side views. **E** – lip, half side view. **F** – lip, view from above. **G** – lip, view from below. **H** – lip, side view. **I** – lip, sagittal section. All drawn from the type – Truong Ba Vuong, BV 285 / AL 391 by L. Averyanov and T. Maisak.



at different elevations, which probably, support their biological isolation. Additionally, *P. truongtamii* grows in rather dry habitats, when *P. rotundipetala* commonly are found on humid wet rocks along stream valleys.

***Pomatocalpa maculosum*** (Lindl.) J.J. Sm., 1912, *Natuurw. Tijdschr. Ned.-Indië* 72: 105. – *Cleisostoma maculosum* Lindl., 1833, *Gen. Sp. Orchid. Pl.*: 227.

#### Fig. 14

Described from Sri Lanka (“Hab in Zeylona, supra arbores, Macrae”). **Type** (“Macrae, J 39”) – K000334622.

= *Cleisostoma andamanicum* Hook.f., 1890, *Fl. Brit. India* 6, 17: 71; id., 1894, *lc Pl.*, pl. 2149. – *Pomatocalpa andamanicum* (Hook.f.) J.J. Sm., 1912, *Natuurw. Tijdschr. Ned.-Indië* 72: 103; *Seidenfaden*, 1988, *Opera Bot.* 95: 106, fig. 62; *Seidenfaden*, Wood, 1992, *Orch. Penins. Malaysia Singapore*: 611, fig. 277 e-i;

Described from Andaman Islands (“South Andaman Islands, Kurz”). **Type** (“South Andamans Coll S. Kurz s.n.”) – K (K000942441).

*Pomatocalpa naevatum* J.J. Sm., 1913, *Natuurk. Tijdschr. Ned.-Indië* 72, 1: 106; *Seidenfaden*, 1988, *Opera Bot.* 95: 107, fig. 64; *Comber*, 1990, *Orch. Java*: 351, figs.

Described from Java (“Java”). **Type** – L0062053.

= *Cleisostoma siamense* Downie, 1925, *Bull. Misc. Inform. Kew* 1925 (10): 406. – *Pomatocalpa siamense* (Downie) Summerh., 1961, *Orchid Rev.* 69: 372; *Seidenfaden*, 1988, *Opera Bot.* 95: 107, fig. 63.

Described from northwestern Thailand (“Mae Tang, Lampang 360 m Kerr 301”). **Type** (“FLORA OF SIAM A.F.G. Kerr 301”) – K000942433.

= *Pomatocalpa linearifolium* Seidenfaden, 1988, *Opera Bot.* 95: 98, fig. 58.

Described from peninsular Thailand (“Ao Luk, Krabi”). **Type** (“Chermsirivatana & Kasem 1335”) – BK (holotype BK257275).

**Habitat, phenology and conservation status.** Trunk and branch epiphytic undershrub. Primary and secondary broad-leaved evergreen submontane humid forests on granite. 600–800 m. Fl. May–June. Rare. Estimated IUCN Red List status – LC (IUCN, 2017).

**Distribution.** Vietnam: Kon Tum (Ngoc Hoi district) and Thua Thien – Hue (Hue town area) provinces. Sri Lanka, Andaman and Nicobar Islands, Myanmar, Thailand, Laos, Malaysia, Java, Sumatra, Borneo, Philippines.

**Notes.** This species widely distributed in tropical Asia represents quite expected addition to the flora of Vietnam. Meanwhile, it was for a long time overlooked in botanical surveys of the country as a rather rare plant. Noteworthy this species is fairly common in lowland areas of Laos allied to Vietnam, but placed to the west of Truong Son Range.

**Studied specimen.** Southern Vietnam, Thua Thien – Hue province, Hue town area, *Nguyen Van Canh s.n.*, September 2015 (LE – photo). Southern Vietnam, Kon Tum province, Ngoc Hoi district, Dak Xu - Dak Nong commune, broad-leaved evergreen humid forest at elevations 600–800 m, 15 May 2017, *Bui Duc Nam, Nguyen Hoang Tuan, s.n.* (LE). Plate – d-EXSICCATES OF VIETNAMESE FLORA 0288/B.D. Nam, N.H. Tuan s.n. a. 2017 (Fig. 14).

***Porpax ustulata*** (E.C. Parish et Rchb.f.) Rolfe, 1908, *Orchid Rev.* 16: 8; *Seidenfaden*, 1986, *Opera Bot.* 89: 122, fig. 73; *Chen et al.*, 2009, *Fl. China* 25: 360; *Xu Z.H. et al.*, 2010, *Wild Orch. Yunnan*: 305, fig. 419;

*Zhou et al.*, 2016, *Phytotaxa* 276: 123. – *Eria ustulata* E.C. Parish et Rchb.f., 1874, *Trans. Linn. Soc. London* 30: 147.

#### Fig. 10C & D

Described from Peninsular Myanmar (“NEIGHBOURHOOD OF MOULMEIN MOULMEIN”). **Type** (“... № 62. *Eria (Conchidium) ustulata* Par. Rchb.f. Presented by REV. C. PARISH, April 1872...” – K001085616.

**Habitat, phenology and conservation status.** Miniature lithophyte. Primary submontane evergreen broad-leaved forest. 900–1000 m. Fl. September. Very rare. Estimated IUCN Red List status – DD.

**Distribution.** Vietnam: Gia Lai province (Chu Mon Ray National Park). Myanmar, Thailand, southern China (Yunnan).

**Notes.** This is typical east Himalayan species with a rather surprising newly discovered isolated enclave in southern Vietnam. Our discovery extends formal species area for about 1200 km in southeastern direction.

**Studied specimen.** Southern Vietnam, Gia Lai province, Chu Mon Ray National Park, primary submontane evergreen broad-leaved forest, lithophyte, 900–1000 m a.s.l., 4 June 2017, *Nguyen Van Canh s.n.*, fl. in cult in September 2017, *Nguyen Van Canh, L. Averyanov AL 403* (LE).

## ACKNOWLEDGEMENTS

Research work, the results of which are presented in this paper, were financially supported in parts by Rufford Small Grant for Nature Conservation “Mapping and assessment of *Xanthocyparis vietnamensis* subpopulations in Cao Bang, Ha Giang and Lang Son provinces, Vietnam” (2014–2015), *The Mohamed bin Zayed Species Conservation Fund “Conservation assessment of endangered Lao-Vietnamese stenoendemic – Pinus cernua, Pinaceae” (2016–2017, # 152511753), Vietnam Academy of Science and Technology, QTRU01.07/18-19 and The Russian Foundation for Basic Research, 18-54-54005 Viet\_a in limits of project “Assessment of the plant diversity in Bat Dai Son Mountains, Ha Giang province” and were carried out in the framework of institutional research project of the Komarov Botanical Institute of the Russian Academy of Sciences “Study of the flora of Indochina” (AAAA-A18-118031290070-6). The authors cordially thank following persons for their kindest assistance in plant collecting and access to their scientifically significant garden collections: Chuong Quang Ngan, L. Osinovetz, Le Minh Dung, Mang Van Lam, Nghiem Xuan Son, Nguyen Huy Hau, Nguyen Minh Duc, Nguyen Phong, Nguyen Thanh Son, Nguyen Van Thien, Nguyen Van Thinh and Vo Van Cong.*

## LITERATURE CITED

- Averyanov, L.V. and A.L. Averyanova. 2005. Rare species of orchids (Orchidaceae) in the flora of Vietnam. *Turczaniniwia* 8(1): 39-97.
- Averyanov, L., P. Cribb, P.K. Loc and N. T. Hiep. 2003a. Slipper Orchids of Vietnam. With an Introduction to the Flora of Vietnam. Royal Botanic Gardens, Kew. Compass Press Limited. 308 p.

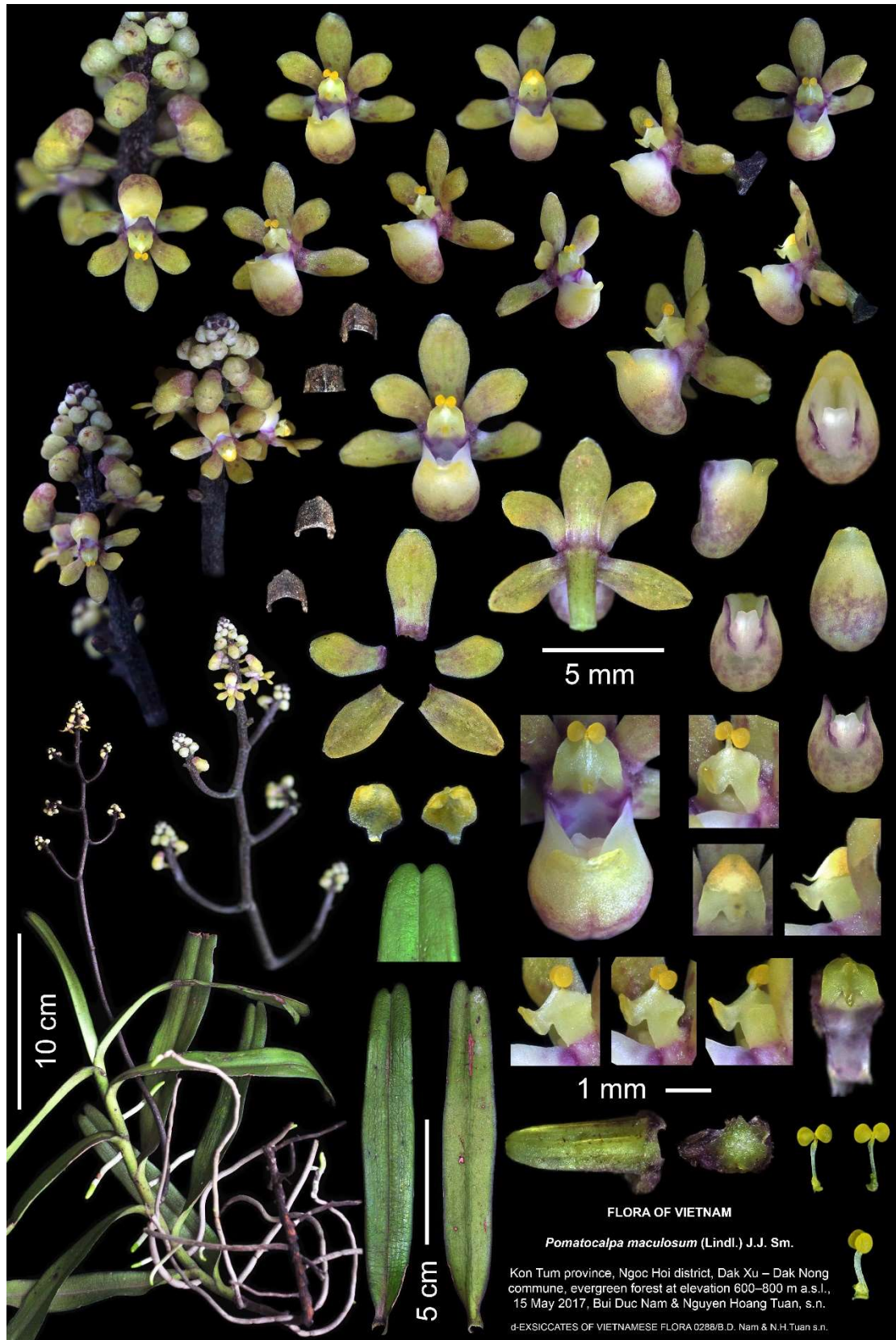


Fig. 14. New orchids in the flora of Vietnam. *Pomatocalpa maculosum* (Lindl.) J.J. Sm. Plate – d-EXSICCATES OF VIETNAMESE FLORA 0288/B.D. Nam et N.H. Tuan s.n. a. 2017. All photos by Nguyen Hoang Tuan, design and correction by L. Averyanov.





- Averyanov, L.V., P.K. Loc, N.T. Hiep and D.K. Harder.** 2003b. Phytogeographic review of Vietnam and adjacent areas of Eastern Indochina. *Komarovia* **3**: 1-83.
- Averyanov, L.V. and T.V. Maisak.** 2017a. New data on orchid diversity of Vietnam, 2012-2016. P. 77-80. Taxonomy and evolutionary morphology of plants. Materials of the Conference dedicated to 85 anniversary of V.N. Tikhomirov. January 31-3 February, 2017. Moscow, MAKS Press. 496 pp.
- Averyanov, L. and T. Maisak.** 2017b. Present data on Vietnam orchid inventory. Abstracts of XIX International Botanical Congress. Shenzhen 23-29 July 2017: 36-37.
- Averyanov, L.V., P.A. Ormerod, V.D. Nong, V.T. Tran, T. Chen and D.-X. Zhang.** 2016a. *Bidoupia phongii*, new orchid genus and species (Orchidaceae, Orchidoideae, Goodyerinae) from southern Vietnam. *Phytotaxa* **266(4)**: 289-294.
- Averyanov, L.V., J. Ponert, P.T. Nguyen, V.D. Nong, K.S. Nguyen and V.C. Nguyen.** 2016b. The Survey of *Dendrobium* sect. *Formosae* in Cambodia, Laos and Vietnam. *Adansonia* **38(2)**: 55-73.
- Averyanov, L.V., B.V. Truong and Q.T. Truong.** 2016c. The genus *Liparis* (Orchidaceae) in Hon Ba nature reserve, Vietnam, Khanh Hoa province. *Turczaninowia* **19(2)**: 34-49.
- Averyanov, L.V., V.D. Nong, K.S. Nguyen, T.V. Maisak, V.C. Nguyen, Q.T. Phan, P.T. Nguyen, T.T. Nguyen and B.V. Truong.** 2016d. New species of orchids (Orchidaceae) in the flora of Vietnam. *Taiwania* **61(4)**: 319-354.
- Averyanov, L.V., K.S. Nguyen, V.D. Nong, V.C. Nguyen, B.V. Truong and T.V. Maisak.** 2017a. *Bulbophyllum* sect. *Hirtula* in eastern Indochina. *Taiwania* **62(1)**: 1-23.
- Averyanov, L.V., C.X. Canh, N.H. Tuan, V.A. Phu, K.S. Nguyen, T.H. Nguyen and T.V. Maisak.** 2017b. The genus *Cyripedium* (Orchidaceae) in the flora of Vietnam. *Turczaninowia* **20(1)**: 118-124.
- Averyanov, L.V., M.S. Nuraliev, A.N. Kuznetsov and S.P. Kuznetsova.** 2018a. *Biermannia longicheila* (Orchidaceae, Aeridinae), a new species from southern Vietnam. *Phytotaxa* **343 (2)**: 194-198.
- Averyanov, L.V., V.C. Nguyen, B.V. Truong, T.V. Maisak, H.T. Luu, K.S. Nguyen, Q.D. Dinh, H.T. Nhuyen, X.C. Chu, G. Tran, V.K. Nguyen and H.S. Le.** 2018b. New Orchids (Orchidaceae, Cymbidieae and Vandaeae) in the Flora of Vietnam. *Taiwania* **63(2)**: 119-138.
- Averyanov, L.V., V.D. Nong, H.T. Nguyen, M.S. Nuraliev, T.V. Maisak and C.A. Nguyen.** 2018c. New species of *Bulbophyllum* (Orchidaceae) in the flora of Vietnam. *Phytotaxa* **00**: 000-000 (in print).
- Chen, X.Q., Z.J. Liu, G.H. Zhu, K.Y. Lang, Z.H. Ji, Y.B. Luo, X.H. Jin, P.J. Cribb, J.J. Wood, S.W. Gale, P. Ormerod, J.J. Vermeulen, H.P. Wood, D. Clayton and A. Bell.** 2009. Orchidaceae. In: Wu, Z.Y., Raven, P.H. and Hong, D.Y. (Eds.) *Flora of China*, vol. 25. Science Press and Missouri Botanical Garden, Beijing and St. Louis, 569 pp.
- Chung, S.W. and T.C. Hsu.** 2006. *Gastrodia shimizuana*, a new record of *Gastrodia* (Orchidaceae) in Taiwan. *Taiwania* **51(1)**: 50-52.
- Clayton, D. and P.J. Cribb.** 2013. The Genus *Calanthe*. Natural History Publications (Borneo). Kota Kinabalu.
- Comber, J.B.** 1990. Orchids of Java. Bentham-Moxon Trust. Kew.
- Comber, J.B.** 2001. Orchids of Sumatra. The Royal Botanic Gardens. Kew.
- IUCN (2017):** The IUCN Red List of Threatened Species. Version 2014.2. <http://www.iucnredlist.org> [Accessed: 1 April 2018].
- Lin, T.P.** 1976. Native Orchids of Taiwan. Vol. 2. Southern Materials Center, INC. Taipei.
- Lin, T.-P., H.-Y. Liu, C.-F. Hsieh and K.-H. Wang.** 2016. Complete list of the native orchids of Taiwan and their type information. *Taiwania* **61(2)**: 78-126.
- Liu Z.-J. and Chen L.-J.** 2011. *Dendrobium hekouense* (Orchidaceae), a new species from Yunnan, China. *Ann. Bot. Fennici* **48(1)**: 87-90.
- Ong, P.T.** 2015. A revision of *Gastrodia* in Peninsular Malaysia. *Malesian Orchid Journal* **15**: 61-76.
- Nguyen, H.T.** 2017. *Dendrobium xichouense* S. J. Cheng & C. Z. Tang - a new record of medicinal plant species for Vietnam. *Pharm. J. (Hanoi)* **57(493)**: 22-26 (in Vietnamese).
- Nguyen, H.T. and L.V. Averyanov.** 2017. Two endangered ornamental orchid species, *Bulbophyllum coveniorum* and *Esmeralda bella* (Orchidaceae), new in the flora of Vietnam. *Turczaninowia* **20(1)**: 68-74.
- Sawa, Y.** 1980. Spontaneous orchids in the intermediate zone of Kochi Prefecture. *Research Reports of the Kochi University, Natural Science* **29**: 59-71.
- Seidenfaden, G. and J.J. Wood.** 1992. The Orchids of Malaysia and Singapore. Olsen & Olsen. Fredensborg.
- Suetsugu, K., M. Nakama, T. Watanabe, H. Watanabe and M. Yokota.** 2012. The northernmost locality of *Gastrodia shimizuana* (Orchidaceae). *J. Jpn. Bot.* **87**: 67-69.
- Vietnam Administrative Atlas.** 2007. Cartographic Publishing House. Hanoi.
- Xiang, X.-G., A. Schuiteman, Li, D.-Z., Huang, W.-C., Chung, S.-W., Li, J.-W., Zhou, H.-L., Jin, W.-T., Lai, Y.-J., Li, Z.-Y. and Jin, X.-H.** 2013. Molecular systematics of *Dendrobium* (Orchidaceae, Dendrobieae) from mainland Asia based on plastid and nuclear sequences. *Mol. Phylogenet. Evol.* **69(3)**: 950-960.