



**Orchid Flora Of Hon Ba Natural Reserve - Khanh Hoa Province  
Vietnam**

**Vuong Ba Truong**

**A Thesis Submitted in Partial Fulfillment of the Requirements  
for the Degree of Master of Science in Botany  
Prince of Songkla University  
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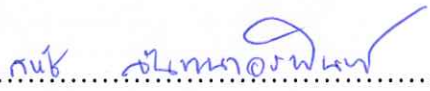
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ชื่อวิทยานิพนธ์      พรรณกล้วยไม้ในเขตสงวน Hon Ba จังหวัด Khanh Hoa

เวียดนาม

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### บทคัดย่อ

การสำรวจกล้วยไม้ในเขตสงวน Hon Ba ตั้งอยู่บนเทือกเขา Annamite ซึ่งเป็นเทือกเขาที่สำคัญแห่งหนึ่งในเวียดนาม ตั้งแต่เดือนมีนาคม ถึงเดือนธันวาคม 2557 พบกล้วยไม้ทั้งสิ้น 126 ชนิดที่มีการดำรงชีวิตแตกต่างกัน 4 แบบ คือ กล้วยไม้อิงอาศัย (82 ชนิด) กล้วยไม้ดิน (21 ชนิด) กล้วยไม้ที่ขึ้นบนหิน (18 ชนิด) และกล้วยไม้ที่อาศัยรา (5 ชนิด) ในจำนวนนี้จัดเป็นกล้วยไม้ที่พบครั้งแรกในเวียดนาม 2 ชนิด คือ *Lecanorchis nigricans* Honda และ *Bulbophyllum dasystachys* J.J. Verm., Thavipoke & Phelps. สกุลที่มีความหลากหลายชนิดมากที่สุดคือ สกุล *Dendrobium* Sw., *Bulbophyllum* Thouras, *Liparis* Rich. และ *Paphiopedilum* Pfitzer ตามลำดับ และจากการพิจารณาการกระจายพันธุ์ทางพฤกษภูมิศาสตร์พบว่าเทือกเขา Annamite เป็นเสมือนเส้นทางคาบเกี่ยวทางการกระจายพันธุ์พืชที่สำคัญของพันธุ์กล้วยไม้จาก 4 ทิศทางของทวีปเอเชีย ได้แก่ เขตหิมาลัย (Himalayan) เขตภาคพื้นทวีปอินโดจีนและพม่า (Indo-China Mainland and Myanmar) เขตจีน-ญี่ปุ่น (Sino-Japanese) และเขตมาเลเซีย (Malesian) ทั้งยังเป็นศูนย์กลางการกระจายพันธุ์ของกล้วยไม้ถิ่นเดียวในเวียดนามหลายชนิด

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## ABSTRACT

The surveys of the Orchids at Hon Ba Nature Reserve, which is the part of the famous Annamite Range in Vietnam, had been achieved from March to December 2014. A total number of one hundred and twenty six orchid species in 4 vegetative types were accounted i.e. epiphyte (82 species), terrestrial (21 species), lithophyte (18 species) and mycoheterotrophic (5 species). Among those, there are two new recorded species to Vietnam i.e. *Lecanorchis nigricans* Honda and *Bulbophyllum dasystachys* J.J.Verm., Thavipoke & Phelps. The most diverse genera were *Dendrobium* Sw., *Bulbophyllum* Thouras, *Liparis* Rich. and *Paphiopedilum* Pfitzer respectively. The phytogeographic study of the orchids occurring in the study area revealed that the Annamite Range had performed as a “cross road” of 4 possible distribution patterns of plants from 4 different regions in Asia i.e. the Himalayan Range, the Indo-China Mainland and Myanmar, the Sino-Japanese, and the Malesian Region as well as a center of origin for many endemic orchid taxa.

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**Vuong Ba Truong**

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## LIST OF ABBREVIATION

### Abbreviations

asl.	Above sea level
ca.	About
cm	Centimeter
diam.	Diameter
et al.	And others
i.e.	That is
km	kilometer
mm	millimeter
sp.	Species
var.	Variety



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## CHAPTER 1

### INTRODUCTION

Vietnam is one of the famous region for the high diversity of orchids due to the fact that the country is situated in the concurrence area concerning phyto-geographical distribution. It is no doubt that the area along this Annam cordillera which arose in the North of Vietnam, down to Me Kong delta in the South is the area where high diversity of orchids of the world could be expected. Less botanical surveys as well as less plants collections in the pass due to the political inconvenience in Vietnam had led to the underestimation of the number of orchid species in this area. More account on the diversity of orchids of the area mentioned, might support the comprehensive understanding of the phyto-geographical patterns, not only for the orchid flora but also other plant species of the Indochina region in general. The information on the Orchids of Vietnam have been gathered and documented by many botanists so far i.e. Gagnepain and Guillaumin (1934); Pham (1972, 1993, 1999); Averyanov (1990, 1994, 1996, 1997, 1999, 2005, 2008, 2010a, 2010b), Seidenfaden (1992), Tran (1998), Nguyen (2001), and Averyanov and Averyanova (2003). On the Update checklist of Orchid of Vietnam, Averyanov and Averyanova (2003) has documented 897 species in 152 genera. Orchid of Vietnam has the wide range of distribution from Himalayas, South East Asia and Malesia. There around 19.2% of orchid are endemic to Vietnam (Averyanov et al., 2003).

#### **Hon Ba Nature Reserve**

Hon Ba Nature Reserve is such a mountainous nature reserve area, located within the Da Lat plateau in the Annamite range. The vegetation is belonging to lower montane forest type according to the classification in Whitemore (1980). Considering bio-geography, it belongs to an Indochina province in South Annamite floristic region according to Averyanov et al. (2003). The Hon Ba Nature Reserve was selected as a study site for orchid diversity according to its good location in this well-known Annamite range as well as its well preserved natural forest with less anthropogenic

disturbance and its rich flora which contained many endangered species e.g. *Pinus krempii* Lecomte, *Fokienia hodginsii* (Dunn) A. Henry & H. H. Thomas, *Aquilaria crassna* Pierre ex Lecomte, *Rhodoleia championii* Hook. f., *Paphiopedilum delenatii* Guillaumin, *P. appletonianum* (Gower) Rolfe etc. Primarily, the present work is trying to document the orchid diversity of this famous phyto-geographical region of the Annam cordillera by using the Hon Ba Nature Reserve as a case study site.

### **Objectives**

1. To document orchid diversity in Hon Ba Nature Reserve, Vietnam.
2. To describe the specie as well as illustration and the environmental information.

### **Literatures review**

#### **Orchid expedition in the past**

In the early time, almost of foreigner botanist who came to Vietnam were naturalists and plant collectors. They brought back to their countries many living plants and also specimens.

The first expedition about flora of Vietnam was reported by Loureiro with the book *Flora Cochinchinensis* in 1790. Only some orchids were documented. The important genera were created by Loureiro i.e. *Aerides* (*Aerides odorata* Lour.) and *Thrixpernum* (*Thrixpernum centipeda* Lour.) (Loureiro, 1790).

Finlayson, from 1821 to 1822, went to Thailand and Hue, wrote a book: *The Mission to Siam, and Hué the Capital of Cochin China, in the Years 1821–2* and brought back to France some orchid specimens, including *Cymbidium finlaysonianum* from Vietnam (Finlayson, 1926).

Thorel, from 1866 to 1867, explored along the Me Kong River and also collected amount number of specimen including orchid and the famous *Nepenthes thorelii*. (Garnier et al., 1873).

Pierre from 1864 to 1877 from South of Vietnam to Cambodia and Thailand he collected, and kept the specimens in Paris, later on Gagnepain described Pierre's

collection and published in Flore forestière de la Cochinchine in 1934. (Gagnepain, 1934).

Poilane a French who travelled around Indochina and collected flowering plants and including Orchids from 1880 to 1930. He collected about 3600 specimens included orchid and sent to Saigon zoo and botanical garden (Jacquet, 2001).

Kloss an English who studied about herb and animal came to Da Lat plateau (Vietnam) in 1918 and also brought back to England museum some orchids specimens which were studied by Ridley later in 1921. (Ridley, 1921).

Micholitz from 1854 to 1932, a German collector, arrived to Vietnam in 1905 and collected many orchids (including living and dry specimens). There are many orchids were named under his name: *Aerides micholitzii*, *Spathoglotti splicata* var. *micholitzii*, *Bulbophyllum micholitzii* and *Coelogyne micholitzii* (Reinikka, 1972).

Finet studied and wrote some books about Orchids of Indochina from 1863 to 1913. In 1910, he studied the orchid specimens from Vietnam and some of them became new species for example the endemic species *Pholidota guibertiae* Finet (Finet, 1910).

Gagnepain from 1929 to 1934 he published around 17 publication about new species of Indochina region in the book Flore générale de l'Indo-Chine with Guillaumin, e.g. endemic species of Vietnam *Coelogyne eberhardtii* Gagnepain also was found in Hon Ba (Gagnepain, 1930).

Guillaumin in 1924, he dealt with Slipper orchids of Indochina including the endemic species of Vietnam *Paphiopedilum delenatii* (Bulletin de la Société Botanique de France) (Guillaumin, 1924). In 1934 Gagnepain and Guillaumin published a list of 96 genera and 485 species for Indochina in the book Flore General de L'Indochine (Ganepain & Guillaumin, 1934).

Tixier in 1966 published about Orchids of Southern Annamite with description and including the climate and geology (Tixier, 1966).

Seidenfaden, from 1965 to 1986, published many books about Thailand orchids: The Orchids of Thailand a Preliminary List Co-author with Smitinand, Orchid Genera in Thailand, Contributions to the orchid flora of Thailand, and The Orchids of Peninsular Malaysia and Singapore with Wood, also the important book The Orchids

of Indochina published in 1992 included 136 genera and 720 species of Vietnam. (Seidenfaden, 1965, 1979, 1982, 1985, 1986)

### **Recently orchid study of Vietnam**

Pham in the book, An illustrated flora of Vietnam Volume 3, described 90 genera and 800 species of orchid, with short and simple descriptions, locations and illustrations. The descriptions based on the herbarium specimens (Pham, 1999).

Tran in his book, Orchid of Vietnam, described 137 genera with 1153 species by the specimens (Tran, 1998).

Averyanov, he had been collected around 3000 specimens of orchid in 20 years under the project of National geographic society and San Diego Orchid society. He described and published hundreds of paper, 6 new genera (*Vietorchis*, *Zeuxinella*, *Christensonia*, *Hamularia*, *Miguelia* and *Parapteroceras*) and more than 120 new species, and hundreds of new records for flora of Vietnam. Among the new species he proposed, some of species became synonym of later studies. (Averyanov, 1988a, 1988b, 1990a, 1990b, 1994, 1996, 1997.)

Averyanov et al. published Slipper Orchid of Vietnam with 22 species including 4 natural hybrid species, with the history, distribution, ecology, photos and descriptions for each species (Averyanov et al., 2003).

Averyanov and Averyanova published Updated checklist of the Orchids of Vietnam with 900 species belong to 152 genera. (Averyanov & Averyanova, 2003)

Ly with the book Field guide of Wild Orchid of Phu Quoc Island he described 53 genera and 99 species (Ly, 2009).

Averyanov (2008–2013) published 4 parts about The Orchids of Vietnam illustrated Survey, with the description, synonym, location and illustration. The other parts will be published in future. (Averyanov, 2008, 2010a, 2011, 2013)

**Part 1:** Subfamilies *Apostasioideae*, *Cypripedioideae* and *Spiranθοideae*  
21 genera and 85 species.

**Part 2:** Subfamily *Orchidoideae* with 12 genera and 66 species.

**Part 3:** Subfamily *Epidendroideae* (primitive tribes – *Neottieae*, *Vanilleae*,

*Gastrodieae, Nervilieae*) 17 genera and 41 species

**Part 4:** Subfamily Epidendroideae (tribes *Arethuseae* and *Malaxideae*) with 17 genera and 166 species.

The Orchids of Cuc Phuong National Park illustrated guide (2013) was written by Averyanov, Nguyen and Phan, with the key to species and short description of orchid species found in Cuc Phuong Nation Park (Averyanov et al., 2013).

### **Orchid study in Hon Ba nature reserve**

Three flora explorations (from 2011 to 2013) were conducted by Institute of tropical biology and Prague botanical garden (Czech) in order to collect the specimens but without any species description, and the number of Orchid collected was unclear.

In 2013, new species of *Vanilla* was proposed: *Vanilla atropogon* (Shuiteman et al., 2013).

In 2013, Averyanov & Truong discovered the new species in Hon Ba *Miguelia cruenta*, that genus *Miguelia* was separate from *Vanilla* (Averyanov, 2013).

Lee et al. published Floristic Diversity of Hon Ba Nature Reserve, Vietnam. Korea National Arboretum. Pocheon, Republic of Korea, 752 pages, a book with simple and short description for each species including photo of habit and specimens. About the Orchidaceae part, there are only 14 species of Orchid recorded. Among of the Orchid species there are some doubtful presentation e.g. *Erythrorchis ochobiensis* (Hayata) Garay, page 714 is synonym of *Erythrorchis altissima* Blume, *Phreatia secunda* Lindl. a species which I have not yet come across in Hon Ba, but the photos in the book page 717 is *Oberonia longibracteata* Lindl.; about the species, *Coelogyne cristata* Lindl., page 710, should be *Coelogyne moonreana* Rofle. Furthermore, they also propose new species *Cordiglottis longipedicellata* J. Lee, T.B. Tran & R.K. Choudhary in 2013 (Lee et al., 2014).

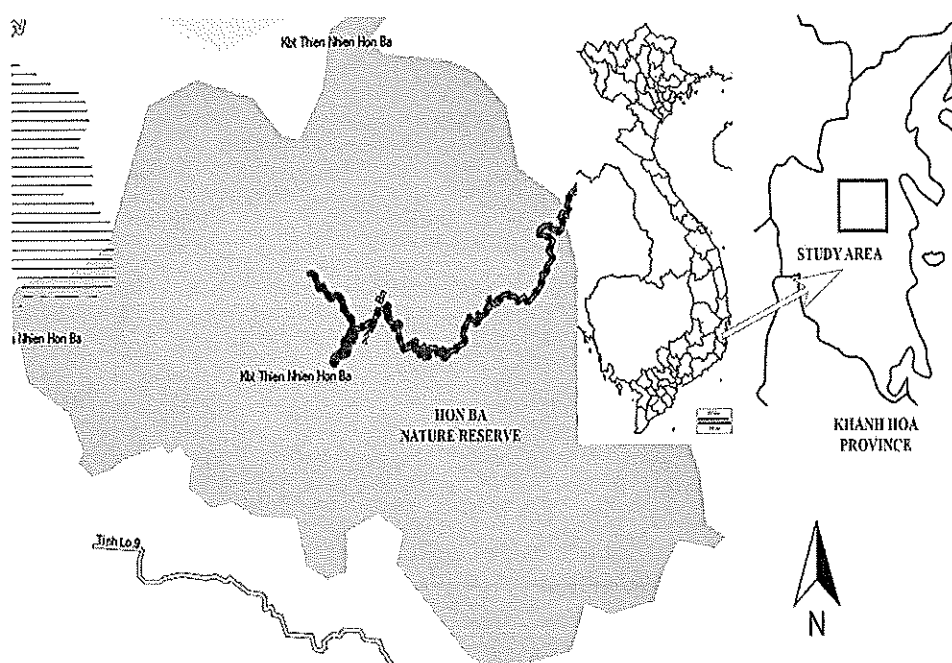
Until recently, there is not yet any systematic survey for only Orchidaceae family and also the full floristic document of Hon Ba nature reserve.

## CHAPTER 2

### MATERIALS AND METHODS

#### The study area

Hon Ba nature reserve located on the South Annamite range near the South China sea coastline (latitude ca.  $12^{\circ}01'45'' - 12^{\circ}12'00''$  N and longitude ca.  $102^{\circ}53'45'' - 109^{\circ}02'34''$  E) with a total area of about 19,164 hectares (Fig. 1). The altitude is ranging between 50 – 1,578 m asl. with the average slopes around  $15^{\circ} - 40^{\circ}$ . It is composed of mostly granite rocks and built up by cretaceous plutonic rocks (granite, granodiorite, leucocratic granite). An exposures of contact metamorphosed Jurassic sedimentary rocks occurred at the base of the mountain massif at the North West and South West borders (siltstones, clay stones, shales and sandstones, metamorphosed to spotted and knotted schists and hornfels) (Technical report of Hon Ba nature reserve, 2013).

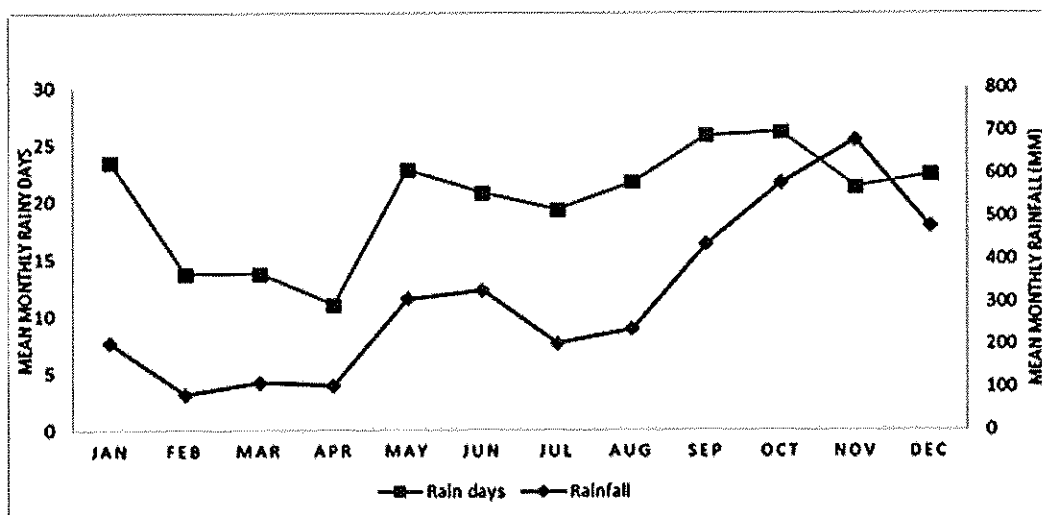


**Figure 1** Map of study side Hon Ba nature reserve.

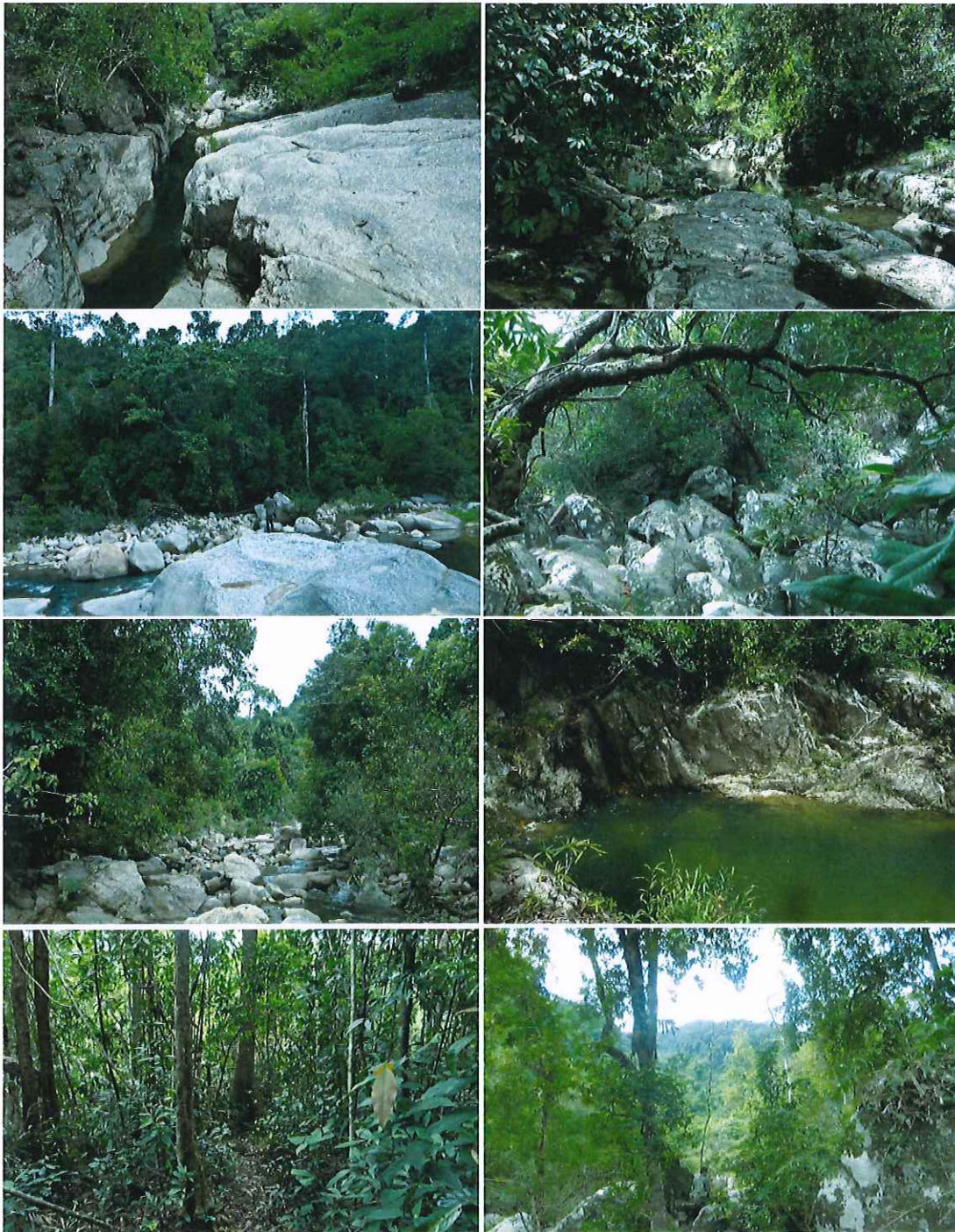


The climate of Hon Ba is monsoon tropical climate (Am) according to Köppen's climate classification system (Kottek et al., 2006). The raining occurred almost every day with no dry month. In addition, heavy rains of 2500 – 3851 mm could also take place. The rainy days/month would be >20 (Schmid, 1974). In general, the rainfall in Hon Ba would start in November, and it rains regularly in this month of ca. 678 mm (Fig. 2). The mean temperature in the area in the warmer months is 18.6 – 19.8°C, while in the cooler time is ca. 14.7 – 16.9°C. The mean humidity all year round is always  $\geq 90\%$  which could reach to 98% occasionally. (Technical report of Hon Ba nature reserve, 2013). Vegetation types at Hon Ba Nature Reserve are classified into 3 main categories, i.e. Closed evergreen tropical monsoon (seasonal) broad-leaved lowland forest and lowland forest along the stream from 50 – 500 m asl. (Plate 1). Closed evergreen tropical monsoon (seasonal) submontane broad-leaved forest 500 – 1000 m asl. (Plate 2). Closed evergreen tropical monsoon (seasonal) mixed lower montane forest 1000 – 1550 m asl. (Plate 3).

Due to the location of the study area which are fallen into the concurrence of different phyto-geographical regions as well as the regular rainfall in such high altitude mountain (> 1,200 m) with the connection to the oceanic climate that might support the growth of rather wild range of orchids, therefore various orchid elements from different phyto-geographical regions could be expected.



**Figure 2** Rain days and rainfall in Hon Ba nature reserve (Technical report of Hon Ba nature reserve, 2013)



**Plate 1** Closed evergreen tropical monsoon (seasonal) broad-leaved lowland forest and lowland forest along the stream from 50 – 500 m asl.





**Plate 2** Closed evergreen tropical monsoon (seasonal) submontane broad-leaved forest  
500 – 1000 m asl.





**Plate 3** Closed evergreen tropical monsoon (seasonal) mixed lower montane forest  
1000 – 1550 m asl., humidity 98% – 99%.

### **Data Collection**

The orchid collection had been carried out once a month from March 2014 to December 2014 in order to cover all flowering seasons of the orchids. All had been made with photographs of their habitats as well as available field notes. The selected collecting trails cover different altitudinal areas from the altitude of ca. 200 m asl. to the summit of ca. 1,578 m. Moreover, the trials consisted of various types of micro-habitat in various (non/less disturbed) vegetation types where orchids occurred e.g. terrestrial on soil, rocky areas, shady habitats, open-sunny habitats, along stream, epiphyte on trees etc.

The specimens had been processed as dry and/or spirit according to Forman and Bridson (1999).

### **Laboratory Works**

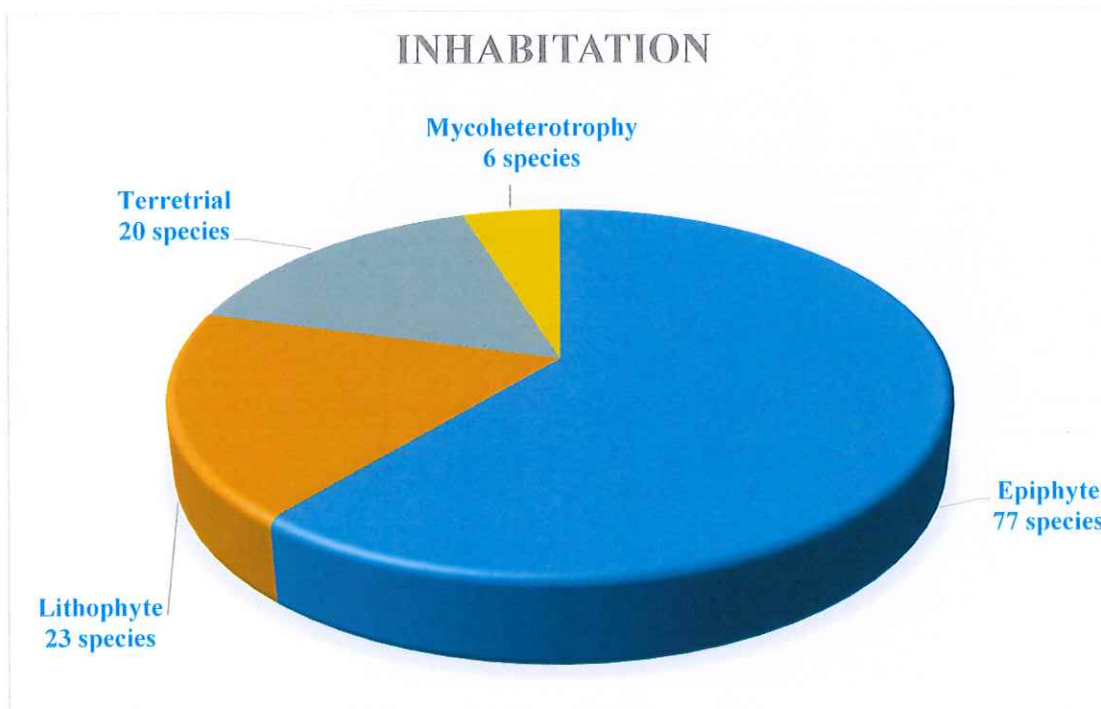
Orchid specimen collected were identified according to available taxonomic references (Averyanov, 1999, 2005, 2008, 2010a, 2010b, 2011; Averyanov & Averyanova, 2003; Pedersen et al., 2011, 2014; Schuiteman & De Vogel, 2000; Seidenfaden, 1992; Seidenfaden & Wood, 1992). The distribution pattern of each taxon had been confirmed by comparing with herbarium specimens in Thailand (PSU), Kew online herbarium (K) and in Vietnam (VNM) as well as the distribution data from available taxonomic literature concerning the orchids in this region of the oriental Asia. Voucher specimens were deposited at Vietnam national herbarium (VNM).

## CHAPTER 3

### RESULTS

#### Orchid diversity in Hon Ba nature reserve

A total of 126 species of orchids belonging to 50 genera were recorded. Among them the genera *Dendrobium*, *Bulbophyllum*, *Liparis*, *Oberonia* and *Paphiopedilum* were the most diverse orchids (Table 1, Fig. 3).



**Figure 3** Number of species by vegetative types of Orchids in Hon Ba

**Table 1** List of Orchids in Hon Ba nature reserve. Inhabitation: E = epiphyte, L = lithophyte, T = Terrestrial, M = Mycoheterotrophy

Scientific name	Alt. (m) asl	Inhabitation	Flowering time	Distribution													
				Cambodia	Himalayan ranges	Japan	Laos	Malasian region	Myanmar	South china	Thailand	Vietnam (E)					
<i>Acanthephippium striatum</i> Lindl.	1467-																
<i>Aerides falcata</i> Lindl. & Paxton	1500	T	Mar		X				X		X		X			X	
<i>A. odorata</i> Lour.	800	E	Jul			X							X				
	980	E	Aug, Sep, Oct				X		X		X				X		
<i>Anoectochilus lylei</i> Rolfe ex Downie	1501	T	Mar, Apr, May										X				
<i>Aphyllorchis pallida</i> Blume	1167	M	Jul, Aug								X					X	
<i>Appendicula gracilis</i> Aver.	1322	E	Jun										X				
<i>A. hexandra</i> (J. Koenig) J.J. Sm.	1318	L	May								X				X		
<i>A. reflexa</i> Blume	1450	L	Apr								X				X		
<i>Arundina caespitosa</i> Aver.	310	L	Mar, Dec													X	
			Whole year														
<i>A. graminifolia</i> (D. Don) Hochr.	1200	T									X				X		
<i>Bulbophyllum apodum</i> Hook. f.	1468	E	Apr								X				X		
<i>B. clipeibulbum</i> J.J. Verm.	1412	E	May								X				X		
<i>B. dasystachys</i> J.J. Verm., Thavipoke & Phelps	1450	E	Sep													X	

Distribution

Scientific name	Alt. (m) asl	Inhabitation	Flowering time	Cambodia	Himalayan ranges	Japan	Laos	Malasian region	Myanmar	South china	Thailand	Vietnam (E)
<i>B. delitescens</i> Hance	1200	E	Sep		X					X		
<i>B. frostii</i> Summerh.	1156	E	Jul									X
<i>B. macranthum</i> Lindl.	258	E	May	X	X			X	X	X	X	
<i>B. retusiusculum</i> Rchb. f.	1520	E	Jul		X		X	X	X	X	X	
<i>B. simondii</i> Gagnep.	1397	E	Apr									X
<i>B. tixieri</i> Seidenf.	1568	E	May									X
<i>B. thaiorum</i> J.J. Sm.	1102	L	May						X		X	
<i>B. pumilio</i> C.S.P. Parish & Rchb. f.	1515	E	May						X	X	X	
<i>B. tortuosum</i> Lindl.	1466	E	May		X		X	X	X	X	X	
<i>Bulbophyllum</i> sp. 1	-	E	Sep									
<i>Bulbophyllum</i> sp. 2	800	E	Apr									
<i>Calanthe angustifolia</i> (Ridl.) Garay	1498	T	Aug, Sep					X		X		
<i>C. lyroglossa</i> Rchb. f.	1467	T	Jul, Aug	X	X	X	X	X	X	X	X	
<i>Campanulorchis globifera</i> (Rolfe) Brieger	1503	E	Apr								X	
<i>Cephalantheropsis longipes</i> (Hook.f.) Ormerod	1517	T	Oct		X		X	X	X	X	X	
<i>Ceratostylis siamensis</i> Rolfe ex C. Downie	1171	E	Jul, Aug	X			X				X	
<i>C. subulata</i> Blume	986	E	Sep - Dec	X			X	X	X	X	X	



Distribution

Scientific name	Alt. (m) asl	Inhabitation	Flowering time	Cambodia	Himalayan ranges	Japan	Laos	Malasian region	Myanmar	South china	Thailand	Vietnam (E)
<i>C. tonkinensis</i> Aver.	1523	E	Oct									X
<i>Cleisostoma birmanicum</i> (Schltr.) Garay	1500	E	Jun						X	X	X	
<i>C. striatum</i> (Rehb. f.) N.E. Br.	1002	E	Jul		X			X		X	X	
<i>C. williamsonii</i> (Rehb. f.) Garay	1066	E	Jul	X	X		X	X	X	X	X	
<i>Cleisostoma</i> sp.	-	E	Sep	-	-	-	-	-	-	-	-	-
<i>Cleisocentron</i> cf. <i>klossii</i> (Ridl.) Garay	1490	E	Mar	-	-	-	-	-	-	-	-	-
<i>Coelogyne eberhardtii</i> Gagnep.	1333	E	Jul									X
<i>C. fimbriata</i> Lindl. var. <i>fimbriata</i>	1176	E	Jul, Aug	X	X		X	X	X	X	X	
<i>C. mooreana</i> Rolfe	1536	E	May, Aug									X
<i>Collabium chloranthum</i> (Gagnep.) Seidenf.	1435	T	- Oct									X
<i>Conchidium pusillum</i> Griff.	1417	L	Jun						X	X	X	
<i>Cordiglotis longipedicellata</i> Joongku Lee, T.B. Tran & R.K. Choudhary	1200	E	Oct									X
<i>Cryptostylis arachnites</i> (Blume) Hassk.	1257	T	Mar	X	X		X	X	X	X	X	
<i>Cymbidium dayanum</i> Rehb. f.	1200-	T	Apr									
<i>C. erythrostylum</i> Rolfe	1500	T	Jul, Aug	X	X		X	X	X	X	X	
<i>C. lancifolium</i> Hook.	1510	E	May									X
	1297	T	May	X	X		X	X	X	X	X	

Distribution

Scientific name	Alt. (m) asl	Inhabitation	Flowering time	Cambodia	Himalayan ranges	Japan	Laos	Malasian region	Myanmar	South china	Thailand	Vietnam (E)
<i>Dendrobium aduncum</i> Wall. ex Lindl.	1067	E	Jul		X		X		X	X	X	
<i>D. aloifolium</i> (Blume) Rchb.f.	800	E	Apr	X				X	X		X	
<i>D. amplum</i> Lindl.	1156	E	Oct	X	X				X	X	X	
<i>D. angustifolium</i> (Blume) Lindl.	1521	E	Jun					X		X	X	
<i>D. crumenatum</i> Sw.	200	E	Mar, Oct	X			X	X	X	X	X	
<i>D. dentatum</i> Seidenf.	1323	E	Mar									X
<i>D. farinatum</i> Schildh. & Schraut	1353	L	Jul									X
<i>D. hamatum</i> Rolfe	1100	E	Sep									X
<i>D. kankhoaense</i> Aver.	1350	E	Jul									X
<i>D. pachyphyllum</i> (Kuntze) Bakh. f.	320	E	Mar		X			X	X		X	
<i>D. pseudotenellum</i> Guillaumin	1510	E	Oct							X		
<i>D. spatella</i> Rchb. f.	944	E	Jun	X	X		X	X	X	X	X	
<i>Dendrobium</i> sp.	1520	E	May	-	-	-	-	-	-	-	-	-
<i>Dendrobium</i> cf. <i>cacuminis</i> Gagnep.	1400	E	Dec	-	-	-	-	-	-	-	-	-
<i>Dendrobium</i> cf. <i>brunneum</i> Schuit. & Peter B.Adams	1300	E	Oct	-	-	-	-	-	-	-	-	-
<i>Eria globulifera</i> Seidenf.	1321	E	Oct		X	X		X		X	X	
<i>E. lactiflora</i> Aver.	1544	E	Mar									X

Distribution

Scientific name	Alt. (m) asl	Inhabitation	Flowering time	Distribution												
				Cambodia	Himalayan ranges	Japan	Laos	Malasian region	Myanmar	South china	Thailand	Vietnam (E)				
<i>E. obscura</i> Aver.	246	E	May													X
<i>E. tomentosa</i> (J.König) Hook.f.	700	E	Mar				X					X	X		X	
<i>Eria</i> sp.	1489	E	May	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Eria</i> cf. <i>scabrilinguis</i> Lindl.	900	E	Sep	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Erythrorchis altissima</i> Blume	900	M	Sep - Dec	X	X	X	X	X	X	X	X	X	X	X	X	X
<i>Gastrochilus calceolaris</i> (Buch.-Ham. ex Sm.) D. Don	1486 1300-	E	Jun		X		X	X	X	X	X	X	X	X	X	X
<i>Geodorum densiflorum</i> (Lam.) Schltr.	1500	T	Jul	X	X		X	X	X	X	X	X	X	X	X	X
<i>Goodyera foliosa</i> (Lindl.) Benth. ex C.B. Clarke	1384	T	Sep		X	X				X			X	X	X	X
<i>Habenaria rhodocheila</i> Hance	402	L	Oct - Dec	X			X	X	X	X	X	X	X	X	X	X
<i>Lecanorchis nigricans</i> Honda	966	M	Jul			X										
<i>L. vietnamica</i> Aver.	1416	M	Jun													X
<i>Liparis caespitosa</i> (Lam.) Lindl.	982	E	Sep	X	X		X	X	X	X	X	X	X	X	X	X
<i>L. chapaensis</i> Gagnep.	1510	L	May - Jul													X
<i>L. mamillata</i> Aver.	1492	L	Sep													X
<i>L. ngoclinensis</i> Aver.	1174	L	Otc													X
<i>Liparis</i> cf. <i>balansae</i> Gagnep.	1300	L														

Distribution

Scientific name	Alt. (m) asl	Inhabitation	Flowering time	Distribution												
				Cambodia	Himalayan ranges	Japan	Laos	Malasian region	Myanmar	South china	Thailand	Vietnam (E)				
<i>Liparis cf. bootanensis</i> Griff.	1500	E	Otc	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Liparis cf. dendrochiloides</i> Seidenf. ex Aver.	-	T	Jul	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Liparis cf. mannii</i> Rchb.f.	1500	E	Otc	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Liparis cf. sootenzanensis</i> Fukuy.	859	L	May	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Liparis cf. tenuis</i> Rolfe ex Downie	-	E	Sep	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Liparis</i> sp.	1410	L	Otc	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Micropera pallida</i> Lindl.	410	E	Sep	X	X	-	X	X	X	X	-	-	-	-	X	-
	1300-															
<i>Miguelia cruenta</i> Aver & Vuong	1500	T	May	-	-	-	-	-	-	-	-	-	-	-	-	X
<i>Mycaranthes floribunda</i> (D.Don) S.C.Chen & J.J.Wood	1376	E	Apr	X	X	-	X	X	X	X	-	-	-	-	X	X
<i>M. pannea</i> (Lindl.) S.C.Chen & J.J.Wood	1320	E	Jul	X	X	-	X	X	X	X	-	-	-	-	X	X
<i>Mycaranthes</i> sp.	1400	E	Jun	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Oberonia falcata</i> King & Prantl	1498	E	Sep	-	X	-	-	-	X	-	-	-	-	-	X	-
	1306-															
<i>O. longibracteata</i> Lindl.	1500	E	Sep	-	X	-	-	-	-	-	-	-	-	-	X	X
<i>Oberonia cf. dolichostachys</i>	1500	E	Oct	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Oberonia cf. caulescens</i>	1410	E	Sep	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Oberonia cf. solanensis</i>	1515	L	Apr	-	-	-	-	-	-	-	-	-	-	-	-	-

Distribution

Scientific name	Alt. (m) asl	Inhabitation	Flowering time	Cambodia	Himalayan ranges	Japan	Laos	Malasian region	Myanmar	South china	Thailand	Vietnam (H)
<i>Odontochilus saprophyticus</i> (Aver.) Ormerod	1505	M	Jun						X	X		
<i>Ornithochilus difformis</i> (Wall. ex Lindl.) Schltr.	1200	E	Sep		X		X	X	X	X	X	
<i>Oxystophyllum carnosum</i> Blume	194 1400-	E	Oct	X			X	X	X		X	
<i>Paphiopedilum appletonianum</i> (Gower) Rolfe	1550	T/L	Mar	X		X	X			X	X	
<i>P. delenatii</i> Guillaumin	800	L	Mar									X
<i>P. x cribbii</i> Aver	1200	L	Jan							X		
<i>P. villosum</i> (Lindl.) Stein var. <i>annamense</i> Rolfe.	1300	L	Jan			X				X		
<i>Pholidota chinensis</i> Lindl.	1474- 1550	E	Jun Jul						X	X	X	
<i>P. leveilleana</i> Schltr.	1420- 1500	T	Mar							X		
<i>Phreatia densiflora</i> Lindl.	1435	E	May					X			X	
<i>Pinalia</i> cf. <i>floribunda</i>	1430	E	Apr									
<i>Platanthera singgalangensis</i> (J.J.Sm.) Efimov	1520	T	May					X	X		X	
<i>Podochilus banaensis</i> Ormerod	1470	L	Apr									X
<i>P. microphyllus</i> Lindl.	1443	L	Apr	X				X	X		X	

Scientific name	Alt. (m) asl	Inhabitation	Flowering time	Distribution										
				Cambodia	Himalayan ranges	Japan	Laos	Malasian region	Myanmar	South china	Thailand	Vietnam (E)		
<i>Pteroceras teres</i> (Blume) Holttum	322	E	Sep to Dec	X	X	X	X	X	X	X	X	X	X	X
	1200—		Whole year											
<i>Spathoglottis plicata</i> Blume	1500	T	year	X	X	X	X	X	X	X	X	X	X	X
<i>Stichorkis compressa</i> (Blume) J.J.Wood	1323	E	Jun		X									
<i>S. gibbosa</i> (Finet) J.J.Wood	1006	E	Sep	X	X	X	X	X	X	X	X	X	X	X
<i>Tainia</i> cf. <i>cordifolia</i> Hook.f.	900	T												
<i>Thecostele alata</i> C.S.P.Parish & Rchb. f.	350	E	Sep	X	X	X	X	X	X	X	X	X	X	X
			Sep, Oct,											
<i>Thrixspermum centipeda</i> Lour	334	E	Nov, Dec	X	X	X	X	X	X	X	X	X	X	X
<i>T. fragrans</i> Ridl.	815	E	May											
<i>Thrixspermum</i> cf. <i>annamense</i>	800	E	May											
<i>Trias nasuta</i> (Rchb.f.) Stapf	330	E	Dec		X				X				X	
<i>Trichoglottis retusa</i> Blume	246	E	Sep					X					X	
<i>T. seidenfadenii</i> Aver.	250	E	May										X	
<i>Trichotostia microphylla</i> Blume	267	E	Mar					X					X	
<i>T. velutina</i> (Lodd. ex Lindl.) Kraenzl.	1215	E	Jul		X	X							X	
<i>Vanilla atropogon</i> Schuit., Aver. & Rybková	235	T	Mar											X
<i>V. albida</i> Blume	300	T	Mar								X		X	

### Species descriptions

There are 126 species of Orchid belong to 51 genera were described and identified. The full description of 102 species with flowering time, ecology and distribution are included.

1. *Acanthephippium striatum* Lindl., Edwards's Bot. Reg. 24 (Misc.): 41. 1838; Seidenf., Opera Bot. 89: 50. 1986; J. B. Comber, Orchids Java: 90. 1990; Seidenf., Opera Bot. 114: 84. 1992; Seidenf. & J. J. Wood, Orchids Penins. Malaysia Singapore: 157. 1992; H. H. Pham, Ill. Fl. Vietnam 3: 877. 2000; N. Pearce & P. J. Cribb, Fl. Bhutan 3(3): 274. 2002; X. Chen, S. W. Gale, & P. J. Cribb in Z. Y. Wu et al. (eds), Fl. China 25: 310. 2009; H. Kurzewil in Santisuk & Balslev (eds), Fl. Thailand 12(2): 310. 2014. (Plate 4 A & B).

Terrestrial sympodial orchid. *Pseudobulbs* conical, ca. 9.5–10 x 0.5–3 cm, several nodes, usually covered by brown sheaths. *Foliage leaves* 1 to 2, ovate to elliptic, ca. 39–40 x 16–16.5 cm, apex acute; petiole glabrous ca. 19–20 cm. *Inflorescence* lateral, from the base of pseudobulb, glabrous, cream colored, ca. 10–14 cm long; peduncle ca. 7–9 cm long; sterile bracts elliptic, apex acute to acuminate, 4–4.2 x 2.4–2.5 cm (flattened) white with 6–7 red veins; rachis glabrous, 3–5 cm long, 4 to 10 flowered; floral bracts glabrous elliptic, ca. 3–4 x 2–2.3 cm (flattened), apex acute, white 7–8 red veins. *Flower* white, cream colored red veins on sepals, open from base, not open widely. *Dorsal sepal* glabrous, elliptic, ca. 2.9–3 x 1.4–1.5 cm, apex acute. *Lateral sepals* glabrous, ovate, ca. 3.1–3.2 x 2–2.1 cm, forming mentum with column foot, ca. 1 cm long, cylindric, apex obtuse. *Petals* glabrous, obovate, apex acute ca. 2.7–2.8 x 1.1–1.2 cm, apex obtuse. *Labellum* glabrous, ca. 2–3 x 2.2–2.5 cm (flattened), 3 lobed; mid lobe triangular, ca. 0.5–0.7 x 0.5–0.6 cm, apex acute, yellowish margin, dark red lines in the middle; lateral lobes falcate 1–1.5 x 0.5–0.7 cm; one obtuse yellowish keel on disk. *Column* glabrous, ca. 1.5 cm long, recurved at apical part; anther cap ovoid, ca. 0.3 cm long; pollinia 8, yellow, in 2 groups of 4, ca. 0.2–0.25 cm long, unequally (2 short, 2 long), narrowly ovate, waxy, caudicles of each group attached to

viscidium, stipe absent. *Ovary* (with pedicel), glabrous, white, ca. 1.1–3.1 cm. *Capsule* not seen.

**Vietnam.** – Hon Ba (Khanh Hoa province), Lam Dong, Lao Cai.

**Distribution.** – China, India, Indonesia, Nepal, Laos, Malaysia, Myanmar, Taiwan.

**Ecology.** – Closed evergreen tropical monsoon (seasonal) mixed lower montane forest, along the stream on sandy soil, wet and humidity. ca. 1467–1500 m asl. Flowering time March to April.

**Specimen examined.** – V. B. TRUONG 029 (PSU).

2. *Aerides falcata* Lindl. & Paxton, Paxton's Fl. Gard. 2: 142. 1851; Seidenf., Opera bot. 114: 428. 1992; H. H. Pham, Ill. Fl. Vietnam 3: 953. 2000; X. Chen & J.J. Wood in Z. Y. Wu et al. (eds), Fl. China 25: 486. 2009. (Plate 4 C & D).

Epiphytic monopodial orchid. *Stem* stout, elongate, up to 30–40 cm long. *Leaves* glabrous, distichous lorate, ca. 12–16 x 1.7–1.8 cm, apex 2 lobed, unequally with one small tail in the middle. *Inflorescence* terminal or lateral, raceme, glabrous, ca. 19–20 cm long, up to 12 flowered; inflorescence bract 2, ca. 0.5–0.65 cm long; floral bract glabrous brown, ovate, 0.45–0.5 cm long, apex obtuse. *Flower* open broadly, petal and sepals brownish white, with distinct pink veins, labellum pink, serrulate. *Dorsal sepal* glabrous, ovate, ca. 1.5 x 0.9 cm, apex acute. *Lateral sepals* glabrous, broadly ovate ca. 1.4 x 1.2 cm, apex acute. *Petals* glabrous, ovate, curved toward, margin incurved, ca. 1.5 x 0.7 cm, apex acute, pinkish veins. *Labellum* glabrous, spurred, 3 lobed; mid lobe ca. 2 x 1.9 cm, margin serrulate, apex emarginated; lateral lobes glabrous, falcate, yellowish base; spur parallel with mid lobe, ca. 0.6 cm long, brown, apex obtuse; callus brown suborbicular near base of labellum; one pink groove on the labellum near the tip of callus. *Column* glabrous ca. 2 cm long, white, pinkish margin, yellowish base; anther cap white, beaked, glabrous, ca. 0.5 cm long; pollinia 2, yellow, subglobose, ca. 0.20–0.25 cm long; stipe ca. 0.2 cm long, slender, attached to viscidium. *Ovary* (with pedicel) glabrous, white, ca. 1.5 cm long. *Capsule* not seen.



**Vietnam.** – Hon Ba (Khanh Hoa province), Son Ia, Kontum, Daklak, Lam Dong, Da Lat, Tay Ninh.

**Distribution.** – China (Yunnan), Cambodia, India, Laos, Myanmar, Thailand.

**Ecology.** – Low land evergreen forest. ca. 800 m asl. Flowering time early in July.

**Specimen examined.** – D. Menzies & D. Du Puy 353 (K, photo); V. B. TRUONG 034 (PSU).

Note: This species was collected by ranger of Hon Ba nature reserve without exactly location.

3. *Aerides odorata* Lour., Fl. Cochinch. 2: 525. 1790; J.B. Comber, Orchids Java: 299. 1990; Seidenf. & J. J. Wood, Orchids Penins. Malaysia Singapore: 673.1992; Seidenf., Opera bot. 114: 426.1992; H. H. Pham, 3. Ill. Fl. Vietnam: 954. 2000; J. B. Comber, Orchids Sumatra: 843. 2001; N. Pearce & P. J. Cribb, Fl. Bhutan 3 (3): 492. 2002; X. Chen & J.J Wood in Z. Y. Wu et al. (eds), Fl. China 25: 385. 2009. – *Epidendrum odoratum* (Lour.) Poir. in J.B.A.M.de Lamarck, Encycl., Suppl. 1: 385. 1810. – *Aeridium odorum* Salisb., Trans. Hort. Soc. London 1: 295. 1812. (Plate 4 E & F).

Epiphytic monopodial orchid. **Stem** stout, ascending, occasion branched, ca. 30 cm long. **Foliage leaves** lorate, ca. 10–12 x 2.5–2.8 cm, apex obtuse, unequally 2 lobes; petiole sheath ca. 2.3–2.5 cm long. **Inflorescence** lateral, glabrous, raceme, ca. 30–33 cm long; rachis ca. 15 cm long, up to 18 flowered; floral bract, glabrous, ovate ca. 0.5–0.55cm long, apex obtuse to slightly acute. **Flower** open from base, glabrous, fragrant, sepal, petals white or cream color, labellum white, spur greenish–white. **Dorsal sepal** glabrous, elliptic, ca. 1.4–1.5 x 0.4–0.45 cm, apex obtuse. **Lateral sepals** glabrous, ovate ca. 1.4–1.45 x 1–1.1 cm, apex acute to obtuse, base adnate to column foot. **Petals** glabrous, elliptic, ca. 1.3–1.35 x 0.8–0.85 cm, apex obtuse. **Labellum** glabrous, ca. 1,5 cm long, spurred, 3 lobed; mid lobe ca. 0.7–0.75 cm long, white, apex acute, incurved; lateral lobes ca. 1.5 x 0.5–0.6 cm, white, erect, obovate, margin entire, slightly incurved; spur horn shape, curve toward ca. 90<sup>0</sup>, ca. 0.9–1 cm long, green on the tip,

greenish-white in the middle. *Column* glabrous, ca. 0.5 x 0.35 cm, long column foot ca. 1 cm long, white, curved near the tip, winged foot; anther cap beaked, white, glabrous, ca. 0.4 cm long; pollinia 2, yellow, ca. 1 mm long, slender white stipe attached to viscidium. *Ovary* (with pedicel) glabrous, white, slender ca. 2–2.5 cm long. *Capsule* oblanceolate, ca. 1.5 – 2 cm long.

**Vietnam** – Hon Ba (Khanh Hoa province), Cao Bang, Tuyen Quang, Tam Dao, Yen Bai, Hue, Hai Vân, Kontum, Đà Lat.

**Distribution.** – Assam, Andaman Islands, Bangladesh, Cambodia, Himalayas, India, Indonesia, Laos, Nepal, Malaysia, Myanmar, Thailand, Philippines.

**Ecology.** – Lowland ever green forest, along the stream or on very high trees, open areas. ca. 980 m asl. Flowering time September to early of October.

**Specimen examined.** – E. de Vogel & P. Cribb 9248 (K, photo), P. T. Ong FRI 67332 (K, photo), P. Rojchana-umpawan 210 (PSU), V. B. TRUONG 035 (PSU).

4. *Anoectochilus lylei* Rolfe ex Downie, Bull. Misc. Inform. Kew 411. 1925; Seidenf. Opera bot. 114: 33.1992; H. H. Pham III. Fl. Vietnam 3: 788. 2000; Aver., Turczaninowia 11(1): 162. 2008; H. Æ. Pedersen in Santisuk & Larsen (eds), Fl. Thailand 12(1): 16. 2011. (Plate 4 G & H).

Terrestrial monopodial orchid. *Rhizome* reddish–brown, fleshy, creeping, ca. 0.3 cm in diam. *Foliage leaves* 2 to 4, ovate, ca. 2–3 x 2.5 cm, apex acute, dark green above, reddish–brown below, adaxial reticulated yellowish–white sometimes pinkish nerves; petiole sheath ca. 0.6–1 cm long, reddish–brown. *Inflorescence* terminal, ca. 18 cm long, fleshy, pubescent with reddish–brown hair; inflorescence bracts 2, brownish, ca. 1.2 cm long; floral bracts ovate, pubescent with white hair, ca. 1 x 0.7 cm, brown. *Flower* open from base, widely open, sepals brown-green, petal pale white and labellum white. *Dorsal sepal* ovate, ca. 0.4–0.6 x 0.3 cm, pubescent with white hair, apex acute. *Lateral sepals* oblong, ca. 0.5–0.7 x 0.3 cm, apex acute, pubescent with white hair, tip slightly outcurved. *Petals* oblong to falcate, as long as dorsal sepal, ca. 0.4 x 0.3 cm. apex acute. *Labellum* white ca. 1.1–1.5 cm long, spurred; spur white,

cylindric, retuse, ca. 0.3–0.4 cm long, parallel with ovary; mesochile have short claw, a pair of dentate flanges; epichile bilobed, ca. 0.8–1.2 cm long, acute angle to each other. *Column* porrect ca. 0.3–0.4 cm long, short bifid rostellum; anther cap ovate, apex acute, ca. 0.4 cm long; pollinia 2, ca. 3 mm long, yellow, soft, attached to ovate viscidium. *Ovary* (with pedicel) greenish–brown, pubescent with white hair, ca. 1.3 cm long. *Capsule* not seen.

**Vietnam** – Hon Ba (Khanh Hoa province), Kontum, Lam Dong, Gia Lai, Quang Tri, Hue

**Distribution.** – Myanmar, Thailand.

**Ecology.** – ca. 1501 m asl. closed evergreen tropical monsoon (seasonal) mixed lower montane forest, under the shade of forest. Flowering time March to April.

**Specimen examined.** – A.F.G. Kerr 297 (K, photo), V. B. TRUONG 030 (PSU).

5. *Aphyllorchis pallida* Blume, Tab. Pl. Jav. Orchid.: t. 16, f. 77 1825; J.B. Comber, Orchids Java: 51. 1990; Seidenf. & J.J. Wood, Orchids Penins. Malaysia Singapore: 44.1992; Seidenf., Opera bot. 114: 33.1992; J. B. Comber, Orchids Sumatra: 120. 2001; H. Æ. Pedersen in Santisuk & Balslev (eds), Fl. Thailand 12(2): 326. 2014. (Plate 5 A & B).

Terrestrial, mycoheterotrophic orchid. *Stem* slender, creamed with dark purple dots; 8 scale-like leaves, brown ca. 0–5–0.6 cm long, apex acute. *Inflorescence* terminal, ca. 6–7.5 cm long, creamed with purple dots; floral bract ovate to oblong, ca. 0.45 x 0.2–0.25 cm, apex acute. *Flower* resupinate, creamed color, open from base, not open widely, face down. *Dorsal sepal* glabrous, oblong, ca. 0.45–0.5 x 0.2–0.25 cm apex acute or obtuse. *Lateral sepals* glabrous, oblong, ca. 0.45–0.5 x 0.15–0.2 cm, apex obtuse. *Petals* glabrous, oblong to falcate, ca. 0.5 x 0.25 cm, apex obtuse. *Labellum* glabrous, ca. 0.3–0.4 cm long; epichile ca. 0.1–0.2 cm long, apex obtuse, fleshy; hypochile creamed, erect, triangular, ca. 0.2 cm long, apex obtuse. *Column* slender, glabrous, ca. 0.2–0.3 cm long, strongly curved in the middle; anther cap white, 0.9 mm long; rostellum triangular; pollinia 2, ca. 0.5 mm long, soft, rounded, yellow, caudicles

absent. *Ovary* (with pedicel) creamed with dark violet marking ca. 0.6–1 cm long. *Capsule* not seen.

**Vietnam.** – Hon Ba (Khanh Hoa province), Chu Yang Sin, Dak Lak, Lac Duong, Lam Dong.

**Distribution.** – Indonesia, Malaysia, Philippines, Thailand.

**Ecology.** – Near the roots of big trees, under the shade of forest, or along the stream, wet and humidity area not common species. Above 1000 m asl. Flowering time early of July to August.

**Specimen examined.** – R.P. Clark 9 (K, photo), A Lamb AL1352/91 (K, photo), J.J. Wood 706 (K, photo), V. B. TRUONG 036 (PSU).

6. *Appendicula reflexa* Blume, Bijdr. Fl. Ned. Ind. 301. 1825; J.B. Comber, Orchids Java: 198. 1990; Seidenf., Opera Bot. 114: 200. 1992; Seidenf. & J. J. Wood, Orchids Penins. Malaysia Singapore: 330. 1992; H. H. Pham, Ill. Fl. Vietnam 3: 799. 2000; J. B. Comber, Orchids Sumatra: 458. 2001; X. Chen & J. J. Wood in Z. Y. Wu et al. (eds), Fl. China 25: 364. 2009. – *Podochilus reflexus* (Blume) Schltr., Mém. Herb. Boissier 21: 31. 1900. (Plate 5 C).

Epiphytic or lithophytic sympodial orchid. *Stems* ca. 40–70cm long, erect. *Leaves* glabrous, distichous, lanceolate, ca. 5–6.1 x 0.5–0.6 cm, apex retuse, with very small seta in the middle; petiole sheath ca. 1.5–1.8 cm long. *Inflorescence* terminal or lateral, glabrous, 6 to 8 inflorescence per stem, 7–10 flowered; inflorescence bract 1 to 2, brown, glabrous; floral bract brownish, glabrous, ovate ca. 0.1 cm long, apex acute. *Flower* greenish white, not open widely. *Dorsal sepal* glabrous, ovate, ca. 0.2 x 0.1 cm, apex obtuse. *Lateral sepals* glabrous, triangular, ca. 0.3 x 0.2 cm, apex acute, lateral sepals forming white mentum, ca. 0.2 cm, apex obtuse. *Petals* elliptic, ca. 0.2 x 0.1 cm, apex obtuse. *Labellum* simple, glabrous, slightly greenish-white, obovate to suborbicular, narrowly in the middle, tip of labellum recurved, apex acute; base appendage concave attached to column. *Column* short, thick, greenish-white, glabrous, ca. 0.1–0.2 cm long; anther cap pale brown, ovate, subterminal, ca. 2 mm long, apex

acute; pollinia 6, into 2 groups, clavate, apex obtuse, ca. 0.9 mm long. **Ovary** (with pedicel) glabrous, pale green, ca. 0.4–0.5 cm long. **Capsule** narrow elliptic, ca. 0.8–0.9 cm long.

**Vietnam.** – Hon Ba (Khanh Hoa province), Đà Lạt, Lâm Đồng, Phú Quốc.

**Distribution.** – Thailand, Indonesia.

**Ecology.** – Closed evergreen tropical monsoon (seasonal) mixed lower montane forest, sometime lithophyte, dry or along the stream, ca. 1450 m asl. Flowering time in the middle of May.

**Specimen examined.** – J. Clemens 333 (K, photo); E. de Vogel & P. Cribb 9154 (K, photo); P. Rojchana-umpawan 153 (PSU); V. B. TRUONG 033 (PSU).

7. *Appendicula gracilis* Aver., Bot. Zhurn. 82(3): 137. 1997. (Plate 5 D & E).

Epiphytic sympodial orchid. **Stem** hanging, branched, up to ca. 30–40 cm long. **Leaves** distichous, elliptic, apex emarginate with small seta in the middle, ca. 0.9–1.1 x 0.4–0.55 cm, twisted at base. **Inflorescence** terminal or lateral, single flowered; floral bract ca. 0.15–0.2 cm long, apex acute. **Flower** ca. 0.6–0.7 cm long (from dorsal sepal to tip of mentum), white sepal and petals, pink twisted labellum. **Dorsal sepal** glabrous, ovate ca. 0.25 x 0.3 cm, apex acute. **Lateral sepals** glabrous, ovate ca. 0.5 x 0.25 cm, apex acute, slightly purple on the tip, lateral sepals forming mentum ca. 0.3–0.35 cm long, apex obtuse. **Petals** ovate to somewhat triangular ca. 0.35 x 0.25 cm, apex slightly emarginated. **Labellum** simple, glabrous, ca. 0.5 x 0.15 cm; adnate with column by small appendage at the base of labellum; apex obtuse, purple, twisted aside; slightly undulated margin. **Column** erect, ca. 0.45–0.5 cm long, white, apex acuminate; anther cap ovate, apex acuminate, ca. 1.5 mm long, purple-white; pollinia 6 in separate 2 groups, yellow, clavate, ca. 0.5 mm long, stipe absent. **Ovary** (with pedicel) slender ca. 0.3–0.4 cm long. **Capsule** not seen.

**Vietnam.** – Hon Ba (Khanh Hoa province), Kontum.

**Distribution.** – Endemic to Vietnam.

**Ecology.** – Closed evergreen tropical monsoon (seasonal) mixed lower montane forest, along the streams, big streams. ca. 1322 m asl. Flowering time on June.

**Specimen examined.** – V. B. TRUONG 032 (PSU).

8. *Appendicula hexandra* (J. Koenig) J.J. Sm., Bull. Jard. Bot. Buitenzorg, sér. 3, 12: 119. 1932; Seidenf., Opera Bot. 114: 200. 1992; J. B. Comber, Orchids Sumatra: 542. 2001. – *Epidendrum hexandrum* J.Koenig in A.J.Retzius, Observ. Bot. 6: 45. 1791. – *Appendicula koenigii* Hook. f., Fl. Brit. India 6: 84. 1890. – *Podochilus hexandrus* (J.Koenig) Schltr., Mém. Herb. Boissier 21: 27. 1900. (Plate 5 F & G).

Epiphytic or sometimes lithophytic sympodial orchid. **Stem** ca. 20–26.5 cm long, pendulous. **Leaves** distichous, glabrous, oblong to elliptic, ca. 0.5–1.2 x 0.5–0.9 cm (smaller size on the tip of the stem), apex obtuse to retuse. **Inflorescence** terminal or lateral, ca. 0.3–3 cm long, greenish-white; peduncle glabrous, short ca.0.2 cm long; rachis glabrous, ca. 2 cm long, 3 to 6 flowered; inflorescence bract 1, apex acute; floral bract ovate, apex acute, as long as pedicel. **Flower** usually opening in succession or in pair, greenish white, lateral lobes red in middle in some occasions. **Dorsal sepal** glabrous, ovate, ca. 0.4–0.5 x 0.15 cm, apex obtuse. **Lateral sepals** glabrous, oblong, ca. 0.4–0.6 x 0.2–0.25 cm, apex obtuse to slightly acute, recurved, green mid vein, lateral sepals forming mentum ca. 0.1 cm long. **Petals** glabrous, narrowly oblong, ca. 0.3–0.4 cm long, apex obtuse. **Labellum** glabrous, saccate, rounded apex (horseshoes), ca. 0.2–0.25 x 0.15 cm; base red on the margin to the middle of labellum. **Column** glabrous, white, short ca. 0.1–0.15 cm long, anther cap greenish white, glabrous, subterminal, ovate, ca. 2.5 mm long, apex acute; pollinia 6, separate into 2 groups of 3, ca. 0.8 mm long, pale yellow, clavate, stipe absent, viscidium unclear. **Ovary** (with pedicel), glabrous, ca. 0.4 cm long. **Capsule** ovoid, ca. 0.3–0.4 cm long, 6 ridges.

**Vietnam.** – Hon Ba (Khanh Hoa province), Đà Lạt, Bảo Lộc, Phú Quốc.

**Distribution.** – Indonesia, Malaya, Thailand.

**Ecology.** – Closed evergreen tropical monsoon (seasonal) mixed lower montane forest, along the stream or dry areas. ca. 1318 m asl. Flowering time March to April.

**Specimen examined.** – A.F.G. Kerr 0117 (K, photo); V. B. TRUONG 031 (PSU).

9. *Arundina graminifolia* (D. Don) Hochr. subsp. *caespitosa* (Aver.) H. A. Pedersen & Schuit.; H. A. Pedersen et al. in Santisuk & Balslev (eds), Fl. Thailand 12(2): 330. 2014. (Plate 6 A & B).

Lithophytic sympodial orchid. *Rhizome* branched 0.2–0.25 cm in diam. *Stem* erect, caespitosa, ca. 10–65 cm tall, ca. 0.2–0.5 cm in diam. *Leaves* 4 to 10 distichous, sessile, glabrous, linear, ca. 9–12 x 0.5 cm, apex acute; leaf sheaths glabrous, ca. 0.7–0.8 cm long. *Inflorescence* terminal, raceme, unbranched, erect; rachis 2–4 flowered; sterile bracts 1 to 4, apex acute; floral bract glabrous, greenish–yellow, broadly ovate, ca. 0.3–0.6 x 0.3–0.5 cm (flattened), apex acute–acuminate. *Flower* purple or pale purple, ca. 2–2.5 cm long, slightly fragrant. *Dorsal sepal* glabrous, oblong, ca. 1.9–2 x 0.6–0.7 cm, apex acute or obtuse. *Lateral sepals* glabrous, oblong, ca. 1.8–1.9 cm, apex obtuse to acute. *Petals* oblong, ca. 2.2–2.3 x 1–1.1 cm, apex short acuminate. *Labellum* glabrous, trumped shaped, embrace column, margin wavy, ca. 2.5 x 1.8 cm, 3-lobed; mid lobe ca. 1.3 x 0.8 cm, emarginated to somewhat bi-lobed; lateral lobes triangular, erect, embrace column, ca. 1.3 x 0.5 cm, apex rounded. *Column* white, slightly incurved ca. 1–1.1 x 0.2–0.3 cm; on the base of the column has very small orange group of papillae; anther cap glabrous, ovate, ca. 1.5 mm long, apex acute; pollinia 8, pale yellow in 2 groups of 4, ca. 1 mm long, clavate, ca. waxy, short caudicles, stipe and viscidium absent. *Ovary* (with pedicel), glossy green or dark purple, ca. 0.7–2.9 x 0.1 cm, dark purple at the base and green above. *Capsule* oblanceolate, longitudinally ridged capsule 3 x 0.5 cm, 6 longitude ridges.

**Vietnam.** – Hon Ba (Khanh Hoa province), Hue.

**Distribution.** – Thailand.

**Ecology.** – Closed evergreen lowland forest, along the stream. ca. 310 m asl. Flowering time February, March.

**Specimen examined.** – B. Scortechini 1504 (K, photo); V. B. TRUONG 027 (PSU).

Note: *Arundina graminifolia* (D. Don) Hochr. subsp. *caespitosa* (Aver.) H. A. Pedersen & Schuit. this species much shorter than subsp. *graminifolia*, only lithophyte along the stream, also the shape of labellum and number of ridges on labellum. The colors are different also.

10. *Arundina graminifolia* (D. Don) Hochr. subsp. *graminifolia* Bull. New York Bot. Gard. 6: 270. 1910; Opera Bot. 114: 77. 1992; Seidenf. & J. J. Wood, Orchids Penins. Malaysia Singapore: 146. 1992; H. H. Pham, Ill. Fl. Vietnam 3: 865. 2000; J. B. Comber, Orchids Sumatra: 458. 2001; X. Chen & S. W. Gale in Z. Y. Wu et al. (eds), Fl. China 25: 315. 2009; H. Æ. Pedersen et al. in Santisuk & Balslev (eds), Fl. Thailand 12(2): 328. 2014. – *Bletia graminifolia* D. Don, Prodr. Fl. Nepal.: 29. 1825. – *Arundina bambusifolia* Lindl., Gen. Sp. Orchid. Pl.: 125. 1831, nom. illeg. – *Cymbidium bambusifolium* Roxb., Fl. Ind. ed. 1832, 3: 460. 1832. (Plate 6 C & D).

Terrestrial sympodial orchid. **Stem** reed-like, unbranched, up to 50 cm – 1 m high, covered by leaf sheaths. **Leaves** linear to lanceolate, apex acuminate, ca. 8–18.3 x 0.5–2 cm, from 5 to many leaves. **Inflorescence** terminal, raceme to panicle, ca. 4–5 cm long then separate into branches, 1 to 4 branch(es); rachis ca. 19 cm long; sterile bract 1–3, green, apex acute, 0.5–1.6 cm; floral bract triangular, ca. 0.1–0.5 cm long, green-greenish, apex acute to acuminate. **Flower** open from 1 to 4 in same time, labellum sepals and petals white, labellum purple margin and yellow in the middle. **Dorsal sepal** glabrous, lanceolate, 3–3.2 x 0.7–0.8 cm, apex acute, 4–5 stripes on the blade. **Lateral sepals** glabrous, lanceolate, ca. 3.4–3.5 x 0.7–0.8 cm, apex acute. **Petals** glabrous, ovate, ca. 3.5–3.6 x 1.5–1.6 cm, apex acute–acuminate. **Labellum** trumpet shape, margin lobed, ca. 4 x 2.5 cm, 3 lobed; mid lobe downcurved ca. 1.3 x 0.8 cm, somewhat square apical undulate, cleft; lateral lobes triangular, embrace column, apex obtuse; abaxial middle of labellum yellow, 3 ridges, 2 long lateral ridges and 1 short mid ridge. **Column** slightly incurved, 1.5–1.8 cm long, middle slightly purple; anther cap ovate, apex obtuse, ca. 3.5 mm long; pollinia yellow, 8 separated into 2 groups, inner pollinia shorter than outer, ca. 1 – 0.8 mm long, short caudicles, stipe and



viscidium absent. **Ovary** (with pedicel) 2.5–2.8 cm long, greenish pink near the tip. **Capsule** lanceolate–narrow elliptic, ca. 4.5 cm long, 6 ridges.

**Vietnam.** – Hon Ba (Khanh Hoa province).

**Distribution.** – Indonesia, Malaysia, Nepal, Philippines.

**Ecology.** – Along the street, closed evergreen tropical monsoon (seasonal) mixed lower montane forest. Above 1200 m asl. Flowering time year round, but mainly from April to June.

**Specimen examined.** – Rantai, J. et al. S 70138 (K, photo), HNK 163 (K, photo), P. Rojchana-umpawan 27, 93 (PSU); V. B. TRUONG 028 (PSU).

11. *Bulbophyllum apodum* Hook. f., Fl. Brit. India 5: 766. 1890; Pham H.H., Ill. Fl. Vietnam 3: 847, 2000; J. B. Comber, Orchids Sumatra: 728. 2001; X. Chen & J. J. Vermeulen in Z. Y. Wu et al. (eds), Fl. China 25: 437. 2009. – *Phyllorkis apoda* (Hook.f.) Kuntze, Revis. Gen. Pl. 2: 677. 1891. (Plate 6 E & F).

Epiphyte sympodial orchid. **Pseudobulb** discoid ca. 0.2 cm long; rhizome stiff, creeping. **Leaves** oblong, apex subacute, ca. 9.5–15.5 x 2–3 cm; petiole ca. 2–4 cm long. **Inflorescence** from base of pseudobulbs, raceme, ca. 14.5 cm long, greenish–white; rachis glabrous, slender ca. 10 cm long, 65 to 68 flowered; inflorescence bracts 3, ca. 1.6–1.7 cm long, greenish–white; floral bract white, lanceolate, ca. 0.5–0.6 cm long, apex acuminate. **Flower** not open widely, white, apex of sepals yellow. **Dorsal sepal** glabrous, lanceolate, ca. 0.5 x 0.1 cm, apex acute to acuminate. **Lateral sepals** longer than dorsal sepal, glabrous, ca. 0.5–0.55 x 0.1–0.2 cm, apex acuminate white with yellow on the tip. **Petals** glabrous, linear 1 mid vein, ca. 0.2 x 0.1 cm, apex obtuse. **Labellum** glabrous, strongly outcurved, simple, ca. 0.3 cm–0.2 cm, 3 veins, margin entire, glabrous, apex obtuse to slightly acute, slightly hairy on apical outside part. **Column** glabrous, white, ca. 0.6–0.7 cm long, foot very short, ca. 0.1 cm long; **stelia** white, triangular; anther cap front projecting in middle, ca. 0.5 mm long, slightly papillose; pollinia 2, obovate, ca. 0.1 mm long, caudicles, stipe and viscidium absent. **Ovary** (with pedicel) white, slender, glabrous ca. 0.2–0.3 cm long. **Capsule** not seen.

**Vietnam.** – Hon Ba (Khanh Hoa province), Lâm Đồng, Đà Lạt, Ban Mê Thuột.

**Distribution.** – China, Himalayas, Indonesia, Malaysia, Philippines, Thailand.

**Ecology.** – Closed evergreen tropical monsoon (seasonal) mixed lower montane forest, from the falling tree, under the shade of forest. ca. 1468 m asl. Flowering time April.

**Specimen examined.** – B. Scortechini s.n.; A.C. Maingay. 1619 (K, photo), V. B. TRUONG 043 (PSU).

12. *Bulbophyllum clipeibulbum* J.J. Verm., Malayan Orchid Rev. 35: 51. 2001; J.J. Verm., Gard. Bull. Singapore 54: 44. 2002. (Plate 6 G & H).

Epiphytic sympodial orchid. *Pseudobulb* somewhat discoid shape, diameter ca. 3–4cm long, pseudobulbs ca. 1.5–1.7 cm apart. *Rhizome* creeping ca. 0.5 cm in diam. *Leaves* single, elliptic, ca. 14–15 x 4 cm, apex acute. *Inflorescence* lateral, raceme, laxly, ca. 53–68 cm long; rachis fleshy, yellow with brown dots, ca. 41–48 cm long; 4 inflorescence bract, apex acute, 1.5–2 cm long 2 lower greenish, 2 upper with brown stripe; floral bract 0.5–0.7 cm long, greenish-yellow with dark red dots. *Flower* open weakly, flower pale yellow-green with, maroon blotches. *Dorsal sepal* ovate, 1.2–1.3 cm long, apex acuminate (ca. 0.5 cm long) recurved, 3 dark red veins, margin finely pubescent with. *Lateral sepals* ovate to somewhat triangular, 1.2 x 0.2 cm, apex acuminate (ca. 0.7 cm long), 3–4 dark red veins, greenish base. *Petals* ovate ca. 0.15 x 0.1 cm, apex obtuse, margin black long ciliate, greenish-yellowish base. *Labellum* simple, white with dark red dots, ca. 0.65 cm – 0.8 cm long, labellum base ovate ca. 0.3 cm long then narrowed and turn to slender; wavy ciliate along margin, long hair on the tip, tip greenish, hair brownish red, base yellow-greenish; 2 rounded ridges from base up to ca. 0.3 cm long, separated by middle groove. *Column* ca. 0.3 cm long, yellowish white; stelia subulate, rounded tip (drumstick shaped) winged margin near base; anther cap brown, bordeaux dots, slightly papillose, ca. 0.7 mm long, apex obtuse; pollinia 4, 2 inner flat, shorter than 2 outer, ca. 0.1–0.15 mm long, caudicles, stipe and viscidium absent. *Ovary* (with pedicel) ca. 0.3–0.4 cm long. *Capsule* not seen.

**Vietnam.** – Hon Ba (Khanh Hoa province), Đak Lak.

Distribution. – Endemic to Vietnam.

**Ecology.** – Closed evergreen tropical monsoon (seasonal) mixed lower montane forest, from falling branch, tree trunks. ca. 1412 m asl. Flowering time middle of May.

**Specimen examined.** – V. B. TRUONG 039 (PSU).

13. *Bulbophyllum dasystachys* J.J.Verm., Thavipoke & Phelps, Phytotaxa 184 (1): 12. 2014. (Plate 7 A & B).

Epiphytic sympodial orchid. *Pseudobulbs* ovate, occurred in groups connected by slender rhizome ca. 0.4–0.5 cm in diam., with much branched matted roots, ca. 1–2 cm apart, ovoid, ca. 1–2 x 1.2–1.5 cm. *Leaves* single, elliptic or slightly oblong, ca. 8–13.5 x 1.8–1.9 cm, apex acute; petiole ca. 2–2.2 cm long. *Inflorescence* axillary, dense raceme, ca. 24 cm long; peduncle green, ca. 19 cm long; scales 4, elongate along peduncle, 1–1.5 cm long, apex acuminate; rachis ca. 5 cm long, pubescent with dark brown papillae; floral bracts green, linear, ca. 0.5–0.65 cm long, acuminate, hairy with minute brown hair. *Flower* small ca. 5 mm long, sepals green, petal pale green, labellum red. *Dorsal sepal*, ovate with 1 mid veined, ca. 0.3–0.35 x 0.2–0.25 cm, apex acute, pubescent with brown hair. *Lateral sepals* ovate-triangular with 1 mid vein, ca. 0.3 x 0.25 cm, apex subacute, pubescent with brown hair. *Petals* triangular with slightly widen base, ca. 0.05–0.1 x 0.05 cm, apex acute, pubescent with long brown hair at the tip. *Labellum* simple, oblong, ca. 0.3–0.35 x 0.2 cm, apex obtuse with green callus, pubescent with brown hair along the margin with long brown hair; callus rounded, papillose, ca. 0.15 cm long; with an elongate mid-ridge down to the base of the labellum. *Column* greenish, strongly incurved, 0.3–0.35 cm long; stelidia white, falcate, ca. 0.1 cm long, obtuse; anther cap greenish yellow, ca. 0.6 mm long; pollinia 4, 2 inner shorter than 2 outer, ca. 0.1 mm long, yellow, caudicles, stipe and viscidium absent. *Ovary* (with pedicel) green, ca. 0.5–0.6 cm long, elongate with dark purple papillae. *Capsule* not seen.

**Vietnam.** – Hon Ba (Khanh Hoa province).

**Distribution.** – Thailand.

**Ecology.** – Closed evergreen tropical monsoon (seasonal) mixed lower montane forest, from falling branch, very rare, ca. 1450 m asl. Flowering in September.

**Specimen examined.** – V. B. TRUONG 041 (PSU).

14. *Bulbophyllum delitescens* Hance, J. Bot. 14: 44. 1876; Seidenf., Opera bot. 114: 286. 1992; H. H. Pham, Ill. Fl. Vietnam 3: 853, 2000; X. Chen & J. J. Vermeulen in Z. Y. Wu et al. (eds), Fl. China 25: 423. 2009. – *Cirrhopetalum delitescens* (Hance) Rolfe, Gard. Chron., n.s., 18: 461. 1882. (Plate 7 C & D).

Epiphytic or lithophytic sympodial orchid. **Rhizome** creeping, ca. 0.6 cm in diam. **Pseudobulbs** ca. 2.3–3 cm high, brown sheathing, pseudobulbs occurred in groups connected by slender rhizome, ca. 4–9 cm long apart, sometimes close together. **Leaves** stout, elliptic–oblong, ca. 15–22 x 4–5 cm, apex acute; petiole 2–2.5 cm long. **Inflorescence** lateral from base of pseudobulb, umbel, glabrous, slender, ca. 20–21 cm long, green with dark red dots, 4-flowered; inflorescence bract 3, brown with dark red dots, ovate, ca. 0.9–1 cm long, apex acute; floral bract glabrous, lanceolate, ca. 0.3–0.35 cm long, apex acuminate. **Flower** red to dark purple, open in same time, not widely open. **Dorsal sepal** ovate, cymbiform, ca. 1–1.1 x 0.65 cm (when flattened), apex obtuse or slightly truncate, with 1 thin long hair tail ca. 0.8 cm long, 3 veins, adaxial scatter papillose. **Lateral sepals** narrowly lanceolate, ca. 6.5–7 x 0.2–0.3 cm, apex acute margin incurved, adnate with column at base and connate together up to ca.  $\frac{3}{4}$  forming tube shape. **Petals** falcate to lanceolate, ca. 0.55–0.6 x 0.2–0.25 cm, apex truncate, with 1 thin seta ca. 0.15 cm long. **Labellum** simple, ca. 0.45 cm long, recurved, apex obtuse, narrowly lanceolate, fleshy, adnate to column foot. **Column** white, ca. 0.45 cm long, dark red dot on foot; **stelia** ca. 3 mm long; anther cap ca. 1.5 mm long, glabrous or slightly papillose; pollinia 4, 2 inner shorter than 2 outer, ca. 0.7–0.8 cm long, pale yellow, caudicles, stipe and viscidium absent. **Ovary** (with pedicel) glabrous, red, ca. 1.5 cm long, curved near the flower. **Capsule** not seen.

**Vietnam:** – Hon Ba (Khanh Hoa province), Cúc Phương, Hà Nam Ninh, Mộc Châu, Sơn La, Ninh Bình, Nho Quan.

**Distribution.** – China, Hong Kong, India, Thailand.

**Ecology.** – Closed evergreen tropical monsoon (seasonal) sub–montane broad–leaved forest, ca. 1200 m asl. Flowering in September.

**Specimen examined.** – V. B. TRUONG 042 (PSU).

15. *Bulbophyllum frostii* Summerh., Bull. Misc. Inform. Kew 76. 1928; Seidenf., Opera Bot. 144: 280, 1992; H. H. Pham, Ill. Fl. Vietnam 3: 852, 2000. – *Cirrhopetalum frostii* (Summerh.) Garay, Hamer & Siegerist, Nordic J. Bot. 14: 621. 1994. (Plate 7 E & F).

Epiphytic sympodial orchid. *Rhizome* creeping, woody, stout ca. 0.3–0.4 cm in diam. *Pseudobulbs* ovoid, ca. 1.5–2 cm long, occurred in group and connected by rhizome ca. 1.5–2 cm apart. *Leaves* single, elliptic, thick, ca. 2.6 x 1.8–2.5 cm, apex slightly retuse. *Inflorescence* lateral from base of pseudobulb, umbel, ca. 3.5 cm long, white with red dots, 2–3 flowered; inflorescence bract 3, ovate, ca. 0.6–1 cm long; floral bract white red dot, ovate, ca. 1.1–1.2 cm long apex acute. *Flower* open in same time, white with red dots, margin brown wavy hair, abaxial with short, hard hair and finely papillose. *Dorsal sepals* ovate, ca. 1.6–1.7 x 1–1.1 cm, apex acute strongly outcurved, margin wavy brown hair, adaxial part white with red dots and short finely papillose, abaxial part white and red dark red near column. *Lateral sepals* lanceolate, adnate and twisted to column, ca. 3.3–3.4 x 1.1–1.2 cm, apex acute, adnate and twisted to column, adaxial part red dots, in the middle to base hard hair and shortly papillose, abaxial glabrous, dark red. *Petals* ovate to falcate, ca. 1 x 0.5–0.6 cm, apex acute, margin hairy (brown/red), adaxial part glabrous, white with dark red dots. *Labellum* simple, ca. 0.8 cm long, fleshy, apex acute; strongly outcurved at base; short brown ciliate at base margin; adaxial lobed, 3 ridges, 2 raised lateral rounded ridges and one small middle ridge. *Column* ca. 1–1.2 cm long, open broadly and curved toward in the middle, base white, apex white red dots; *stelioidia* triangular; anther cap white with finely papillose, suborbicular, ca. 1.5 mm long; pollinia 4, ca. 1.2–1.4 mm long, obovate, 2 inner smaller

than 2 outer yellow, rounded; caudicles, stipe and viscidium absent. *Ovary* (with pedicel) ca. 2–2.2 cm long, white, red dots. *Capsule* not seen

**Vietnam.** – Hon Ba (Khanh Hoa province), Đà Lạt, Gia Lai, Kontum.

**Distribution.** – Endemic to Vietnam.

**Ecology.** – Closed evergreen tropical monsoon (seasonal) mixed lower montane forest, rare species, ca. 1156 m asl. Flowering in July.

**Specimen examined.** – Sandes, M. s.n. (K), V. B. TRUONG 040 (PSU).

16. *Bulbophyllum macranthum* Lindl., Edwards's Bot. Reg. 30: t. 13. 1844; J.B. Comber, Orchids Java: 274. 1990; Seidenf., Opera Bot. 411, 1992; Seidenf. & J. J. Wood, Orchids Penins. Malaysia Singapore: 477. 1992; H. H. Pham, Ill. Fl. Vietnam 3: 860. 2000; J. B. Comber, Orchids Sumatra: 766. 2001. – *Sarcopodium macranthum* (Lindl.) Lindl. & Paxton, Paxton's Fl. Gard. 1: 155. 1851. – *Phyllorkis macrantha* (Lindl.) Kuntze, Revis. Gen. Pl. 2: 677. 1891. – *Carparomorchis macrantha* (Lindl.) M.A.Clem. & D.L.Jones, Orchadian 13: 499. 2002. (Plate 7 G & H).

Epiphytic sympodial orchid. *Rhizome* creeping ca. 0.5–0.8 cm in diam., stout, covered by brown sheaths. *Pseudobulbs* ovoid, ca. 1–1.5 cm high, pseudobulbs occurred in groups connected by rhizome, ca. 4–8 cm long apart, numerous roots along the rhizomes. *Leaves* single, fleshy, glabrous, oblong to elliptic, ca. 7–20 x 3–4 cm, apex retuse; petiole short ca. 1.2 cm long. *Inflorescence* lateral base of pseudobulb or from the rhizome, single flowered. *Flower* open widely, ca. 3.5 cm long, fleshy, white with irregular dark red marking. *Dorsal sepals* glabrous, oblong, cymbiform, margin entire, ca. 2–2.5 x 0.9 cm (flattened), apex acute, incurved near the top. *Lateral sepals* falcate, ovate, cymbiform, 2.3–2.8 x 0.8–0.9 cm, apex acuminate, abaxial connate ca. 3 cm long create a groove for labellum outcurved. *Petals* glabrous, oblong to slightly falcate, ca. 1.5–2 x 0.4–0.5 cm, apex acute, outcurved. *Labellum* white, ca. 0.7 cm long, 3 lobed, adnate to column foot; mid lobe linear, apex acute ca. 0.25 cm long, ca. 90° with lateral lobes; lateral lobes very small, obtuse. *Column* pale red winged on the tip, ca. 0.5–1 cm long, incurved, winged on apical part, pale yellow, base greenish–white;

lacking stelidia; anther cap yellow, ovate, ca. 2 mm long; *pollinia* 4, ca. 0.8–1 mm long, 2 inner smaller than 2 outer, caudicles, stipe and viscidium absent. **Ovary** (with pedicel) glabrous, ca. 4–5.5 cm long, yellowish–white, dark red dots near the base of flower and pedicels. **Capsule** not seen. Smell fragrant.

**Vietnam.** – Hon Ba (Khanh Hoa province), Tam Dao, Vinh Phuc, Hue, Phong Nha, Tay Ninh, Phu Quoc.

**Distribution.** – Burma, Indonesia, Malaysia, New Guinea, Philippines, Thailand.

**Ecology.** – Closed evergreen tropical monsoon (seasonal) broad-leaved lowland forest, along the stream, ca. 258 m asl. Flowering in May.

**Specimen examined.** – R. Mitchell 55 (K, photo), J. Kulip & M George. 140809 (K, photo), V. B. TRUONG 045 (PSU).

17. *Bulbophyllum thaiorum* J.J. Sm., Bull. Jard. Bot. Buitenzorg, sér. 2 8: 28. 1912; Seidenf., Dansk Bot. Arkiv. 33(3): 173. 1979; Li., Ye. & Xing, Bull. Bot. Re., Har 29: 260. 2009. – *Cirrhopetalum papillosum* Rolfe, Bull. Misc. Inform. Kew 1908: 70. 1908. – *Bulbophyllum papillosum* (Rolfe) Seidenf. & Smitinand, Orch. Thail. (Prelim. List): 364. 1961. nom. illeg. – *Bulbophyllum thailandicum* Seidenf. & Smitinand, Orch. Thail. (Prelim. List): 797. 1965. nom. illeg. (Plate 8 A & B).

Lithophytic sympodial orchid. **Rhizome** creeping, slender, ca. 0.3 cm in diam. **Pseudobulb** dark red–purple, ca. 2 cm high, ovoid, pseudobulbs occurred in groups connected by rhizome ca. 0.5 cm apart. **Leaves** single, glabrous, dark green above, dark red–purple below, elliptic, ca. 7.7 x 2.9–3 cm; petiole ca. 1.5 cm long. **Inflorescence** lateral, from the base of pseudobulb, umbel, slender, ca. 9.1 cm long, red–dark red; inflorescence bract glabrous, oblanceolate, ca. 2, pale red ca. 0.7 cm long, apex acute; floral bract glabrous, linear to lanceolate, ca. 0.3–0.4 cm long, apex acute, pale red, with red mid vein. **Flower** red, open in same time. **Dorsal sepal** ovate, ca. 0.4–0.5 x 0.25 cm, apex obtuse, one middle vein. **Lateral sepals** lanceolate, ca. 1.8–2 cm long, apex acute, 2 lateral sepals connate almost the length, adaxial with densely papillose at base and scatter from middle to apical part, abaxial twisted and attached to column. **Petals**

glabrous, ovate to falcate, ca. 0.3 x 0.2 cm, apex obtuse, 2 to 3 dark red veins. **Labellum** simple, fleshy, glabrous, recurved, ligulate, ca. 0.3 cm long, adaxial 2 rounded ridges separate by middle groove, attached to column foot. **Column** ca. 2 mm long, foot ca. 1 mm long; stelidia ca. 1.5 mm long, triangular; anther cap glabrous or slightly papillose, rounded, ca. 0.9 mm long; pollinia 4, ovate, ca. 0.5 mm long, 2 inner shorter than outer, caudicles, stipe and viscidium absent. **Ovary** (with pedicel) red, glabrous, slender, ca. 0.5–0.8 cm long. **Capsule** not seen.

**Vietnam.** – Hon Ba (Khanh Hoa province).

**Distribution.** – Myanmar, Thailand.

**Ecology.** – Closed evergreen tropical monsoon (seasonal) mixed lower montane forest, along the stream or dry stones, ca. 1381 m asl. Flowering in early May, young flower buds in middle of April.

**Specimen examined.** – A.F.G. Kerr 104 (K, photo), V. B. TRUONG 155 (PSU).

18. *Bulbophyllum pumilio* (Parish & Rchb. f.) Parish & Rchb. f., Trans. Linn. Soc. London, Bot. 30: 153. 1874; Seidenf., Dansk Bot. Arkiv. 33(3): 173. 1979; Seidenf., Opera Bot. 292: 300, 1992; H. H. Pham, Ill. Fl. Vietnam 3: 854. 2000. – *Cirrhopetalum pumilio* (C.S.P. Parish & Rchb. f.) Hook. f., Fl. Brit. India 5: 778. 1890. – *Phyllorkis pumilio* (C.S.P. Parish & Rchb. f.) Kuntze, Revis. Gen. Pl. 2: 677. 1891. (Plate 8 C & D).

Epiphytic sympodial orchid. **Rhizome** creeping, ca. 0.15 cm in diam. **Pseudobulbs** ovoid, occurred in groups connected by rhizome, ca. 0.4–0.5 cm long apart, young pseudobulb covered by brown sheath. **Leaves** single, glabrous, oblong, ca. 4–6 cm long, apex retuse. **Inflorescence** glabrous, slender, lateral, umbel, ca. 7.5 cm long, pale green, tip reddish–green, sheathing at base of inflorescence ca. 1.5 cm long, 6 flowered; inflorescence bract 1, brown, ovate ca. 0.6 cm long, apex acute; floral bract ovate, ca. 0.2–0.3 cm long, apex acute. **Flower** reddish–pink, open in same time. **Dorsal sepal** obovate, cymbiform, ca. 0.35 x 0.15 cm, apex obtuse–subacute, adaxial red papillose. **Lateral sepals** fused together, linear to lanceolate, ca. 2.5 x 0.7 cm, abaxial



base of lateral sepals twisted attach to column, 3–4 dark red lines, adaxial only densely papillose at base. *Petals* glabrous, broadly ovate to somewhat rounded, ca. 0.3 x 0.25 cm, apex obtuse. *Labellum* simple, glabrous, lanceolate, recurved near the tip, fleshy, ca. 0.25 cm long; adaxial 2 rounded ridges separated by middle groove from base to near tip of labellum. *Column* yellowish, base reddish, middle with red dots, ca. 1mm long, foot 1.5 mm long; stelidia triangular; anther cap yellow finely papillose, ca. 0.05 cm long, rounded projection; pollinia 4, 2 inner shorter than 2 outer, broadly ovate, slightly flat; caudicles, stipe and viscidium absent. *Ovary* (with pedicel) glabrous, ca. 0.8–1 cm long, red–dark red. *Capsule* not seen.

**Vietnam.** – Hon Ba (Khanh Hoa province).

**Distribution.** – Myanmar, Thailand.

**Ecology.** – Closed evergreen tropical monsoon (seasonal) mixed lower montane forest, ca. 1490 m asl. Flowering in in middle of May.

**Specimen examined.** – C.J. Brooks s.n. (K, photo), V. B. TRUONG 156 (PSU).

19. *Bulbophyllum retusiusculum* Rchb. f., Gard. Chron. 1869: 1182. 1869; Seidenf., Opera Bot. 114: 294, 1992; Seidenf. & J. J. Wood, Orchids Penins. Malaysia Singapore: 453. 1992; H. H. Pham, Ill. Fl. Vietnam 3: 855. 2000; N. Pearce & P.J. Cribb, Fl. Bhutan 3(3): 473. 2002; S. C. Chen et al. in Z. Y. Wu et al. (eds), Fl. China 25: 427. 2009. – *Cirrhopetalum retusiusculum* (Rchb.f.) Hook.f., Fl. Brit. India 5: 776. 1890. – *Phyllorkis retusiuscula* (Rchb.f.) Kuntze, Revis. Gen. Pl. 2: 677. 1891. (Plate 8 E & F).

Epiphytic sympodial orchid. *Rhizome* creeping, ca. 0.2 cm in diam. *Pseudobulbs* ovoid, ca. 1 cm high, occurred in groups connected by rhizome ca. 0.7–1.3 cm long apart. *Leaves* single, oblong, ca. 2.5–5 x 1–1.5 cm, apex slightly emarginated; petiole ca. 0.5–1.2 cm long. *Inflorescence* lateral, slender, umbel, ca. 7–7.5 cm long, 6 flowered; inflorescence bract 2, ovate, ca. 0.4–0.7 cm long, lanceolate, apex acute; floral bract, lanceolate, ca. 0.3 cm long, apex acute. *Flower* pink, petal very dark pink, labellum yellow. *Dorsal sepals* oblong, ca. 0.45–0.5 x 0.2–0.25 cm, apex

emarginated, adaxial glabrous. *Lateral sepals* lanceolate, ca. 1.5 x 0.4–0.5 cm, apex acute, adaxial connate together and base slightly papillose the margin, abaxial twisted and attached to column. *Petals* glabrous, falcate to broadly ovate, ca. 0.5 x 0.25 cm, apex obtuse, bend backward when full opening. *Labellum* glabrous, simple, lanceolate, recurved in the middle, fleshy, ca. 0.3–0.5 cm long, adaxial 2 rounded ridges separated by middle groove from base of labellum to near apical part of labellum. *Column* white glabrous, ca. 0.3–0.4 cm long, pink in middle; stelia white, triangular; anther cap adaxial slightly papillose, rounded, ca. 0.7 mm long; pollinia 4, ovate, ca. 0.2–0.3 mm long, 2 inner slightly same size with 2 outer, caudicles, stipe and viscidium absent. *Ovary* (with pedicel) 1–1.2 cm long, slender, curved, base pale pink, tip yellow. *Capsule* not seen.

**Vietnam.** – Hon Ba (Khanh Hoa province).

**Distribution.** – Bhutan, China, Himalayas, India, Laos, Malaysia, Myanmar, Nepal, Sikkim, Thailand.

**Ecology.** – Closed evergreen tropical monsoon (seasonal) mixed lower montane forest along the stream, ca. 1.550 m asl. Flowering in July.

**Specimen examined.** – A.F.G. Kerr 098 (K, photo), V. B. TRUONG 038 (PSU).

20. *Bulbophyllum simondii* Gagnep., Bull. Mus. Natl. Hist. Nat., sér. 2, 22: 401. 1950; Seidenf., Opera Bot. 114: 857, 1992; H. H. Pham, Ill. Fl. Vietnam 3: 855, 2000. (Plate 8 G & H).

Epiphytic sympodial orchid. *Rhizome* creeping, branched, ca. 0.4 cm in diam. *Pseudobulbs* ovoid ca. 1.5–1.8 cm high, occurred in groups connected by rhizome 2.5–5.5 cm long apart. *Leaves* single, elliptic, ca. 4–5 x 1.3–1.5 cm, apex acute. *Inflorescence* greenish–yellow, lateral, umbel, ca. 0.6–1.1 cm long; inflorescence bract 2, pale green, ovate, ca. 0.2 cm long, apex acute; floral bracts whitish–yellow, ovate, ca. 0.3 cm long, apex acute to acuminate. *Flower* sepals and petals pale yellow at base and yellow on tip, open widely. *Dorsal sepal* glabrous, ovate ca. 0.8–0.9 x 0.3 cm, apex acuminate. *Lateral sepals* glabrous, ovate, ca. 0.8–0.9 x 0.3–0.4 cm, apex acuminate.

**Petals** glabrous, ovate, ca. 0.5–0.6 x 0.3 cm, apex yellow, apex acuminate, 3 yellow veins. **Labellum** simple, glabrous, fleshy, ca. 0.15 cm long, apex acute; 2 yellow rounded keels from base up to near the tip; margin yellowish–white, slightly erose; attached to column foot. **Column** whitish–yellow glabrous, ca. 1 mm long, foot ca. 0.5 mm long; stielidia white, slender, subulate (triangular), ca. 0.1 cm long; anther cap pale yellow, ca. 4 mm long, suborbicular; pollinia 4, ca. 1 mm long, 2 inner slightly half of 2 outer, yellow; caudicles, stipe and viscidium absent. **Ovary** (with pedicel) slender, ca. 0.5–0.7 cm long, yellowish–green. **Capsule** not seen.

**Vietnam.** – Hon Ba (Khanh Hoa province).

**Distribution.** – Endemic to Vietnam.

**Ecology.** – Closed evergreen tropical monsoon (seasonal) mixed lower montane forest, grow together with *B. tixieri*, ca. 1397 m asl. Flowering in middle of May.

**Specimen examined.** – V. B. TRUONG 044 (PSU).

21. *Bulbophyllum tixieri* Seidenf., Opera Bot. 114: 300, 1992; H. H. Pham, Ill. Fl. Vietnam 3: 857. 2000. (Plate 9 A & B).

Epiphytic sympodial orchid. **Rhizome** creeping, slender but stout ca. 0.2 cm in diam. **Pseudobulbs** ovoid, ca. 0.5–1 cm high; pseudobulb occurred in groups connected by slender rhizome ca. 3–4 cm apart. **Leaves** single, glabrous, oblong–elliptic, ca. 1–2 x 0.8–1 cm, apex retuse. **Inflorescence** lateral, from base of pseudobulbs or sometimes from the rhizome, slender, glabrous, red, 4.5–4.7 cm long, 5 flowered; inflorescence bract 2, apex acute, ca. 0.3–0.5 cm long reddish–white; floral bracts glabrous, apex acute, reddish on the tip–green at the base. **Flower** open broadly, sepals and petals yellowish–white, labellum yellow, with reddish groove in the middle. **Dorsal sepals** glabrous, ovate, ca. 0.5–0.6 x 0.25 cm, apex acute, 3 veins. **Lateral sepals** longer than dorsal sepal, glabrous, elliptic, ca. 0.6–0.7 x 0.3–0.5 cm, apex acute, 1 mid veins, slightly incurved. **Petals** glabrous, ovate, ca. 0.2–0.3 x 0.1–0.15 cm, apex obtuse. **Labellum** simple, ca. 0.3 cm long, broadly at base and narrowly to the tip, strongly outcurved in the middle, apex subacute; 2 rounded ridges separate by reddish groove in

the middle, from base proximal third; margin entire, adaxial glabrous. *Column* glabrous, white, reddish in the middle; anther cap yellow, short obtuse horn, ca. 1.7 mm long; *stelia* yellowish white, somewhat triangular; pollinia 4, ca. 1–1.2 mm long, 2 inner shorter than 2 outer, caudicles, stipe and viscidium absent. *Ovary* (with pedicel) glabrous, pale yellow, ca. 0.8–1 cm long. *Capsule* not seen.

**Vietnam.** – Hon Ba (Khanh Hoa province), Lam Dong, Da Lat.

**Distribution.** – Endemic to Vietnam.

**Ecology.** – Closed evergreen tropical monsoon (seasonal) mixed lower montane forest, from the falling branches, ca. 1568 m asl. Flowering in April.

**Specimen examined.** – V. B. TRUONG 046 (PSU).

22. *Bulbophyllum tortuosum* Lindl., Gen. Sp. Orchid. Pl. 50. 1830; J.B. Comber, Orchids Java: 259. 1990; Seidenf., Opera Bot. 114: 305, 1992; Seidenf. & J. J. Wood, Orchids Penins. Malaysia Singapore: 503. 1992; H. H. Pham, Ill. Fl. Vietnam 3: 859, 2000; J. B. Comber, Orchids Sumatra: 766. 2001; N. Pearce & P.J. Cribb, Fl. Bhutan 3(3): 755. 2002. – *Diphyes tortuosa* Blume, Bijdr. Fl. Ned. Ind.: 311. 1825. – *Phyllorkis tortuosa* (Blume) Kuntze, Revis. Gen. Pl. 2: 678. 1891. (Plate 9 C & D).

Epiphytic sympodial orchid. *Rhizome* hanging, pendent, branched, slender. *Pseudobulb* narrowly ovoid, ca. 1–2 cm high, smoothly, sometimes covered by sheaths, pseudobulbs occurred in groups connected by rhizome ca. 0.4 cm long apart. *Leaves* single, glabrous, lanceolate, 2–4 x 0.5–0.8 cm, apex acute; petiole very short to subsessile. *Inflorescence* lateral, single flower, from base of pseudobulbs or from the rhizome; floral bract glabrous, lanceolate, apex long acute. *Flower* ca. 5 mm long, not open widely, pale purple sepals and dark purple labellum. *Dorsal sepal* ovate, glabrous ca. 0.5 x 0.2 cm, apex acute, margin finely ciliate. *Lateral sepals* oblong, glabrous, ca. 0.5 x 0.2 cm, apex acute, attached with column at base, adaxial margin finely ciliate, abaxial inner margin fused together near tip form tube shaped. *Petals* white, glabrous, linear, ca. 0.9 mm long, apex obtuse. *Labellum* simple, adnate to column foot, narrowly ovate, ca. 0.1 cm long, apex acute, outcurved; adaxial 2 dark rounded purple lateral

ridges separate by white groove from base up to 0.06 cm long; margin finely ciliate near base. **Column** white glabrous, very short ca. 0.9 mm long; stelia elongate, slender, apex acute; anther cap white, glabrous ca. 0.6 mm long; pollinia 4, ca. 0.2 mm long, 2 inner smaller than 2 outer, white, ovate; caudicles, stipe and viscidium absent. **Ovary** (with pedicel), pale green, glabrous, ca. 0.3–0.5 cm long. **Capsule** greenish, elliptic, 0.4–0.5 cm long, 8 ridges.

**Vietnam.** – Hon Ba (Khanh Hoa province).

**Distribution.** – Bhutan, Himalayas, Indonesia, Laos, Myanmar, Malaysia, Thailand.

**Ecology.** – closed evergreen tropical monsoon (seasonal) mixed lower montane forest, ca. 1466 m asl. Flowering in middle of May.

**Specimen examined.** – A.F.G. Kerr 0693 (K, Photo); P. T. Ong et al. FRI 67671 (K, Photo); E. de Vogel & P. Cribb 9245 (K, photo), V. B. TRUONG 037 (PSU).

**23. *Calanthe angustifolia*** (Blume) Lindl., Gen. Sp. Orchid. Pl.: 251. 1833; J.B. Comber, Orchids Java: 92. 1990; Seidenf. & J. J. Wood, Orchids Penins. Malaysia Singapore: 171. 1992; J. B. Comber, Orchids Sumatra: 258. 2001; S. C. Chen et al. in Z. Y. Wu et al. (eds), Fl. China 25: 295. 2009; H. A. Pedersen et al. in Santisuk & Balslev (eds), Fl. Thailand 12(2): 344. 2014. – *Amblyglottis angustifolia* Blume, Bijdr. Fl. Ned. Ind.: 369. 1825. – *Alismorkis angustifolia* (Blume) Kuntze, Revis. Gen. Pl. 2: 650. 1891. (Plate 9 E & F).

Terrestrial sympodial orchid. **Rhizome** creeping, slender, ca. 0.3 cm in diam. **Pseudobulbs** insignificant cylindrical, ca. 3 cm long, sheathing at base, brown–brownish. **Foliage leaves** lanceolate to narrowly elliptic, ca. 40–55 x 2.5–3 cm, apex acuminate; petiole glabrous, ca. 15–17 cm long, base white. **Inflorescence** lateral, from base of stem, erect, glabrous, ca. 20–30 cm long; peduncle glabrous, ca. 14–18 cm long; sterile bracts 6, lanceolate, apex acute 4–7 cm long, ca. 2.5–3.5 cm wide (flattened) white; rachis pale green, glabrous, ca. 6–12 cm long; floral bract white, caducous, longer than flower ca. 3 cm long. **Flower** white sepals and petals, yellow labellum, flower ca. 2.5 cm long (from spur to dorsal sepal). **Dorsal sepal** glabrous, ovate to elliptic, ca. 1.5–

1.7 x 0.5–0.65 cm (flattened), apex acuminate, margin slightly incurved near the apex, 3 veins. *Lateral sepals* glabrous, elliptic, ca. 1.5–1.7 x 0.5–0.6 cm, apex acuminate, margin slightly incurved near the apex, 3 veins. *Petals* glabrous, elliptic, ca. 1.4–1.5 x 0.4–0.5 cm, apex acute or subacute, 1 mid vein and 4 lateral veins. *Labellum* base adnate to column wing, 3 lobed; mid lobe obovate, apex retuse to cleft, ca. 0.7 x 0.8 cm, margin outcurved; lateral lobes oblong, ca. 0.5–0.6 x 0.2–0.3 cm, margin slightly outcurved; adaxial disk with 2 triangular ridges; spur white glabrous, curved, narrowly in middle, ca. 0.5–1.3 cm long. *Column* white, glabrous, ca. 0.8–0.9 cm long, slightly curve; anther cap and pollinia not seen. *Ovary* (with pedicel) glabrous, ca. 1.5–2 cm long, white. *Capsule* white 0.6–0.7 cm long, 6 ridges.

**Vietnam.** – Hon Ba (Khanh Hoa province).

**Distribution.** – China, Indonesia, Malaysia, Philippines.

**Ecology.** – Closed evergreen tropical monsoon (seasonal) mixed lower montane forest. Flowering in late of August to September.

**Specimen examined.** – J. B. Comber 1726 (K, photo) V. B. TRUONG 052 (PSU).

24. *Calanthe lyroglossa* Rchb. f., Otia Bot. Hamburg. 1: 53. 1878; Seidenf., Dansk Bot. Ark. 29(2): 22. 1975; Opera Bot. 114: 99, 1992; Seidenf. & J. J. Wood, Orchids Penins. Malaysia Singapore 175. 1992; H. H. Pham, Ill. Fl. Vietnam 3: 872, 2000; X. Chen, P. J. Cribb & S. W. Gale in Z. Y. Wu et al. (eds), Fl. China 25: 427. 2009; H. Kurzweil in Santisuk & Balslev (eds), Fl. Thailand 12(2): 358. 2014. – *Alismorkis lyroglossa* (Rchb.f.) Kuntze, Revis. Gen. Pl. 2: 650. 1891. (Plate 9 G).

Terrestrial sympodial orchid. *Pseudobulbs* insignificant cylindric, ca. 3 cm high. *Foliage leaves* 3 to 8 leaves, lanceolate, ca. 15–43 x 2.5–3.5 cm, apex acuminate; petiole green, glabrous, ca. 10–15 cm long. *Inflorescence* lateral, from base of pseudobulb, semi dense to dense, erect ca. 25–27 cm long; peduncle glabrous, ca. 15–20 cm long; rachis glabrous, ca. 12–15 cm long, 35 to 45 flowered; sterile bracts 5–6, glabrous, broadly obovate, lanceolate, ca. 1–4.5 x 2–2.5 cm (flattened), apex acute, 6–7 veins, base greenish-white, tip green, small brown dots in the middle; floral bract

glabrous, caducous, lanceolate, longer than flower, ca. 3.5 x 0.5–1 cm, apex acute. **Flower** open broadly, flower uniform yellow, ca. 2.1 cm long (from spur to dorsal sepal). **Dorsal sepal** glabrous, elliptic, ca. 1.35–1.4 x 0.6–0.7 cm, apex acute, 3 veins. **Lateral sepals** glabrous, elliptic, ca. 1.25–1.3 x 0.5–0.6 cm, apex acute, 3 veins. **Petals** glabrous, elliptic, ca. 1.2 x 0.6 cm, apex obtuse to acute, 1 mid veins. **Labellum** glabrous, ca. 1 cm long, base attached with column wing, 3-lobed; mid lobe ca. 0.5 x 0.3 cm, apex emarginate; lateral lobe ca. 0.3 x 0.35 cm, apex obtuse; disk with 2 erect, triangular ridges; spur glabrous, clavate, obtuse, ca. 0.8 cm long. **Column** glabrous, thick, ca. 0.5 cm long; anther cap white, beaked, ca. 2.5–3 mm long; pollinia 8, ca. 0.9–1 mm long, into 2 groups, yellow, oblanceolate, ca. 0.15 cm long, caudicles and viscidium present, stipe absent. **Ovary** (with pedicel) green, glabrous, ca. 1.7–1.8 cm long. **Capsule** not seen.

**Vietnam.** – Hon Ba (Khanh Hoa province)

**Distribution.** – China, India, Indonesia, Japan, Malaysia, Myanmar, Philippines, Taiwan, Thailand.

**Ecology.** – Closed evergreen tropical monsoon (seasonal) mixed lower montane forest. ca. 1400 m asl. Flowering in July.

**Specimen examined.** – A.F.G. Kerr 399 (K, photo) V. B. TRUONG 051 (PSU).

Note: the labellum of the collected specimen quite different with short claw between mid-lobe and lateral lobes. Lateral also wider.

25. *Campanulorchis globifera* (Rolfe) Brieger, *Orchideen*: 1(11–12): 750. 1981. – *Eria globifera* Rolfe *Gard. Chron.*: 2: 449. 1905. (Plate 9 H).

Epiphytic sympodial orchid. **Rhizome** creeping, stout, woody, ca. 0.4 cm in diam. **Pseudobulb** ovoid, ca. 2–2.5 cm high, usually covered by brown sheaths, pseudobulb in group connected by rhizome, ca. 4–5 cm apart. **Leaves** single, elliptic, ca. 9–11 x 2–2.5 cm, apex acute; petiole ca. 2–3 cm long. **Inflorescence** terminal, synanthous; peduncle ca. 7–8 cm long, base covered by 2 sheaths, brown with dark brown lines; floral bract brown, ovate somewhat triangular, ca. 0.3–0.4 cm long, apex

acute. *Flower* resupinate, open in succession or in pair, pubescent with brown hair, white sepals and petals with red stripes, labellum yellow undulate. *Dorsal sepal* white, obovate, ca. 3–3.5 x 0.6–0.7 cm, apex acute, 8–9 red lines from the base to the middle of dorsal sepal. *Lateral sepals* ovate, ca. 2.6–2.7 x 0.7 cm, apex acuminate, 7–8 red lines from the base to the middle of lateral sepals, forming short mentum, pubescent with brown hair. *Petals* glabrous, lanceolate, ca. 3–3.2 x 0.5–0.6 cm, apex slightly acute, 8–9 red lines from the base to the middle of petals. *Labellum* ca. 2.5 cm long, 3 lobed; mid lobe obovate somewhat triangular, ca. 1.3 cm long, apex acute, strongly outcurved, adaxial undulate with irregular rounded keels from middle to margin; lateral lobes white, erect, ovate, ca. 2 cm long, apex acute, with irregular red lines; adaxial of labellum 3 rise keel, 2 lateral keels triangular short higher than mid keel, run from base to neat tip ca. 0.5 cm long, *Column* pale yellow, ca. 0.7 cm long, winged at apical part, column foot ca. 0.6 cm long; anther cap yellow, broadly elliptic, ca. 2 mm long; pollinia 8, ca. 1 mm long, separate in to 2 groups of 4, clavate, yellow or pale yellow, stipe absent. *Ovary* (with pedicel) green, ca. 0.5–0.7 cm long, pubescent with white hair. *Capsule* not seen.

**Vietnam.** – Hon Ba (Khanh Hoa province).

**Distribution.** – Thailand.

**Ecology.** – Closed evergreen tropical monsoon (seasonal) mixed lower montane forest, on the branches or trunk, densely close together. Common species on the top of Hon Ba. Flowering in April.

**Specimen examined.** – W Micholitz s.n. (K, photo), V. B. TRUONG 086 (PSU).

26. *Cephalantheropsis longipes* (Hook.f.) Ormerod, *Orchid Digest* 62: 156. 1998; S. C. Chen et al. in Z. Y. Wu et al. (eds), *Fl. China* 25: 295. 2009; H. Zurbewil in Santisuk & Balslev (eds), *Fl. Thailand* 12(2): 378. 2014. – *Calanthe longipes* Hook.f., *Fl. Brit. India* 6: 195. 1890. – *Alismorkis longipes* (Hook.f.) Kuntze, *Revis. Gen. Pl.* 2: 650. 1891. – *Phaius longipes* (Hook.f.) Holttum, *Gard. Bull. Singapore* 11: 286. 1947. (Plate 10 A & B).



Terrestrial sympodial orchid. **Stem** erect, many node, 30–40 cm long, ca. 0.5 cm in diam. **Foliage leaves** 3 to 4, elliptic, ca. 12–13 cm x 3–3.2 cm, apex subacute; petiole sheath ca. 1.8–1.85 cm long. **Inflorescence** lateral, along the stem, erect, laxly, 1 to 3, ca. 15–24 cm long; rachis ca. 10–12 cm long, 5 to 10 flowered; sterile bract 2.5–3 x 0.7–0.8 cm, apex acute; floral bract caducous, lanceolate, apex acute, ca. 3–3.2 x 0.5–1 cm. **Flower** white, open not widely from base to tip, flower turn to be yellow or orange when old. **Dorsal sepal** lanceolate, ca. 1.1–1.2 x 0.4–0.5 cm, apex acute, abaxial pubescent with, white hair. **Lateral sepal** lanceolate, ca. 1.2–1.3 x 0.5–0.6 cm, apex acuminate, 3 veins, abaxial pubescent with white hair. **Petals** ovate, 0.9–1 x 0.3–0.4 cm, apex acute, 3 veins. **Labellum** ca. 0.8 cm long, 3 lobed; mid lobe orbiculate to quadrate, margin undulate, ca. 0.3–0.35 x 0.35–0.4 cm, apex emarginated, claw at base of mid lobe, entire margin; lateral lobes triangular, truncate, margin erose, ca. 0.3 cm long; adaxial disk with 2 ridges from labellum base up to middle, from middle of labellum white slender ridges turn to fleshy yellow ridges on claw to base of mid lobe. **Column** short, white, ca. 0.4–0.5 cm long; anther cap pale yellow, broadly ovate, ca. 1.5 mm long apex acute; pollinia 8, ca. 0.8–1 mm long, into 2 groups of 4, size equally, ovoid to obovoid, caudicles present, stipe and viscidium absent. **Ovary** (with pedicel) white, 2–2.5 cm long, pubescent with white hair. **Capsule** not seen.

**Vietnam.** – Hon Ba (Khanh Hoa province), Lai Châu, Lào Cai, Huế, Lâm Đồng.

**Distribution.** – China, India, Indonesia, Myanmar, Malaysia, Philippines, Taiwan, Thailand.

**Ecology.** – Closed evergreen tropical monsoon (seasonal) mixed lower montane forest, with *Pinus krempfii* Lecomte and *Fokienia hodginsii* (Dunn) A. Henry & H.H. Thomas ca. 1517 m asl. Flowering in October.

**Specimen examined.** – V. B. TRUONG 054 (PSU).

27. *Ceratostylis siamensis* Rolfe ex C. Downie, Bull. Misc. Inform. Kew 379. 1925; Seidenf., Opera Bot. 89: 112, 1986; Opera Bot. 114: 161, 1992; H.H. Pham, Ill. Fl. Vietnam 3: 796. 2000. (Plate 10 C & D).

Epiphytic sympodial orchid, grown on the group. *Stem* erect, short, ca. 0.5 cm long, covered by overlapping sheaths. *Leaves* single, glabrous, linear, ca. 3.5–6 x 0.2 cm, apex unequally 2 lobes, leaves fleshy, thick. *Inflorescence* lateral, from the base of stem, glabrous; peduncle ca. 0.6 cm long, single flowered; floral bract glabrous, ovate, ca. 0.2 cm long, sheathing at inflorescence and base of leaf, ca. 0.8 cm long. *Flower* not open widely, sepals and petals white, white red lines, labellum white, fleshy. *Dorsal sepal* fleshy, glabrous, lanceolate, ca. 0.45 x 0.1–0.15 cm, apex acute, 23 red stripes; *lateral sepal* fleshy, glabrous, ovate, ca. 0.5–0.55 x 0.15–0.2 cm, 1–2 red stripes, lateral sepals attached with column and forming mentum, ca. 0.2 cm long. *Petals* glabrous, narrowly elliptic, ca. 0.9–0.95 x 0.05–0.1 cm, apex acute, 1 red mid vein. *Labellum* glabrous, ca. 0.9–0.95 cm long, 3-lobed; mid lobe white rounded, fleshy ca. 0.1 x 0.15 cm; lateral lobes triangular, concave, apex obtuse, rise continue from the margin of spur; adaxial of labellum pubescent with white hair; labellum base adnate with column foot. *Column* white, ca. 0.3 cm long, curved in the middle, apex with 2 obtuse arms; anther cap white, ovate, glabrous, ca. 0.7 mm long, apex acute; pollinia 8, ca. 0.2–0.3 mm long, separate into 2 groups of 4 attached to small viscidium, stipe and caudicles absent. *Ovary* (with pedicel) ca. 0.3 cm long, ovary with 3–4 red stripes. *Capsule* not seen.

**Vietnam.** – Hon Ba (Khanh Hoa province), Lai Châu, Sapa, Huế, Đà Lạt.

**Distribution.** – Laos, Thailand.

**Ecology.** – Closed evergreen tropical monsoon (seasonal) mixed lower montane forest, ca. 1171 m asl. Flowering in July.

**Specimen examined.** – A.F.G. Kerr 213, 01012 (K, photo), V. B. TRUONG 055 (PSU).

28. *Ceratostylis subulata* Blume Bijdr., Fl. Ned. Ind. 7: 306. 1825; Seidenf., Opera Bot. 89: 109, 1986; Opera Bot. 114: 161, 1992; H. H. Pham, Ill. Fl. Vietnam 3: 797. 2000; S. X. Chen & J. J. Wood in Z. Y. Wu et al. (eds), Fl. China 25: 361. 2009. (Plate 10 E & F).

Epiphytic sympodial orchid. *Rhizome* numerous ca. 4 cm long. *Stem* erect, cylindrical, ca. 8–15 cm long, grow in group close together. *Leaves* single, on the tip of stem erect, cylindrical, ca. 2.5–2.8 x 0.3–0.4 cm, apex acute, apical slightly concave. *Inflorescence* terminal, 1 to 3 flowered; peduncle red, ca. 0.25–0.3 cm long, white pubescent with, brown sheaths at base; floral bract brown, ovate ca. 0.3 cm long, apex acute. *Flower* open widely, with red–dark red sepals and petals, labellum, fleshy, yellow. *Dorsal sepal* narrowly oblong, ca. 0.4–0.5 x 0.1–0.2 cm, apex slightly acute, outcurved, abaxial slightly white pubescent with. *Lateral sepals* red, oblong, ca. 0.4–0.5 x 0.15–0.25 cm, apex acute, outcurved, forming mentum ca. 0.4–0.5 cm long, abaxial white pubescent with. *Petals* lanceolate, 0.35–0.4 x 0.15–0.2 cm, apex slightly acute. *Labellum* yellow, simple, spatulate, ca. 0.25–0.3 cm long, apex obtuse, apical yellow, fleshy, thick then turn narrowly into claw, abaxial with 2 white keels. *Column* white ca. 0.2–0.3 cm long, column foot ca. 0.1 cm long, apex 2 obtuse arms; anther cap yellow, ovate, ca. 0.5 mm long, apex acute; pollinia 8, white, ca. 0.2–0.3 mm long, in 2 groups of 4, same size, obovate, stipe and caudicles absent, viscidium present. *Ovary* (with pedicel) red, slender, concave, ca. 0.3–0.35 cm long, pubescent with. *Capsule* not seen.

**Vietnam.** – Hon Ba (Khanh Hoa province), Hà Nam Ninh, Thừa Thiên, Đà Lạt, Lâm Đồng.

**Distribution.** – Cambodia, China, Indonesia, Laos, Malaysia, Philippines, Thailand.

**Ecology.** – Closed evergreen tropical monsoon (seasonal) mixed lower montane forest. ca. 986 m asl. Flowering time September to October.

**Specimen examined.** – W. Griffith 5213 (K, photo), B. Scortechini s.n. (K, photo), V. B. TRUONG 057 (PSU).

29. *Ceratostylis tonkinensis* (Gagnep.) Aver., Bot. Zhurn. SSSR 73(1): 107. 1988; Seidenf., Opera Bot. 114: 161, 1992; H. H. Pham, Ill. Fl. Vietnam 3: 797. 2000. – *Eria tonkinensis* Gagnep., Bull. Mus. Natl. Hist. Nat., sér. 2, 2: 311. 1930. (Plate 10 G & H).

Epiphytic sympodial orchid. *Stems* erect to suberect, ca. 1.5–1.7 cm long, base usually overlapping sheathing. *Leaves* green, lanceolate, ca. 6–9.5 x 1.3–1.8 cm, apex obtuse, not equally 2 lobes, thick; petiole green, ca. 1.5–2 cm long, covered by overlapping sheaths. *Inflorescence* lateral, from base of stem, 1–2 flowered; peduncle ca. 1.7–1.6 cm long, pubescent with white hair; floral bract ovate, ca. 0.15–0.2 cm long, apex acute; inflorescence bract (1 to 2) white, narrowly ovate, ca. 1.2–1.3 cm long, apex acute. *Flower* white, not open widely. *Dorsal sepal* elliptic, ca. 0.55–0.6 x 0.2–0.25 cm, apex acute, abaxial slightly pubescent with white hair. *Lateral sepals* ovate, ca. 0.5–0.6 x 0.25–0.3 cm, apex acute, forming mentum rounded, ca. 0.3–0.4 cm long, slightly hairy. *Petals* lanceolate, ca. 0.4–0.5 x 0.15–0.2 cm, apex acute. *Labellum* fleshy, ca. 0.7–0.8 cm long, 3 lobed; mid lobe fleshy, ca. 0.15 x 0.1 cm, apex acute; lateral lobe erect, triangular, apex obtuse, margin erose, 2 to 3 pale purple teeth; labellum adaxial 3 ridges extend from base to apical; base outcurved, ca. 0.2 cm long, margin white ciliate. *Column* glabrous, 0.25–0.3 cm long, column foot ca. 0.15 cm long, apex 2 erect arms, obtuse; anther cap white, glabrous, broadly ovate, ca. 1 mm long; pollinia 4, ca. 0.8 mm long, into 2 groups, waxy, attached to small viscidium, stipe and caudicles absent. *Ovary* (with pedicel) ca. 0.5–0.6 cm long pubescent with, brown hair. *Capsule* not seen.

**Vietnam.** – Hon Ba (Khanh Hoa province), Tam Đảo, Vĩnh phú.

**Distribution.** – Endemic to Vietnam.

**Ecology.** – Closed evergreen tropical monsoon (seasonal) mixed lower montane forest. ca. 1523 m asl. Flowering in middle of October.

**Specimen examined.** – V. B. TRUONG 056 (PSU).

30. *Cleisostoma birmanicum* (Schltr.) Garay, Bot. Mus. Leaflet 23(4): 170. 1972; Seidenf., Opera Bot. 114:393. 1992; H. H. Pham, Ill. Fl. Vietnam 3: 936. 2000; X. Chen & J. J. Wood in Z. Y. Wu et al. (eds), Fl. China 25: 461. 2009. – *Echioglossum birmanicum* Schltr., Notizbl. Bot. Gart. Berlin-Dahlem 8: 125. 1922. – *Sarcanthus birmanicus* (Schltr.) Seidenf. & Smitinand, Orch. Thail. (Prelim. List): 665. 1965. (Plate 11 A & B).

Epiphytic monopodial orchid. *Stem* cylindrical, pendent, up to 35 cm long, ca. 0.5 cm in diam. *Leaves* distichous, glabrous, lanceolate, ca. 10–18 x 1–1.4 cm, apex acute; petiole sheath brown, dark brown ca. 1.5 cm long. *Inflorescence* lateral, raceme, unbranched, glabrous, ca. 3.5 cm long, 10 to 11 flowered; peduncle short, thick with ca. 1–2 sheath(s) at base, brown, 0.2–0.3 cm long, apex acute; rachis ca. 3 cm long. *Flower* open widely, sepals and petal red with yellow margin, labellum yellow. *Dorsal sepals* glabrous, ovate, cymbiform, ca. 1.2–1.8 x 0.35 cm, apex obtuse; adaxial dark red, tip yellow, one yellow mid vein. *Lateral sepals* ovate to slightly falcate, ca. 1.35 x 0.35 cm, apex obtuse to subacute, adaxial dark red, tip yellow, one mid vein yellow, adaxial dark red, tip margin yellow. *Petals* lanceolate, ca. 0.6–0.65 x 0.2–0.25 cm, apex obtuse. *Labellum* glabrous, ca. 0.35 cm long, yellow, 3 lobed; mid lobe triangular, fleshy, 1 white appendage on tip, a longitudinal fleshy lamella in middle; lateral lobes falcate to triangular, ca. 0.2–0.25 cm long, apex acute; spur glabrous, 90° with ovary when buds turn to nearly parallel when open widely, orbicular, yellow callus inside spur, entire. *Column* glabrous, ca. 0.5 cm long, lacking foot, tip dark red; anther cap broadly ovate, ca. 1.5 mm, dark red; pollinia 4, separate into 2 pairs, unequally size, solid, attached to slender and white stipe; caudicles absent, viscidium present. *Ovary* (with pedicel) slender, glabrous, 0.5–0.75 cm long, dark red. *Capsule* not seen.

**Vietnam.** – Hon Ba (Khanh Hoa province).

**Distribution.** – China, NE India, Malaysia, Thailand.

**Ecology.** – Closed evergreen tropical monsoon (seasonal) mixed lower montane forest, epiphyte on tree trunk very high, ca. 1000 m asl. Flowering in July. Rare species.

**Specimen examined.** – A. Lamb & H. Lohok AL379/85 (K, photo), V. B. TRUONG 063 (PSU).

32. *Cleisostoma williamsonii* (Rchb. f.) Garay, Bot. Mus. Leaflet. 23(4): 176. 1972; J.B. Comber, Orchids Java: 335. 1990; Seidenf., Opera Bot. 114:395. 1992; H.H.Pharm, Ill. Fl. Vietnam 3: 939. 2000; J. B. Comber, Orchids Sumatra: 881. 2001; N. Pearce & P. J. Cribb, Fl. Bhutan 3(3): 512. 2002; X. Chen & J. J. Wood in Z. Y. Wu et al. (eds),

Fl. China 25: 462. 2009. – *Sarcanthus williamsonii* Rchb.f., Hamburger Garten-Blumenzeitung 21: 353. 1865. – *Echioglossum williamsonii* (Rchb.f.) Szlach., Fragm. Florist. Geobot., Suppl. 3: 137. 1995. (Plate 11 E & F).

Epiphytic monopodial orchid. *Stem* pendent, fleshy, slender, branched, internode ca. 2–3 cm. *Leaves* fleshy linear to lanceolate, terete, ca. 6–9 cm long, apex obtuse. *Inflorescence* axillary, branched, 20 to 40 flowered; peduncle bract 2, pale brown; floral bract ovate, ca. 0.05–0.1 cm long, apex acute. *Flower* open widely, sepals and petals pinkish–white, labellum purple. *Dorsal sepal* glabrous, ovate, ca. 0.25–0.3 x 0.1–0.15 cm, apex acute, pink mid vein. *Lateral sepals* ovate, glabrous, ovate, ca. 0.35 x 0.2 cm, apex obtuse to subacute. *Petals* white, oblong, glabrous, ca. 0.15–0.2 x 0.1 cm, apex acute. *Labellum* spurred, ca. 0.4–0.45 cm long, 3 lobed; mid lobe pink, triangular, fleshy, ca. 0.2 x 0.05 cm, apex obtuse, adaxial one ridge from the middle and convex near the tip of callus ca. 0.1 cm long; lateral lobes purple, erect, ca. 0.15 cm long, apex obtuse; callus slightly 3 lobed, base finely papillose; spur white ca. 0.2–0.25 cm long. *Column* ca. 0.2–0.25 cm long white, tip pink; anther cap and pollinia not seen (missing). *Ovary* (with pedicel) 0.4–0.6 cm long. *Capsule* (young capsule) ca. 0.9 cm long.

**Vietnam.** – Hon Ba (Khanh Hoa province).

**Distribution.** – Bhutan, China, NE–India, Indonesia, Malaysia, Myanmar, Thailand.

**Ecology.** – Closed evergreen tropical monsoon (seasonal) mixed lower montane forest, ca. 1066 m asl. Flowering in July.

**Specimen examined.** – C. Curtis 2560 (K, photo), P. Rojchana-umpawan 211 (PSU), V. B. TRUONG 064 (PSU).

33. *Coelogyne eberhardtii* Gagnep., Bull. Mus. Natl. Hist. Nat., sér. 2, 2: 423. 1930; Seidenf., Opera Bot. 114:109. 1992; H. H. Pham, Ill. Fl. Vietnam 3: 880. 2000. (Plate 11 G & H).

Terrestrial sympodial orchid. *Rhizome* thick and stiff, brown sheaths along rhizome. *Pseudobulbs* ca. 2–10 cm high sometimes with brown sheaths, pseudobulbs

occurred in groups connected by rhizome ca. 0.5 cm apart. *Leaves* 2, glabrous, oblanceolate, ca. 21–24 x 2.5–2.7 cm, apex acute; petiole short ca. 1–2 cm long. *Inflorescence* glabrous, heteranthous, terminal, raceme, greenish–yellow; peduncle ca. 20 cm; rachis glabrous, 2 flowered; floral bract caducous. *Flower* open widely, ca. 4 cm long, open in succession, sepals and petals pale brown, labellum white with 3 dark red–brown ridges. *Dorsal sepal* glabrous, broadly ovate, ca. 5 x 3.3 cm, apex acute, 1 green-yellow mid vein. *Lateral sepals* glabrous, ovate, ca. 5.3 x 1.7 cm, apex acute. *Petals* glabrous, linear, ca. 4.6 x 0.6 cm, apex acute. *Labellum* glabrous, ca. 3.7 x 3 cm, 3 lobed; mid lobe slightly retuse, margin white, wavy; lateral lobes erect, oblong, ca. 3 x 1 cm, apex obtuse, margin entire; adaxial of labellum three dark brown, fleshy, undulate ridges from hypochile to base of mid lobe; abaxial one middle groove from base of labellum to mid lobe. *Column* white, glabrous, ca. 2.7 x 0.8 cm, winged open broadly from middle to tip, curved backside in the middle, margin erose; anther cap white, ca. 1.4 mm long, short horn in the middle, near base; pollinia 4, ca. 1–1.1 mm long, in 2 pairs not equally inner and outer, attached with caudicles, stipe and viscidium absent. *Ovary* (with pedicel) glabrous, slender, ca. 3.8 cm long, brownish–green. *Capsule* not seen.

**Vietnam.** – Hon Ba (Khanh Hoa province).

**Distribution.** – Endemic to Vietnam.

**Ecology.** – Closed evergreen tropical monsoon (seasonal) mixed lower montane forest, along the main road, very wet, foggy, with fern and bryophytes. ca. 1333 m asl. Flowering in July.

**Specimen examined.** – V. B. TRUONG 071 (PSU).

**Note:** This species was collected as terrestrial orchid, but it should be epiphytic species.

34. *Coelogyne fimbriata* Lindl. var. *fimbriata* Bot. Reg. 11: t. 868 (1825) – *Broughtonia linearis* Wall. ex Lindl., Gen. Sp. Orchid. Pl.: 42. 1830. – *Coelogyne fimbriata* var. *acuminata* Regel, Index Seminum (LE) 1855: 18. 1855. – *Broughtonia linearis* Wall. ex Hook.f., Fl. Brit. India 5: 836. 1890. – *Pleione chinensis* Kuntze, Revis. Gen. Pl. 2: 680. 1891. – *C. pallens* Ridl., J. Straits Branch Roy. Asiat. Soc. 39:

81. 1903. – *C. fimbriata* var. *annamica* Finet ex Gagnep. in H.Lecomte, Fl. Indo-Chine 6: 309. 1919. (Plate 12 A & B).

Epiphytic sympodial orchid. **Rhizome** creeping, slender ca. 0.3–0.4 cm in diam. **Pseudobulbs** ca. 4.5–5.2 cm long, narrow cylindrical–fusiform, pseudobulbs occurred in groups connected by rhizome ca. 4.5–5 cm apart, rhizome with brown sheath. **Leaves** 2, green, glabrous, oblong–lanceolate, ca. 7–11 x 1.5–2.8 cm, apex acute; petiole very short ca. 1–1.5 cm long. **Inflorescences** heteranthous, glabrous, raceme, 2 to 3 flowered; peduncle ca. 6.3–6.5 cm long, base with scale leaves ca. 6–9, close together, tip slightly brown, apex acute; floral bract caduceous. **Flower** open widely and in succession, ca. 2.5 cm long, pale brown, labellum white. **Dorsal sepals** glabrous, lanceolate, 2.7 x 1 cm, apex acute, 6–7 veins on the blade. **Lateral sepals** glabrous, lanceolate, ca. 2.5–2.6 x 0.7–0.8 cm, apex acute, 5 veins green. **Petals** linear, ca. 2.2–2.3 x 0.05 cm, apex acute. **Labellum** glabrous, ca. 2.5 cm long, 3 lobed; mid lobe elliptic, margin fimbriate, ca. 2 x 1 cm, apex acute, base brownish markings; lateral lobes somewhat triangular, ca. 1.5 cm long, apex obtuse, 2–3 irregular brown stripes, margin near mid lobe and tip strongly fimbriate, base lateral lobes brown; adaxial with 2 long undulate ridges from the callus base to nearly the tip ca. 2 cm long, 1 mid small brown ridge ca. 0.4 cm long. **Column** glabrous, ca. 1.3 cm long, curved in the middle, top winged; anther cap yellowish–white, ca. 3–4 mm long, suborbicular shaped, slightly curved in the middle, small horn on the middle base; pollinia 4, ca. 1 mm long, in pairs 2 inner slightly smaller than 2 outer attached to short caudicles; stipe and viscidium absent. **Ovary** (with pedicel) white, slender, ca. 1.2 cm long. **Capsule** oblanceolate, ca. 2.5–2.8 cm long.

**Vietnam.** – Hon Ba (Khanh Hoa province).

**Distribution.** – Myanmar, Thailand, Malaysia, Borneo.

**Ecology.** – Closed evergreen tropical monsoon (seasonal) mixed lower montane forest, ca. 1176 m asl. Flowering in on July.

**Specimen examined.** – V. B. TRUONG 072 (PSU).



35. *Coelogyne mooreana* Rolfe, Bull. Misc. Inform. Kew 129. 1907; Seidenf., Opera Bot. 114: 113. 1992; H. H. Pham, Ill. Fl. Vietnam 3: 882. 2000. (Plate 12 C & D).

Lithophytic sympodial epiphytic orchid. **Rhizome** creeping, stout, ca. 0.3 cm in diam. **Pseudobulbs** ovoid or oblong, ca. 5–6.5 cm high, pale brown sheath, pseudobulbs occurred in groups connected by rhizome, ca. 0.4 cm long apart. **Leaves** 2, green, glabrous, lanceolate ca. 20–22 x 3.5–5 cm, apex acute; petiole ca. 8–10 cm long. **Inflorescence** heteranthous, terminal, raceme, glabrous, ca. 20 cm long, greenish–white at base; floral bracts glabrous, caducous, greenish–white, linear, apex acute ca. 2–3.5 cm long. **Flower** not open widely, sepals and petals white, labellum white with yellow marking and white hair on labellum, flower open same time. **Dorsal sepal** glabrous, elliptic, ca. 4–4.1 x 1.5 cm, apex acute, ca. 4 veins. **Lateral sepals** glabrous, lanceolate to narrow elliptic, ca. 3.5–3.7 x 1.5–1.8 cm, apex acute, 5–6 veins. **Petals** glabrous, elliptic, ca. 3.5–3.5 x 1.2–1.3 cm, apex acute, 6–7 veins. **Labellum** glabrous, ca. 9.5 x 2.5–3 cm (when flattened at lateral lobes), 3 lobed; mid lobe ovate, white ca. 1.5 x 1.3 cm, apex acute, margin slightly undulate, adaxial base yellow with few yellow–white hair at the base; lateral lobes white, oblong ca. 2 cm long, apex obtuse, incurved embrace the column, adaxial dense yellow–white hair; abaxial 2 yellow groove of the base mid lobe to lateral lobes. **Column** white, glabrous, ca. 2.5–2.7 cm long, winged, open broadly from middle to tip, margin lobed; anther cap pale yellow, ovate, ca. 1.2 mm long, short horn near base; pollinia 4, ca. 0.9 mm long, in 2 pairs, ovate, slightly unequal and flat, pale yellow, attached to small caudicles; stipe and viscidium absent. **Ovary** (with pedicel) greenish white ca. 1.5–2 cm long. **Capsule** not seen.

**Vietnam.** – Hon Ba (Khanh Hoa province).

**Distribution.** – Endemic to Vietnam.

**Ecology.** – Closed evergreen tropical monsoon (seasonal) mixed lower montane forest, ca. 1536 m asl. Flowering in middle of May.

**Specimen examined.** – W. Micholitz s.n. (K, photo), V. B. TRUONG 069 (PSU).

36. *Collabium chloranthum* (Gagnep.) Seidenf., Opera Bot. 72: 26. 1984; Seidenf., Opera Bot. 114: 325. 1992; H. H. Pham, Ill. Fl. Vietnam 3: 921 2000; *Calanthe chlorantha* Gagnep., Bull. Soc. Bot. France 79: 162. 1932. – *Chrysoglossum chloranthum* (Gagnep.) Tang & F.T.Wang, Acta Phytotax. Sin. 1: 77. 1951. – *Collabiopsis chlorantha* (Gagnep.) S.S.Ying, Col. Ill. Orch. Taiwan 2: 457. 1990. (Plate 12 E & F).

Terrestrial sympodial orchid. **Rhizome** creeping. **Pseudobulbs** ovoid, ca. 3.5–4 cm long. **Leaves** green, dark green, to brown–purple, ovate, ca. 15–17 x 6.5–6.7 cm, apex acute, undulate blade, margin lobed; petiole 1–1.5 cm long. **Inflorescence** terminal from leafless new pseudobulb shoot, raceme, ca. 19–20 cm long, greenish–brown; peduncle ca. 13 cm long; sterile bract 2–3, ca. 1.8–2.7 cm long, apex acute; rachis ca. 6 cm long, 10 to 11 flowered; floral bract pale brown, ca. 0.8–1 cm long, apex acuminate. **Flower** ca. 1 cm long, with pale green sepals and petals, labellum fimbriate, white, twisted ca. 90° with column. **Dorsal sepal** pale green, glabrous, oblong, ca. 1.2–1.5 cm x 0.35 cm, 3 veins, apex acute. **Lateral sepals** pale green, glabrous, oblong, ca. 1–1.1 cm x 0.35–0.4 cm, apex acute, 1 mid vein. **Petals** glabrous, elliptic, ca. 1–1.15 cm x 0.5 cm, apex acute, curved toward, 3 veins. **Labellum** ca. 0.8 cm x 0.6 cm, fimbriate, apex acute; adaxial with 2 high raising, pale purple keels, falcate, ca. 0.2 cm long continue on epichile with 2 lower white, erose, dentate ridges up to near tip; apical adaxial white ciliate; base strongly curved. **Column** glabrous, ca. 0.5 cm long, white; tip yellow, twisted down; anther cap yellowish–white, ca. 1 mm long, pollinia 2, ca. 0.7 mm long, solid, caudicles, stipe and viscidium not present. **Ovary** (with pedicel) green–pale purple, glabrous, ca. 1–1.2 cm long, pedicel twisted when connect to rachis. **Capsule** not seen.

**Vietnam.** – Bidoup – Lam Dong province, Hon Ba – Khanh hoa province.

**Distribution.** – Endemic to Vietnam.

**Ecology.** – Closed evergreen tropical monsoon (seasonal) mixed lower montane forest, ca. 1435 m asl. Flowering in June.

**Specimen examined.** – V. B. TRUONG 068 (PSU).

37. *Conchidium pusillum* Griff., Not. Pl. Asiat. 3: 321, pl. 310. 1851; X. Chen, Y. Luo & J. J. Wood. in Z. Y. Wu et al. (eds), Fl. China 25: 347. 2009. – *Eria pusilla* (Griff.) Lindl., J. Proc. Linn. Soc., Bot. 3: 48. 1858. – *Pinalia pusilla* (Griff.) Kuntze, Revis. Gen. Pl. 2: 679. 1891. – *Eria pusilla* (Griff.) Lindl., J. Proc. Linn. Soc., Bot. 3: 48. 1858. – *Pinalia pusilla* (Griff.) Kuntze, Revis. Gen. Pl. 2: 679. 1891. (Plate 12 G & H).

Lithophytic sympodial orchid. **Rhizome** creeping, slender ca. 0.5–1 mm in diam. **Pseudobulbs** orbicular to suborbicular, ca. 0.4–0.5 cm long, grow in pair, pseudobulbs close together or ca. 1.3–1.5 cm long apart. **Leaves** 2 to 3, glabrous, oblanceolate, ca. 0.8–1.4 x 0.2–0.5 cm, apex obtuse or slightly truncate, one small seta in the middle of leaves ca. 0.15 cm long, sheathing at base; petiole 0.2–0.25 cm long. **Inflorescence** terminal, ca. 1.5–2.9 cm long, single flowered; inflorescence bract narrowly ovate, ca. 0.05–0.07 cm long, apex acuminate; floral bract pale green, glabrous, ovate, ca. 0.2–0.3 cm long, apex acuminate. **Flower** not open widely, pale yellow. **Dorsal sepal** pale yellow, glabrous, lanceolate, ca. 0.65–0.7 x 0.25–0.3 cm, apex acute, 3 veins. **Lateral sepals** pale yellow, oblique, glabrous, ovate, ca. 0.8–0.9 x 0.25–0.3 cm, apex acuminate, lateral sepals adnate with column foot, form mentum ca. 0.2–0.25 cm long, incurved. **Petals** pale yellow, glabrous, lanceolate, ca. 0.7–0.8 x 0.2–0.3 cm, acuminate, 3 veins. **Labellum** simple, lanceolate, glabrous, ca. 0.4–0.5 cm long, open broadly in the middle then narrowly near the apical part, apex acute; margin irregularly denticulate; disk with 2 or 3 lines from base of labellum to middle. **Column** glabrous, ca. 0.7 mm long, column foot ca. 2.5 mm long; anther cap pale yellow white, glabrous, suborbicular, ca. 1 mm long; pollinia 8, ovoid, ca. 0.5 mm long, slightly flat, pale red, caudicles and stipe absent. **Ovary** (with pedicel) pale green, glabrous, ca. 0.2–0.25 cm long, slightly curve. **Capsule** not seen.

**Vietnam.** – Hon Ba (Khanh Hoa province), Bidoup, Da Lat, Vinh Phu, Tam Dao.

**Distribution.** – China, India, Myanmar, Thailand.

**Ecology.** – Closed evergreen tropical monsoon (seasonal) mixed lower montane forest, lithophyte with bryophytes, *Oberonia longibracteata* Lindl., ca. 1417 m asl. Flowering in middle of October.

**Specimen examined.** – W. Griffith 666 (K, photo), V. B. TRUONG 087 (PSU).

38. *Cordiglottis longipedicellata* J. Lee, T.B. Tran & R.K. Choudhary, Ann. Bot. Fennici 50: 95. 2013. (Plate 13 A & B).

Epiphytic monopodial orchid. *Foliage leaves* conduplicate at base, lanceolate, flat, ca. 12–13 x 0.4–0.5 cm, apex acute, slightly falcate, base overlapping by the other leaves. *Inflorescence* lateral from base of stem, slender, pendulous, ca. 1.5 cm long, single flowered; peduncle slender, glabrous, ca. 0.4–0.5 cm long; floral bract pale green, glabrous, ovate, ca. 0.1 x 0.05 cm, apex acute. *Flower* single, open widely, sepals and petal white, fused at column, labellum white, saccate, purple dots. *Dorsal sepal* glabrous, elliptic, erect, fleshy, ca. 0.5 x 0.15 cm, apex obtuse. *Lateral sepals* glabrous, ovate, ca. 0.4 x 0.2 cm, apex obtuse. *Petals* glabrous, ovate ca. 0.5 x 0.15 cm, apex obtuse. *Labellum* glabrous, saccated, 3 lobbed; mid lobe white, ca. 0.3 cm long, apex acute incurved; lateral lobe glabrous somewhat triangular, ca. 0.4 cm long, apex obtuse with many purple dot on adaxial; adaxial disc yellow callus, spatulate, fleshy, glabrous. *Column* short ca. 0.15 cm long, foot ca. 0.2 cm long; anther cap white, ovate, ca. 1 mm long, apex acute; pollinia 4, ca. 0.5–0.6 mm long, into 2 groups, unequal in size, solid, pale yellow, stipe slender attached to small viscidium, caudicles absent. *Ovary* (with pedicel) white, glabrous, slender, ca. 1 cm long. *Capsule* not seen.

**Vietnam.** – Hon Ba (Khanh Hoa province).

**Distribution.** – Endemic to Vietnam.

**Ecology.** – Closed evergreen tropical monsoon (seasonal) mixed lower montane forest, ca. 1200m asl., very rare. Flowering in March.

**Specimen examined.** – V. B. TRUONG 058 (PSU).

39. *Cryptostylis arachnites* (Blume) Blume, Collection des Orchidées 133. 1858. Seidenf., Opera Bot. 411. 1992; Seidenf. & J.J. Wood, Orchids Penins. Malaysia Singapore: 49.1992; H. H. Pham, Ill. Fl. Vietnam 3: 790. 2000; H. A Pedersen in Santisuk & Larsen (eds), Fl. Thailand 12(1): 44. 2011. – *Zosterostylis arachnites* Blume, Bijdr. Fl. Ned. Ind.: 419. 1825. (Plate 13 C & D).

Terrestrial sympodial orchid. **Rhizome** brown, creeping, fleshy. **Foliage leaves** broadly ovate, glabrous, ca. 10 x 5.5 cm, apex acuminate, blade netted veins; petiole dark brown, fleshy, ca. 3.5 cm long. **Inflorescence** lateral from rhizome, raceme, ca. 41 cm long, brown red, 5 – 10 flowered; inflorescence sheathing at base, ca. 3 cm long; inflorescence bracts 2, narrowly lanceolate, brown with dark red dots, apex acuminate; rachis ca. 10–15 cm long; floral bracts lanceolate, ca. 1.5 x 0.3 cm, apex acuminate, brown with dark red dots. **Flower** open widely, with short pedicel, dark brownish–red, greenish brown sepals and petals margin incurved form needle shape, labellum pale red with very dark red dots on apical part. **Sepals** somewhat similar, linear–lanceolate, ca. 1.5–1.6 cm long, apex acuminate, margin incurved, ca. 2–3 veins. **Petals** shorter than sepals, glabrous, linear, ca. 0.7–0.8 cm long, apex acuminate, 1 vein. **Labellum** oblong, immobile, apical part acuminate, very dark red dots on apical (from the middle of middle of labellum), incurved or sometimes outcurved in the middle; disk finely white pubescent with white hair. **Column** greenish–white, short, glabrous, ca. 0.2–0.3 cm long; anther cap yellow ca. 2 mm; pollinia 4, ca. 1.5 mm long, oblanceolate, into 2 pairs mealy, yellow, attached directly to viscidium, caudicles and stipe absent. **Ovary** (with pedicel) ca. 1.1–1.5 cm long, green with dark red dots. **Capsule** not seen.

**Vietnam.** – Hon Ba (Khanh Hoa province), Quảng Ninh, Tây Nguyên, Nha Trang, Bảo Lộc.

**Distribution.** – China, Indonesia, Malaysia, Philippines, Taiwan, Thailand.

**Ecology.** – Closed evergreen tropical monsoon (seasonal) mixed lower montane forest, ca. 1257 m asl. Flowering in April.

**Specimen examined.** – T. Lobb s.n. (K, photo), F.R.R. Schlechter 19546 (K, photo), V. B. TRUONG 059 (PSU).

40. *Cymbidium dayanum* Rchb.f., Gard. Chron. 1869: 710. 1869; Seidenf., Opera Bot. 114: 339, 1992; Seidenf. & J. J. Wood, Orchids Penins. Malaysia Singapore: 549. 1992; H. H. Pham, Ill. Fl. Vietnam 3: 916. 2000; N. Pearce & P. J. Cribb, Fl. Bhutan 3(3): 261. 2002; Z. Liu, X. Chen & P. J. Cribb in Z. Y. Wu et al. (eds), Fl. China 25: 265. 2009; P. J. Cribb & H. A. Pedersen in Santisuk & Balslev (eds), Fl. Thailand 12(2): 451. 2014; – *Cymbidium eburneum* var. *dayanum* (Rchb.f.) Hook.f., Fl. Brit. India 6: 12. 1891. (Plate 13 E & F).

Epiphytic or terrestrial monopodial orchid. *Pseudobulbs* fusiform, bilaterally flattened, ca. 3–4 cm long, usually covered by sheaths. *Leaves* linear, sessile, ca. 20–43 x 1.2–1.3 cm, apex acute, abaxial one prominent mid vein. *Inflorescence* lateral, from the base, pendulous, ca. 19 cm long, 7 flowered; inflorescence bracts 6, ca. 4.5–7 cm long, apex acute with dark green – pale maroon stripes; floral bract pale green, ovate, ca. 0.7–0.8 cm long, apex acute, base purple. *Flower* open widely in same time, sepal and petals yellow with maroon stripes from base to mid, labellum yellow with maroon stripe and yellow at base. *Dorsal sepal* glabrous, oblong, ca. 3.1–3.5 x 0.6–0.7 cm, apex acute or short acuminate, 1 mid vein maroon, margin slightly erose from middle to base. *Lateral sepal* glabrous, oblong, ca. 3.2–3.3 x 0.8 cm, apex acute or acuminate, 1 maroon mid stripe, margin from middle to base slightly erose. *Petals* glabrous, oblong, ca. 2.5 cm x 0.8 cm, apex acute, 1 maroon mid stripe, margin erose. *Labellum* glabrous, ca. 2.5 cm long, 3 lobed; mid lobe ca. 1.2 x 0.7 cm, apex acute, apical part strongly outcurved, margin dark red, middle yellow, adaxial papillose, with minute white hair on 2 yellow line continue from ridges to middle of mid lobe; lateral lobes yellow, triangular, from the base of labellum rise up to ca. 1.3 x 0.2 cm, apex obtuse, margin dark red, 3–4 irregular maroon stripes fused together on maroon margin; adaxial 2 rounded, pubescent with white hair on the ridges from the base of labellum to base of mid lobe. *Column* dark maroon, glabrous, ca. 1.2–1.3 cm long, slightly curved; anther cap pale yellow, ca. 2 mm long, slightly papillose; pollinia 2, elliptic, ca. 1 mm long, dark yellow, deep cleft; stipe slender, white attached to very small viscidium,

caudicles absent. **Ovary** (with pedicel) slender, glabrous, ca. 2–2.7 cm long, green, base purple. **Capsule** fusiform, 6 ridges, ca. 8–10, ellipsoid shape.

**Vietnam.** – Hon Ba (Khanh Hoa province).

**Distribution.** – Bhutan, Cambodia, China, India, Indonesia, Japan, Malaysia, Myanmar, Philippines, Taiwan, Thailand.

**Ecology.** – Closed evergreen tropical monsoon (seasonal) mixed lower montane forest, ca. 1300 up to 1510 m asl. Flowering in July to September.

**Specimen examined.** – A.F.G. Kerr 113 (K, photo), R. Pantling 51 (K, photo), V. B. TRUONG 062 (PSU).

41. *Cymbidium erythrostylum* Rolfe, Gard. Chron. 2: 427. 1905. Seidenf., Opera Bot. 114: 343, 1992; H. H. Pham, Ill. Fl. Vietnam 3: 917. 2000. – *Cyperorchis erythrostyla* (Rolfe) Schltr., Repert. Spec. Nov. Regni Veg. 20: 108. 1924. (Plate 13 G & H).

Epiphytic sympodial orchid. **Pseudobulbs** somewhat fusiform, bilaterally flattened, ca. 4–5 cm long. **Leaves** linear, ca. 43–50 x 1.2–1.3 cm, apex acute, margin entire. **Inflorescence** pale green, terminal, pendulous, glabrous, raceme, ca. 27–28 cm long; peduncle glabrous, pale green, ca. 20–21 cm long, slightly zigzag; inflorescence bract 5, narrowly ovate, ca. 7 cm long, apex acuminate, margin slightly revolute; rachis glabrous, 3 to 4 flowered; floral bracts glabrous, narrowly lanceolate to linear, ca. 2.2–4.5 cm long, apex acuminate. **Flower** open widely, white sepals and petals, labellum, yellowish–white embrace column trumpet shape, with many red stripes. **Dorsal sepal** glabrous, obovate, ca. 4.5–4.7 x 2 cm, apex obtuse, 11–13 veins. **Lateral sepals** glabrous, ovate to falcate, ca. 4.1–4.2 x 2.2 cm, apex acute, 14–15 veins, abaxial mid vein slightly pale red. **Petals** glabrous, elliptic, ca. 4.1–4.2 x 1.6–1.9 cm, apex slightly acute, ca. 11–12 veins. **Labellum** glabrous, ca. 3 x 3.5 cm, 3 lobed; mid lobe yellow margin, ca. 1 cm long, triangular, apical part erose into 3 teeth, 2 lateral teeth falcate, apex obtuse, mid tooth somewhat triangular, apex acute; lateral lobes erect, rounded, apex obtuse, adaxial finely pubescent with white hair; adaxial of labellum densely

pubescent with white hair (longer than lateral lobes), disk 3 rounded ridges from base up to the end of mid lobe turn into single 3 lobed callus, apical callus swelling. **Column** glabrous, red, ca. 2.6 cm long, apex slightly incurved, margin and adaxial densely pubescent with white hair; anther cap white ovate, ca. 2 mm long, swelling, apex obtuse; pollinia 2, subglobose, ca. 1.8 mm long, deep cleft, yellow, slender and short stipe attached to viscidium, caudicles absent. **Ovary** (with pedicel), slender, glabrous, white ca. 4–4.5 cm long. **Capsule** not seen

**Vietnam.** (Endemic) – Hon Ba (Khanh Hoa province), Ba Na, Da Lat

Distribution. – Endemic to Vietnam

**Ecology.** – Closed evergreen tropical monsoon (seasonal) mixed lower montane forest, along the stream, ca. 1490 m asl. Flowering in early of May.

**Specimen examined.** – H.F.C. Sander s.n. (K, photo), V. B. TRUONG 060 (PSU).

42. ***Cymbidium lancifolium*** Hook., Exot. Bot.1: t. 51. 1823; Seidenf., Opera Bot. 72: 68, 37. 1994; H. H. Pham, Ill. Fl. Vietnam 3: 918. 2000; N. Pearce & P. J. Cribb, Fl. Bhutan 3(3): 269. 2002; Z. Liu, X. Chen & P. J. Cribb in Z. Y. Wu et al. (eds), Fl. China 25: 278. 2009; P. J. Cribb & H. A. Pedersen in Santisuk & Balslev (eds), Fl. Thailand 12(2): 458. 2014. – *Cymbidiopsis lancifolia* (Hook.) H.J.Chowdhery, Indian J. Forest. 32: 157. 2009. (Plate 14 A & B).

Terrestrial sympodial orchid. **Rhizome** white, thick, always above the ground. **Pseudobulbs** narrowly fusiform, erect, bilateral sides flat, ca. 4–8 x 0.8 cm, tapering the apical, covered by sheath at base, pseudobulbs. **Leaves** 3, oblong ca. 10–12.5 x 3.6–4 cm, apex acuminate, leaves base narrowly form petiole; petiole ca. 2.5–3.5 cm long. **Inflorescence** lateral, from base of pseudobulb, raceme, ca. 8 cm long, 3 flowered; inflorescence bracts 3, ovate, ca. 1.2–2 cm long, apex acute; floral bracts lanceolate, ca. 0.7–1 cm long. **Flower** open widely in same time, petals and sepals pale green with maroon stripes in middle, labellum with maroon lines. **Dorsal sepal** glabrous, oblong, ca. 2.8–3 x 0.5–0.6 cm, apex acute, 3 greenish veins on the blade. **Lateral sepals** oblique, oblong, ca. 2.6–3 x 0.5–0.6 cm, 3 pale yellow veins. **Petals** glabrous, narrow



elliptic, ca. 2.6–3 x 0.6–0.7 cm, 1 maroon mid stripe from base to middle (ca. 1.5–1.6 cm long). **Labellum** ca. 1.4–1.5 cm long, 3 lobed; mid lobe ovate, ca. 0.5 x 0.7 cm, apical part strongly outcurved, apex acute, one big maroon dot near the tip; lateral lobes pale green, apex rounded to obtuse, maroon stripes from margin to middles and confluent on margin; adaxial of labellum two ridges from base up to 0.6–0.7 cm long in mid lobe, apex convergent form tube shape. **Column** pale green glabrous, ca. 1.2–1.3 x 0.3 cm, maroon dots in the middle; anther cap pale green, glabrous, ca. 1.5 mm long; pollinia 2, subglobose ca. 1 mm long, white; white stipe attached to small yellow viscidium, caudicles absent. **Ovary** (with pedicel) pale green, glabrous, erect, ca. 2.3–2.5 cm long. **Capsule** not seen.

**Vietnam.** – Hon Ba (Khanh Hoa province), Đà Lạt, Lâm Đồng.

**Distribution.** – China, Bhutan, Cambodia, Himalayas, Indonesia, Japan, Laos, Malaysia, Myanmar, Nepal, Taiwan, Thailand.

**Ecology.** – Closed evergreen tropical monsoon (seasonal) mixed lower montane forest, ca. 1297 m asl. Flowering in the middle of May.

**Specimen examined.** – N. Wallich s.n. (K, photo), A.F.G. Kerr 227 (K, photo), V. B. TRUONG 061 (PSU).

43. *Dendrobium aduncum* Wall. ex Lindl., Edwards's Bot. Reg.: 28(Misc.): 58, 1842; Seidenf., Opera Bot. 114: 237, 1992; Seidenf. & J.J. Wood, Orchids Penins. Malaysia Singapore: 391. 1992; N. Pearce & P. J. Cribb, Fl. Bhutan 3(3): 415. 2002. Z. Guanghuam J. Zhanhe, J. J. Wood & H. P. Wood in Z. Y. Wu et al. (eds), Fl. China 25: 389. 2009 – *Callista adunca* (Lindl.) Kuntze, Revis. Gen. Pl. 2: 654. 1891. (Plate 14 C & D).

Epiphytic sympodial orchid. **Stem** pendent, ca. 30–40 cm long, with many nodes, internodes ca. 0.7–1.2 cm long, covered by brownish sheaths. **Leaves** not seen (without leaves when collected). **Inflorescence** lateral, from deciduous leaves stems, raceme; peduncle ca. 0.4–0.5 cm long, covered by 2–3 brown sheaths; floral bract ovate, ca. 0.5 cm long, apex acute. **Flower** open widely, sepal and petal white somehow pale

purple, anther cap dark purple. *Dorsal sepal* glabrous, lanceolate, ca. 1.5 x 0.65 cm, apex acute, 4–5 veins. *Lateral sepals* glabrous, ovate, ca. 1.4–1.5 x 0.5 cm, apex acute, this specimen, lateral sepals forming very small mentum, indistinct. *Petals* ovate, ca. 1.5 x 0.65 cm, apex acute, 6–7 veins. *Labellum* simple, ca. 1.1 cm long, broadly ovate when flattened; shortly white claw, glabrous, ovate, ca. 0.35 x 0.4 cm, apex acuminate; adaxial of labellum densely pubescent with white hair; square callus at base pubescent with white hair. *Column* white, glabrous, ca. 0.4 cm long, with 2 triangular teeth on the tip, apex acute; column foot ca. 0.6 x 0.65 cm; anther cap dark purple minute papillae, ca. 2–3 mm long, broadly ovate; pollinia 4, ca. 0.7 mm long, in 2 pairs, size equally, white, clavate; caudicles, stipe and viscidium absent. *Ovary* (with pedicel) slender, pinkish–white, ca. 1.5 cm long. *Capsule* not seen.

**Vietnam.** – Hon Ba (Khanh Hoa province), Quảng Ninh, Ninh Bình, Quảng Bình, Tây Nguyên, Tây Ninh.

**Distribution.** – China, India, Myanmar, Thailand.

**Ecology.** – Closed evergreen tropical monsoon (seasonal) mixed lower montane forest, rare, ca. 1067 m asl. Flowering in July.

**Specimen examined.** – V. B. TRUONG 075 (PSU).

44. *Dendrobium aloifolium* Rchb.f., Ann. Bot. Syst. 6: 279. 1861; Seidenf., Opera Bot. 83: 207. 1985; J. B. Comber, Orchids Java: 241.1990; Seidenf., Opera Bot. 114: 249. 1992; Seidenf. & J. J. Wood, Orchids Penins. Malaysia Singapore: 411. 1992; H. H. Pham, Ill. Fl. Vietnam 3: 835. 2000; J. B. Comber, Orchids Sumatra: 648. 2001; – *Macrostomium aloifolium* Blume, Bijdr. Fl. Ned. Ind.: 335. 1825. – *Oxystophyllum macrostoma* Hassk., Tijdschr. Natuurl. Gesch. Physiol. 10: 122. 1843., nom. superfl. – *Callista aloifolia* (Blume) Kuntze, Revis. Gen. Pl. 2: 653. 1891. – *Aporum aloifolium* (Blume) Brieger in F.R.R.Schlechter, Orchideen Beschreib. Kult. Zücht., ed. 3, 1(11–12): 676. 1981. (Plate 14 E & F).

Epiphytic sympodial orchid. *Stem* pendulous up to ca. 12–23 cm long, base with dry sheaths, internode ca. 2–2.5 cm long. *Leaves* distichous, lanceolate, ca. 1.5–3 x 0.4–

1.1 cm, apex acute, smaller on the tip of the stem, leaves on apical stem fleshy. **Inflorescence** terminal, single flower; peduncle very short with overlapping brown sheaths. **Flower** open broadly, sepals and petal strongly bend backward, flower white. **Dorsal sepal** glabrous, lanceolate, ca. 0.3 x 0.2 cm, apex acute, bend backside. **Lateral sepals** glabrous, lanceolate, ca. 0.3–0.4 x 0.3 cm, 2, lateral sepals forming mentum, obtuse, parallel with ovary. **Petals** glabrous, glabrous, narrowly lanceolate, ca. 0.2 x 0.1 cm. **Labellum** glabrous, fleshy, straight, attached to column at base, oblong, ca. 0.25 cm long, 3 lobed; mid lobe white, raised up over column, broadly ovate, ca. 0.25 x 0.2 cm, apex slightly bi-lobed, lobules rounded; lateral lobes white, fleshy, small, slightly erect, 0.15 cm long, apex obtuse; labellum mid lobe raise above column. **Column** white glabrous, ca. 0.15 cm long, straight parallel with labellum; anther cap pale yellow, glabrous, ovate ca. 0.8 mm long; pollinia 4, ca. 0.5 mm long, in 2 pairs, solid; stipe, caudicles and viscidium absent. **Ovary** (with pedicel) greenish white, glabrous, 0.4–0.5 cm long. **Capsule** not seen.

**Vietnam.** – Hon Ba (Khanh Hoa province), Đà Lạt, Định Quán, Nam Cát Tiên, Sông Bé, Lộc Ninh

**Distribution.** – Cambodia, Indonesia, Laos, Myanmar, Malaysia, Philippines, Thailand.

**Ecology.** – Closed evergreen tropical monsoon (seasonal) sub-montane broad-leaved forest, ca. 800 m asl. Flowering in April.

**Specimen examined.** – J. B. Comber, 1272 (K, photo), A.F.G. Kerr 0828 (K, photo) P. Rojchana-umpawan 86 (PSU), V. B. TRUONG 082 (PSU).

45. *Dendrobium amplum* Lindl., Gen. Sp. Orchid. Pl. 74. 1830. – *Sarcopodium amplum* (Lindl.) Lindl., Fol. Orchid. 2: Sarcop. 1. 1853. – *Bulbophyllum amplum* (Lindl.) Rchb.f. in W.G. Walpers, Ann. Bot. Syst. 6: 244. 1861. *Callista ampla* (Lindl.) Kuntze, Revis. Gen. Pl. 2: 654 (1891). – *Katherinea ampla* (Lindl.) A.D.Hawkes, Lloydia 19: 95, 1956. – *Epigeneium amplum* (Lindl.) Summerh., Kew Bull. 12: 260 (1957). (Plate 14 G & H)

Sympodial epiphytic orchid. **Rhizome** creeping, hard, covered by hard sheath, ca. 0.5–0.6 cm in diam. **Pseudobulbs** elliptic, ca. 2.5–3 cm high, pseudobulbs grow in group connected by rhizome. **Leaves** 2, glabrous, elliptic–oblong, ca. 9–9.5 x 3.5 cm, apex obtuse and retuse; petiole ca. 1.2–1.3 cm long. **Inflorescence** shorter than leaves, single flower; peduncle glabrous, ca. 2.5 cm long, covered by sheaths; floral bract glabrous, ovate, ca. 1.2–1.3 x 0.5 cm (flattened), apex acuminate. **Flower** open widely, ca. 4 cm long, single flower. **Dorsal sepal** glabrous, lanceolate, ca. 5.5 x 0.7–0.8 cm, apex acute, open broadly at base. **Lateral sepals** glabrous, lanceolate to falcate ca. 4.9–5 x 0.7–0.8 cm, apex acute, open broadly at base, attached with column. **Petals** glabrous, linear to lanceolate, ca. 5–5.3 x 0.3–0.4 cm, apex acute, open broadly at base. **Labellum** glabrous, pandurate, ca. 3.2 cm long, 3 lobed; mid lobe, wider than base of labellum, ca. 2.2 x 0.8 cm, margin outcurve, apex acute; lateral lobe, erect, 1.3 x 0.7 cm wide, apex obtuse, incurved; adaxial of disk 3 ridges in the middle, mid ridge ca. 0.5 cm long arrange higher than lateral ridges, 2 lateral ridges ca. 0.7–0.8 cm long, 3 ridges continue run up to middle of mid lobe but not high as on disk. **Column** and foot slightly same size ca. 1.5 cm long, glabrous; anther cap and pollinia missing, missing, caudicles, stipe and viscidium absent. **Ovary** (with pedicel) glabrous, ca. 4.7 cm long. **Capsule** not seen.

**Vietnam.** – Hon Ba (Khanh Hoa province), Lai Châu, Sơn La, Lào Cai, Lâm Đồng

**Distribution.** – China, Bhutan, Himalayas, India, Myanmar, Nepal, Thailand.

**Ecology.** – Closed evergreen tropical monsoon (seasonal) mixed lower montane forest, ca. 1156 m asl. Flowering could be in middle of October.

**Specimen examined.** – V. B. TRUONG 095 (PSU)

**Note:** The specimens collect with wilted flower.

46. *Dendrobium angustifolium* (Blume) Lindl., Gen. Sp. Orchid. Pl.: 76. 1830. *Desmotrichum angustifolium* Blume, Bijdr. Fl. Ned. Ind.: 329 (1825). – *Callista angustifolia* (Blume) Kuntze, Revis. Gen. Pl. 2: 654. 1891. – *Ephemerantha angustifolia* (Blume) P.F.Hunt & Summerh., Taxon 10: 102. 1961. – *Flickingeria*

*angustifolia* (Blume) A.D.Hawkes, *Orquídea* (Rio de Janeiro) 27: 301. 1965. (Plate 15 A & B).

Epiphytic sympodial orchid. **Rhizome** creeping, or pendulous, ca. 0.3 cm in diam., internode with sheaths, ca. 1.3–1.5 cm long. **Pseudobulbs** fusiform, ca. 1.5–2 x 0.5–0.7 cm. **Leaves** single, lanceolate ca. 5–5.1 x 1 cm, apex retuse. **Inflorescence** terminal, sheathing at base; floral bract glabrous, white, ovate, ca. 0.2 cm long, apex acute. **Flower** open widely, ca. 1.5 cm long and easy wilted in half day, sepal pale brown with brown stripes, petals purple, labellum yellow and purple. **Dorsal sepal** glabrous, ovate ca. 0.5 x 0.3 cm, apex acute. **Lateral sepals** glabrous, triangular, broader than dorsal sepals, ca. 1.3 x 0.5 cm, adnate to column, 2 lateral sepals forming mentum ca. 0.6 cm long, apex acute. **Petals** glabrous, lanceolate, ca. 0.4 x 0.15 cm. **Labellum** glabrous, ca. 1.95 cm long, claw at base ca. 0.4 cm long, 3 lobed; mid lobe pale yellow, ca. 0.45 cm long, deeply bi-lobed, lobules obovate; lateral lobes white, erect, rounded, ca. 0.3–0.2 cm long; adaxial with 2 purple ridges run from base and rise high up in base of mid lobe. **Column** glabrous, ca. 0.7 cm long; anther cap ovate, pale yellow, ca. 1 mm long, apex obtuse; pollinia 4, ca. 0.6–0.7 mm long, in 2 pairs, solid, stipe, caudicles and viscidium absent. **Ovary** (with pedicel) pale yellow, glabrous, slender, ca. 1.2 cm long. **Capsule** not seen.

**Vietnam.** – Hon Ba (Khanh Hoa province), Tây Nguyên, Lâm Đồng.

**Distribution.** – Indonesia, Malaysia, Thailand.

**Ecology.** – Close evergreen tropical monsoon (seasonal) mixed lower montane forest, ca. 1521 m asl. Flowering in middle June to July.

**Specimen examined.** – J.J. Wood 939 (K, photo), V. B. TRUONG 098 (PSU).

47. *Dendrobium crumenatum* Sw., *J. Bot.* (Schrader) 1799(2): 237. 1800; Seidenf. *Opera Bot.* 83: 200. 1985; J. B. Comber, *Orchids Java*: 219. 1990; Seidenf., *Opera Bot.* 114: 248. 1992; Seidenf. & J. J. Wood, *Orchids Penins. Malaysia Singapore*: 409. 1992; H. H. Pham, *Ill. Fl. Vietnam* 3: 833. 2000; J. B. Comber, *Orchids Sumatra*: 589. 2001; Z. Guanghuam J. Zhanhe, J. J. Wood & H. P. Wood in Z. Y. Wu et al. (eds), *Fl. China*

25: 395. 2009 – *Onychium crumenatum* (Sw.) Blume, Bijdr. Fl. Ned. Ind.: 326. 1825.  
 – *Callista crumenata* (Sw.) Kuntze, Revis. Gen. Pl. 2: 654 (1891). – *Aporum crumenatum* (Sw.) Brieger Orchideen 1: 671. 1981. (Plate 15 C & D).

Epiphytic or lithophyte sympodial orchid. *Pseudobulbs* obovate, ca. 3–11 cm long covered by sheaths. *Stem* stiff, thicker at part with leaves and slender with leafless part. *Leaves* 2 to 5, glabrous, lanceolate, ca. 4–5 x 1.7–2.3 cm, apex slightly retuse. *Inflorescence* lateral, from the leafless of stem, at internode, 5 to 20 flowered; floral bract elliptic, ca. 0.6 cm long, apex acute. *Flower* white, open widely in same time and wilted very fast, ca. 2.5 cm long. *Dorsal sepal* white, lanceolate, ca. 1.8–1.9 x 0.5 cm, apex acute. *Lateral sepals* ovate, ca. 1.6 x 0.1–0.2 cm, apex acute to subacute, forming narrow mentum, ca. 1 cm long, pale yellow on top of mentum. *Petals* glabrous, oblong, ca. 1.7 cm x 0.5 cm, apex acute. *Labellum* glabrous, ca. 2.6 cm long, 3 lobed; mid lobe obovate, ca. 0.5 cm x 0.8 cm; lateral lobe white, erect, obovate, ca. 1.5 cm x 0.4 cm, apex obtuse; margin of mid lob and lateral lobes slightly erose; disk with 5 yellow denticulate ridges from base of labellum to base of mid lobe, 3 mid ridges higher than 2 lateral ridges. *Column* glabrous, ca. 0.8 cm long, foot ca. 1.1 cm long, stelia triangular on the top of column, column margin dentate; anther cap white, suborbicular, ca. 2.1 mm long; pollinia 4, ca. 1.5–1.8 mm long, in 2 pairs, 2 inner slightly shorter than outer, clavate, solid, slightly curved in middle, stipe, caudicles and viscidium absent; *Ovary* (with pedicel) slender, glabrous, ca. 1–1.5 cm long. *Capsule* not seen.

**Vietnam.** – Hon Ba (Khanh Hoa province), Cà Ná, Phan Rang, Đắc Lắc, Đồng Nai.

**Distribution.** – Cambodia, India (Andaman Islands), Indonesia, Laos, Malaysia, Myanmar, Philippines, Sri Lanka, Taiwan, Thailand. Flowering when climate change suddenly, in March, May or September.

**Ecology.** – Closed evergreen tropical monsoon (seasonal) broad-leaved lowland forest, ca. 200 m asl.

**Specimen examined.** – A.F.G. Kerr 0375 (K, photo), P. Rojchana-umpawan 138 (PSU), V. B. TRUONG 080 (PSU)

48. *Dendrobium dentatum* Seidenf., Nordic J. Bot. 1: 206. 1981; Opera Bot. 114: 247. 1992; H. H. Pham, Ill. Fl. Vietnam 3: 835. 2000. – *Ceraia dentata* (Seidenf.) M.A.Clem., Telopea 10: 291. 2003. (Plate 15 E & F).

Epiphytic sympodial orchid. *Pseudobulbs* fusiform ca. 1–2 cm long, scabrous, grow in dense group. *Stem* glabrous, needle shape, ca. 11.5 cm, erect. *Leaves* glabrous, needle shape, slender ca. 5.1–6 cm long, apex acute. *Inflorescence* glabrous, 1.5 cm, 1 to 3 flowered; peduncle glabrous, ca. 1.2 cm long; floral bract glabrous, linear–lanceolate, ca. 0.2 cm, apex acute. *Flower* white, ca. 0.6–0.7 cm, sepals and petals uniform white, labellum white. *Dorsal sepals* glabrous, ovate, ca. 0.41 x 0.11 cm, apex obtuse. *Lateral sepals* glabrous, ovate to triangular, ca. 0.45–0.5 cm x 0.4–0.5 cm, apex obtuse, attached to column form glabrous mentum ca. 0.35 cm long. *Petals* glabrous, falcate, narrowly lanceolate ca. 0.3 x 0.1 cm, apex obtuse. *Labellum* glabrous, ca. 1–1.5 x 0.25–0.4 cm (when flattened), 3 lobed; mid lobe white, very short, ca. 0.05–0.1 x 0.1 cm, apex slightly acute; lateral lobes white, somewhat ovate, ca. 0.35 x 0.15 cm, rounded, red stripes from the margin to the middle callus; adaxial disk 3 yellow ridges run from middle of labellum to base of mid lobe ca. 0.1 cm long. *Column* glabrous, white, ca. 0.25 cm long, column foot indistinct; anther cap white, glabrous, ovate, ca. 0.5 mm long; pollinia pale yellow 4, ca. 0.1 mm long, into 2 pairs, stipe, caudicles and viscidium absent. *Ovary* (with pedicel) slender ca. 0.3 cm. *Capsule* not seen.

**Vietnam.** – Hon Ba (Khanh Hoa province), Lạng Sơn, Sơn Tây, Hà Nam Ninh, Quảng Bình, Tây Nguyên, Lâm Đồng, Đà Lạt.

**Distribution.** – Endemic to Vietnam.

**Ecology.** – closed evergreen tropical monsoon (seasonal) sub–montane broad–leaved forest. Flowering in March.

**Specimen examined.** – F. Evrard 1390 (K, photo), V. B. TRUONG 079 (PSU).

49. *Dendrobium farinatum* Schildh. & Schraut, J. Orchideenfr. 11: 374. 2004; Aver., Turczaninowia 15(1):11–18. 2012. (Plate 15 G).

Terrestrial sympodial orchid. *Stem* erect usually covered by grey sheaths, ca. 7–10 cm long, greenish – yellow, base stem slender and open broadly ca. 3–6 internode forming pseudobulbs. *Leaves* glabrous, on the top of pseudobulbs, from 2 to 4 leaves, lanceolate, ca. 1.5–4 x 0.6–0.7 cm, apex retuse. *Inflorescence* only 1 inflorescence with 2 flowered; peduncle ca. 0.3 cm long, covered by grey sheath; inflorescence bract 2, ovate, ca. 0.3 cm long; floral bract lanceolate, ca. 0.25 cm long, apex acute. *Flower* uniform orange, slightly undulate, rarely open widely. *Dorsal sepal* glabrous, ovate to somewhat triangular, ca. 0.65–0.7 x 0.4–0.45 cm, apex acute, margin fleshy. *Lateral sepals* glabrous, triangular, ca. 0.65 x 0.55 cm, apex acute, lateral sepals attached to column form mentum ca. 0.5 cm long, slightly curved up. *Petals* glabrous, broadly ovate, ca. 0.45 x 0.3 cm, apex obtuse. *Labellum* ovate (flattened) ca. 0.5 x 0.2 cm, 3 lobed; mid lobe orange, very short ca. 0.05 cm long, apex obtuse; lateral lobes triangular from hypochile and rise high up near the base of mid lobe ca. 0.3 x 0.1 cm, apex obtuse; adaxial of labellum pubescent with white hair; disk with swelling callus. *Column* glabrous, ca. 0.3 cm long, foot column ca. 0.35 cm long, winged on apical part, stelia somewhat triangular; anther cap white, ovate, ca. 2 mm long; pollinia 4, ca. 0.8 mm long, 2 pairs, solid, waxy; stipe, caudicles and viscidium absent. *Ovary* (with pedicel) glabrous, ca. 2.3 cm long, curved. *Capsule* not seen.

**Vietnam.** – Hon Ba (Khanh Hoa province), Lai Chau (?).

**Distribution.** – Endemic to Vietnam.

**Ecology.** – close evergreen tropical monsoon (seasonal) mixed lower montane forest along the road with bryophytes, very rare, ca. 1353 m asl. Flowering in July.

**Specimen examined.** – V. B. TRUONG 073 (PSU).

Note: The species was first described as a new species for Vietnam but the location of species was not clear. Until 2012, it was found in Hon Ba falling on the ground, and later this species was rediscovered again with terrestrial habit. This species may be an epiphytic orchid.



50. *Dendrobium hamatum* Rolfe, Bull. Misc. Inform. Kew 1894: 224. 1894; Seidenf., Opera Bot. 114: 224. 1992; H. H. Pham, Ill. Fl. Vietnam 3: 831. 2000; – *Eurycaulis hamatus* (Rolfe) M.A.Clem., Telopea 10: 286. 2003. (Plate 16 A).

Epiphytic sympodial orchid. **Stem** very long, up to 1 m long, internode ca. 1–3 cm long, leafless when flowering. **Inflorescence** lateral or terminal, 1 to 5, glabrous, ca. 4–5 cm long, from leafless part; peduncle short cover by 2 brown sheaths, ca. 0.45–0.5 cm long, apex acute; rachis ca. 2–2.2 cm long, dark brown; floral bract pale brown ca. 0.4–0.6 cm long, apex acute. **Flower** open widely, pink to pale pink sepals and petals, labellum white wavy margin. **Dorsal sepal** glabrous, ovate, ca. 2.5–2.75 x 1.2–1.25 cm, apex obtuse, 5 dark pink veins. **Lateral sepals** glabrous, ovate, ca. 4 x 1.15 cm, pale pink inside, outside pink to dark pink, apex acute, 5–6 pink veins, lateral sepals attached with column form glabrous, mentum, narrow conic, point backward, ca. 2–2.2 cm long. **Petals** oblong, ca. 2.5–2.25 x 1.7 cm, apex obtuse, inside pinkish, 5 veins. **Labellum** glabrous, ovate to obovate, ca. 4x 1.8–1.9cm, margin wavy, apex slightly retuse, abaxial one dark mid vein; long claw at base ca. 1.1–1.2 cm long, yellow margin. **Column** glabrous, 2.5 cm long, white inside, base yellow, outside pink–pinkish, narrowly from middle to base; anther cap white, ca. 3.5–4 mm long, broadly ovate, margin finely ciliate; pollinia 4, in 2 pairs, oblanceolate, ca. 1.1 mm long, pale yellow, size equally, slightly concave; stipe, caudicles and viscidium absent. **Ovary** (with pedicel) pale pink, slender, ca. 2–2.5 cm long, curved, ovary 6 ridges. **Capsule** not seen.

**Vietnam.** – Hon Ba (Khanh Hoa province), Son La, Lai Châu, Lâm Đồng.

**Distribution.** – Endemic to Vietnam.

**Ecology.** – Closed evergreen tropical monsoon (seasonal) mixed lower montane forest. Flowering in Early September to early October.

**Specimen examined.** – V. B. TRUONG 076 (PSU).

51. *Dendrobium khamhoense* Aver., Lindleyana 14: 216. 1999. (Plate 16 B).

Epiphytic sympodial orchid. *Stem* erect, close together, ca. 30–32 cm long, internode ca. 1–15 cm long. *Leaves* glabrous, lanceolate, ca. 4–6 x 0.5–0.7 cm, apex obtuse, not equally 2 lobes. *Inflorescence* lateral along the stem, 1 to 4, inflorescence arise from internode opposite leaves, single flowered; inflorescence bract 1, pale brown, ca. 0.2–0.2 cm long, apex acute; floral bract green, glabrous, ovate, 0.2 cm long, apex acute. *Flower* open broadly, sepal and petal white with irregular orange web veins almost in middle, bend backside, labellum straight toward, column parallel with labellum. *Dorsal sepal* glabrous, ovate, ca. 1 x 0.65 cm, apex slightly retuse or acute. *Lateral sepals* glabrous, ovate, ca. 1.5 x 0.65 cm, apex acute, lateral sepals attached with the column, forming white mentum, cylindric, ca. 0.7 cm long, apex obtuse, slightly curved. *Petals* glabrous, lanceolate, ca. 0.8–0.85 x 0.3 cm, apex obtuse. *Labellum* pandurate, ca. 1.3 cm long, base one long claw ca. 0.3–0.4 cm long, 3 lobed; mid lobe yellow, fleshy, ca. 0.7 x 0.25 cm, apex bilobed, lobules circular; lateral lobes erect, apex obtuse orange web veins, lateral lobes nearly embrace the column; 3 white ridges from the base of mid lobe to the middle of labellum; 2 lateral ridges from base of labellum, to the middle with very dark purple channeled between 2 ridges. *Column* glabrous, white ca. 1.1–1.15 cm long, open broadly near tip, middle of column with dark purple dots; anther cap very dark purple with 2 dots finely ciliate, ca. 2 mm long; pollinia 4, ca. 1.5 mm long, in 2 pairs, narrowly obovate, pale yellow, stipe, caudicles and viscidium absent. *Ovary* (with pedicel) pale yellow, glabrous, slender, 1.7–1.8 cm long. *Capsule* not seen.

**Vietnam.** – The original publication of this species was found in Khanh Son (West of Hon Ba) Khanh Hoa province, near Hon Giao Range on the border of Lam Dong and Khanh Hoa provinces.

**Distribution.** – Endemic to Vietnam.

**Ecology.** – Closed evergreen tropical monsoon (seasonal) mixed lower montane forest, ca. 1350 m asl. Flowering in July to September.

**Specimen examined.** – V. B. TRUONG 074 (PSU).

Note: *Dendrobium kanhhoaense* is very similar to *D. nemorale* from the Philippines, however *D. kanhhoaense* differs in having a straight forward labellum.

**52.** *Dendrobium pachyphyllum* (Kuntze) Bakh.f., Blumea 12: 69. 1963; Seidenf., Opera Bot. 83: 10. 1985; Opera Bot. 114: 207. 1992; Seidenf. & J. J. Wood, Orchids Penins. Malaysia Singapore: 363. 1992; H. H. Pham, Ill. Fl. Vietnam 3: 814. 2000; J. B. Comber, Orchids Sumatra: 582. 2001. – *Callista pachyphylla* Kuntze, Revis. Gen. Pl. 2: 654. 1891. (Plate 16 C & D).

Epiphytic sympodial orchid. **Rhizome** creeping, dense close together. **Pseudobulbs** lanceolate ca. 2.7–2.8 x 0.5 cm, base slender. **Leaves** 2, glabrous, from the apex of pseudobulbs, lanceolate, ca. 1.7–3 x 0.3–0.6 cm, apex acute or slightly unequal 2 lobes. **Inflorescence** glabrous, terminal, only one flowered was collected; peduncle short ca. 0.5 cm long, base covered by brown sheaths; floral bract ca. 0.3 cm long, brown. **Flower** not open widely, sepal white with many irregular stripes, petals white, labellum white. **Dorsal sepal** glabrous, lanceolate, ca. 0.5 x 0.2 cm, apex obtuse or slightly acute, abaxial 5 red stripes. **Lateral sepals** glabrous, triangular, ca. 0.8 x 0.45 cm, apex obtuse, attached to column, forming glabrous, mentum, narrow triangular, ca. 1 cm long, apex rounded, white, red stripes. **Petals** white, glabrous, narrowly lanceolate, ca. 0.4 x 0.15 cm, apex obtuse, one red stripe in the middle. **Labellum** glabrous, simple, ca. 1 cm long, epichile rounded, slightly undulate margin; callus yellow on the middle of epichile; base long narrow claw ca. 0.5 cm long. **Column** white, ca. 0.4 cm long, foot ca. 0.35 cm long; anther cap pale yellow, suborbicular, ca. 1.1 mm long; pollinia 4, ca. 0.6 mm long, in 2 pairs, solid, waxy, yellow, stipe, caudicles and viscidium absent. **Ovary** (with pedicel) glabrous, pale green, slender ca. 0.4 cm long. **Capsule** not seen.

**Vietnam.** – Hon Ba (Khanh Hoa province), Lâm Đồng, Đà Lạt.

**Distribution.** – Bhutan, Cambodia, India, Laos, Myanmar, Thailand.

**Ecology.** – closed evergreen tropical monsoon (seasonal) broad-leaved lowland forest, ca. 320m asl. Flowering in March.

**Specimen examined.** – E. de Vogel & P. Cribb, 9228 (K, photo); O. Beccari, 442 (K, photo), V. B. TRUONG 078 (PSU).

**53.** *Dendrobium pseudotenellum* Guillaumin, Bull. Mus. Natl. Hist. Nat., sér. 2, 36: 697. 1965; Seidenf., Opera Bot. 114: 244. 1992; H. H. Pham, Ill. Fl. Vietnam 3: 834. 2000; – *Ceraia pseudotenella* (Guillaumin) M.A.Clem., Telopea 10: 293. 2003. (Plate 16 E & F).

Sympodial epiphytic orchid. *Pseudobulbs* ovoid, ca. 1–1.5 cm long, 2 internode. *Stem* glabrous, erect, slender, needle shape, pale yellow–green, unbranched, many nodes on stem, internode ca. 1–2.5 cm long. *Leaves* glabrous, suberect, slender, needle shape, ca. 4–8 cm long, apex acute, sheathing at base. *Inflorescence* glabrous, lateral or sometimes terminal, 3 to 4; peduncle ca. 0.4 cm long, covered by overlapping sheaths; floral bract glabrous, ovate ca. 0.2–0.25 cm long, apex acute. *Flower* single, white, falcate, sepals, petals and labellum white. *Dorsal sepals* glabrous, ovate ca. 0.7–0.8 x 0.3–0.4 cm, apex slightly acute. *Lateral sepals* glabrous, triangular, ca. 0.7–0.8 x 0.6 cm, apex obtuse, outcurved at apical part, forming glabrous mentum ca. 0.5 cm long, pointing forward, nearly 90° with ovary, apex obtuse, narrowly conic. *Petals* glabrous, oblong, ca. 0.5–0.6 x 0.2 cm. *Labellum* glabrous, ca. 1 cm long, 3-lobed; mid lobe ca. 0.2–0.25 cm long, margin fimbriate, outcurved; lateral lobes erect, ca. 0.5 x 0.3 cm, rounded, margin entire, 3–4 purple stripes; adaxial disk 3 rounded ridges from middle of labellum up to base of mid lobe. *Column* white, glabrous, ca. 0.2 cm long, with foot ca. 0.5 cm long; anther cap broadly ovate, ca. 1 mm long, glabrous; pollinia 4, ca. 0.5 mm long, in 2 pairs, 2 laterals longer than 2 in middle, solid, yellow, stipe, caudicles and viscidium absent. *Ovary* (with pedicel) glabrous, slender, white–pale red, ca. 0.55–0.6 cm long. *Capsule* not seen.

**Vietnam.** – Hon Ba (Khanh Hoa province), Nha Trang, Cam Ranh, Lâm Đồng, Tây Nguyên.

**Distribution.** – China.

**Ecology.** – Closed evergreen tropical monsoon (seasonal) mixed lower montane forest, ca. 1510 m asl. Flowering in October.

**Specimen examined.** – V. B. TRUONG 083 (PSU).

Note: The differences between *D. pseudotenellum* and *D. dentatum* are: Pseudobulbs: *D. pseudotenellum* ovoid, rounded, *D. dentatum* fusiform. Flower: *D. pseudotenellum* flower much bigger, mid lobe wider and ridges on adaxial 3, while *D. dentatum* flower smaller, narrower, mid lobe smaller and ridges on mid lobe yellow.

54. *Dendrobium spatella* Rchb.f., Hamburger Garten- Blumenzeitung 21: 298. 1865; Seidenf., Opera Bot. 83: 209. 1985; N. Pearce & P. J. Cribb, Fl. Bhutan 3(3): 422. 2002; Z. Guanghuam J. Zhanhe, J. J. Wood & H. P. Wood in Z. Y. Wu et al. (eds), Fl. China 25: 396. 2009. – *Callista spatella* (Rchb.f.) Kuntze, Revis. Gen. Pl. 2: 655. 1891. – *Aporum spatella* (Rchb.f.) M.A.Clem., Telopea 10: 297. 2003. (Plate 16 G & H).

Sympodial epiphytic orchid. **Stem** erect, up to ca. 35 cm long, slender and covered by sheaths at base, unbranched, internode ca. 0.8–1.2 cm long. **Leaves** distichous, hard, lanceolate, ca. 2–4 x 0.5–0.7 cm, apex acute, alternate, fleshy; petiole sheath embrace stem. **Inflorescence** lateral, the apical part of stem leafless; floral bract small glabrous, triangular, ca. 5 mm long. Flower white, small ca. 1 cm long. **Dorsal sepals** ovate, glabrous, ca. 0.3 x 0.15 cm, apex obtuse. **Lateral sepals** glabrous, triangular, ca. 0.7 x 0.3 cm, apex acute, strongly outcurved, attached with column, forming pale red leafless mentum ca. 0.3–0.4 cm long, apex obtuse. **Petals** glabrous, oblong, ca. 0.4 x 0.2 cm, margin lobed, strongly revolute looks like needle shape. **Labellum** simple, obovate, glabrous, ca. 1 x 0.6 cm, outcurved, margin strongly; adaxial 3 pale yellow – red ridges in the middle, reddish dots in apical part. **Column** white, glabrous, ca. 0.25 cm long, foot ca. 0.2 cm long; anther cap white, glabrous, elliptic ca. 1 mm long; pollinia 4, in 2 groups of 2, solid, ca. 0.6 mm long, yellow, stipe, caudicles and viscidium absent. **Ovary** (with pedicel) pale green ca. 0.5 cm long. **Capsule** elliptic, green, slightly purple, ca. 0.5 cm long, smoothly, not ridge.

**Vietnam.** – Hon Ba (Khanh Hoa province), Lạc Sơn, Hoà Bình, Hương Sơn, Hà Tĩnh.

**Distribution.** – Bhutan, Cambodia, China, India, Laos, Myanmar, Thailand.

**Ecology.** – Closed evergreen tropical monsoon (seasonal) mixed lower montane forest, epiphyte on tree branches, open areas, ca. 944 m asl. Flowering in June.

**Specimen examined.** – Y. Dorji, N. Pearce & P. Cribb 41 (K, photo), V. B. TRUONG 072 (PSU).

55. *Eria globulifera* Seidenf., Opera Bot. 62: 125. 1982; Opera Bot. 114: 191. 1992; H. H. Pham, Ill. Fl. Vietnam 3: 811. 2002. (Plate 17 A & B).

Epiphytic sympodial orchid. *Pseudobulbs* grown close together, oblong, ca. 5–7 x 1.5–2 cm, narrowly, slender and falcate at base but open broadly from middle to tip. *Leaves* 3 to 4, lanceolate ca. 9–14 x 1.7–2.3 cm, apex acute. *Inflorescence* terminal, raceme, ca. 3.3 cm long, pubescent with, brown hair; peduncle white ca. 1.5 cm long, pubescent with brown hair; inflorescence bracts 4, ovate, ca. 0.7–0.8 x 0.5–0.7 cm, apex acute, apex acute; floral bract white, glabrous, broadly ovate ca. 0.55–0.6 x 0.4 cm. *Flower* open widely, uniform white, labellum apex yellow. *Dorsal sepal* white, glabrous, ovate ca. 0.55–0.6 x 0.35–0.4 cm, apex obtuse. *Lateral sepals* broadly ovate to falcate, ca. 0.55–0.6 x 0.5 cm, apex obtuse or subacute. *Petals* elliptic, ca. 0.55–0.6 x 0.2–0.25 cm, apex obtuse. *Labellum* outcurved, ca. 0.45 x 0.35 cm (cross the lateral lobes, flattened), fleshy at apical lobes, 3 lobed; mid lobe yellow orbicular, ca. 0.15 x 0.15 cm, apex obtuse or subacute; lateral lobes white, continue with the base of mid lobe, somewhat triangular, not erect or slightly erect, ca. 0.15 x 0.2 cm; at the base claw ca. 0.2 cm long, pale yellow, adnate to column foot. *Column* ca. 0.2 cm long, foot column ca. 0.1–0.15 cm long, winged in the middle; anther cap white ca. 1.5 mm long; pollinia 8, ca. 0.7 mm long, in 2 groups of 4, oblanceolate, apex obtuse, slightly compressed in laterally attached to caudicles, stipe absent. *Ovary* (with pedicel) slender, white, ca. 0.4 cm long, pubescent with, brown hair. *Capsule* not seen.

**Vietnam.** – Hon Ba (Khanh Hoa province).

**Distribution.** – Himalayas, Laos, Thailand.

**Ecology.** closed evergreen tropical monsoon (seasonal) mixed lower montane forest. – ca. 1321 m asl. Flowering time early in October.

**Specimen examined.** – V. B. TRUONG 091 (PSU).

56. *Eria lactiflora* Aver., Lindleyana 14: 219. 1999. (Plate 17 C & D).

Sympodial epiphytic orchid. **Rhizome** short ca. 1–1.5 cm long, with numerous root with finely ciliate. **Stems** green, sometimes brown–red, hard, erect ca. 15 cm long, 7–10 internode. **Leaves** 1 to 2, narrow elliptic, ca. 5–7 x 0.5–1.3 cm, apex acute. **Inflorescence** terminal, holding 1–2 flowered; peduncle, ca. 2 cm long; inflorescence bract 3, 2 lower in paired apex obtuse, ca. 1–1.5–2 x 0.7 cm, one upper ca. 1.5–1.2 cm, apex acuminate; floral bract cymbiform, ovate, ca. 2 x 0.8 cm. **Flower** open weakly, pure white. **Dorsal sepal** ovate, curved forward, ca. 1–1.3 x 0.4–0.7 cm, apex subacute. **Lateral sepals** ovate, ca. 1.2–1.3 x 0.4–0.5 cm, apex acute, forming mentum ca. 0.8 cm long, curved toward, 90° with ovary. **Petals** falcate, ca. 1.3–1.5 x 0.5–0.6 cm, apex subacute. **Labellum** obovate, ca. 1 x 0.8 cm (flattened), outcurved, slightly 3 lobed; mid lobe acute ca. 0.2 cm long; sidelobe erect, rounded, ca. 0.5 x 0.4 cm; disk with 3 finely pale yellow ciliate stripes, 2 lateral stripes run from base of labellum up to mid lobe and mid strip up to tip of mid lobe. **Column** white, ca. 0.4–0.5 cm long, orange at the base of the column; anther cap and pollinia not seen. **Ovary** (with pedicel) slender, glabrous pale green ca. 1.5 cm long. **Capsule** not seen.

**Vietnam.** – Hon Ba (Khanh Hoa province), Lam Dong.

**Distribution.** – Endemic to Vietnam.

**Ecology.** – Closed evergreen tropical monsoon (seasonal) mixed lower montane forest, quite common species the top of mountain, above 1300 m asl. Flowering in March to April.

**Specimen examined.** – V. B. TRUONG 084 (PSU).

57. *Eria obscura* Aver., Bot. Zhurn. SSSR 73(1): 101. 1988; Seidenf., Opera Bot. 114: 188. 1992; H. H. Pham, Ill. Fl. Vietnam 3: 810. 2002. (Plate 17 E & F).

Epiphytic sympodial orchid. *Stem* erect, stout, fleshy up ca. 10–15 x 0.6 cm, green covered by overlapped brown sheaths. *Leaves* 2 to 4, lanceolate, ca. 5–12 x 1.2–1.5 cm, apex obtuse, unequally 2 lobes. *Inflorescence* 2 to 3, terminal or axillary, raceme, pale green, pubescent with brown hair, ca. 15–20 cm long, up to 20 flowered; inflorescence bract 1 to 2, brown, narrowly lanceolate, ca. 0.5–1.1 cm long, apex acute; floral bract brown, lanceolate, ca. 0.2–0.4 x 0.15 cm, apex acute. *Flower* not open widely from base to tip, sepals white, pubescent with brown hair, petal white glabrous, labellum glabrous pale yellow. *Dorsal sepals* pale white, ca. 0.3 cm x 0.1 cm, pubescent with brown hair, red mid line from the tip to the middle. *Lateral sepals* ovate somewhat triangular, ca. 0.3–0.4 x 0.2 cm, slightly red line from the tip to the middle, abaxial pubescent with brown hair, forming very short mentum ca. 0.1 cm long, rounded. *Petals*, linear to lanceolate, ca. 0.3 x 0.05 cm, apex obtuse, mid red vein. *Labellum* not clearly 3 lobed, ca. 0.3–0.4 x 0.2 cm, apex slightly acute; adaxial one red line run from base up to tip; apical part strongly outcurved ca. 0.05 cm long; margin slightly erose. *Column* pale brown, ca. 0.5 cm long, column foot ca. 0.4 cm long; anther cap purple and white, ca. 1 mm long, ovate, obtuse; pollinia 8, narrowly elliptic, white, ca. 0.6 mm long, stipe absent. *Ovary* (with pedicel) white, ca. 0.4 cm long, pubescent with, pale brown hair. *Capsule* not seen.

**Vietnam.** – Hon Ba (Khanh Hoa province), Gia Lai, Kontum, Lam Dong.

**Distribution.** – Endemic to Vietnam.

**Ecology.** – Closed evergreen tropical monsoon (seasonal) broad-leaved lowland forest, ca. 246 m asl. Flowering in May.

**Specimen examined.** – V. B. TRUONG 089 (PSU).

58. *Eria tomentosa* (J.König) Hook.f., Fl., Brit. India 5(16): 803. 1890; Seidenf., Opera Bot. 114: 175. 1992; H.H.Pharm, Ill. Fl. Vietnam 3: 806. 2000. – *Epidendrum tomentosum* J.Koenig in A.J.Retzius, Observ. Bot. 6: 53. 1791. – *Pinalia tomentosa*



(J.Koenig) Kuntze, Revis. Gen. Pl. 2: 679. 1891. – *Dendrolirium tomentosum*  
(J.Koenig) S.C.Chen & J.J.Wood, Fl. China 25: 350. 2009. (Plate 17 G & H).

Epiphytic sympodial orchid, terrestrial in occasion. *Pseudobulbs* rhombic or elliptic, ca. 5.5–7 x 2.6–3 cm, pseudobulbs in group connected by rhizome. *Rhizome* stout, hard, ca. 0.5 cm in diam, covered by brown sheaths. *Leaves* 2, elliptic, ca. 25–26 x 4.7–6.5 cm, apex acute; petiole short ca. 1–2.5 cm long. *Inflorescence* lateral, raceme, from base pseudobulbs, ca. 25–26 cm long, tomentose white hair from the base to the tip, ca. 3–21 flowered; peduncle ca. 10.5 cm long, overlapping sheathing at base, ca. 3.3–3.4 x 2.1–2.2 cm (flattened; floral bracts lanceolate, ca. 1.5–1.8 x 0.5–0.7 cm (flattened)). *Flower* ca. 2 cm across when open, sepals covered by dense white tomentose, labellum strongly outcurved. *Dorsal sepal* ovate to triangular, ca. 1.9 x 0.3 cm, apex acute, 6 stripes in the middle, covered by dense pubescent white hair. *Lateral sepals* ovate to triangular, ca. 0.9–1 x 0.3–0.4 cm, covered by dense white tomentose, 5–7 dark brown stripes for each lateral sepals, form mentum ca.0.3cm long, apex obtuse. *Petals* linear and thin ca. 0.6 x 0.15 cm, dark brown line in the middle. *Labellum* oblong in outline shape, ca. 1–1.1 x 0.5 cm (flattened), 3 lobed; mid-lobe ovate, ca. 0.3 x 0.1 cm; lateral-lobe erect ca. 0.3 x 0.15 cm, apex obtuse; adaxial disk 2 lateral flat ridges run to middle of labellum then rise higher, make this part swelling, and continue nearly the tip of labellum. *Column* white, ca. 1 cm long, foot column ca. 0.3 cm long, broadly apical and narrowly at base; anther cap white, suborbicular, glabrous, ca. 1 mm long; pollinia 8, separate into 2 groups of 4, yellow, solid, narrowly obovate, ca. 0.4 mm long size equally, caudicles yellow, slender, ca. 0.1 mm. *Ovary* (with pedicel) 1.1–1.2 cm long, tomentose, white hair. *Capsule* (young) ca. 4 cm long, lanceolate, tomentose, 6 ridges.

**Vietnam.** – Hon Ba (Khanh Hoa province), Gia Lai, Kontum, Lam Dong.

**Distribution.** – China, Laos, Myanmar, Thailand.

**Ecology.** – Closed evergreen tropical monsoon (seasonal) broad-leaved lowland forest up to closed evergreen tropical monsoon (seasonal) submontane broad-leaved forest, along the stream or along the road. Ca. 700 m asl. Flowering in March.

**Specimen examined.** – Rottler s.n. (K, photo), V. B. TRUONG 085 (PSU).

59. *Erythrorchis altissima* Blume, Rumphia 1: 200, pl. 70. 1835 [1837]; J. B. Comber, Orchids Java: 73. 1990; Seidenf. & J. J. Wood, Orchids Penins. Malaysia Singapore: 132. 1992; J. B. Comber, Orchids Sumatra: 127. 2001; X. Chen, S. W. Gale & P. J. Cribb in Z. Y. Wu et al. (eds), Fl. China 25: 171. 2009. – *Cyrtosia altissima* Blume, Bijdr. Fl. Ned. Ind.: 396. 1825. – *Haematorchis altissima* (Blume) Blume, Rumphia 4: t. 200 B. 1849. – *Galeola altissima* (Blume) Rchb.f., Xenia Orchid. 2: 77. 1865. (Plate 18 A & B).

Terrestrial, mycoheterotrophic monopodial orchid. **Stem** reddish-brown, glabrous, vertical climbing up to ca. 2 m high or horizontal creeping in occasionally, slender, cylindric, branched, internodes ca. 9 cm long. **Leaf** scale like, ovate, apex acute or short acuminate. **Inflorescences** terminal or lateral, branched, glabrous, ca. 15–20 cm long; peduncle glabrous, ca. 4 cm long; inflorescence bract ovate, ca. 1–1.5 cm long, apex obtuse-acute, dark brown; rachis glabrous yellowish-brown, ca. 12–15 cm long; pedicel (with ovary), ca. 1–1.5 cm long, brownish-yellow; floral bract triangular ca. 0.25–0.3 cm long, apex acute. **Flower** open widely from base to tip, resupinate, sepals and petals uniform yellowish-brown. **Dorsal sepal** glabrous, oblong, ca. 1.5–1.6 x 0.4 cm, apex obtuse or subacute, 5 veins. **Lateral sepals** glabrous, oblong, ca. 1.4–1.5 x 0.6–0.65 cm, apex obtuse, 5 veins. **Petals** glabrous, oblong, ca. 1.5–1.55 x 0.25–0.3 cm, apex obtuse, abaxial 1 prominent mid ridge. **Labellum** somewhat quadrate (flattened), ca. 1.3 x 1.2 cm; 3 lobed; mid lobe ca. 0.4 x 0.25 cm, margin lobed, one sub-circle callus on the base of mid lobe; lateral lobes ca. 0.95 x 0.35 cm, brownish; adaxial middle with 2 pubescent with rounded ridges convergent at base then run up to middle of labellum and divergent, above one round pubescent with callus at base of mid lobe, brownish-red finely papillose vertical stripes on 2 lateral side of 2 ridges. **Column** pale brown, glabrous, ca. 0.55 cm long, lack of column foot, curved toward in the middle; anther cap, ovate, ca. 2 mm long, apex obtuse; pollinia 2, ca. 1 mm long, solid, yellow, caudicles, stipe, viscidium absent. **Capsule** not seen.

**Vietnam.** – Hon Ba (Khanh Hoa province).

**Distribution.** – Cambodia, India, Indonesia, Japan, Laos, Malaysia, Myanmar, Philippines, Thailand.

**Ecology.** – Closed evergreen tropical monsoon (seasonal) mixed lower montane forest, ca. 900 m asl. Flowering in September to October.

**Specimen examined.** – W. Smits & A. Lamb AL 1464/92 (K, photo), V. B. TRUONG 097 (PSU).

60. *Gastrochilus calceolaris* (Buch.–Ham. ex Sm.) D. Don, Prodr. Fl. Nepal.: 32. 1825; Seidenf., Opera Bot. 114: 439. 1992; Seidenf. & J. J. Wood, Orchids Penins. Malaysia Singapore: 689. 1992; H. H. Pham, Ill. Fl. Vietnam 3: 926. 2000; N. Pearce & P.J. Cribb, Fl. Bhutan 3 (3): 520. 2002; X. Chen, J. Zhane & J. J. Wood in Z. Y. Wu et al. (eds), Fl. China 25: 493. 2009. – *Aerides calceolaris* Buch.–Ham. ex Sm. in A.Rees, Cycl. 39(1): n° 11. 1818. – *Epidendrum calceolare* (Buch.–Ham. ex Sm.) D.Don, Prodr. Fl. Nepal.: 32. 1825. – *Saccolabium calceolare* (Buch.–Ham. ex Sm.) Lindl., Gen. Sp. Orchid. Pl.: 223. 1833. (Plate 18 C & D).

Epiphytic monopodium orchid. **Stem** usually curved, ca. 15 cm long, ca. 0.5 cm in diam. **Leaves** distichous, falcate, linear to lanceolate or narrowly oblong, ca. 9–18 x 1–1.5cm, apex obtuse, unequally 2 lobes. **Inflorescence** lateral along the stem, 2 or 3, raceme, glabrous, ca. 2 cm long, 1 to 5 flowered; inflorescence bract, ovate, ca. 0.15–0.3 cm long, apex acute; floral bract glabrous, ovate, ca. 0.2 cm long, apex acute. **Flower** open widely uniform flower yellow with maroon blotches. **Dorsal sepal** glabrous, oblong, ca. 0.7–0.8 x 0.3 cm, apex acute or obtuse. **Lateral sepals** glabrous, oblong, ca. 0.7–0.8 x 0.3 cm, apex obtuse curved toward. **Petals** glabrous, oblong, ca. 0.6–0.7 x 0.3 cm, apex obtuse. **Labellum** yellow with maroon dots, epichile yellow, triangular, ca. 0.15–0.2 x 0.2 cm, apex obtuse, spreading toward, margin long white hair adnate below hypochile margin by small cushion somehow heart-shaped; hypochile saccate shape, margin fleshy, maroon blotches, margin cavity near epichile. **Column** yellow short ca. 0.25–0.3 cm long, margin with small papillose; anther cap white, glabrous, ca. 2 cm long, beaked; pollinia 2, solid ca. 0.9 mm long, suborbicular, stipe slender attached to bilobed elongate viscidium, caudicles absent. **Ovary** (with

pedicel) slender, glabrous, slightly flat, ca. 1.2–1.3 cm long. **Capsule** end of June, ca. 2 cm long, 6 ridges.

**Vietnam.** – Hon Ba (Khanh Hoa province), Hà Giang, Thái Nguyên, Tam Đảo, Ninh Bình, Quảng Trị, Kontum, Lâm Đồng.

**Distribution.** – Bhutan, China, India, Malaysia, Myanmar, Nepal, Thailand.

**Ecology.** – Closed evergreen tropical monsoon (seasonal) mixed lower montane forest, along the stream or dry areas, ca. 1486 m asl. Flowering in June.

**Specimen examined.** – P.T. OngFRI 57336 (K, photo), G. P. Lewis, 187 (K, photo), V. B. TRUONG 099 (PSU).

**61.** *Geodorum densiflorum* (Lam.) Schltr., Repert. Spec. Nov. Regni Veg. Beih. 4:259. 1919; Seidenf., Opera Bot. 114: 333. 1992; Seidenf. & J. J. Wood, Orchids Penins. Malaysia Singapore: 543. 1992; H.H.Pharm, Ill. Fl. Vietnam 3: 911. 2000; J. B. Comber, Orchids Sumatra: 217. 2001; N. Pearce & P.J. Cribb, Fl. Bhutan 3(3):255. 2002; X. Chen, P. J. Cribb & S. W. Gale in Z. Wu et al. (eds), Fl. China 25:259. 2009; Watthana & H. A. Pedersen et al. in Santisuk & Balslev (eds), Fl. Thailand 12(2): 533. 2014. – *Limodorum densiflorum* Lam., Encycl. 3: 516. 1792. (Plate 18 E & F).

Terrestrial sympodial orchid. **Corms** rounded to ovoid, ca. 3–4.5 cm long, 3 cm in diam. **Leaves** 3 to 4, elliptic to oblong, pleated, 10–26 cm x 5–7 cm, apex acute; petiole form pseudobulb stem. **Inflorescence** lateral, from base of new pseudobulbs or from old pseudobulbs, erect, glabrous, ca. 30–39 cm long, grow with; peduncle ca. 25 cm long covered by 3–4 inflorescence bract; inflorescence bracts ovate, ca. 3–8 cm x 1.5 cm (flattened), apex acute; rachis pendulous, ca. 4–5 cm long, 20–24 flowered; floral bract narrowly lanceolate, ca. 1.1–1.3 cm long, apex acute. **Flower** white, pink to maroon. **Dorsal sepal** pinkish–white, glabrous, oblong, 1.1 cm x 0.3 cm, apex acute white, one prominent vein in the middle. **Lateral sepals** white–pinkish, glabrous, oblong, ca. 1.15 x 0.35 cm, apex acuminate. **Petals** pinkish–white, glabrous, lanceolate, ca. 1.15–1.2 x 0.4–0.5 cm, apex obtuse. **Labellum** glabrous, simple, apex retuse, ca. 1.25 x 1.9 cm (flattened), slightly narrow below apex, margin incurved, wavy; adaxial

disk with 2 pinkish–white callus from the middle to near the apex, ca. 0.4 cm long; irregular pink–maroon stripes in lateral of callus. **Column** glabrous, ca. 0.5 cm long, column foot ca. 3 mm long; anther cap ca. 2 mm long; pollinia 2, ca. 0.5 mm long, short cleft, ovate, solid; slender stipe attached to viscidium, caudicles absent. **Ovary** (with pedicel) slender, ca. 1–1.2 cm long. **Capsule** ca. 3–4 cm long, oblong, 6 ridges.

**Vietnam.** – Hon Ba (Khanh Hoa province), Son La, Lai Châu, Lào Cai, Quảng Trị, Đà Nẵng, Phước Thành.

**Distribution.** – Bangladesh, Bhutan, Cambodia, China, India, Myanmar, Thailand, Vietnam to Malesian region.

**Ecology.** – Closed evergreen tropical monsoon (seasonal) submontane broad-leaved forest to evergreen tropical monsoon (seasonal) mixed lower montane forest, only recorded along the main road, open areas, along with grass and *Psilotum nudum* (L.) P. Beauv., ca 1300 – 1500 m asl. Flowering in July to middle of July.

**Specimen examined.** – H. Cuming 2107 (K, photo), A. Henry 1375 (K, photo), V. B. TRUONG 100 (PSU).

62. *Goodyera foliosa* (Lindl.) Benth. ex C.B. Clarke, J. Linn. Soc., Bot. 25: 73. 1889; Seidenf., Opera Bot. 114: 333. 1992; H. H. Pham, Ill. Fl. Vietnam 3: 781. 2000; N. Pearce & P.J. Cribb, Fl. Bhutan 3(3):255. 2002; X. Chen, K. Lang, S. W. Gale, P. J. Cribb & P. Ormerod in Z. Wu et al. (eds), Fl. China 25: 259. 2009. – *Georchis foliosa* Lindl., Gen. Sp. Orchid. Pl.: 496. 1840. – *Orchiodes foliosum* (Lindl.) Kuntze, Revis. Gen. Pl. 2: 675. 1891. – *Epipactis foliosa* (Lindl.) A.A.Eaton, Proc. Biol. Soc. Wash. 21: 64. 1908. (Plate 18 G & H).

Terrestrial monopodial orchid. **Rhizome** brown, fleshy, curved in hooked–like, 4 nodes ca. 2.5–4 cm long. **Stem** erect, fleshy, ca. 9 cm long. **Leaves** 3 to 5, green, oblong ca. 4–4.5 x 1.8–2.3 cm, apex acute; petiole sheathing at base ca. 2–2.5 cm long. **Inflorescence** terminal, raceme, ca. 6.8–7 cm long, pubescent with white hair; peduncle ca. 2.7 cm long; sterile bracts 2, ovate, ca. 1.4–1.55 cm long, apex acuminate; rachis ca. 5 cm long, up to 11 flowered; floral bract ovate, ca. 1–1.3 x 0.15–0.2 cm (flattened),

apex acuminate, abaxial pubescent with white hair. **Flower** open weakly, reddish–white, abaxial white pubescent with, petals white glabrous, labellum white–yellow. **Dorsal sepals** ovate, ca. 0.7–0.8 x 0.25–0.3 cm (flattened), apex acute, abaxial pubescent with white hair. **Lateral sepals** narrowly ovate, ca. 0.8–0.85 x 0.3–0.35 cm, apex subacute to obtuse, abaxial pubescent with white hair. **Petals** rhombic, ca. 0.6–0.7 x 0.25–0.3 cm, forming with dorsal sepal a hood. **Labellum** simple, ca. 0.5–0.6 x 0.3 cm; epichile lanceolate, ca. 0.2 cm long, apex white acute, outcurved; hypochile saccate, adaxial white papillose. **Column** glabrous, ca. 0.3–0.4 cm long, rostellum bifid, ca. 0.25 cm long; anther cap ca. 1.5 mm long; pollinia 2, ca. 1 mm long, subglobose sectile, attached to small viscidium, stipe absent, caudicles present. **Ovary** (with pedicel) fusiform, ca. 0.5–0.6 cm long, white pubescent with. **Capsule** not seen.

**Vietnam.** – Hon Ba (Khanh Hoa province), all over Vietnam.

**Distribution.** – Bhutan, China, India, Japan, Nepal, Taiwan.

**Ecology.** – Closed evergreen tropical monsoon (seasonal) mixed lower montane forest, ca. 1384 m asl. Flowering in September.

**Specimen examined.** – Griffith s.n. (K, photo), V. B. TRUONG 101 (PSU).

63. *Habenaria rhodocheila* Hance, Ann. Sci. Nat., Bot., sér. 5, 5: 243. 1866; Seidenf., Opera Bot. 114: 333. 1992; Seidenf. & J. J. Wood, Orchids Penins. Malaysia Singapore: 113. 1992; H. H. Pham, Ill. Fl. Vietnam 3: 781. 2000; X. Chen & P. J. Cribb in Z. Wu et al. (eds), Fl. China 25:259. 2009; H. Kurzweil in T. Santisuk & Larsen (eds), Fl. Thailand 12(1): 178. 2011. – *Smithanthe rhodocheilia* (Hance) Szlach. & Marg., Orchidee (Hamburg) 55: 174. 2004. (Plate 19 A & B).

Lithophytic sympodial orchid. **Tubers** fleshy, oblong, short creeping. **Stem** erect, 6 leaves, ca. 0.6 cm long. **Foliage leaves** glabrous, lanceolate, ca. 2.5–1.8 x 0.8–0.9 cm, apex acute, margin wavy. **Inflorescence** terminal, raceme, ca. 7 cm long; rachis 2.5–3 cm long, 1 to 6 flowered; floral bract ovate, ca. 2.2–2.6 x 1.5–1.6 cm (flattened), apex acuminate. **Flower** usually open in succession or in pair, petals and sepals uniform orange, ca. 2.5 cm in diam. **Dorsal sepal** orange, elliptic, cymbiform, ca. 0.8–1 x 0.5–

0.6 cm (flattened), apex acute, forming a hood with petals. *Lateral sepals* orange, glabrous, falcate to ovate, ca. 0.7–0.8 x 0.5–0.6 cm, apex acute, bend backward, 1 middle veins. *Petals* glabrous, spatulate, ca. 0.7–0.75 x 0.3–0.4 cm, apex acute. *Labellum* orange, glabrous, ca. 2–2.5 cm long, short claw at base ca. 0.5 cm long, margin slightly erose, red collar on the entrance of spur mouth, 3 lobed; mid lobe spatulate, ca. 1.4–1.5 x 1.1 cm long, apex deep emarginated, small apiculate in middle; lateral lobes ovate ca. 1.5–1.6 x 0.7–0.8 cm, apex obtuse; spur cylindrical, pendulous, ca. 3–4 cm long, apex usually 90° or parallel with ovary. *Column* pale orange, ca. 0.5–0.6 cm long; rostellum triangular, 2 elongated arms; anther canals ca. 0.5–0.6 cm long; pollinia 2, sectile, ca. 0.7 mm long, 2 pollinia attached with 2 long slender caudicles, open broadly at base, white, ca. 0.35 cm long and naked yellow viscidium ca. 0.2 cm long, stipe absent. *Ovary* (with pedicel) slender, orange, ca. 2.2–2.5 cm long. *Capsule* not seen.

**Vietnam.** – Hon Ba (Khanh Hoa province).

**Distribution.** – Bhutan, China, India, Japan, Nepal, Taiwan, Thailand.

**Ecology.** – Closed evergreen tropical monsoon (seasonal) broad-leaved lowland forest, along the stream, ca. 402 m asl. Flowering in October.

**Specimen examined.** – A.F.G. Kerr. 0176 (K, photo), A. Rodger 201 (K, photo), V. B. TRUONG 102 (PSU).

64. *Lecanorchis nigricans* Honda, Bot. Mag. (Tokyo) 45: 470. 1931; J. Ohwi, Fl. Japan (in English): 336. 1965; T. S. Liu & H. J. Su, Fl. Taiwan 5: 1039. 1978; T. Hashim., Ann. Tsukuba Bot. Gard.9: 27. 1990; X. Chen, P. J. Cribb & S. W. Gale in Z. Y. Wu et al. (eds), Fl. China 25: 172. 2009; S. Suddee et al., Thai For. Bull. (Bot.) 38: 1–7. 2010. H. A. Pedersen et al. in T. Santisuk & Larsen (eds), Fl. Thailand 12(1): 178. 2011. (Plate 19 C &D).

Terrestrial, mycoheterotrophic, rhizomatous herbs; rhizome dark brown, slender, curved in hooked-like forming aerial flowering shoot, branched. *Flowering shoot* 6–17 cm long erect, dark brown; nodes with sheaths; sheaths glabrous, ovate, ca.

0.3 cm long, apex acute, base amplexicaul, margin membranous. *Inflorescence* in raceme; glabrous; rachis ca. 2.5–10 cm long, 3–16 flowered; bracts ovate, glabrous, brown, apex acute, 0.2–0.25 x 0.1–0.2 cm. *Flower* long–pedicelled, yellowish. *Dorsal sepal* yellowish green, glabrous, oblanceolate with 3–5 veined, mid veined rather dark, apex obtuse 1.3–1.35 x 0.2 cm, concave. *Lateral sepals* yellowish green, glabrous, oblanceolate, mid veined dark, apex obtuse, 1.35–1.4 x 0.2–0.25 cm, concave, flattened. *Petals* yellowish white, glabrous oblanceolate, apex obtuse, ca. 0.45–0.5 x 0.15–0.2 cm, concave, flattened. *Labellum* purplish white, simple, spatulate to obovate, 6–7 veined, ca. 1.3–1.4 x 0.5–0.7 cm, flattened, adnate to column for more/less half of the column length then forming a tube with base papillose inside; epichile purplish, slightly 3 lobes with obscure side lobed or not lobed, mid lobe/limb obtuse, slightly expanded with incurved irregularly margin, pubescent with multicellular hair. *Column* white, glabrous, incurved, 1.2 cm long, winged at the top end; anther cap white, glabrous, subterminal, ovate ca. 0.2 mm long; pollinia missing. *Ovary* (with pedicel) glabrous, ca. 1.5–2 cm long. *Capsule* cylindric, ca. 2.5 x 0.5 cm.

**Vietnam.** – Hon Ba (Khanh Hoa province).

**Distribution.** – Japan, South China, Taiwan, Thailand.

**Ecology.** – Primary humid broad-leaved evergreen montane forests, ca. 966 m asl., Very rare. Flowering time July.

**Specimen examined.** – V. B. TRUONG 103 (PSU).

65. *Lecanorchis vietnamica* Aver., Rheedeia 15: 92 (2005); Turczaninowia: 14(2): 55. 2011. (Plate 19 E & F).

Terrestrial, mycoheterotrophic, rhizomatous herbs orchid. *Rhizome* slender, vertical, brown–dark brown. *Flowering shoot* erect, slender ca. 20–29 cm long, dark brown–black, several black bract ca. 0.25–0.4 cm long, apex acute. *Inflorescence* terminal, glabrous ca. 7–8 cm long, branched; floral bract glabrous ovate ca. 0.05–0.1 cm long dark brown, apex obtuse. *Flower* open from base, not open widely, curved down, sepals petals and labellum uniform pale brown. *Dorsal sepal* brown, glabrous,



oblong, ca. 1.2–1.3 x 0.3 cm, apex obtuse, 3 veins on the blade, margin entire slightly fleshy. *Lateral sepals* pale brown, glabrous, oblong, ca. 1.3 x 0.3 cm, apex obtuse, 3 veins, margin entire. *Petals* pale brown, oblong, glabrous, falcate, ca. 1.3–1.4 x 0.25 cm, apex obtuse, margin entire, slightly fleshy. *Labellum* pale brown, ca. 1.3 x 0.3 cm, 3 lobed; mid lobe obovate, ca. 0.5 x 0.2 cm, apex obtuse outcurved, adaxial densely wavy white hair, apical part hair pale purple–brown; lateral lobes pale brown–white somewhat triangular, glabrous, ca. 1.1 x 0.3–0.35 cm, erect, apex acute, adnate with column ca. 0.3 cm long, form saccate shape with column. *Column* white–pale green in middle, glabrous, ca. 0.7 cm long, tip rounded, open broadly at base, column foot lacking; anther cap glabrous, white, ca. 1 mm long; pollinia 2, ca. 0.6 mm long, caudicles, stipe and viscidium absent. *Ovary* (with pedicel) ca. 1.5–2 cm long, pale brown. *Capsule* cylindrical shape, black, ca. 2 cm long.

**Vietnam.** (Endemic) – Hon Ba (Khanh Hoa province), Kontum, Lam Dong, Lao Cai, Nghe An, Quang Nam, Thua Thien Hue.

Distribution. – Endemic to Vietnam.

**Ecology.** – ca 1416 m asl. Primary humid broad-leaved evergreen montane forests, under the shade of canopy, very rare. Flowering time June–July.

**Specimen examined.** – L. Averyanov, P.K. Loc, N.T. Vinh HAL 7247 (LE, photo), V. B. TRUONG 104 (PSU).

66. *Liparis cespitosa* (Lam.) Lindl., Bot. Reg. 11 Sub T. 882, 1825; Seidenf., Opera Bot. 114: 139. 1992; Seidenf. & J. J. Wood, Orchids Penins. Malaysia Singapore: 235. 1992; H. H. Pham, Ill. Fl. Vietnam 3: 902. 2000; X. Chen, P. Ormerod & J. J. Wood in Z. Y. Wu et al. (eds), Fl. China 25: 222. 2009; Aver., Turczaninowia 16 (1): 108. 2013. – *Epidendrum cespitosum* Lam., Encycl. 1: 187. 1783. – *Malaxis cespitosa* (Lam.) Thouars, Hist. Orchid.: t. 90. 1822. *Leptorkis cespitosa* (Lam.) Kuntze, Revis. Gen. Pl. 2: 671. 1891. – *Cestichis cespitosa* (Lam.) Ames, Orchidaceae 2: 132. 1908. – *Stichorkis cespitosa* (Lam.) Thouars ex Marg. in H.B.Margonska & D.L.Szlachetko, Orchid. Tahiti: 61. 2010. (Plate 19 G & H).

Epiphytic sympodial orchid. *Pseudobulbs* ovoid, ca. 0.55 x 0.7 cm, caespitose, arrange close together on rhizome. *Leaves* single, glabrous, lanceolate, ca. 1.3–2.25 x 0.5–0.55 cm, apex acuminate; petiole ca. 0.5–0.6 cm long. *Inflorescence* terminal, raceme, erect, synanthous, glabrous, ca. 3–3.4 cm long, winged; peduncle glabrous, ca. 1–1.5 cm long; rachis glabrous, ca. 1.5–1.7 cm long, 6 to 9 flowered; floral bract narrow triangular, ca. 0.25–0.3 cm long, apex acute. *Flower* small, ca. 0.3–0.4 cm long, pale yellow, sepals and petals curved backward, open from base. *Dorsal sepal* glabrous, oblique, oblong, ca. 0.2–0.25 x 0.1–0.15 cm, apex acute. *Lateral sepals* glabrous, oblong, ca. 0.25–0.3 x 0.1 cm, apex acute. *Petals* linear, ca. 0.1–0.2 cm long, linear–needle shape, circle curved. *Labellum* glabrous, oblong or somewhat rectangular ca. 0.25 x 0.1 cm, apex emarginated with short acuminate in middle, strongly outcurved, 2 short triangular ridges at the base, margin slightly undulate. *Column* pale yellow, ca. 0.15 cm long, slightly curved on the tip, with very narrow wing on the tip; anther cap pale yellow, ca. 0.4 mm long, ovate or slightly suborbicular, pollinia 4, ca. 0.1 mm long, solid; without caudicles, stipe and viscidium. *Ovary* (with pedicel) slender, glabrous, ca. 0.3–0.5 cm long, pale green. *Capsule* (young) ovoid, ca. 0.3–0.35 cm long.

**Vietnam.** – Hon Ba (Khanh Hoa province), Dong Nai, Kon Tum, Lam Dong, Lao Cai.

**Distribution.** – Tropical regions of Africa to Asia and Pacific islands.

**Ecology.** – Primary humid broad-leaved evergreen montane forests, along the stream, ca. 986 m asl. Flowering in September.

**Specimen examined.** – L. Averyanov et al. HAL 2313 (LE, photo), P. Rojchanaumpawan 274 (PSU), V. B. TRUONG 107 (PSU).

67. *Liparis chapaensis* Gagnep., Bull. Soc. Bot. France 79: 166. 1932; Seidenf., Opera Bot. 114: 139. 1992; H. H. Pham, Ill. Fl. Vietnam 3: 90. 2000; X. Chen, P. Ormerod & J. J. Wood in Z. Y. Wu et al. (eds), Fl. China 25: 223. 2009; Aver., Turczaninowia 16 (1): 114. 2013. – *Stichorkis chapaensis* (Gagnep.) Marg., Szlach. & Kulak, Acta Soc. Bot. Poloniae 77: 37. 2008. (Plate 20 A & B).

Lithophytic sympodial orchid. *Pseudobulbs* ca. 2 cm long x 0.6–1 cm high, ovoid, densely close together. *Leaves* single, narrow oblanceolate ca. 4.5–6 x 0.75–0.8 cm, apex acuminate; petiole ca. 0.5 cm long. *Inflorescence* terminal, arching, synanthous, glabrous, ca. 4–4.8 cm long; peduncle ca. 2.8 cm long, slightly flat, wings from 2 lateral side ca. 0.05 cm long; rachis ca. 2 cm long; floral bract subulate–narrow lanceolate, ca. 0.35–0.55 x 0.1 cm, apex acute–acuminate. *Flower* open from base sepals and petal greenish–yellow, labellum greenish–yellow–orange. *Dorsal sepal* glabrous, linear ca. 0.5 x 0.15–0.2 cm, apex acute, margin revolute. *Lateral sepals* glabrous, linear, ca. 0.7 x 0.2 cm, apex acute, margin revolute, curved like circle. *Petals* glabrous, linear–fusiform falcate, ca. 0.5–0.6 cm long, apex acute. *Labellum* simple, obovate, ca. 0.65 x 0.5 cm, apex truncate and mucronate, strongly outcurved in the middle; margin slightly denticulate; adaxial 2 triangular callus at base. *Column* white, glabrous, obovate, ca. 0.4–0.45 cm long, apical part pointing forward, apex short triangular winged; anther cap and pollinia not seen. *Ovary* (with pedicel) glabrous, slender, green, ca. 0.6 cm long. *Capsule* not seen.

**Vietnam.** – Hon Ba (Khanh Hoa province).

**Distribution.** – China, Myanmar.

**Ecology.** – Primary humid broad-leaved evergreen montane forests, lithophyte on the rock in middle of small stream. ca. 1520 m asl. Flowering time July.

**Specimen examined.** – L. Averyanov et al. 2326 (LE, photo), V. B. TRUONG 106 (PSU)

68. *Liparis mamillata* Aver., Updated Checkl. Orchids Vietnam: 82. 2003; Turczaninowia 16 (1): 81. 2013. (Plate 20 C & D).

Lithophytic sympodial orchid. *Rhizome* brown, slender, creeping, horizontal. *Pseudobulbs* ovoid, ca. 1.6–1.7 cm high, covered by brownish papyraceous sheaths, arrange close together on rhizome. *Leaves* single, glabrous, ovate, ca. 4.5–4.7 x 3–3.2 cm, apex acute; petiole ca. 1.9–2 cm long. *Inflorescence* synanthous, ca. 10–11 cm long; peduncle ca. 4.5–5 cm long, covered by 2 inflorescence bracts, purplish on the tip

ca. 0.7–2.5 cm long; rachis ca. 4.5 cm long, flat and 2 lateral wings ca. 0.5 mm long, 3–7 flowered, pale green from the base to middle, dark purple on the tip; floral bracts ovate, ca. 0.4–0.6 cm long, apex acute, dark purple base, greenish tip. *Flower* open from base, ca. 2 cm long, sepals pale green, petals and labellum dark purple. *Dorsal sepal* ovate to triangular, ca. 0.8–0.9 x 0.25 cm (flattened), apex acute, margin revolute like needle shape. *Lateral sepals* ovate to triangular, ca. 0.7–0.8 x 0.25 cm, apex acute, margin revolute needle shape. *Petals* linear, ca. 0.5–0.8 cm long, apex acute. *Labellum* simple, ovate, open broadly in middle and narrower at base, ca. 0.8–0.9 x 0.4–0.5 cm, apex acute, margin dark purple, purple finely ciliate; 2 erect, raising calli at base turn to flat parallel stripes up to nearly apex of labellum. *Column* white, glabrous, ca. 0.5–0.6 cm long, slender at apical and open broadly at base, tip two short triangular winged; anther cap green – pale yellow, ca. 1 mm long; pollinia 4, ca. 0.7 mm long, pale green–yellow. *Ovary* (with pedicel) ca. 0.5–0.6 cm long, dark purple, base twisted. *Capsule* not seen.

**Vietnam.** – Hon Ba (Khanh Hoa province), Dak Nong, Ta Dung.

**Distribution.** – Endemic to Vietnam.

**Ecology.** – Primary humid broad-leaved evergreen montane forests, humidity, ca. 1402–1492 m asl. Flowering in May.

**Specimen examined.** – L. Averyanov et al. VH 6046 (LE, photo), V. B. TRUONG 113 (PSU).

69. *Liparis ngoclinhensis* Aver., Turczaninowia 16 (1): 81. 2013. (Plate 20 E & F).

Lithophytic sympodial orchid. *Pseudobulbs* grow close together, ovoid, ca. 3 cm tall, covered by thin brownish sheath. *Leaves* single, orbiculate, ca. 7–8 x 6–6.5 cm, apex acute or short acuminate, margin lobed; petiole ca. 2–2.5 cm long. *Inflorescence* terminal, synanthous, ca. 17–19 cm long, winged ca. 0.5 mm long, base white, dark purple from middle to tip; peduncle ca. 9.5 cm long, covered by sheaths; rachis ca. 8–9 cm long, dark red, 19–20 flowered; floral bract very small, greenish–dark purple, triangular, ca. 0.15–0.2 cm long, apex obtuse. *Flowers* open broadly from base to tip,

sepals pale green, petals pale purple, labellum purple with pale green. *Dorsal sepal* narrowly ovate, ca. 1–1.2 x 0.35 cm, apex acute, margin revolute. *Lateral sepals* narrowly ovate, ca. 1.35 x 0.3–0.35 cm, apex acute, margin revolute. *Petals* linear 0.8 x 0.15–0.2 cm, apex acute, margin revolute. *Labellum* simple, obovate, ca. 1 x 1.2 cm, apex emarginated small apiculate in middle, margin finely serrulate, strongly outcurved; adaxial longitudinal rounded callus from base of labellum run from the middle to near the apex of labellum. *Column* pale yellow–green, ca. 4–4.5 mm long, curved toward in the middle, middle to tip green–greenish; base open broadly; anther cap pale purple, narrowly elliptic, ca. 1 mm long; pollinia 4, solid, ca. 0.5 mm long, caudicles, stipe and viscidium absent. *Ovary* (with pedicel) glabrous, ca. 0.35–0.4 cm long, dark purple, twisted when attached to rachis. *Capsule* not seen.

**Vietnam.** – Hon Ba (Khanh Hoa province), Dak Nong, Ta Dung.

**Distribution.** – Endemic to Vietnam.

**Ecology.** – Primary humid broad-leaved evergreen montane forests, ca. 1174 m asl. Flowering in late of August.

**Specimen examined.** – L. Averyanov et al. VH 1154 (LE, photo), V. B. TRUONG 109 (PSU).

70. *Micropera pallida* (Roxb.) Lindl., Edwards's Bot. Reg. 18: t. 1522. 1832; J.B. Comber, Orchids Java: 343. 1990; Seidenf., Opera Bot. 114: 382. 1992; Seidenf. & J. J. Wood, Orchids Penins. Malaysia Singapore: 617. 1992; H. H. Pham, Ill. Fl. Vietnam 3: 934. 2000; J. B. Comber, Orchids Sumatra: 898. 2001; *Aerides pallida* Roxb., Fl. Ind. ed. 1832, 3: 475. 1832. *Camarotis pallida* (Roxb.) Lindl., J. Proc. Linn. Soc., Bot. 3: 37. 1858. (Plate 20 G).

Epiphytic monopodial orchid. *Stem* climbing, terete, hard, ca. 0.6 cm in diam. *Leaves* distichous, oblanceolate, ca. 9–10 x 1–1.2 cm, apex retuse; petiole sheath liked attached to stem. *Inflorescence* lateral along the stem, raceme, 1 to 2, pendulous, glabrous, ca. 12.5 cm long; peduncle ca. 2.9–3 cm long; inflorescence bract 3, triangular, ca. 0.2–0.25 cm long, apex obtuse; rachis ca. 7–8 cm long, 7 flowered; floral

bract small, brown, ovate to triangular, ca. 0.1–0.15 cm long, apex acute. **Flower** open widely sepals and petal bend backward, flower yellow. **Dorsal sepal** glabrous, lanceolate, ca. 0.5–0.55 x 0.2–0.25 cm, apex obtuse. **Lateral sepals** glabrous, lanceolate to falcate, ca. 0.5–0.6 x 0.2–0.3 cm, apex obtuse, slightly curved. **Petals** glabrous, lanceolate, yellow, ca. 0.4–0.5 x 0.2 cm, apex acute. **Labellum** glabrous, ca. 0.9–1 cm long, 3 lobed; mid lobe pale yellow, very short, triangular, ca. 0.3 x 0.1 cm, apex obtuse, thick, fleshy, with 2 teeth on the apical point inward; lateral lobes pale yellow–white, somewhat quadrangular, ca. 0.3–0.4 x 0.2 cm; spur ca. 0.4 cm long, conic shape, apex obtuse; adaxial bi-lobed callus extend to the spur apex. **Column** glabrous, ca. 0.3–0.35 cm long, white, apex one white long tail, ca. 0.25 cm long; rostellum beaked ca. 0.2–0.25 mm long, slightly curved in middle; anther cap ca. 1.5 mm long, white, glabrous, ovate, apex acute; pollinia 4, equal size, ca. 0.7 mm long, ovoid, solid; slender stipe attached to small viscidium, caudicles absent. **Ovary** (with pedicel) 1–1.2 cm long, green, tip yellowish. **Capsule** (young) linear, ca. 5.5 cm long.

**Vietnam.** – Hon Ba (Khanh Hoa province), Dong Nai (Cat Tien national park), Phước Bình, Phú Quốc.

**Distribution.** – Cambodia, India, Indonesia, Laos, Malaysia, Myanmar, Thailand.

**Ecology.** – Closed evergreen tropical monsoon (seasonal) broad-leaved lowland forest, along the stream or dry area, ca. 410 m asl. Flowering in September.

**Specimen examined.** – C.B. Clarke 14202 (K, photo), V. B. TRUONG 120 (PSU).

**71. *Miguelia cruenta* Aver & Vuong, *Taiwania* 60(1): 36. 2015. (Plate 21 A & B).**

Terrestrial and epiphytic monopodial orchid, lithophytic in occasionally. **Stem** green, pale yellow, creeping, fleshy, terete, ca. 0.5–2 cm in diam., up to 10 m high, internode ca. 6–12 cm long. **Leaves** fleshy, slightly falcate, elliptic–narrowly ovate, ca. 15–35 x 5–6 cm, apex acuminate; petiole short ca. 1.5–2 cm long, twisted attached to stem. **Inflorescence** lateral, cyme, branched, from leaves axil ca. 5 cm long; peduncle very short ca. 0.5 cm long or subsessile; inflorescence bract ovate to triangular, green fleshy ca. 3–4 cm long, curved, stiff; internode bract short triangular ca. 0.6–0.7 cm

long apex obtuse, node bract ca. 0.5 x 0.6 cm, apex acute; floral bract ovate, broadly ovate, ca. 0.8 x 0.9 cm, apex acute. *Flower* open in pair, opposite, widely open, ca. 4–5 cm across, sepals and petals greenish–yellow, labellum pale green with red keels. *Dorsal sepal* glabrous, greenish–yellow, oblanceolate, concave, ca. 4 x 1.2 cm, apex obtuse. *Lateral sepals* glabrous, greenish–yellow, falcate, concave, ca. 3.6 x 1.5 cm, apex obtuse, abaxial one middle keel. *Petals* glabrous, oblanceolate to falcate ca. 4.2 x 1.3 cm, apex obtuse. *Labellum* pale green, trumpet shaped, ca. 4.5 x 2.5 cm (flattened), simple, adnate to the lateral side of column, ca. 2.9 cm long; margin undulated; adaxial with many longitude low red keels from base raise up fleshy at middle of labellum, lateral labellum with flat red keels; white callus in the middle of labellum ca. 0.6–0.7 cm long; apical part of adaxial with a group of clavate white papillose, size increase from lower to upper part, wavy ca. 0.1–0.3 cm long. *Column* glabrous, white ca. 1.7–1.8 cm long, 0.3 cm in diam.; rostellum fleshy; anther cap glabrous, white, ca. 4 mm long; pollinia 4, ca. 1.5–2 mm long, clavate shaped, 2 inner smaller than 2 outers, pale yellow; caudicles, stipe and viscidium absent. *Ovary* (with pedicel) terete, ca. 7.5–9 cm long, curved in the middle. *Fruit* not seen.

**Vietnam.** – Hon Ba (Khanh Hoa province).

**Distribution.** – Endemic to Vietnam.

**Ecology.** – Primary humid broad-leaved evergreen montane grow along the small or big stream, humidity areas, from 900m to 1547m asl. Flowering in middle of May, flowered very rare.

**Specimen examined.** – V. B. TRUONG 003 (VNM, LE); V. B. TRUONG 119 (PSU)

72. *Mycaranthes floribunda* (D.Don) X. Chen & J. J. Wood, Fl. China 25: 348. 2009. – *Dendrobium floribundum* D.Don, Prodr. Fl. Nepal.: 34. 1825. – *Eria paniculata* Lindl. in N.Wallich, Pl. Asiat. Rar. 1: 32. 1830. – *Callista floribunda* (D.Don) Kuntze, Revis. Gen. Pl. 2: 654. 1891. – *Pinalia paniculata* (Lindl.) Kuntze, Revis. Gen. Pl. 2: 679. 1891. (Plate 21 C & D).

Epiphytic sympodial orchid. *Stem* erect, ca. 30–40 cm long, caespitose, base sheathing. *Leaves* up to 7, oblong to narrowly oblong, ca. 10–23 cm x 1.4–2.1 cm, apex acuminate; petiole sheath-like ca. 3–5 x 1–2 cm. *Inflorescence* terminal, raceme, ca. 20–25 cm long, 50–60 flowered, inflorescence green, pubescent with white hair; peduncle ca. 6–7 cm long; inflorescence bract 3–4, ovate, ca. 0.8–1.2 cm long, apex acute; rachis ca. 13–14 cm long; floral bracts glabrous, linear, curved, 0.5–0.6 cm long, apex acute. *Flower* open widely from base, sepals pale yellowish–white, petals white, labellum white with maroon dots. *Dorsal sepal* elliptic, ca. 0.4 cm x 0.3 cm, apex obtuse, 3–4 veins. *Lateral sepals* ovate to falcate, ca. 0.3 x 0.4 cm, lateral sepals forming mentum ca. 0.3 cm long, 90° with ovary, covered by white pubescent with white hair. *Petals* white, elliptic, glabrous, ca. 0.3–0.4 x 0.15 cm, margin slightly erose. *Labellum* ca. 0.4–0.5 cm long, somewhat square shape, 3 lobed; mid lobe white suborbicular, apex emarginated, margin slightly erose; lateral lobes white, triangular, suberect, apex obtuse; adaxial 3 soft woolly calli, apex big globose callus, on disk one cylindrical, longitudinal callus extent from base to apex callus, another globose callus at base, yellow, smaller than apex callus. *Column* glabrous, ca. 1.2 x 0.1 cm; anther cap reddish ca. 1 mm long, pollinia 8, ca. 0.6 mm long, clavate, equal size, caudicels, stipe and viscidium absent. *Ovary* (with pedicel) slender, ca. 1.5–2 cm long, white, pubescent with white hair. *Capsule* not seen.

**Vietnam.** – Hon Ba (Khanh Hoa province).

**Distribution.** – Bhutan, Cambodia, NE India, Laos, Myanmar, Nepal, Thailand.

**Ecology.** – Primary humid broad-leaved evergreen montane forests, ca. 1376 m asl. Flowering in April.

**Specimen examined.** – J. D. Hooker 67 (K, photo), Menzies & D. Du Puy 394 (K, photo), V. B. TRUONG 088 (PSU).

73. *Mycaranthes pannea* (Lindl.) X. Chen & J. J. Wood, Fl. China 25: 348. 2009. – *Eria pannea* Lindl., Edwards's Bot. Reg. 28 (Misc.): 64. 1842. – *Pinalia pannea* (Lindl.) Kuntze, Revis. Gen. Pl. 2: 679. 1891. (Plate 21 E & F).



Epiphytic sympodial orchid. **Rhizome** creeping, slender, ca. 0.5 cm in diam. **Stems** ca. 1–2 cm long, base covered by brown sheaths, connected by rhizome, ca. 2–4 cm apart. **Leaves** 2 to 4, glabrous, fleshy, terete, ca. 2.5–4.5 x 0.35 cm, apex obtuse. **Inflorescence** brown, terminal, covered by white pubescent with hair, ca. 1.7 cm long, 2–3 flowered; floral bract ca. 0.5 cm long, white pubescent with white hair, apex acute. **Flower** open widely pale green–yellow sepals, reddish–yellow petals, labellum dark purple nearly black. **Dorsal sepal** elliptic, ca. 0.55 x 0.3 cm, apex acute abaxial white pubescent with. **Lateral sepals** oblique triangular–ovate, ca. 0.8 x 0.6 cm, apex acute, abaxial white pubescent with, lateral sepals forming mentum. **Petals** narrowly ovate–triangular, ca. 0.5 x 0.25 cm, base greenish, tip yellow, apex acute, slightly hairy, narrow elliptic. **Labellum** simple, obovate, ca. 0.6–0.7 cm long, apex acute fleshy, base narrowed, greenish–yellow or very dark red (old flower nearly black); abaxial one mid ridges, base slightly pubescent with; adaxial apical with elliptic callus ca. 0.25 cm long from middle of labellum up to apex, in base one narrow, linear callus ca. 0.2 cm from base up to near middle, margin slightly pubescent with. **Column** strongly curved toward near the tip, 0.55 cm long, column foot ca. 0.2 cm long; anther cap suborbicular, glabrous, yellow–red, ca. 2 mm long; pollinia 8, ca. 0.9 mm long, equal size, clavate shaped, caudicels, stipe and viscidium absent. **Ovary** (with pedicel) very short ca. 0.6–0.7 cm long, green, pubescent white hair. **Capsule** not seen

**Vietnam.** – Hon Ba (Khanh Hoa province), Da Lat, Gia Lai, Kon Tum.

**Distribution.** – Bhutan, Cambodia, China, India, Indonesia, Laos, Malaysia, Myanmar, Singapore, Thailand.

**Ecology.** – Primary humid broad–leaved evergreen montane forests, ca. 1320 m asl. Flowering time July.

**Specimen examined.** – D. Menzies & D. Du Puy 199 (K, photo), R. de Kok et al. S 97865 (K. photo), P. Rojchana-umpawan 82, 251 (PSU), V. B. TRUONG 090 (PSU).

74. *Oberonia falcata* King & Pantl., J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 64: 329. 1895; Seidenf., Opera Bot. 114: 156. 1992; Seidenf. & J. J. Wood, Orchids Penins. Malaysia Singapore: 250. 1992; H. H. Pham, Ill. Fl. Vietnam 3: 934. 2000; J. B.

Comber, Orchids Sumatra: 198. 2001; N. Pearce & P. J. Cribb, Fl. Bhutan 3(3): 229. 2002. – *Oberonia caudata* King & Pantl., J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 66: 581. 1897. – *Oberonia pendula* Ridl., J. Straits Branch Roy. Asiat. Soc. 61: 38. 1912. (Plate 21 G & H).

Epiphytic monopodial orchid. **Stem** pendent, fleshy, flexuous, base covered by leaf sheaths, ca. 7–9 cm long, internode ca. 1.2–3 cm long. **Leaves** 5 to 6, linear to falcate ca. 1.5–5 x 0.4–0.6 cm, apex acute, leaves not joined at base; petiole sheaths–liked ca. 1.5–2 cm long. **Inflorescence** terminal, pendulous, glabrous, ca. 9–12 cm long, densely flowered; peduncle short, glabrous, ca. 0.8 cm long, cylindric; rachis slender glabrous, ca. 9–10 cm long; floral bract ca. 0.15–0.2 cm long, shorter than flower, apex acuminate, margin slightly erose. **Flower** numerous, small size, ca. 0.15 cm long, open widely from base. **Dorsal sepal** glabrous, ovate, ca. 0.5 mm long, apex obtuse, concave, erect. **Lateral sepals** glabrous, ovate, ca. 0.5 mm long, apex obtuse (arrange below labellum). **Petals** glabrous, narrowly ovate, ca. 0.3 mm long, apex obtuse. **Labellum** glabrous, ca. 1.5 mm long, 3–lobed; mid lobe somewhat square, apex emarginate with small sinus in the middle divided into two lanceolate lobules, apex acute; lateral lobes triangular, apex acute. **Column** short glabrous, ca. 0.4 mm long, tip winged, slightly triangular wings; anther cap glabrous, 0.25 mm long; pollinia 4, with 2 pairs, ovoid, ca. 0.1 mm long, pale yellow, caudicles, stipe and viscidium absent. **Ovary** (with pedicel) slender, ca. 0.2 cm long. **Capsule** not seen.

**Vietnam.** – Hon Ba (Khanh Hoa province), Mộc Châu, Sơn La, Kon Plong, Kontum, Phú Quốc.

**Distribution.** – Bhutan, India, Indonesia, Nepal, Malaysia, Thailand.

**Ecology.** – Primary humid broad-leaved evergreen montane forests, epiphyte on very high tree branch, ca. 1498 m asl. Flowering in September.

**Specimen examined.** – R. Pantling 218 (K, photo), P. S. Green, 2463 (K, photo), L. Averyanov et al. HAL 8879 (LE, photo), V. B. TRUONG 121 (PSU).

75. *Oberonia longibracteata* Lindl., Gen. Sp. Orchid. Pl. 15. 1830; Seidenf. Opera Bot. 114:156. 1992; H. H. Pham. Fl. Vietnam. 3: 896. 2000; X. Chen, P. Ormerod & J. J. Wood in Z. Y. Wu et al. (eds), Fl. China 25: 239. 2009 – *Malaxis longibracteata* (Lindl.) Rehb.f. in W.G.Walpers, Ann. Bot. Syst. 6: 209. 1861. – *Iridorkis longibracteata* (Lindl.) Kuntze, Revis. Gen. Pl. 2: 669. 1891. (Plate 22 A & B).

Lithophytic monopodial orchid. **Stem** short ca. 0.7 cm long, often enclosed in leaf base, conduplicate. **Root** white, cylindrical, ca. 0.05–0.1 cm in diam. **Leaves** 5–6 form in turfs, fleshy, linear to lanceolate ca. 2–4.5 x 0.5–0.6 cm, apex acuminate. **Inflorescence** terminal, glabrous, ca. 3.5–3.6 cm long, peduncle ca. 1 cm long; inflorescence bract 1–2, ca. 1–2 0.5 cm long; rachis ca. 0.25 cm long; floral bract lanceolate, ca. 0.4–0.5 cm long, apex acute, much longer than flower, open broadly near base. **Flower** minutes, open widely, petals sepals pale red, labellum red, margin entire. **Dorsal sepal** glabrous, ovate ca. 0.05 cm long, 0.03–0.05 cm, apex obtuse. **Lateral sepals** broadly ovate, glabrous, ca. 0.05–0.1 x 0.05 cm, apex obtuse or slightly acute, bend backward. **Petals** glabrous, ca. 0.05–0.09 x 0.04 cm, apex acute. **Labellum** glabrous, 3-lobed, ca. 0.15 cm long; mid lobe, broad elliptic, ca. 0.06 x 0.04 cm, apex mucronulate; lateral lobes ovate-triangular, ca. 0.05–0.08 x 0.03 cm, margin entire, apex acute. **Column** glabrous, short, ca. 0.05 cm long, erect, apical part winged; anther cap yellow, glabrous, ovate, ca. 0.24 mm long; pollinia 4, in 2 unequally size pairs, waxy, ca. 0.2 mm long. **Ovary** (with pedicel) slender, glabrous, ca. 0.07 cm long. **Capsule** ovoid, 6 ridges, recorded on April already dry.

**Vietnam.** – Hon Ba (Khanh Hoa province), Tam Đảo, Ba Vi, Tây Nguyên (Kon Plong, Kontum), Đồng Nai.

**Distribution.** – Sri Lanka, Thailand.

**Ecology.** – Primary humid broad-leaved evergreen montane forests, ca. 1306–1500 m asl. Flowering time on September.

**Specimen examined.** – J. Macrae, 25 (K, photo), L. Averyanov et al. HLF5486 (LE, photo), V. B. TRUONG 122 (PSU).

76. *Odontochilus saprophyticus* (Aver.) Ormerod, *Taiwania* 48: 141. 2003; X. Chen, S. W. Gale, P. J. Cribb & P. Ormerod in Z. Y. Wu et al. (eds), *Fl. China* 25: 82. 2009. – *Pristiglottis saprophytica* Aver., *Updated Checklist Orchids Vietnam*: 90. 2003. (Plate 22 C & D).

Mycoheterotrophic monopodial orchid. **Flowering shoot** erect, ca. 7.6–10 cm high. **Rhizome** fleshy, ca. 3 cm long, ca. 0.4 cm in diam. **Leaves** scale-like, 7 to 9, overlapping, ca. 0.3–0.6 cm long, apex acute, pubescent with. **Rachis** ca. 2.6 cm long, 2 to 6 flowered; floral bract reddish–brown, elliptic, ca. 0.8–1 cm long, apex acuminate, pubescent with. **Flower** widely open, sepals and petals brown pubescent with white hair, labellum white. **Dorsal sepal** ovate, cymbiform, ca. 0.6 cm x 0.3 cm, apex acute, abaxial pubescent with white hair, together with petals form a hood. **Lateral sepals** oblong to falcate, ca. 0.5 x 0.35 cm, apex acute–obtuse, 1 brown mid vein. **Petals** oblong to falcate, ca. 0.65 x 0.15 cm, apex acute. **Labellum** white, ca. 1 cm long, T-shaped, hypochile saccate, at base 2 calli; mesochile ca. 0.4–0.5 cm long, irregular papillae, papillae near epichile bigger than at base; epichile 2-lobed, subovate bilobules, ca. 0.35 x 0.65 cm. **Column** white, ca. 0.3 cm long; 2 circular wings at base; anther cap ovoid, ca. 2 mm long, apex acuminate; pollinia 2, clavate, ca. 1.6 mm long, 2 pollinia attached to slender stalks and small viscidium. **Ovary** (with pedicel) slender, ca. 1 cm long reddish–brown, pubescent with white hair, brownish white hair. **Capsule** not seen.

**Vietnam.** – Hon Ba (Khanh Hoa province), Lâm Đồng.

**Distribution.** – China.

**Ecology.** – Closed evergreen tropical monsoon (seasonal) mixed lower montane forest, ca. 1505 m asl. Flowering in June to July.

**Specimen examined.** – V. B. TRUONG 126 (PSU).

77. *Ornithochilus difformis* (Wall. ex Lindl.) Schltr., *Repert. Spec. Nov. Regni Veg. Beih.* 4: 277. 1919; Seidenf., *Opera Bot.* 114: 357. 1992; Seidenf. & J. J. Wood, *Orchids Penins. Malaysia Singapore*: 588. 1992; H. H. Pham, *Fl. Vietnam* 3: 896. 2000; N. Pearce & P. J. Cribb, *Fl. Bhutan* 3(3): 534. 2002; S. C. Chen et al. in Z. Y. Wu et

al. (eds), Fl. China 25: 448. 2009. – *Aerides difformis* Wall. ex Lindl., Gen. Sp. Orchid. Pl.: 242. 1833. – *Sarcochilus difformis* (Wall. ex Lindl.) Tang & F.T.Wang, Acta Phytotax. Sin. 1: 92. 1951. – *Trichoglottis difformis* (Wall. ex Lindl.) T.B.Nguyen & D.H.Duong in T.B.Nguyen (ed.), Fl. Taynguyen. Enum.: 206. 1984. (Plate 22 E & F).

Epiphytic monopodial orchid. **Stem** short ca. 3 cm long, 1.2 cm in diam. **Leaves** glabrous, oblong, ca. 24–25 x 5–6 cm, apex acute; petiole sheath ca. 0.5–0.6 cm long. **Inflorescence** lateral, panicle, glabrous, ca. 40–47 cm long; rachis glabrous, ca. 20–29 cm long, up to 80 flowered; floral bract glabrous, pale yellow, triangular, ca. 0.15–0.2 x 0.1 cm, apex acute. **Flower** open widely from base to tip, ca. 0.8 cm long in diam., sepals and petals yellow with 2–4 red veins in middle, labellum dark maroon with yellow stripes. **Dorsal sepal** glabrous, oblong, ca. 0.55–0.6 x 0.2–0.25 cm, apex subacute, tip slightly curved down. **Lateral sepals** glabrous, oblong, ca. 0.55–0.6 x 0.25 cm, apex obtuse, tip slightly curved down. **Petals** glabrous, narrow oblong, ca. 0.4–0.5 x 0.1 cm, apex acute to obtuse, tip slightly curved down. **Labellum** ca. 0.5 x 0.8 cm, 3 lobules epichile; lateral lobules margin strongly fimbriate; apical lobule margin entire involed, forming with hypochile 90°; adaxial 2 calli, disk with one high rising callus in middle, at the spur entrance one papillae cushion callus; spur greenish–yellow, ca. 0.5 cm long, slightly curve in the middle, apex acute point forward. **Column** white with red veins, ca. 0.15–0.2 cm long, apex with papillose hair; rostellum elongate; anther cap ovate, truncate ca. 1.2 mm long; pollinia 4, ca. 0.9 mm long, separate into 2 pairs, unequal size, caudicles absent, stipe and viscidium present. **Ovary** (pedicel) greenish–yellow, glabrous, slender, ca. 1.2–1.3 cm long. **Capsule** not seen.

**Vietnam.** – Hon Ba (Khanh Hoa province).

**Distribution.** – Bhutan, China, India, Indonesia, Laos, Malaysia, Myanmar, Nepal, Thailand.

**Ecology.** – Closed evergreen tropical monsoon (seasonal) submontane broad-leaved forest, ca. 1200m asl. Flowering in September.

**Specimen examined.** – J. Jukian, A. Lamb, 4 (K, photo), E. de Vogel, & P. Cribb, 9143 (K, photo), V. B. TRUONG 127 (PSU).

78. *Oxystophyllum carnosum* Blume, Bijdr. Fl. Ned. Ind.: 336. 1825. – *Dendrobium concinnum* Miq., Fl. Ned. Ind. 3: 644. 1859. – *Dendrobium carnosum* (Blume) Rchb.f. in W.G. Walpers, Ann. Bot. Syst. 6: 280. 1861. nom. illeg. – *Callista carnosa* (Blume) Kuntze, Revis. Gen. Pl. 2: 654. 1891. – *Aporum carnosum* (Blume) Rauschert, Feddes Repert. 94: 438. 1983. (Plate 22 G & H).

Epiphytic or lithophytic sympodial orchid. **Stem** up to 15 cm long. **Leaves** 6 to 10, erect, narrowly lanceolate, ca. 5–8 x 0.5–0.8 cm, apex acute, joined at base. **Inflorescence** terminal or lateral, ca. 1–1.5 cm long, covered by brown sheaths; floral bract triangular, small yellow, ca. 0.15–0.2 cm long, apex acute. **Flower** single or sometimes in pairs, sepals and petals yellow, labellum yellow with red dots on abaxial, dark red at base. **Dorsal sepal** broadly elliptic to ovate, ca. 0.3–0.35 x 0.2–0.25 cm, apex acute. **Lateral sepals** glabrous, ovate, ca. 0.65 x 0.35 cm, apex acute, 4–5 nerves, apex obtuse, adnate with column forming short mentum, ca. 0.4 cm long, conic shape. **Petals** glabrous, lanceolate, ca. 0.2–0.25 x 0.1–0.15 cm, apex obtuse, red dots. **Labellum** simple, ca. 0.5–0.6 cm long, apex obtuse strongly outcurved, apical adaxial convex papillose cushion, margin finely papillose from apical to base labellum; on disk 3 keels, short middle keel and 2 lateral keel from base to middle of labellum. **Column** glabrous, ca. 0.4–0.5 cm long; anther cap ca. 1.5–2 mm long, pale yellow; pollinia 4, in 2 pairs, ca. 0.8–0.9 mm, caudicles, stipe and viscidium absent. **Ovary** (with pedicel) ca. 0.25–0.4 cm long green. **Capsule** ovate–obovate 0.55–0.6 cm long.

**Vietnam.** – Hon Ba (Khanh Hoa province), Lâm Đồng, Đà Lạt, Phú Quốc

**Distribution.** – Cambodia, Indonesia, Malaysia, Thailand.

**Ecology.** – Closed evergreen tropical monsoon (seasonal) broad-leaved lowland forest, lithophyte or epiphyte along the streams, ca. 194 m asl. Flowering in October.

**Specimen examined.** – A. Lamb AL1276/90 (K, photo), Cumberlege 884 (K, photo), P. Rojchana-umpawan 37, 64 (PSU), V. B. TRUONG 077 (PSU).

79. *Paphiopedilum appletonianum* (Gower) Rolfe, Orchid Rev.4: 364. 1896; Seidenf., Opera Bot. 114: 19. 1992; H.H.Pham. Ill. Fl. Vietnam 3: 763. 2000; Aver. et al., Slipper orchid of Vietnam: 218, 2003. Z. Liu, X. Chen & P. J. Cribb in Z. Y. Wu et al. (eds), Fl. China 25: 43. 2009; P. J. Cribb in Santisuk & Larsen (eds), Fl. Thailand 12(1): 198. 2011. – *Cypripedium appletonianum* Gower, Garden (London 1871–1927) 43: 95. 1893. – *Cypripedium bullenianum* var. *appletonianum* (Gower) Rolfe, Orchid Rev. 1: 135. 1893. – *Cordula appletoniana* (Gower) Rolfe, Orchid Rev. 20: 2. 1912. – *Paphiopedilum hookerae* subsp. *appletonianum* (Gower) M.W.Wood, Orchid Rev. 85: 11. 1977. (Plate 23 A & B).

Lithophytes, terrestrial or occasion epiphytic monopodial orchid. **Foliage** leaves 4 to 8, oblong to elliptic ca, 10–20 x 2–4 cm, apex acute or tridenticulate, irregular dark green dots on the blade, base with purple markings. **Inflorescence** erect, ca. 35 cm long, dark red–purple, pubescent with white hair; peduncle floral bracts green, sometimes dark purple, minute pubescent with white pubescent, lanceolate, apex acute or acuminate. **Flower** single, ca. 5–6 cm across. **Dorsal sepal** ovate, ca. 2.5–3.5 x 2–3.2 cm, apex apiculate or acute, green–greenish–white, stripes dark red, sometimes green. **Synsepal** elliptic, ca. 1.5–3 x 1–1.5 cm, apex acuminate, green–greenish with green longitude green, pubescent with black hair. **Petals** spatulate, ca. 4–5.5 x 1–1.5 cm, apex acute, twisted in middle or near the base of petals, upper margin with dark warts, margin hairy, with long and short hair, pinkish–dark pink, greenish at base, mid veined dark pink, dark maroon dots (or sometimes absent) from the base and margin to middle of petals. **Labellum** saccate, ca. 3–4 cm long, front margin entire, slightly hair; on the base big brown, wart dots on adaxial. **Colum** green–pale yellow, short, ca. 4 mm long, slightly curved down, slightly pubescent with white hair; staminode obcordate, 1 tooth or 2 to 3 teeth with 2 lateral teeth longer than mid teeth, falcate, adaxial finely papillose, pale yellow on the margin, dark purple in the middle and yellowish in the center, fertile anther 2, pollen gel-like sticky, not aggregated into pollinia. **Ovary** (with pedicel) ca. 3–3.6 cm long, pubescent with purple hair. **Capsule** not seen

**Vietnam.** – Hon Ba (Khanh Hoa province), Lam Dong, Daklak.

**Distribution.** – China, Cambodia, Laos, Thailand.

**Ecology.** – Closed evergreen tropical monsoon (seasonal) mixed lower montane forest, ca. 1400 – 1550 m asl. Flowering in March and April.

**Specimen examined.** – M.W. Wood 761031-6 (K, photo), V. B. TRUONG 128 (PSU).

80. *Paphiopedilum delenatii* Guillaumin, Bull. Soc. Bot. France 71: 554; Seidenf., Opera Bot. 114: 16. 1992; H. H. Pham Ill. Fl. Vietnam 3: 763. 2000; Aver. et al. Slipper Orchids Vietnam: 89, 2003; Aver., Turczaninowia 11(1): 61, 2008. - *Cypripedium delenatii* (Guillaumin) C.H.Curtis, Gard. Chron., ser. 3, 89: 208. 1931. (Plate 32 E & F).

Lithophytic monopodium orchid. *Leaves* 5-6, distichous, elliptic, apex tridentate. *Inflorescence* terminal, peduncle brown maroon, hirsute white hair, floral bract ovate, embrace peduncle, apex acute. *Flower* open widely, sepals and petals white, labellum pink. *Dorsal sepal* ovate, apex acute, pubescent white hair in both side. *Synsepal* ovate, apex acute, pubescent white hair both side. *Petals* broadly ovate, margin slightly undulate, apex obtuse, pubescent white hair both side. *Labellum* subglobose in outline shaped, margin in upper part incurved, finely pubescent with white hair. *Column* short, slightly curved down; staminode ovate, apex obtuse, convex in middle, margin slightly ciliate, yellow-purple in middle. *Ovary* (with pedicel), slightly curved, pubescent with maroon hair. *Capsule* not seen.

**Vietnam.** – Hon Ba (Khanh Hoa province).

**Distribution.** – Endemic of Vietnam (Distribute along the border of North Vietnam and South China (?)).

**Ecology.** – Lithophyte on granite stone along the streams. Only one location ca. 800 m asl. Flowering in March. Very rare species.

**Specimen examined.** – Impossible to collect.

81. *Paphiopedilum x cribbii* Aver. Orchids (West Palm Beach) 75: 458. 2006; Turczaninowia 11(1): 86, 2008. (Plate 33 A & B).



Lithophytic monopodial orchid. Leaves 5-6, elliptic, apex acute or minute tridentate, with finely dark green blotches on adaxial. *Inflorescence* terminal, erect, ca. 20 cm long, pubescent with dark purple hair, single flowered; peduncle erect, ca. 12 cm long, pubescent with dark purple hair; floral bract ovate, ca. 1.5 cm long, apex acute, dark purple hair. *Flower* open widely, glossy, dorsal sepal yellow, dark red-purple in middle, synsepal pale green-yellow, petal dark purple-pale brown, labellum brown-pale yellow-green. *Dorsal sepal* broadly obovate, ca. 5 x 3 cm, apex acute, finely white ciliate on margin, abaxial finely pubescent white hair. *Synsepal* elliptic, ca. 3 cm long, apex obtuse, margin revolute, abaxial finely pubescent white hair. *Petals* narrowly obovate, ca. 5 x 2.5 cm, apex acute, upper margin slightly undulate, scatter long hair at margin and base and finely ciliate at apical part. *Labellum* ca. 4.5 cm long, glossy, margin at base incurved, margin near column villose with dark purple hair. *Column* 0.5 cm long, finely ciliate; staminode cordate, ca. 1 x 0.9 cm, apex acute, unclear umbo in middle, margin finely ciliate. *Ovary* (with pedicel) ca. 3 cm long, longitudinal ridges, pubescent with white hair. *Capsule* not seen.

**Vietnam.** – Hon Ba (Khanh Hoa province).

**Distribution.** – South China.

**Ecology.** – Lithophyte along the stream with *Paphiopedilum appletonianum* population. Above 1200m asl. Very rare. Flowering in January.

**Specimen examined.** – L. Averyanov & P. K. Loc. HAL 8626 (HN, photo), V. B. TRUONG 173 (PSU).

**82.** *Paphiopedilum villosum* (Lindl.) Stein var. *annamense* Rolfe, Bot. Mag. 133: t. 8126. 1907; Aver. et al., Slipper Orchids Vietnam: 215, 2003; Aver., Turczaninowia 11(1): 78, 2008. - *Paphiopedilum villosum* f. *annamense* (Rolfe) Braem in G.J.Braem, C.O.Baker & M.L.Baker, Gen. Paphiopedilum Nat. Hist. Cult. 2: 245. 1999. (Plate 32 G & H).

Lithophytic monopodial orchid. *Leaves* 5 to 6, linear to lanceolate, apex slightly unequal 2 lobes, purple dots at base. *Inflorescence* terminal, suberect, pale green,

villose with brown-maroon hair; floral bract elliptic, apex obtuse. *Flower* open widely, dorsal sepal white with brown-purple-green in middle, synsepal green, petal, green purple-pale brown in middle, labellum pale brown-green. *Dorsal sepal* broadly obovate apex slightly retuse, margin finely ciliate. *Synsepal* embrace labellum, narrowly ovate, apex acute, margin finely ciliate. *Petals* broadly obovate, apex acute, margin finely ciliate. *Labellum* narrowly at base, margin near staminode incurved, glabrous. *Column* very short and slightly curved down, villose brown hair; staminode obcordate, apex acute, finely ciliate at base near column, small umbo in middle. *Ovary* (with pedicel) densely villose purple hair, ovary curved toward. *Capsule* not seen.

**Vietnam.** – Hon Ba (Khanh Hoa province).

**Distribution.** – Laos, South China.

**Ecology.** – Lithophyte, very rare, ca. 1300 m asl. Flowering in January.

**Specimen examined.** – was stolen by tourist.

83. *Pholidota chinensis* Lindl., J. Hort. Soc. London 2: 308. 1847; Seidenf., Opera Bot. 114: 125. 1992; H. H. Pham, Ill. Fl. Vietnam 3: 888. 2000; X. Chen & J. J. Wood in Z. Y. Wu et al. (eds), Fl. China 25: 337. 2009. – *Coelogyne chinensis* (Lindl.) Rehb.f. in W.G. Walpers, Ann. Bot. Syst. 6: 237. 1862. (Plate 23 C & D).

Epiphytic or lithophytic sympodial orchid. *Pseudobulbs* elliptic to narrow elliptic, ca. 7–13 x 2–2.5 cm, grow in group, connected by rhizome. *Rhizome* stout, creeping, ca. 0.8 cm in diam. *Leaves* 2, oblanceolate to elliptic, ca. 10–21 x 4–6 cm, apex acute to acuminate, 3 veins; petiole ca. 2.8–3 cm long. *Inflorescence* lateral from base of pseudobulb, heteranthous, pendulous, raceme, glabrous, ca. 35–37 cm long; inflorescence bract 1, broadly ovate, ca. 1–2 cm long, apex acute; rachis arching, glabrous, 25 to 30 flowered; floral bract red, broadly ovate, ca. 2.1–2.2 x 1.5–1.6 cm, apex acute. *Flower* sepals greenish–white, open from the top, petals white, labellum white with dark brown mark in the middle. *Dorsal sepal* glabrous, ovate, ca. 1 x 0.7 cm, apex obtuse or slightly acute, 4 veins. *Lateral sepals* glabrous, ovate, ca. 1.1–1.2 x 0.5–0.6 cm, apex acute, abaxial one prominent mid keel. *Petals* glabrous, lanceolate,

ca. 0.5–1 x 0.1–0.5 cm, apex obtuse to subacute. **Labellum** glabrous, 3 lobed; mid lobe suborbicular, apex mucronate or slightly emarginated, strongly outcurved, apex margin finely papillose; lateral lobes white, margin brown, ovate, erect, 0.4 x 0.3 cm, apex obtuse; saccated at labellum base, with 3 keels on abaxial. **Column** white, glabrous, ca. 0.6 cm long, open broadly in apical part; anther cap white, glabrous, ca. 1.3 mm long; pollinia 4, ca. 1 mm long, white, slightly equal size, broadly ovate to obovate, caudicles present, viscidium and stipe absent. **Ovary** (pedicel) slender, ca. 0.5–0.7 cm long. **Capsule** not seen.

**Vietnam.** – Hon Ba (Khanh Hoa province).

**Distribution.** – China, Myanmar.

**Ecology.** – Closed evergreen tropical monsoon (seasonal) mixed lower montane forest, ca. 1474–1550 m asl. Quite common species the top location. Flowering in June–July.

**Specimen examined.** – M Poilane. 31380 (K, photo), J. B. Simmons 544 (K, photo), V. B. TRUONG 133 (PSU).

84. *Pholidota leveilleana* Schltr., Repert. Spec. Nov. Regni Veg. 12(312–316): 107. 1913; Seidenf., Opera Bot. 114:889, 1992; Pham Hoang Ho. Ill. Fl. Vietnam 3: 889. 2000; X. Chen & J. J. Wood in Z. Y. Wu et al. (eds), Fl. China 25: 337. 2009. (Plate 23 E& F).

Terrestrial sympodial orchid. **Pseudobulbs** oblong to ovoid, ca. 2.5–5 x 1.8–2 cm, connected by rhizome, base covered by membranous sheaths in occasionally. **Rhizome** stout, short ca. 0.5 cm in diam. **Leaves** 2, glabrous, lanceolate to oblong, ca. 4–15 x 2 cm, apex acute; petiole ca. 2.5–3 cm long. **Inflorescence** lateral, from base of pseudobulb, heteranthous, pendulous, 1 to 2, ca. 10–15 cm, unbranched, brown, fleshy; peduncle ca. 8 cm long, sheathing at base; rachis slender than peduncle, somewhat zigzag, ca. 9 cm long, 30–40 flowered; floral bract broadly ovate to rhombic, conduplicate, membranous ca. 0.8 x 0.5 cm, apex acute. **Flower** open from base, small ca. 0.6 cm across, sepals white, abaxial brown, petals white, labellum white with tinged yellow in the middle. **Dorsal sepal** elliptic, ovate, ca. 0.4–0.5 x 0.3–0.4 cm. **Lateral**

*sepals* elliptic, glabrous, ca. 0.4–0.6 x 0.3–0.5 cm, apex acute. *Petals* glabrous, ovate to elliptic, ca. 0.3–0.4 x 0.1–0.3 cm, apex obtuse. *Labellum* glabrous, oblong, ca. 0.5–0.6 cm long; epichile elliptic, apex emarginated, margin undulate; hypochile ca. 0.15 cm long, concave in the middle, with 3 veins from the base up to the apex of labellum; adaxial on base of epichile yellow papillose; base of labellum 2 yellow dots. *Column* yellowish–white, glabrous, ca. 2–3 mm long, winged; anther cap ovate, apex acute, ca. 2 mm long; pollinia 4, solid, ca. 0.7 mm long; caudicles present, stipe and viscidium absent. *Ovary* (with pedicel) ca. 0.5 cm long, pale red.

**Vietnam.** – Hon Ba (Khanh Hoa province), Lai Châu, Tây Nguyên, Lâm Đồng, Thừa Thiên Huế.

**Distribution.** – China.

**Ecology.** – Closed evergreen tropical monsoon (seasonal) mixed lower montane forest, along the main road to the top of mountains, only recorded as terrestrial orchid, ca. 1420–1500 m asl.

**Specimen examined.** – V. B. TRUONG 132 (PSU).

**85.** *Phreatia densiflora* (Blume) Lindl., Gen. Sp. Orchid. Pl.: 64. 1830; Seidenf. & J. J. Wood, Orchids Penins. Malaysia Singapore: 344. 1992; B. Comber, Orchids Sumatra: 572. 2001. (Plate 23 G & H).

Epiphytic monopodial orchid. *Stem* without pseudobulb ca. 2.5 cm long, brown sheathing at base. *Leaves* 4 to 6 (-10), linear–lanceolate, ca. 8–8.5 x 0.5 cm, apex obtuse, unequally two lobes. *Inflorescence* 2, lateral from stem, raceme, glabrous, arching, ca. 14–14.6 cm long; peduncle glabrous, ca. 4 cm–8 cm, inflorescence bract green, brown on tip, 3–4, linear, ca. 0.6–0.7 cm long, apex acuminate; rachis slender, glabrous ca. 4 cm–8 cm long; floral bract brown, glabrous, ovate 0.4–0.5 x 0.1 cm acuminate. *Flower* open from base, dense, minute, uniform white sepals, petals and labellum. *Dorsal sepal* glabrous, ovate ca. 0.9–1 x 0.5 mm, apex acute. *Lateral sepals* glabrous, broad ovate, ca. 1 mm x 0.7 mm, apex acute, forming broad and short mentum. *Petals* glabrous, linear to lanceolate, ca. 0.5–0.9 mm long, apex obtuse.

**Labellum** glabrous, horse shoes shaped outline, margin entire, ca. 1.5 mm long, apex broadly rounded, recurved, base turn narrowly. **Column** white, glabrous, short, ca. 0.9 mm long green–greenish, anther cap yellow–white, elliptic, ca. 0.25 mm long, pollinia 8, ca. 0.1 mm long, in 2 pairs of 4, yellow, caudicles and viscidium present, stipe absent. **Ovary** (with pedicel) slender, glabrous, ca. 0.3–0.5 cm long. **Capsule** not seen

**Vietnam.** – Hon Ba (Khanh Hoa province), Ninh Binh, Thừa Thiên, Tây Nguyên, Lâm Đồng.

**Distribution.** – China.

**Ecology.** – Closed evergreen tropical monsoon (seasonal) mixed lower montane forest, epiphyte on tree trunk along the small stream, ca. 1435 m asl. Flowering in middle of May. Rare species.

**Specimen examined.** – F.R.R. Schlechter 15993 (K, photo), V. B. TRUONG 135 (PSU).

86. *Platanthera singgalangensis* (J.J.Sm.) Efimov, Turczaninowia 12(3–4): 17. 2009; Aver., Turczaninowia 13(2) : 12. 2012. (Plate 24 A & B).

Terrestrial sympodial orchid. **Rhizome** creeping, fleshy, thick ca. 5–6 cm long. **Stem** glabrous slender but robust, ca. 20–30 cm long, 4 sessile leaves. **Leaves** directly from rhizome, elliptic, ca. 5–10 x 3–4 cm, apex acute; petiole ca. 4–5 cm long; leaves on stem distant sessile, elliptic–ovate, ca. 10–11 x 3.5–4 cm, apex acute. **Inflorescence** terminal from rhizome, raceme, glabrous, ca. 60–65 cm long, longitude ridged; inflorescence bract 2, triangular, ca. 2.1–12 x 0.6–4 cm, apex acute; floral bract glabrous, ovate, ca. 1–1.5 x 0.7 cm, apex acute. **Flower** uniform green–white, open widely, open from base to tip. **Dorsal sepal** glabrous, broadly ovate, concave, ca. 0.5–0.6 x 0.5 cm, apex obtuse, forming a hood with petals. **Lateral sepals** glabrous, lanceolate, ca. 0.7–0.8 x 0.3 cm, apex acute. **Petals** glabrous ovate, ca. 0.7 x 0.3 cm, apex obtuse. **Labellum** glabrous, simple, ligulate, ca. 0.8–1 x 0.3 cm, open broadly near the base ca. 0.4–0.45 cm wide, labellum curved backside; spurs glabrous, cylindric, ca. 1.5–1.8 cm long. **Column** glabrous, ca. 0.5 x 0.4 cm, rounded; staminode at base of

anther, elliptic ca. 1 mm long; pollinia 2, ca. 2 mm long, falcate, separate apart, attached to slender caudicles ca. 1 mm long and naked viscidium, stipe absent. **Ovary** (with pedicel) glabrous ca. 1–1.7 cm long, slightly curved, ovary twisted. **Capsule** not seen.

**Vietnam.** – Hon Ba (Khanh Hoa province), Cao Bang, Kontum, Lam Dong, Lao Cai, Vinh Phuc.

**Distribution.** – Indonesia, Malaysia, Myanmar, Philippines, Thailand.

**Ecology.** – closed evergreen tropical monsoon (seasonal) mixed lower montane forest, ca. 1520 m asl. Flowering in May.

**Specimen examined.** – V. B. TRUONG 134 (PSU).

87. *Podochilus banaensis* Ormerod, *Taiwania* 48: 142. 2003. (Plate 24 C & D)

Lithophytic, sympodial orchid. **Stem** ca. 14–18 cm long, grow densely close. **Leaves** glabrous, distichous, ca. 0.5–0.8 x 0.2–0.4 cm, apex acute, close to each other; petiole sheaths oblique, twisted connected to stem ca. 0.4–0.5 cm long. **Inflorescence** glabrous, terminal on the tip of stem, raceme, ca. 0.7–1.5 cm long; peduncle glabrous ca. 0.5 cm long; rachis glabrous, slender, erect, ca. 0.75 cm long, 4–5 flowered; floral bracts glabrous, ovate, 0.15 x 0.05 cm, apex acute. **Flower** pure white, not widely open. **Dorsal sepal** glabrous, ovate, cymbiform, ca. 0.2–0.3 x 0.1 cm apex acute, abaxial 1 middle prominent vein. **Lateral sepals** glabrous, ovate to triangular, ca. 0.2–0.3 x 0.15 cm, abaxial 1 middle prominent vein, forming with column foot short mentum, ca. 0.15 cm long, apex obtuse. **Petals** glabrous, broadly elliptic, ca. 0.15 x 0.05 cm, apex obtuse. **Labellum** white glabrous, short pandurate shape, ca. 0.3 x 0.15 cm; apical part orbicular, concave; claw at base ca. 0.05 x 0.03 cm. **Column** white, glabrous, short, ca. 0.15 cm long; anther cap and pollinia not seen. **Ovary** (with pedicel) ca. 0.2–0.3 cm long, white. **Capsule** elliptic, with 6 ridges

**Vietnam.** – Hon Ba (Khanh Hoa province), Quảng Ninh.

**Distribution.** – Endemic to Vietnam.

**Ecology.** – Closed evergreen tropical monsoon (seasonal) mixed lower montane forest, ca. 1470 m asl. Flowering in April.

**Specimen examined.** – V. B. TRUONG 129 (PSU).

88. *Podochilus microphyllus* Lindl., Gen. Sp. Orchid. Pl.: 234. 1833; Seidenf., Opera Bot. 114: 200, 1992; Seidenf. & J. J. Wood, Orchids Penins. Malaysia Singapore: 344. 1992; H. H. Pham. Ill. Fl. Vietnam 3: 198. 2000; B. Comber, Orchids Sumatra: 556. 2001; N. Pearce & P. J. Cribb, Fl. Bhutan 3(3): 395. 2002. (Plate 24 E & F).

Lithophytic sympodial orchid. *Stem* ca. 5–13 cm long, slightly red on the tip of stem. *Leaves* distichous, narrowly lanceolate, glabrous, ca. 0.5–0.8 x 0.2–0.3 cm, apex acute or mucronate. *Inflorescence* white slightly pink, terminal, raceme, glabrous, ca. 1.1–1.2 cm long; rachis slender, glabrous, ca. 0.5 cm long, 1 to 7 flowered; floral bracts pink, ca. 0.1–0.15 cm long. *Flower* white with pinkish on the apex of petals, sepals and labellum, not open widely. *Dorsal sepal* pale purple on the tip, glabrous, ovate, ca. 0.2–0.3 x 0.05 cm, apex acute. *Lateral sepals* pale purple on the tip, glabrous, ovate to triangular, ca. 0.3–0.4 x 0.1 cm, apex acute, adnate with column foot and forming short obtuse mentum. *Petals* glabrous, oblong, ca. 0.1 cm long, less than 0.05 cm wide, apex obtuse to subacute, pale purple apex. *Labellum* white, simple, narrowly rhombic, glabrous, contracted at base, ca. 0.3 x 0.1 cm, apex acute, margin have pinkish dots; adaxial base high rising callus, apex truncate at base; 3 stripes from base of labellum then up to tip. *Column* white, glabrous, very short, ca. 0.16 cm long; anther cap and pollinia not seen. *Ovary* (with pedicel), white, slender, ca. 0.1–0.2 cm long. *Capsule* not seen.

**Vietnam.** – Hon Ba (Khanh Hoa province), Quang Ninh, Kon Tum, Hà Giang, Lam Dong, Phu Quoc.

**Distribution.** – Cambodia, Indonesia Malaysia, Myanmar, Thailand.

**Ecology.** – Closed evergreen tropical monsoon (seasonal) submontane broad-leaved forest, along the stream, lithophyte associated with *Appendicula* spp, *Paphiopedilum delenatii*, ca. 800 m asl. Flowering in April.

**Specimen examined.** – J.J. Wood 686 (K, photo) R.Yong 210 (K, photo), V. B. TRUONG 131 (PSU).

89. *Pteroceras teres* (Blume) Holttum, Kew Bull. 14: 271. 1960; Seidenf., Opera bot. 114: 430. 1992; H. H. Pham, Ill. Fl. Vietnam 3: 956. 2000; B. Comber, Orchids Sumatra: 868. 2001; N. Pearce & P. J. Cribb, Fl. Bhutan 3(3): 550. 2002. – *Dendrocolla teres* Blume, Bijdr. Fl. Ned. Ind.: 289. 1825. – *Aerides teres* (Blume) Lindl., Gen. Sp. Orchid. Pl.: 240. 1833. – *Sarcochilus teres* (Blume) Rchb.f. in W.G. Walpers, Ann. Bot. Syst. 6: 499. 1863. – *Thrixspermum teres* (Blume) Rchb.f., Xenia Orchid. 2: 121. 1868. (Plate 24 G & H).

Epiphytic monopodial orchid. **Stem** pendent, unbranched, ca. 15–16 cm long. **Leaves** lanceolate, falcate, ca. 12–13 x 1–2 cm, apex not equally 2 lobes. **Inflorescence** lateral along stem, raceme, ca. 5–40 cm long; peduncle glabrous, ca. 3–4 cm long; inflorescence bract triangular, glabrous, ca. 0.15–0.2 cm long, apex obtuse; rachis glabrous, pendulous, ca. 7–38 cm long; floral bract broadly triangular, ca. 0.05–0.1 cm long. **Flower** open widely in succession, ca. 1.2 cm across, petals and sepals yellow with maroon dots. **Dorsal sepal** glabrous, obovate, ca. 0.5–0.6 x 0.2–0.25 cm, apex obtuse, concave. **Lateral sepals** glabrous, obovate, ca. 0.55–0.6 x 0.3–0.35 cm, apex obtuse. **Petals** glabrous narrowly obovate, ca. 0.5–0.55 x 0.2 cm, apex obtuse. **Labellum** spurred, adnate to column foot, 3 lobed; spur dark maroon, on the tip of labellum, cylindrical, ca. 0.5 mm long, apex obtuse; mid lobe white, right behind spur entrance, callus like, swollen, ca. 0.15–0.2 cm long, margin finely papillose, margin finely ciliate; lateral lobes erect, oblong, ca. 0.15 x 0.05 cm, apex obtuse, margin finely ciliate. **Column** glabrous, ca. 0.1–0.15 cm long, foot column ca. 0.3–0.35 cm long; anther cap ca. 1 mm long, white, glabrous, apex acute; pollinia 2, subglobose, solid, cleft, yellow, stipe white, slender ca. 0.25 mm connected to small viscidium, caudicles absent. **Ovary** (with pedicel) glabrous, slender, ca. 0.3–0.5 cm long. **Capsule** cylindrical, ca. 2–2.3 cm long.

**Vietnam.** – Hon Ba (Khanh Hoa province), Lâm Đồng, Đồng Nai, Phú Quốc.

**Distribution.** – Cambodia, Himalaya, Indonesia, Laos, Myanmar, Nepal, Thailand.

**Ecology.** – Lowland forest, along the stream, common species, ca. 322 m asl. Flowering in September.



**Specimen examined.** – A. Lamb AL1163/89 (K, photo); F.R.R. Schlechter 15968 (K, photo); A.D. Kerr 1641 (K, photo)), P. Rojchana-umpawan 62 (PSU); V. B. TRUONG 136 (PSU).

90. *Spathoglottis plicata* Blume, Bijdr. Fl. Ned. Ind. 8: 401, pl. 76. 1825. Seidenf. & J.J. Wood, Orchids Penins. Malaysia Singapore: 161. 1992; Seidenf., Opera bot. 114: 86. 1992; H. H. Pham, Ill. Fl. Vietnam 3: 875. 2000; B. Comber, Orchids Sumatra: 294. 2001; N. Pearce & P. J. Cribb, Fl. Bhutan 3(3): 308. 2002; X. Chen & A. Bell in Z. Wu et al. (eds), Fl. China 25: 287. 2009. (Plate 25 A & B).

Terrestrial sympodial orchid. *Pseudobulbs* conical, ca. 0.6–2.5 cm long. *Foliage leaves*, lanceole, apex acute, glabrous, ca. 26 x 3.5–3.6 cm; petiole ca. 6–12 cm long. *Inflorescence* lateral, from the base of pseudobulb ca. 37 cm long, 10 to 15 flowered; peduncle ca. 30 cm long; sterile bracts 3, ovate, ca. 2.5 cm long, apex acute; floral bracts ovate, ca. 1.5 x 0.5 cm, apex acute. *Flower* pink, labellum purple with yellow markings, open broadly or half-closed. *Dorsal sepal* pink, glabrous, obovate, ca. 1.8 x 0.9 cm, apex acute. *Lateral sepals* glabrous, obovate, 1.6–1.8 x 0.9 cm, apex acute, dark pink prominent ridge in the middle on abaxial. *Petals* pink glabrous, broadly elliptic, ca. 2 x 1 cm, apex acute. *Labellum* pink, ca. 1.5 x 1.6 cm, glabrous except hypochile and calli, 3 lobed; mid lobe dark pink, on the tip pinkish, reniform, obtuse, apex slightly acute ca. 1.1 x 1.5 cm; lateral lobes dark pink, oblong, apex obtuse; hypochile and twin yellow rise calli pubescent with white hair. *Column* pinkish, dark pink on the tip, glabrous; anther cap and pollinia not seen. *Ovary* (with pedicel) maroon, slender, finely hairy (white), ca. 3.8 cm long. *Capsule* ellipsoid, hairy, ca. 3 cm long.

**Vietnam.** – Hon Ba (Khanh Hoa province), Lâm Đồng, Ninh Thuận, Đồng Nai.

**Distribution.** – Bhutan, Cambodia, Himalayas Indonesia, India, Myanmar, Laos, Philippines, Sri Lanka, Thailand.

**Ecology.** – Only in open area, along the main road. 1200 – 1500 m asl. The range of distribution of this species in Hon Ba quite long. Flowering all over the year.

**Specimen examined.** – W. Griffith 5193 (K, photo); G. Dennis 2356 (K, photo), P. Rojchana-umpawan 26, 197 (PSU), V. B. TRUONG 137 (PSU).

91. *Stichorkis compressa* (Blume) J. J. Wood, Orchids Mount Kinabalu 2: 531. 2011. – *Malaxis compressa* Blume, Bijdr. Fl. Ned. Ind.: 390. 1825. – *Liparis compressa* (Blume) Lindl., Gen. Sp. Orchid. Pl.: 32. 1830. – *Leptorkis compressa* (Blume) Kuntze, Revis. Gen. Pl. 2: 671. 1891. – *Cestichis compressa* (Blume) Ames, Orchidaceae 1: 8. 1905. – *Disticholiparis compressa* (Blume) Marg. & Szlach., Orchidee (Hamburg) 55: 176. 2004. (Plate 25 C & D).

Epiphytic sympodial orchid. **Rhizome** slender, creeping, ca. 0.3 cm in diam., covered by brown sheaths. **Pseudobulbs** ovate, ca. 1.3–1.5 cm long, pseudobulbs grow in group connected by rhizome, ca. 2.3–4 cm long apart. **Leaves** single, narrowly lanceolate, ca. 19–23 x 1.5–1.8 cm, apex acute, narrowly to base forming petiole; petiole ca. 1.3–2.5 cm long. **Inflorescences** terminal, heteranthous, glabrous, ca. 15–25 cm long, laterally compress, winged ca. 0.1–0.15 cm long; rachis glabrous, ca. 2.5 cm long formed by distichous, persistent, conduplicate floral bract; floral bract ca. 0.5–0.7 cm long, two lowest bracts rise continuously with the inflorescence wings. **Flower** open in succession or 2 in same time, open from base, uniform orange, ca. 1.3 cm broad, sepals behind labellum, petals somewhat 90° with ovary. **Dorsal sepal** glabrous, lanceolate, ca. 1–1.1 x 0.2 cm, margin slightly revolute, 1 mid ridges on abaxial. **Lateral sepals** glabrous, lanceolate to falcate, ca. 1 x 2 cm, margin slightly revolute, 1 mid ridges on abaxial. **Petals** glabrous, linear, ca. 1 cm long, apex acute, margin revolute. **Labellum** orange glabrous, orbicular, ca. 1.2 x 1.1 cm, apex emarginated, with short rounded mucronate from mid ridge, margin slightly; short claw at the base labellum, attached to column foot, 90° curved; 1 mid ridge from the claw run up to the tip of labellum, apex retuse, 1 very small tail in the middle of tip. **Column** orange, glabrous ca. 0.5 cm long, open broadly at base, apical part curved forward somewhat 90° with the rest of column; anther cap yellow–green, glabrous, ovate, ca. 1 mm long; pollinia

4, ca. 0.6 mm long, pale yellow, caudicles, stipe and viscidium absent. **Ovary** (with pedicel) orange, slender ca. 1.2–1.3 cm long.

**Vietnam.** – Hon Ba (Khanh Hoa province).

**Distribution.** – Malaysia, Indonesia, Philippines.

**Ecology.** – closed evergreen tropical monsoon (seasonal) mixed lower montane forest, along the stream, ca. 1323 m asl. Flowering in July.

**Specimen examined.** – S.N. Phoon et al. FRI 63796 (K, photo); M.J.S. Sands 170 (K, photo), V. B. TRUONG 109 (PSU).

**92.** *Stichorkis gibbosa* (Finet) J. J. Wood, Orchids Mount Kinabalu 2: 531. 2011. – *Liparis gibbosa* Finet, Bull. Soc. Bot. France 55: 342. 1908. – *Disticholiparis gibbosa* (Finet) Marg. & Szlach., Orchidee (Hamburg) 55: 178. 2004. (Plate 25 E & F).

Epiphytic sympodial orchid. **Rhizome** slender, ca. 0.2–0.3 cm in diam. with many node, internode ca. 0.3–1 cm long. **Pseudobulb** ovate, slightly flat, ca. 1–1.2 cm high, pseudobulbs in group connected by rhizome ca. 1–5–2 cm long apart. **Leaves** single, glabrous, narrowly lanceolate, ca. 15–18 x 0.8–0.9 cm, apex acute; petiole ca. 2–2.3 cm long. **Inflorescence** terminal, flat, winged, glabrous, synanthous, ca. 13–15 cm long; rachis ca. 2.5–3.5 cm long, formed by distichous, persistent, conduplicate floral bract; floral bract glabrous ca. 0.5–0.6 x 0.15 cm apex acute, sterile bract ca. 0.15 cm long. **Flower** orange, ca. 0.6 cm long, sepals curved down, petals erect. **Dorsal sepal** glabrous, ovate, ca. 0.4 x 0.2 cm, apex obtuse, margin slightly revolute. **Lateral sepals** glabrous, ovate, ca. 0.5 x 0.2 cm, apex obtuse or slightly acute one dark orange mid vein. **Petals** glabrous, oblanceolate, ca. 0.4 x 0.15 cm, apex obtuse. **Labellum** glabrous ca. 0.3–0.35 cm long, apex acute strongly outcurved; abaxial base of labellum margin gibbous form 2 rounded ridges; at base of labellum fleshy short claw ca. 0.1 cm long, with 2 small fleshy ridges in the middle. **Column** glabrous, ca. 0.3 cm long, winged at apical part column 2 small erect triangular; anther cap pale yellow, glabrous, broadly ovate, ca. 0.9 mm long; pollinia 4, ca. 0.4 mm long, pale yellow, caudicles, stipe and

viscidium absent. **Ovary** (with pedicel) orange, glabrous, slender, ca. 0.5–0.7 cm long. **Capsule** obovate, ca. 0.7 cm long.

**Vietnam.** – Hon Ba (Khanh Hoa province).

**Distribution.** – Cambodia, Indonesia, Laos, Malaysia, Thailand.

**Ecology.** – Closed evergreen tropical monsoon (seasonal) mixed lower montane forest, along the stream, ca. 1006 m asl. Flowering in September.

**Specimen examined.** – P.F. Hunt, 2990 (K, photo); A.F.G. Kerr 464 (K, photo), V. B. TRUONG 110 (PSU).

**93.** *Thecostele alata* (Roxb.) C.S.P. Parish & Rehb.f., Trans. Linn. Soc. London 30: 144. 1874; Seidenf. & J.J. Wood, Orchids Penins. Malaysia Singapore 562.1992; Seidenf., Opera bot. 114: 346. 1992; H.H. Pham, Ill. Fl. Vietnam 3: 922. 2000; B. Comber, Orchids Sumatra: 294. 2001; T. Seelanan & H. A. Pedersen in Santisuk & Balslev (eds), Fl. Thailand 12 (2): 652. 2014 – *Cymbidium alatum* Roxb., Fl. Ind. 3: 459. 1832. (Plate 25 G & H).

Epiphytic sympodial orchid. **Pseudobulbs** conical, ca. 4.5–7 x 1.5 cm long, close together, 4 distinct ridges. **Leaves** elliptic–narrow elliptic, glabrous, ca. 19–20 x 3.5–4 cm, apex acute; petiole stalk ca. 1.5 cm long. **Inflorescence** lateral, grow from base of pseudobulbs, pendulous, ca. 30–40 cm long; rachis ca. 15–30 cm long. inflorescence bract 1 to 4, ovate, ca. 0.4–0.5 cm long, apex acute, brown–brownish, floral bract very small glabrous, broadly triangular ca. 0.15–0.2 cm long, apex acute. **Flower** ca. 1.5 cm long, sepals pale yellow with maroon blotches, petals pale white with maroon stripe in middle, labellum white with maroon blotches, margin finely ciliate. **Dorsal sepal** glabrous, oblong, concave ca. 0.5–0.7 x 0.5 cm, apex acute, red mid blotches and dots. **Lateral sepals** glabrous, ovate ca. 0.6–1 x 0.4–0.5 cm, apex acute, dark red blotch. **Petals** glabrous, linear, ca. 0.9–1 x 0.05–0.1 cm, apex obtuse slightly curved down, red mid vein. **Labellum** short claw adnate to column foot, ca. 0.6–0.7 cm long, 3–lobed; mid lobe obovate, apex obtuse deep emarginate bilobules; lateral lobes oblong, falcate erect ca. 0.25 x 0.1 cm, apex obtuse. **Column** glabrous, 0.5–0.6 x 0.15–

0.2 cm, column foot 0.2–0.25 cm long, apex 2 white stelidia ca. 0.25 cm long, apex acute; anther cap white, ca. 1 mm long, pollinia 2, globose, ca. 0.4 mm long, deep cleft, solid, yellow, attached with slender short stipe to viscidium, caudicles absent. **Ovary** (with pedicel) ca. 0.5–0.8 cm long, green. **Capsule** fusiform, ca. 3–3.5 cm long.

**Vietnam.** – Hon Ba (Khanh Hoa province), Phú Lộc, Bạch Mã, Thừa Thiên – Huế, Lộc Ninh, Sông Bé.

**Distribution.** – Bangladesh, Indonesia, Laos, Malaysia, Myanmar, Philippines, Thailand.

**Ecology.** – Closed evergreen tropical monsoon (seasonal) broad-leaved lowland forest, along the stream, ca. 350 m asl. Flowering in September

**Specimen examined.** – L. Jr. Wray 2557 (K, photo); R. Yong 224 (K, photo), Rojchana-umpawan 213 (PSU), V. B. TRUONG 140 (PSU)

**94.** *Thrixspermum centipeda* Lour., Fl. Cochinch.: 520. 1790; Seidenf. & J.J. Wood, Orchids Penins. Malaysia Singapore: 643. 1992; Seidenf., Opera bot. 114: 402. 1992; H.H.Pharm, Ill. Fl. Vietnam 3: 948. 2000; N. Pearce & P. J. Cribb, Fl. Bhutan 3(3): 128. 2002; SX. Chen & A. Bell in Z. Wu et al. (eds), Fl. China 25: 470. 2009. – *Epidendrum thrixspermum* Raeusch., Nomencl. Bot., ed. 3: 265. 1797. – *Sarcochilus centipeda* (Lour.) Náves in F.M.Blanco, Fl. Filip., ed. 3, 4 (13A): 238. 1880. (Plate 26 A).

Epiphytic monopodial orchid. Stem almost pendulous, ca. 15cm long, covered by leaf sheaths. **Leaves** oblong, ca. 9–11.5 x 2.5–3 cm, apex not equally 2 lobes; petiole sheaths. **Inflorescence** lateral along the stem, ca. 10–16 cm long; rachis glabrous, ca. 3.5–6 cm long, flat; floral bract glabrous persistent, distichous, conduplicate, ca. 0.3–0.6 cm long, apex acute. **Flower** open widely in succession (rarely 2 flowers in same time). **Dorsal sepal** glabrous, lanceolate to narrow elliptic, ca. 2.4–2.5 x 0.25 cm, apex acuminate. **Lateral sepals** glabrous, linear to lanceolate, ca. 2.5 x 0.25 cm, curved down, apex acuminate. **Petals** glabrous, linear to lanceolate, ca. 2.2–2.3 cm x 0.2–0.25 cm, apex acuminate. **Labellum** glabrous, saccate, apex obtuse, ca. 1 cm long, 3 lobed;

mid lobe white, ca. 0.5–0.6 x 0.2–0.25 cm, apex obtuse, thick and fleshy, adaxial finely papillose, base pale yellow with brown–red blotches; lateral lobes glabrous, ovate with broadly base, ca. 0.5–0.7 x 0.2–0.3 cm, erect, apex obtuse, point forward, margin yellow, middle yellow with red–brown dots; callus on disk at saccated labellum. **Column** white, glabrous, short, ca. 2 mm long, column foot ca. 2.5 mm long; anther cap and pollinia not seen. **Ovary** (with pedicel) glabrous, slender ca. 1–1.1 cm long. **Capsule** lanceolate ca. 6.4–6.5 cm long, 6 high ridges.

**Vietnam.** – Hon Ba (Khanh Hoa province).

**Distribution.** – China, Cambodia, India, Indonesia, Laos, Malaysia, Myanmar, Thailand.

**Ecology.** – Closed evergreen tropical monsoon (seasonal) broad-leaved lowland forest, along the stream, ca. 334 m asl. Flowering in September to October.

**Specimen examined.** – S. A. Thomas 228 (K, photo); G Seidenfaden. 2373 (K, photo); C.E. Carr 131 (K, photo), P. Rojchana-umpawan 61 (PSU), V. B. TRUONG 142 (PSU).

95. *Thrixspermum fragrans* Ridl., J. Nat. Hist. Soc. Siam 4: 121. 1921; Seidenf., Opera bot. 114: 403. 1992; H. H. Pham, Ill. Fl. Vietnam 3: 949. 2000. (Plate 26 B & C).

Epiphytic monopodial orchid. **Stem** pendulous, ca. 6–7 cm long covered by leaves sheaths. **Leaves** lanceolate, ca. 3.5–10 x 1.1–1.5 cm, apex emarginated–unequally 2 lobes. **Inflorescence** 5 to 6, lateral, glabrous, ca. 1.11–2.2 cm long; peduncle glabrous, short, 0.4–0.5 cm long; rachis ca. 1.4 cm long, slightly flat, from 1 to 2 flowered; floral bract glabrous, ovate, conduplicate, ascending overlapping, ca. 0.3–0.4 cm long, apex acute. **Flower** white, open widely, ca. 1.5 cm long. **Dorsal sepal** lanceolate, ca. 1–1.1 x 0.4–0.5 cm, apex acuminate. **Lateral sepals** ovate to falcate, ca. 1.1–1.5 x 0.4–0.5 cm, apex acuminate. **Petals** linear to lanceolate, ca. 1.1–1.2 x 0.2–0.3 cm, apex acuminate. **Labellum** saccate, 3 lobed; mid lobe white, conical shape ca. 0.4–0.5 cm long, apex obtuse; lateral lobes ca. 1.2–1.3 cm long, apex obtuse, irregular red blotches; adaxial disk of labellum 2 short slender triangular calli, at base of saccate

finely orange or yellow papillose; anther cap white, suborbicular, glabrous, ca. 1.1 mm long; pollinia 4, ca. long mm long, arrange in 2 pairs, solid, caudicles absent, stipe and viscidium present. **Column** white glabrous, 0.6 x 0.3 cm, base to middle with red dots. **Ovary** (with pedicel) slender, ca. 0.4–0.5 cm long. **Capsule** not seen.

**Vietnam.** – Hon Ba (Khanh Hoa province).

**Distribution.** – Endemic to Vietnam.

**Ecology.** – Closed evergreen tropical monsoon (seasonal) mixed lower montane forest, rare species, ca. 815 m asl. Flowering in middle of May.

**Specimen examined.** – V. B. TRUONG 141 (PSU).

96. *Trias nasuta* (Rchb.f.) Stapf, Bot. Mag. 152: t. 9150. 1928; Seidenf., Opera bot. 114: 259. 1992; H.H.Pham, Ill. Fl. Vietnam 3: 949. 2000. – *Bulbophyllum nasutum* Rchb.f., Gard. Chron. 1871: 1482. 1871. – *Phyllorkis nasuta* (Rchb.f.) Kuntze, Revis. Gen. Pl. 2: 677. 1891. (Plate 26 D).

Epiphytic sympodial orchid. **Pseudobulbs** ovoid ca. 1.1–1.8 x 0.8–1.5 cm, grow in group, connect by rhizome, ca. 0.3–1.2 cm apart. **Rhizome** creeping, ca. 0.2 cm in diam., covered by brown sheaths. **Leaves** lanceolate, ca. 6–11.5 x 1–2 cm, apex acute; petiole twisted, ca. 0.5 cm long. **Inflorescence** 1 or 2, lateral, from base of pseudobulbs; peduncle covered brown sheaths, very short, ca. 1.5 mm long; floral bract brown, ovate to triangular, ca. 0.2–0.3 cm long, apex obtuse. **Flower** open widely ca. 2 cm across, sepals and petals pale yellow-green, labellum yellow with dark purple in middle. **Dorsal sepal** ovate, ca. 1.5 x 1 cm, apex acute, 5–7 veins. **Lateral sepals** broadly ovate, ca. 1.5 x 0.5–0.8 cm, apex acuminate, 5–6 veins. **Petals** linear, ca. 0.4–0.5 x 0.15–0.2 cm, apex subacute, one red mid vein. **Labellum** simple, oblong, ca. 1–1.1 x 0.5 cm, scatter papillose on adaxial, at base on short yellow ridge run from base ca. 0.3 cm long; the auricle thin, slender, broadly open at base and narrowly to apex, ca. 0.5 cm long, apex subacute, pointing forward the apex of labellum. **Column** ca. 0.5 cm long, foot column ca. 0.4 cm long, open broadly at base, curved on the apex; stelidia ca 4 mm long, yellow, apex purple; operculum short prolongation, ca. 2 mm long, apex obtuse, pale yellow;

pollinia 4, solid, equal size, stipe, caudicles and viscidium absent. **Ovary** (with pedicel) ca. 1.6 cm long. **Capsule** broadly obovate, ca. 2.5 cm long, 1.5 cm in diam.

**Vietnam.** – Hon Ba (Khanh Hoa province), Sa Thầy, Kon Tum, Tân Biên, Tây Ninh, Tây Nguyên, Lâm Đồng, Đồng Nai.

**Distribution.** – Burma, Thailand.

**Ecology.** – Closed evergreen tropical monsoon (seasonal) broad-leaved lowland forest, along the stream, ca. 330 m asl. Flowering time December.

**Specimen examined.** – C. Curtis s.n.; C.S.P. Parish 263 (K, photo), V. B. TRUONG 148 (PSU).

97. *Trichoglottis retusa* Blume, Bijdr. Fl. Ned. Ind.: 360. 1825; Seidenf. & J. J. Wood, Orchids Penins. Malaysia Singapore: 601. 1992; Seidenf., Opera bot. 114: 374. 1992; H. H. Pham, Ill. Fl. Vietnam 3: 949. 2000; J. B. Comber, Orchids Sumatra: 931. 2001. (Plate 26 E).

Epiphytic monopodial orchid. **Stem** climbing, ascending or pendulous in occasions. **Leaves** lanceolate, distichous, ca. 6–10.3 x 1.8–2.3 cm, apex retuse, not equally 2 lobes, very small seta in the middle; petiole sheath 1.3–2 cm long. **Inflorescence** glabrous, lateral, usually opposite of leaves; peduncle ca. 0.3 cm long; floral bract ovate to triangular, ca. 0.2–0.3 cm long, apex acute. **Flower** open widely ca. 1.5 cm in diam., sepals, petals and labellum yellow with purple blotches. **Dorsal sepal** lanceolate, ca. 1.8–1.85 x 0.4–0.5 cm, apex acute. **Lateral sepals** lanceolate to falcate, ca. 1.7–1.9 x 0.5 cm, apex acute, slightly broader than dorsal sepal. **Petals** narrowly lanceolate ca. 1.5–1.6 x 0.2–0.3 cm, apex acute. **Labellum** spurred, oblong in outline, ca. 1.5 cm long, 3-lobed; mid lobe simple, oblong, apex obtuse mucronate, adaxial densely hair, near at base small callus; lateral lobes from base of mid lobe, erect, narrowly lanceolate, apex acute, margin scatter hair; spur white, glabrous, ca. 0.6 cm long, apex obtuse, in middle one short triangular ridges, apex acute. **Column** glabrous, shorted, winged, ca. 0.4–0.5 cm long, lacking foot; stelidia strongly curved almost embrace apical part of column; anther cap ovate, yellow–red ca. 1 mm long; pollinia 4,



subglobose, arrange into 2 pairs, unequal size; stipe white, slender, ca. 0.7 mm long, viscidium almost as long as stipe, caudicles absent. *Ovary* (with pedicel) ca. 1.5–1.7 cm long. *Capsule* (young), ca. 1.5 cm long

**Vietnam.** – Hon Ba (Khanh Hoa province), Lâm Đồng, Đồng Nai.

**Distribution.** – Indonesia, Malaysia, Myanmar, Thailand.

**Ecology.** – Closed evergreen tropical monsoon (seasonal) broad-leaved lowland forest, along the stream, ca. 246 m asl. Flowering in May.

**Specimen examined.** – C. L. Blume s.n. (K, photo); L. G. Saw, FRI 44759 (K, photo), V. B. TRUONG 144 (PSU).

98. *Trichoglottis seidenfadenii* Aver., Bot. Zhurn. 73: 429. 1988; Seidenf. & J. J. Wood, Orchids Penins. Malaysia & Singapore: 601. 1992; Seidenf., Opera bot. 114: 374. 1992; H. H. Pham, Ill. Fl. Vietnam 3: 949. 2000. (Plate 26 F).

Epiphytic monopodial orchid. *Stem* climbing, slender, ca. 50–80 cm long, erect, slightly flat. *Leaves* glabrous, distichous, lanceolate, ca. 4.5–9 x 1.5–1.7 cm, apex retuse, one small seta in the middle. *Inflorescence* glabrous, lateral, opposite with leaves, single flowered; peduncle glabrous, very short ca. 0.4–0.5 cm long; floral bracts, ca. 0.1 cm long, apex obtuse, slightly acute. *Flower* widely open sepals petals yellow with distinct brown blotches, labellum white, hairy. *Dorsal sepal* lanceolate, concave, ca. 1.2–1.7 x 0.4–0.5 cm, apex acute. *Lateral sepals* broader than dorsal sepal, ovate, ca. 1.3–1.5 x 0.5–0.7 cm, apex subacute. *Petals* glabrous, linear to lanceolate, ca. 1–1.3 x 0.3–0.4 cm apex obtuse. *Labellum* 3 lobed; mid lobe ovate somewhat triangular, white, ca. 1.2–1.3 x 0.3–0.5 cm, adaxial densely finely long pubescent with hair, pink in the middle, hypochile short at labellum base, concave ca. 0.1–0.15 cm long, finely short pubescent with white hair; lateral lobes white, margin slightly hairy, erect, ca. 0.2 x 0.25 cm, apex obtuse, abaxial 2 small triangular horizontal spread, ca. 0.15–0.2 cm long, apex acute. *Column* white, glabrous, ca. 0.4–0.8 cm long, narrowly at base; stelia 2, ca. 1 mm long, slightly curved; anther cap ca. 1.1 mm long, white; pollinia

4, ca. 0.6 mm long, in 2 pairs, stipe ca. 0.5 mm long; caudicles absent, viscidium present. **Ovary** (with pedicel) greenish–yellow, slender, glabrous. **Capsule** not seen  
**Vietnam.** – Hon Ba (Khanh Hoa province), Lâm Đồng, Đồng Nai, Côn Đảo.

**Distribution.** – Thailand.

**Ecology.** – Closed evergreen tropical monsoon (seasonal) broad-leaved lowland forest, along the stream, ca. 250 m asl. Flowering in May.

**Specimen examined.** – V. B. TRUONG 145 (PSU).

99. *Trichotosia microphylla* Blume; Seidenf. & J.J. Wood, Orchids Penins. Malaysia Singapore: 261. 1992; Seidenf., Opera bot. 114: 163. 1992; H. H. Pham, Ill. Fl. Vietnam 3: 800. 2000; J. B. Comber, Orchids Sumatra: 514. 2001; S. C. Chen & A. Bell in Z. Wu et al. (eds), Fl. China 25: 358. 2009. – *Eria microphylla* (Blume) Blume, Mus. Bot. 2: 184. 1856. – *Pinalia microphylla* (Blume) Kuntze, Revis. Gen. Pl. 2: 678. 1891. (Plate 26 G & H).

Epiphytic sympodial orchid. **Stem** up to 3–6 cm long, hirsute, cylindric, slender, cover by leaves sheaths, grow in group connected by rhizome ca. 1.5 cm apart. **Rhizome** slender, covered by white sheaths. **Leaves** 8 to 15, fleshy, pubescent with white hair, lanceolate, ca. 0.5–1.5 x 0.3–0.5 cm, apex acute or obtuse. **Inflorescence** terminal, single flowered. **Flower** greenish–yellow, abaxial pubescent with white hair, petals, sepals and labellum yellow. **Dorsal sepal** ovate, ca. 0.2–0.3 x 0.1 cm, apex obtuse. **Lateral sepals** oblong, ca. 0.4–0.5 x 0.3 cm, apex obtuse, lateral sepals forming short mentum, ca. 0.2 cm long. **Petals** oblong, ca. 0.2–0.3 x 0.1 cm, apex obtuse. **Labellum** simple, oblong, ca. 0.4–0.5 x 0.1–0.2 cm, apex obtuse, slightly outcurved, contracted in the middle; margin finely ciliate; adaxial finely papillose; at base one elliptic callus in the middle (dark color), from there 2 lateral swelling ridges extent to the middle of labellum. **Column** glabrous, ca. 0.1 cm long, foot column ca. 0.3 cm long; anther cap yellow, broadly ovate, ca. 1 mm long slightly curved in the middle; pollinia 8, ca. 0.3 mm long, stipe and viscidium absent, caudicles present. **Ovary** (with pedicel) slender, ca. 0.3 cm long, pubescent with white hair. **Capsule** not seen.

**Vietnam.** – Hon Ba (Khanh Hoa province) Lâm Đồng, Quảng Ninh, Thanh Hóa, Thừa Thiên – Huế, Kon Tum.

**Distribution.** – China, Malaysia, Thailand.

**Ecology.** – Closed evergreen tropical monsoon (seasonal) broad-leaved lowland forest, along the stream, ca. 267 m asl. Flowering in March–April.

**Specimen examined.** – J. J. Wood, 620 (K, photo); Cumberlege 892 (K, photo), V. B. TRUONG 147 (PSU).

**100.** *Trichotosia velutina* (Lodd. ex Lindl.) Kraenzl., Pflanzenr. 140. 1911; Seidenf. & J.J. Wood, Orchids Penins. Malaysia Singapore: 265. 1992; Seidenf., Opera bot. 114: 163. 1992; H. H. Pham, Ill. Fl. Vietnam 3: 800. 2000; J. B. Comber, Orchids Sumatra: 519. 2001. – *Eria velutina* Lodd. ex Lindl., Edwards's Bot. Reg. 26(Misc.): 86. 1840. – *Pinalia velutina* (Lodd. ex Lindl.) Kuntze, Revis. Gen. Pl. 2: 679. 1891. (Plate 27 A & B).

Epiphytic sympodial orchid. **Stems** ca. 21–45 cm long, pendulous, pubescent with brown hair. **Leaves** lanceolate, sessile, ca. 7–11 x 2–2.5 cm, pubescent with brown hair, apex not equally 2 lobes; leaves sheath ca. 3.3–3.5 cm long. **Inflorescence** 1 to 4, lateral, along the stem, ca. 1–1.5 cm long, pubescent with brown hair; inflorescence bract ovate, ca. 0.3–0.4 cm long, apex obtuse, pubescent with brown hair; floral bract green, ovate, concave, ca. 0.5–0.8 cm long, apex obtuse, pubescent with brown hair. **Flower** open widely, sepals white, pubescent with brown hair, petals and labellum white, glabrous. **Dorsal sepal** narrowly ovate, ca. 1 x 0.3 cm, apex obtuse or subacute. **Lateral sepals** ovate to triangular, concave, ca. 1 x 0.5 cm, apex obtuse, adnate to the column foot forming mentum, ca. 0.5 cm long, apex obtuse. **Petals** narrowly oblong, glabrous, ca. 0.8 x 0.1 cm. **Labellum** simple, spatulate, ca. 1.2 cm long; adaxial in the middle 2 ridges fused in base extent in near the tip and separate; between 2 ridges on tip finely yellow papillose band, base margin hairy. **Column** white, ca. 1–1.2 cm long, middle reddish, slightly curved in the middle; anther cap dark purple in apical part,

broadly ovate, ca. 1.3 mm long; pollinia 8, ca. 0.7 mm long, pale yellow, stipe and viscidium absent, caudicles present. *Capsule* not seen.

**Vietnam.** – Hon Ba (Khanh Hoa province), Thanh Hóa, Kon Tum, Đồng Nai, Phú Quốc.

**Distribution.** – Indonesia, Malaysia, Myanmar, Thailand.

**Ecology.** – Closed evergreen tropical monsoon (seasonal) broad-leaved lowland forest, along the stream, ca. 1215 m asl. Flowering in July.

**Specimen examined.** – R. Yong 230 (K, photo); Carr, C.E. K117 (K); P. Rojchanaumpawan 109, 201 (PSU), V. B. TRUONG 146 (PSU).

**101.** *Vanilla atropogon* Schuit., Aver. & Rybková, Orchideen J. 1: 10. 2013. (Plate 27 C & D).

Terrestrial or lithophyte in occasion, monopodial, climbing or creeping orchid. *Stem* fleshy, up to 3 m long, internodes ca. 5.5–11.5 cm long. *Leaves* elliptic, ca. 14–17.5 x 4.7–6.4 cm, apex acute; petiole ca. 1.5–2 cm. *Inflorescence* terminal, subsessile, ca. 6–10 cm long, 11 to 30 flowered; floral bracts oblong, ca. 0.6–1 cm long, apex acute. *Flower* open widely, sepal and petal pale yellow–green, labellum with irregular dark maroon blotches. *Dorsal sepal* oblong, concave, ca. 3.3–3.5 x 1.3–1.4 cm, apex acute. *Lateral sepals* oblong, concave, ca. 3.2–3.3 x 1.2–1.3 cm, apex obtuse or slightly acute. *Petals* elliptic, concave, ca. 3.2–3.3 x 1.4–1.5 cm, 1 prominent ridges in middle. *Labellum* ca. 1.1 x 2.1 cm, when flattened ca. 2.5–2.6 cm long, 3 lobed; mid lobe sub-orbicular ca. 1.2 x 1.5 cm, apex truncate or emarginated, numerous subulate hair on adaxial, maroon on base, pink on the middle and white on the tip; lateral lobes sub-orbicular, ca. 1 cm x 0.9 cm, apex rounded, margin erose, adaxial base of lateral lobes with numerous, parallel ridges; central callus ca. 0.5 cm long on adaxial of labellum, white finely pillose hair, pointing backward. *Column* white slender, slightly curved towards the apex, ca. 1.2–1.3 x 0.2–0.3 cm, glabrous; anther cap ca. 3 mm long; pollinia 4, clavate, ca. 1.7 mm long, 2 outer longer than 2 inner, white; caudicles, stipe and

viscidium absent. **Ovary** (with pedicel) glabrous, ca. 3.5–4.5 cm long. **Fruit** (young green) fleshy, a berry, ca. 5 cm long.

**Vietnam.** – Hon Ba (Khanh Hoa province).

**Distribution.** – Endemic to Vietnam.

**Ecology.** – Lowland evergreen forest, along the stream, ca. 235 m asl. Flowering in February to March.

**Specimen examined.** – Rybkova et al. 2013 00920 (K, photo), V. B. TRUONG 150 (PSU).

**102.** *Vanilla albida* Blume, Catalogus: 100. 1823; J. B. Comber, Orchid of Java: 76. 1990; Seidenf., Opera Bot. 114: 72. 1992; Seidenf. & J. J. Wood, Orchids Penins. Malaysia Singapore: 127. 1992; J.B.Comber, Orchids Sumatra: 130. 2001; H. A. Pedersen et al. in T. Santisuk & Larsen (eds), Fl. Thailand 12(1): 268. 2011. (Plate 27 E & F).

Terrestrial or epiphytic monopodial climbing orchid. **Stem** fleshy, internodes 10–12 cm long, transparent sticky latex. **Leaves** elliptic, 10–18.1 x 3–4.2 cm; petiole 1–1.8 cm long. **Inflorescence** lateral, from leaves axillary, ca. 1.2–3.8 cm long, 4 to 9 flowered; floral bracts ovate, ca. 0.4–0.5 x 0.6 cm (flattened), apex acute. **Flower** long-pedicelled, sepals greenish from the base, on the tip pure white, labellum white, margin wavy. **Dorsal sepal** oblong, glabrous, ca. 5–5.1 x 1.2 cm, apex acute. **Lateral sepals** glabrous, oblong, ca. 5.7 x 1.3 cm, apex acute. **Petals** glabrous, oblong, ca. 5.7 x 1.2 cm, apex acute, 1 prominent mid ridges on abaxial. **Labellum** slightly 3 lobed, ca. 3 cm when flattened, callus white in the middle of labellum, fringed; mid lobe margin on the tip of mid-lobe outcurved, long white papillae on the tip of mid lobe; lateral lobes margin edge slightly wavy, adnate, embrace with almost the length of column. **Column** ca. 4.4 cm long, slender, slightly curved towards the apex .white, greenish–yellow in the middle; anther cap pale green ca. 3–3.5 mm long; pollinia, 4, ca. 1.6–1.9 mm long, 2 outer longer than 2 inner, clavate, apex obtuse, yellow, caudicles, stipe and viscidium absent. **Ovary** (with pedicel) ca. 4–4.1 cm long. **Berry** not seen.

**Vietnam.** – Hon Ba (Khanh Hoa province), Đà Lạt.

**Distribution.** – Indonesia, Malaysia, Taiwan, Thailand.

**Ecology.** – Closed evergreen tropical monsoon (seasonal) broad-leaved lowland forest, ca. 300 m asl. Flowering in March.

**Specimen examined.** – H. C. Robinson, s.n. (K, photo); A.F.G. Kerr, 0805A (K, photo), V. B. TRUONG 152 (PSU).

### Unidentified species

Among 23 unresolved species, 8 species are unidentified to species level according to the incomplete materials, 15 species are still uncertain for their specific status due to the morphological variations as well as the available materials used in this study.

#### 103. *Bulbophyllum* sp. (Plate 28 A & B).

Epiphytic sympodial orchid. *Pseudobulb* orbicular to sub-orbicular 4–5 cm in diam., close together. *Leaves* single, oblong, ca. 0.9–1 x 0.3–0.4 cm, apex acute or slightly unequal 2 lobes; petiole short, ca. 1–1.5 mm. *Inflorescence* lateral from base of pseudobulb, ca. 1–2 cm long, from 1 to 3 for each pseudobulb, single flowered; floral bract small, ovate, ca. 1.5–2 mm long, apex acute. *Flower* open weakly, dorsal sepal and petals pale yellow–green with orange stripes, lateral sepals orange, labellum maroon, apex yellow. *Dorsal sepal* narrowly ovate, ca. 5–5.5 x 1.5–2 mm, apex acute, 3 stripes. *Lateral sepals* longer than dorsal sepal, lanceolate, ca. 1 x 0.4–0.5 cm, apex acute. *Petals* small, linear, ca. 2–2.5 x 0.5 mm, apex obtuse, slightly contracted in middle. labellum simple, glabrous, (inconspicuous 3 lobed), ca. 3–3.5 mm long, strongly curved down near base, margin outcurved; at base one middle channeled from base to position labellum outcurved. *Column* dark red, ca. 0.5 mm long, column foot much longer than column, ca. 2 mm long; stelidia subulate ca. 0.5–1 mm long, apex acute; anther cap, pollinia not seen. *Ovary* (with pedicel) orange, slender, glabrous, ca. 1.2 cm long. *Capsule* not seen.

**Vietnam.** – Hon Bà (Khanh Hoa province).

**Ditribution.** –

**Ecology.** – Epiphyte on tree branches, above 1300m asl. Flowering in September. Rare species.

**Specimen examined.** – V. B. TRUONG 157 (PSU)

**104. *Bulbophyllum* sp.** (Plate 28 C & D)

Epiphytic sympodial orchid. *Pseudobulb* elliptic, arrange close together ca. 0.3 cm x 0.2 cm, occur in group, connected by very short rhizome. Leaves single, elliptic, ca. 0.4–0.45 x 0.25 cm, apex acute. *Inflorescence* lateral from base of pseudobulb; inflorescence bract 1, ovate, ca. 0.5 mm long, apex acute; floral bract ca. 0.5 mm long, apex acute. *Flower* single sepals and petals orange, labellum dark red. *Dorsal sepal* pale orange, ovate, 2 x 1 mm, apex acute, 3 orange stripes. *Lateral sepals* pale orange, broadly ovate, ca. 2 x 1.5 mm, apex acute, 3 orange stripes. *Petals* lanceolate, ca. 1 mm x 0.5 mm, apex subacute. *Labellum* dark red, 3 lobed, mid lobe fleshy, broadly elliptic, glabrous, apex obtuse; lateral lobes suberect, apex acute, dark red. *Column* ca. 0.5 mm long; stelidia not seen; anther cap ovate, apex acute, yellow, caudicles, stipe and viscidium absent. *Ovary* (with pedicel) ca. 2 mm long, slender, yellow. *Capsule* not seen

**Vietnam.** – Hon Bà (Khanh Hoa province).

**Ditribution.** –

**Ecology.** – Epiphyte on one woody climber, along the stream, ca. 800 m asl. very rare species. Grow in same place with *Paphiopedilum delenatii*.

**Specimen examined.** – V. B. TRUONG 158 (PSU).

Note: This species belongs to section *Minutissimum* and close to *B. moniliforme*, but the pseudobulbs of this species is elliptic but *B. moniliforme* rounded.

105. *Cleisostoma* sp. (Plate 28 E)

Epiphytic monopodial orchid *Stem* arching, stout, up to 30 cm long. *Leaves* narrow elliptic, ca. 10-14.5 x 1.8-2 cm, apex not equally 2 lobed, green; petiole sheath, 2-3cm long, glabrous, brown with dark red dots. *Inflorescence* axillary, along the stem branched, green, 13 cm long; rachis ca. 6-12 cm long; inflorescence bract around 2-3, ca. 0.3-0.5 cm long, brown-brownish; floral bract ovate, ca. 0.15-0.2 cm long, apex acute, dark brown. *Flower* open widely from base to tip, yellow with dark red lines in middle. *Dorsal sepal* oblanceolate, 1.2-1.25 x 0.8-0.85 cm (flattened), adaxial margin yellow with middle dark red, one small yellow vein from basal to middle. *Lateral sepals* broadly oblanceolate, ca. 1.3-1.35x 0.2-0.3cm (flattened), apex acute-obtuse. *Petals* elliptic, ca. 1.1-1.15 x 0.2-0.25 cm, apex acute, curved inside. *Labellum* yellow, fleshy, thick, ca. 1 cm long, saccate, 3 lobed; mid lobe ca. 0.5 cm long, yellow, bearing 2 teeth on the tip and one thick fleshy subglobose callus; lateral lobes erect, 0.8 cm long, apex acute, adaxial 2 red veins. *Column* short, 0.75 cm long, 2 wings on the basal 0.35cm long, yellow outside, on the tip 1 red line about 0.25cm long, inside white yellowish; anther cap ovate to obovate ca. 0.3-0.4 cm long, white with some dark red lines; pollinia yellow, elliptic, ca. 0.15 cm long, caudicle absent, stipe and viscidium present. *Ovary* (with pedicel) ca. 2-2.3 cm long, dark red, curve toward in the middle. *Capsule* not seen.

**Vietnam.** – Hon Bà (Khanh Hoa province).

**Distribution.** –

**Ecology.** – Epiphyte on tree trunk, around the top of mountain. Flowering in September.

Rare species.

**Specimen examined.** – V. B. TRUONG 066 (PSU).

Note: This species looks quite close to *C. birmanicum* but inflorescent shorter, labellum quite different, having bigger callus on disk, also teeth on mid lobe.



106. *Cleisocentron cf. klossii* (Ridl.) Garay (Plate 28 F).

This species impossible to collect the specimen because it epiphyte on very high tree, about 10 m. Epiphytic monopodial orchid. *Stem* elongated. *Leaves* distichous, sheathing at base. *Inflorescence* lateral, raceme, pendulous. *Flower* many, pink, white spur.

**Vietnam.** – Hon Bà (Khanh Hoa province).

**Distribution.** Endemic of Vietnam.

107. *Dendrobium* sp. (Plate 28 G).

Epiphytic sympodial orchid. *Stem* ca. 20-50cm long, erect, internode ca. 3.5-4 cm long, internode close to the top shorter than below. *Leaves* oblong ca. 4.5-7.5 cm long x 1.5-2 cm, apex obtuse unequally. *Flower* single near tip of stem, open widely. *Dorsal sepal* white, elliptic, 3 x 1.1 cm, apex acute. *Lateral sepals* white, elliptic, ca. 3.1-3.2 x 1.1 cm, apex acute, 2 lateral sepals forming mentum, ca. 2 cm long, white, cylindric. *Petals* white broadly elliptic ca. 2.6-2.7 x 1.4-1.5 cm, apex acute. *Labellum* ca. 4 x 1.9-2 cm, 3 lobed, (flattened); mid lobe white, ca. 3 x 1.2 cm, apex acute, narrowly ovate; lateral lobes erect, ca. 1 x 1.5 cm, apex obtuse, embrace column; adaxial with 7 ridges from base run up to middle of mid lobe. *Column* red, ca. 1 cm long, caudicle, stipe and viscidium absent. *Ovary* (with pedicel) white 2.5 cm long. *Capsule* not seen.

**Vietnam.** – Hon Bà (Khanh Hoa province).

**Distribution.** –

**Ecology.** – Epiphyte on very high tree, on the top of mountain, ca. 1520 m asl. Flowering in May.

**Specimen examined.** – V. B. TRUONG 081 (PSU).

Note: This species quite close to *Dendrobium trankimianum*, but labellum embrace the column and flower not open widely, *Dendrobium* sp. has seven prominent ridges on labellum but *D. trankimianum* has only 5 ridges.

**108.** *Dendrobium cf. brunneum* Schuit. & Peter B. Adams. – *Epigeneium chapaense* Gagnep., Bull. Mus. Natl. Hist. Nat., sér. 2, 4: 596. 1932. – *Sarcopodium chapaense* (Gagnep.) Tang & F.T.Wang, Acta Phytotax. Sin. 1: 83. 1951. (Plate 28 H)

Epiphytic sympodial orchid. *Rhizome* creeping, stout, woody. *Pseudobulb* elliptic, dark brown sheathing, hard and stout, hard root from below. *Leaves* 1, obovate, apex emarginate. *Inflorescence* terminal, heteranthous, single flower; floral bract pale brown, membranous. *Flower* brown–yellow, open widely. *Dorsal sepal* ovate, apex acute, close down to column. *Lateral sepals* broader than dorsal sepal, broadly ovate, apex acute, apical part outcurved. *Petals* linear to lanceolate, apex acute. *Labellum* 3 lobed; mid lobe obovate in outline shape, apex obtuse and deep emarginated divided into 2 bi-lobules; lateral lobes suberect, apex obtuse; adaxial at base 2 short raise quadrate ridge. *Column* winged, without stolidia, slightly curved on the apical part, anther cap elliptic, pale brown–white; pollinia not seen. Ovary (with pedicel) green, glabrous with longitude 6 ridges. *Capsule* not seen.

**Vietnam.** – Hon Bà (Khanh Hoa province).

**Distribution.** – Endemic of Vietnam. (North of Vietnam).

**Ecology.** – Epiphyte on tree branched around top of mountain with humidity and cool conditions, above 1300 m asl. Flowering in October. Flower rare.

**Specimen examined.** – V. B. TRUONG 096 (PSU).

**109.** *Dendrobium cf. cacuminis* Gagnep., Bull. Mus. Natl. Hist. Nat., sér. 2, 2: 233 1930. – *Sarcopodium cacuminis* (Gagnep.) Tang & F.T.Wang, Acta Phytotax. Sin. 1: 82. 1951. – *Epigeneium cacuminis* (Gagnep.) Summerh., Kew Bull. 12: 260. 1957. (Plate 29 A)

Epiphytic sympodial orchid. *Rhizome* creeping, woody, stout ca. 0.3 cm in diam. *Pseudobulb* usually brown with pale green- yellow, ovoid, ca. 2.5 cm high, stout, hard, glossy, grow close together. *Leaves* 2, oblanceolate, ca. 10-12 x 1.2-1.5 cm, apex retuse, purple mid vein. *Inflorescence* terminal, heteranthous, ca. 20 cm long; peduncle

ca. 7 cm long; rachis ca. 14-15 cm long, ca. 16 flowered; floral bract brown, ovate ca. 0.5 cm long, apex acute. **Flower** open widely from base, sepals and petals white, yellow labellum. **Dorsal sepal** lanceolate, ca. 1.5 x 0.4 cm, apex obtuse to subacute. **Lateral** sepals lanceolate, broader than dorsal sepal, ca. 1.5 cm x 0.6 cm, apex acute. **Petals** lanceolate, ca. 1.5 x 0.4 cm, apex acute. **Labellum** yellow, ovate to narrowly ovate in outline shape, ca. 1 cm long, 3 lobed; mid lobe ovate to broadly ovate ca. 2.5 x 3.5 mm, apex obtuse, adaxial 4 to 5 not prominent yellow ridges; adaxial labellum disk 3 white calli, 2 lateral calli longer with apex (base side) bi-lobules, middle callus shorter. **Column** white, narrowly obovate in outline shape, ca. 7 mm long, winged from base to apical part, column foot ca. 0.5 mm long; anther cap ca. 1.5 mm long, beaked; pollinia 2, obovate, waxy, ca. 0.5 mm long; stipe, caudicles and viscidium absent. **Ovary** (with pedicel) green, slender, ca. 1.5 cm long. **Capsule** (young) cylindric, glossy, ca. 1.3 cm long.

**Vietnam.** – Hon Bà (Khanh Hoa province).

**Distribution.** – Endemic of Vietnam.

**Ecology.** – Epiphyte on very high tree trunk, around top of mountain, above 1400 m asl. Flowering in December.

**Specimen examined.** – V. B. TRUONG 170 (PSU).

**110.** *Didymoplexis* cf. *pallens* Griff., Calcutta J. Nat. Hist. 4: t. 17. 1844; X. Chen, S. W. Gale & P. J. Cribb in Z. Y. Wu et al. (eds), Fl. China 25: 221. 2009; Aver., Turczaninowia 14(2): 63. 2011. – *Epiphanes pallens* (Griff.) Rchb.f. in B. Seemann, Fl. Vit.: 296 1868.. – *Gastrodia pallens* (Griff.) F. Muell., Contr. Phytogr. New Hebrides: 22. 1873. (Plate 29 B).

Mycoheterotrophic monopodial orchid. **Rhizome** brownish-white, creeping, fusiform. **Stem** white, slender up to 8 cm long, with several scale-like along the stem. Inflorescence raceme Rachis ca. 1 cm long, 4 – 5 flowered; floral bract brown, ovate to triangular, apex acute. **Flower** open in succession, uniform white with brown stripes on abaxial. **Dorsal sepal** narrowly ovate apex obtuse, usually connate with petals more

than 1/2 length. *Lateral sepals* connate to petals ca. 1/3 length, and each other more than 1/2 length forming bi-lobules, lobule ovate, apex obtuse, apical part outcurved. *Petals* broadly ovate, apex obtuse. *Labellum* broadly obovate in outline shape, lateral lobes sub-erect, margin erose; disk adaxial with yellow papillae on mid vein. *Column* slightly curved, apex with 2 white wings; anther cap white, elliptic, caudicle and stipe absent, viscidium present.

**Vietnam.** – Hon Bà (Khanh Hoa province).

**Distribution.** – China, India, Indonesia, Myanmar, Taiwan, Thailand.

**Specimen examined.** – V. B. TRUONG 169 (PSU).

Note. – The species was damaged through the transportation.

**111.** *Eria* cf. *scabrilinguis* Lindl., J. Proc. Linn. Soc., Bot. 3: 51.1858. – *Pinalia scabrilinguis* (Lindl.) Kuntze, Revis. Gen. Pl. 2: 679. 1891) – *Eria boniana* (Gagnep.) Tang & F.T.Wang, Acta Phytotax. Sin. 1: 84 (1951). (Plate 29 C & D).

Epiphytic sympodial orchid. *Pseudobulb* ovoid to narrowly ovoid, ca. 2-4 cm high, grow densely close together. *Leaves* 2, oblanceolate, ca. 20-22 x 4-5 cm, apex acute. *Inflorescence* terminal, synanthous, ca. 5-15 cm long; peduncle ca. 5-6 cm long; inflorescence bract 2, ovate, ca. 1-3 cm long, apex acute; rachis ca. 9 cm long, 4 to 20 flowered; floral bract white, ovate, ca. 0.25-0.3 cm long, apex acute. *Flower* open not widely from base, sepals and petals white, labellum white with purple blotches. *Dorsal sepal* oblanceolate, ca. 1.5 -0.35 cm, apex acute. *Lateral sepals* lanceolate, ca. 0.8-1 x 0.5 cm, apex acute, forming short mentum ca. 2 mm long, apex obtuse, slightly curved. *Petals* lanceolate to falcate, ca. 1.3 x 0.3 cm, apex acute. *Labellum* white ca. 0.7-0.8 cm long, 3 lobed; mid lobe ovate, ca. 0.3-0.4 x 0.25 cm, apex subacute, adaxial with 5 raise laminate keel, deeply laciniate, purple-white; lateral lobes erect, falcate, ca. 0.5 - 0.3 cm, apex obtuse, purple blotch in middle; adaxial of labellum with 3 raise laminate keel from base to mid lobe and continue to 3 middle raise laminate keel. *Column* white, ca. 0.6-0.8 cm long, apex curved down; anther cap pale purple-white, ca 1.5 mm long;

pollinia 8, obovate, ca. 0.6 mm long, apex obtuse. **Ovary** (with pedicel) pale green-white, ca. 0.5-0.6 cm long. **Capsule** bright brown, obovate, ca 1.5 cm long.

**Vietnam.** – Hon Bà (Khanh Hoa province).

**Distribution.** – Endemic of Vietnam.

**Ecology.** – Epiphytic on tree trunk, in large group, below 1000 m asl. Flowering in September.

**Specimen examined.** – V. B. TRUONG 168 (PSU).

Note: This specimen was damaged.

**112. *Eria* sp.** (Plate 29 E & F).

Epiphytic sympodial orchid. **Stems** 10-12 cm long, green-greenish, slightly curved, arrange like fan shape, fleshy. **Leaves** 3 to 4, lanceolate, ca. 10-14 x 3.5-3.7 cm, apex acute. **Inflorescence** terminal from new stem, ca. 5 cm long, white, 12 flowered, (flowers arrange like circle), pubescent brown hair; inflorescence bract 1, ovate, white, ca. 0.9-1 cm long, apex acute. **Flowers** open from base, white with yellow lip on apex, red to dark red at base. **Dorsal sepal** white elliptic, ca. 0.6-1 cm long, apex acute-obtuse, basal margin pale red, 3-4 veins on the blade. **Lateral sepals** white ovate, apical part slightly falcate, ca. 1-1.1 x 0.6 cm, adnate with column foot, forming mentum at the base, reddish on the basal. **Petals** white oblanceolate ca. 0.9 x 0.4 cm, apex acute, slightly reddish at the basal. **Labellum** ca. 0.5cm long, 3 lobed; mid lobe yellow ca. 0.35 cm long, apex truncate; lateral lobes white margin pale red in the middle, sub erect, apex obtuse, abaxial 2 prominent keels. **Column** white, dark red in the middle, tip white, margin slightly reddish; anther cap white ca. 2 mm long, somewhat rhombic shaped; pollinia 8, oblanceolate ca. 1.5 mm long, white, caudicles, stipe and viscidium absent. **Ovary** (with pedicel) white, ca. 0.5-0.6 cm long, brown hair. **Capsule** not seen.

**Vietnam.** – Hon Bà (Khanh Hoa province).

**Distribution.** –

**Ecology.** – ca. 1489 m asl. Flowering in in the middle of May. Rare species.

**Specimen examined.** – V. B. TRUONG 093 (PSU).

**Note:** It looks very close to *Eria bipunctata* Lindl., but shorter inflorescence, and labellum mid lobe apex truncate and wider than *E. bipunctata*.

**113.** *Liparis* cf. *balansae* Gagnep., Bull. Soc. Bot. France 79: 165. 1932; Seidenf., Opera Bot. 114: 138. 1992; H. H. Pham III. Fl. Vietnam 3: 901. 2000; X. Chen, P. Ormerod & J. J. Wood in Z. Y. Wu et al. (eds), Fl. China 25: 221. 2009; Aver., Turczaninowia, 16 (1): 118. 2013. – *Stichorkis balansae* (Gagnep.) Marg., Szlach. & Kulak, Acta Soc. Bot. Poloniae 77: 37. 2008. (Plate 29 G & H).

Lithophytic sympodial orchid. *Pseudobulb* ovoid, ca. 2 cm long, grow close together. *Leaves* single, elliptic, ca. 12 x 2.8 cm, apex acute, 5-6 veined. *Inflorescence* terminal, synanthous, arching, ca. 20-21.5 cm long, winged; rachis ca. 11 cm long, distant 8 flowered; inflorescence bract 2, ovate, ca. 1.1 cm long, apex acuminate; floral bract narrowly ovate, ca. 1.5-1.6 cm long, apex acuminate. *Flower* pure green, open widely from base to tip. *Dorsal sepal* green, narrowly lanceolate, revolute, ca. 1.3-1.4 x 0.3 cm, apex subacute. *Lateral sepals* green, lanceolate, revolute, ca. 1-1.2 x 0.3 cm, apex subacute. *Petals* green, linear, ca. 1.2-1.3 cm long. *Labellum* broadly obovate, simple, ca. 1.2 x 1.3 cm long, apex emarginated with very short apiculate, claw at base, outcurved near base; one green channeled low ridge in middle from base up to middle; base with 2 short dark green calli. *Column* white, green in apical part, ca. 0.7-0.8 cm long, apical point toward, winged on apical part ca. 3 mm long; anther cap green, ovate, ca. 1.5- 2 mm long, caudicles, stipe and viscidium absent. *Ovary* (with pedicel) slender, ca. 1.3-1.5 cm long, ovary slightly twisted. *Capsule* not seen.

**Vietnam.** – Hon Bà (Khanh Hoa province).

**Distribution.** – China, Thailand.

**Ecology.** – Lithophyte with bryophyte, ca. 1300 m asl. Flowering in October.

**Specimen examined.** – V. B. TRUONG 111 (PSU).

114. *Liparis* cf. *bootanensis* Griff., Not. Pl. Asiat. 3: 278. 1851. Seidenf., Opera Bot. 114: 152. 1992; Seidenf. & J. J. Wood, Orchids Penins. Malaysia Singapore: 233. 1992; H. H. Pham III. Fl. Vietnam 3: 901. 2000; N. Pearce & P. J. Cribb, Fl. Bhutan 3 (3): 204. 2002; X. Chen, P. Ormerod & J. J. Wood in Z. Y. Wu et al. (eds), Fl. China 25: 221. 2009; Aver., Turczaninowia, 16 (1): 115. 2013. – *Leptorkis bootanensis* (Griff.) Kuntze, Revis. Gen. Pl. 2: 671. 1891. – *Stichorkis bootanensis* (Griff.) Marg., Szlach. & Kulak, Acta Soc. Bot. Poloniae 77: 37. 2008. (Plate 30 A & B).

Epiphytic sympodial orchid. *Pseudobulb* ovoid, ca. 2 cm long, smooth, grow close together. *Leaves* single, oblong, ca. 15-16 x 2.5 – 3 cm, apex acute; petiole ca. 1-1.2 cm long. *Inflorescence* terminal, synanthous, ca. 15 cm long, winged; rachis ca. 5 cm long, arching; floral bract ovate, ca. 0.6-1 x 0.15-2 cm, apex acuminate. *Flower* open widely from base to tip, uniform pale green-orange. *Dorsal sepal* lanceolate, ca. 0.9 x 0.25 cm, apex acute, margin revolute. *Lateral sepals* lanceolate, ca. 0.7 x 0.3 cm, apex acute, margin revolute. *Petals* linear, ca. 0.9 cm long. *Labellum* obovate in outline shaped, ca. 0.8-1 cm long, strongly curved near base, apex emarginate, small apiculate in middle, margin outcurved and slightly erose; 2 short triangular ridges at base. *Column* ca. 0.6 cm long, triangular winged, apex point down; anther cap ovoid, 0.8 mm long, caudicles, stipe and viscidium absent. *Ovary* (with pedicel) ca. 2 cm long. *Capsule* not seen.

**Vietnam.** – Hon Bà (Khanh Hoa province).

**Distribution.** – China, Bhutan, India, Indonesia, Japan, Malaysia, Myanmar, Philippines, Thailand.

**Ecology.** – Epiphyte on tree trunk, around the top of mountain, humidity and cool condition. ca. 1500 m asl. Flowering in October.

**Specimen examined.** – P. Rojchana-umpawan 55, 173 (PSU), V. B. TRUONG 115 (PSU).

Note: The specimen was damaged.

115. *Liparis* cf. *dendrochiloides* Seidenf. ex Aver., Bot. Zhurn. (Leningrad) 73: 432. 1988; Seidenf., Opera Bot. 114: 139. 1992; H. H. Pham Ill. Fl. Vietnam 3: 902. 2000; Aver., Turczaninowia, 16(1): 112. 2013. – *Stichorkis dendrochiloides* (Seidenf. ex Aver.) Marg., Szlach. & Kulak, Acta Soc. Bot. Poloniae 77: 37. 2008. (Plate 30 C & D).

Terrestrial sympodial orchid. *Pseudobulbs* ovoid, ca. 2 cm high grow close together. *Leaves* single, lanceolate, ca. 8-10 cm x 1.5-1.8 cm, apex acute; petiole ca. 1.4-1.5 cm long. *Inflorescence* green, terminal, synanthous. 15-18 cm long, 6 longitude ridges; rachis ca. 5 cm long; inflorescence base sheathing (up to 5 sheaths) ca. 0.7-2.5 x 0.5-0.8 cm (flattened), apex long acuminate; inflorescent bract 1, triangular, ca. 0.8 cm long, apex acuminate; floral bract narrowly triangular, ca. 5 mm long, apex acuminate. *Flower* yellow, small, floral bract longer than flower, open widely from base. *Dorsal sepal* narrowly ovate ca. 0.2-0.25 x 0.05 cm, apex acute, apical part outcurved. *Lateral sepals* ovate, ca. 0.2-0.25 x 0.1 cm, apex acute, apical part outcurved. *Petals* linear, ca. 0.15-0.2 cm long, apex acute, margin revolute, incurved. *Labellum* simple, obovate in outline shaped, ca. 0.2-0.25 cm x 0.2 cm, apex acute, strongly curve outside near the base, 1 mid channeled; apex acute. *Column* ca. 0.15 cm long, slightly curve in the middle, yellow; anther cap white, caudicles, stipe and viscidium absent. *Capsule* sub-globular, 6 ridges.

**Vietnam.** – Hon Bà (Khanh Hoa province).

**Distribution.** – Endemic of Vietnam.

**Ecology.** – Lithophyte on the main road (car road), could be epiphyte, on the top of mountain, humidity and cool condition. Flowering in July.

**Specimen examined.** – V. B. TRUONG 117 (PSU).

Note: This species is very similar to *Liparis longibracteata* Aver., but the different is leaves shape and pseudobulbs arrangement.



**116.** *Liparis* cf. *mannii* Rchb.f., Flora 55: 275. 1872; Seidenf., Opera Bot. 114: 134. 1992; H. H. Pham Ill. Fl. Vietnam 3: 902. 2000; X. Chen, P. Ormerod & J. J. Wood in Z. Y. Wu et al. (eds), Fl. China 25: 224. 2009; Aver., Turczaninowia, 16 (1): 104. 2013. – *Leptorkis mannii* (Rchb.f.) Kuntze, Revis. Gen. Pl. 2: 671. 1891. – *Stichorkis mannii* (Rchb.f.) Marg., Szlach. & Kulak, Acta Soc. Bot. Poloniae 77: 38. 2008). (Plate 30 E & F).

Epiphytic sympodial orchid. *Pseudobulb* grow close together, ovoid, ca. 1.5-2 cm long, green-greenish. *Leaves* single, lanceolate, ca. 9-17 x 0.8-0.8 cm, apex acute. *Inflorescence* terminal, synanthous, ca. 12-20 cm long, winged; rachis ca. 6-10 cm long; inflorescence bract 2, white, linear, ca. 0.8-0.95 cm long; floral bract linear, ca. 0.25-0.3 cm long. *Flower* resupinate, yellow, open from base to tip. *Dorsal sepals* yellow, narrowly ovate, ca. 0.25-0.3 cm long, apex obtuse. *Lateral sepals* yellow, narrowly ovate, ca. 0.25-0.35 cm long, apex obtuse, sepals margin revolute. *Petals* linear, ca. 0.3-0.35 cm long, yellowish, needle shape. *Labellum* pale yellow, glabrous, ca. 0.3-0.35 cm long, 3 lobed; mid lobe somewhat rhombic, ca. 0.3 x 0.2-0.25 cm, margin irregularly erose; lateral lobes erect to falcate, ca. 0.15-0.2 cm long, apex acute. *Column* green – pale yellow, erect, ca. 0.2 cm long, broadly open at base, apex point toward; anther cap pale yellow, ovate, ca. 1 mm long, apex acute; pollinia 4, ca. 0.6 mm long, clavate; stipe, caudicles and viscidium absent. *Ovary* (with pedicel) ca. 0.3-0.35 cm long greenish. *Capsule* not seen.

**Vietnam.** – Hon Bà (Khanh Hoa province).

**Distribution.** – China, India.

**Ecology.** – Epiphyte on tree branches, deep inside the forest, around top of mountain above 1500 m asl. Flowering in middle of October.

**Specimen examined.** – V. B. TRUONG 114 (PSU).

117. *Liparis* cf. *sootenzanensis* Fukuy., Rep. (Annual) Taihoku Bot. Gard. 3: 84. 1933; H. H. Pham Ill. Fl. Vietnam 3: 902. 2000; X. Chen, P. Ormerod & J. J. Wood in Z. Y. Wu et al. (eds), Fl. China 25: 219. 2009; Aver., Turczaninowia, 16 (1): 85. 2013. – *Liparis macrantha* var. *sootenzanensis* (Fukuy.) S.S.Ying, Col. Ill. Indig. Orch. Taiwan 1(2): 224. 1977. – *Liparis nigra* var. *sootenzanensis* (Fukuy.) T.S.Liu & H.J.Su, Fl. Taiwan 5: 1047. 1978. – *Diteilis sootenzanensis* (Fukuy.) M.A.Clem. & D.L.Jones, Orchadian 15: 41. 2005. (Plate 30 G & H).

Lithophytic sympodial orchid. *Stem* fleshy 13-22 cm long green-greenish, slightly curved near the basal, stem arrange close together. *Leaves* 3-4 leave, on the tip of stem, elliptic, ca. 11-17 x 4.5-5.8 cm, apex acuminate, abaxial surface prominent black-dark violet veins; petiole sheath, ca. 1.5-2 cm long, slightly reddish-green margin. *Inflorescence* terminal, synanthous, ca. 22-25 cm long, 6 longitude ridges, 17-18 flowered; floral bract triangular, very short, ca. 0.3-0.5 cm long, apex acute, purple. *Flower* open widely from base to tip, sepals, petals and labellum pale yellow – green. *Dorsal sepal* lanceolate, ca. 1.6-2 x 0.2 cm, revolted margin, greenish at basal, purplish on the tip. *Lateral sepals* lanceolate, ca. 1.1-1.2 x 0.2-0.3 cm, apex acute, revolted margin. *Petals* linear, slightly curved 1.5-1.6 cm long, red when old, reddish-green young flowers. *Labellum* obovate, ca. 2 cm long, apex emarginated, margin finely fimbriate (1.3 cm long), margin near basal not fimbriate (0.5 cm long); strongly outcurved toward in the middle; base with 2 triangular ridges turn to low rides up to the middle of labellum. *Column* green (young flowers), yellow-reddish (old flowers), anther cap green, pollinia yellow, caudicles, stipe and viscidium absent. *Capsule* not seen.

**Vietnam.** – Hon Bà (Khanh Hoa province).

**Distribution.** – China, Taiwan, Thailand.

**Ecology.** – Lithophyte with humus on the rock, along the stream, 859 m asl. Flowering in middle of May.

**Specimen examined.** – V. B. TRUONG 116 (PSU).

Note: This species is quite abnormal in comparison with the color. The normal color of *L. sootenzamensis* is green or pale yellow-green, but with this species is pale yellow-green with purple.

**118.** *Liparis* cf. *tenuis* Rolfe ex Downie, Bull. Misc. Inform. Kew 1925: 372. 1925; Aver., Turczaninowia, 16 (1): 102. 2013. – *Platystyliparis tenuis* (Rolfe ex Downie) Marg., Richardiana 7: 40. 2007. (Plate 31 A & B).

Epiphytic sympodial pseudobulb. **Pseudobulb** narrowly ovoid, ca. 1.15-1.2 cm x 0.4-0.55 cm, 1 to 2 longitude ridges. **Leaves** 2, ca. 2-3 cm x 0.7-0.8 cm, apex acute. **Inflorescence** terminal, heteranthous, ca. 7.2-7.5 cm; rachis ca. 4-4.1 cm long, up to 8 flowered; inflorescence bract 5, ovate, ca. 0.3-0.35 cm long, apex acute; floral bract narrowly ovate, ca. 0.2-0.3 cm long, apex acute. **Flower** resupinate, open widely from base to tip, sepals, petals and labellum pale green. **Dorsal sepal** narrowly lanceolate, ca. 0.4 cm x 0.1-0.2 cm, apex acute, margin incurve. **Lateral sepals** lanceolate, ca. 0.5-0.55cm long, 0.1-0.2cm wide, margin incurve. **Petals** linear, ca. 0.4 cm x 0.05cm, apex acute. **Labellum** glabrous, glossy, ca. 0.25 cm x 0.25-0.3 cm, apex obtuse with one small tail in the middle; strongly outcurved, epichile ca. 2 mm x 2.5 mm, somewhat orbicular; hypochile claw-like attached to column disk 2 raise somewhat triangular ridge. **Column** pale green, ca. 0.3-0.4 cm long; anther cap ovate, ca. 0.7 mm long, apex acute; pollinia not seen. **Ovary** (with pedicel) ca. 0.3-0.35 cm long. **Capsule** not seen. **Vietnam.** – Hon Bà (Khanh Hoa province).

**Distribution.** – Thailand.

**Ecology.** – Epiphyte on tree branches, along the stream. Flowering in on September, Rare species.

**Specimen examined.** – V. B. TRUONG 108 (PSU).

Note: This species could be *Liparis tenuis*, but the specimen was damage. Also this species looks like *Liparis filiformis* Aver. but the inflorescence of *L. filiformis* pendulous while this species erect.

119. *Liparis* sp. (Plate 31 C & D).

Lithophytic sympodial orchid. *Pseudobulb* ovate-broad elliptic ca. 1.5-2.2 cm long, grow close together. *Leaves* 2, lanceolate, ca. 6-13 x 1.2-1.6 cm, apex acute, one prominent mid vein and 2 lateral veins. *Inflorescence* terminal, synanthous, erect, apical slightly arching, ca. 15-25 cm long; rachis ca. 8-15 cm long, densely 28-35 flowered; floral bract lanceolate, ca. 0.9-1.8 cm long, apex acute; inflorescence bract, 3 ca. 1.5-1.6 cm long, apex acute. *Flower* open from base, flower pale yellow-green. *Dorsal sepal* lanceolate, ca. 0.4-0.5 x 0.2-0.3 cm, apex acute, apical part strongly outcurved. *Lateral sepals* lanceolate, green, ca. 0.5-0.6 x 0.2-0.3 cm, apex acute, margin incurved, tip curved down. *Petals* linear, slender, ca. 0.5-0.6 cm long. *Labellum* oblong in outline shaped with the short claw at base; epichile sub-quadrate, ca. 0.5-0.6 cm x 0.4-0.5 cm, apex truncate, margin irregular erose, open broadly at tip, apex slightly serrate, strongly curve down near basal; 2 short lateral ridges from base up to middle of labellum. *Column* glabrous, ca. 0.4-0.5 cm long basal open broadly, apex point toward; anther cap white, broadly ovate, caudicles, stipe and aviscidium absent. *Ovary* (with pedicel) 0.9-1 cm long, green. *Capsule* not seen.

**Vietnam.** – Hon Bà (Khanh Hoa province).

**Distribution.** –

**Ecology.** – Lithophyte with bryophyte and *Oberonia longibracteata* on dry rock. ca. 1410 m asl. Flowering in late October.

**Specimen examined.** – V. B. TRUONG 118 (PSU).

120. *Mycaranthes* sp. (Plate 31 E & F).

Epiphytic sympodial orchid. *Stem* up to 5 cm long, *Leaves* 6, lanceolate 8-35 x 2-2.1 cm, curved leaves, apex unequally 2 lobes, jointed at base. *Inflorescence* terminal, pubescent with white hair, not so dense; floral bract yellow, ovate ca. 0.1-0.2 cm long, apex acute. *Flower* dense, open widely from base to tip, yellow with red blotches. *Dorsal sepal* elliptic ca. 0.25-0.3 cm long, margin yellow, red in the middle,

apex acute, curved toward (not flat), abaxial pubescent with brown hair. *Lateral sepals* ca. 0.3 x 0.25 cm margin yellow, red (big) dots in the middle, apex obtuse, back side hairy. Petals linear, ca. 0.25 cm x 0.15 cm, apex obtuse to truncate, mid red dots. *Labellum* ca. 0.45cm long, 3 lobed; mid lobe truncate, bi lobules, yellow with red dots; lateral lobes yellow with red dots, sub erect, elliptic, ca. 0.25 cm x 0.15 cm; adaxial 2 ridges from base of labellum up to the middle and raise higher, yellow woolly raise callus subglobose on the base of mid lobe. *Column* 0.4 cm long, red margin, middle whitish, anther cap white, caudicels, stipe and viscidium absent. *Ovary* (with pedicel) slender, ca. 0.6-0.7cm long, pubescent with white hair. *Capsule* not see.

**Vietnam.** – Hon Bà (Khanh Hoa province).

**Distribution.** –

**Ecology.** – Epiphytes on very high tree, along the stream around the top of mountain, above 1400 m asl. This species was collected in middle of June, when the flowers almost finish. Flowering may be in early of June.

**Specimen examined.** – V. B. TRUONG 171 (PSU).

**121.** *Oberonia cf. caulescens* Lindl., Gen. Sp. Orchid. Pl.: 15. 1830; Seidenf., Opera Bot. 114: 152. 1992; H. H. Pham Ill. Fl. Vietnam 3: 763. 2000; N. Pearce & P. J. Cribb, Fl. Bhutan 3(3): 223. 2002; X. Chen, P. Ormerod & J. J. Wood in Z. Y. Wu et al. (eds), Fl. China 25: 241. 2009; Aver., Turczaninowia, 16 (1): 156. 2013 – *Malaxis caulescens* (Lindl.) Rehb.f. in W.G.Walpers, Ann. Bot. Syst. 6: 215. 1861. – *Iridorkis caulescens* (Lindl.) Kuntze, Revis. Gen. Pl. 2: 669. 1891. (Plate 31 G & H).

Epiphytic sympodial orchid. *Leaves* lanceolate, ca. 7-20 x 1-1.2cm, apex acute, conduplicate, jointed at base, compress and flat. *Inflorescence* terminal, ca. 24 cm long, not fleshy; rachis 14.5 cm long; inflorescence bract 1, lanceolate, ca. 0.2-0.25 cm long, apex acute; floral bract green, lanceolate, ca. 0.3-0.3cm long, apex acute. *Flowers* minute, petals, sepals red, open from the tip. *Dorsal sepal* orange-reddish, ovate, ca. 0.15 x 0.1 cm, apex subacute. *Lateral sepals* elliptic shape 0.15-0.2 x 0.05-0.1 cm, orange. *Petals* elliptic, ca. 0.15-0.2 x 0.05 cm, orange, apex obtuse. *Labellum* 3-lobed,

mid lobes red-reddish tip green, bi-lobules, ca. 1 mm long, apex acuminate, slightly curved up; lateral lobes red-reddish, ovate or somewhat triangular, ca. 0.05-0.1 cm long, apex acute, spread. **Column** short, ca. 0.05 cm long, reddish; anther cap yellow, semi-circular, caudicle, stipe and viscidium absent. **Ovary** (with pedicel) ca. 0.2-0.25 cm long. **Capsule** not seen.

**Vietnam.** – Hon Bà (Khanh Hoa province).

**Distribution.** – Bhutan, China, India, Nepal.

**Ecology.** – Around the top of mountain, ca. 1410 m asl. Humidity and cool weather. Flowering in on September. Rare species.

**Specimen examined.** – V. B. TRUONG 124 (PSU).

Note: The differences between *Oberonia cf. caulescens* and *Oberonia cf. dolichostachys*: *O. cf. caulescens* bi-lobules apex acuminate and curved up while *O. cf. dolichostachys* apex obtuse; *O. cf. caulescens* the space between bi-lobules V shape very narrow and 2 lobules can touch, when *O. dolichostachys* space between bi-lobules wider and 2 lobules not touch.

**122.** *Oberonia cf. dolichostachys* Aver., Turczaninowia 16(1): 158. 2013 (Plate 32 A & B).

Epiphytic sympodial orchid. Leaves lanceolate, ca. 8-11.6 cm x 0.3-0.85 cm, apex acute, conduplicate, jointed at base, compress and flat. **Inflorescence** terminal, ca. 20 cm long, not fleshy; peduncle ca. 5 cm long; inflorescence bract numerous, slender, apex acute; rachis ca. 13 cm long; floral bract narrowly ovate, ca. 0.15-0.2 cm long, apex acuminate. **Flower** open from tip to base, flower pale orange-yellow. **Dorsal sepal** ovate, ca. 0.8-1 mm long, apex obtuse to subacute. **Lateral sepals** ovate, ca. 0.9 mm long, apex obtuse to subacute. **Petals** narrowly ovate, ca. 0.8 mm long. **Labellum** somewhat subquadrate to oblong in outline shaped, ca. 1.5 x 0.5 mm, margin entire, 3 lobed; mid lobe deep emarginate, divide into bi-lobules, 2 lobules ovate, apex obtuse not touch each other; lateral lobes somewhat semi-circular, spread, apex acute. **Column** very short, ca. 0.5 mm long; anther cap elliptic, caudicle, stipe and viscidium absent.

**Ovary** (with pedicel), slender, ca. 1 mm long. **Capsule** (young) from the tip of inflorescence, ca. 1.5 mm long.

**Vietnam.** – Hon Bà (Khanh Hoa province).

**Distribution.** – Endemic of Vietnam.

**Ecology.** – Epiphyte on tree trunk around top of mountain, above 1500 m asl. The specimen was collected when there are young capsule, Flowering in early of October.

**Specimen examined.** – V. B. TRUONG 123 (PSU).

**123. *Oberonia cf. solanensis* Aver., Turczaninowia 16(1): 154. 2013. (Plate 32 C & D).**

Lithophytic sympodial orchid. **Stem** often enclosed in leaf base. **Leaves** conduplicate jointed at base, lanceolate, ca. 4.5-5 x 0.4-0.6 cm, apex acute. **Inflorescence** terminal, ca. 15 cm long many minute flower in whorl; floral bracts greenish-brown, slender, needle shape, apex acute. **Flower** very small, red, open from the tip of inflorescence. **Dorsal sepal** ovate, apex subacute. **Lateral sepals** broadly ovate, apex subacute. **Petals** elliptic, apex obtuse. **Labellum** 3 lobed; mid lobe concave, broadly ovate, brown dark red in the middle of the lip, apex slightly truncate; lateral lobes flat (not erect) apex acute. **Column** white, ca. 0.5 mm long; anther cap yellow, elliptic, apex obtuse, caudicle, stipe and viscidium absent. **Ovary** (with pedicel) slender ca. 1 mm long. **Capsule** not seen.

**Vietnam.** – Hon Bà (Khanh Hoa province).

**Distribution.** – Endemic of Vietnam.

**Ecology.** – Top of the mountain humidity and cold region, ca. 1515 m asl.. Flowering in April. Rare species.

**Specimen examined.** – V. B. TRUONG 125 (PSU).

**124.** *Pinalia cf. floribunda* (Lindl.) Kuntze, Revis. Gen. Pl. 2: 678. 1891; *Eria floribunda* Lindl., Edwards's Bot. Reg. 29 (Misc.): 43. 1843. *Trias floribunda* (Lindl.) Mason, Burmah, ed. 3: 809. 1860. – *Urostachya floribunda* (Lindl.) Brieger in F.R.R.Schlechter, Orchideen Beschreib. Kult. Zücht., ed. 3, 1(11–12): 716. 1981., with incorrect basionym ref. (Plate 33 C & D).

Epiphytic sympodial orchid. *Stem* erect, leave sheathing, ca. 9-11 cm long. *Leaves* 2-3, on the tip of stem, lanceolate, ca. 9.5-10 x 0.6-0.7 cm, apex acute, margin slightly curved inside. *Inflorescence* lateral, arching, raceme, ca. 8 cm long, pubescent brown hair, up to 30 flowered. *Flower* white, small, sepals abaxial minute pubescent brown hair. *Dorsal sepal* ovate, ca. 0.3 cm long, apex acute. *Lateral sepals* broadly ovate, ca. 0.3-0.4 cm long, apex acute, forming short mentum, apex obtuse. *Petals* glabrous, narrowly ovate, ca. 0.1 cm long. *Labellum* missing. *Column* white, dark red on the tip; anther cap and pollinia missing. *Ovary* (with pedicel) slender, white, ca. 0.5-0.6 cm long, pubescent brown hair. *Capsule* not seen.

**Vietnam.** – Hon Bà (Khanh Hoa province).

**Distribution.** – Indonesia, Myanmar, Thailand.

**Ecology.** – Epiphyte on tree branches along the stream, top of mountain, ca. 1430 m asl. Flowering in April.

**Specimen examined.** – V. B. TRUONG 92 (PSU).

**125.** *Tainia cf. cordifolia* Hook.f., Hooker's Icon. 19: ad pl. 1861. 1889; N. Pearce & P. J. Cribb, Fl. Bhutan 3(3): 314. 2002; X. Chen & J. J. Wood in Z. Y. Wu et al. (eds), Fl. China 25: 282. 2009. – *Mischobulbum cordifolium* (Hook.f.) Schltr., Repert. Spec. Nov. Regni Veg. Beih. 1: 98. 1911. (Plate 33 E & F).

Terrestrial sympodial orchid. *Pseudobulb* elongate, fleshy, narrowly in apical part. *Leaves* green to dark green, ovate to broadly ovate, apex acute; long petiole, glabrous, dark green, from the tip of pseudobulb, fleshy. *Inflorescence* heteranthous, from base of pseudobulb, glabrous, erect, raceme, up to 7 flowered; inflorescence bract



linear, elongated, apex acute; floral bract narrowly ovate, apex acute. *Flower* large open widely, sepals and petals brown with pale purple stripes, labellum lateral lobes white with purple blotches, mid lobe brown. *Dorsal sepal* narrowly ovate, apex acute. *Lateral sepals* narrowly ovate, apex acute, adnate with column foot forming broadly obtuse mentum. *Petals* lanceolate, apex acute. *Labellum* broadly ovate, 3 lobed; mid lobe triangular, apex acute; lateral lobes erect, elliptic, apex obtuse; adaxial disk with 3 lamellae, 2 lateral rise higher than middle, from base up to middle of mid lobe. *Column* curved somewhat parallel with labellum, winged, distinct foot; caudicles present, stipe and viscidium absent. *Ovary* (with pedicel) dark green, glabrous. *Capsule* elliptic.

**Vietnam.** – Hon Bà (Khanh Hoa province).

**Distribution.** – China, Taiwan.

**Ecology.** – Not common species, found in 900 m asl. Flowering time June

**Specimen examined.** – V. B. TRUONG 139 (PSU).

**126.** *Thrixspermum* cf. *annamense* (Guillaumin) Garay, Bot. Mus. Leaflet. 23: 206. 1972; Seidenf., Opera Bot. 114: 407. 1992; H. H. Pham, Ill. Fl. Vietnam 3: 948. 2000; X. Chen & J. J. Wood in Z. Y. Wu et al. (eds), Fl. China 25: 469. 2009. (Plate 33 G & H)

Epiphytic monopodial orchid. *Leaves* elliptic, ca. 3.5-6 x 1.1-1.3 cm, apex emarginated unequally 2 lobes, one small seta in the middle. *Inflorescence* lateral along the stem, 2-3.8cm long, 1 to 2, 5-6 flowered, greenish, dark purple at basal, inflorescence bract 1 to 2, ca. 1 mm long, dark purple below and green above; floral bract ca. 1 mm long purplish – green. *Flower* open in pair same time, open widely, uniform yellow with brown blotches. *Dorsal sepal* yellow, elliptic, ca. 0.5 x 0.4 cm, apex obtuse, incurved in the middle; *lateral sepals* yellow, broadly elliptic ca. 0.5-0.6 x 0.5 cm, apex obtuse, incurved in the middle. *Petals* yellow, narrowly elliptic ca. 0.4 x 0.3 cm, apex obtuse. *Labellum* yellow, ca. 1 cm long, 3 lobed, saccate; mid lobe yellow ca. 0.2 cm long, 3 teeth (mid tooth ca. 0.5 mm long shorter than 2 lateral teeth ca. 1 mm long, falcate); lateral lobes ca. 0.3 cm long, apex obtuse, point toward, 3-5 red lines for each side; longitudinal callus yellow, finely ciliate. *Column* white, ca. 1

mm long, in middle red margin, apical part winged, column foot ca. 1.2 mm long; anther cap white semi-circle ca. 1.5 mm long, pollinia 4, ca. 0.5 mm long, subglobose unequal size, white, stipe white slender, ca. 0.7 x 0.4 mm attached to elongate white viscidium.

**Ovary** (with pedicel) green, slender ca. 0.25-0.3 cm long. **Capsule** not seen.

**Vietnam.** – Hon Bà (Khanh Hoa province).

**Distribution.** – China, Taiwan, Thailand.

**Ecology.** – Epiphyte on the tree branches, together with *Thrixspermum fragrans*.

Flowering in middle of May.

**Specimen examined.** – V. B. TRUONG 143 (PSU).

## CHAPTER 4

### DISCUSSION AND CONCLUSION

#### **Orchid species diversity with inhabitation at Hon Ba Nature Reserve according to altitudinal gradient (Fig. 4).**

The numbers of the orchid species found at Hon Ba Nature Reserve reaches its peak at the altitudinal range between 1,200 – 1,500 m. And this falls into the areas of lower montane forest vegetation where the rather moist condition of habitats with more/less “cool” temperature is found. This is also quite characteristic among other types of vegetation in the Tropic. Moreover, various kinds of micro habitats due to the canopy of trees in various vegetation types as well as the topographic features of the areas e.g. close trees V.S. shady tree, open sunny on the top site of the canopy V.S. close at the bottom site of the canopy, rocky, rich humus soil with always humid condition etc., might accommodate various orchids as well.

#### **The orchid species groups according to the inhabitation**

*a. Epiphytic form:* when the inhabitation of the orchids in the areas were taken into account, the epiphytic orchids are the most diverse ones. Almost all of them are occurring on the tree trunks/branches. Eight species of epiphytes are in the lowland area, below 500 m asl. with very dry and warm habitat conditions i.e. *Bulbophyllum macranthum*, *Dendrobium pachyphyllum*, *Micropera pallida*, *Pteroceras teres*, *Thecostele alata*, *Thrixspermum centipeda* and *Trias nasuta*, and the other 69 species found occurring above 1000 m asl. where the weather is more humid i.e. *Appendicula gracilis*, *Bulbophyllum tortuosum*, *B. retusiusculum*, *B. clipeibulbum*, *B. frostii*, *B. dasystachys*, *B. delitescens*, *B. apodum*, *B. simondii*, *B. tixieri*, *Cleisocentron klossii*, *Ceratostylis subulata*, *C. siamensis*, *C. tonkinensis*, *Cordiglottis longipedicellata*, *Cleisostoma striatum*, *C. williamsonii*, *C. birmanicum*, *Coelogyne fimbriata* var. *fimbriata*, *Dendrobium khanhoaense*, *D. aduncum*, *D.hamatum*, *D.dentatum*, *D.*

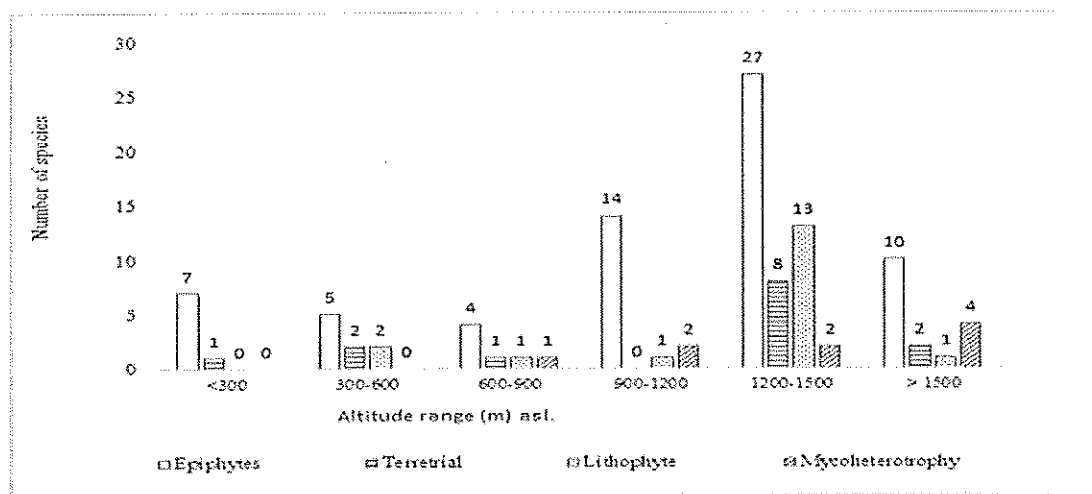
*pseudotenellum*, *D. spatella*, *Dendrobium sp*, *Eria lactiflora*, *E. globulifera*, *Mycaranthes pannea*, *Gastrochilus calceolaris.*, *Liparis caespitosa*, *Oberonia falcate*, *Pholidota chinensis*, *Phreatia densiflora*, *Trichotosia velutina*, *Thrixspermum fragrans*, *Trichotosia microphylla*. *Stichorkis compressa*, and *S. gibbosa*.

b. *Terrestrial and semi-terrestrial forms*: for this aspect, there are two species in the genus *Vanilla* that have been recorded as the semi-terrestrial orchids. They are growing on the ground as “creepers” i.e. *Vanilla atropogon* and *V. albida*. These 2 species of *Vanilla* had been recorded in the lowland areas below 600 m asl. However, in the areas above 900 m asl. with the dense canopy forest and more humidity, the number of terrestrial orchid increases. There are 18 species that belong to 15 genera are considered as the terrestrial orchids i.e. *A. graminifolia* subsp. *graminifolia*, *Acanthephippium striatum*, *Anoectochilus lylei*, *Calanthe lyroglossa*, *C. angustifolia*, *Cephalantheropsis longipes*, *Coelogyne eberhardtii*, *Collabium chloranthum*, *Cryptostylis arachnites*, *Cymbidium lancifolium*, *C. dayanum*, *Dendrobium farinatum*, *Geodorum densiflorum*, *Goodyera foliosa*, *Miguelia cruenta*, *Pholidota leveilleana*, *Platanthera singgalangensis*, *Tainia cordifolia*, and *Spathoglottis plicata*.

c. *Lithophytic form*: considering this aspect, the species of *Arundina graminifolia* subsp. *caespitosa* and *Habenaria rhodocheila* are among those with the lithophytic orchids in the lowland areas below 500 m asl. They both grow along the stream. The other species of such form had been recorded in the areas above 800 m asl., they are often found together with the bryophytes in the shady areas. There are 20 species in this category that belong to 7 genera i.e. *Appendicula hexandra*, *A. reflexa*, *Bulbophyllum thaiorum*, *B. delitescens*, *Coelogyne mooreana*, *Conchidium pusillum*, *Liparis ngoclinhensis*, *L. chapaensis*, *L. cf. balansae*, *L. mamillata*, *L. cf. sootenzanensis*, *L. cf. dendrochiloides*, *Liparis sp.*, *Oberonia longibracteata*, *O. cf. solanensis*, *Paphiopedilum appletonianum*, *P. delenatii*, *P. villosum*, *P. x cribbii*, *Podochilus banaensis*, and *P. microphyllus*. Despite the fact that most areas are somehow rocky, however, the lithophytic orchids had reached their most diversity only in such high altitude over 1000 m asl. (Fig.4). This might be according to the fact that the lower

montane forest in such high altitude contains also high humidity. Hence, it produced much litter/humus that later deposited on the rock surfaces as it occurred on the bark of the trees. This might be favored by many orchid species comparing to the rocky areas in other vegetation types with lower humidity and less litter.

d. Mycoheterotrophic form: There are 6 species of mycoheterotrophic orchids that had been found in the present study. All of them had been found above 1000 m asl., where the weather is rather wet with high precipitation i.e. *Aphyllorchis pallida*, *Didymoplexis pallens*, *Erythrorchis altissima*, *Lecanorchis nigricans*, *L. vietnamica*, and *Odontochilus saprophyticus*. The mycoheterotrophic orchids, mostly considered as rare orchids, were the least diverse ones of the present study. Due to their small size and some characters i.e. pale/dark flower color, achlorophyllous leafless, they could be easily overlooked.



**Figure 4** Inhabitation of orchid species by altitude at Hon Ba Nature reserve.

#### Notes on the status of orchids in Hon Ba Nature Reserve.

##### The Common species.

There are two species that could be easily found above 1400 m asl. viz. *Campanulorchis globifera* and *Eria lactiflora*. They usually grow together in large populations as epiphytes which sometimes damage the branches of trees where they

occurred in the rainy season when they would be soaked with water that the branch would not be able to accommodate their weight. The other common one in high altitude is a small orchid: *Podochilus banaensis*, which could be found on rocks along the stream between 1000- 1500 m asl.

Otherwise, the other common species in the study area are *Spathoglottis plicata* and *Arundina graminifolia* subsp. *graminifolia*. These two species could be seen common along the road side above 1000 m asl. However, as they were also considered as “not rare” species by the Nature reserve, therefore collected by the tourists. These could also create serious problem for the population of two species in future. While *Cymbidium dayanum* that grows along the road is not that attractive having grass-like leaves and growing among grass.

On the other hand, in the lowland areas, *Vanilla atropogon* could be easily found along the stream in a large population.

When considering the epiphytic ones, the common epiphytic species of the lowland are among *Pteroceras teres*, *Thrixspermum centipeda* and *Dendrobium crumenatum* which are frequently found along the stream. Moreover, it is interesting that they often associated with the rubiaceaceous antplants: *Myrmecodia* sp. and *Hydnophytum* sp.

### **The Rare species.**

When considering the rare orchid species in Hon Ba, the slipper orchids in genus *Paphiopedilum* could be considered here as rare orchids also in the study area as the population of such plants decrease continually due to the illegal collections for trade. All the species in this genus have been listed on the Appendix I of CITES i.e.:

- *Paphiopedilum appletonianum*. There is still a rather large population of this orchid in Hon Ba Nature Reserve, found in 5-6 locations (details in description part). They occurred as lithophyte along the stream, in deep and steep slopes. Its dorsal sepal and petals are rather variable in both shape (ovate to broadly ovate) and color (dark purplish to greenish pink with dark purple dots V.S. without dots).

IUCN Status: Red data list, Endangered.  
(<http://www.iucnredlist.org/details/43320105/0>).

- *Paphiopedilum delenatii*. This one is among the rarest orchid of Vietnam. It had been considered as extinct in the wild in Vietnam. It is to be noticed here that the wild population with few individuals had been discovered again in the present study at 800 m asl. in the areas of stiff slope with 20-25 degree.

IUCN Status: Red data list, Critical Endangered. (<http://www.iucnredlist.org/details/191709/0>).

- *Paphiopedilum villosum* var. *annamense*. Hon Ba Nature Reserve is a new locality record of this species from the present study. It is such a pity that there are only three individuals found on the wet rocks in the lower montane forest.

IUCN Status: Vulnerable. (<http://www.iucnredlist.org/details/201858/0>).

- *Paphiopedilum* x *cribbii*. This one is considered as a natural hybrid between *P. appletonianum* and *P. villosum*. Only three individuals have been discovered on the rock along the stream among *P. appletonianum* population. However, this rare orchid has not been listed in the red data list of IUCN.

In additions, there are few more orchid species that have not been recored as rare species by IUCN nor CITES in general, however due to few individuals found in the present study in Hon Ba Nature Reserve, they are considered as “rare”, at least in the study area i.e. *Cleisocentron klossii*, *Dendrobium farinatum*, *Coelogyne eberhardtii*, *Bulbophyllum dasystachys*, *Bulbophyllum frostii*, *Cleisostoma striatum*, *Cordiglottis longipedicellata*, *Dendrobium aduncum*, *Lecanorchis nigricans*, *Phreatia densiflora*, and *Thrixspermum fragrans*.

### **The Distribution patterns of orchids of Hon Ba Nature Reserve in different floristic regions.**

Considering the orchid species found in the study area, six patterns of the distribution ranges of the orchid elements found could be recognized i.e.

1. *The Himalayan range elements* (Fig.5). This is a mountainous range of distribution over the Himalaya, which originated in the West of Nepal then continued eastwards along the Himalayan range down to South-East Asia according to the Southern branch of the Himalayan mountain system which falls into the Southern part

of China in Yunnan province; North of Myanmar; North of Thailand as well as Laos and connected to Vietnam over this famous Annamite range where Hon Ba Nature Reserve had situated as a part of it. This has created such a “migratory bridge” for plants/animals in the high mountainous areas over 1,000 m asl. between the Himalaya and Mainland South-East Asia. The orchid species that confined to this distribution range occurred only in the mountainous areas over 1,000 m asl., mostly with special conditions of a habitat (moist; cool; littered etc.) and therefore, considered as rare orchids e.g. *Bulbophyllum delitescens*, *Dendrobium aduncum*, *D. amplum*, *Eria globulifera*, *Oberonia longibracteata*, *Trias nasuta*.

2. ***The Indo-china Mainland (including Myanmar) elements*** (Fig.5) The range of this distribution pattern is mostly on the mainland South-East Asia which begin in the North-eastern part of Myanmar in Shan Plateau, then continued down South to Thailand, then across the Chao Praya River Basin to Laos, Vietnam and Cambodia which has been so-called “Indo-China”. The species fall into this distribution range could be found both on the highland areas e.g. mountain; plateau or in the lowland areas e.g. *Campanulorchis globulifera*, *Ceratostylis siamensis* etc. and one new record species orchid of Vietnam i.e. *Bulbophyllum dasystachys*, which had been discovered as a second record so far in the present study since it was first described (type from unknown source in Thailand?), had confirmed the characteristic of this range of distribution that contain many species confined to only this Indo-China Mainland on the one hand and this might also indicate the potential of the area as a centre of origin for many orchid species of the world, on the other hand.

3. ***The Malesian region elements*** (Fig.5) Malesian region is an area with the most diverse plant species of the world (Whitmore, 1984), which also influenced the flora of the mainland South-East Asia. The orchid elements of the Malesian region also occurred in this Annamite range of Vietnam. The interesting phenomena concerning the distribution process might concern the fact that the orchid elements occurring in Vietnam and in the neighboring countries of Thailand and Cambodia had never been found in the Choa praya River Basin and the Korat Plateau which is the mainland that



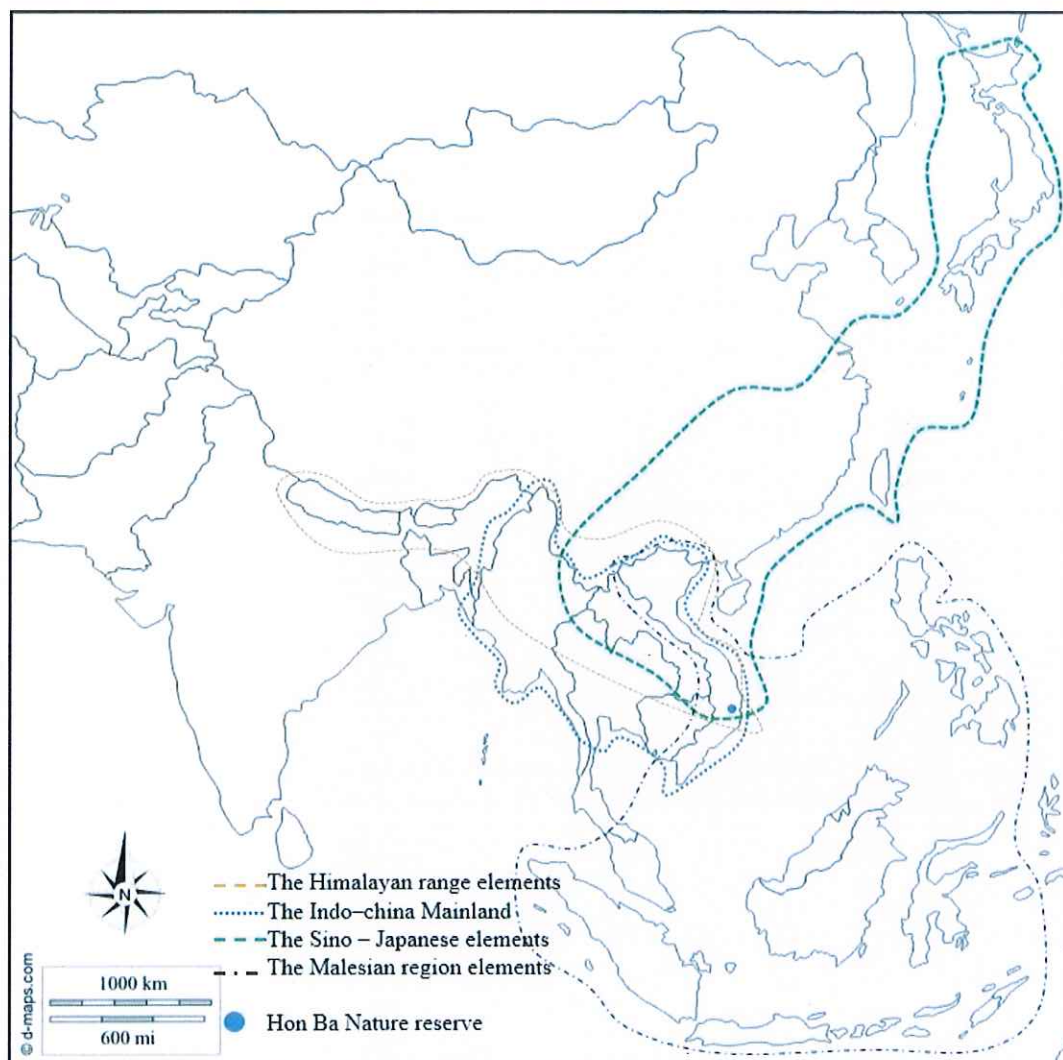
connected part of the Malesian region on the mainland South-East Asia and the Indo-China where Vietnam situated. The example of orchids of the Malesian region; Peninsular Thailand and some occurred also in South-eastern part of Thailand next to Cambodia as well as in Cambodia which had been found in Hon Ba Nature Reserve are: *Aphyllorchis pallida*, *Appendicula hexandra*, *Phreatia densiflora*, *Trichoglottis retusa* and *Vanilla albida*. In addition, *Stichorkis compressa* is the only Malesian element found in this Annamite Range at Hon Ba Nature Reserve which has different route of distribution to other Malesian elements found, as this one had been recorded only in the Philippines archipelago and west Borneo, then Vietnam and not even on the mainland Malesian in the Peninsular Malaysia.

4. ***The Sino – Japanese elements.*** (Fig.5) Few species of orchids in the study area had been found confining only to the oriental part of Asia in Japan and South-East China, down to the North of Thailand and Laos. One was *Cymbidium dayanum*. And the other is the new record species to Vietnam i.e. *Lecanorchis nigricans*, discovered as first time in the Annamite Range in the present study.

5. ***The endemic elements to the Annamite range.*** There are quite numbers of the orchid species that characterized the floristic region of this Annamite range in particular, which have never been recorded anywhere else. Some could be seen at Hon Ba Nature Reserve i.e. *Bulbophyllum delitescens*, *B. frostii*, *Cleisocentron klosii*, *Trichoglottis seidenfadenii*.

6. ***The common distributed orchid elements.*** Besides those former mentioned orchid elements in Hon Ba Nature Reserve, there are few orchid species which have wide range of distribution in various floristic regions. They may occur mostly in such disturbed habitats/edge of the forest i.e. *Arundina graminifolia*, *Bulbophyllum apodum*, *Clelostoma williamsonii*, *Coelogyne fimbriata*, *Cryptostylis arachnites*, *Dendrobium spatella*, *Spathoglottis plicata*, *Thrixspermum centipeda*, *Liparis caespitosa*, *Mycaranthes floribunda*, *M. pannea*. And some have larger distribution range, extended

to Japan or vice versa i.e. *Calanthe angustifolia*, *C. lyroglossa*; *Cymbidium dayanum*, *C. lancifolium*, *Erythrorchis altissima*.

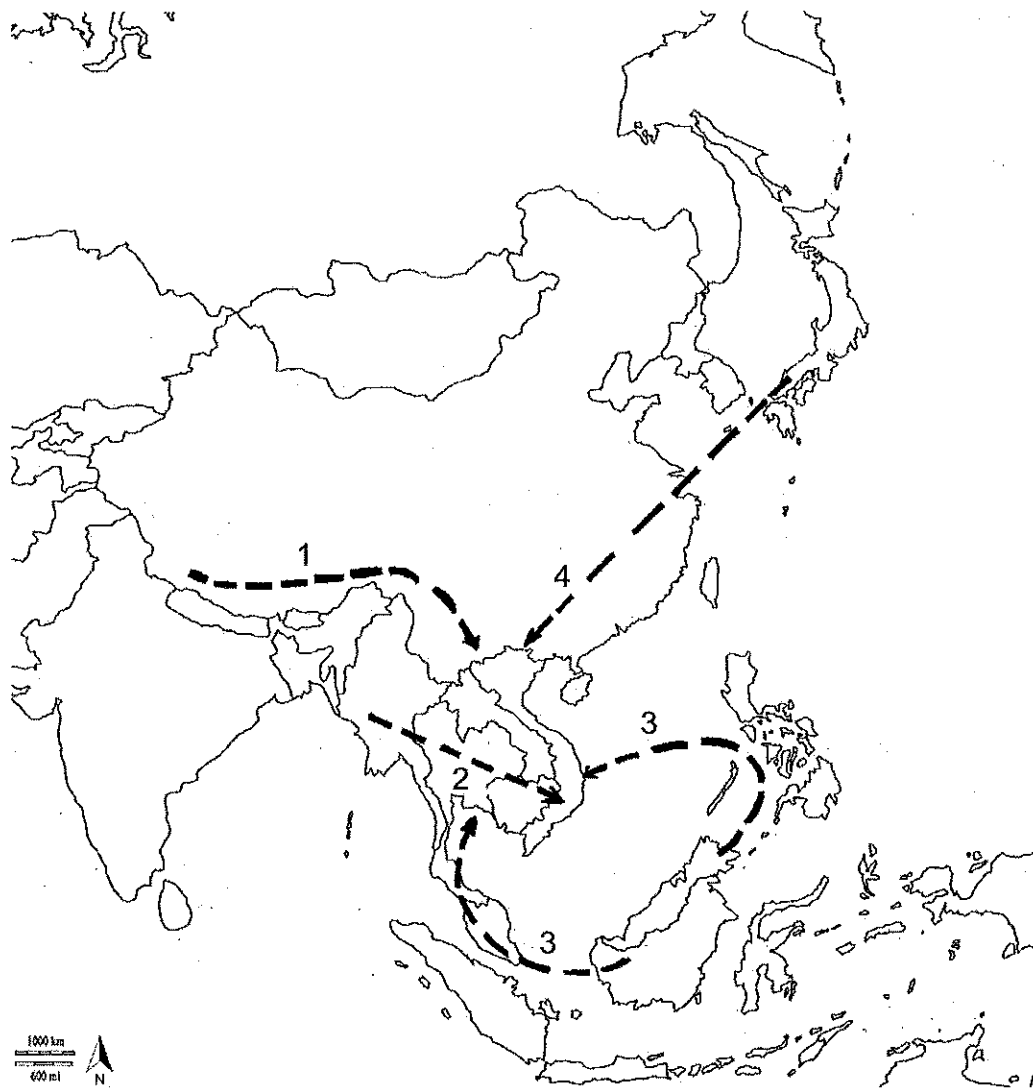


**Figure 5** Distribution ranges of the orchid species found in Hon Ba Nature Reserve, Central Vietnam in different floristic regions of South-East & East Asia.

**Notes on the possible distribution routes of the orchid elements found in Hon Ba Nature Reserve. (Fig.6)**

The investigations of the orchid elements at Hon Ba Nature Reserve which is the part of the famous Annamite Range in Vietnam had supported that the region is performing as a “cross road” for plant distributions from different nearby floristic regions. The

different distribution patterns of orchid elements found at Hon Ba had shown that this mountain range could be considered on the one hand as an important “distribution corridor” for plants, especially for the elements that occurred in high altitude > 1,000 m asl. as the mentioned mountain range has connected various separate floristic regions (Himalayan region; Mainland South-East Asian region; Malesian region as well as sub-region of Sino-Japanese). Considering the orchids element found in this Nature Reserve, proposed routes of orchid distribution might be estimate according to the distribution range of different orchid elements as: 1.) the route that took place over the Himalayan southern branches down to the Annamite range (Fig.6); 2.) the Mainland South-East Asiatic route that took place from west part of the Annamite Range crossing Irrawaddy River Basin in Myanmar; Chao Praya River Basin in Thailand then continued through Korat Plateau to the Annamite Range(Fig.6); 3.) the Malesian route that could separate into two path: one is the route that distributed through peninsular Thailand and Malaysia toward the South-eastern part of Thailand through Cambodia to Vietnam and the other took place in the West of Borneo across the South China sea to Annamite range (Fig.6); 4.) The Sino-Japanese route that took place along the coast of China from Japan in the North, then toward the South to Annamite range or vice versa(Fig.6). And on the other hand, the Annamite range performed as a given (sub-) floristic region which could be seen from several endemic species of this range that were recorded also from the study area, In order to draw much clearer picture of the phyto-geography in this famous Annamite range which has centered in Vietnam, more collections not only of orchid elements, but also other groups of plants in the whole Annamite Range would be, therefore, needed in future.



**Figure 6** Distribution patterns of orchids in different floristic regions.

#### **Notes on the orchid diversity in Vietnam**

It is hesitated to compare the diversity of orchids in Hon Ba Nature Reserve with any other place in Vietnam as the study of orchid in Vietnam in the pass had never focused on any area base locality. In any case, when the recent orchid collection of Mr. Nong Van Duy from the Bidoup national park, Da Lat plateau, South of Vietnam, which fall in the same Annamite range (*per com.*) had been taken into account, the diversity in both places is not much different from each other (see table 2). It is to be marked here that there are only twenty-six common species in both place in spite of their position in the same range of mountain (the Anamite Range) i.e. *Bulbophyllum apodum*, *Bulbophyllum retusiusculum* *Calanthe angustifolia*, *Calanthe lyroglossa*, *Coelogyne*

*mooreana*, *Cymbidium erythrostylum*, *Cymbidium lancifolium*, *Dendrobium amplum*, *Dendrobium angustifolium*, *Epigeneium cacuminis*, *Epigeneium chapaense*, *Eria globulifera*, *E. tomentosa*, *Gastrochilus calceolaris*, *Goodyera foliosa*, *Stichorkis compressa*, *Oberonia falcata*, *Mycaranthes floribunda*, *Paphiopedilum appletonianum*, *Pholidota chinensis*, *Pholidota levelleana*, *Pinalia floribunda*, *Thrixspermum centipeda*, *Trichotosia microphylla*. Among the species, there are 2 endemic species *Coelogyne mooreana* *Cymbidium erythrostylum* (*per com.*). These are probably too less common species between such near-by localities from each other. And this might suggest that the missing orchid elements from one another localities (Hon Ba Nature Reserve V.S. the Bidoup national park) might due to the an-explored/ inaccessed localities in each place. More investigations of orchids that would focus on the area base localities are, therefore, needed.

Table 2 number of orchid taxa recorded from the Hon Ba nature reserve and Bidoup National park

<b>Taxon rank</b>	<b>Hon Ba nature reserve</b>	<b>Bidoup National park (<i>per com.</i>)</b>
genera	51	38
species	126 (26 endemic)	100 (21 endemic)

### **Suggestions and conservation measures.**

As elsewhere in SE Asia, protected areas in Vietnam are likely to be suffered from many threats, among them hunting, deforestation and mining activities that affecting diversity of remnant forest, mostly fragmented habitats with major consequences for its resilience, Hon Ba Nature Reserve is rather important as it performed as the “Biodiversity cross-road” of plants in the Indo-China Region, more information on the plant diversity in either plant groups in the area, including the adjacent ones would be useful in order to get much clearer phyto-geographic view point of the region of how plant diversity in a given area took place, Illegal trade of native plants (including orchids) as well as habitat deterioration by many means, such as reforestation program, would soon deplete such biodiversity of the area, As the Hon Ba

Nature Reserve is not only has an important natural-historical value to Vietnam, however, it is one of those important jigsaws in order to make up the clearer picture of the phyto-geography of the Indo-China region as a whole, Moreover, more flora investigation and the intensive botanical surveys should be encouraged throughout the Indo-China region which also includes Vietnam, the Korat Plateau in the North-east of Thailand, Laos PDR as well as the Kingdom of Cambodia before the natural information on plant biodiversity would be destroyed by various anthropogenic activities e.g. habitat deteriorations, various reforestation programs etc.

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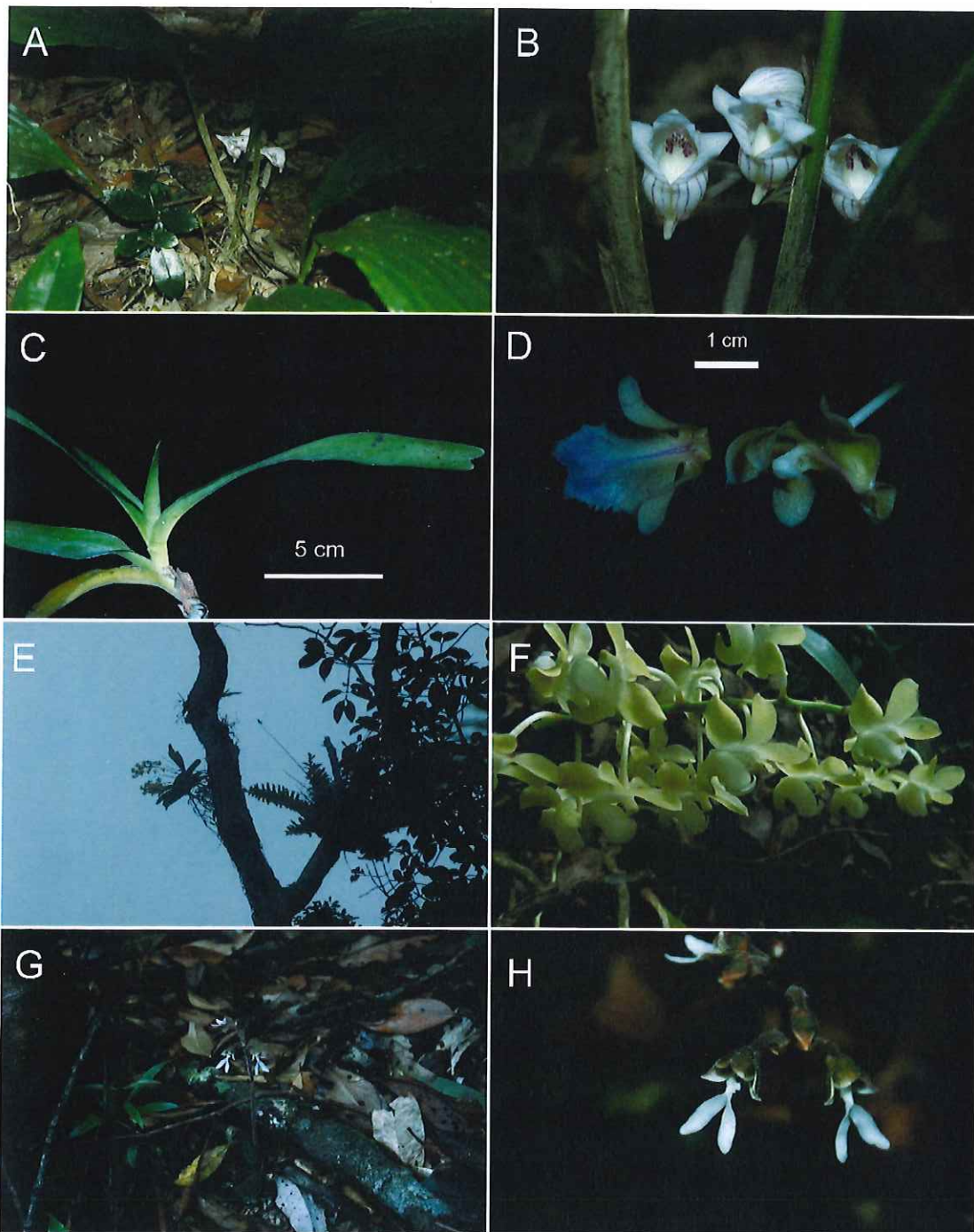
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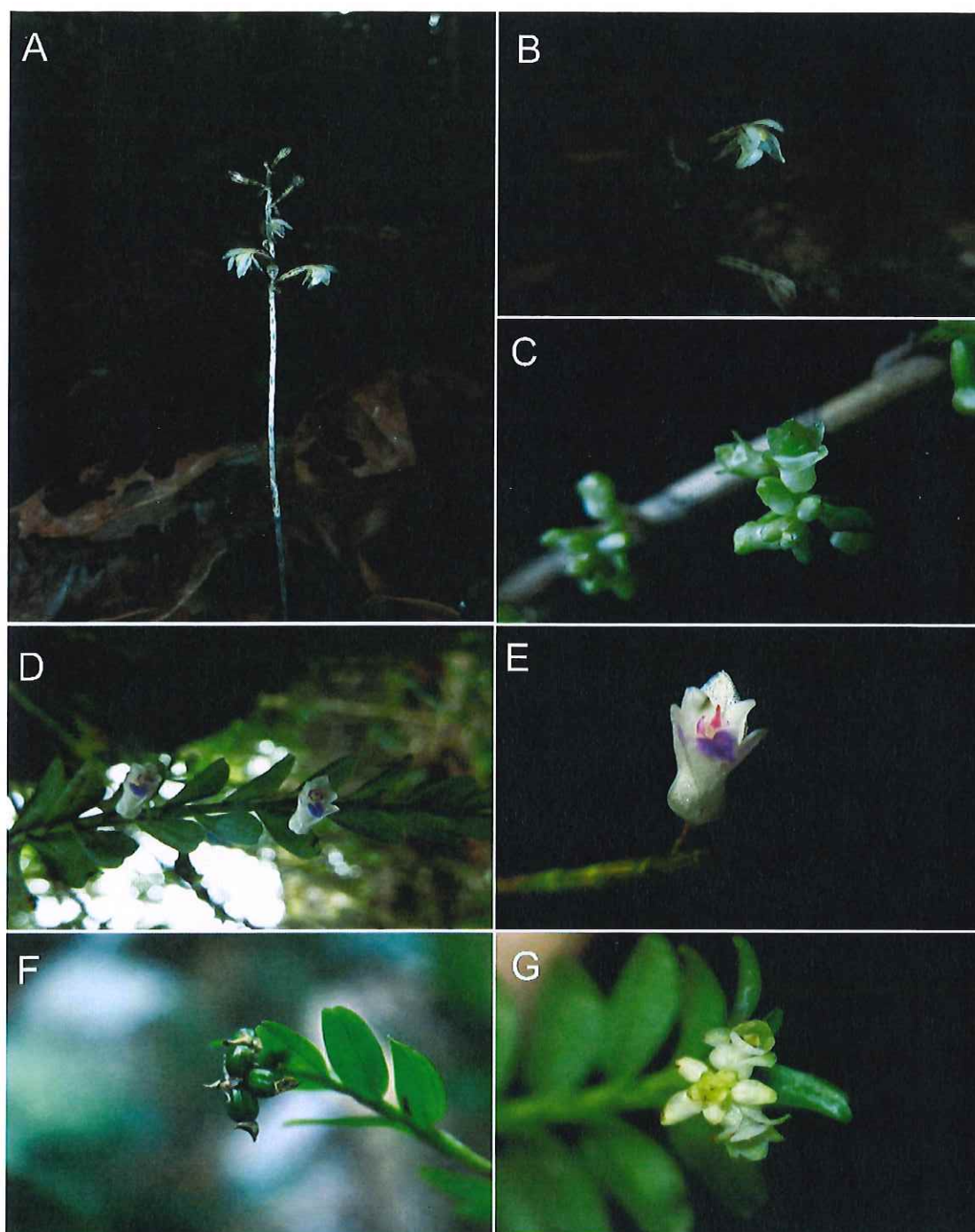
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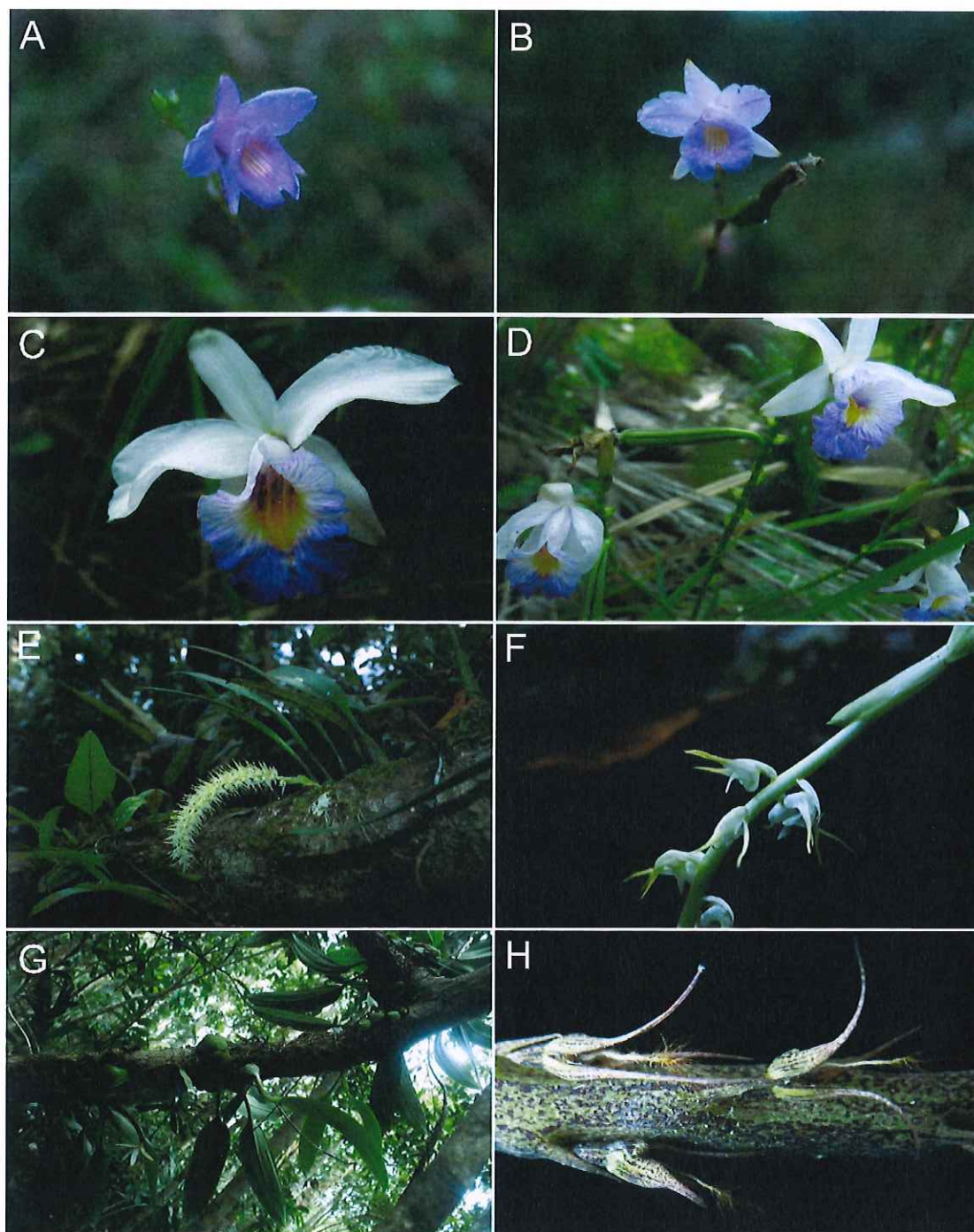
**Plate 4** A – B. *Acanthephippium striatum* Lindl.; C – D, *Aerides falcata* Lindl. & Paxton; E – F. *Aerides odorata* Lour.; G – H, *Anoectochilus lylei* Rolfe ex Downie.



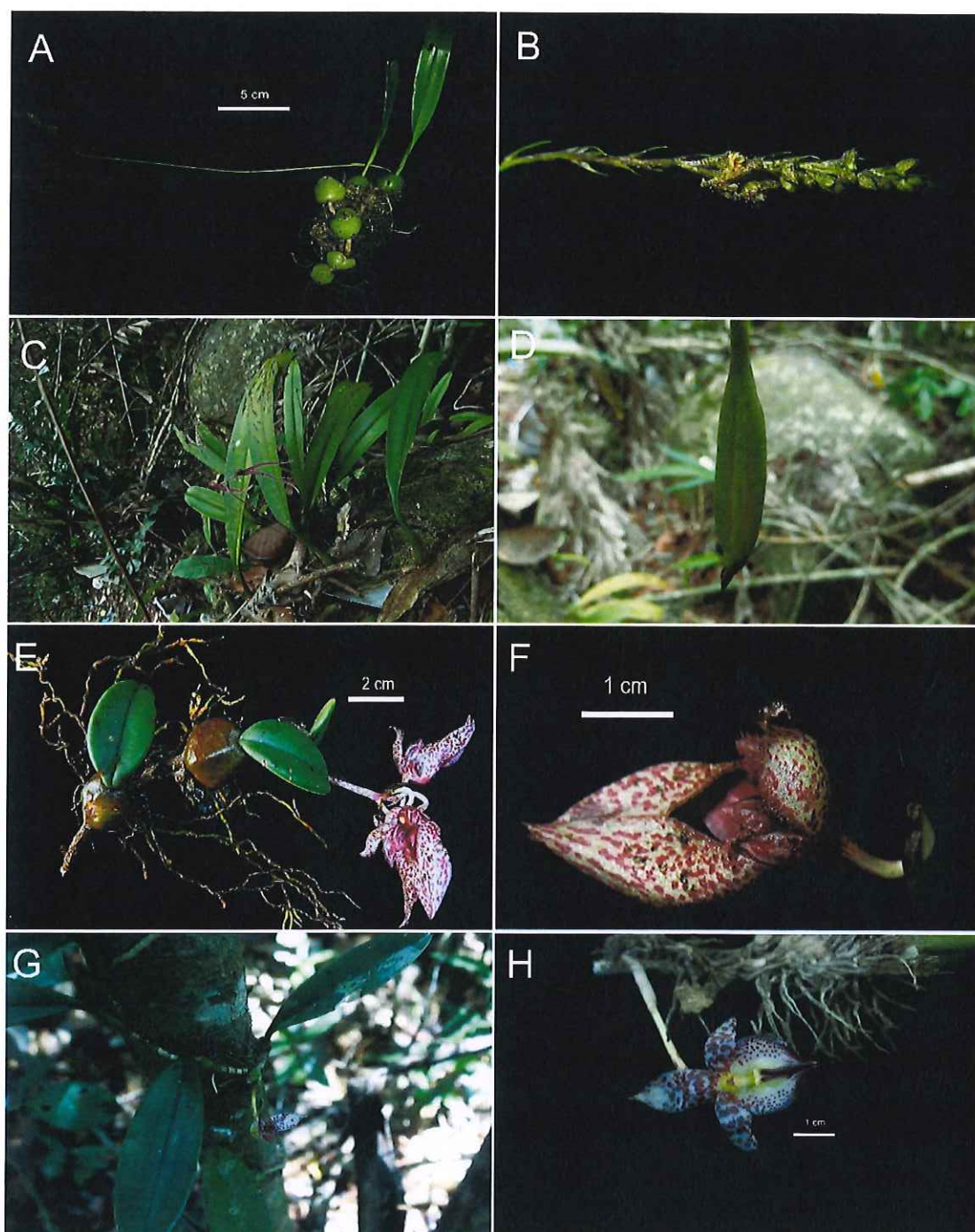


**Plate 5** A – B. *Aphyllorchis pallida* Blume; C. *Appendicula reflexa* Blume; D – E. *Appendicula gracilis* Aver.; F – G. *Appendicula hexandra* (J. Koenig) J.J. Sm.



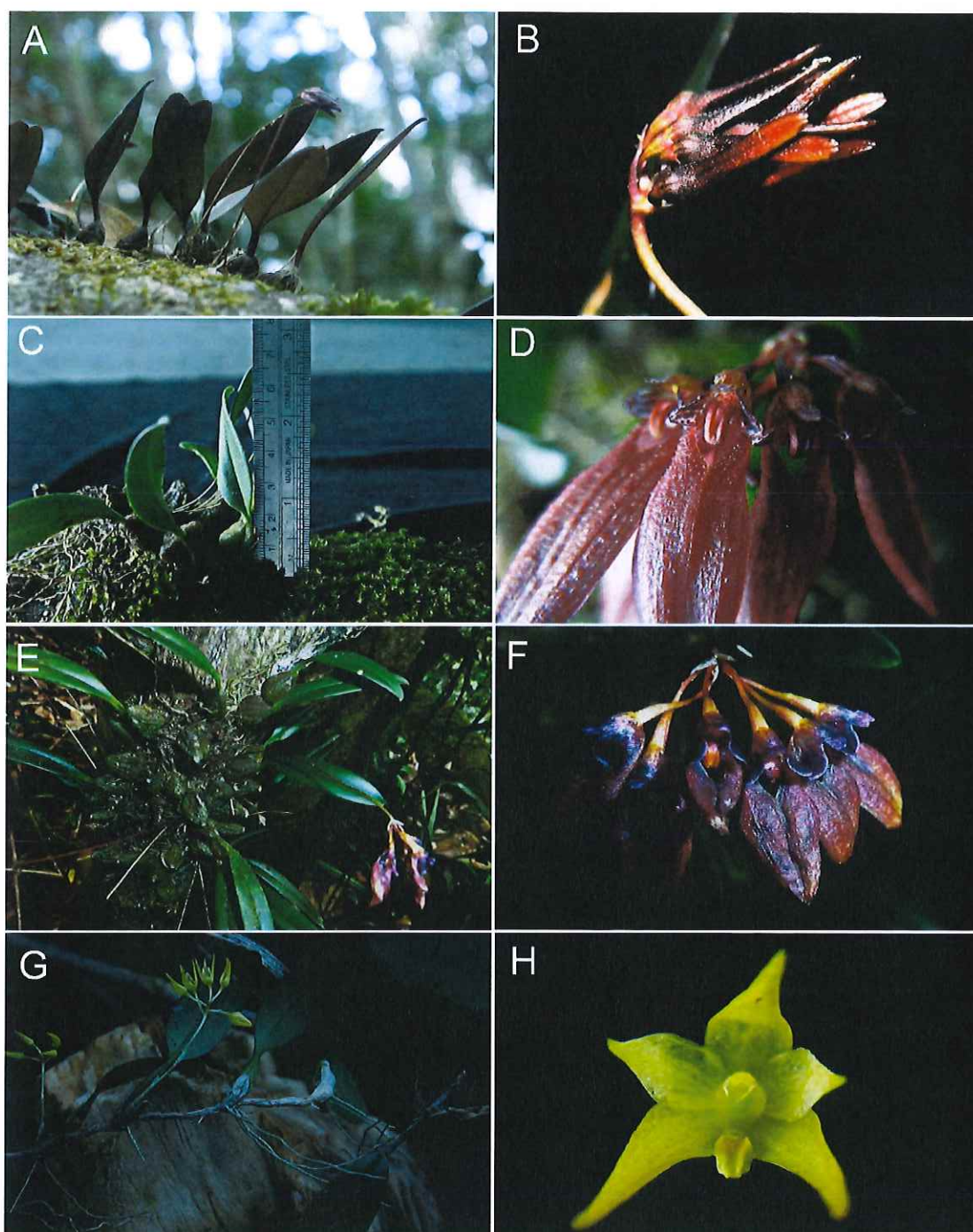


**Plate 6** A – B. *Arundina graminifolia* (D. Don) Hochr. subsp. *caespitosa* (Aver.) H. A. Pedersen & Schuit.; C – D, *Arundina graminifolia* (D, Don) Hochr. subsp. *graminifolia*; E – F *Bulbophyllum apodum* Hook. f.; G – H, *Bulbophyllum clipeibulbum* J.J. Verm.

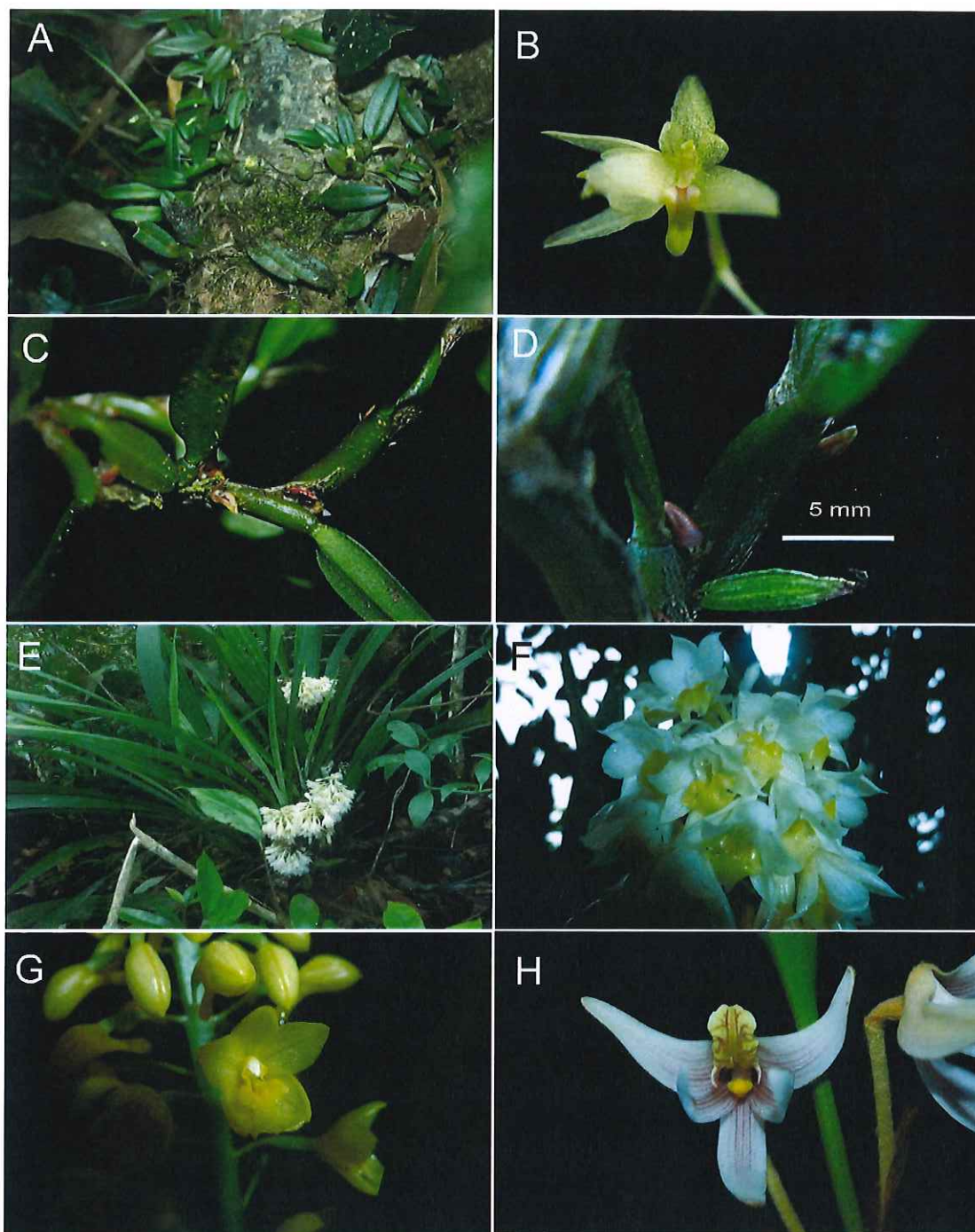


**Plate 7** A – B. *Bulbophyllum dasystachys* J.J.Verm.; C – D. *Bulbophyllum delitescens* Hance; E – F. *Bulbophyllum frostii* Summerh.; G – H. *Bulbophyllum macranthum* Lindl.



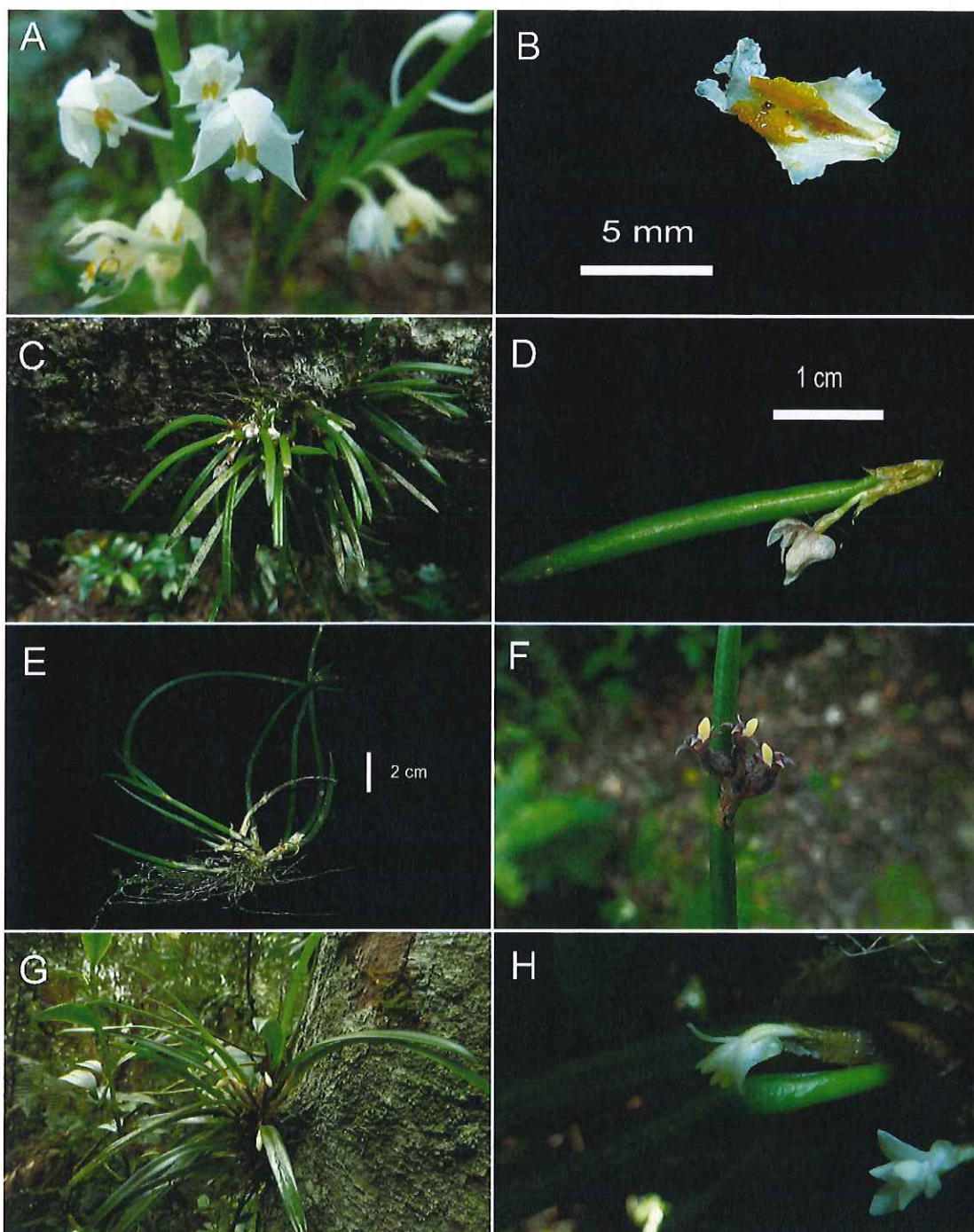


**Plate 8** A – B. *Bulbophyllum thaiorum* J.J. Sm.; C – D. *Bulbophyllum pumilio* C.S.P.Parish & Rchb. f.; E – F. *Bulbophyllum retusiusculum* Rchb. f.; G – H. *Bulbophyllum simondii* Gagnep.

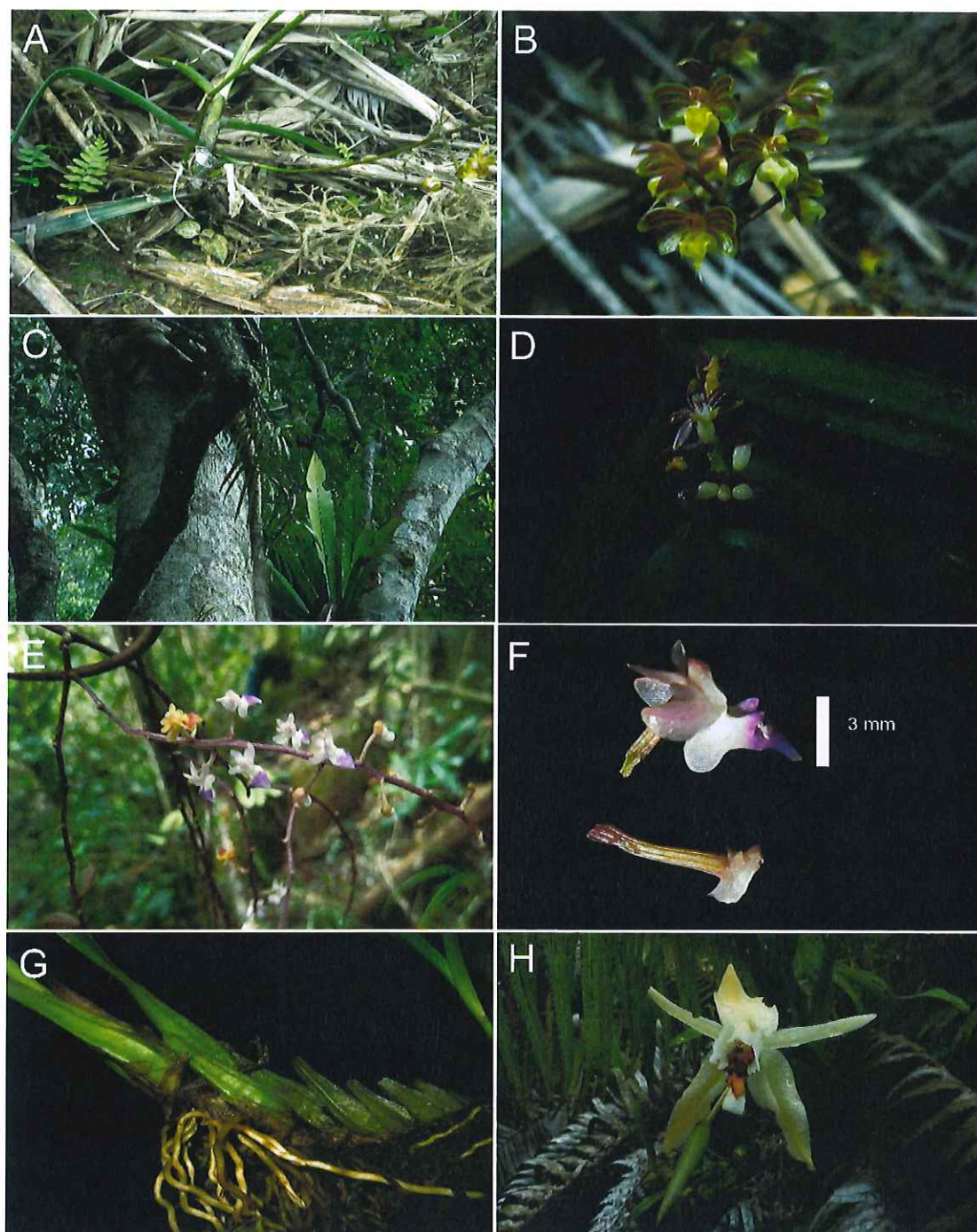


**Plate 9** *Bulbophyllum tixieri* Seidenf.; C – D. *Bulbophyllum tortuosum* Lindl.; E – F. *Calanthe angustifolia* (Blume) Lindl.; G. *Calanthe lyroglossa* Rehb. f.; H *Campanulorchis globifera* (Rolfe) Brieger.



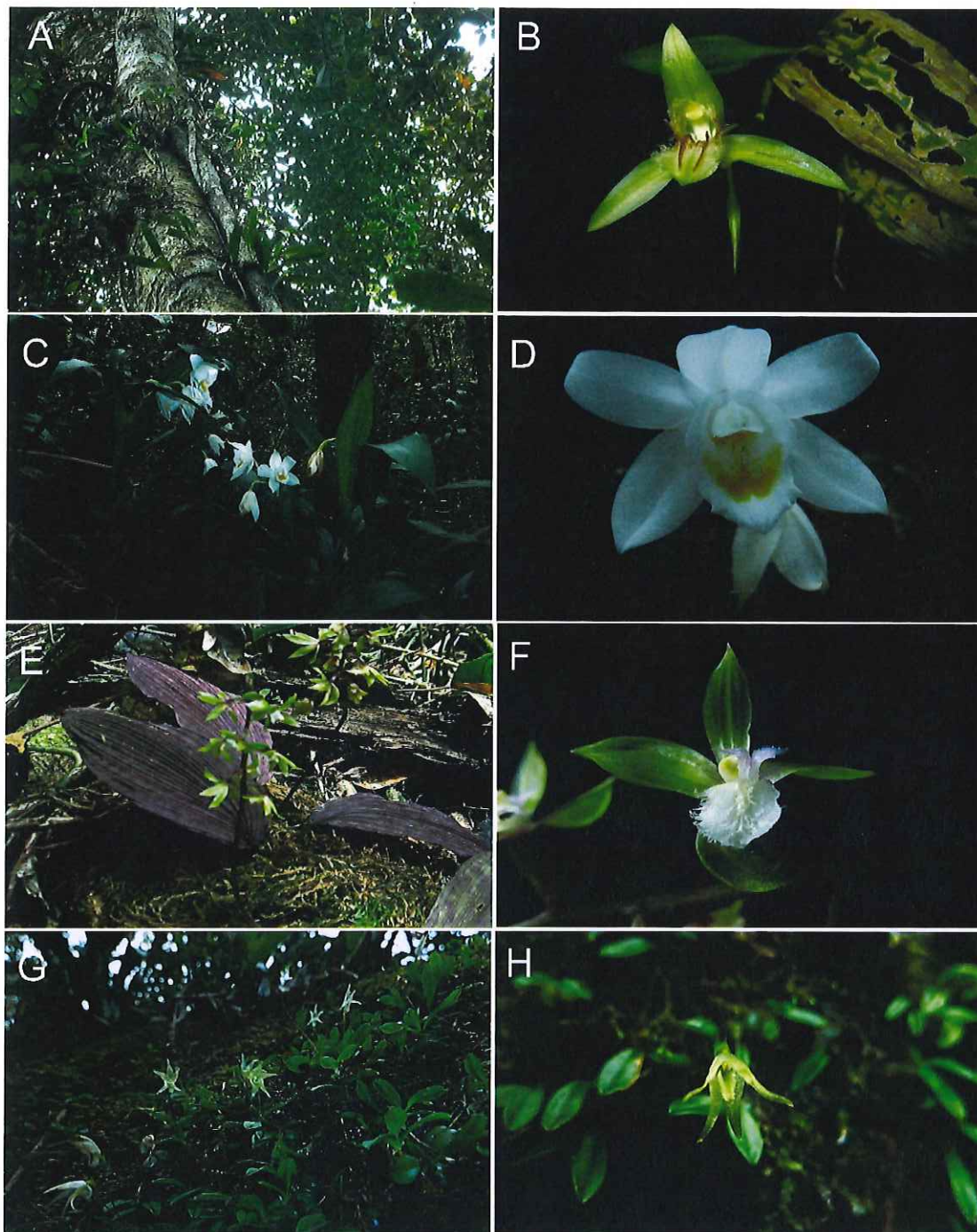


**Plate 10** A – B. *Cephalantheropsis longipes* (Hook.f.) Ormerod; C – D. *Ceratostylis siamensis* Rolfe ex C. Downie; E – F. *Ceratostylis subulata* Blume; G – H *Ceratostylis tonkinensis* (Gagnep.) Aver.

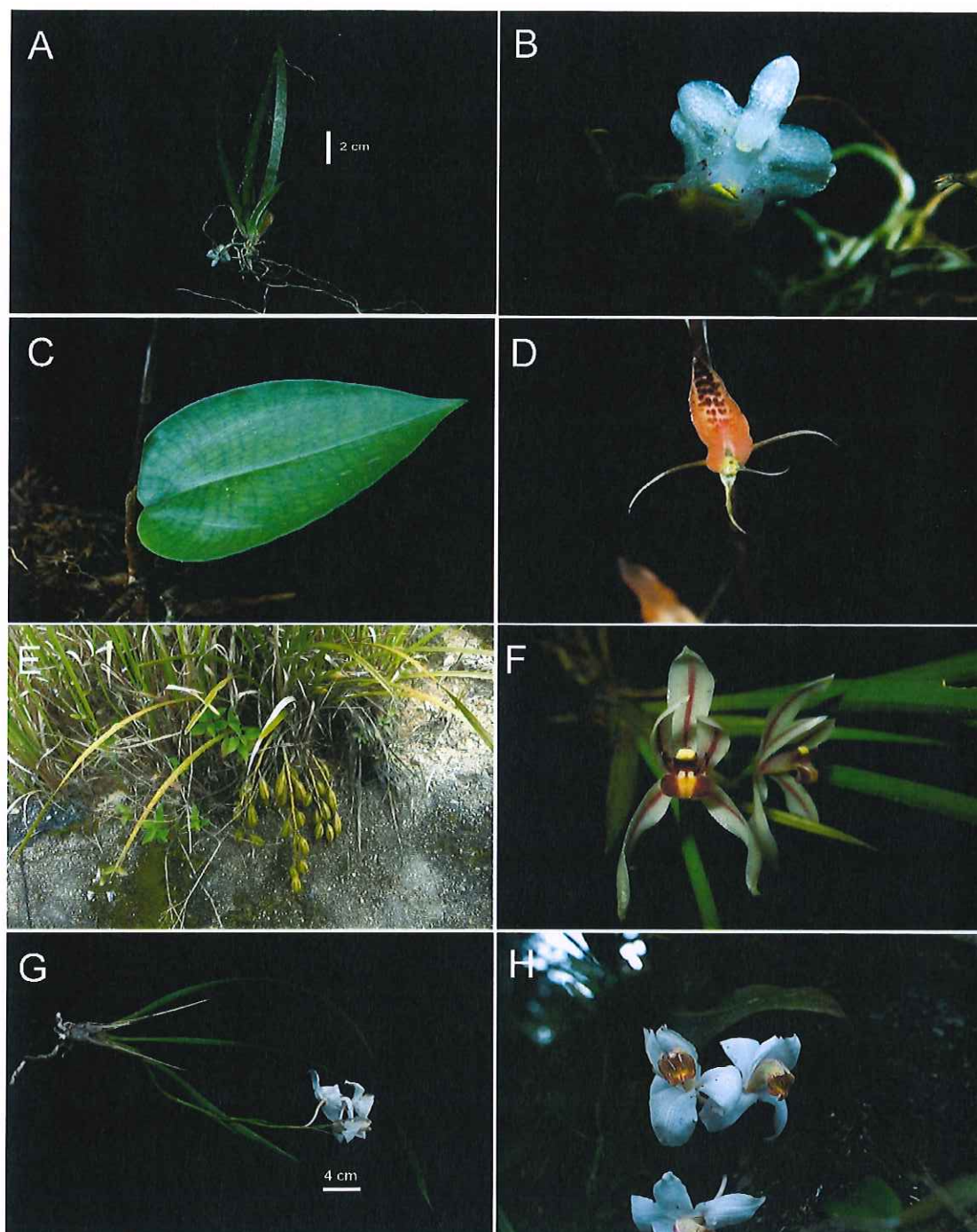


**Plate 11** A – B. *Cleisostoma birmanicum* (Schltr.) Garay; C – D. *Cleisostoma striatum* (Rchb. f.) N.E. Br.; E – F. *Cleisostoma williamsonii* (Rchb. f.) Garay; G – H. *Coelogyne eberhardtii* Gagnep.



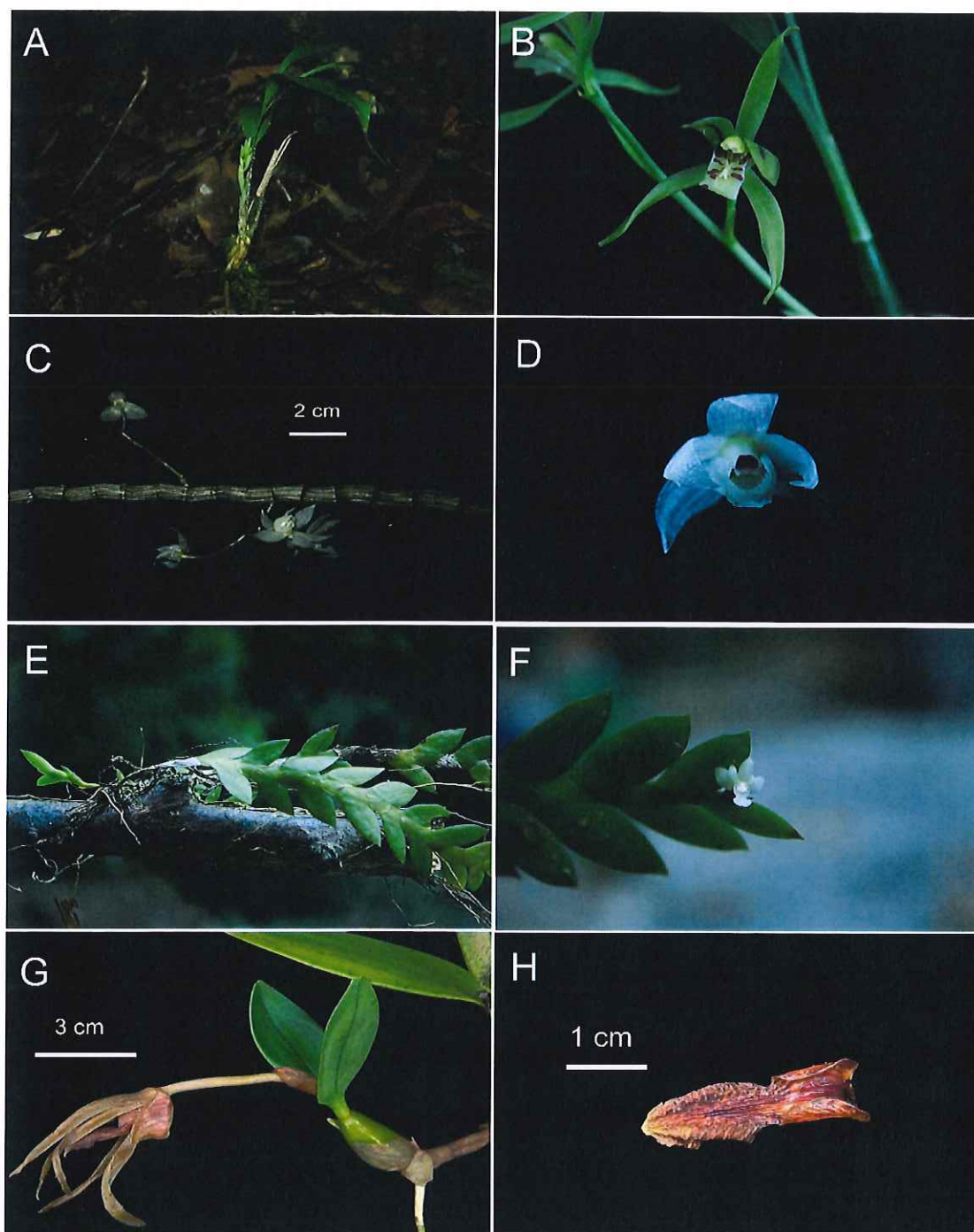


**Plate 12** A – B. *Coelogyne fimbriata* Lindl. var. *fimbriata*; C – D. *Coelogyne mooreana* Rolfe; E – F. *Collabium chloranthum* (Gagnep.) Seidenf.; G – H. *Conchidium pusillum* Griff.

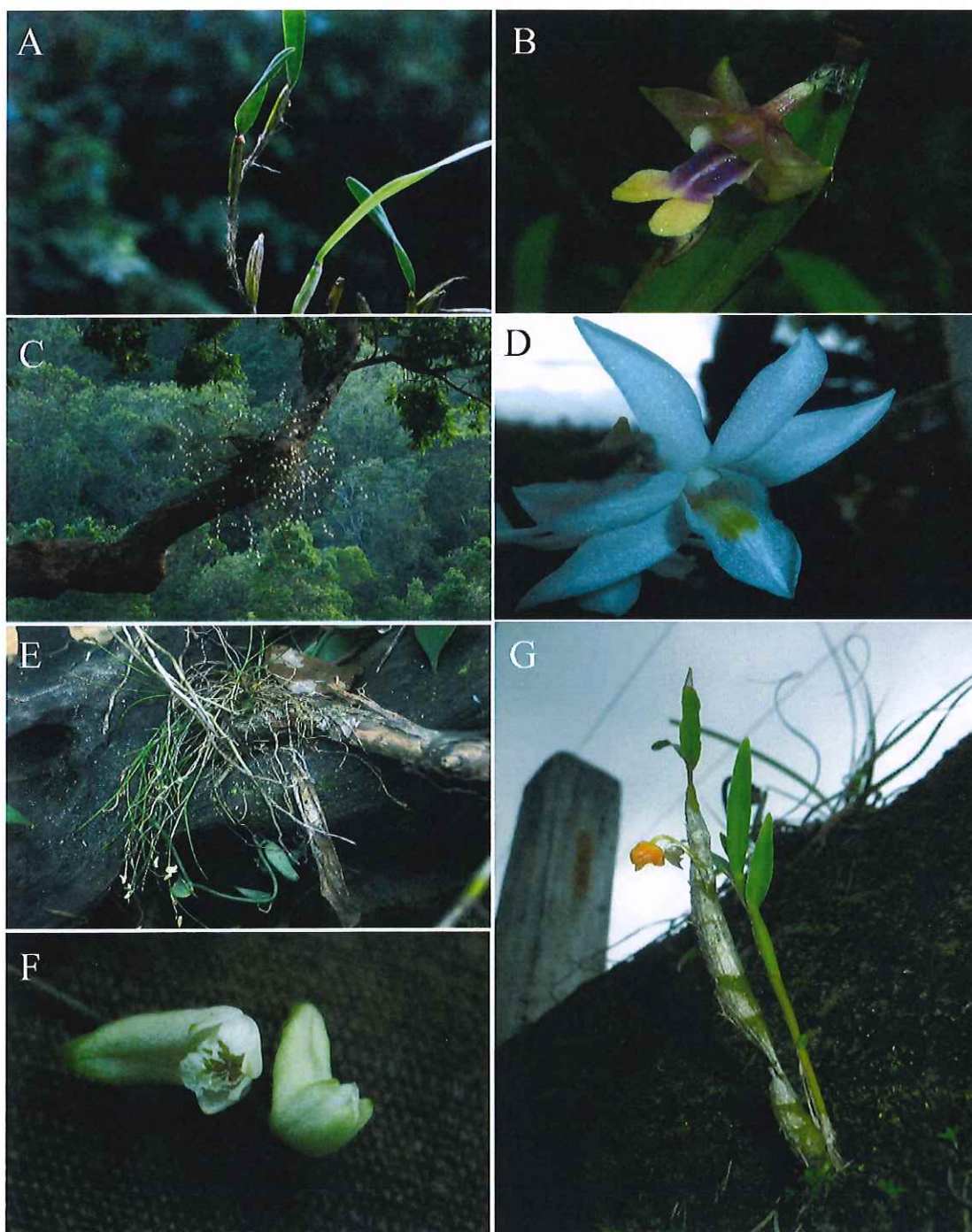


**Plate 13** A – B. *Cordiglottis longipedicellata* Lee et al.; C – D. *Cryptostylis arachnites* (Blume) Blume; E – F. *Cymbidium dayanum* Rchb.f.; G – H. *Cymbidium erythrostylum* Rolfe



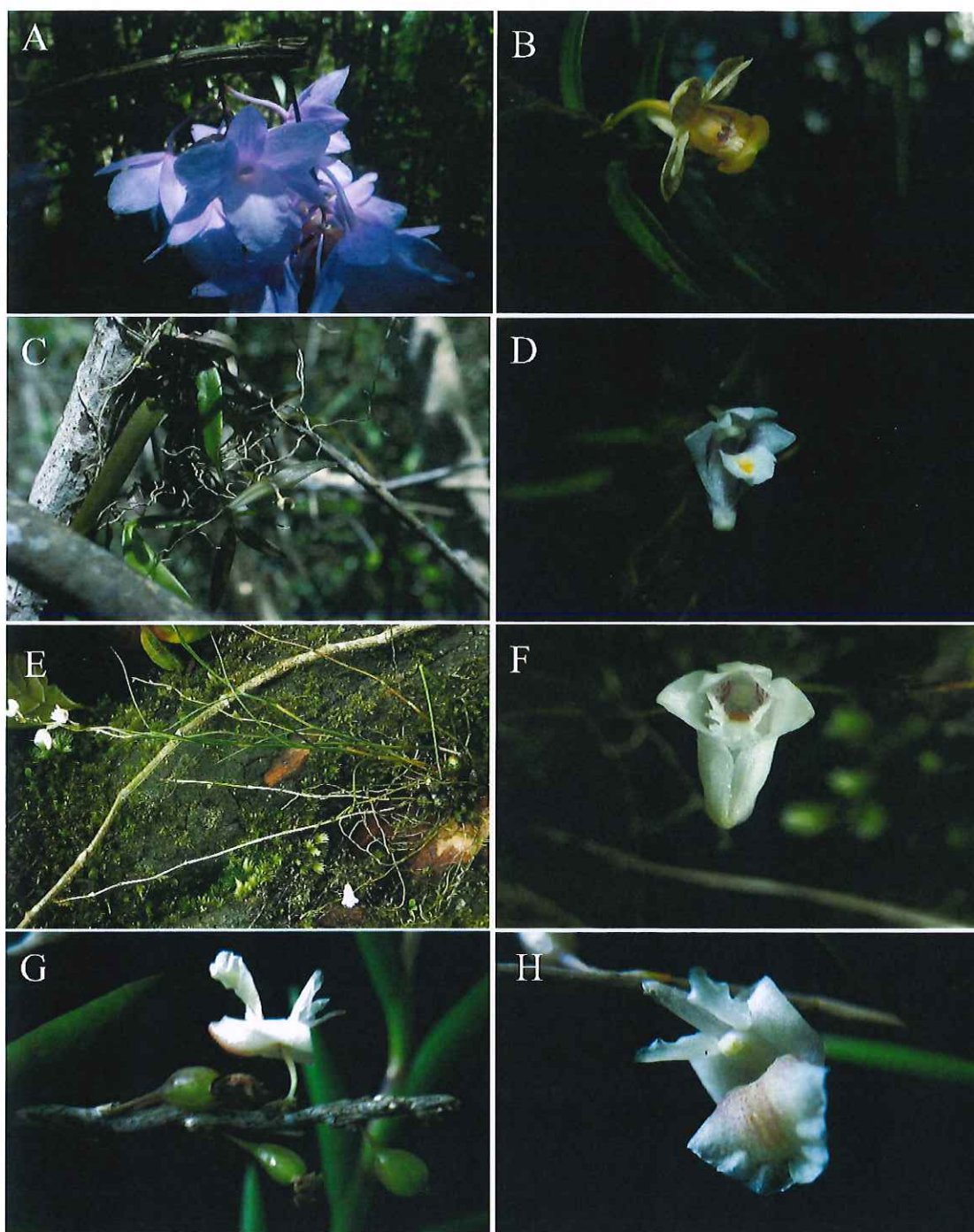


**Plate 14** A – B. *Cymbidium lancifolium* Hook; C – D. *Dendrobium aduncum* Wall. ex Lindl.; E – F. *Dendrobium aloifolium* Rchb.f.; G – H. *Dendrobium amplum* Lindl.

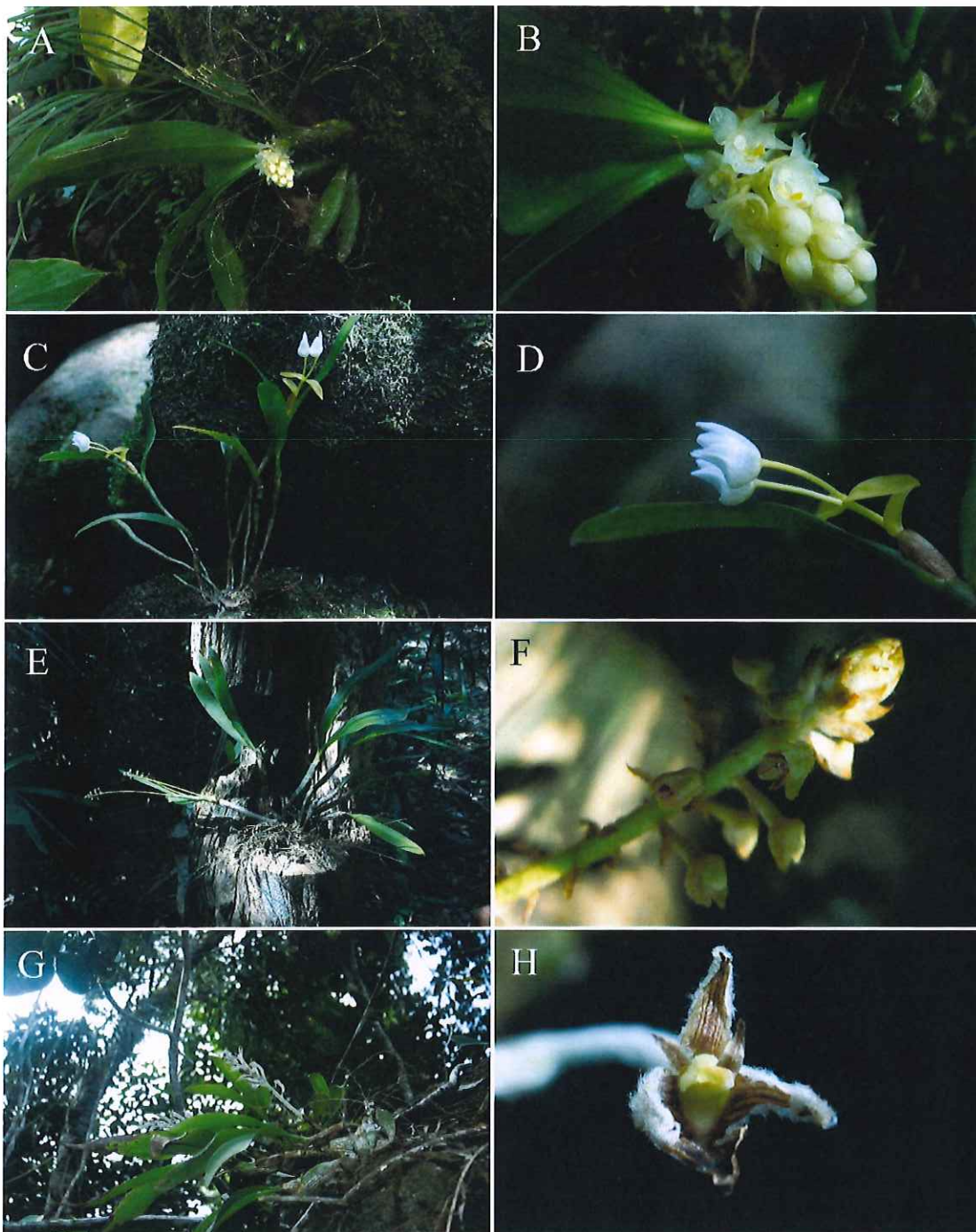


**Plate 15** A – B. *Dendrobium angustifolium* (Blume) Lindl.; C – D. *Dendrobium crumenatum* Sw.; E – F. *Dendrobium dentatum* Seidenf.; G. *Dendrobium farinatum* Schildh. & Schraut.



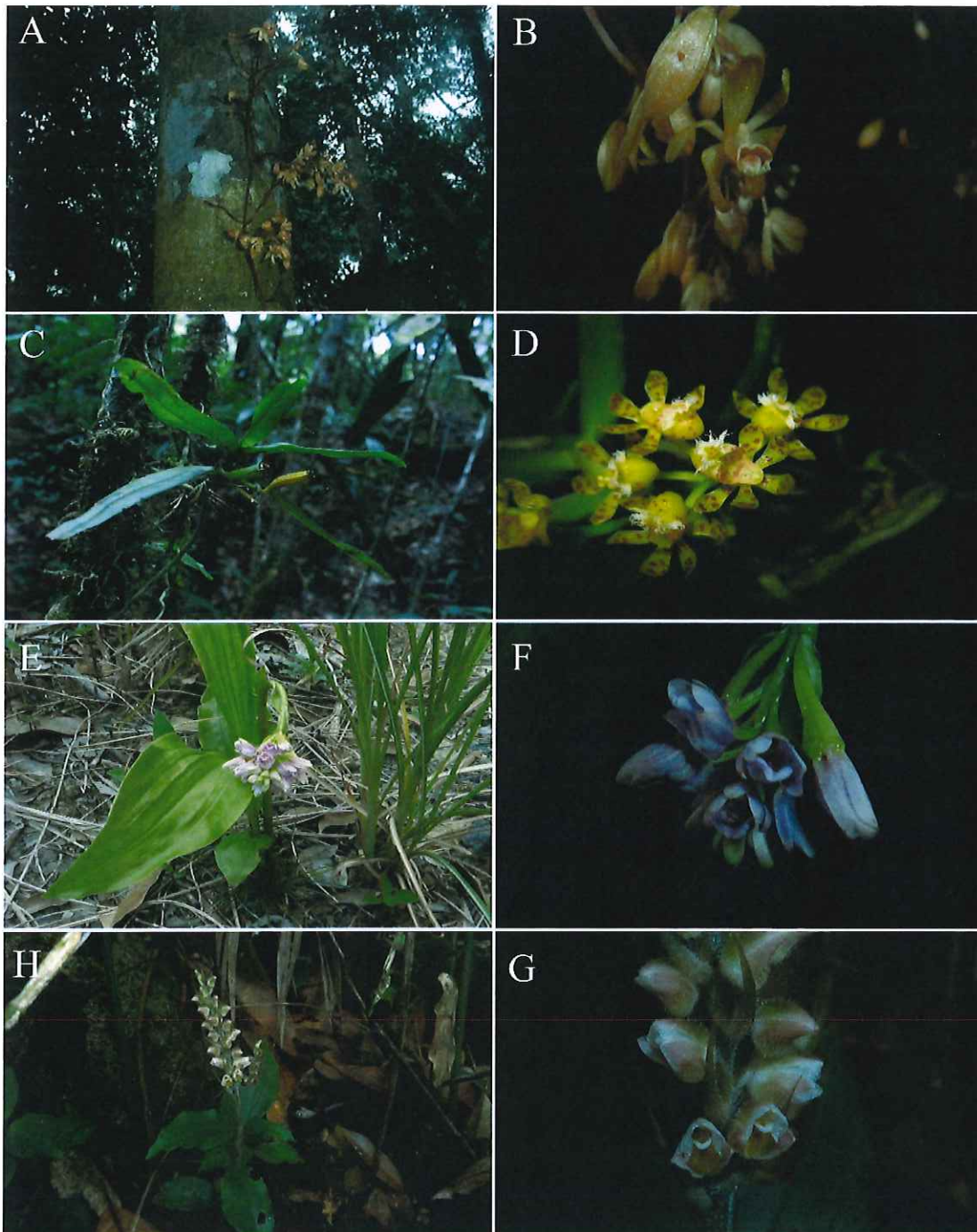


**Plate 16** A. *Dendrobium hamatum* Rolfe; B. *Dendrobium khanhoaense* Aver.; C – D. *Dendrobium pachyphyllum* (Kuntze) Bakh.f.; E – F. *Dendrobium pseudotenellum* Guillaumin; G – H. *Dendrobium spatella* Rchb.f.

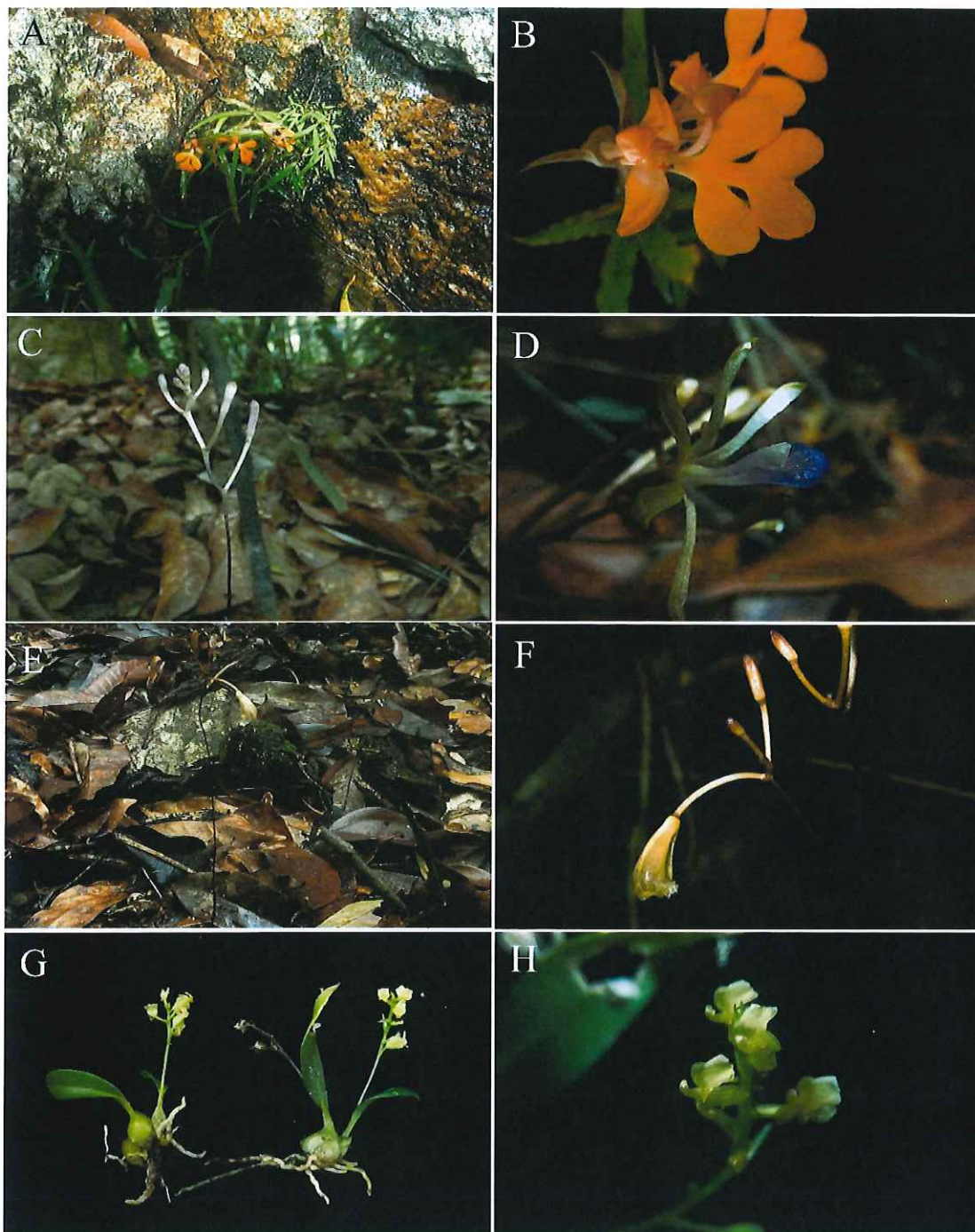


**Plate 17** A – B. *Eria globulifera* Seidenf.; C – D. *Eria lactiflora* Aver.; E – F. *Eria obscura* Aver.; G – H. *Eria tomentosa* (J.König) Hook.f.



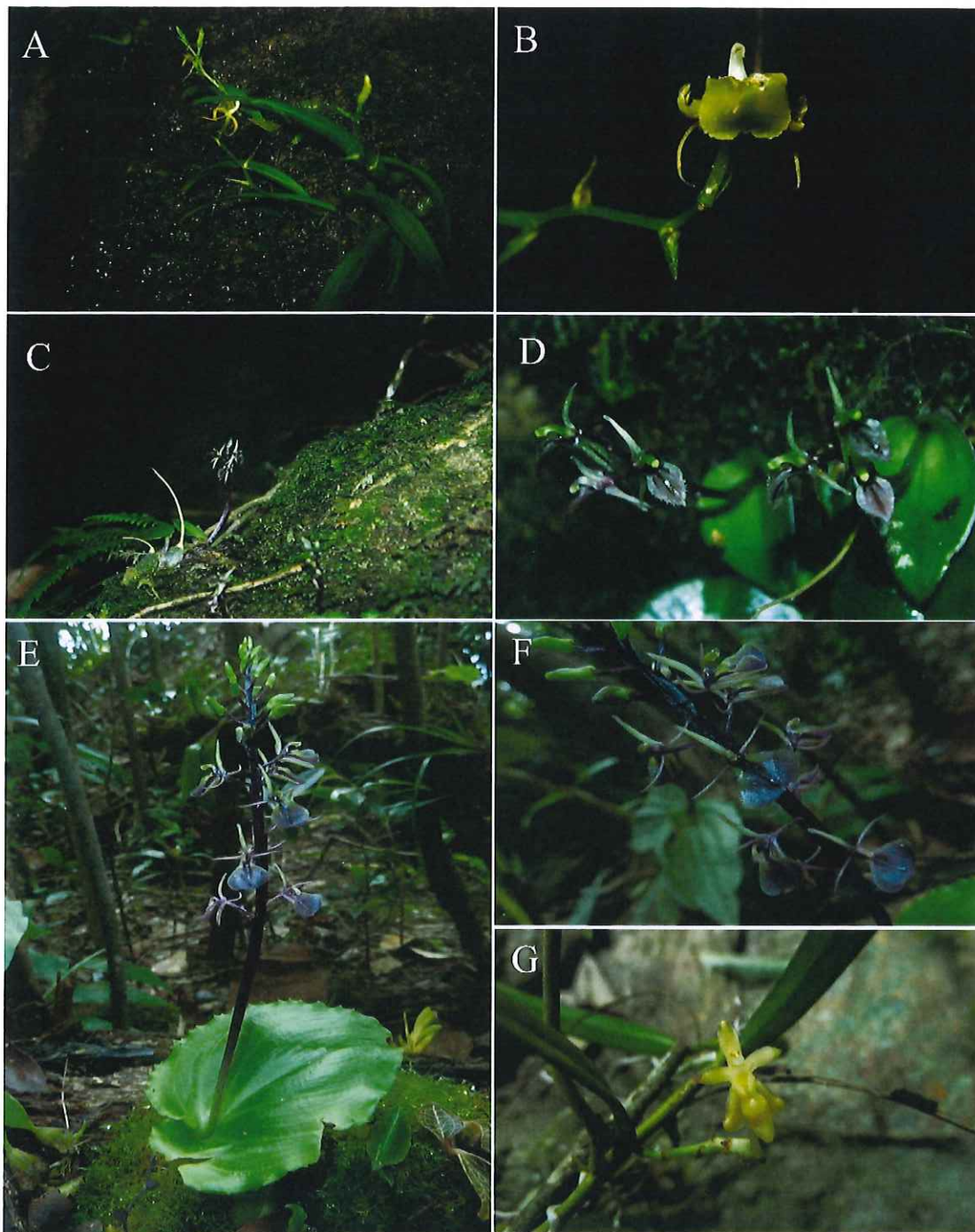


**Plate 18** A – B. *Erythrorchis altissima* Blume; C – D. *Gastrochilus calceolaris* (Buch.–Ham. ex Sm.) D. Don; E – F. *Geodorum densiflorum* (Lam.) Schltr.; G – H. *Goodyera foliosa* (Lindl.) Benth. ex C.B. Clarke.

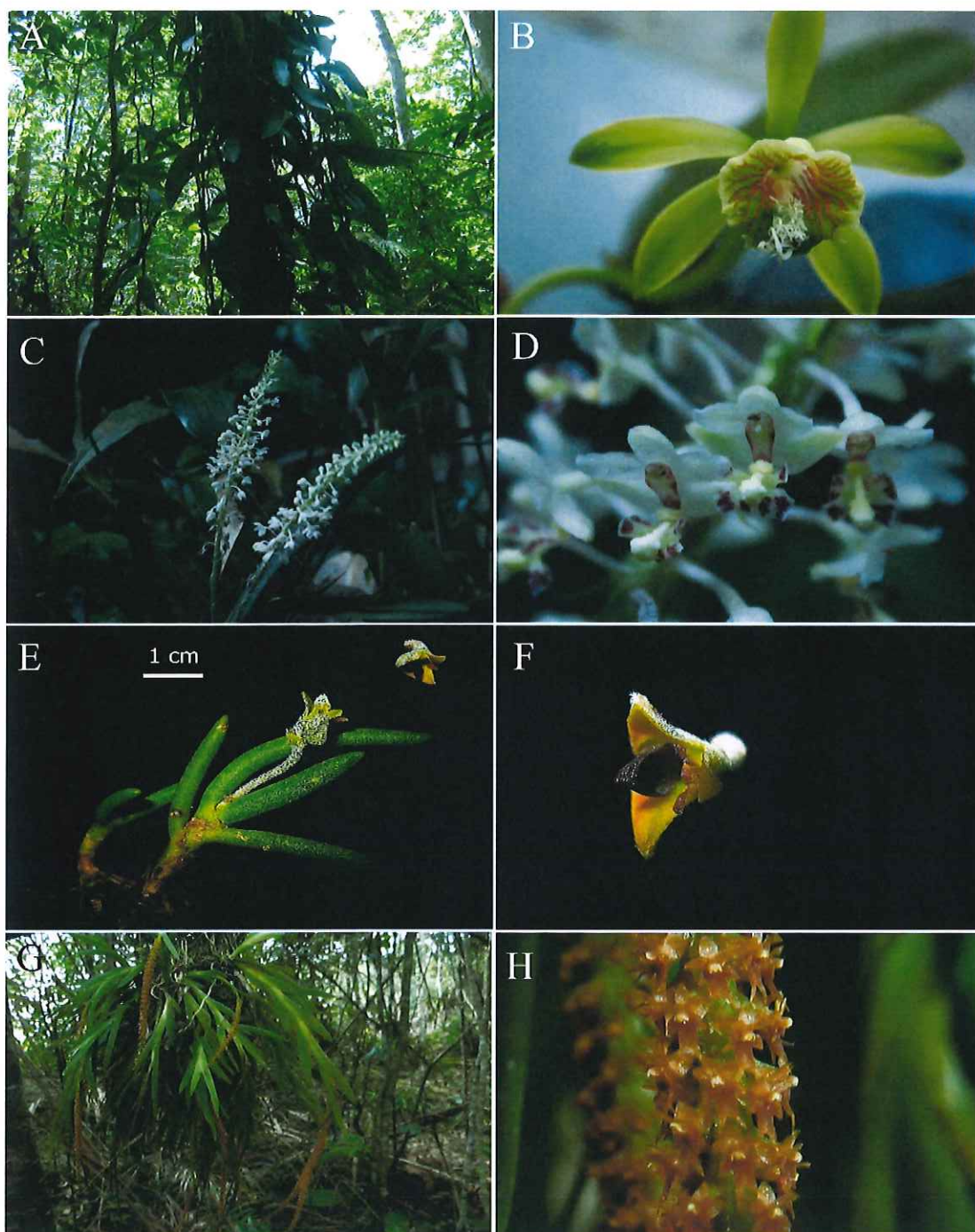


**Plate 19** A – B. *Habenaria rhodocheila* Hance; C – D. *Lecanorchis nigricans* Honda;  
E – F. *Lecanorchis vietnamica* Aver.; G – H. *Liparis cespitosa* (Lam.) Lindl.



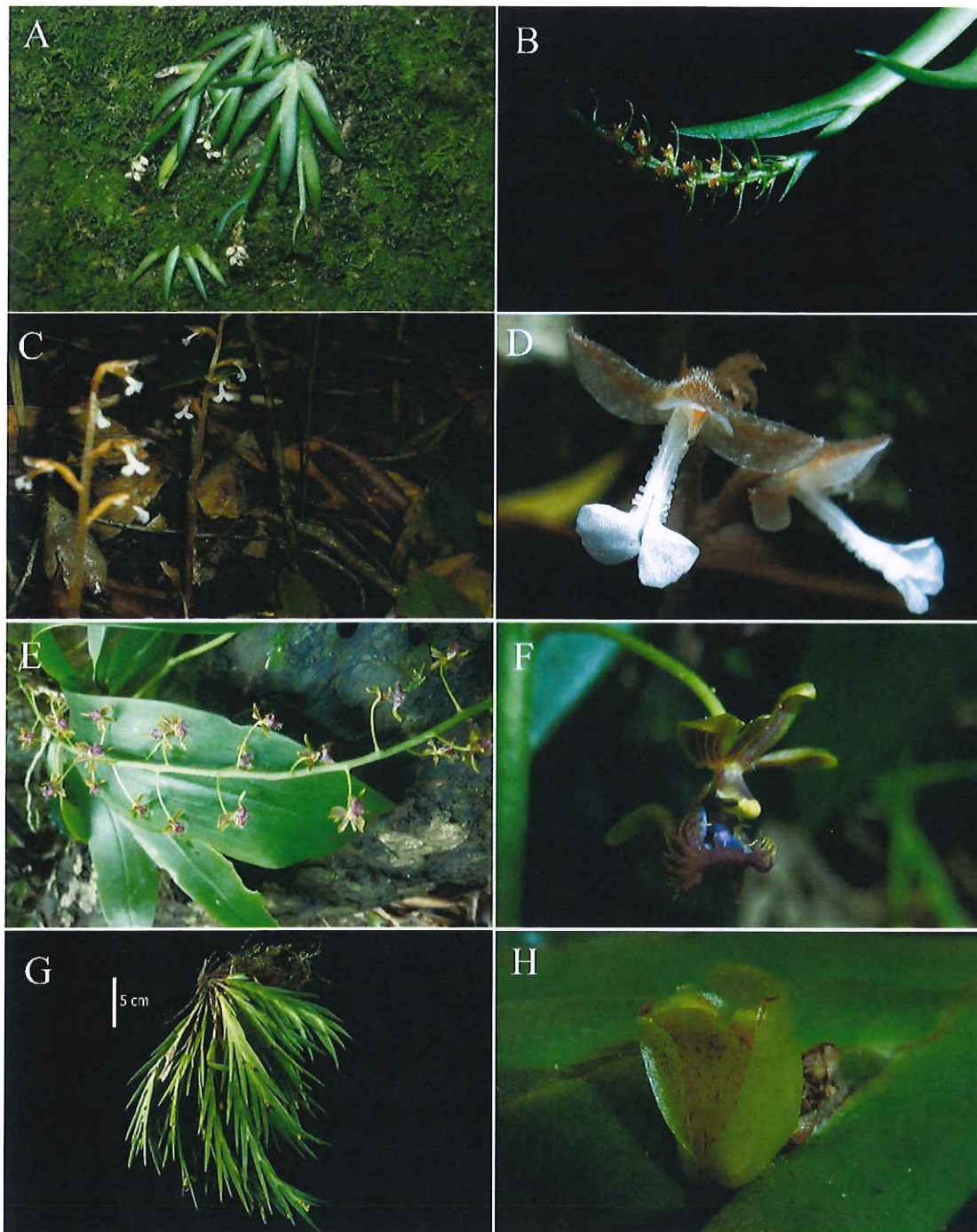


**Plate 20** A – B. *Liparis chapaensis* Gagnep.; C – D. *Liparis mamillata* Aver.; E – F. *Liparis ngoclinhensis* Aver.; G. *Micropera pallida* (Roxb.) Lindl.

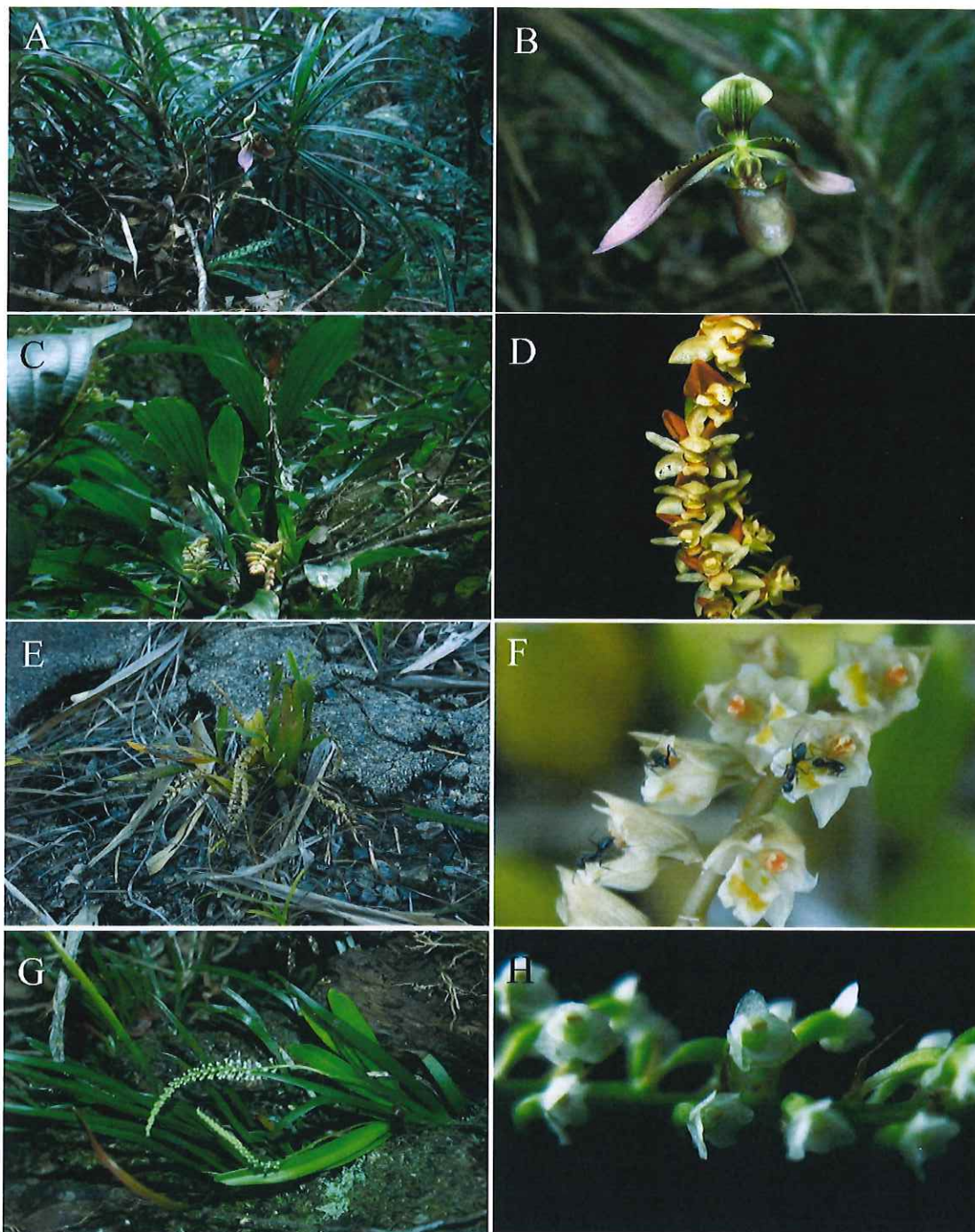


**Plate 21** A – B. *Miguelia cruenta* Aver. & Vuong; C – D. *Mycaranthes floribunda* (D.Don) S.C.Chen & J.J.Wood; E – F. *Mycaranthes pannea* (Lindl.) S.C.Chen & J.J.Wood; G – H. *Oberonia falcata* King & Pantl.



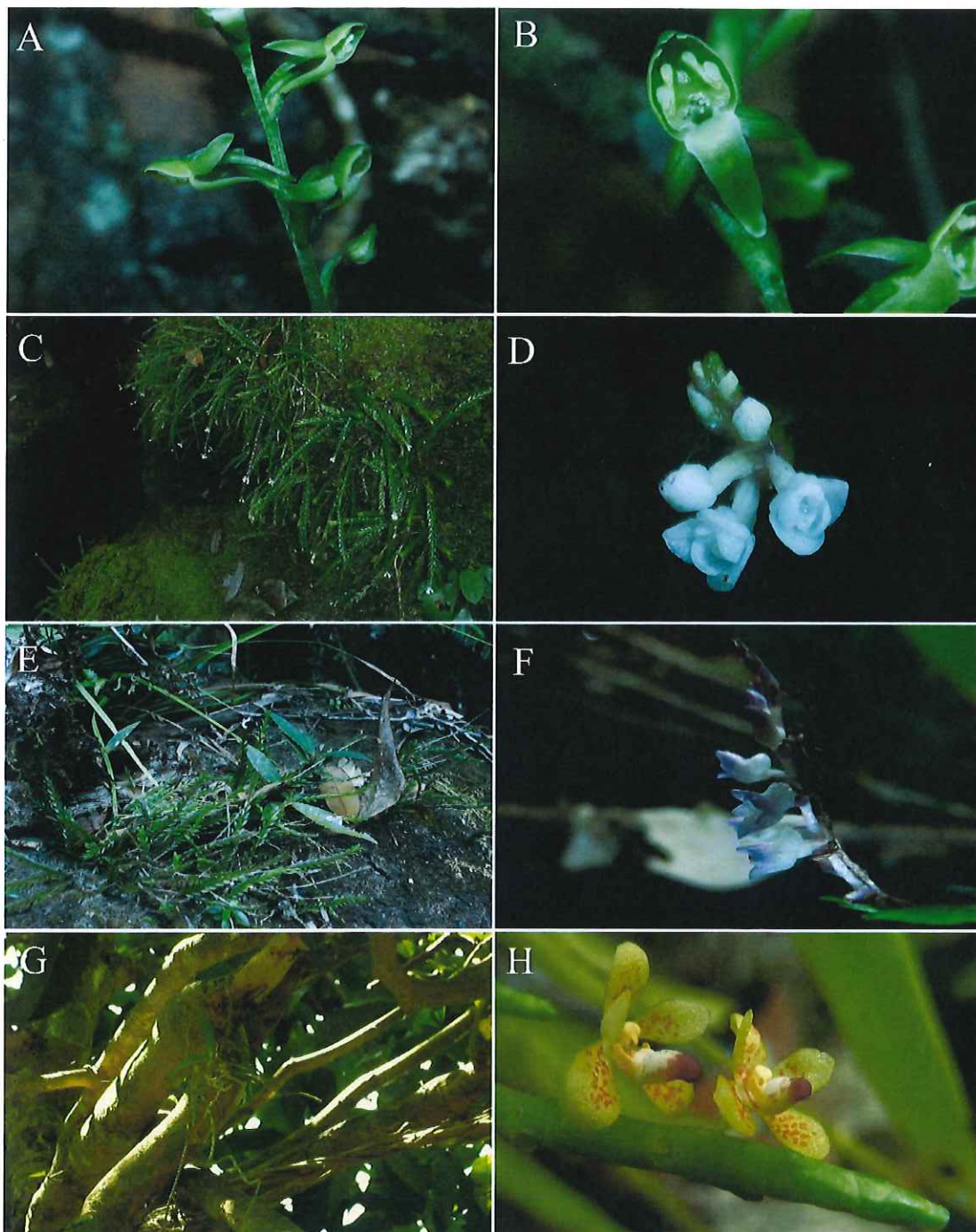


**Plate 22** A – B. *Oberonia longibracteata* Lindl.; C – D. *Odontochilus saprophyticus* (Aver.) Ormerod; E – F. *Ornithochilus difformis* (Wall. ex Lindl.) Schltr.; G – H. *Oxystophyllum carnosum* Blume

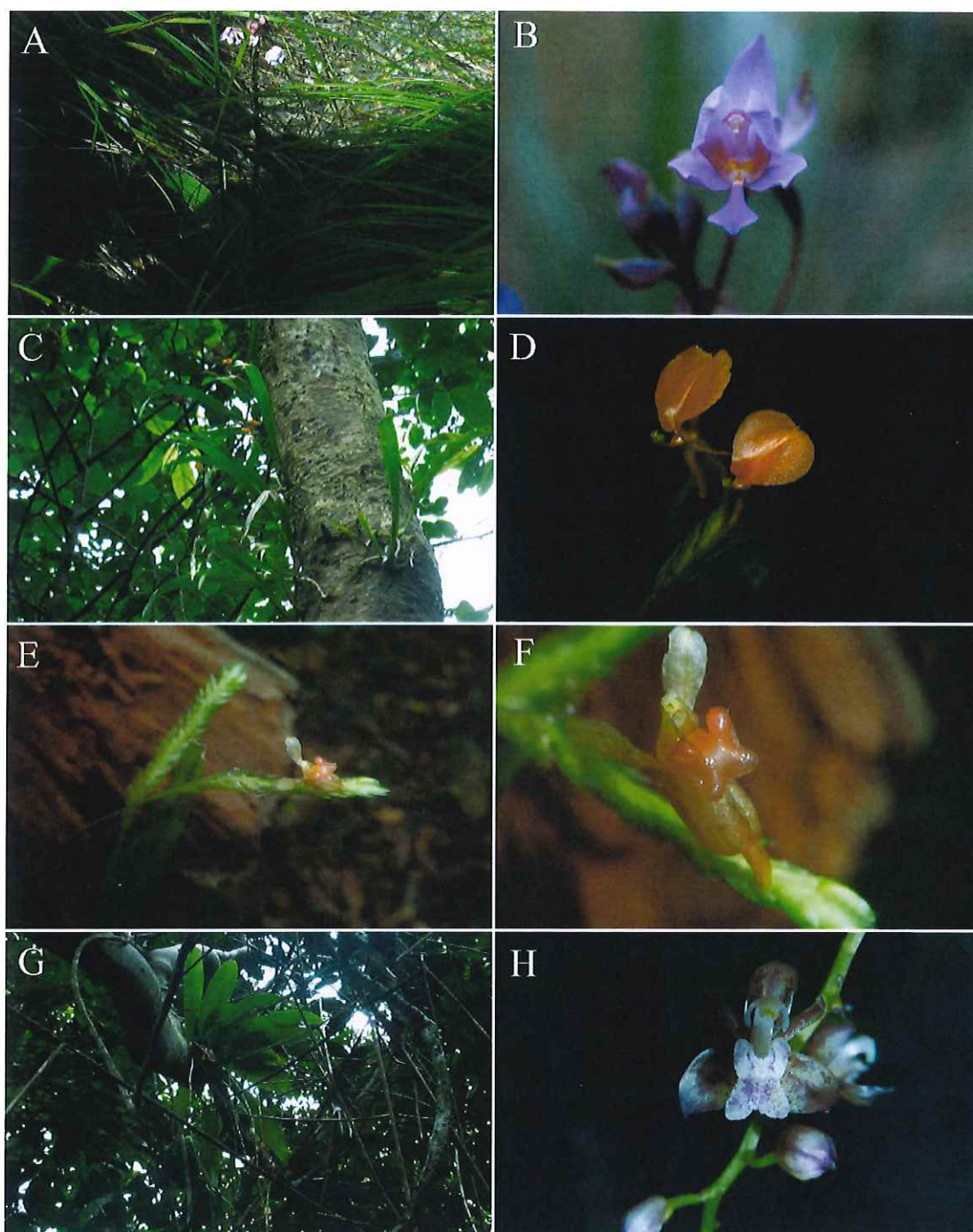


**Plate 23** A – B. *Paphiopedilum appletonianum* (Gower) Rolfe; C – D. *Pholidota chinensis*; E – F. *Pholidota leveilleana* Schltr.; G – H. *Phreatia densiflora* (Blume) Lindl.



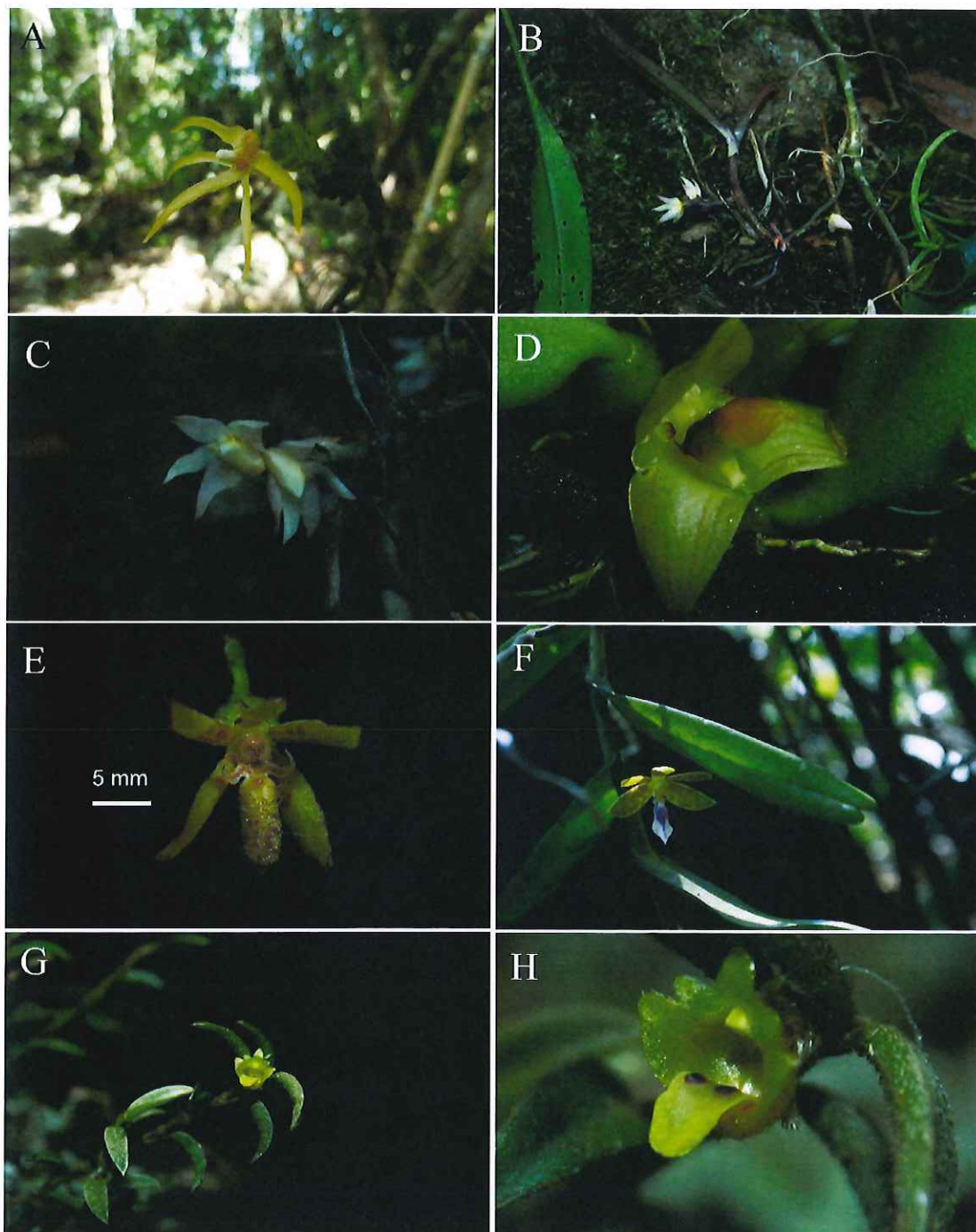


**Plate 24** A – B. *Platanthera singgalangensis* (J.J.Sm.) Efimov; C – D. *Podochilus banaensis* Ormerod; E – F. *Podochilus microphyllus* Lindl.; G – H. *Pteroceras teres* (Blume) Holttum.

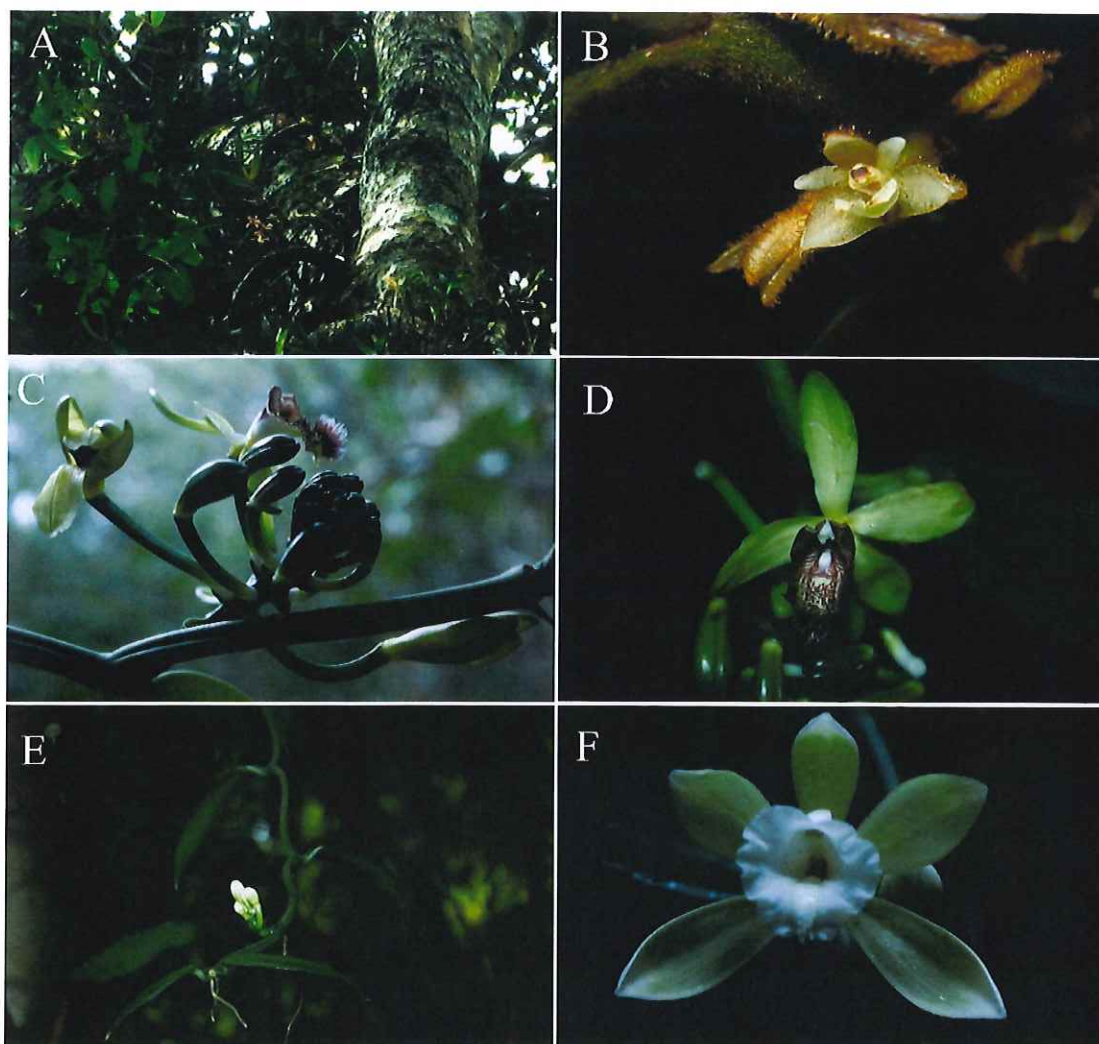


**Plate 25** A – B. *Spathoglottis plicata* Blume; C – D. *Stichorkis compressa* (Blume) J.J.Wood; E – F. *Stichorkis gibbosa* (Finet) J.J.Wood; G – H. *Thecostele alata* (Roxb.) C.S.P.Parish & Rchb.f.



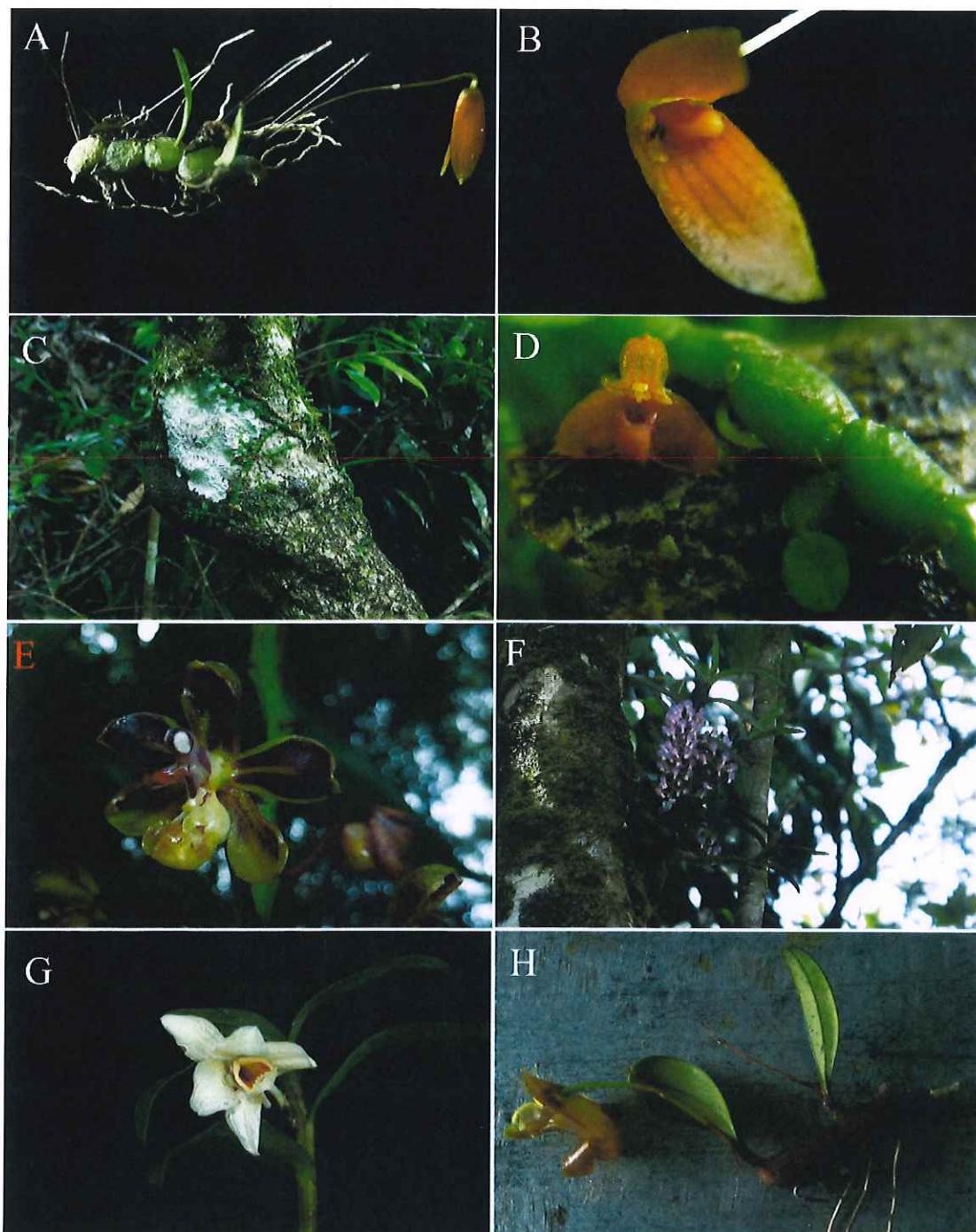


**Plate 26** A *Thrixspermum centipeda* Lour.; B – C. *Thrixspermum fragrans* Ridl.; D. *Trias nasuta* (Rehb.f.) Stapf; E. *Trichoglottis retusa* Blume; F. *Trichoglottis seidenfadenii* Aver. G – H. *Trichotosia microphylla* Blume.

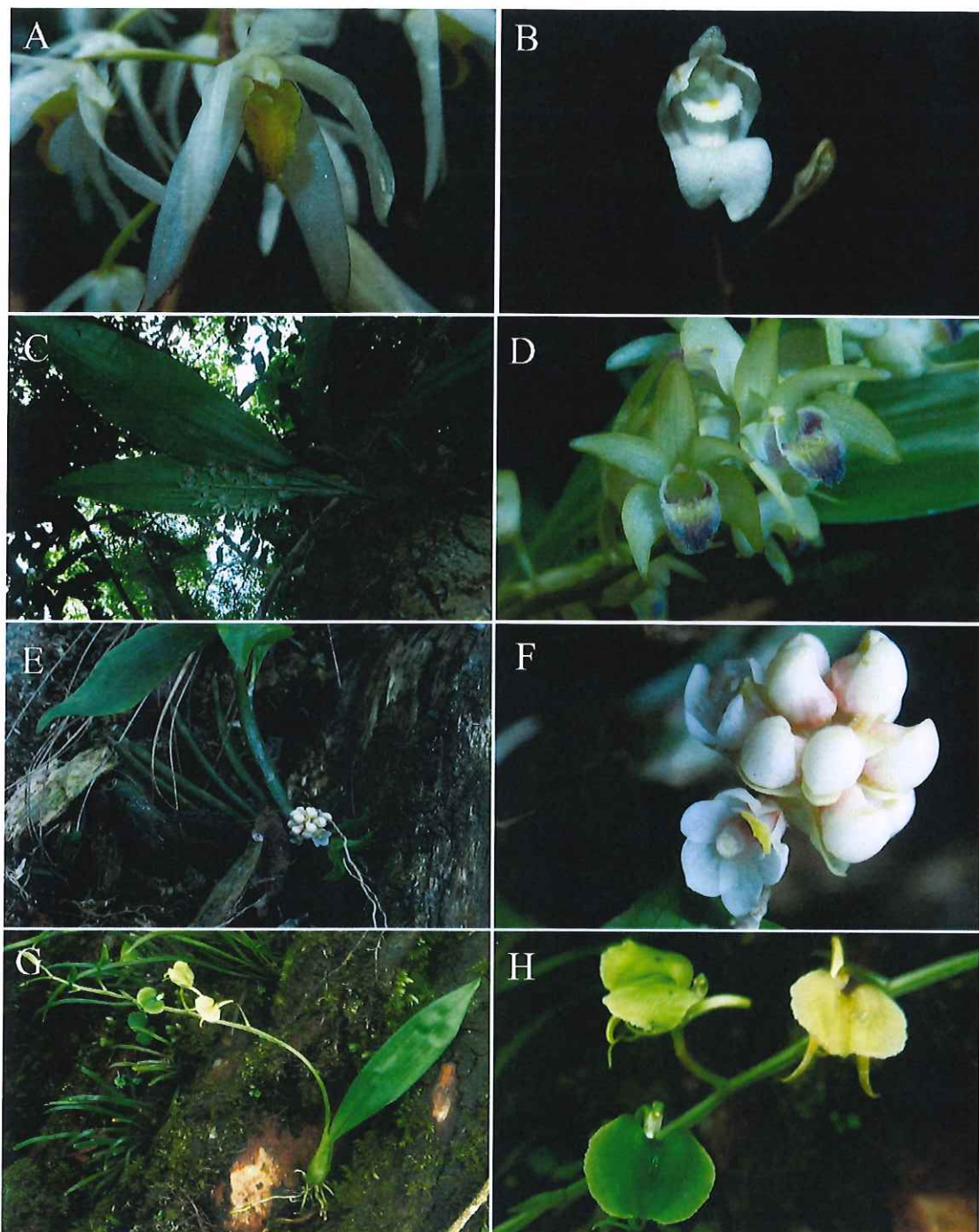


**Plate 27.** A – B. *Trichotosia velutina* (Lodd. ex Lindl.) Kraenzl.; C – D. *Vanilla atropogon* Schuit., Aver. & Rybková; E – F. *Vanilla albida* Blume.



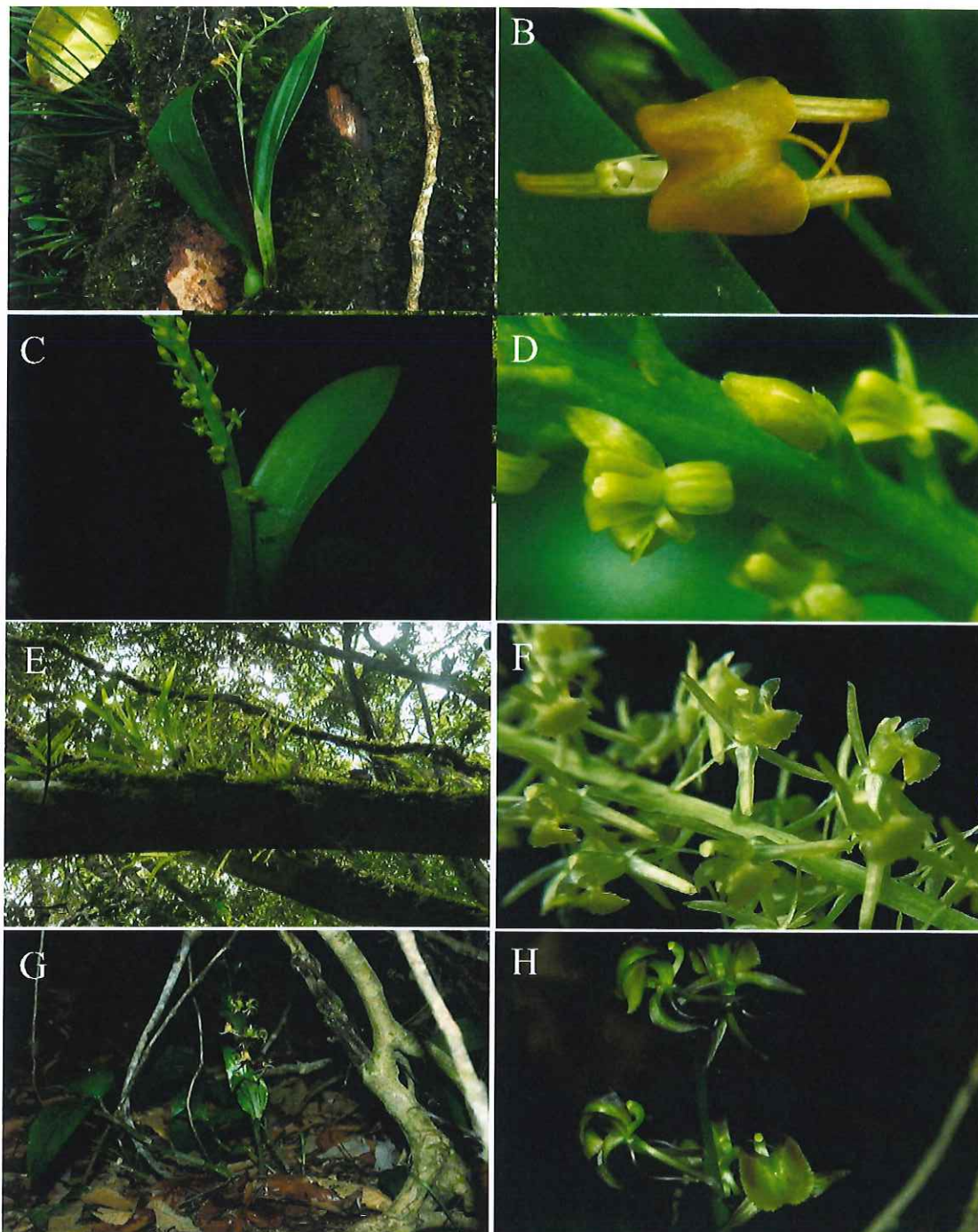


**Plate 28** A – B. *Bulbophyllum* sp. 1; C – D. *Bulbophyllum* sp. 2; E. *Cleisostoma* sp.; F. *Cleisocentron* cf. *klossii* (Ridl.) Garay; G. *Dendrobium* sp.; H. *Dendrobium* cf. *brunneum* Schuit. & Peter B.Adams

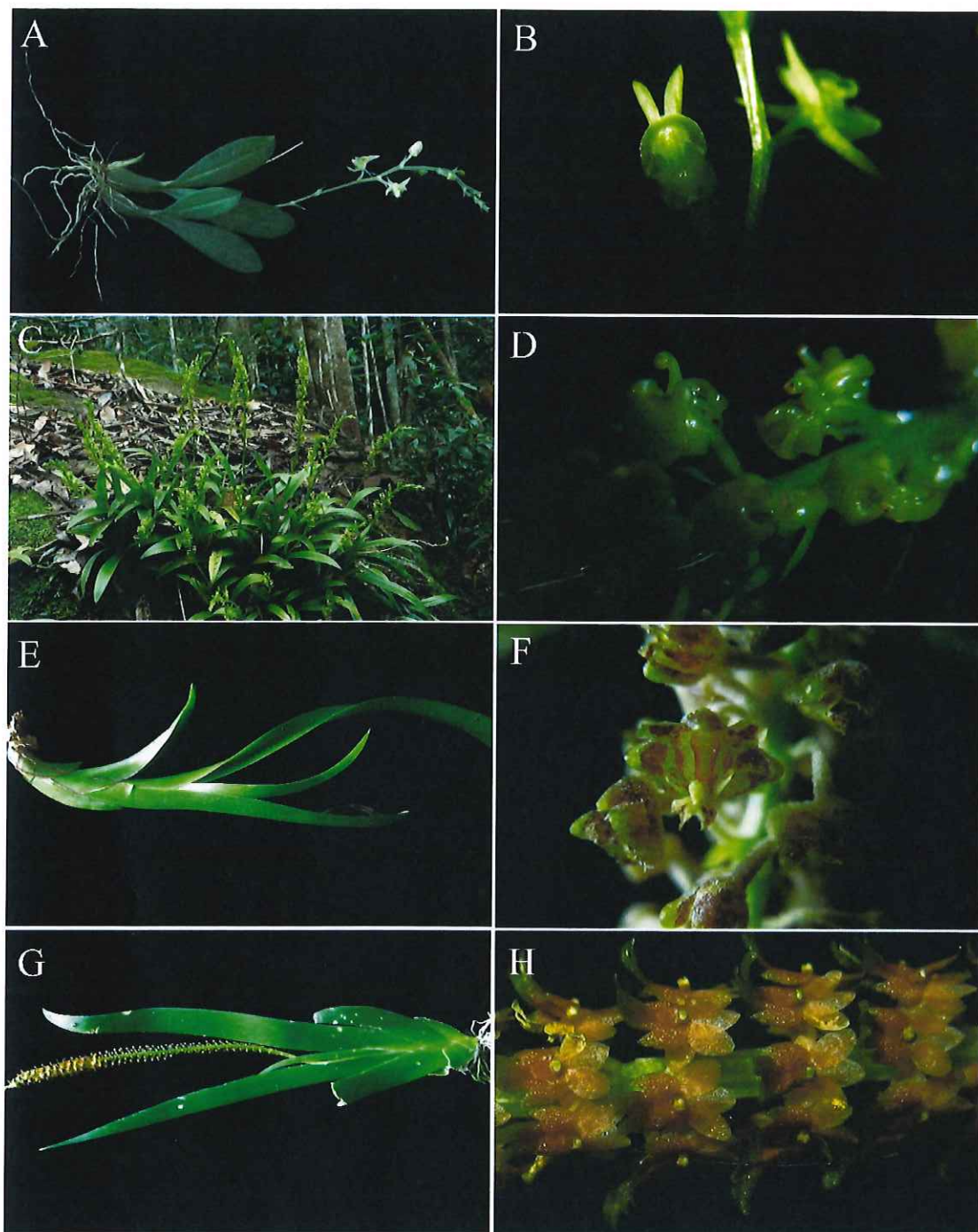


**Plate 29** A. *Dendrobium* cf. *cacuminis* Gagnep.; B. *Didymoplexis* cf. *pallens* Griff.; C – D. *Eria* cf. *scabrilinguis* Lindl.; E – F. *Eria* sp.; G – H. *Liparis* cf. *balansae* Gagnep.



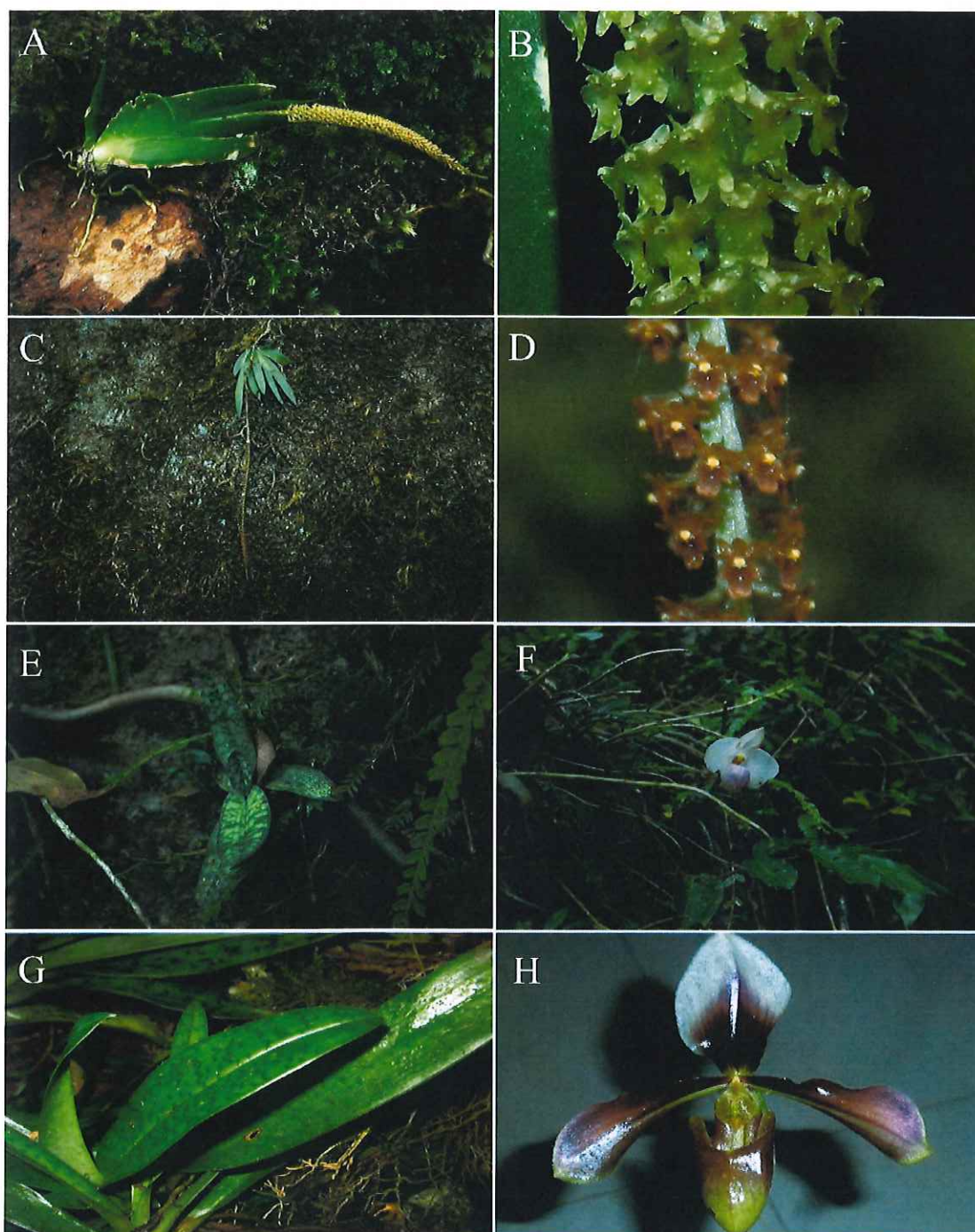


**Plate 30.** A – B. *Liparis* cf. *bootanensis* Griff; C – D. *Liparis* cf. *dendrochiloides* Seidenf. ex Aver.; E – F. *Liparis* cf. *mannii* Rchb. f.; G – H. *Liparis* cf. *sootenzanensis* Fukuy.

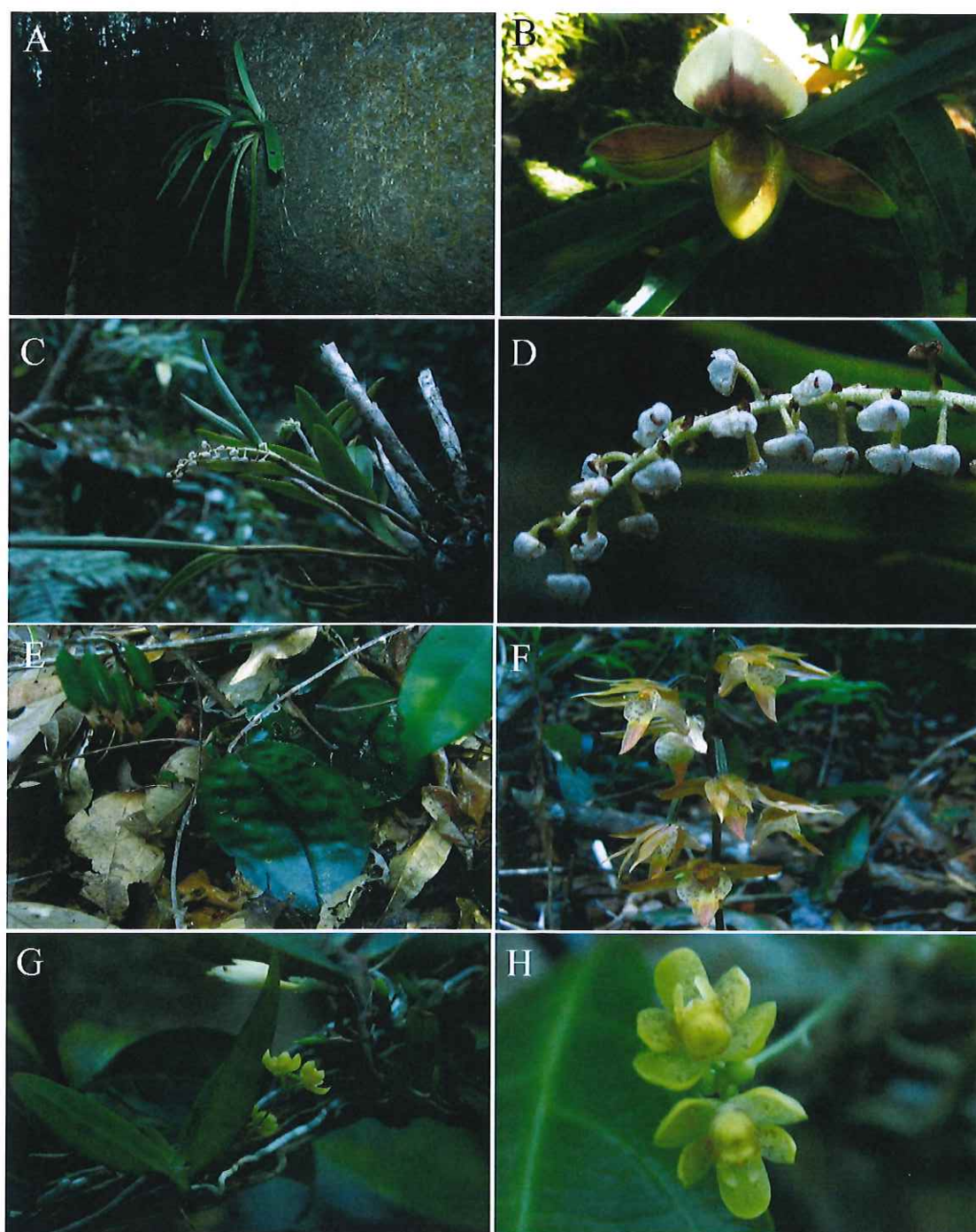


**Plate 31.** A – B. *Liparis* cf. *tenuis* Rolfe ex Downie.; C – D. *Liparis* sp.; E – F. *Mycaranthes* sp.; G – H. *Oberonia* cf. *caulescens* Lindl.





**Plate 32.** A – B. *Oberonia cf. dolichostachys* Aver.; C – D. *Oberonia cf. solanensis* Aver.; E – F. *Paphiopedilum delenatii* Guillaumin; G – H. *Paphiopedilum x cribbii* Aver.



**Plate 33.** A–B. *Paphiopedilum villosum* (Lindl.) Stein var. *annamense* Rolfe; C – D. *Pinalia* cf. *floribunda* (Lindl.) Kuntze; E – F. *Tainia* cf. *cordifolia* Hook. f.; G – H. *Thrixspermum* cf. *annamense* (Guillaumin) Garay.

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