

Some Orchid species found in Kalay area

Htar Lwin

Abstract

The studied area is situated on the South-Western part of Region, Kalay area. It lies between 22° 16' and 23° 41' N latitude and 93° 57' and 94° 46' E longitude. The studied area was characterized by ranges, pleasant climate and rich in natural plant resources. The wild species of orchids were collected during the years of 2006-2007. The research work consisted of 12 species belonging to 9 genera of the family Orchidaceae. It provided Taxonomic knowledge and distinctive characters of studied species. Although the terrestrial orchids were widely distributed in throughout the studied area, some epiphytic species like *Pholidota articulata* Lindl., *Rhynchostylis retusa* Blume and *Vanda thwaitesii* Hook. found upon the giant trees in the unreserved dense-forest.

Introduction

Myanmar forms the north-west corner of the Indo-Chinese or Further Indian region. Although extending from latitude 11° to 25°, still by far the greatest portion of it is situated within the influence of the monsoons. The greater part of the country is hilly or mountainous and thus favourable to the existence of forests (S. Kurz. 1877). Kalay area is surrounded by Chin Hills and Pondaung Ponnyar Ranges, and north latitude is passed through northern part of this area, so it has advantages like pleasant surroundings and climate, and grows a variety of natural plant resources. Kalay area due to its distinct physiological background favoured with a rich diversity flowering species, it includes some of the wild orchid species are growing.

Orchids are best known for their conspicuous and complex floral structure (Kress *et al.* 2009).The flower of orchids are exceptionally varied in size and form, and the habitats of the plants are equally diverse. The flowers of one Venezuela species have less than one millimeter in diameter, while those of a species native to Madagascar may be more than forty-five centimeters long. One species of *Dendrobium* orchid from Java has flowers that are so delicate they perish within five or six minutes of opening. Many

orchids are epiphytic on bark of trees, others are aquatic or terrestrial, and a saprophytic species, native to Western Australia grows and flowers entirely underground (Nyo Maung, 2007). The floral structure are distinctive in consisting of **resupinate** (resulting in a 180° shifted floral parts) flowers with a showy **labellum** (the posterior inner median tepal, early in development), the androecium and gynoecium adnate (termed a **column**, **gynostegium**, or **gynostemium**), the pollen grains often fused into 1-several masses (**pollinia**), bearing a sticky-tipped stalk (Michael G. Simpson 2009).

The aim and objectives of this research are to record the native terrestrial orchids of Kalay area and to evaluate the valuable orchid species in all parts in Myanmar.

Materials and Methods

The specimens are properly collected during the flowering and fruiting periods from the year 2006 to the year 2007. Field notes are made of precise locations and of habitat types. Identification of collected specimen is carried out by referring to Flora of British India (Hooker 1954), Flora of Java (Backer 1963), and Flora of Ceylon (Dassanayake 2001). Firstly tried to know its generic name. The next steps are to determine the specific identity of the unknown is solved. The index for nomenclatural data referred is Index Kewensis (Hooker 1895) by which the names and synonyms of plants up to the rank of species being confirmed. All the collected specimens have been taken as photographs of their inflorescences. The herbarium specimens were deposited at the herbarium of Mandalay University for references and other scientific studies.

Results

Coelogyne nitida Lindl. in Wall., Cat. 1954. (Figure 1.A)

Local name : Unknown

Flowering period : December to May

Sympodial epiphytes. Roots clinging. Pseudobulbs one-jointed, erect, fusiform or ovate, yellowish-green to green. Leaves ovate-lanceolate, 2-leaves per pseudobulb, deciduous, leafy at anthesis. Inflorescences basal racemes, erect, 1-on each pseudobulb,

2- to 4-flowered; peduncular bracts 6 to 7, ovate to ovate-oblong, creamy white; floral bracts ovate-lanceolate, creamy white to pale yellow. Flowers 3.0-4.2 cm in diameter, creamy white to white; dorsal sepals elliptic-lanceolate; lateral sepals oblong-lanceolate; petals elliptic-lanceolate, labellum distinctly 3-lobed, creamy white to white with yellow blotch; lateral lobes oblong to sub-orbicular; mid lobes oblong, creamy white or white with brown striations and yellow blotch at the tip; spur not distinct, column flat, white, with membranous wings; anthercaps ovoid to sub-globose, 2-locules, white; pollinia 4, oblanceolate to sub-clavate cohering in pairs by a granular viscus, yellow, waxy; stigma sub-quadrangular, creamy white; ovary oblongoid.

This species is growing in the wet places of the forest.

Specimen examined: Se Gyi Chaung area, N 23° 12'075" and E 93° 12'147", Elevation 720.3m; January 20th, 2007; Htar Lwin.

Cymbidium sundaicum Schltr., Flora of Java.3: 395.1965. (Figure 1.B)

Local name : Unknown

Flowering period : February to May

Sympodial terrestrial. Roots fibrous and tuberous; fibrous root fleshy, cylindrical, white; tubers ovoid, white; stems leafy, erect, hidden by the leaf-sheaths. Leaves lorate, deciduous, leafy at anthesis; leaf-sheaths white. Inflorescences axillary, raceme, erect, 1- to 2 on each pseudobulb; peduncular bracts 4 to 5, oblong-lanceolate, persistent, pale green to brownish-white; floral bracts narrowly triangular, deciduous, pale green. Flowers 4.5-5.5 cm in diameter, light yellowish green with reddish-brown stripes; dorsal sepals lanceolate, yellowish-green with reddish-brown stripes; lateral sepals falcately ovate, spreading or drooping, yellowish-green with reddish-brown stripes; petals lanceolate, yellowish-green with reddish-brown stripe; labellum 3-lobed; lateral lobes light yellowish green with reddish brown, interrupted transverse streaklets; mid-lobe ovate, light yellowish green with irregularly reddish-brown blotched; column yellowish white, with reddish brown-speckled, basally thickened; anther terminal, 2-loculed; pollinia 2, yellowish, waxy; viscidium white; stigma light yellowish green, shining; ovary oblongoid, with 6-longitudinal ridges; fruit capsule, pyriform.

This species is growing in the wet places of the dense forest.

Specimen examined : Zi Chaung area, N 23°20'135" and E 94°08' 112",
Elevation 689.2 m; February 28th, 2007; Htar Lwin.

Dendrobium transparens Wall., Cat. no. 2008. 1829. (Figure 1.C)

Local name : Unknown

Flowering period : March to May

Sympodial epiphytes. Roots clinging. Pseudobulbs many jointed, erect, or pendulous, terete, green to grayish green. Leaves alternate and distichous, linear - lanceolate to oblong-lanceolate, deciduous, leafless at anthesis; sheaths membranous, white. Inflorescences axillary racemes, 3 to many on each pseudobulb, 1- to 3-flowered; peduncular bracts ovate to oblong, persistent, membranous; floral bracts oblong, deciduous. Flowers 3.5-4.0 cm in diameter, pale purplish white and pale purplish white with light or bright violet central labellum; dorsal sepals lanceolate; lateral sepals falcately lanceolate; petals elliptic to broader ovate; labellum elliptic-oblong from a convolute cuneate base, attached to the base of the column-foot, not differentiated into lateral lobes and midlobes; spur conical; column short, white with violet base; anthercaps oblong; pollinia 4, dark yellow, waxy; caudicles and viscidium absent; stigma oblong, white with violet margins, shining; ovary oblongoid; fruits not seen.

This species is growing in the wet places of the forest.

Specimen examined : Khon Tha area, N 23°35'119" and E 94°25' 013",
Elevation 348.04 m; February 28, 2007; Htar Lwin.

Geodorum purpureum R.Br. in Ait., Hort. Kew. ed. 2: 5. 207. 1810. (Figure 1.D)

Local name : Unknown

Flowering period : April to May

Sympodial terrestrials. Roots fibrous, white. Rhizomes tuberous, sub-globose, white. Leaves simple, alternate, elliptic-lanceolate, deciduous, green, leafy at anthesis; sheath membranous, pale green. Inflorescences lateral racemes, erect, flowering part drooping, 12- to 20-flowered; peduncular bracts about 4, basally sheathing; floral bracts lanceolate, membranous, deciduous. Flowers about 9.0 mm in diameter, membranous to

sub-coriaceous, white and white with violet streaks and yellow labellum; dorsal sepals linear lanceolate; lateral sepals linear lanceolate; petals ovate-oblong; labellum cymbiform, shallowly 3-lobed; lateral lobes white with violet streaks and striations; mid lobe white with yellow blotch; basal spur present, white; column short, stout purplish white, column-foot absent; anther caps sub-globose, white with violet tips; pollinia 2, sub-globose, yellow, waxy; stipes short and membranous; stigma sub-orbicular; ovary oblongoid.

This species is growing in the moist places of the forest.

Specimen examined : Zi Chaung area, N 23°20'165" and E 94°08' 122", Elevation 689.2 m; May 21st, 2006; Htar Lwin.

Habenaria horsfieldiana Krzl., Flora of Java. 3: 253. 1965. (Figure 1.E)

Local name : Unknown

Flowering period : November to January

Sympodial terrestrials. Roots fibrous and tuberous; fibers fleshy; tubers ellipsoid, white. Stems leafy, erect, partially covered by the leaf-sheaths. Leaves simple, alternate; oblong-lanceolate, persistent, green, leafy at anthesis; sheaths pale green. Inflorescences terminal spikes, lax, solitary, 4- to 6-flowered; peduncular bracts about 4, oblong-lanceolate, deciduous, pale green; floral bracts lanceolate. Flowers white, about 2.5 cm in diameter; dorsal sepals ovate, concave; lateral sepals ovate; petals ovate; the labellum sub-orbicular, distinctly 3-lobed; lateral lobes ovate, margins entire; mid-lobes ovate, margin entire, acute at the tips; spur narrow, straight or slightly incurved, white with pale green tip; anther cells broad, divaricate, adnate to the column, white; the pollinia 2, one in each cell, clavate, yellow, granular. Ovary oblongoid, with 6-longitudinal grooved and ribbed; caudicles about 3.0 mm long, white, turned towards the base of the anther, the viscidium membranous; stigma 2, distinct.

This species is growing in the moist places under the shade of trees.

Specimen examined : Zi Chaung area, N 23°20'145 " and E 94°08' 100", Elevation 689.2 m; February 13, 2007; Htar Lwin.

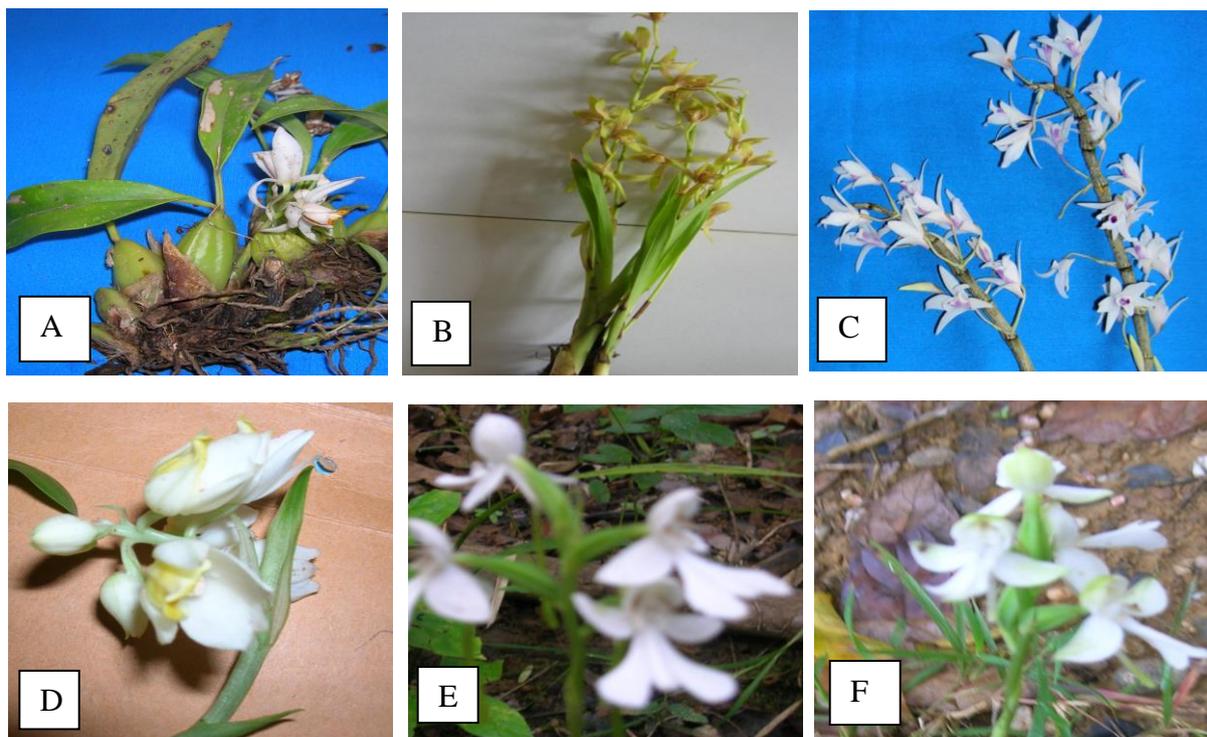


Figure 1.

- A. *Coelogyne nitida* Lindl.
 B. *Cymbidium sundaicum* Schltr.
 C. *Dendrobium transparens* Wall.
 D. *Geodorum purpureum* R.Br.
 E. *Habenaria horsfieldiana* Krzl.
 F. *Habenaria plantaginina* Lindley,

Habenaria plantaginina Lindley, Gen. et Sp. Orch. 323. 1853. (Figure 1.F)

Orchis platyphyllos Roxb., Fl. Ind. 3: 450. 1832.

Local name : Unknown

Flowering period : November to January

Sympodial terrestrials. Roots fibrous and tuberous; fibers fleshy; tubers oblong, white. Stems leafy, erect, partially covered by the leaf-sheaths. Leaves simple, alternate; narrowly-oblong persistent, green, leafy at anthesis; sheaths pale green. Inflorescences terminal spikes, lax, solitary, 3- to 5-flowered; peduncular bracts many, lanceolate, deciduous, pale green; floral bracts subulate-lanceolate. Flowers white, about 1.6 cm in diameter; dorsal sepals ovate-oblong; lateral sepals falcately oblong; petals linear-

lanceolate; labellum more than twice as long as the sepals, distinctly 3-lobed; lateral lobes half-ovate, margins entire; mid-lobes as long, narrowly linear; spur slender, pendulous, slightly incurved, white with pale green tip; anther cells divergent below, adnate to the column, white; the pollinia 2, one in each cell, pyriform, granular. Ovary oblongoid, slender and beaked; caudicles broad, inserted on a concave, lanceolate gland dividing longitudinally, the viscidium membranous; stigma 2, distinct.

This species is growing in the moist places under the shade of trees.

Specimen examined : Zi Chaung area, N 23°20'145 " and E 94°08' 100",

Elevation 689.2 m; February 13, 2007; Htar Lwin.

Habenaria dichopetala Thw., Enum. Pl. Zeyl. 309. 1861. (Figure 2.A)

Local name : Unknown

Flowering period : November to January

Sympodial terrestrials. Roots fibrous and tuberous; fibers fleshy; tubers oblong, white. Stems leafy, erect, partially covered by the leaf-sheaths. Leaves simple, alternate, narrowly-oblong persistent, green, leafy at anthesis; sheaths pale green. Inflorescences terminal spikes, lax, 3- to 5-flowered; peduncular bracts many, lanceolate, deciduous, pale green; floral bracts subulate-lanceolate. Flowers white, about 1.6 cm in diameter; dorsal sepals ovate-oblong; lateral sepals falcately oblong; petals linear-lanceolate; labellum more than twice as long as the sepals, distinctly 3-lobed; lateral lobes half-ovate, margins entire; mid-lobes as long, narrowly linear; spur slender, pendulous, slightly incurved, white with pale green tip; anther cells divergent below, adnate to the column, white; the pollinia 2, one in each cell, pyriform, granular. Ovary oblongoid, slender and beaked; caudicles broad, inserted on a concave, lanceolate gland dividing longitudinally, the viscidium membranous; stigma 2, distinct.

This species is growing in the moist places under the shade of trees.

Specimen examined : Zi Chaung area, N 23°20'145 " and E 94°08' 100",

Elevation 689.2 m; February 13, 2007; Htar Lwin.

Pecteilis sussannae* (L.) Rafin., Flor.Tell. 2: 38.1836. (Figure 2.B)Orchis sussannae* L., Sp. Pl. 939.1753.

Local name : Padein-ngo

Flowering period : June to August.

Sympodial terrestrials. Roots fibrous and tuberous; fibers fleshy, white; tubers ellipsoid, white. Stems leafy, erect, partially covered by the leaf- sheaths. Leaves simple, alternate, ovate-lanceolate, persistent, leafy at anthesis; leaf-sheaths pale green. Inflorescences terminal, racemes, erect, 1- to 3-flowered; floral bracts ovate, sub-coriaceous, persistent. Flowers 4.5-5.0 cm in diameter, pure white; dorsal sepals obovate, concave; lateral sepals ovate-oblong, reflexed; petals subulate; labellum suborbicular, attached to the base of the column, distinctly 3-partite; lateral segments cuneate, divided into several narrow segments; median segments broadly linear; spur narrow linear, elongate, white with pale green apex, slightly curved; column white, column-foot absent; anthers oblong, broad, divaricate, white; pollinia 2, one on each cell, clavate, yellow, granular, caudicles white, turned towards the base of the anther; viscidium membranous, the rostellum smooth and shining , between the 2 cells of the anther; stigmas 2; ovary broadly oblongoid, slightly curved, with 6-ridges, resupinate.

This species is growing in the moist places under the shade of trees.

Specimen examined: Zi Chaung area, N 23° 12'85" and E 93°12'47", Elevation 720.3 m; July 12th, 2006; Htar Lwin.

Peristylus plantagineus* (Lindl.) Lindl., Gen. et. Sp. Orch. 300. 1835. (Figure 2.C)Herminium plantagineum* Lindl., Bot. Reg. 18: 1832.

English name : Unknown

Flowering period : June to September

Sympodial terrestrials. Roots fibrous and tuberous; fibers fleshy, white; tubers ellipsoid, white. Stems leafy, erect, covered by the leaf-sheaths. Leaves simple, alternate,

oblong-lanceolate, persistent, leafy at anthesis. Inflorescences terminal, spike, erect, dense-flowered; floral bracts lanceolate, persistent. Flowers 4.5-5.0 mm in diameter, white; dorsal sepals ovate, lateral sepals ovate-oblong; petals orbicular; labellum ovate, concave base, attached to the base of the column, shortly 3-lobed; spur globose, very small; column continuous into the lip, white; anthers cells 2-locule, lateral, white; pollinia 2, one on each cell, clavate, , yellowish, granular, the caudicles white; viscidium membranous, small, the rostellum short, acute; stigmatic process short; ovary oblongoid, erect, green.

This species is growing in the moist places under the shade of trees.

Specimen examined: Zi Chaung area, N 23°20'515" and E 94°08'702", Elevation 689.2 m; July 29th, 2007; Htar Lwin.

Pholidota articulata Lindl.in Wall., Cat. n. 1992. (Figure 2.D)

Local name : Unknown

Flowering period : March to May

Sympodial epiphytes. Roots clinging, glabrous, greenish-white to brownish-white. Pseudobulbs many-jointed, erect, oblong, terete to slightly quadrangular. Leaves elliptic-lanceolate, mostly 2-leaves per pseudobulb, at the top of the internodes, slightly pliated, deciduous. Inflorescences terminal racemes, arising from the leaves axil, about 30-flowered; peduncular bracts not found; peduncles zig-zag in flowering part; floral bracts rhombic-ovate, caducous, creamy white to pale yellowish-green. Flowers about 1.2 cm in diameter, sub-coriaceous, creamy white to yellowish-white; pedicels pale green; dorsal sepals ovate, concave, creamy white to yellowish-white; the lateral sepals ovate-lanceolate, slightly falcate, creamy white to yellowish-white; petals elliptic - lanceolate, creamy white; labellum cymbiform with didymous mid-lobe, with 5 basal lamellate nerves, creamy white with yellow disk; lateral lobes saccate; the mid lobe bi-fid; spur indistinct; column short and slender, white to yellowish-white, the column-foot not distinct; anthercaps ovoid, glabrous, pale yellow to orange; pollinia 4, sub-globose to pyriform, yellow, waxy, cohering in pairs by a viscus; stigma orbicular, about 1.0 mm

long and wide; ovary trigonous, glabrous, pale green. Fruits capsules, ovoid, about 1.5 cm long, glabrous, pale green.

This species is growing upon the tree in the moist places of the forest.

Specimen examined : Se Gyi Chaung area, N 23°21'715" and E 94°6' 151", Elevation 800.4 m; March 27th, 2007; Htar Lwin.

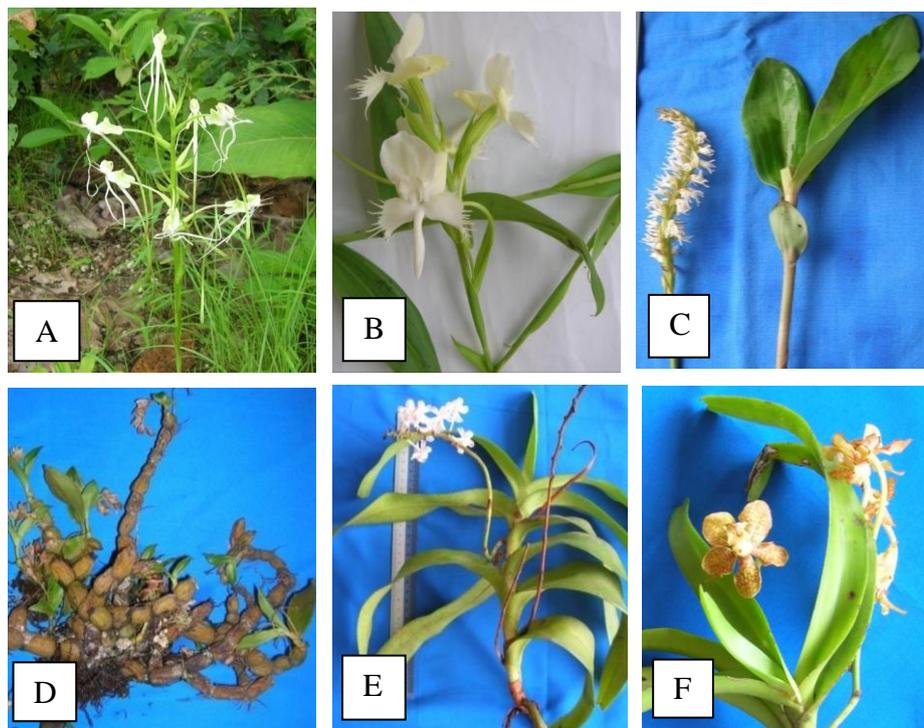


Figure 2.

- A. *Habeneria dichopetala* Thw.
- B. *Pecteilis sussannae* (L.) Rafin.
- C. *Peristylus plantagineus* (Lindl.) Lindl.
- D. *Pholidota articulata* Lindl.
- E. *Rhynchostylis retusa* Blume
- F. *Vanda thwaitesii* Hook.

Rhynchostylis retusa Blume, Bijdr. 286. Pl. 49. 1825. (Figure 2.E)

Local names : Foxtail orchid, Kyaung-mi-tu

Flowering period : March to May

Sympodial stout epiphytes. Roots clinging. Pseudobulbs absent. Leaves alternate and distichous, linear, recurved, unequally lobed at the tip, persistent, leafy at

anthesis; sheaths membranous, brown. Inflorescences axillary racemes, many flowered; peduncular bracts oblong, persistent, membranous; floral bracts cordate-acute, persistent. Flowers 1.5-2.0 cm in diameter, white with light violet pink; dorsal sepals ovate; lateral sepals obliquely ovate; petals oblong-ovate; labellum 3-lobed, clawed; lateral lobes obscure, mid-lobe elongate; spur saccate, rounded; column short, white, rostellum shortly beaked; anthercaps long; pollinia 2, pinkish white, waxy; caudicles short; stigma oblong, white; ovary oblongoid; fruits obconic, with ridge.

This species is growing upon the large trees of the forest.

Specimen examined: Zi chaung area, N 23°20'119" and E 94°8' 613", Elevation 698.04 m; February 28, 2007; Htar Lwin.

Vanda thwaitesii Hook. f. in Trimen, Handb. Fl. Ceylon 4: 193. 1898. (Figure 2.F)

Local name : Unknown

Flowering period : January to March

Monopodial epiphytes. Roots long drooping and clinging, white. Stems leafy, erect, lower internodes covered with brown coriaceous sheath. Leaves alternate and distichous; blades linear oblong, rigid, falcately recurving, coriaceous, persistent, glabrous on both surfaces, green, entire along the margin, bifid at the tips, leafy at anthesis. Inflorescences axillary racemes, more or less erect, 2- to 3-flowered; peduncle yellowish green; peduncular bracts 4, sheathing, membranous, persistent, dark brown; floral bracts ovate, whitish green. Flowers about 3.7 cm in diameter, fleshy, yellowish-green, streaked and spotted with reddish-brown and pal yellow; pedicels angular, glabrous, white, twisted(resupinate); dorsal sepals obovate-oblong, yellowish-green with brownish-red speckles; lateral sepals orbicular-ovate, yellowish-green with brownish-red speckles; petals obovate-oblong; labellum infundibuliform, sessile on the base of the column, 3-lobed; lateral lobes small, erect; mid-lobes broad, ovate, 2-lobulate; spur shorter than the lobes, straight, acute; column short, stout; the anther caps broadly ovoid; pollinia 2, obovoid, yellow, waxy, the caudicles short flat; viscidium very minute, white; the stigma obovoid; ovary narrowly oblongoid with ridges.

This species is growing in the moist places of the forest.

Specimen examined : Se Gyi Chaung area, N 23°21'035" and E 94°6' 791", Elevation 800.4 m; Apri16th, 2007; Htar, collected no.181.

Discussion and Conclusion

In this research, there are 12 species belonging to 10 genera under the family Orchidaceae. All the studied species are growing in wild. The species of *Coelogyne nitida* Lindl., *Dendrobium transparens* Wall., *Pholidota articulata* Lindl., *Rhynchostylis retusa* Blume, and *Vanda thwaitesii* Hook. are found as epiphytic and the species of *Cymbidium sundaicum* Schltr., *Geodorum purpureum* R.Br., *Habenaria horsfieldiana* Krzl., *Habenaria plantaginina* Lindley, *Habenaria dichopetala* Thw., *Pecteilis sussannae* (L.) Rafin., and *Peristylus plantagineus* (Lindl.) Lindl. are occurred as terrestrial. Three species such as *Coelogyne nitida* Lindl., *Dendrobium transparens* Wall. and *Pholidota articulata* Lindl. are showed the jointed pseudobulbs, two species of *Rhynchostylis retusa* Blume and *Vanda thwaitesii* Hook. are found as non-pseudobulb and the rest species are occurred as tuberous. Monopodial type is found in *Vanda thwaitesii* Hook. and the others are showed the sympodial type. In the species of *Coelogyne nitida* Lindl., *Dendrobium transparens* Wall. and *Pholidota articulata* Lindl., the number of pollinia is four and the rest species have two pollinia. Among the studied species, *Vanda thwaitesii* Hook. is probably extinct now as no other collector has found and there are no specimens in the Peradeniya Herbarium nor in Kew and *Rhynchostylis retusa* Blume is rare species and occurred in 11 countries including Myanmar mentioned by The Flora of Ceylon, volume two.

The Orchidaceae is monophyletic with all orchids being derived from a unique single orchid ancestor that lived perhaps over 80 million years ago. The orchids are most closely related evolutionarily to all the other plants in the Asparagales, such as asparagus, onions, irises, and amaryllis. Pollination of orchid flowers is effected by various insects, birds, bats, or frogs. A single fertilized orchid flower may produce over one million of tiny seeds, which lack any type of nutritive cells. When the seeds reach an appropriate habitat, they must form an antimate ecological relationship with a particular fungus. This relationship between the orchids and their fungal partners has resulted in the evolution of the large number of species in this family.

Hooker (1894) stated that 123 genera 1104 species in the book of “The Flora of British India”. Although Kress *et al.*(2003) recorded that 128 genera and 739 species in the book of Checklist of Myanmar, the species of *Cymbidium sundaicum* Schltr., *Habenaria horsfieldiana* Krzl., *Habenaria plantaginia* Lindley, *Habenaria dichopetala* Thw., *Peristylus plantagineus* (Lindl.) Lindl. and *Vanda thwaitesii* Hook. are not recorded in this book.

The wild orchids are still naturally distributed in everywhere in Myanmar and it is finally hoped that this research work will partially fulfil the orchid informations in Myanmar.

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References

- Backer, C.A. and R.C. Backhuizen Van Den Brink 1963-1968. Flora of Java, Vol III. Noordhoff. Ltd. Groningen.
- Dassanaayake, M.D. 1981. A Revised Handbook to the flora of Ceylon. Vol II, University of Peradeniya, Department of Agriculture, Peradeniya, Sir Lanka and the Smithsonian Institution, Washington, D.C., U.S.A.
- Hooker, J.D. 1894. Flora of British India. Part V & VI Recve Co. Itd. Kent, London.
- Hooker, H.D. and B.D. Jackson 1895. Index Kewensis. Vol.I, Vol.II, A-Z and Supplements. Clarendon Press, Oxford Univ. London.
- Kress, J. *et al.* (2003). A Checklist of the Trees, Shrubs, Herbs and Climbers of Myanmar. Department of Systematic Biology-Botany, National Museum of Natural History, Washton, DC.
- Kress. J. W. and Shirley Sherwood (2009). The Art of Plant Evolution. Royal Botanic Garden, Kew.
- Kurz, S. 1877. Forest Flora of British Burma. Office of the Superintendent of Government Printing, Calcutta.
- Nyo Maung, 2007. Flowering Plants and Civilization, Department of Botany, University of East Yangon.
- Simpson, M. G. (2006). Plant Systematic, Elsevier Academic Press, Burlington. USA.

Professoer and Head, Department of Botany, Banmaw University