

Taxonomic Study on Five *Dendrobium* Species from Mt. Poppa Area

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Abstract

Mt. Poppa area is mostly covered with tropical evergreen forests and distribution of many wild orchids. Among them, five species of *Dendrobium* are described in this research. All collected species are fully described with necessary photographs. Moreover, the artificial key to the species of the plants is also described. The system of Seidenfaden (1992) was adopted as the classification system in the present research.

Keywords: Taxonomic, *Dendrobium*, species

Introduction

The taxonomic description of 5 species from *Dendrobium* belonging to the Orchidaceae has been studied. Orchids are one of the most outstanding and significant flowering plants of the Myanmar flora due to their glamorous, striking, elegant flower. The research paper deals with some members of plant growing in Mt. Poppa area in Kyauk Pa Daung Township, Nyaung Oo District, Mandalay Region. The area is famous for its rich biodiversity and its valuable natural resources. It lies between North latitudes 20° 55' 13" and East longitudes 95° 15' 14".

In this study area, the members of Subfamilies: Orchidoideae and Epidendroideae are terrestrial orchid; they are found to be locally abundant. The family orchidaceae belonging to the tribes Opyrdeae, Arethuseae and Malaxideae are widely distributed in this area.

In this study, all the collected specimens had been arranged by the classification system of Seidenfaden (1992). He represented that a total of 140 genera and about 800 species and varieties of orchids are included. In 1895, Grant reported that a total of 86 genera and 581 species and varieties of orchids were distributed in Myanmar. In 1961, Hundley and Chit Ko Ko listed 113 genera, 850 species and varieties of Myanmar orchids. And then they listed 128 genera and 739 species as Myanmar native orchids in 1986. Although several workers had worked out an selected genera in flora of Mt. Poppa area, the orchids are widely distributed and its taxonomic information is still needed to be recorded in this area.

The studies on the species of orchidaceae are based on their morphological characters. Taxonomic description of each species, photographic plates and figure have been given together with the distinctive characters. The species were collected monthly from June to July in 2016.

Materials and Methods

Orchidaceae species were collected from Mt. Poppa area, which is located in Kyauk Pa Daung Township, Mandalay Region, were preserved and used for identification and description. All the collected species are noted by photographs while flowering. The diagnostic characters are recorded in detail. Field notes are made of precise locations and its plant characters. The field studies had been done in every two months intervals.

Identification of an unknown specimen is carried out by referring to Flora of British India (1894), Flora of Ceylon (1918) Flora of Java (1963; 1968), Flora of Malaya (1964), the orchids of Indochina (1992). The first step is solving the generic name. Again the species names of the collected plants are resolved. The final verification is made by examination of the herbarium species from old records.

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All the collected specimens have been identified and described their characters, then constructed the artificial key to the genera and also to the species. Most of the plant specimens have been air dried and pressed.

Results

The present study deals with five species of *Dendrobium* in Orchidaceae. They are collected from Mt. Poppa area of Kyauk Pa Daung Township.

Artificial Key to the Species

All the collected species had been constructed by using their characters into the artificial key as follows.

1. Leaves normal, dorsiventral -----2
1. Leaves terete ----- *Dendrobium clavator*
 2. Leaf sheath without dark hairs -----3
 2. Leaf sheath with dark hairs -----*Dendrobium draconis*
3. Stems elongate than 5.0 -----4
3. Stems dwarf than 5.0 cm ----- *Dendrobium dixanthum*
 4. Leaves oblong-lanceolate ----- *Dendrobium parcum*
 4. Leaves ovate-lanceolate or oblanceolate -----
-----*Dendrobium delacourii*

1. *Dendrobium clavator* Ridl., J.Linn. Soc.32:255, 1896. (Figure 1. A)

English Name : Unknown

Local Name : Unknown

Flowering period from December to February.

Sympodial epiphyte. Roots clinging, 1.0-1.5 mm in diameter, cylindrical, white to brownish white, glabrous. Pseudobulbs one-jointed, erect, fusiform, 6.0-6.5 cm long and 5.0-6.0 cm wide, 6-ridges, invested by sheaths, yellowish green, glabrous, internodes, 1.1-1.3 cm long and 5.0-6.0 cm wide, superposed. Stem slender, 40.0-50.0 cm long and 4.0-5.0 mm wide, brownish green, glabrous. Leaves terete, alternate, 3.0-3.5 cm long and 4.0-5.5 mm wide, coriaceous, often furrow at upper surfaces, channel above, leafy at anthesis, yellowish green, glabrous. Inflorescences terminal and axillary racemes, solitary 1-2 on each internodes, 5.0-7.0 cm long and 1.5-2.0 cm wide, white; peduncular bracts 3, oblong, 5.0-6.0 mm long and 2.5-3.0 mm wide, membranous, deciduous, margins entire, tips acute, pale green, glabrous; peduncles cylindrical, short, 1.0-1.5 cm long and 3.0-3.5 mm wide, pale green, glabrous; floral bract ovate, 6.0-7.0 mm long and 2.0-4.0 mm wide, membranous, deciduous, margins entire, tips acute, green, glabrous. Flower 1.3-1.5 cm across at anthesis, white with pale yellow veins in the side lobe of lip and yellow callus; pedicels slender, 1.0-1.2 cm long and 3.0-4.0 mm wide, pale green, glabrous; dorsal sepals ovate-lanceolate, 1.0-1.2 cm long and 0.2-0.3 cm wide, coriaceous, the margins entire, the tips acute, creamy white, glabrous; lateral sepals linear-oblong, 1.5-1.7 cm long and 0.2-0.3 cm wide, coriaceous, the margins entire, the tips acute, creamy white, glabrous; lateral petals linear-lanceolate, 1.0-1.2 cm long and 2.0-2.5 mm wide, coriaceous, margins entire, tips acute, creamy white, glabrous; lip 3 lobe, spatulate with a long claw, sidelobe of lip rounded serrulate in front, midlobes narrowed to the obtuse base, 1.5-1.7 cm long and 0.5-0.6 cm wide, margins entire, tips crenulate and crisped, red veins in the sidelobe of the lip and yellow callus, glabrous; spur nearly straight, 0.6-0.7 cm long and 1.5-2.0 mm wide, tip obtuse, yellowish white; column short, 5.0-6.0 mm long and 2.0-3.0 mm wide, white; column-foot 0.8-1.0 mm long and 0.2-0.3 mm wide, yellowish white; anthercaps ovate, 0.2-0.3 cm long and wide, yellowish white, glabrous; pollinia 4, ovoid, 1.0-1.2 mm long and wide, in one group of 4, yellow, waxy; caudicle and viscidium absent;

stigmatic surfaces oblong, 1.0-1.5 mm long and 0.8-1.0 mm wide; ovary oblongoid, 3.0-4.0 mm long and 1.0-1.5 mm wide, yellowish white, glabrous.

Distribution : Shan State, Myanmar, Thailand (Seidenfaden, 1992).

Specimens Examined: Mt. Poppa Mountain, June, 15, 2016; 1447 m; No 20° 55' 13", E 95° 15' 14"; Ahnge Htwe and groups; collection No. 3.

2. *Dendrobium delacourii* Guill., Bull. Mus. Paris. 1924. (Figure 1. B)

D. ciliatum Parish, Bot. Mag. t. 5430, 1890.

English Name : Unknown

Local Name : Unknown

Flowering period from April to May.

Sympodial epiphyte. Root clinging, slender, 1.0-1.5 mm in diameter, white, glabrous. Pseudobulbous fusiform, 6.0-9.0 cm long and 2.0-2.5 cm wide, erect, stout, green, slightly pubescent; stem dwarf, terete, above the leaves, 4.0-5.0 cm long and 0.8-0.9 cm wide, membranous, sheathing base, green, glabrous; leaves alternate and distichous, oblanceolate, 9.0-10.0 cm long and 1.5-2.0 cm wide, coriaceous, sheathing base, margins entire, tips obtuse, leafy at anthesis, green above and pale green beneath, glabrous. Inflorescences simple raceme, scapes strict long terminal and axillary, 1 to 2 spike an each pseudobulbs, 5.5-6.0 cm long and 2.5-3.0 cm wide, 5- to 12-flowered; peduncular bracts 3-4, ovate-lanceolate, 3.0-6.0 mm long and 4.0-4.5 mm wide, persistent, membranous, margins entire, tips acute, pale green, glabrous; peduncle slender, cylindrical, short, 4.0-5.0 cm long and 0.2-0.3 cm wide, coriaceous, green, glabrous; floral bracts ovate-lanceolate, 0.5-0.6 cm long and 0.2-0.3 cm wide, margins entire, tips sub-acute, coriaceous; brownish white, glabrous. Flowers 2.0-3.0 cm across at anthesis, light greenish yellow sepals and petals, lip brownish yellow with brown stripes, sidelobes dark brown; pedicels slender, 1.5-1.6 cm long and 1.5-2.0 mm wide, greenish yellow, glabrous; dorsal sepal ovatelanceolate, 1.1-1.2 cm long and 3.0-3.5 mm wide, 5-veined, erect, coriaceous, the margins entire, the tips acute, light greenish yellow, glabrous; lateral sepals falcatedecurved, 1.2-1.3 cm long and 2.5-3.0 mm wide, margins entire, tip obtuse, coriaceous, lateral petal oblong-lanceolate, 1.2-1.3 cm long and 1.5-2.0 mm wide, coriaceous, margins entire, tips acute, light greenish yellow, glabrous; lip cuneately-oblong, 1.3-1.4 cm long and 8.0-9.0 mm wide, side lobe incurved, 1.0-1.1 cm long and 2.0-2.5 mm wide, margins entire, tips obtuse, dark brown, midlobe small ovate-fimbriate with long clavate hairs on the nerves brownish yellow with brown stripes; spur short, conical, tip obtuse, 2.5-3.0 mm long and 1.0-1.5 mm wide, greenish yellow, glabrous; column short, 4.0-5.0 mm long and 2.0-3.0 mm wide, pale yellow; column-foot 0.2-0.3 mm long and 3.0 mm wide, pale yellow; anthercap orbicular, 2.0-2.5 mm long and wide, yellowish white, glabrous; pollinia 4, oblong, 1.3-1.5 mm long and 0.3-0.4 mm wide, in one group of 4, waxy, yellow; caudicle and viscidium absent; stigmatic surfaces elliptic, 2.5-3.0 mm long and 1.5-2.0 mm wide; ovary oblongoid, 5.0-8.0 mm long and 1.5- 2.0 mm wide, greenish yellow, glabrous. Fruits capsule, clavate, 6-grooved, 3.0-3.5 cm long and 1.8-2.0 cm wide, coriaceous, green, glabrous.

Distribution : Kachin State, Shan State, Myanmar, Tenasserim, Thailand, Indochina (Gunna Seidenfaden and Tem Smilinand, 1960).

Specimens Examined: Mt. Poppa Mountain, June, 15, 2016; 1447 m; No 20° 55' 13", E 95° 15' 14"; Ahnge Htwe and groups; collection No. 5.

3. *Dendrobium dixanthum* Rchb. f. Gard. Chron. 674. 1865. (Figure 1. C)

English Name : Unknown

Local Name : Shwe-war-ka-lay

Flowering period from February to April.

Sympodial epiphytes. Roots clinging, 1.0-1.2 mm in diameter, cylindrical, white, glabrous. Pseudobulbs many-jointed, erect, oblongoid, 15.0-35.0 cm long and 0.5-0.8 cm wide, yellowish green and covered with white sheaths, glabrous, the internodes 2.5 - 3.5 cm long and 0.5-0.8 cm wide, cylindrical, superposed. Leaves alternate and distichous, oblong-linear to lanceolate, 5.0-7.5 cm long and 1.5-2.0 cm wide, sub-coriaceous, deciduous, margins entire, tips acute, leafless at anthesis, greenish above and paler beneath, surfaces glabrous, the sheath membranous 2.5-3.0 cm long and 0.8-1.0 cm wide, white. Inflorescences terminal and axillary racemes, 3-6 on upper part of each pseudobulb, 5.5-9.0 cm long and 3.0-8.0 mm wide, 2- to 3-flowered; peduncular bracts 3, oblong to ovate-oblong, 3.0-4.0 mm long and 2.5-3.0 mm wide, membranous, persistent, margins entire, tips obtuse, creamy white to yellowish white, the surfaces glabrous; peduncles slender, cylindrical, short, 1.3-1.5 cm long and 1.0-1.5 mm wide, pale green, glabrous; floral bracts triangular, 2.0-3.0 mm long and 1.0-1.5 mm wide, membranous, deciduous, margins entire, tips obtuse, pale yellow, surfaces glabrous, hyaline. Flowers 2.5-3.0 cm across at anthesis, membranous, golden yellow, fragrant; pedicels slender, 1.0-1.2 cm long and 0.9-1.0 mm wide, yellowish green, glabrous; dorsal sepals ovatelanceolate, 1.3-1.5 cm long and 5.0-7.0 mm wide, margins entire, tips acute, golden yellow, surfaces glabrous; lateral sepals oblong-lanceolate, 1.7-2.0 cm long and 5.0-7.0 mm wide, margins entire, tips sub-acute, golden yellow, surfaces glabrous; lateral petals elliptic, 1.7-1.8 cm long and 7.0-8.0 mm wide, margins entire, tips sub-acute, golden yellow, surfaces glabrous; lip-sub-orbicular, attached to the base of the column, not differentiated into sidelobe and midlobes, 1.8-2.0 cm long and 1.7-1.8 cm wide, margins slightly pectinate, tips obtuse or rounded, golden yellow, surfaces pubescent within and glabrous without; spur saccate, 4.0-5.0 mm long and 3.0-5.0 mm wide, tips sub-acute; column short, straight, 4.0-5.0 mm long and 1.5-2.0 mm wide, yellow; column-foot 3.5-4.0 mm long and 1.5-2.0 mm wide, yellow with reddish striations; anthercaps ovoid, 1.3-1.5 mm long and 1.0-1.5 mm wide, yellowish white; pollinia 4, oblong, each 0.8-1.0 mm long and 0.2-0.3 mm wide, in 1 group of 4, waxy, yellow; caudicles and viscidum absent; stigmatic surfaces oblong, 1.8-2.0 mm long and 1.3-1.5 mm wide, yellow; ovary oblongoid, 0.8-1.0 cm long and 1.3-1.5 mm wide, pale yellowish green, glabrous. Fruits not seen.

Distribution : Tenasserim, Tanintharyi Division, Mon State, Shan State, Myanmar, Thailand. (Gunnar Seidenfaden and Tem Smitinand, 1960)

Specimens Examined: Mt. Poppa Mountain, June, 15, 2016; 1447 m; No 20° 55' 13", E 95° 15' 14"; Ahnge Htwe and groups; collection No. 6.

4. *Dendrobium draconis* Rchb.f., Bot. Zeit. 214; 1862. (Figure 1. D)

English Name : Unknown

Local Name : Unknown

Flowering period from January to April.

Sympodial epiphytes. Roots clinging, 1.0-1.5 mm in diameter, cylindrical, white to brownish white, glabrous. Pseudobulbs many-jointed, erect, oblongoid, 25.0-35.0 cm long and 1.0-1.2 cm wide, invested by the sheaths, green to whitish green, internodes 2.0-2.5 cm long, superposed. Leaves alternate and distichous, ovate-oblong, 5.2-5.5 cm long and 1.5-2.0 cm wide, thinly coriaceous, deciduous, margins entire, tips oblique, leafless or leafy at anthesis, green, glabrous; sheaths membranous, dark pubescent; Inflorescences terminal and axillary racemes, 1 to 3 on each pseudobulb, 5.0-7.0 cm long and 6.5-10.0 cm wide, 2 to 4-flowered; peduncular bracts 4; lanceolate, ovate to ovate-triangular, 0.4-0.5 cm long and 0.3-0.6 cm wide, membranous, persistent, margins entire, tips acute, brownish white, glabrous; peduncles cylindrical, short, 1.0-1.2 cm long and 3.0-4.0 mm wide, pale green, glabrous; floral bracts triangular, 4.0-5.0 mm long and 2.0-4.0 mm wide, membranous, deciduous, margins entire, tips acute, creamy white, black-hair present. Flowers 3.5-5.5 cm across at anthesis, sub-

coriaceous, white, pedicels 1.8-2.0 cm long and 2.0-3.0 mm wide, slightly curved, creamy white, glabrous; dorsal sepals oblong, 2.2-2.4 cm long and 5.0-6.0 mm wide, keeled on the dorsal surfaces, margins entire, tips acute, white, glabrous; lateral sepals lanceolate, 2.2-2.4 cm long and 0.5-0.6 cm wide, margins entire, tips acute, white, glabrous; lateral petals ovate, 2.5-3.0 cm long and 1.3-1.5 cm wide, margins slightly undulate, tips acute and recurved, white, glabrous; lip distinctly 3-lobed, 2.5-3.0 cm long and 1.4-1.6 cm wide, sidelobes oblong, 0.5-0.7 cm long and 0.3-0.5 cm wide, midlobes ovate, 2.5-3.0 cm long and 1.1-1.3 cm wide, much longer than broad, margins crispy, tips obtuse, with 3 golden yellow ribs in the lower part, basally orange or orange-red streaked, forming a kind of auricles to the base, glabrous; spur conical 1.2-1.5 cm long and 0.5-0.8 cm wide, tip obtuse, white; column long, 1.0-1.2 cm long and 0.3-0.4 cm wide; column-foot 0.5-0.6 cm long and 0.2-0.3 cm wide; anthercaps ovoid, 2-lobed, 2.0-2.5 mm long and 1.0-1.2 mm wide, creamy white; pollinia 4, oblong, 1.5-2.0 mm long and 1.0-1.5 mm wide, waxy, yellow; caudicle and viscidium absent; stigmatic surfaces oblong, 1.5-2.0 mm long and 1.5-2.0 mm wide, white; ovary oblongoid, 0.6-0.8 cm long and 0.4-0.5 cm wide, slightly curved, creamy white, glabrous. Fruit capsule, clavate, 6-grooved, 3.5-4.0 cm long and 1.8-2.0 cm wide, coriaceous, green, glabrous.

Distribution : North East India, Bago Division, Mandalay Division, Shan State, Myanmar, Thailand (Seidenfaden, 1992).

Specimens Examined: Mt. Poppa Mountain, June, 15, 2016; 1447 m; No 20° 55' 13", E 95° 15' 14"; Ahnge Htwe and groups; collection No. 7.

5. *Dendrobium parcum* Rchb. f. in Gard. Chrem. Xen-Orchid. ii. t.169;

1866. (Figure 1. E)

English Name : Unknown

Local Name : Kyee-chey

Flowering period from February to March.

Sympodial epiphytes. Roots clinging, about 1.0 mm in diameter, cylindrical, brownish white, glabrous. Pseudobulbs many jointed and branched, erect, cylindrical, slightly flattened slender, 5.0-50.0 cm long and 0.7-1.0 cm wide, glabrous, brownish purple and furrowed when old, the internodes 1.5-3.0 cm long, superposed. Leaves alternate and distichous, linear oblong-lanceolate, 5.0-6.5 cm long and 0.5-1.0 cm wide, margins entire, tips acute to slightly emarginate, leafless at anthesis, greenish above and paler beneath, surface glabrous, the sheaths membranous, about 1.0 cm long and 1.5 cm wide, white. Inflorescences terminal and axillary racemes, 1 to 4 on each pseudobulb, 2.5-2.7 cm long and wide, 3- to 5-flowered; peduncular bracts about 2, sheathing, 0.2-0.25 cm long and 2.0 mm wide, membranous, deciduous, the surface glabrous, pale yellowish green, margins entire, tips acute; peduncle shorty, slender, cylindrical, about 5.0-6.0 mm long and 1.0-1.5 mm wide, pale green, glabrous; floral bracts ovate-lanceolate, 1.5-2.0 mm long and about 2.0 mm wide, membranous, margins entire, tips acute, pale yellowish green, surface glabrous. Flowers 4.5-5.0 mm across at anthesis, membranous, pale yellowish green; pedicels 6.5-7.5 mm long and 1.0-1.5 mm wide, pale green, glabrous; dorsal sepals ovate, concave, 3.5-4.5 mm long and 1.0-2.0 mm wide, one nerved, margins entire, tips sub-acute to obtuse, pale yellowish green, surfaces glabrous; lateral sepals obliquely triangular, 5.0-7.0 mm long and 2.0-2.5 mm wide, margins entire, tips subacute, pale yellowish green, surface glabrous; lateral petals linear-spathulate, 3.0-4.0 mm long and 1.5-2.0 mm wide, margins entire, tips obtuse, pale yellowish green, surface glabrous; lip dilated cuneiform, not differentiated into sidelobes, and midlobe, 8.0-9.0 mm long and 2.5-4.0 mm wide, margins entire, tips 2-lobed or emarginate, dull yellowish green speckled with purple, surface glabrous; spur conical, long narrow, 0.4-0.5 cm long and 0.2-0.3 cm wide, pale yellowish green, tips obtuse; column 2.0-2.5 mm long and 2.0 mm wide, pale yellowish green; column-foot not distinct; anthercaps ovoid, 0.5-1.0 mm long

and wide, white, glabrous; pollinia 4, clavate, 0.6-0.75 mm long and 0.4-0.5 mm wide, waxy, yellow; caudicle and viscidium absent; stigmatic surface oblong, 0.4-0.5 mm long and wide, glossy green; ovary oblongoid, 6.0-7.5 mm long and 2.0-3.0 mm wide, pale yellowish green, glabrous. Fruit not seen.

Distribution : Mandalay Division, Shan State, Myanmar, Thailand. (Seidenfaden, 1992)

Specimens Examined: Mt. Poppa Mountain, June, 15, 2016; 1447 m; No 20° 55' 13", E 95° 15' 14"; Ahnge Htwe and groups; collection No. 9.

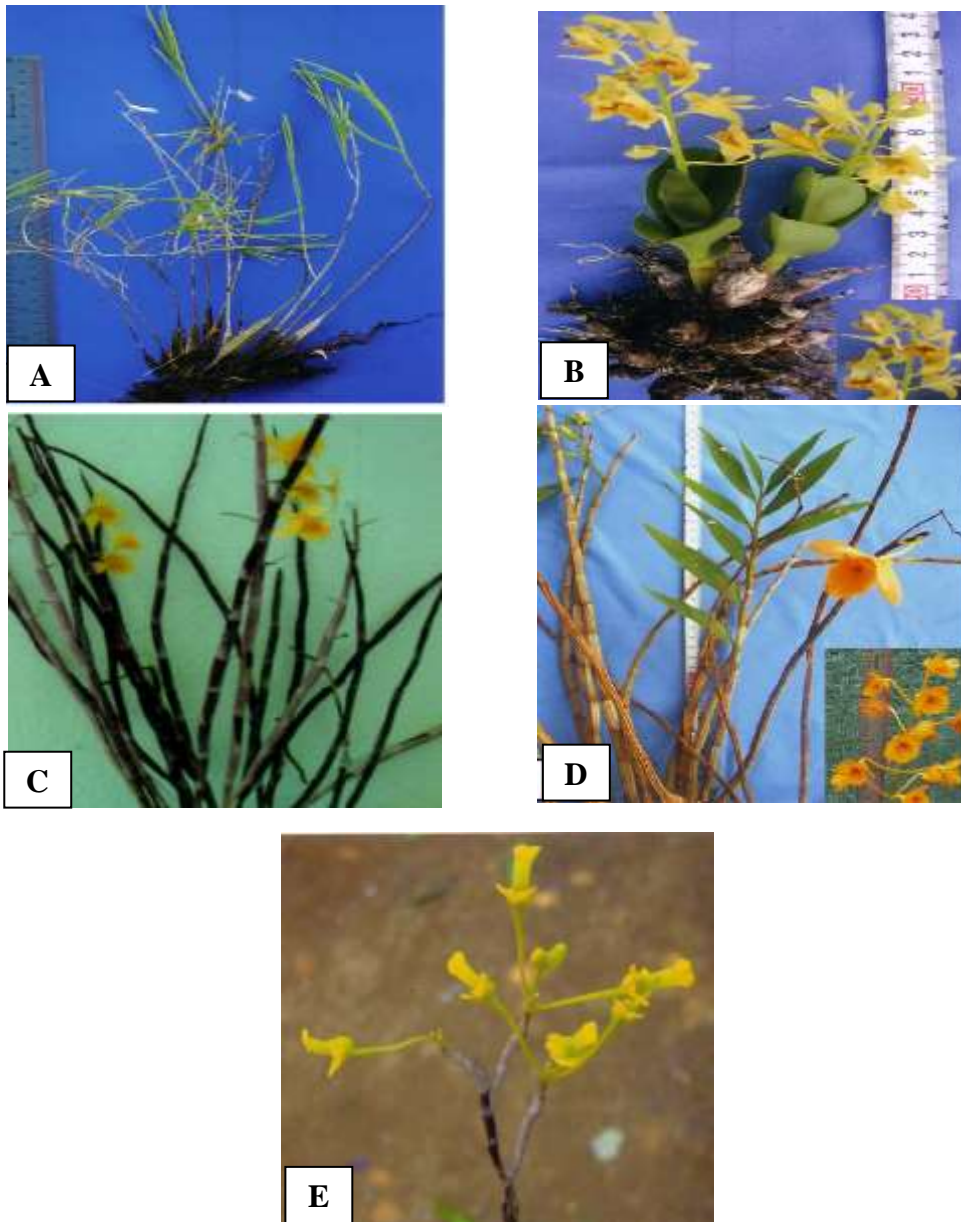


Figure 1. A. *Dendrobium clavator* Ridl. B. *Dendrobium delacourii* Guill.
 C. *Dendrobium dixanthum* D. *Dendrobium draconis* Rchb.f.
 Rchb.f.
 E. *Dendrobium parcum* Rchb.f.

Discussion

The selected area for this monographic study is Mt. Poppa area, between 20° 55' 15" N latitude and 95° 15' 14" E longitude. This area is forming a closed canopy which prevents the sunlight from reaching the lower layer. So, this area is mostly covered with tropical evergreen forests and distribution of many wild orchids. Among them, 5 species of *Dendrobium* are described in this research.

Dendrobium spp. are included in family Orchidaceae and subfamily Epidendroideae. The subfamily Epidendroideae are the major orchid group, with more than half of all orchid species in this subfamily. Most are epiphytes with some terrestrial. The popular *Dendrobium* spp. are well known in this subfamily. All the species of the genus *Dendrobium* has large, showy flowers.

The genus *Dendrobium* has a wide distribution extending from India and Ceylon to Chin and Japan, Southeast Malaysia to Australia and New Zealand. The ever popular *Dendrobium* is one of the most recorded orchid to grow being handsome, floriferous and hardy.

Pseudobulbs come in all sorts of shapes. They are long vertical canes up to 1.5 m in length in the horn *Dendrobium*, dangling pendulous rods in the nobile *Dendrobium* round and differing in the slender stem, narrower less coriaceous leave larger flower that are membranous, the terete over.

Most of the *Dendrobium* spp., have many-jointed pseudobulbs. The shapes of pseudobulbs are variable within the species. In *Dendrobium clavator*, *Dendrobium delacourii* are fusiform but those of other species are many jointed and oblongoid.

The inflorescences is solitary of *Dendrobium clavator* but these of the rest species are 1 to many on each pseudobulbs.

The labellum or lip is mostly 3 lobed, with one midlobe and 2-sidelobes. The lip of *Dendrobium delacourii* are cuneately-oblong. *Dendrobium parcum*, lip are dilated-cuneiform but these of the other species are orbicular and 3 lobed.

The spur are nearly straight in *Dendrobium clavator* but those of the rest species are saccate and conical. The shape of pollinia is clavate in *Dendrobium parcum* but those of the other species are ovoid and oblong.

Therefore, it can be concluded that some *Dendrobium* spp. are still widely thrived in the study area and it is needed to conserve the orchid's resources from extinctions of rare species. This study will partially fulfill the requirement of orchid's information of the Mt. Poppa area in Myanmar.

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References

- Backer, C.A. and C. Bakhuizen Van Den Brink. JR. 1968. **"Flora of Java Vol. III"**. Noordhoff, Ltd. Groningen.
- Benson, L. 1957. **"Plant Classification"**. D. C, Health and Co. Moss. Boston.
- Charles Schweinurth, 1960. **"Orchids of Peru"**. Vol. 30. Natural History Museum Press. Chicago. U.S.A.
- 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.
- Grant, B. 1895. **"The Orchid of Burma"**. Central Press. Rangoon.
- Gunnar Seidenfaden, 1977. **"Orchid Genera in Thailand V Orchidoideae"**. Printed in Denmark by Adelsbogtrykkeriet i Odense ISBN 87-7420-0151
- Hooker, J.D., 1894. **"The Flora of British India"**. Vol. V & VI. L. Reeve & Co, London.
- Hundley, H.G. and Chit Ko Ko, 1961. **"List of Trees, Shrubs, Herbs and Principle Climbers of Myanmar"**. Supdt., Govt. Printing and Stay.
- 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, Washington DC. USA.
- Lawrence, G. H. M., 1951. **"Taxonomy of Vascular Plants"**. The Macmillan Co., New York
- Sanders. 1927. Sanders' Orchid Guide, Sanders Ltd. St, Albans. England and Burges, Belgium.
- Seidenfaden, G. & T. Smitnand. 1959-1965. **"The Orchids of Thailand"**. A Preliminary List. Part I - IV. The Siam Soc. Bangkok.
- Van Steenis, C. G. G. J. 1954-1958. **"Flora Malesiana"**. Ser. I. Vol. 4. Noordhoof. Ltd. Grenigen.