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Morphology and Taxonomic Identity of a Leafless orchid *Aphyllorchis* from Bukidnon, Philippines

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ABSTRACT

A mycoheterotroph leafless *Aphyllorchis* orchid was collected from the Bukidnon, Philippines. Morphological examinations of its inflorescence suggest its close similarities to *A. halconensis* which presents a new record in Mindanao Island, specifically in the province of Bukidnon. Full description of this species, its habitat ecology, along with photographs and illustrations are provided for easy identification.

Key words: *Aphyllorchis*, Orchidaceae, Bukidnon, Mindanao, Philippines.

INTRODUCTION

Orchidaceae is the second largest family of flowering plants in the world comprising 20,000-25,000 species distributed in 770-880 genera (Chase 2005, Jalal et al. 2008, APG III 2009). This family is cosmopolitan, but the majority of species are found in the tropics and subtropics, ranging from sea level to almost 5,000 m elevation in nearly all environments except open water and true desert (Rao et al. 2009). Their flowers are typically

zygomorphic with an outer whorl of three petals as is typical for monocots and their various plant parts are used in folk medicine (Delforge 2005; Dutta & Sarma 2013). They are considered to be the most highly evolved in the floral specialization and diversified form among the monocotyledons (Yonzon et al. 2012). Orchids are also important for their aesthetic value and work as ecological indicators (Joshi et al. 2009).

Aphyllorchis Blume is a mycoheterotroph, terrestrial and leafless group of orchid with 30

known members around the world (Xinqi & Gale 2009). Several plant lineages have developed ways to obtain carbon from their mycorrhizal symbionts, a mode of life known as mycoheterotrophy (Leake 1994). Mycoheterotrophic orchids are mostly associated with ectomycorrhizal fungi in temperate regions or with saprobes or parasites in tropical regions (Roy et al. 2009). The majority of mycoheterotrophic lineages are monocots, both in species diversity and number of independent origins (Merckx et al. 2013). To date, only three species of *Aphyllorchis* have been reported from the Philippines, namely – *A. halconensis* Ames, *A. montana* Rchb.f. and *A. pallida* Blume (Pelser et al. 2011 onwards).

During field exploration on April 1, 2017 at the Center for Ecological Development and Recreation (CEDAR), two individuals of a rare terrestrial orchid species belonging to genus *Aphyllorchis* was found and recorded in Mindanao Island, specifically in the province of Bukidnon for the first time. Field collection of voucher specimens and taxonomic identification were carried out with the availability of the plant samples and spirit collection of the flowers. Morphological examinations showed that the collected specimen was *A. halconensis*, a Philippine endemic species belonging to family Orchidaceae (Gonzales et al. 2000). This species has been recorded only by Ames (1923) at Calapan, Mount Halcon, Mindoro Island in Luzon and Pelser et al. (2011 onwards) at Negros Occidental province in Visayas. Hence, this present paper reports on the extended distribution with notes on habitat ecology of *A. halconensis* in the country and as a new distributional record in the province of Bukidnon in Mindanao. The spirit collection of the flowers was deposited at the Central Mindanao University Herbarium (CMUH), Musuan, Bukidnon, Philippines.

TAXONOMIC DESCRIPTION

Aphyllorchis halconensis Ames, Sched. Orchid. 6 (1923) 7 (Fig. 1 and 2)

A terrestrial, erect, achlorophyllous, mycoheterotrophic, leafless herb that reached up to 120 cm tall. Rhizome short, stout, terete, 3-7 cm in length, 1-1.2 cm in diameter, yellowish-brown to light brown, bearing roots. Roots scattered, tuberous, 3-5.5 cm long, 0.8-1 cm in diameter, yellowish-brown to light brown. Stem have many loose tubular/membranous opposite sheaths, those near the base of the plant closer together than those near the terminal. Sheaths 1.7-3 cm long, the upper ones longest about 10.5 cm apart, the lowermost ones shortest about 1.4 cm apart. Inflorescence loosely raceme up to 13 cm long with 16-19 flowers. Floral bracts 1-2 cm long, 3.5 mm wide, linear-lanceolate-shaped. Flowers white, erect or

ascending when young, more or less perpendicular to rachis during blooming, hardly opened or rarely spreading. Pedicel with the ovary straight, 19-26 mm long, densely glandular. Lateral sepals about 1.1-1.6 cm long, 3.7 mm wide, oblong to lanceolate (when flattened), acute apex, narrower compared to the dorsal sepal, white adaxially, purple-dotted abaxially. Dorsal sepal 1.2-1.5 cm long, concave, ovate (when flattened), acute apex, arching forward over the slender column, white adaxially, purple-dotted abaxially. Petals 1.3-1.6 cm long, about 3.5-3.9 mm wide above the middle, thinner, oblong to lanceolate, acute apex, straight or slightly falcate at apex, margin entire, purplish lining the middle of the adaxial surface. Labellum 1.2-1.4 cm long, unequally 3-lobed; lateral lobes basal, 2.5-2.7 mm long to the sinus formed with the middle lobe, triangular, subacute; middle lobe 1 cm long, about 4-6 mm wide below the middle, lanceolate, deeply carinate at the cymbiform tip. Disc thickened between the lateral lobes, bicarinate at the base of the middle lobe, the keels somewhat crenulate. Column 8-11 mm long, slender, curved forward, dilated upward. Ovary has short pedicel, 2.4 cm long, slightly curved. Anther cap oblong to ellipsoid, 2 mm long, yellowish, bearing 2 pollinaria, each 2-partite, soft, yellowish. Fruits not observed.

Etymology: The specific epithet denotes the first collection in Mt. Halcon, Mindoro Island by Ames (1923).

Flowering: Flowering appears to occur between the months of February to May.

Habitat/Ecology: In the CEDAR (8°15'8.76"N, 125°2'4.056"E), Impalutao, Impasug-ong, Bukidnon, this achlorophyllous terrestrial orchid species naturally grows in slope, filtered canopy on wet to moist substrate in loams rich in decaying ground leaf litter and humus. This habitat preference might be due to the reports of Rasmussen and Whigham (1998), Batty et al. (2001) and Bergman et al. (2006) that leaf litter quantity and quality has an effect on some symbiotic associations, such as mycorrhiza-plant associations in tropical forests. Terrestrial orchids are also in need of species-specific fungi for seed germination and growth (Warcup 1973, Clements et al. 1986). On the other hand, mycoheterotrophy plants receive carbon from soil fungi colonizing their roots, forming the so-called mycorrhizal symbiosis (Smith and Read 2008).

Occurrence: Two individuals were found in the habitat at an altitude 804 masl. A search in the nearby areas was done three times (April-June 2017), but no further individual or population was observed.

Table 1. *Aphyllorchis* species recorded in the Philippines (Averyanov 2011; Fan et al. 2011; Pelser et al. 2011 onwards).

SPECIES	ELEVATION	HABITAT	DISTRIBUTION
1. <i>A. halconensis</i>	300-1,000 masl	Terrestrial	Endemic to the Philippines (MINDORO: Mt. Halcon in Mindoro Oriental and NEGROS: Negros Occidental)
2. <i>A. montana</i>	800-1,500 masl	Terrestrial in broadleaved forests on deep limestone and silicate soils (R)	Vietnam (Kien Giang, Ninh Tuan, Thanh Hoa, Vung Tau). Mainland tropical Asia, Hainan, Kalimantan, India, Sri Lanka, China, Japan, Ryukyu Isls, Thailand, Peninsular Malaysia, Sumatra, Borneo, New Guinea, Taiwan, Philippines (LUZON: Benguet, Laguna, Rizal, MINDANAO: Davao, Agusan)
3. <i>A. pallida</i>	330-1,400 masl	Terrestrial in humid forest and in primary mixed and coniferous forests on deep silicate soils. Can be found also under evergreen forest and dwarf habit and dark color camouflaged with the litter in the tropical rainforests (VR).	Vietnam (Dak Lak, Lam Dong). Thailand, Malacca, Sumatra, Kalimantan, Peninsular Malaysia, Java, Borneo, China (Hainan) and Philippines (MINDORO: Mt. Halcon and vicinity in Mindoro Oriental)

R – rare , VR – very rare

Table 2. Morphological differences among *A. halconensis*, *A. montana* and *A. pallida*. Data from *A. halconensis* followed the description of Ames (1923), *A. montana* (Averyanov 2011; Hsieh et al. 2013) and *A. pallida* (Averyanov 2011; Tagane et al. 2015), respectively.

Characters	Actual specimen	<i>A. halconensis</i>	<i>A. montana</i>	<i>A. pallida</i>
Plant Height	reached up to 120 cm	115 cm (11.5 dm) tall	30-50 cm tall	15-30 cm tall
Flower	prominent lip, very distinct to petals and sepals	N/A	prominent lip, more than 8 mm across	not widely open with a lip shorter than tepals, less than 8 mm across
Flower color	white with purple lining the middle of petals, Purplish in the abaxial surface.	bluish purple and white	yellow	white, cream
Sepals	oblong to lanceolate (when flattened), acute apex, narrower compared to the dorsal sepal, white adaxially, purple-dotted abaxially, 1.1-1.6 cm long by 3.7 mm wide (lateral). Concave, ovate (when flattened), acute apex, white adaxially, purple-dotted abaxially, 1.2-1.5 cm long (dorsal)	oblong-lanceolate, about 1.3 cm long by 3.5 mm (lateral) and strongly concave, 1.5 cm long (dorsal)	fleshy and keeled in apical half, 8-10 mm long	ovate, 4-5 mm long
Shape of petal apex	acute	acute	obtuse	obtuse
Column	slim to slender, curved forward, dilated upward, 8-11 mm long	slender, curved forward, dilated upward, 9 mm long	bended at the middle, widened to the apex, 1 cm long	obovoid-cylindrical, slightly arcuate, 1.8 mm long

Global Distribution: Philippines (endemic). The extent of distribution of this species is inadequately known.

Distribution within the Philippines: LUZON: Calapan, Mount Halcon, Mindoro Island (Ames 1923); VISAYAS: Negros Occidental province (Pelser et al. 2011 onwards); and MINDANAO: CEDAR, Bukidnon province (present study). Other *Aphyllorchis* species that are recorded in the Philippines are summarized in Table 1 with their elevation, habitat and distribution. Their morphological differences are also presented in

Table 2 to aid for its easy taxonomic identification and species' delineation.

Specimen examined: Philippines: Mindanao, Bukidnon, Municipality of Impasug-ong, Impalutao, CEDAR (8°15'8.76"N, 125°2'4.056"E), NPM 004-2017, 10 July 2017, CMUH.

Conservation status: *A. halconensis* has not been assessed by the IUCN Red List of Threatened Species, but is in the Catalogue of Life (IUCN 2017).



Fig. 1. *Aphyllorchis halconensis*. a. Habit; b. Frontal view of the flower; c. Stem, Rhizome and Roots.

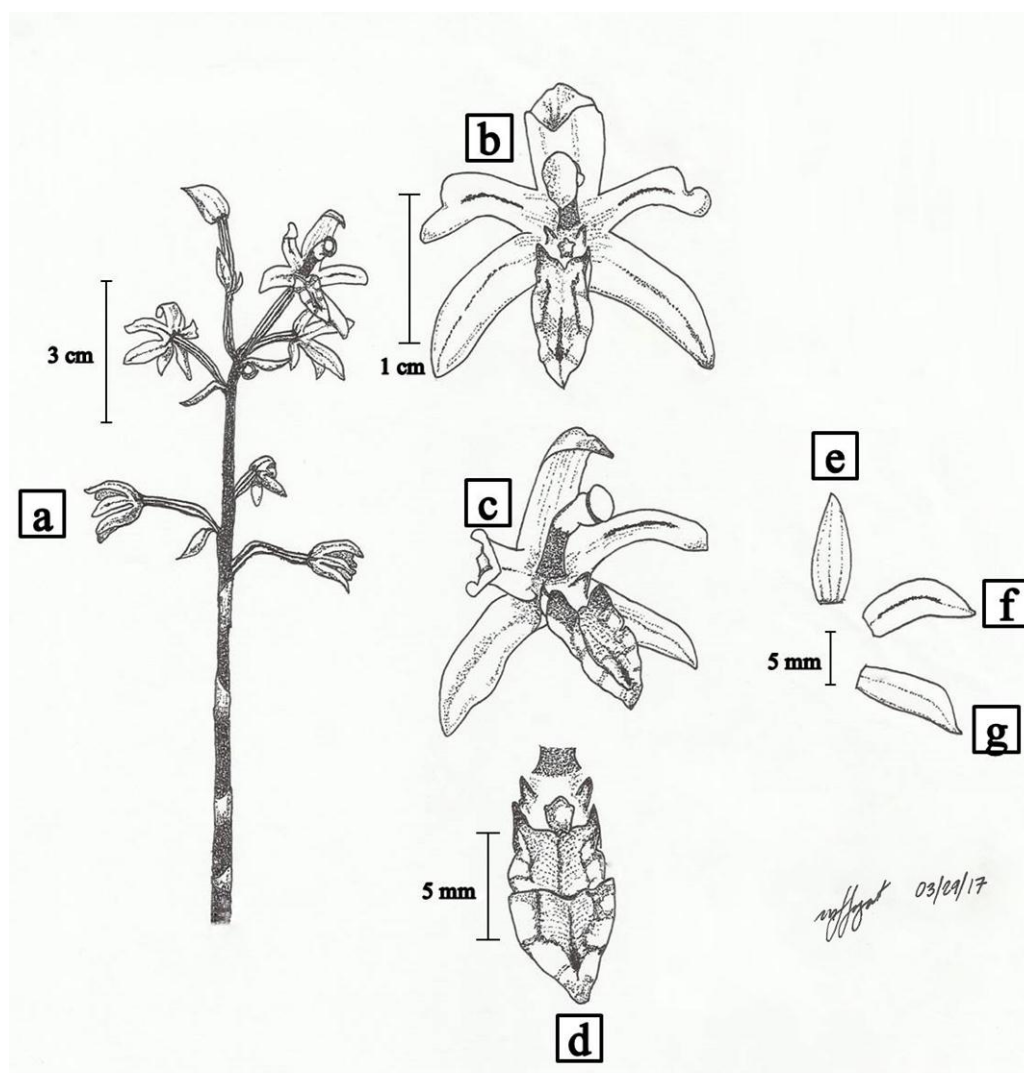


Fig. 2. *Aphyllorchis halconensis*. a. Inflorescence; b. Close-up (frontal) view of the flower; c. Close-up (profile) view of the flower; d. Labellum from above; e. Dorsal sepal (flattened); f. Petal (flattened); g. Lateral sepal (flattened).

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