

Six new *Orchidantha* species (Lowiaceae) from Borneo

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ABSTRACT. Six new *Orchidantha* species (Lowiaceae) from Borneo, *O. gigantea* Škorničk. & A.Lamb, *O. ismailii* Škorničk. & A.Lamb, *O. jiewhoei* Škorničk. & A.Lamb, *O. lutescens* Škorničk. & A.Lamb, *O. nilusii* Škorničk. & A.Lamb and *O. ultramafica* Škorničk. & A.Lamb are described here. This brings the total number of species in the family to 34 of which 17 are endemic to Borneo. Detailed descriptions, colour plates, preliminary IUCN conservation assessments and a key to all Bornean *Orchidantha* species are provided.

Keywords. Data Deficient, Kalimantan, *Orchidantha gigantea*, *Orchidantha ismailii*, *Orchidantha jiewhoei*, *Orchidantha lutescens*, *Orchidantha nilusii*, *Orchidantha ultramafica*, Sabah, Vulnerable, Zingiberales

Introduction

Lowiaceae, with a single genus *Orchidantha* N.E.Br., currently accommodates 28 species after the addition of recent new species from northern Vietnam (Trần & Leong-Škorničková, 2010; Leong-Škorničková et al., 2014; Trần et al., 2020), Peninsular Malaysia (Leong-Škorničková, 2014), China (Zou et al., 2017; Zou et al., 2019) and Borneo (Syauqina et al., 2016, 2019; Poulsen & Leong-Škorničková, 2017).

An introduction to the family can be found in Pedersen (2001) and Trần & Leong-Škorničková (2010). Additional remarks can be found in Leong-Škorničková et al. (2014) and Poulsen & Leong-Škorničková (2017), the latter with a particular focus on Borneo.

The centre of diversity of the genus is in Borneo with eleven species so far known, of which one is known from Brunei, four from Sabah and five from Sarawak. The original wild origin of *Orchidantha borneensis* N.E.Br. (Brown, 1886) remains unknown as explained in detail in Poulsen & Leong-Škorničková (2017).

Two ex situ living collections of Lowiaceae have been established in Sabah for more than 15 years, namely in Sabah Agriculture Park in Tenom and in Kipandi Butterfly Park near Kota Kinabalu. These collections are regularly enriched by material collected by the second, third and fourth authors, and now include most of the known diversity of the genus in Borneo as well as yet undescribed species. Most

Orchidantha species in these collections usually flower between February and March. Access to these collections and additional fieldwork enabled the first author, who is progressing with a monograph on the family, to study most of the currently known Bornean species from living flowering material in detail. It became clear that at least six taxa were new to science and are therefore described and illustrated below. The identity of several other accessions is still pending further investigations. This brings the total number of currently recognised species in the family to 34, of which 17 are endemic to Borneo. With more exploration, more species can be expected, particularly from underexplored Kalimantan.

The descriptions are based on living flowering material. The style of description follows the recent works cited above (e.g., Poulsen & Leong-Škorničková, 2017), the general plant descriptive terminology follows Beentje (2016). Colour plates for all six new taxa are provided, with a focus on capturing the flower morphology in detail. A key to all *Orchidantha* species in Borneo is also given. Provisional IUCN conservation assessments are provided in line with the most recent guidelines (IUCN Standards and Petitions Committee, 2019).

There are almost no records of uses for Lowiaceae species. In Sabah, the bases of very young shoots are sometimes pulled out by local people and the tender bases are chewed on as a refreshing vegetable, somewhat reminiscent of fresh cucumber in taste. In Peninsular Malaysia, the leaves are occasionally used as a wrapping material. All Lowiaceae species form dense clumps and once established in a suitable habitat, they grow fairly fast. As such, several species with flowers which are nearly scentless or emit only a mild and not so offensive smell are becoming increasingly popular as foliage plants in Thailand, Peninsular Malaysia and Singapore, where they are readily available in nurseries.

New species

***Orchidantha gigantea* Škorničk. & A.Lamb, sp. nov.**

Similar to *Orchidantha holttumii* K.Larsen in the claw-like shape of the flowers, but differs by being a more robust plant to 3.5 m in height, the lamina gradually tapering to the base and to 350 × 20.5 cm, and all parts of the flower being larger (vs to 1.5 m high, adult leaves clearly petiolate with lamina 30–80 × 7–10 cm, and overall smaller flowers in *O. holttumii*). – TYPE: Malaysia, Sabah, Papar district, Kawang Forest Reserve, altitude c. 310 m, 5°47'3"N 116°4'27.5"E, evergreen forest on the slopes, 10 March 2012, *Lamb & Leong-Škorničková AL 2260* (holotype SAN; isotype SING; both including material in spirit as part of a single specimen). (Fig. 1 & 2).

Robust clump-forming herb, up to 3.5 m tall, c. 12 leaves per shoot; juvenile plants with distinctly petiolate leaves, petioles not present in adult plants; *leaves* to 350 cm long, with no distinct petiole; *lamina* narrowly elliptic, slightly unequal, to 20.5 cm wide, base narrowly attenuate, apex attenuate. **Inflorescence** on a slender, branched, pale to cream-coloured, burrowing stem with prominent bracts and/or their scars;



Fig. 1. *Orchidantha gigantea* Škorničk. & A.Lamb. **A.** Habit of mature plants. **B.** Mature plant with Anthony Lamb as a scale. **C.** Base of the plant with flower. All from the type population, Lamb & Leong-Škorničková AL 2260. (Photos: J. Leong-Škorničková).



Fig. 2. *Orchidantha gigantea* Škorničk. & A.Lamb. **A & B.** Detail of flowers. **C.** Stigma with anthers and petals attached (left); stigma in front, side and back view (middle), and petals (right) (scale bar in mm). **D.** Details of petals (top view). All from the type population, *Lamb & Leong-Škorničková AL 2260*. (Photos: J. Leong-Škorničková).

prophyll, second and third bracts cream-white; *prophyll* triangular, two keeled, c. 18–20 mm long, 12–14 mm wide at base; *second bract* 30–35 mm long, 15–20 mm wide at base; *third bract* 55–60 mm long, 18–21 mm wide at base; *floral bract* appearing above the soil or with the proximal part burrowed in the soil, light green shading into white at base, c. 110 mm long. **Flowers** open in the morning, presented above the ground, emitting an intense smell of dung; *pedicel* 55–60 mm long; *ovary extension* 120–135 mm long, cream-white to greenish; *sepals* yellow-green, narrowly elliptic, cuspidate, glabrous, entire; *dorsal sepal* 140–150 mm long, 32–37 mm wide; *lateral sepals* overlapping, often crossing and supporting the labellum, 135–155 mm long, 28–33 mm wide; *lateral petals* overlapping at base and covering stamens and style, dark purple, narrowly elliptic, apiculate, 43–45 mm long, 12–14 mm wide, outer margin undulate in the distal half; *labellum* elliptic with strongly raised midrib (c. 3 mm wide), 120–130 mm long (inclusive of a 3–5 mm long acuminate tip), c. 30 mm

wide, dark purple throughout but fading more or less to yellow towards apex, sides strongly reticulate with vertical lines more pronounced, sides and margins of labellum undulate and involute distally. **Stamens** c. 24 mm long; **filaments** c. 9 mm long, c. 2 mm broad, cream-white with slight purple tinge; **anther thecae** introrse, 15 mm long, longitudinally dehiscent throughout their length. **Style** cream-white, c. 22 mm long; **stigma** c. 15 mm long, deeply 3-lobed, dorsal surface warm dirty yellow, stigma lobes with purple tinge, conduplicate, margin membranous, minutely laciniate; **median lobe** 9–10 mm long; **lateral lobes** 7–8 mm long; **viscidium** V-shaped and extending from the base to almost half of the lateral lobe (pronounced in side view). **Fruits** not seen.

Distribution. So far known only from the type locality in Kawang Forest Reserve in Sabah, where it is locally abundant.

Habitat and phenology. Hill forest on slopes. Flowering was observed in February and March.

Etymology. The specific epithet refers to the gigantic size of this species, which can reach 3.5 m in height.

Provisional IUCN conservation assessment. *Orchidantha gigantea* is so far known from a single location. While it is locally common, the population does not exceed 1000 adult individuals and the area of occurrence (AOO) is less than 20 km². This taxon should therefore be considered as Vulnerable (VU D1, D2).

Additional specimens examined. BORNEO: **Sabah:** Papar district, Kawang Forest Reserve, 26 Jun 2003, *Postar & Rouben SAN 144690* (SAN).

Notes. *Orchidantha gigantea*, with its leafy shoots reaching up to 3.5 m in height, is by far the largest and the most robust member of the entire family. This species is most similar to *Orchidantha holttumii* (Larsen, 1993) to which it is compared in the diagnosis. The flower of *Orchidantha gigantea* also resembles that of *O. megalantha* Škorničk. & A.D.Poulsen (Poulsen & Leong-Škorničková, 2017), but the latter species is only to 1 m tall with distinctly petiolate leaves.

***Orchidantha ismailii* Škorničk. & A.Lamb, sp. nov.**

Orchidantha ismailii is similar to *O. ultramafica* Škorničk. & A.Lamb in the habit of adult plants having distinctly petiolate leaves and flowers with a purple labellum, but *O. ismailii* differs in being a more robust plant with lamina 71–122 × 15.5–24 cm, sepals 68–73 × 15–18 mm, lateral petals 23–27 × 7–8 mm, cream-white with purple tinge in apical half, and the labellum c. 75 × 24 mm (vs. smaller more delicate plant with lamina 40–80 × 6–11 cm, sepals 50–57 × 8–9 mm, lateral petals 16–18 × 3–5 mm, purple, and the labellum 50–60 × 17–20 mm in *O. ultramafica*). – TYPE: Material cultivated in Sabah Agriculture Park in Tenom, originally from Malaysia, Sabah, Kota

Marudu district, proximity of Serinsim substation, cultivated material vouchered on 13 March 2012 as *Lamb & Leong-Škorničková* AL 2263 (holotype SAN; isotype SING; both including material in spirit as part of a single specimen). (Fig. 3 & 4).

Robust clump-forming herb, up to 1.8 m tall, 4–8 leaves per shoot; juvenile and adult plants distinctly petiolate; *leaves* of mature plants to 190 cm long; *petiole* to 50–85 cm long; *lamina* elliptic, slightly unequal, 71–122 × 15.5–24 cm, base obtuse, apex attenuate. **Inflorescence** subterranean, branched, pale to cream-coloured, with prominent bracts and/or their scars. Prophyll, second and third bracts white slightly tinged with maroon especially towards apex; *prophyll* triangular, 2-keeled, c. 15 mm long, c. 8 mm wide; *second bract* c. 20 mm long, c. 14 mm wide; *third bract* c. 38 mm long, c. 16 mm wide; *floral bract* appearing above the soil, lanceolate, apiculate, light green or cream-coloured, more or less tinged maroon especially in apical half, 48–57 mm long, 20–22 mm wide. **Flowers** open in the morning, presented above the ground, and emitting an unpleasant smell; *pedicel* c. 33 mm; *ovary extension* 120–125 mm long, cream-white; *sepals* green, abaxially with slight maroon tinge at apex of dorsal sepal and apices and margins of lateral sepals (in distal half), narrowly elliptic, cuspidate, glabrous, entire; *dorsal sepal* reflexed at anthesis, 68–72 mm long, 15–17 mm wide; *lateral sepals* overlapping, crossing and supporting the labellum, 70–73 mm long, 17–18 mm wide; *lateral petals* overlapping at base and covering stamens and style, cream-white with purple tinge in apical half, elliptic to slightly oblong, apiculate, 23–27 mm long, 7–8 mm wide, tip weakly reflexed; *labellum* elliptic with a raised midrib (c. 2 mm wide) and prominently raised reticulated pattern, apiculate, slightly involute, c. 70 mm long, 20–23 mm wide, black-purple, velvety, margin weakly undulate. **Stamens** c. 17 mm long; *filaments* c. 4 mm long, cream-white; *anther thecae* introrse, 11–13 mm long, longitudinally dehiscent throughout their length. **Style** cream-white, c. 14 mm long; *stigma* 10–11 mm long, deeply 3-lobed, dorsal surface cream-white at base, lobe margins dark purple; lobes obliquely truncate, conduplicate margin membranous, fimbriate; *median lobe* 6–7 mm long; *lateral lobes* 4–5 mm; *viscidium* greyish, heart-shaped (pronounced in side view). **Fruit** a 3-locular, loculicidal capsule embedded in the soil, ovoid, narrowing to a beak at apex, bluntly trigonous, c. 65 mm long (incl. beak c. 15 mm), c. 23 mm in diameter, cream-coloured at base (parts embedded in the ground), deep purple distally (part above ground). **Seeds** up to 10 per locule, 6–8 mm long, 6–7 mm in diameter, brown, minutely hairy, ampulliform with a seed coat swelling forming a neck that bears 4–7 white, twisted, 12–20 mm long aril-threads with sparse minute hairs.

Distribution. So far known only from the type locality.

Habitat and phenology. Evergreen lowland forest. In cultivation this species flowers in February and March.



Fig. 3. *Orchidantha ismailii* Škorničk. & A.Lamb. **A.** Habit of mature plants. **B.** Leafy shoots with prominent petioles in adult plant. **C.** Flower. All from the type, *Lamb & Leong-Škorničková* AL 2263. (Photos: J. Leong-Škorničková).



Fig. 4. *Orchidantha ismailii* Škorničk. & A.Lamb. **A.** Detail of flower. **B.** Stigma with anthers and petals attached; stigma in front, side and back view, and petals (scale bar in mm). **C.** Details of petals (top view). All from the type, *Lamb & Leong-Škorničková* AL 2263. (Photos: J. Leong-Škorničková).

Etymology. Named after Mr M.C. Ismail Salam, the Director of Sabah Agriculture Department, who has relentlessly supported field exploration and the establishment of ex situ collections led by the staff of Sabah Agriculture Park in Tenom.

Provisional IUCN conservation assessment. *Orchidantha ismailii* is so far known only from a single location. While it is locally common, the population does not exceed 1000 adult individuals and the area of occurrence (AOO) is less than 20 km². The area is not under any legal protection. This taxon should therefore be considered as Vulnerable (VU D1, D2).

***Orchidantha jiewhoei* Škorničk. & A.Lamb, sp. nov.**

Orchidantha jiewhoei is clearly distinct among all Bornean *Orchidantha* species by its obcordate pure white labellum, and ovate weakly plicate leaf blades with round to cordate bases. – TYPE: Malaysia, Sabah, Kinabatangan District, near Kg. Imbak, 3 km from Imbak valley, evergreen forest near river, 10 April 2014, *Gokusing AL 2510* (holotype SAN; isotype SING; both including material in spirit as part of a single specimen). (Fig. 5 & 6).

Clump-forming herb to 0.75 m tall, 2–6 leaves per shoot; juvenile and adult plants distinctly petiolate; *leaves* of mature plants to 80 cm long; *petiole* to 43 cm long; *lamina* broadly elliptic to ovate, slightly unequal, 37–44 × 14–18 cm, weakly plicate, base obtuse, rounded to subcordate, apex attenuate. **Inflorescence** on a branched burrowing stem with prominent bracts and/or their scars; prophyll, second and third bracts cream at base, green distally, sometimes slightly tinged reddish; *prophyll* triangular, 2-keeled, c. 17 mm long, c. 11 mm wide; *second bract* c. 25 mm long, c. 14 mm wide; *third bract* c. 45 mm long, c. 18 mm wide, cuspidate; *floral bract* appearing above the soil or with the proximal part burrowed in the soil, brownish-purple, 70–80 mm long, c. 23 mm wide. **Flowers** open in the morning, presented above the ground, emitting a somewhat pleasant and rather complex scent with notes of vanilla, gardenia and alcohol, but also with slight hint of rancid coconut oil; *pedicel* c. 20 mm; *ovary extension* c. 105 mm long, cream-white; *sepals* yellow-green adaxially, with purplish tinge abaxially, narrowly elliptic, glabrous, entire; *dorsal sepal* 75–80 mm long, 13–17 mm wide, margins reflexing, apex broadly acute; *lateral sepals* 80–85 mm long, 15–18 mm wide; margins reflexing, apices broadly acute; *lateral petals* overlapping at base and covering stamens and style, white in basal half, purple in apical half, c. 13 mm long, c. 3 mm wide; *labellum* clawed at base, obcordate and concave distally, 45–50 mm long (including claw), c. 45 mm at widest point, pure white with slightly raised reticulate pattern, margin entire, claw c. 15 mm long, with prominently inflexed sides, dark purple (almost black) abaxially, adaxially white in the centre with dark purple sides. **Stamens** c. 9 mm long; *filaments* 4–5 mm long, c. 0.7 mm broad, cream-white; *anther thecae* 4–5 mm long, longitudinally dehiscent throughout their length. **Style** white, c. 9 mm long; *stigma* 6–6.5 mm long, deeply 3-lobed, dorsal surface cream with purple mottling; stigma lobes cream, conduplicate, margin membranous, minutely and irregularly serrulate; *median lobe* c. 4 mm long; *lateral lobes* c. 3 mm long; *viscidium* V-shaped. **Fruits** not seen.

Distribution. So far known only from the type locality, where it is locally rare.

Habitat and phenology. Growing in evergreen hill forests near rivers. Flowering was observed in April and May.

Etymology. We name this species for Mr Tan Jiew Hoe, president of the Singapore Gardening Society, for his generous support of the development of the living plant collections in Kipandi Butterfly Park.



Fig. 5. *Orchidantha jiewhoei* Škorničk. & A.Lamb. **A.** Habit of mature plants. **B & C.** Flowers. All from the type, *Gokusing AL 2510*. (Photos: L. Gokusink).



Fig. 6. *Orchidantha jiewhoei* Škorničk. & A.Lamb. **A.** Detail of labellum. **B.** Stigma with anthers and petals attached. **C.** Flower dissection (from left): dorsal sepal, lateral sepals, labellum, petals, apical part of ovary extension with anthers and stigma attached (scale bar in cm). **D.** Details of stigma (semi-dorsal and front view). **E.** Sap beetle (*Nitidulidae* sp.) exiting the claw area of the flower. **F.** Detail of sap beetle (*Nitidulidae* sp.). A–D from the type, *Gokusing* AL 2510. (Photos: A, B & D, A. Lamb; C, J. Leong-Škorničková; E & F, S. Bosuang).

Provisional IUCN conservation assessment. *Orchidantha jiewhoei* is so far known only from a single location. The population does not exceed 1000 adult individuals and the area of occurrence (AOO) is less than 20 km². This taxon should therefore be considered as Vulnerable (VU D1, D2). An ex situ collection of this species is preserved in Kipandi Butterfly Park.

Notes. *Orchidantha jiewhoei* is the only *Orchidantha* species with a pure white labellum recorded from Borneo. Species with a white labellum were, until this find, known only from Peninsular Malaysia and southern Thailand, e.g., *Orchidantha fimbriata* Holttum, *O. longiflora* (Scort.) Ridl. and *O. siamensis* K.Larsen. None of these can be easily confused with *Orchidantha jiewhoei* even when sterile or as herbarium material. The prominently petiolate leaves ending in ovate weakly plicate leaf blades with round to cordate bases, as well as the broadly obcordate shape of the labellum, are so far unique in the family.

Lowiaceae are known for their complicated stigma morphology (Pedersen & Johansen, 2004) which plays a major role in a sophisticated deceit pollination system involving beetles. Diurnal pollination by scarabaeid dung beetles from the genus *Onthophagus* was first discovered and described in detail from Borneo on *Orchidantha inouei* Nagam. & S.Sakai (Nagamasu & Sakai, 1999; Sakai & Inoue, 1999). *Orchidantha grandiflora* Mood & L.B.Pedersen, *O. quadricolor* L.B.Pedersen & A.Lamb, and *O. suratii* L.B.Pedersen, J.Linton & A.Lamb were also reported to be pollinated by three different species of *Onthophagus* beetles, suggesting a high species-specific dependence between plant and the pollinator (Pedersen, 2003). More recently, Vislobokov et al. (2017) reported nocturnal pollination by carrion beetles from the genus *Phaeochrous* in *Orchidantha virosa* Škorničk. & Q.B.Nguyen. The pollination of white-flowered species was studied in Peninsular Malaysia by Pedersen (2003), and she suggested that fruit beetles from the genera *Tricanus* and *Pocadius* (both in the Nitidulidae and often associated with puffball mushrooms) are involved in the pollination of *Orchidantha fimbriata* and *O. maxillarioides* (Ridl.) K.Schum. respectively (Pedersen, 2003). Ong Poh Teck (Forest Research Institute Malaysia, pers. comm.) has also confirmed and photographed a *Tricanus* sp. visiting a white-flowered *Orchidantha* species (*O. aff. fimbriata*) grown in FRIM. Photographic records by Dr Steven Bosuang (Kipandi Butterfly Park) suggest that sap beetles (Nitidulidae) are also involved in the pollination of *Orchidantha jiewhoei* (see Fig. 6E & F) in Borneo. Indeed, the smell of the labellum in these species is often reminiscent of mushrooms (often partly decomposed mushrooms) supplemented by various smells coconut oil and sweat. More pollination studies are needed, particularly in the white-flowered species.

***Orchidantha lutescens* Škorničk. & A.Lamb, sp. nov.**

Orchidantha lutescens is clearly distinct among all *Orchidantha* species by its narrow pale yellow labellum. – TYPE: Material cultivated in Sabah Agricultural Park in Tenom, originally from Borneo, presumably Kalimantan, cultivated material vouchered on 13

March 2012 as *Lamb & Leong-Škorničková AL 2268* (holotype SAN, isotype SING; both including material in spirit as part of a single specimen). (Fig. 7 & 8).

Clump-forming herb to 0.8 m high, c. 8 leaves per shoot; juvenile and adult plants distinctly petiolate; *leaves* of mature plants to 140 cm long; *petiole* to 45–85 cm long; *lamina* narrowly elliptic, slightly unequal, 43–56 × 8.5–10.5 cm, base obtuse, apex attenuate. **Inflorescence** on a branched burrowing stem with prominent bracts and/or their scars; prophyll, second and third bracts cream-white; *prophyll* triangular, 2-keeled, c. 9 mm long, c. 7 mm wide; *second bract* c. 18 mm long, c. 11 mm wide; *third bract* c. 35 mm long, c. 12 mm wide; *floral bract* appearing above the soil or with the proximal part burrowed in the soil, cream-white, slightly tinged with maroon at apex, c. 57 mm long, c. 12 mm wide. **Flowers** open in the morning, presented above the ground, emitting a smell of dung and urine; *pedicel* c. 23 mm; *ovary extension* c. 75 mm long, cream-white; *sepals* semi-translucent, yellow-green, linear, glabrous, entire; *dorsal sepal* reflexed at anthesis, c. 48 mm long, 7–8 mm wide, cuspidate at apex; *lateral sepals* overlapping supporting the labellum, c. 52 mm long, c. 9 mm wide, minutely cuspidate at apices; *lateral petals* overlapping at base and covering stamens and style, greenish white, c. 8 mm long (including c. 1.5 mm long fine cusp), c. 3 mm wide; *labellum* narrowly elliptic with a raised midrib (c. 1.5 mm wide), 45–50 mm long ending in very fine tip, 13–15 mm wide, light yellow with blue-purple shading in the basal 1/3–1/4, margin entire. **Stamens** 3.5–4 mm long; *filaments* 0.5–1 mm long; c. 0.5 mm broad, cream-white; *anther thecae* 2.5–3 mm long, longitudinally dehiscent throughout their length. **Style** cream-white, 2–2.5 mm long; *stigma* c. 5 mm long, deeply 3-lobed, dorsal surface cream-white, stigma lobes cream-white, conduplicate, margin minutely lacinate; *median lobe* c. 2 mm long; *lateral lobes* c. 1.5 mm long; *viscidium* V-shaped (pronounced in side view). **Fruits** not seen.

Distribution. Borneo. The origin of this living accession is uncertain due to a lost label. According to the staff of Sabah Agricultural Park in Tenom, the accession was received in the 1990s through a nursery in Java and the original plants are believed to have originated from Sepau Sintang in Kalimantan.

Habitat and phenology. Nothing is currently known about the original habitat of this species. In cultivation this species flowers in February and March.

Etymology. The specific epithet refers to the pale yellow colour of the labellum.

Provisional IUCN conservation assessment. As the provenance of this species remains somewhat uncertain and nothing is known about its distribution or population sizes, this species has to be provisionally treated as Data Deficient.



Fig. 7. *Orchidantha lutescens* Škorničk. & A.Lamb. **A.** Habit of mature plants. **B.** Flowers. All from the type, Lamb & Leong-Škorničková AL 2268. (Photos: J. Leong-Škorničková).



Fig. 8. *Orchidantha lutescens* Škorničk. & A.Lamb. **A.** Flower (semi-side view). **B.** Flower (front view). **C.** Stigma with anthers and petals attached; stigma in semi-front and back view, and petals (scale bar in mm). **D.** Details of petals (top view). All from the type, *Lamb & Leong-Škorničková AL 2268*. (Photos: J. Leong-Škorničková).

***Orchidantha nilusii* Škorničk. & A.Lamb, sp. nov.**

Similar to *Orchidantha grandiflora* Mood & L.B.Pedersen in the colour of the flowers, but differs in the lamina gradually tapering to the base (petiole absent) and to 215 × 16–20.5 cm, and the lateral sepals spreading at an angle of c. 55° (vs adult leaves clearly petiolate and with lamina 40–90 × 10–15 cm, and the lateral sepals reflexed at anthesis

and spreading at an angle c. 90°). – TYPE: Malaysia, Sabah, Papar district, near old recreational Forest Reserve, altitude c. 336 m, 5°15'5.5"N 116°6'39.3"E, evergreen forest on steep slopes, 10 March 2012, *Lamb & Leong-Škorničková AL 2261* (holotype SAN; isotype SING; both including material in spirit as part of a single specimen). (Fig. 9 & 10).

Robust clump-forming herb, up to 1.5 m tall, c. 10 leaves per shoot; juvenile plants with distinctly petiolate leaves, petioles not present in adult plants; *leaves* to 215 cm long, with no distinct petiole; *lamina* elliptic, slightly unequal, 16–20.5 cm wide, base narrowly attenuate, apex attenuate, young leaves flushed with purple beneath. **Inflorescence** on a branched burrowing stem with prominent bracts and/or their scars; prophyll, second and third bracts white, more or less tinged with maroon towards the apices; *prophyll* triangular, 2-keeled, c. 15 mm long, c. 12 mm wide at base; *second bract* 20–25 mm long, c. 14 mm wide at base; *third bract* 35–43 mm long, 12–14 mm wide; *floral bract* appearing above the soil, linear to lanceolate, apiculate, dark purple, 90–110 mm long, c. 28 mm wide, sheathing the c. 125 mm long, white-greenish ovary extension. **Flowers** open in the morning, presented above the ground, emitting a distinctive smell of dung and dark chocolate; *pedicel* c. 38 mm; *ovary extension* 105–125 mm long, white-greenish; *sepals* light greenish, slightly tinged with purple especially near apices, linear, cuspidate, glabrous, entire; *dorsal sepal* reflexed at anthesis, 105–115 mm long, 12–13 mm wide; *lateral sepals* spreading at an angle of c. 55°, 105–115 mm long, 14–16 mm wide; *lateral petals* overlapping at base and covering stamens, style and most of the stigma, pale green at base with more or less pink tinge towards apices, narrowly elliptic, apiculate, sometimes slightly undulate distally, 26–30 mm long, 7–8 mm wide; *labellum* broadly elliptic with a raised midrib, 95–105 mm long (inclusive of a 5–6 mm long acuminate tip), 40–50 mm wide, dark purple with velvety appearance, sides prominently reticulate, margin entire. **Stamens** c. 20 mm long; *filaments* 2–4 mm long, c. 1 mm broad, cream-white; *anther thecae* introrse, 15–17 mm long, longitudinally dehiscent throughout their length. **Style** white, c. 16 mm long; *stigma* 13–14 mm long, deeply 3-lobed, dorsal surface greenish, stigma lobes white-greenish, conduplicate, margin membranous, narrowly lacinate; *median lobe* 8–9 mm long; *lateral lobes* 5–6 mm long; *viscidium* broadly V-shaped (almost heart-shaped) and extending from the base to a 1/3 of the length of the lateral lobe (pronounced in side view). **Fruits** not seen.

Distribution. So far known only from the type locality, where it is abundant.

Habitat and phenology. Growing on slopes in hill forest. Flowering observed in February and March.

Etymology. We name this species after Dr Reuben Nilus (Forest Research Centre, Sabah Forestry Department, Malaysia), who brought the existence of the species described in this paper as *Orchidantha gigantea* to our attention.



Fig. 9. *Orchidantha nilusii* Škorničk. & A.Lamb. **A.** Habit of mature plants. **B.** Flowers. All from the type, Lamb & Leong-Škorničková AL 2261. (Photos: J. Leong-Škorničková).



Fig. 10. *Orchidantha nilusii* Škorničk. & A.Lamb. **A & B.** Detail of flowers. **C.** Stigma with anthers and petals attached; stigma in front, side and back view; and petals (scale bar in mm). **D.** Detail of petals (top view). All from the type, *Lamb & Leong-Škorničková AL 2261*. (Photos: J. Leong-Škorničková).

Provisional IUCN conservation assessment. *Orchidantha nilusii* is so far known only from a single location. While it is locally common, the population does not exceed 1000 adult individuals and the area of occurrence (AOO) is less than 20 km². The area is under no legal protection and this taxon should therefore be considered as Vulnerable (VU D1, D2).

***Orchidantha ultramafica* Škorničk. & A.Lamb, sp. nov.**

Orchidantha ultramafica is similar to *O. quadricolor* L.B.Pedersen & A.Lamb, but it is a more delicate plant with a narrower lamina, 40–80 × 6–11 cm, purple petals, a dark purple labellum, and overall smaller flowers (vs lamina 50–110 × 13–16 cm, white

petals, labellum dark purple at base, yellow in distal half, and overall larger flowers in *O. quadricolor*). – TYPE: Material cultivated in Sabah Agriculture Park in Tenom, originally collected by Mr Aninguh Surat in Malaysia, Sabah, Beluran district, Ulu Sapa Payau Forest Reserve, Telupid, on ultramafic soils, cultivated material vouchered on 13 March 2012 as *Lamb & Leong-Škorničková AL 2266* (holotype SAN; isotype SING; both including material in spirit as part of a single specimen). (Fig. 11 & 12).

Clump-forming herb, up to 1 m tall, c. 8 leaves per shoot; juvenile and adult plants distinctly petiolate; *leaves* of mature plants to 130 cm long; *petiole* to 20–50 cm long; *lamina* narrowly elliptic, slightly unequal, 40–80 × 6–11 cm, base narrowly obtuse, apex narrowly attenuate. **Inflorescence** on a branched burrowing stem with prominent bracts and/or their scars; prophyll, second and third bracts cream-white, more or less tinged with maroon especially towards the apices; *prophyll* triangular, 2-keeled, c. 11 mm long, c. 7 mm wide; *second bract* c. 18 mm long, c. 8 mm wide; *third bract* 24–28 mm long, 9–10 mm wide; *floral bract* appearing above the soil or with the proximal part burrowed in the soil, cream-white, tinged with maroon at apex, 50–60 mm long, c. 13 mm wide. **Flowers** open mostly in the morning (some also observed to open during the day), presented above the ground, emitting a smell of dung; *pedicel* 12–35 mm; *ovary extension* 100–115 mm, cream-white at base, light greenish apically; *sepals* semi-translucent, yellow-green, linear, glabrous, entire; *dorsal sepal* reflexed at anthesis, 50–55 mm long, 6–8 mm wide, cuspidate at apex; *lateral sepals* 53–57 mm long, 8–9 mm wide, overlapping at base and supporting the labellum, minutely cuspidate at apices; *lateral petals* overlapping at base and covering stamens and style, purple, often darker towards the margins and apex, narrowly elliptic, apiculate, 16–18 mm long, 3–5 mm wide; *labellum* elliptic with a raised midrib (midrib c. 1.5 mm wide), 50–60 mm long (inclusive of an acuminate tip up to 2 mm long), 17–20 mm wide, dark purple, margin entire. **Stamens** 10–11 mm long; *filaments* 2–3 mm long, c. 0.7 mm broad, cream-white; *anther thecae* 8–9 mm long, longitudinally dehiscent throughout their length. **Style** white, 8–10 mm long; *stigma* 8–9 mm long, deeply 3-lobed, dorsal surface greenish, stigma lobes dark purple, conduplicate, margin membranous, narrowly lacinate; *median lobe* c. 6 mm long; *lateral lobes* c. 4 mm long; *viscidium* V-shaped and extending from the base to a 1/3 of the length of the lateral lobe (pronounced in side view). **Fruits** not seen.

Distribution. This species is so far known only from ultramafic areas near Telupid in Ulu Sapa Payau Forest Reserve, Beluran district, Sabah. A living accession is cultivated at Sabah Agriculture Park in Tenom.

Habitat and phenology. Lowland dipterocarp forest, on ultramafic soils. Flowering in cultivation has been observed in February and March, but the specimen label on *Jamirus & Kurzweil SAN 146603* (SAN) suggests that the species has been also found in flower at the end of September.



Fig. 11. *Orchidantha ultramafica* Škorničk. & A.Lamb. **A.** Habit of mature plants. **B.** Flowers. All from the type, *Lamb & Leong-Škorničková* AL 2266. (Photos: J. Leong-Škorničková).



Fig. 12. *Orchidantha ultramafica* Škorničk. & A.Lamb. **A & B.** Detail of flowers. **C.** Stigma with anthers and petals attached; stigma in front, side and back view, and petals (scale bar in mm). **D.** Details of petals (top view). All from the type, *Lamb & Leong-Škorničková AL 2266*. (Photos: J. Leong-Škorničková).

Etymology. The species epithet reflects the preference of this species for ultramafic soils.

Provisional IUCN conservation assessment. We have no adequate information about the number and size of the populations. The species is known only from a single location which is under legal protection. We provisionally assess this species as Data Deficient (IUCN, 2019) until further evidence enables a more precise assessment.

Additional specimens examined. BORNEO: **Sabah:** Beluran district, Ulu Sapa Payau FR, Telupid, 29 Sep 2006, *Jamirus & Kurzweil SAN 146603* (SAN).

Key to *Orchidantha* species in Borneo

- 1a. Lateral sepals overlapping and supporting the labellum 2
 1b. Lateral sepals spreading, not supporting the labellum 12
- 2a. Labellum light yellow with pale blue-purple shading near base *O. lutescens*
 2b. Labellum dark purple or purple, sometimes in combination with yellow or white
 3
- 3a. Adult plants with distinctly petiolate leaves 4
 3b. Adult plants with non-petiolate leaves, with lamina gradually tapering to the base
 9
- 4a. Labellum elliptic, prominently aristate, arista spiral, c. 2.6 cm long
 *O. sarawakensis*
 4b. Labellum elliptic to narrowly elliptic with acute to apiculate apex 5
- 5a. Labellum strongly involute with sides of the labellum prominently undulate 6
 5b. Labellum shallowly boat-shaped 8
- 6a. Flowers large; sepals more than 9–16 cm long and labellum 7–14 cm long 7
 6b. Flowers small; sepals and labellum not exceeding 2.5 cm *O. micrantha*
- 7a. Sepals c. 9 cm long; labellum c. 7 cm long *O. holttumii*
 7b. Sepals 14–16 cm long; labellum 12.5–13.5 cm long *O. megalantha*
- 8a. Delicate plant with lamina 40–80 × 6–11 cm; lateral petals purple
 *O. ultramafica*
 8b. Robust plant with lamina 71–122 × 15.5–24 cm; lateral petals cream-white with
 purple tinge in apical half *O. ismailii*
- 9a. Labellum elliptic to narrowly elliptic, prominently apiculate, more or less involute
 with sides of the labellum undulate 10
 9b. Labellum broadly elliptic, shallowly boat-shaped with sides of the labellum
 straight, apicule small *O. quadricolor*
- 10a. Plant to 2 m tall; leaves 9.5–13.5 cm wide; sides of the labellum weakly undulate
 11
 10b. Plant to 3.5 m tall; leaves to 20.5 cm wide; sides of the labellum prominently
 undulate *O. gigantea*
- 11a. Sepals 73–100 × 11–12 mm; petals whitish with purple tips *O. sabahensis*
 11b. Sepals 57–70 × 11–14(–18) mm; petals dark purple *O. suratii*

- 12a. Labellum blackish violet or dark purple, with or without yellow or whitish apex;
leaf base attenuate to obtuse 13
- 12b. Labellum white; leaf base obtuse, rounded to subcordate *O. jiewhoei*
- 13a. Labellum purple with whitish or warm yellow apex 14
- 13b. Labellum blackish violet or dark purple throughout 15
- 14a. Labellum purple with whitish apex, and sometimes also whitish midrib
..... *O. inouei*
- 14b. Labellum purple with warm yellow apex *O. ranchanensis*
- 15a. Robust plant to 1.5 m tall 16
- 15b. Small plant c. 0.3 m tall *O. borneensis*
- 16a. Leaves of adult plants distinctly petiolate; lateral sepals reflexed at anthesis and
spreading at an angle c. 90° *O. grandiflora*
- 16b. Leaves of adults plants not petiolate with lamina gradually tapering to the base;
lateral sepals spreading at an angle c. 55° *O. nilusii*

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