Studies on Schismatoglottideae (Araceae) of Peninsular Malaysia III: New species for the Schismatoglottis Calyptrata Clade

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Abstract. Three new colonial species of Schismatoglottis Calyptrata clade are described from Peninsular Malaysia and compared with the four already known morphologically similar species described from there. All seven species are illustrated from living plants and an identification key is provided.

Keywords: Araceae, Schismatoglottis, Calyptrata clade, Peninsular Malaysia.

INTRODUCTION

With the exclusion of Schismatoglottis calyptrata (Roxb.) Zol. & Moritzi (sensu Hay 1996; Hay in Hay and Yuzammi 2000) from the flora of Peninsular Malaysia (Wong et al. 2018; Wong and Boyce 2020) the Schismatoglottis Calyptrata Clade (Wong et al. 2016, 2018) is currently represented in the Malay Peninsula by four described species: Schismatoglottis cordifolia Ridley (Ridley 1911: 112; Figures 1 and 10B), S. guabatuensis S.Y.Wong & P.C.Boyce (Wong and Boyce 2020: 1; Figure 10C), S. lowiae S.Y.Wong & P.C.Boyce (Wong and Boyce 2017: 31; Figures 2 and 10E), and S. wallichii Hook.f. (Hooker 1893: 537; Figs. 3 and 10G). During pollination biology studies by the third author (Hoe and Wong 2016; Hoe et al. 2018, 2020; Wong et al. 2016) it became evident that several populations encountered did not correspond to any of these four species, nor did they match any described species from Sumatera or further east. In conclusion we consider these populations to represent undescribed species and here describe three novel Peninsula Malaysian species belonging in the Calyptrata clade. Geology in this paper is specified based on Tate et al. (2008).
Figure 1. *Schismatoglottis cordifolia* Ridl. A. Plant in habitat. B. Bloom at pistillate anthesis. C. Bloom at pistillate anthesis, spathe limb naturally shed, nearside of lower spathe artificially removed. D. Detail of appendix and staminate florets. E. Detail of pistillate zone and interstice, nearside lower spathe artificially removed. All from Zalhazman bin Hamzah s.n.
Figure 2. *Schismatoglottis lowiae* S.Y.Wong & P.C.Boyce. A. Plant in habitat. B. Bloom at pistillate anthesis. C. Bloom at pistillate anthesis, nearside of spathe artificially removed. D. Detail of pistillate zone and interstice, nearside lower spathe artificially removed. All from AR-3286.
Figure 3. *Schismatoglottis wallichii* Hook.f. A. Plant in habitat. B. Bloom at pistillate anthesis. C. Bloom at onset of staminate anthesis, spathe limb beginning to shed. D. Bloom at late staminate anthesis, spathe limb splitting into numerous circumferential pieces. E. Spadix at pistillate anthesis, spathe artificially removed. F. Pistillate floret zone. G. & H. Staminate zone fertile to tip (G) and with a few terminal stamnodes (H). A–G from AR-16; H from AR-762.
*Schismatoglottis caesia* S.Y.Wong, P.C.Boyce & Y.C.Hoe, sp. nov.

Type: Malaysia, Kelantan, Gua Musang, Kuala Koh, Taman Negara Kuala Koh, 4°52.333’N 102°26.872’E, 11 Jan 2014, *Hoe Yin Chen* AR-4332 (holotype KEP; isotype SAR). (Figures 4, 5 and 10A).

**Diagnosis**

*Schismatoglottis caesia* is immediately differentiated from all other species of the *Schismatoglottis* Calyptrata clade by the glaucous pale grey leaf blades.

**Description**

Medium sized moderately robust, evergreen, stoloniferous colonial herb, 20–60 cm tall. Stems hypogeal, hapaxanthic, 0.8–1.8 cm diam. Leaves 3–6 together; petiole D-shaped, smooth, 15–19 cm long, slightly channelled along its length, green, distally with darker longitudinally broken-striate striations; petiolar sheath, 8 cm long × 0.5 wide, sheathing for 2/5 of petiole length, persistent, membranous, fully attached with a very short ligule, equal on both sides, slightly in rolled or sometimes straight, tapering, green with scattered greenish striate dotted; blades ovato-sagittate to ovato-cordate (sometimes oblong-lanceolate with the base cordate), 17.5–19 cm long × 7–10.5 cm wide, weakly coriaceous, glaucous pale grey, posterior lobes subtriangular, 3–4.5 cm long, sinus 4–5.5 cm across, apex of anterior lobe acute for 2–3 cm, ultimately mucronate for 2.5 mm; midrib adaxially flush with blade, raised abaxially, 3.5 mm wide at the insertion of the leaf blade; primary lateral veins 16 per side, diverging at 30°–80° from the midrib, raised adaxially towards the midrib, marginally impressed, entirely raised abaxially; interprimary veins raised adaxially, alternating irregularly with primaries; few (0–2) secondary veins emerging from each primary veins (3–4 from primary veins near to insertion); pelucid canals inconspicuous. Blooms 1–3 in a synflorescence, erect at anthesis, emitting an esteric smell during pistillate anthesis; odour absent during staminate anthesis; pedunule 10–12 cm long × 4–8 mm diam., terete, green; spathe 12 cm long; lower spathe narrowly ovoid, 4.8 cm long × 1.8 cm wide, green, externally longitudinally ridged, separated from spathe limb by a constriction coinciding with lower staminate zone; spathe limb pale greenish yellow and turbinate at anthesis, 7 cm long × 3.8 cm wide, mucronate for 4.5 mm, slightly paler prior to stamine anthesis, caducous in a single piece at the onset of stamine anthesis; spadix 8 cm long, shorter than spathe, sessile; pistillate zone fusiform, 4 cm long × 8 mm wide, ½ length of spadix, light green; pistils sub-cylindric to sub-globose, 1.5–2 mm long × 0.6–1 mm wide, densely arranged; style barely differentiated; stigma sub-globose, truncate, narrower than ovary, 0.3 mm diam., wet with stigmatic secretion at the onset of pistillate anthesis; interpistillar staminodes scattered, slightly exceeding the pistils in height, clavate, stipe hardly differentiated, tip about 0.5 mm in diam., white; interstice sub-cylindric, 0.5–0.8 cm long × 5 mm wide, narrower than pistillate and stamine zones, partially naked occupied by scattered flattened pistils, with 1 whorl of flattened spherical staminodes in the distal part, these intergrading into the lower staminate zone, pistillodes flattened in proximal part of interstice; stamine zone sub-cylindric, narrower at proximal end, wider at distal end, 1.5–2 cm long × 8–10 mm wide, ½ length of spadix, yellowish white; staminate florets 1 mm long × 0.5 mm wide, butterfly-shaped from above, densely arranged, each comprising 2 truncate stamens, tops depressed, overtopped by a broad, raised connective; pollen powdery, white; appendix bullet-shaped, 1.3–1.5 cm long × 1 cm wide, about 1/5 length of spadix, slightly wider (0.2–0.5 mm) than the top of stamine zone, yellowish white; staminodes polygonal, sub-globose towards the tip of the appendix, 2 mm long × 0.5 mm wide, densely arranged. Inflorescences 1–3, fruiting part 4.5 cm long × 2 cm wide, on decline peduncles; lower spathe entirely persistent, splitting and reflexing downwards when at fruit maturity; fruits 3 mm long × 1–2 mm wide, light yellow; seeds ovoid ellipsoid, longitudinally ridged, 0.4 mm diam., encased in yellow gel.

**Etymology**

The specific epithet is derived from the Latin noun, ‘caesius’, bluish grey, referring to the unique colouration of the leaf blades.

**Distribution**

*Schismatoglottis caesia* is only known from two populations in east Kelantan, separated by about 120 km.

**Ecology**

Perhumid lowland tropical forests, on alluvial sandstone-derived mud overlying Triassic granite, along track margins and on steep slopes along the margins of streams, 50–100 m asl.

**Notes**

The glaucous leaf blades of *Schismatoglottis caesia* are highly distinctive, even sterile juvenile plants are readily identifiable and immediately distinguished from the co-occurring *S. lowiae*. The type population occurs...
Figure 4. Schismatoglottis caesia S.Y. Wong, P.C. Boyce & Y.C. Hoe. A. Plant in habitat. B. Leaf blade abaxial surface. C. Detail of petiole. D. Synflorescence showing sequential development (left to right). All from AR-4332.
Figure 5. *Schismatoglottis caesia* S.Y.Wong, P.C.Boyce & Y.C.Hoe. A. Bloom at pistillate anthesis, nearside spathe artificially removed. B. Bloom at pistillate anthesis. C. Detail of pistillate zone. D. Detail of upper part of pistillate zone, interstice with flattened staminodes, and lowermost part of staminate zone. E. Appendix and upper part of staminate zone. All from AR-4332.
adjacent to (although not associated with) Ordovician-
Devonian Karst, suggesting that the species is not able to
colonize karst. By the same token there are species in the
Calyprata clade (e.g., S. guabatuensis) that never occur
away from limestone. Such geological obligations appear
to be a contributing factor behind the high species diver-
sity that aroids, and several other herbaceous and woody
plant families, display in SE Asia (e.g., Wong and Boyce
2021).

Additional specimens examined (paratypes)

MALAYSIA. Kelantan. Tanah Merah, Hulu Kusial,
Gua Ipoh, Lata Hujan, 5°43’53.1”N 102°01’03.5”E, 16 Mar
2016, Wong Sin Yeng & P.C. Boyce AR-3317 (KEP, SAR)
& Wong Sin Yeng & P.C. Boyce AR-3318 (KEP, SAR);
Tanah Merah, Jedok, Kampung Lawang, Lata Biji,
5°43’54.37”N 102° 0’58.80”E, 16 Mar 2016, Wong Sin
Yeng & P.C.Boyce AR-3322 (KEP, SAR).

Schismatoglottis laxipistillata S.Y.Wong, P.C.Boyce &
Y.C.Hoe, sp. nov.

Type: Malaysia, Kedah, Merbok Division, Bedong,
Hutan Lipur Rekreasi Tupah Merbok, just out-
side the entrance, beside the boundary of a quarry,
5°44’2.88”N100°26’30.60”E, 11 Dec 2013, Hoe Yin Chen
AR-3318 (holotype SAR; isotype KEP). (Figures 6, 7 and
10D).

Diagnosis

Schismatoglottis laxipistillata is distinguished from
the other species in the Calyptrata Clade by its laxly
arranged pistils.

Description

Medium to moderately robust, evergreen, stolonif-
erous herb forming clumps, 35–40 cm tall. Stems hypo-
geal, hapaxanthic, 1–2 cm diam. Leaves 3–8 together;
petiole D-shaped, smooth, 18–20 cm long, white to very
pale green, weakly channelled for ½ its length, longi-
tudinal striations raised distally, darker green; petiolar
sheath 5–8 cm long × 0.5–1 cm wide, sheathing for 1/3
of petiole length, persistent, membranous, fully attached
with a very short ligule, equal at both sides, slightly in-
rolled or sometimes straight, tapering, green with scat-
tered greenish broken-striate; blades ovato-sagittate to
ovato-cordate (sometimes oblong-lanceolate with the
base cordate), 29 cm long × 16 cm wide, weakly coria-
ceous, adaxially dull green, some plants variegated with
spattered grey-green central stripes, abaxially paler,
posterior lobes subtriangular, 3.5–5 cm long, sinus 3–7
cm across, apex of anterior love acute for 2 cm, ulti-
mately mucronate for 3 mm; midrib adaxially flush
with blade, raised abaxially, 4 mm at insertion; primary
lateral veins 13 per side, diverging at 30°–80° from the
midrib, raised adaxially towards the midrib, marginally
impressed, entirely raised abaxially; interprimary veins
raised adaxially, alternating irregularly with primaries;
few (0–2) secondary veins from each primary veins (1–2
arising from primary veins near to insertion); tertiary
veins inconspicuous; vein-like pellucid canals not vis-
ible. Inflorescences up to five in a synflorescence, erect,
emitting an esteric smell during pistillate anthesis—but
not during staminate anthesis; peduncle 8–16 cm long
× 3–8 mm wide, terete, green, erect at anthesis; spathe
10.5 cm long; lower spathe narrowly ovoid, 4.2 cm long
× 2 cm wide, green, externally longitudinally ridged,
separated from spathe limb by a constriction coincid-
ing with the interstice; spathe limb turbinate, 6.5 cm
long × 3.5 cm wide, mucronate for 3 mm, pale green-
ish yellow at pistillate anthesis, slightly pallid prior to
staminate anthesis, caducous in a single piece at onset
of staminate anthesis; spadix 8.5 cm long, shorter than
spathe, sessile; pistillate zone fusiform, 4 cm long ×
7 mm wide, 1/2 length of spadix, light green; pistils
sub-cylindric to sub-globose, 1.5 mm long × 0.5–1 mm
wide, laxly arranged; style barely differentiated; stigma
globose from above, truncated, smaller than ovary, 0.3
mm diam., wet with stigmatic secretion at the onset
of pistillate anthesis; interstipillar staminodes clavate,
stipe slender, 0.5 mm in diam., only slightly taller than
pistils, scattered, white; interstice sub-cylindric, 0.6–1
cm long × 5 mm wide, more slender than pistillate and
staminate zone, partially naked with a few flattened
irregular closely packed spheroid staminodes at the dis-
tal end, partially intergrading into the lower staminate
zone, and with a few flattened pistillodes at the prox-
imal end; staminate zone obconic, 1.8 cm long × 10 mm
wide, ⅓ length of spadix, yellowish white; stamine flo-
rets 1 mm long × 0.5 mm wide, butterfly-shaped from
above, densely arranged, each comprising 2 truncate
stamens, with a broad connective, densely arranged,
yellowish white; pollen powdery, white; appendix bullet-
shaped, 1.6 cm long × 1 cm wide, ⅓ length of spadix,
equal or weakly (0.2 mm) wider than apex of staminate
zone, yellowish white; staminodes sub-globose to polyg-
onal, 2 mm long × 0.4–1 mm wide, densely arranged.
Inflorescences 1–5 together, persistent spathe 5 cm
long × 2 cm wide, declinate; lower spathe entirely per-
sistent, splitting from the top with segments reflexed
when ripe; fruits 3 mm long × 1–2 mm wide, light yel-
low; seeds ovoid ellipsoid, 0.4 mm diam., 4–8 per fruit,
with greenish yellow gel.
Figure 6. *Schismatoglottis laxipistillata* S.Y. Wong, P.C. Boyce & Y.C. Hoe. **A.** Plant in habitat. **B.** Base of plant with emerging bloom. **C.** Leaf blade abaxial surface. **D.** & **E.** Detail of upper portion (**D**) and lower portion (**E**) of petiole. All from *AR-4331*
Figure 7. *Schismatoglottis laxispillata* S.Y.Wong, P.C.Boyce & Y.C.Hoe. A. Bloom at pistillate anthesis, nearside spathe artificially removed. B. Bloom at pistillate anthesis. C. Detail of upper part of pistillate zone, interstice with flattened staminodes, and lowermost part of staminate zone. D. Detail of staminate zone. E. Detail of pistillate zone. All from AR-4331
Etymology

The specific epithet refers to the uniquely, in the species group, laxly arranged pistils.

Distribution

Schismatoglottis laxipistillata is only known from its locality at Hutan Lipur Rekreasi Tupah where it is threatened by land clearance for quarrying.

Ecology

Perhumid lowland forest, occurring beside the margin of the waterfall and stream and restricted to steep Ordovician-Devonian Karst slopes in pockets of occasionally inundated mud. About 100 m asl.

Notes

Initially it was thought that the lax pistillate florets were an artefact of the first specimen encountered, but their occurrence is highly uniform through the known population.

Additional specimen examined (paratypes)

MALAYSIA. Kedah. Merbok, Bedong, Hutan Lipur Rekreasi Tupah, 5°44’39.30”N 100°26’30.24”E, 104 m asl, 11 Dec 2013, Hoe Yin Chen AR-4330 (KEP, SAR).

Schismatoglottis pantiensis S.Y.Wong, P.C.Boyce & Y.C.Hoe, sp. nov.

Type: Malaysia, Johor, Kota Tinggi, Hutan Simpan Panti, starting point of trail to Mount Panti, 1°48’35.70”N 103°51’5.94”E, 4 Dec 2013, Hoe Yin Chen AR-4322 (holotype KEP; isotype SAR). (Figures 8, 9 and 10F).

Diagnosis

The spadix of Schismatoglottis pantiensis is superficially similar to that of S. lowiae differing by the pistillate zone extending to almost half the length of the spadix (vs about 1/3), by the interstice up to three times longer, and with the interstice staminodes and staminate florets readily distinguishable (vs interstice staminodes and staminate florets almost indistinguishable until pollen is shed from the anthers), and consequently their respective zones easily discerned, and by a short bullet-shaped appendix comprised of clearly individuated staminodes (vs appendix blunt-cylindrical with the individual staminodes not discernible.)

Description

Medium to moderately robust, evergreen, stoloniferous herb forming clumps, 35–40 cm tall. Stems hypogean, hapaxanthic, 1–1.5 cm diam. Leaves 3–7 together; petiole D-shaped, smooth, 15–18 cm long, green, weakly channelled throughout its length, longitudinal striations raised and darker distally; petiolar sheath, 8 cm long × 0.5 wide, sheathing for 1/3–1/2 of petiole length, persistent, membranous, fully attached with a very short ligule, equal at both sides, slightly in-rolled or sometimes straight, tapering, green with scattered greenish broken striations blades ovato-sagittate to ovato-cordate (sometimes oblong-lanceolate with the base cordate), 16–23 cm long × 9–13 cm wide, softly coriaceous, adaxially glossy green, abaxially paler, posterior lobes subtriangular, 4–6 cm long, sinus 4.5–5 cm across, apex of anterior lobe acute for 2 cm, ultimately mucronate for 5 mm; midrib adaxially flush with blade, raised abaxially, 4 mm at the insertion of blade; primary lateral veins 14 per side, diverging at 30°–80° from the midrib, raised adaxially towards the midrib, marginally impressed, entirely raised abaxially; interprimary veins raised adaxially, alternating irregularly with primaries; secondary veins rather; vein-like pellucid canals not visible. Inflorescences up to 3 per synflorescence, erect, emitting an esteric smell during pistillate anthesis, this absent during staminate anthesis; peduncle 13 cm long × 6 mm wide, terete, green, erect at anthesis; spadix 7 cm long, shorter than spathe, sessile; pistillate zone cylindric, 3.5 cm long × 7 mm wide, length of spadix, light green; pistils sub-globose, 1 mm long × 0.5–1.2 mm wide, densely arranged; style short, light green; stigma sub-globose from above, truncate, smaller than ovary, 0.3 mm diam., wet with stigmatic secretion at the onset of pistillate anthesis; interpistillar staminodes absent; interstice cylindric, 0.8–1 cm long × 6 mm wide, very slightly narrower than pistillate and staminate zone, not naked, comprised 10–12 whorls of sub-globose staminodes that resemble staminodes of appendix, densely packed, staminodes not impressed; staminodes 0.5–1 mm wide, sub-globose, light yellow; staminate zone sub-cylindric, narrower at proximal but wider at distal end, 1.7 cm long × 7–9 mm wide, 1/4 length of spadix, yellowish white; staminate florets butterfly-shaped from above, 1 mm long ×
Figure 8. *Schismatoglottis pantiensis* S.Y.Wong, P.C.Boyce & Y.C.Hoe. A. Plant in habitat. B. Base of plant with emerging sequentially produced blooms. C. Leaf blade adaxial surface. D. Detail of petiole. All from AR-4322.
Figure 9. Schismatoglottis pantiensis S.Y.Wong, P.C.Boyce & Y.C.Hoe. A. Bloom at pistillate anthesis, nearside lower spathe and spathe limb artificially removed. B. Detail of interstice, staminate zone, and appendix. C. Detail of pistillate zone. D. Bloom at pistillate anthesis. All from AR-4322.
0.5 mm wide, densely arranged, each comprising 2 truncate stamens, tops depressed, connective narrow; pollen powdery, white; appendix bullet-shaped, 0.9 cm long × 0.9 cm wide, 1/7 length of spadix, base about equaling top of staminate zone, yellowish white; staminodes sub-globose, 1 mm diam., densely arranged. Inflorescences 1–3 together, 3.2–5.2 cm long × 0.8–1.5 cm wide, declinate; lower spathe entirely persistent, splitting and reflexed when ripe; fruits 2 mm long × 1–1.8 mm wide, light green; seeds ovoid ellipsoid, 0.4 mm diam., 4–17 per fruit, encased with greenish yellow gel.

**Etymology**

The specific epithet is derived from the name of the type locality plus the Latin suffix, -ensis, to indicate originating from.

**Distribution**

_Schismatoglottis pantiensis_ is only known from Hutan Simpan Panti, Kota Tinggi, Johor.

**Ecology**

Lowland tropical forest on deep permanently moist podzols, below 25 m asl.

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**Additional specimens examined (paratypes)**

**MALAYSIA.** Johor. Kota Tinggi, Hutan Simpan Panti, starting point of trail to Mount Panti, 1°48’35.70”N 103°51’5.94”E, 4 Dec 2013, Hoe Yin Chen AR-4323 (KEP, SAR) & AR-4326 (KEP, SAR) & AR-4337 (KEP, SAR).

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**Key to the Peninsula Malaysian species of Schismatoglottis Calyptrata Clade**

1a. Spadix fertile to the tip, or with at most a few terminal staminodes; spathe limb splitting into numerous circumferential pieces before falling. Perak, vicinity of Taiping..........
   ........................................................................ _Schismatoglottis wallichii_

1b. Spadix with a distinct sterile appendix; spathe limb caducous in a single piece .................................................. 2

2a. Leaf blades glaucous. East Kelantan, Triassic granite..........
   ........................................................................ _Schismatoglottis caesia_

2b. Leaf blade not glaucous .................................................. 3
3a. Pistillate florets laxly arranged. Kedah, Hutan Lipur Rekreasi Tupah Merbok, Ordovician-Devonian Karst........

Schismatoglottis laxipistillata

3b. Pistillate florets densely arranged........................................ 4

4a. Interpistillar staminodes present......................................... 5

4b. Interpistillar staminodes absent............................................. 6

5a. Pistillate floret zone green, accounting for less than half of the spadix length; interpistillar staminodes only slightly taller than the associated pistils; appendix conical 1.5 times longer than wide. Batu Caves, Silurian limestone......

Schismatoglottis guabatuensis

5b. Pistillate floret zone white, accounting for more than half of the spadix length; interpistillar staminodes twice as tall as the associated pistils; appendix hemispherical and about as wide as long. Hulu Perak, Cambrian Baling sandstones..

Schismatoglottis cordifolia

6a. Pistillate zone accounting for almost half the length of the spadix; interstice staminodes and staminate florets readily distinguished, and their respective zones easily discerned; appendix short bullet-shaped comprised of clearly differentiated staminodes. Johor, Hutan Simpan Panti, permanently moist podzols........

Schismatoglottis pantiensis

6b. Pistillate zone accounting for about 1/3 the length of the spadix; interstice staminodes and staminate florets closely similar, the zones not readily separable at first sight; appendix blunt-cylindrical with the individual staminodes not discernible. Heavy clay soils over granite; widespread but localized in Kelantan, Perak, and northern Selang.......

Schismatoglottis lowiae

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