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Taxonomic studies of Araceae in Myanmar VIII: Two new species and three new records for the genus *Typhonium*

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ABSTRACT: As part of our ongoing research to revise and reveal the true diversity of the family Araceae in Myanmar, we describe two new *Typhonium* species, *T. karsticola* and *T. pallescens*, from Mon State and the Sagaing Region. Additionally, we report for the first time the occurrence of *T. albidinervium*, *T. laoticum*, and *T. roxburghii* in Myanmar. A detailed taxonomic account of the two new species including morphological comparison with closely similar species and relevant information on the newly recorded species are provided below. With the addition of these two new species and three newly recorded species, Myanmar now has a total of 17 *Typhonium* with 47% endemicity.

KEY WORDS: Aroideae, Areae, Indochina, Karst limestone, paddy fields, *Typhonium karsticola*, *Typhonium pallescens*.

INTRODUCTION

The genus *Typhonium* Schott *sensu stricto* (Cusimano *et al.*, 2010; Hay *et al.*, 2022), belonging to the family Araceae Juss., comprises tuberous, sometimes rhizomatous or stoloniferous, terrestrial, and seasonally dormant herbaceous plants (Mayo *et al.*, 1997). It is distributed across South, Southeast, and East Asia, the Malay Archipelago, and Australia, with center of diversity in Indochina (Low *et al.*, 2020; Hay and Hein, 2022; Hay *et al.*, 2022). *Typhonium* is the largest genus in the tribe Areae, comprising over 70 species (POWO, 2024), with some estimates suggesting there may be more than 100 species (Boyce and Croat, 2011; Boyce *et al.*, 2012). Thailand, with 40 species and 70% endemicity, represents the center of species diversity for the genus (Low *et al.*, 2020; Saensouk *et al.*, 2024), followed by Vietnam, which has 24 recorded species (Luu *et al.*, 2024).

In Myanmar, Naive *et al.* (2020) listed 12 species of *Typhonium*. However, *T. listeri* Prain has since been transferred to the genus *Sauromatum* Schott (*sensu* Cusimano *et al.*, 2010) as *S. listeri* (Prain) K.Z.Hein & A.Hay, and its occurrence in Myanmar remains unconfirmed (Hay and Hein 2020). Additionally, *T. violifolium* Gagnepain and *T. cordifolium* Hu (Fig. 3L), previously considered as synonyms by Sriboonma *et al.* (1994), were later recognized as separate species by Murata *et al.* (2010). The lectotype of *T. violifolium* was collected from Ko Samui Island in Peninsular Thailand (Sriboonma *et al.*, 1994), with no confirmed specimens from Myanmar or outside Thailand. Therefore, *T. listeri* and *T. violifolium* have been excluded from the list of the genus in Myanmar. Following the addition of two new species, *T. edule* K.Z.Hein & Naive (Fig. 3G) and *T. aungmyintwinii* K.Z.Hein & Naive (Fig. 3I) (Naive and Hein, 2021; Hein and Naive, 2021), the total number of species in Myanmar has increased to 12, half of which are endemic.

Two unidentified species of *Typhonium* were collected by two plant enthusiasts (Saw Chit Soe Paing and Kyaw P. Hein) in Mon State and the Sagaing Region. Samples sent to the first author were subjected to morphological examination, comparison with protologues and relevant literature, as well as digitized type specimens of *Typhonium* from Myanmar and neighboring countries. Results of the investigation revealed that these specimens do not match any known *Typhonium* species, thus, we hereby describe them as species new to science in this paper. Furthermore, the first records of the following species are reported in Myanmar: *T. albidinervium* C.Z.Tang & H.Li, *T. laoticum* Gagnep., and *T. roxburghii* Schott. These discoveries increase the total number of *Typhonium* in Myanmar to 17, making it the third center of diversity for the genus, after Thailand and Vietnam.

MATERIALS AND METHODS

Measurements and descriptions were based on fresh, and spirit-preserved materials. The description follows the recent work of Saensouk *et al.* (2024), while Araceae morphological terminology follows Mayo et al. (1997) implemented by the descriptive terminology of Beentje (2016). Herbarium citations adhere to the Index Herbariorum (Thiers, 2024). All relevant literature and type specimens of *Typhonium* species from Myanmar and

neighboring countries were examined in different herbaria (*viz.* A, AAU, B, BK, BKF, C, CAL, CMU, E, HITBC, K, KKU, KUN, L, M, MO, P, PE, QBG and SING) using high-resolution images available through https://plants.jstor.org/ and the Global Biodiversity Information Facility (GBIF) accessed from https://www.gbif.org. An assessment of conservation status was carried out following IUCN (2024).

TAXONOMIC TREATMENT

Typhonium karsticola K.Z.Hein, Saensouk & Naive, ***sp. nov***. **Fig. 1**

***Type*:** MYANMAR. Mon State, Mawlamyine District, Kyaikmaraw Township, Chaunghanakwa Hill, ca. 100 m, a.s.l., 20 April 2024, *S. C. S. Paing 008* (holotype: TTM!).

***Diagnosis*:** *Typhonium karsticola* is most similar to *Typhonium orbifolium* Hett. & Sookch. from Thailand (Hetterscheid *et al*., 2001), but it differs in having a hysteranthous habit (vs. synanthous in *T. orbifolium*), clavate staminodes with a red or reddish-white slender base and a white globose head (vs. white clavate staminodes in *T. orbifolium*), a shorter staminate zone (ca. 4 mm vs. 9–10 mm in *T. orbifolium*), yellow stamens (vs. white stamens in *T. orbifolium*), and a spreading-declinate appendix (vs. erect in *T. orbifolium*). The shape of the staminodes in *Typhonium karsticola* resembles those of *Typhonium praelongum* Serebryanyi & Hett. from Vietnam (Serebryanyi *et al*., 2023), but it differs significantly by having a depressed-globose tuber (vs. conic tuber in *T. praelongum*), a much shorter peduncle (0.3–0.4 cm vs. 6–7 cm in *T. praelongum*), a spathe limb 3–4 times longer than the spathe tube (vs. spathe limb 7–9 times longer than the spathe tube in *T. praelongum*), and a shorter spadix (ca. 7 cm vs. ca. 35 cm in *T. praelongum*).

Description*:** Small, hysteranthous, deciduous herbs, up to 25 cm tall. ***Stem hypogeal, depressed globose tuber, ca. 2.0 cm in diameter, ca. 1.5 cm high, externally brown, internally white. ***Roots*** filiform, ca. 1.0 mm in diameter, white. ***Leaves*** solitary or 2 together; *petioles* 14.0–17.0 cm long, 3–4 mm in diameter, erect, older ones ascending to spreading, cylindrical, terete, glabrous, basal subterranean portion white, upper aerial portion pale green or greenish white; *petiolar sheath* ca. 1.5 cm long, ca. 1/10 of petiole length; *leaf blade* 12.0–18.5 × 9.3–12.5 cm, ovate to broadly ovate, chartaceous, adaxially medium green, abaxially pale green, glabrous on both sides, margin entire or sinuate (when young), *anterior lobe* apex attenuate or acuminate, *posterior lobes* pointing downwards, ca. 1/4 the length of the anterior lobe, apexes rounded, sinus between posterior lobes acute or lobes overlapping; *midrib* adaxially impressed, abaxially raised, rounded, ca. 3 mm wide at the base, ca. 1.5 mm wide at center, then narrowing towards blade apex; *primary lateral veins* 4–6 per side, lower 3 or 4 arising simultaneously, adaxially impressed, abaxially raised, diverging from the midrib at 30–70°, anastomosing at 3–4 mm from margin into a submarginal (intramarginal) collective vein; *interprimary veins* somewhat less conspicuous than primary veins; *higher order venation* reticulate. ***Inflorescence*** solitary, appearing before the leaves, subtended by a cataphyll; *cataphyll* up to 0.5 cm long, triangular-ovate, chartaceous, reddish brown, becoming withering brown; *peduncle* 3–4 mm long, ca. 2 mm in diameter, almost entirely subterranean, reddish green, terete, glabrous; *spathe* 3.2–3.5 cm long, strongly differentiated into a spathe tube and a spathe limb by a constriction; *spathe tube* 9–10 mm long, ca. 7 mm in diameter, convolute, ellipsoid or ovoid, externally greenish or pinkish pale brown with darker reddish brown venation, internally pinkish white; *spathe limb* 2.3–2.5 cm long, ca. 6 mm in diameter at base, oblong-lanceolate, externally greenish or pinkish pale brown with darker reddish brown venation, internally pinkish white or white, basal part of limb shortly convolute, upper part erect or slightly arched, margins entire, apex obtuse or rounded. ***Spadix*** sessile, 6.8–7.0 cm long, much longer than spathe; *pistillate zone* ca. 2 mm long, ca. 3.5 mm in diameter at the base, shortly conical, with 2–3 rows of congested pistils; *ovary* ca. 0.8 mm high, ca. 0.6 mm in diameter, obovoid, white, unilocular with one basal ovule held obliquely on the funicle, on a basal placenta; *stigma* sessile, ca. 0.3 mm in diameter, discoid, pinkish white, papillate; *sterile interstice* between pistillate and staminate zones ca. 7 mm long, ca. 1.6 mm in diameter, upper part naked, terete, glabrous, glossy white, lower 2–3 mm covered with 2–3 spirals of staminodes; *staminodes* clavate with a slender base and globose head, 2.5–3.0 mm long, 0.7–0.8 mm in diameter at widest point, slightly fused at their bases, curved downwards or outwards, glabrous, apex rounded, basally red or reddish white, apically white; *staminate zone* ca. 4 mm long, ca. 3 mm in diameter, shortly subcylindric; *stamens* congested, not ostensibly arranged into staminate flowers, 0.4–0.5 mm in diameter, yellow; *appendix* sessile, 5.5–5.7 cm long, 1.7–2.0 mm in diameter at base, narrowly cylindrical, tapering towards apex, spreading-declinate, upper half verrucose, shallowly sulcate near the base, ivory, apex narrowly acute, base attenuate. ***Infructescence*** not seen.

Distribution and habitat: *Typhonium karsticola* is only known from its type locality, Chaunghanakwa Hill of Mon State, Myanmar. It was discovered in a karst limestone ecosystem, growing on the crevices of limestone with a closed to semi-open canopy of tropical mixed deciduous forests, between an elevation of approximately 100–150 m a.s.l.

***Phenology*:** Flowering in April.

***Etymology*:** The specific epithet '*karsticola*' is derived from the German noun 'karst' (referring to a limestone landscape), and the Latin suffix '*-cola*', (meaning inhabitant of or dwelling in), with reference to the species'

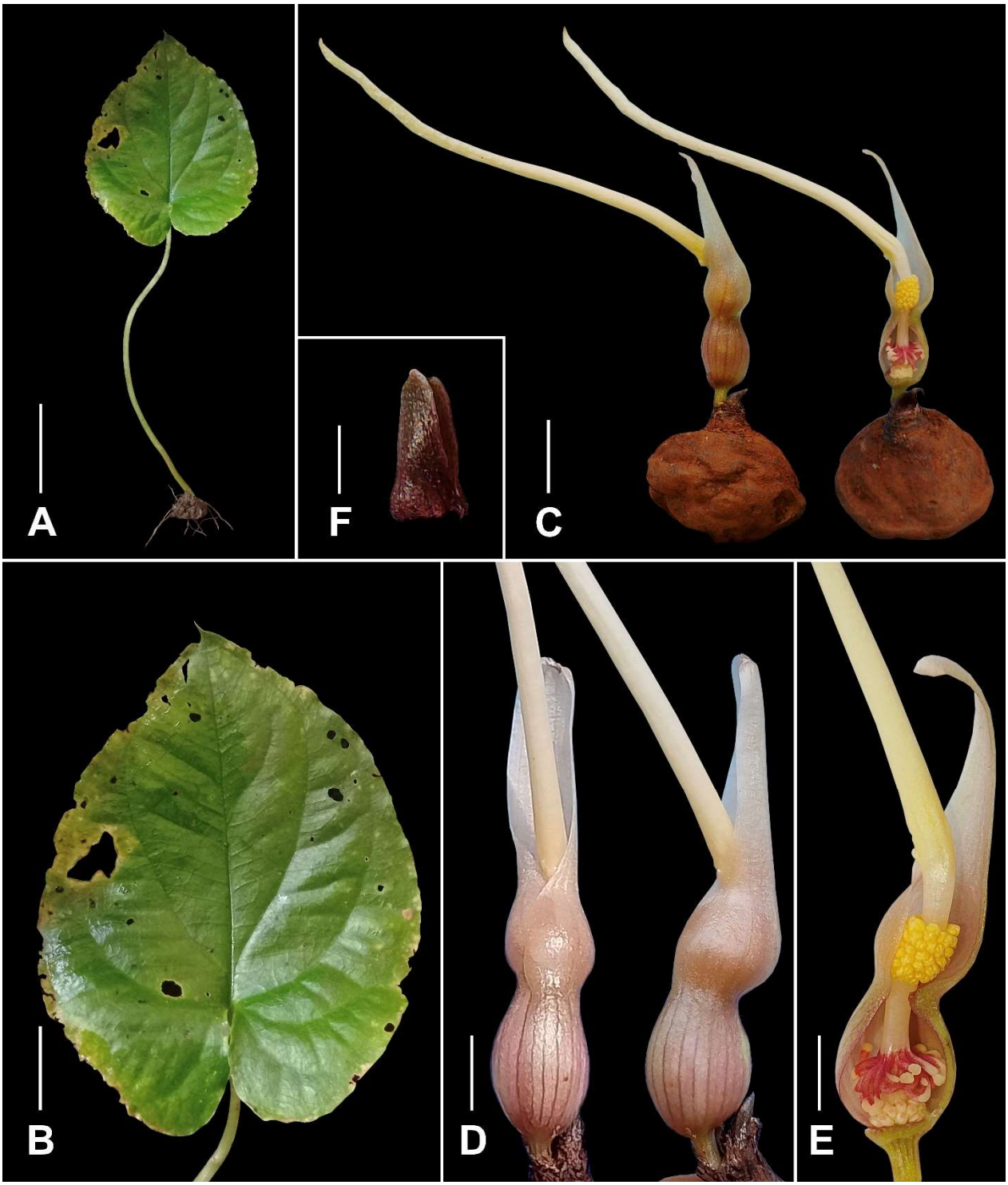

Fig. 1. ***Typhonium karsticola*** sp. nov. **A.** Excavated plant, **B.** Leaf, **C.** Excavated flowering plants (nearside spathe artificially removed in the right photo), **D.** Front and side views of side views of inflorescence, **E.** Detail of spadix showing pistillate zone, sterile interstice, staminate zone and basal part of appendix (nearside spathe artificially removed). **F.** Cataphyll. Scale bars: A.=5 cm, B.=2 cm, C.=1 cm, D. & E.=5 mm, F.=2 mm. Photos by: S. C. S. Paing.

habitat preference being crevices of limestone within karst landscapes.

***Provisional conservation status*:** This new species is known only from its type locality and requires further observation to determine if other populations exist in neighboring areas. Due to insufficient data on its distribution and population size, we herein proposed it to be classified as 'Data Deficient' (DD) according to IUCN Red List criteria (IUCN Standards and Petitions Subcommittee, 2024). However, this classification does not rule out the possibility that the species is not threatened as additional surveys are necessary to ascertain its conservation status.

***Taxonomic notes*:** *Typhonium karsticola* is also similar to *T. digitatum* Hett. & Sookch. from Thailand (Hetterscheid *et al.*, 2001), but the latter differs by having staminodes with digitately lobed apices (vs. globose apices in *T. karsticola*). Among the *Typhonium* species with a hysteranthous habit, *T. karsticola* resembles *T. echinulatum* Hett. & Sookch. from Thailand (Hetterscheid *et al.*, 2001), however, the latter differs by having an echinate sterile interstice between the pistillate and staminate zones (vs. glabrous in *T. karsticola*).

Typhonium pallescens K.Z.Hein, Saensouk & Naive, ***sp. nov***. **Fig. 2**

***Type*:** Cultivated in Monywa, 1 July 2022, *K. Z. Hein 046* (original colletion: MYANMAR. Sagaing Region, Sagaing District, Sagaing Township, Htan Taw Seik village, 22°11'41.5824"N, 95°39'36.1008"E, ca. 80 m a.s.l., 6 August 2021, *K. P. Hein s.n.*) (holotype: TTM!).

***Diagnosis*:** *Typhonium pallescens* is unique within the genus by the pedatisect leaf blade with up to 11 linear lobes, the simultaneous development of 2 or 3 inflorescences, and the adaxial surface of the spathe limb which is dark purple during early pistillate anthesis and gradually becomes pale purplish-brown at late pistillate anthesis. The pedatisect leaf blade of *T. pallescens* closely resembles that of *T. pedatisectum* Gage from Magway Region, Myanmar (Gage, 1903) with up to 11 linear lobes, but it differs by having a lanceolate spathe limb (vs. ovate spathe limb in *T. pedatisectum*), a white sterile interstice (vs. pink or red in *T. pedatisectum*), and an ivory or pale orange appendix (vs. purplish-black in *T. pedatisectum*).

Description*:** Small, deciduous herbs, to 40 cm tall. ***Stem hypogeal, subglobose tuber, ca. 2.3 cm in diameter, externally brown, internally white. ***Roots*** filiform, ca. 1 mm in diameter, white. ***Leaves*** 2–4 together; *petioles* 20.0–24.5 cm long, ca. 4 mm in diameter, erect, cylindrical, terete except the shallowly sulcate upper half, glabrous, basal subterranean portion white, upper aerial portion uniformly green; *petiolar sheath* ca. 3.5 cm long, ca. 1/4 of petiole length; *leaf blade* of mature leaves pedatisect with up to 11 lobes, all lobes linear, progressively shorter from the anterior lobes to the posterior ones, chartaceous, adaxially medium green, abaxially pale green, glabrous on both sides, *anterior lobe* 13.0–14.0 × 0.8–0.9 cm, apex acute, margin entire, base decurrent; *posterior lobes* 10.0–3.0 × 0.7–0.3 cm, carrying 8 to 10 lobes, apices acute, margins entire, bases decurrent; *primary lateral veins* of lobes 5–6 per side, adaxially impressed, abaxially raised, diverging from the midrib at 15–18°, anastomosing at ca. 1 mm from margin into a submarginal (intramarginal) collective vein; *higher order venation* reticulate. ***Inflorescence*** 2–3 together, simultaneously appearing together with the leaves; *peduncle* 1.5–4.0 cm long, 0.3–0.5 cm in diameter, almost entirely subterranean, reddish green or greenish white, terete, glabrous; *spathe* 12.0–16.0 cm long, strongly differentiated into a spathe tube and a spathe limb by a constriction; *spathe tube* 1.5–2.0 cm long, ca. 1.2 cm in diameter, convolute, ovoid, externally uniformly green or with scattered purple mottling, internally green or dark purplish green; *spathe limb* 10.5–14.0 cm long, 8–10 mm in diameter at base, lanceolate, externally uniformly green or purplish green, internally dark purple and erect during early pistillate anthesis and gradually becomes pale purplish brown and horizontally reflexed with upper part slightly coiled at late pistillate anthesis, margins entire, apex narrowly acute. ***Spadix*** sessile10.0–13.5 cm long, slightly shorter than spathe; *pistillate zone* 3.5–4.5 mm long, 0.5–0.6 mm in diameter at the base, shortly conical, with 4–5 rows of congested pistils; *ovary* ca. 1.5 mm high, ca. 0.1 mm in diameter, obovoid, white, unilocular with one basal ovule held obliquely on a funicle, on a basal placenta; *stigma* sessile, ca. 0.8 mm in diameter, discoid, white, papillate; *sterile interstice* between pistillate and staminate zones 1.7–2.0 cm long, 1.5–2.0 mm in diameter, upper part naked, terete, glabrous, glossy white, lower ca. 0.4 cm covered with 5–6 spirals of staminodes; *staminodes* subulate or fusiform, 2.0–3.5 mm long, 0.5–0.7 mm in diameter, free, slightly distant from each other, perpendicular to the spadix axis or slightly curved downwards, glabrous, apex acute, white or ivory; *staminate zone* 1.0–1.2 cm long, ca. 0.4 cm in diameter, cylindric; *stamens* congested, not ostensibly arranged into staminate flowers, 0.8–1.0 mm in diameter, pale yellow; *appendix* sessile or subsessile, 7.0–10.0 cm long, 4–5 mm in diameter at base, narrowly elongate-conical, tapering towards apex, erect, glabrous, ivory or pale orange, apex narrowly acute, base truncate. ***Infructescence*** not seen.

Distribution and habitat: At present, *Typhonium pallescens* is known exclusively from its type locality (Sagaing Township, Myanmar) growing near paddy-cultivated land at elevations of about 80 m a.s.l.

Phenology: Flowering from June to August.

Etymology: The specific epithet is derived from the Latin '*pallescens*' (becoming pale), referring to the adaxial surface of the spathe limb, which is dark purple during early pistillate anthesis and gradually becomes pale purplish brown at late pistillate anthesis.

Fig. 2. ***Typhonium pallescens*** sp. nov. **A.** Cultivated flowering plant, **B.** Leaf, **C.** Front and side views of inflorescence at early pistillate anthesis with emerging young inflorescence, **D.** Side view of inflorescence at late pistillate anthesis **E.** Detail of spadix showing pistillate zone, sterile interstice, staminate zone and basal part of appendix (nearside spathe artificially removed). Scale bars: A.=5 cm, B.=3 cm, C. & D.=2 cm, E.=1 cm. Photos by: K. Z. Hein.

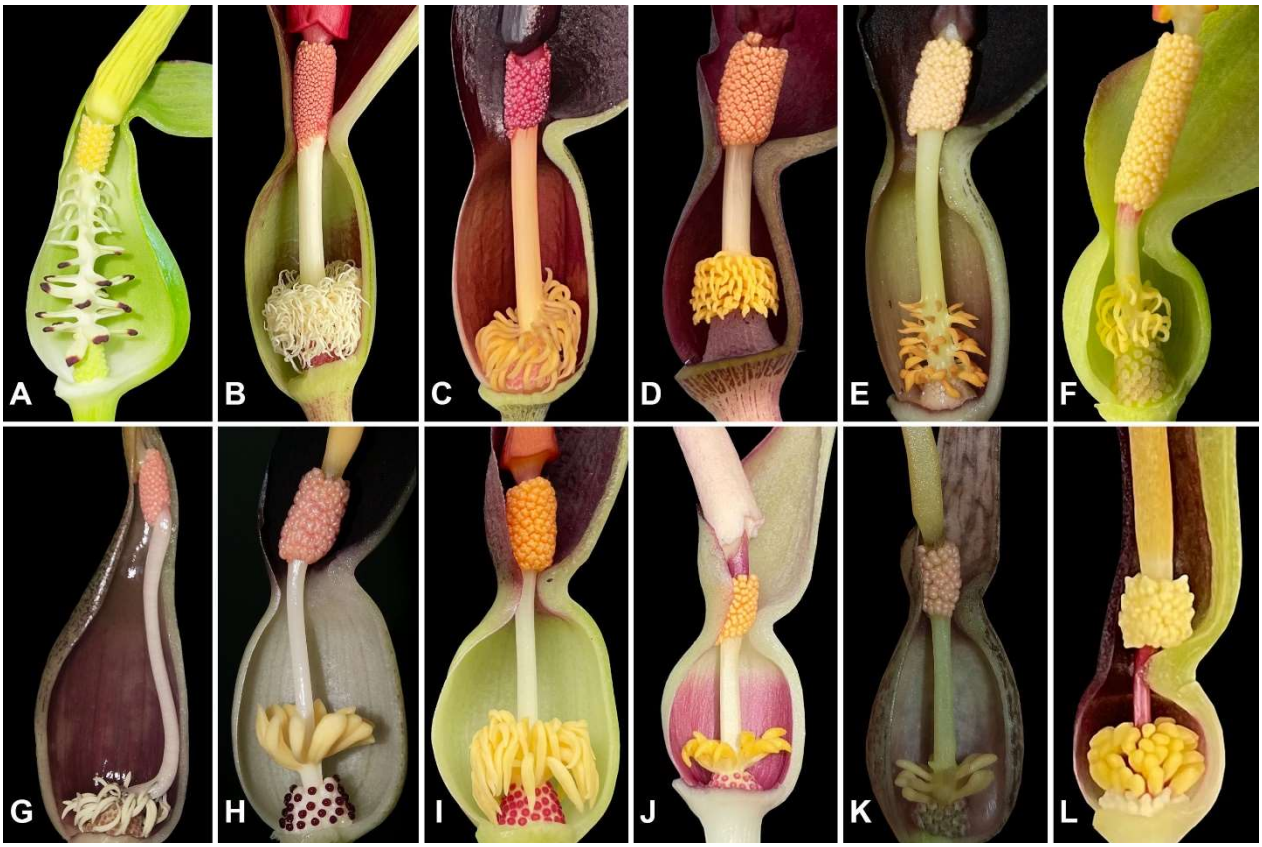

Fig. 3. Detail of spadices of Burmese ***Typhonium*** species (nearside spathe artificially removed). **A.** ***Typhonium flagelliforme***, **B.** ***T. trilobatum***, **C.** ***T. neogracile***, **D.** ***T. roxburghii***, **E.** ***T. praecox***, **F.** ***T. inopinatum***, **G.** ***T. edule***, **H.** ***T. albidinervium***, **I.** ***T. aungmyintwinii***, **J.** ***T. sagaingense***, **K.** ***T. laoticum***. **L.** ***T. cordifolium***. Photos by: K. Z. Hein.

Provisional conservation status: The species is currently known only from its type locality, which is close to human settlement and paddy fields, posing potential threats from habitat disturbance and agricultural expansion. The exact population size remains unknown, and there is a need for further exploration to identify any additional populations. Given the limited data on its distribution and population size, the species is herein proposed as 'Data Deficient' (DD) following the IUCN Red List criteria (IUCN Standards and Petitions Subcommittee, 2024).

***Taxonomic notes*:** The pedatisect leaves with linear lobes of *Typhonium pallescens* also resemble those of *T. bognerianum* J.Murata & Sookch. (Hetterscheid *et al*., 2001), *T. edule* K.Z.Hein & Naive (Naive and Hein, 2021), *T. lineare* Hett. & V.D.Nguyen (Hetterscheid and Nguyen, 2001), and *T. watanabei* J.Murata, Sookch. & Hett. (Murata *et al*., 2002). However, *T. pallescens* differs from all these species by having a leaf blade with up to 11 lobes, the simultaneous development of 2 or 3 inflorescences, a spathe that is externally uniformly green or has only scattered purple mottling, and a subsessile ivory or pale orange appendix. The inflorescence of *T. pallescens* is also similar to *T. inopinatum* Prain (Fig. 3F) (King and Prain, 1898) and *T. pottingeri* Prain (King and Prain, 1898), but it significantly differs by having a pedatisect leaf blade with up to 11 lobes (vs. sagittate or hastate in *T. inopinatum* and trisect or trifoliate in *T. pottingeri*), and staminodes that are perpendicular to the spadix axis or slightly curved downwards (vs. staminodes curved downwards in *T. inopinatum* and variously curled in *T. pottingeri*).

New Records

Typhonium albidinervium C.Z.Tang & H.Li, Acta Phytotax. Sin. 15(2): 105 (1977). **Fig. 3H**

Holotype: CHINA. Guangdong Province, Conghua, 28 February 1975, *C.Z. Tang 0853* (KUN [KUN548975!]).

Distribution and habitat: *Typhonium albidinervium* is distributed in Southern China, Laos, Thailand (Boyce *et al.*, 2012) and Myanmar (this study). In Myanmar, it grows on the crevices of karst limestone hills under a closed to semi-open canopy of tropical mixed deciduous forests between an elevation of approximately 50–100 m a.s.l.

Phenology: Flowering in Myanmar from April–June.

Specimen examined: Cultivated in Monywa, 5 May 2021, *K. Z. Hein 047* (original colletion: MYANMAR. Kayin State, Hpa-an District, Hpa-an Township, Hpa-gat, Bat Cave, ca. 60 m a.s.l., April 2021, *S. C. S. Paing s.n.* (TTM!, new country record).

Typhonium laoticum Gagnep., Bull. Soc. Bot. France 89: 11 (1942). **Fig. 3K**

Lectotype (first-step lectotypification designated by Sriboonma *et al.* (1994); second-step lectoptypification designated here)**:** THAILAND. Northeastern – Mukdahan Province [previously a district of Nakhon Phanom Province], ca. 100 m a.s.l., 14 May 1932, *A. F. G. Kerr 21453* (K [K000099889!]; isolectotypes: K [K000099890!, K000099891], BKF!).

Sriboonma *et al.* (1994) designated a sheet at K as the lectotype, however, there are three sheets and we chose the well-preserved specimen with the barcode K00099889 as the lectotype.

Distribution and habitat: *Typhonium laoticum* is distributed in Laos, Thailand (Boyce et al., 2012) and Myanmar (this study). In Myanmar, it grows in lowland tropical mixed deciduous forests under a semi-open canopy at elevations of approximately 10–50 m a.s.l.

Phenology: Flowering in Myanmar from May–August.

Specimen examined: Cultivated in Monywa, 19 August 2021, *K. Z. Hein 048* (original colletion: MYANMAR. Mon State, Mawlamyine District, Mawlamyine Township, Mawlamyine, ca. 20 m a.s.l., *Phyo Min s.n.*) (TTM!, new country record).

Typhonium roxburghii Schott, Aroideae 1: 12 (1853). *Typhonium divaricatum* var. *roxburghii* (Schott) Engl., Monogr. Phan. 2: 612 (1879). **Fig. 3D**

Lectotype (designated by Nicolson and Sivadasan (1981)**:** SRI LANKA. *G. H. K. Thwaites 3764* (K [K000099886!]; isolectotypes: BM!, P [P00733237!], PDA!).

See Nicolson and Sivadasan (1981) for complete information on its synonyms.

Distribution and habitat: *Typhonium roxburghii* is native to Southern India and Sri Lanka, extending across Malesia to Northern Australia (Nicolson & Sivadasan, 1981; Hay *et al.*, 2022). It has been introduced and naturalized in Comoros, Brazil, Tanzania and Western Australia (POWO, 2024). In Myanmar, the species is found near roadsides and human settlements, making its status as either native or introduced uncertain.

Phenology: Flowering in Myanmar from April–July.

Specimen examined: Cultivated in Monywa, 22 April 2022, *K. Z. Hein 049* (original colletion: MYANMAR. Mon State, Mawlamyine District, Mawlamyine Township, Mawlamyine, ca. 20 m a.s.l., *Nyi Nyi Htway s.n.*) (TTM!, new country record).

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