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Research

Typhonium kbangense, a new species of Araceae (Aroidea–Areae) from Central Vietnam

Van Du Nguyen, Chi Toan Le, Quang Diep Dinh, Thi Van Anh Nguyen, Van Tien Tran and Thomas B. Croat

V. Du Nguyen (<https://orcid.org/0000-0003-1703-4058>) ✉ (vandu178@gmail.com) and T. Van Anh Nguyen, Inst. of Ecology and Biological Resources – Vietnam Academy of Science and Technology, Nghia Do, Cau Giay, Hanoi, Vietnam. VDN also at: Graduate Univ. of Science and Technology – Vietnam Academy of Science and Technology, Nghia Do, Cau Giay, Hanoi, Vietnam. – C. Toan Le (<https://orcid.org/0000-0002-5339-4440>), Hanoi Pedagogical Univ. 2, Xuan Hoa, Phuc Yen, Vinh Phuc, Vietnam. – Q. Diep Dinh (<https://orcid.org/0000-0002-1462-0070>), Inst. of Applied Technology – Thu Dau Mot Univ., Phu Hoa Ward, Thu Dau Mot City, Binh Duong Province, Vietnam. – V. Tien Tran (<https://orcid.org/0000-0001-7407-318X>), Vietnam National Academy of Public Administration, Dong Da, Hanoi, Vietnam. – T. B. Croat, Missouri Botanical Garden, St. Louis, MO, USA.

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Typhonium kbangense is described as a new species from Vietnam. It is one of eleven species recently found in central and southern Vietnam. It belongs to the pedate leaf blade group of species and is closest to *T. bachmaense* and *T. dongnaiense*, but is differentiated from the two latter by having much longer sterile flowers, not dense as in *T. dongnaiense*, and without being clavate apically as in *T. bachmaense*. A table of morphological characters for the three species, the ecological characteristics, specific habitat and conservation status of the new species are estimated and provided.

Keywords: Araceae, Gia Lai province, new species, plant taxonomy, *Typhonium kbangense*, Vietnam

Introduction

In the family Araceae, *Typhonium* is a medium-sized genus with an estimated number of species ranging from 37 (Mayo et al. 1997), 69 including *Sauromatum* (Govaerts et al. 2002), to about 100 (Hettterscheid and Sookchaloem 2012). They are distributed from East Himalaya throughout tropical and subtropical Asia as far east as New Guinea and Australia (Mayo et al. 1997, Govaerts et al. 2002, Hettterscheid 2013, eMonocot Team 2021), though molecular studies indicate that nearly all the hitherto recognised New Guinea and Australian *Typhonium* species are in a distinct clade for which the generic name *Lazarum* A. Hay is available (Cusimano et al. 2010). Recently, since 2000 to now, 36 new species have been described from Indochina including Thailand (Hettterscheid and Boyce 2000, Hettterscheid and Nguyen 2001, Hettterscheid et al. 2001, Nguyen 2008, 2017, Nguyen and Croat 2010, Galloway 2012, 2015, Hettterscheid and Sookchaloem 2012, Hettterscheid 2013, Luu et al. 2017, Sookchaloem and Maneeanakekul 2017, Van et al. 2017, 2021, Nguyen et al. 2021). Among of them, 11 species have been discovered in central and southern Vietnam. In early 2021, the first and third authors carried out field work in the Tay Nguyen plateau of central Vietnam and collected some specimens of *Typhonium*





Figure 1. *Typhonium kbangense* sp. nov. V.D. Nguyen & Q.D. Dinh. (A) Plant habit, (B) plant with inflorescences, (C) under ground parts of the plant, (D) leaf blade, (E) sexual part of the spadix, (F) base of spadix with female and sterile flowers, (G) male flower portion, (H) female portion under microscope view, (I) male portion under microscope view. (A, D, E, F, G, H and I photograph by V. D. Nguyen, B and C photograph by Q. D. Dinh).

in K'Bang district of Gia Lai province of Vietnam. The morphological characters of the specimens showed that they are close to *T. bachmaense* and *T. dongnaiense* in having pedate leaf blades. However, they are strongly different from the two later species by having sterile flower part above female portion much longer, sterile flowers crimson red with a bright yellow acumen, bent downward or strongly curved close toward the spadix axis. All morphological characters of this *Typhonium* show that it is different from all known species of the genus. This species is named as *Typhonium kbangense* for the district where the type specimens were collected. Owing to this discovery, the total species of *Typhonium* in Vietnam is increased to 18.

This paper describe the ecology, biology and conservation status of the species and a table for comparisons between three closest species, *T. bachmaense*, *T. dongnaiense* and *T. kbangense*.

Taxonomical treatment

Typhonium kbangense V.D. Nguyen & Q.D. Dinh sp. nov. (Fig. 1)

Diagnosis

A species close to *T. bachmanense* and *T. dongnaiense* with all three of them having pedate leaf blades, a narrow elongate triangular spathe lamina and an elongate conical appendix. However, different from both the latter species by having sterile flowers 12 mm long and crimson red at lower portion and with yellow terminal acumen (versus having sterile flowers only 5 mm long and pink to pale red, with yellow flattened clavate apex in *T. bachmaense* and sterile flowers slender subulate to filiform, 8 mm long, bright yellow in *T. dongnaiense*). It also differs from *Typhonium dongnaiense* in having sterile flowers with a yellow acuminate apex and not densely arranged and a stigma much smaller than ovary surface, 0.2/1 mm (versus sterile flowers pale yellow terminal the same lower part, densely arranged, stigma quite large in comparison to ovary surface, 0.5/0.8 mm).

Type: Vietnam, Gia Lai province, K'Bang district, K'Bang town, Chre village, Hang Doi waterfall, 29 Apr 2021, GPS 14°09'32.75"N, 108°38'16.84"E, N.V. Du & Q.D. Dinh 02 (HN, holotype and isotype).

Etymology

The specific epithet is derived from the name of the K'Bang district of Gia Lai Province, where the type specimens were collected.

Description

Tuberous, herbaceous plant, ca 30 cm tall. Tuber irregular, globose or oblong-ovate, 2–4 cm long, 2 cm wide or diam., at base usually truncated, with 1-several lateral shoots, dingy white outside, white inside. Roots numerous, concentrated at tuber apex, rather stout, branched, 4–7 cm long. Leaves 2; petiole cylindrical, slender, ca 30 cm long, lower part sheathed up to 6–7 cm long, 4 mm wide at base, often underground, white, upper part cylindrical, 2.5 mm diam. at base and 1.5 mm diam. at top, dull green; leaf blade fully pedate, 5–7-lobed, with central leaflet sessile, symmetrical, nearly elliptical, 9 cm long, ca 4 cm wide, obtuse or rounded base, abruptly acute to acuminate with acumen ca 1 cm long; lateral leaflets lanceolate, 5.0–10.0 cm long, 2.0–3.5 cm wide, attached to one side of rachis with outermost lobe irregular, 5–7 cm long, 3–4 cm wide, acute at base, outer margin broadly rounded and decurrent along rachis at base, dark green above, lighter below; lateral veins 6–7 pairs on each side of leaflets, 7–8 mm distant each other, collective vein 3–5 mm distant from margin. Inflorescence solitary;

peduncle shorter or equal to petiole sheath, 5–6 cm long, usually underground, white, outer covered by a cataphyll 6–7 cm long; spathe emerging from leaves first, up to 34 cm long, its tube oblong or cylindrical, ca 2 cm long, ca 1.5 cm diam., base and apex slightly truncated, milky white outside, with many black dots, brownish at the top; spathe lamina tightly clasping male zone and appendix with elongate subulate shape at first, completely opened with narrowly triangular shape, 32

cm long, 2.5 cm wide at the base, dull brown, darker brown at base, lighter and duller brown near top. Spadix equalling spathe in length; pistillate zone basal, conical, ca 4 mm diam. at base, 2.5–3.0 mm in diam., pinkish red; sterile portion between male and female portions ca 2 cm long, above with a naked axis, 1.2 cm long, 1.5 mm in diam., smooth and white, below with a sterile flowering part, cylindrical, 8 mm long, 8.5 mm in diam., covered not densely by sterile flowers, crimson

Table 1. Morphological characters of *Typhonium bachmaense*, *T. dongnaiense* and *T. kbangense*.

Characters	<i>T. bachmaense</i>	<i>T. dongnaiense</i>	<i>T. kbangense</i>
Stem	Short tuberous-rhizome; branched; 1.0–3.0 long × 0.7–1.5 cm in diam.	Tuberous globose to subglobose; 1 cm long × 2 cm in diam.	Tuberous, irregular in shape, globose or oblong ovate, 2–4 cm long × 2 cm in diam.
Leaves	1–2	1	1–2
Petiole	Smooth, slender, 15–28 cm long, green to violet – brown	Smooth, slender, 20–25 cm long, brown grey, brownish mottled, green at upper part	Smooth, slender, up to 30 cm long, sheath part 6–7 cm long, underground part white, upper part green.
Leaf blade	Fully pedate, leaflets 5–7	Fully pedate, leaflets 5	Fully pedate, leaflets 5–7
Central leaflet	Elliptic to elliptic-lanceolate, 8.5–10.0 cm long × 1.5–4.0 cm wide, sessile	Symmetrical elliptic, 8–12 cm long × 4–6 cm wide, sessile or subsessile	Symmetrical elliptic, 9 cm long × 4 cm wide, sessile
Lateral leaflets	Ovate, oblong-ovate to lanceolate, 8.0–10.0 cm long × 3.0–4.5 cm, petiolulate	Asymmetrical, 8–12 cm long × 4–6 cm wide, petiole 5 mm long	Lanceolate, 5.0–10.0 cm long, 2.0–3.5 cm wide, sessile, inner side base decurrent on rachis.
Peduncle	0.5–2.0 cm long, white or pinkish, subterranean	4 cm long, subterranean, white to pink	5–6 cm long, subterranean in flowering period, emerging above ground when in fruit, up to 5–6 cm long.
Spathe	11–23 cm long	20–25 cm long	Up to 34 cm long
Spathe tube	Globose 0.7–1.5 cm in diam., glossy dark brown; base creamy with reddish brown dots	Elliptical, 2.0–2.5 cm long × 1.0–1.5 cm in diam., pale green outside, with dark brown dots	Oblong or cylindrical, 2 cm long, 1.5 cm in diam., milky white outside with abundant black dots, brown at top
Spathe limb	Lanceolate or narrowly elongate-triangular, 10.0–21.0 cm long, 2.0–3.7 cm wide at base when flattened, outside glossy dirty dark brown, sometime with dark spots	Linear lanceolate or narrowly elongate-triangular, 18.0–23.0 cm long, 1.5–2.0 cm wide at base when flattened, dark brown on both surfaces	Elongate narrowly triangular, 32 cm long, 2.5 cm wide at base when flattened, dull brown, darker brown at base
Spadix	Slightly longer than spathe, 12–24 cm long, sessile	Long as spathe, sessile	Long as spathe, sessile
Female portion	Conical, 1–3 mm long × 3–6 mm at base, 1–2 mm at top, flowers congested	Hemispherical, 2.0–2.5 mm high × 6.0–7.0 mm wide at base, flowers congested	Conical, 4.0 mm wide at base, 2.5–3.0 mm at apex, flowers congested
Sterile interstice	0.8–1.2 cm long, not densely covered by sterile flowers at base, upper part naked and smooth	1.5 cm long, densely covered by sterile flowers at base, upper part naked and smooth	2 cm long, not densely covered by sterile flowers at base, upper part naked and smooth
Male portion	Cylindrical, oblique at top and base, 2–7 × 4–5 mm, pink, flowers congested	Cylindrical, size 5 × 6 mm, pink, flowers congested	Elliptical, oblique at top and base, 4.5 mm long × 3.5 mm wide, orange yellow, flowers congested
Appendix	Stipitate, stipe 1–3 mm long, brown; narrow elongate-conical to filiform, 10–22 cm long, 4–5 mm in diam. at base; base expanded, truncate, top acute; brown to yellow brown	Shortly stipitate, stipe 1–2 mm long, white; narrow elongate-conical to filiform, 16–20 cm long, 4 mm in diam. at base; base expanded, top acute; orange to pale yellow	Sessile, elongate-conical, 32 cm long, ca 5 mm in diam. at base, base flared on male portion, apex, brown
Ovaries	Elongate or lageniform, 1.0–1.5 × 0.5–1.0 mm in diam.	Obvoid, 1.0 mm long × 0.8 mm in diam.	Ovoid, slightly angled, ca 1 mm indiam. at top
Stigma	Sessile, disciform, 0.3–0.4 mm in diam.	Disciform, 0.5 mm in diam., white to yellow, penicillate	Sessile, disciform, small, ca 0.2 mm in diam., dark reddish brownish
Sterile flowers	Elongate-clavate, dilated and flattened at top, curved downwards, 5.0 mm long, 0.8 mm in diam., reddish purple, top pale yellow to whitish	Slender-subulate to filiform, 6–8 mm long, perpendicular to spadix axil, apices curved downward	Slender stick-shaped, 7.0–12.0 mm long, 0.5–0.8 mm in diam., upper part flattened, with a concave slit on surface, bended downward or folded in spadix axil, crimson red at lower part and bright yellow at acuminate apex
Stamens	Pale pink, pore apical, elongate.	Pink, opening by aslit at apex.	Orange yellow, pore apical, globose

red; staminate flowering portion elliptical, ca 4.5 mm long, 3.5 mm at widest point, orange-yellow; appendix elongate-conical, 32 cm long, at base spreading, slightly flared and a little covering male flower part, 5 mm wide at base, brown, sessile. Ovary ovoid, slightly angled, ca 1 mm diam. at apex, with a pink-red ring around the stigma; stigma sessile, round, small, ca 0.2 mm in diam., dark reddish-brownish; stamens free, subsessile, ca 1 mm in diam., 0.5 mm long; anthers subglobose, up to 0.5 mm in diam., dehiscent by oval pores at apex; pollen orange-yellow; sterile flowers slender, cylindrical, slightly flattened with a concave slit at middle, ca 7.0–12.0 mm long, 0.5–0.8 mm in diam., crimson red, turned outward from spadix axil by a 90° angle, the upper part bent down or folded in toward axis, at apex acute with an 1.0–1.5 mm long acumen, bright yellow.

Ecology

Tropical humid, semi-deciduous forest on the slope of high mountain, at 720 m a.s.l.

Phenology

Flowering in April, flowering from midnight to morning for about two days with a slightly foul smell.

Distribution

Only known in Vietnam, Gia Lai Province, K'Bang District.

Habitat

The plant grows on soil, near a waterfall, in open places.

Conservation

Typhonium kbangense is known from one locality only, with a very small population (about 1 km radius), and several individuals around Hang Doi waterfall in K'Bang district town of Gia Lai Province where visited by many tourists. This place will be changed by the development of tourism in the future and the habitat of the species will be strongly effected in the area. Based on criterions of IUCN (2020), the species could be assessed as EN (b2, c2).

Discussion

In the genus *Typhonium*, the pedate leaf bade group includes three species viz. *T. bachmaense*, *T. dongnaiense* and *T. kbangense*, three of them share the following morphological characters (besides pedately leaf blades): narrow elongate-lanceolate to triangular spathes and with the spadix appendix elongate narrow-conical or subulate. However, their morphological characters of the sterile flowers are completely different. The morphological characters of *Typhonium bachmaense*, *T. dongnaiense* and *T. kbangense* are compared in the Table 1.

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Author contributions

Du Nguyen and **Chi Toan Le** contributed equally to this publication. **Du Nguyen**: Conceptualization (equal); Data curation (equal); Funding acquisition (equal); Investigation (equal); Methodology (equal); Writing – original draft (equal). **Chi Toan Le**: Conceptualization (equal); Formal analysis (equal); Writing – original draft (equal); Writing – review and editing (equal). **Diep Dinh**: Investigation (equal); Writing – review and editing (equal). **Van Anh Nguyen**: Data curation (equal); Formal analysis (equal); Writing – review and editing (equal). **Tien Tran**: Data curation (equal); Formal analysis (equal); Writing – review and editing (equal). **Thomas Croat**: Methodology (equal); Writing – review and editing (equal).

Data availability statement

There are no additional data for this paper.

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