



Original Article

Two New Records of Species and A New Synonym of Genus *Typhonium* (Araceae) For Flora of Indochina

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Abstract: Two species of the genus *Typhonium* are described as the new species for the Flora of Indochina. *T. cordifolium* was discovered for the first time in Cambodia and Vietnam and *T. khonkaenensis* was found for the first time in Vientian of Laos. In the paper, the name *T. rhizomatosum* Galloway & Schmidt is recorded as a new synonym of *T. cordifolium* S. Y. Hu, while *T. khonkaenensis* is confirmed as a separated species in the genus *Typhonium*.

Keywords: *Typhonium*, synonym, Cambodia, Laos, Vietnam, Indochina.

1. Introduction

The genus *Typhonium* (Araceae) includes about 80 species [1] and distributed from India to China and down to South-Eastern Asia countries and to North-Eastern Australia [2, 3]. Recently up to 33 new species for science were described from Indochina including Thailand [1, 4-14]. In Indochina (Cambodia, Laos and Vietnam), Gagnepain [15] recorded only 6 species as *T. acetosella*, *T. blumei*, *T. divaricatum*

(= *T. blumei*), *T. diversifolium*, *T. flagelliforme*, *T. laoticum* and *T. trilobatum*. Since 1994 until now, 14 new species of this genus were described for science by different authors, in different years [1, 9, 10-14, 16]. However, 13 of them was found in Vietnam, only one species as *T. attapeuensis* was found in Laos [5] and any species was found in Cambodia. During carried out expedition in Cambodia in 2007 and Southern Vietnam in 2017, the first author collected 2 collections of *Typhonium*, those were identified as *T. rhizomatosum* [4]. Recently, after we checked again the herbarium specimens of the 2 collections and the original description of *T. rhizomatosum*, we recognized

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that the morphological characters of *T. rhizomatosum* are completely matched to the original description of *T. cordifolium* made by Hu [17]. Following the International Code of Botanical Nomenclature, 2006 - Vienna Code [18], the name *Typhonium rhizomatosum* Galloway & Schmidt has been become a synonym of the name *T. cordifolium* S. Y. Hu. In other expedition in Laos in 2008, the first author collected the other specimens of *Typhonium* in Vientian city. The morphological characters of spathe, sterile flowers and leaves of the plant are matched to the species *T. khonkaenensis* which was described as a new species from Thailand [5]. In this paper, *T. cordifolium* S.Y. Hu and *T. khonkaenensis* A. Galloway, S. Charoenwong are described as 2 new species records for the flora of Indochina. The paper also confirmed that the name *Typhonium rhizomatosum* is the synonym of the name *T. cordifolium* and the species *T. khonkaenensis* is separated from other species in the genus *Typhonium*.

2. Materials and Methods

2.1. Materials

- The materials of this study are specimens collected in Cambodia, Laos, and Vietnam. The herbarium specimens were treated and stored in the herbarium of the Institute of Ecology and Biological Resources - Vietnam Academy of Science and Technology (see studied specimens).

2.2. Methods

- The method used for this study is the method of morphological character comparison. The characters of vegetative organs and mainly sexual organs of the living and dried specimens were analyzed and compared to the original descriptions of the species. Besides that, the author group also referenced different monograph and other literature (see literatures).

- The living plants and inflorescences of the species were also photographed and illustrated to show characterizes of each species.

3. Result and Discussions

3.1. Descriptions of Species

Typhonium cordifolium S. Y. Hu 1968. Dansk. Bot. Ark. 23: 446, Pl. 86; Hett. and Sookchaloem 2012. Fl. Thail. 7(2): 305.

Type: Thailand, Kanchanaburi, K. Larsen 10577 (Hol. C; Iso. BKF!)

- *Typhonium rhizomatosum* A. Galloway and P. Schmidt, Aroideana 35: 59 (2012) syn. nov. *Type:* Thailand, Kanchanabury, Galloway 1326-01-T (QBG).

Tuberous to rhizomatous plant, c. 10-15 cm tall; Tubers in different shapes, c. 2-3 cm long, lower portion sub-cylindrical to conical, alittle horizontal, upper conical, 8-15 mm in diam. at middle, covered by many roots in filiform out side, lateral shoots long developed, up to 10 cm long, slight brown in color, apex expanded into tuber. Leaves 1-2, up ward from tuber after inflorescence; petiole slender, 5-10 cm long, green to dark green; leaf blade ovate to elliptic, 5-7.5 cm long, 3-4 cm wide, base obtus to round, sometime cordate, apex slight oblong, round at tip; lateral vein 3-4 pairs, upward from midrib with angle 35-45°. Peduncle 3-20 mm long, under grown; spathe c. 8 cm long; tube portion ovate to subglobose, c. 1 cm long, 0.5 cm in diam., light brown-green outside, brown or reddish brown inside; spathe lamina oblong to lanceolate, base convoluted, upper part completely opened, curving backward, acute at apex, thin, outside grossy purple, inside dull dark purple. Spadix sessile, nearly long as spathe, c. 7.5-10 cm long; female portion sub cylindrical, short, covered by several ovary rows, c. 2 mm long, 2.5-4 mm in diam. at base; sterile portion 6-14 mm long, covered by several sterile flowers at base, upper smooth, light brown in color; male portion truly cylindrical, c. 3 mm long, 2.5 mm in diam., truncated and oblique at base and apex; appendix subulate, light oblong at base, middle slightly thickened, apex acute, dirty light yellow brown in color. Ovary long conical, c. 2 mm long, 1 mm in diam. at apex, lower oblong, 1 cell with 1 ovule; stigma round, slight pressed, sessile or subsessile; stamens free,

c. 1 mm long, stipe c. 0.4 mm long, anthers elliptical, c. 0.4 mm long, connection conspicuous, narrow; sterile flowers slightly clavate, or stick form, c. 3-4 mm long, 1.3 mm at apex, perpendicular to spadix axis or curved upwards, base whitish, light orangeish yellow. (Fig. 2: A–E).

Studied specimens: Cambodia: Phnom Penh city, V. D. Nguyen, J. T. Hoe, CBD-VN 215 (HN); Vietnam: Dong Thap province, Lap Vo district, Dinh Yen commune, An Khanh Pegoda, V. D. Nguyen, P. MatthewsVN-JP 28(HN).

Habitat: grow undershade of shrubs, humus soil.

Distribution: Vietnam: Dong Thap (Lap Vo); Cambodia: Phnom Penh; Thailand: Kanchanaburi.

Conservation: Before the species was recorded as an endemic plant in Thailand [8], now the species has been found in Cambodia and Vietnam (see Fig. 3). Thus, the species is not belong to the Red list of IUCN based on the criteria for Critically Endangered, Endangered and Vulnerable [19].

Typhonium khonkaenensis A. Galloway, S. Charoenwong, Aroideana 38: 11 (2015).

Type: Thailand: Khon Kaen province, Galloway AGA-2513-01-T (holo. QBG)

Tuberous plant, c. 15 cm high. Tuber subglobal to subcylindrical, up to 1-2 cm long, 1.2-1.5 cm in diam., dull white out side, white inside. Leaves 2-5 together, medium greenish; leaf blade entire, round, elliptic to elongate elliptic, sometime slightly lanceolate, 2.5-5(8) cm long, 1.2-3.2(5) cm wide, base cordate or not, with or without basal lobes; basal lobes round and slightly overlaped together or triangular, slightly obtuse or light acute; leaf blade apex round to obtuse, not rarely concaved or acute, arista c. 1 mm long; lateral veins conspicuous at beneath surface; petiole 3-12 cm long, sheathed at base 2-3 cm long, with shallow canals. Inflorescence solitary; peduncle 2-3(4) cm long; spathe tube portion subovate, c. 1 cm long, 0.7 cm in diam., bright brown to brown outside, light pink inside; spathe lamina elongate triangular, sometime lower half wide

triangular, abruptly narrowed at top into line form and circinnately recurved or not, 6-7(8) cm long, 2 cm wide at base, dark brown at lower half, white or dull yellow-greenish at upper. Spadix longer than spathe, 10-12(15) cm long; female portion conical, 2 mm long, 3-4 mm wide at base, ovaries densely; sterile portion c. 12 mm long, covering with 7-10 steriles flowers, scattered in arrange, seperately located at c. 7 mm from female portion, above naked; male portion subovate to subglobal, 1.3-1.5 mm long, 1.2-1.4 mm in diam., flowers densely, yellow in color; appendix needle to slender subulate form, 10-11 cm long, 1-1.2 mm in diam., light brown to dark brown. Ovaries subglobal, c. 0.3-0.5 mm diam., white, unique cell with unique basal ovule; stigma wide, disciform, prominent from ovary, c. 0.1 mm in diam., pinkish to redish; anthers separated, subglobal, c. 0.3 mm diam., yellow, dehiscence by pore at apex; sterile flowers sessile, ovate, pressed, c. 2-3 mm long, 1 mm wide, outward or slightly curved upward from spadix axis, dark orange yellow (Fig. 1, Fig. 2: F & G).

Studied specimens: Laos, Vientian city, V. D. Nguyen, X. P. Vu L-VN 259 (HN)

Habitat: grow undershade of shrubs, on illuvium soil.

Distribution: Laos (Vientian); Thailand (Khon Kaen).

Conservation: *T. khonkaenensis* is distributed in 2 places of 2 countries (see Fig. 3), however the distance of 2 places is not too far each other so that the distribution of the species is not too large (<20,000 km²). The population of the species in Thailand was not reported [5]. In Laos the species was known only in Vientian with a small population and few individuals (< 1000). Following the IUCN criteria for Critically Endangered, Endangered and Vulnerable, it should be arranged at the rank VUB1 D1 [19].

3.2. Discussion

The morphological characters of *T. rhizomatosum* are completely matched to

T. cordifolium not only in having tuberous - rhizomatous stem, leaf blade ovate to oblong ovate with cordate base, but also in having a small inflorescence, spathe lamina lanceolate, curving back, sterile flowers are cylindrical to clavate and perpendicular to the spadix axis or slightly curved upward [4, 17]. Additionally, the type of *T. rhizomatosum* was also collected in Kanchanaburi (Thailand) where the type of *T. cordifolium* was collected before.

Typhonium khonkaensis belongs to the group including *T. acetocella*, *T. circinnatum*, *T. cordifolium*, *T. griseum*, *T. laoticum*, *T. obifolium* and *T. violifolium* from Thailand, *T. huense* and *T. stigmatilobatum* from Vietnam. Among them, the species is closest to *T. circinnatum* by having spathe revolute at upper portion and *T. laoticum* by having sterile flowers separated from female portion.

When composing this paper, the authors referenced the website of Royal Botanic Garden, Kew [20], the website showed that species *T. khonkaensis* Galloway & Charoenwong is the synonym of the species *T. inopinatum* Prain, the species has a wide distribution in Bangladesh and India. The website also cited two literatures of Kumar et al., [21] and Sasikala et al., [22] those literatures did not accept the name *T. khonkaensis*. However, after checking all the literatures concerning to *T. inopinatum* in Thailand as well India [16, 23, 21, 24, 25], there are not any mention to the species *T. khonkaensis*. After studying the morphological characters of *T. khonkaensis* and *T. inopinatum* we confirm that *T. khonkaensis* is separated from *T. inopinatum* by distinguished characters mentioned in the Table 1.

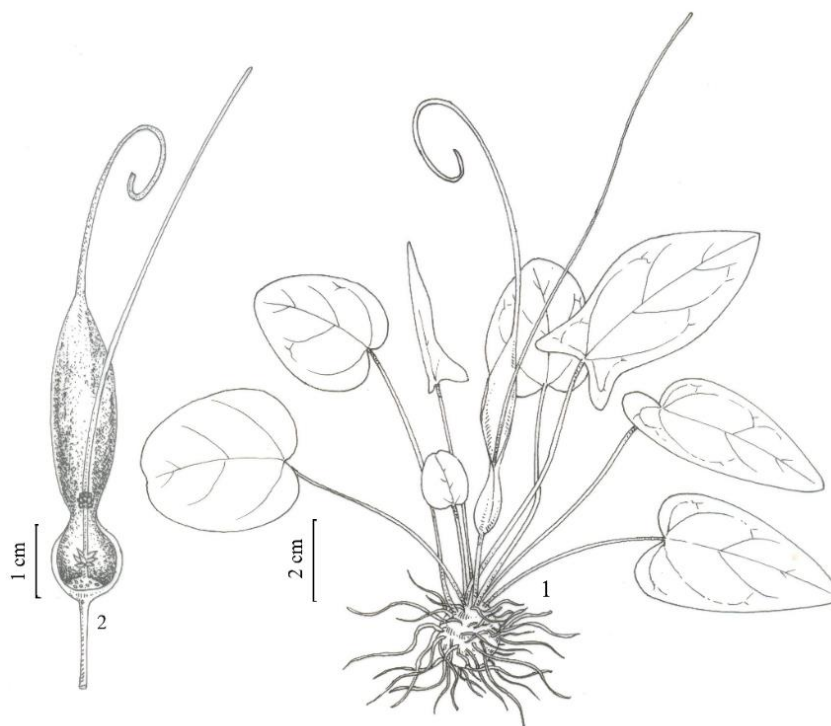


Fig. 1. *Typhonium khonkaensis* Galloway & Charoenwong.

1. All the plant with inflorescence; 2. Inflorescence with spathe cut out a part.
(Illustrated from specimen V. D. Nguyen, V. X. Phuong, L-VN 259 by Nguyen Kim Chi).



Figure 2. *Typhonium cordifolium* S.Y. Hu (A-E) and *T. khonkaenensis* Galloway & Chaenwong (F & G). A, D & F. All plant; B. Inflorescence side view; C, E & G. Organs of spadix; F. Plant and inflorescence; G. Inflorescence with spathe opened tube part. (Photographed by Nguyen Van Du).

Table 1. Morphological characters of *T. khonkaenensis* and *T. inopinatum*

Characters	<i>T. khonkaenensis</i>	<i>T. inopinatum</i>
Tuber	Subglobal to subcylindrical, size 1–2 × 1.2–1.5 cm, dull white out side	Subcylindric to globose, 2–3 × 0.8–1.5 cm.
Number of leaves	2–5	?
Leaf blade shape	Leaf blade entire, round, elliptic to elongate elliptic, sometime slightly lanceolate, size: 2.5–5 × 1.2–3.2 cm, base cordate or not	Trilobed, ovate to triangular or hastate, acuminate at apex, size: 5–14 × 4–10 cm.
Spathe lamina shape	Elongate triangular, sometime lower half wide triangular, abruptly narrowed at top into line form and convoluted or not, 6–7 cm long	Narrow ovate to lanceolate, 9–10 cm long.

Spathe colour	Dark brown at lower half, white at upper.	Greenish to dark purple
Spadix long	Longer than spathe	Shorter than spathe, 4–9 cm long
Female portion	Female portion conical, 2 mm long, 3–4 mm wide;	Conical, 3–4 cm long; greenish.
Sterile flowers and shape	7–10, ovate, stout, size: 2 × 1 mm wide, deep yellow	More than 10, filiform, bifurcate or pointed at tip, decurved, 2–4 mm long
Male portion	Subovate to subglobal, size: 1.3–1.5 × 1.2–1.4 mm;	Cylindrical, 5–11 × 2–3 mm long; pale yellow.
Appendix and size shape	Elongate stick to subulate form, size: 10–11 × 0.1–0.12 cm in diam., light brown to dark brown	Conical, truncated at base, stipitate, purple. Size: 1.8–4.1(6.5) cm long.

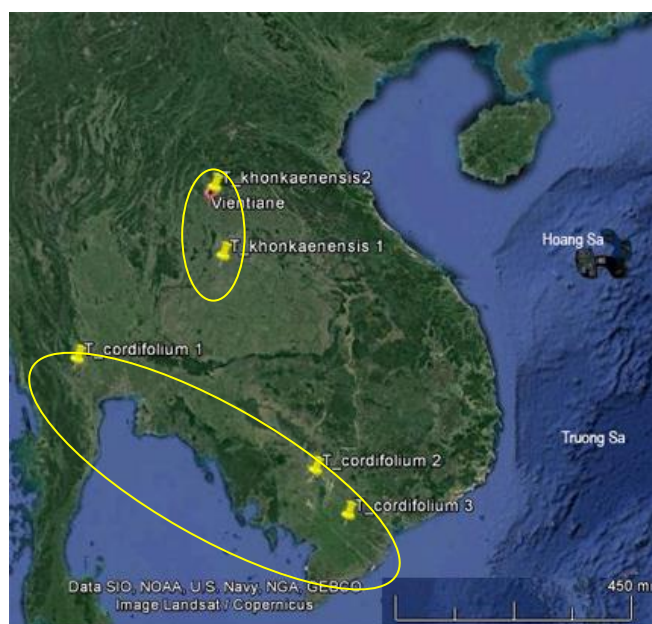


Figure 3. Distribution of *Typhonium cordifolium* and *T. khonkaenensis* (the map is taken from Googleearth).

4. Conclusion

- Base on above mentions, this is the first time *Typhonium cordifolium* S. Y. Hu and *T. khonkaenensis* Galloway and Charoenwong recorded for Flora of Indochina.

- For the first time *Typhonium rhizomatosum* Galloway and Schmidt is recorded as the synonym of *T. cordifolium* S.Y. Hu. In the genus *Typhonium*, *T. khonkaenensis* is separated from *T. inopinatum* and other species

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