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Typhonium rhizomatosum (Araceae), A NEW RECORD FOR THE FLORA OF VIETNAM

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ABSTRACT

Typhonium rhizomatosum A.Galloway & P.Schmidt is reported here as a new record to the flora of Vietnam. It is described and illustrated with detailed photographs of key morphological characters. Besides, the sequences of *mat*K and *trn*L-F regions were also successfully sequenced to confirm its identity.

Keywords: *Typhonium rhizomatosum*, *Typhonium cordifolium*, new record, *mat*K, *trn*L-F.

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INTRODUCTION

The genus *Typhonium* of the family Araceae has about 80 to 100 species distributed over the world (Boyce et al., 2012; Hetterscheid, 2013; Low et al., 2021; Sriboonma et al., 1994). A recent study by Low et al. (2021) proves that the genus originates from Indochina with a diversity of nearly 40 species described. In Vietnam, twenty one *Typhonium* species have been reported (Boyce et al., 2012; Cusimano et al., 2010; Gagnepain, 1942a,b; Hetterscheid & Nguyen, 2001; Luu et al., 2017; Nguyen, 2005; Nguyen, 2008; Nguyen & Croat, 1997; Nguyen & Croat, 2010; Nguyen et al., 2021; Nguyen et al., 2022; Nguyen & Vu, 2004; Pham-Hoang, 1993; Pham-Hoang, 2003; Serebryanyi et al., 2023; Van et al., 2017; Van et al., 2021). Among these, *Typhonium cordifolium* S.Y.Hu used to be considered endemic to Thailand (Boyce et al., 2012) but was found in Myanmar by Murata et al. (2010) and was recently in Vietnam and Cambodia by Nguyen et al. (2022). Noticeably, Nguyen et al. (2022) reduced *Typhonium rhizomatosum* as a synonym of *T. cordifolium* based on their morphological similarity.

Typhonium rhizomatosum was described by A.Galloway and P. Schmidt (Galloway, 2012) as a new species based on cultivated collections originating from Kanchanaburi province of Thailand. According to Galloway (2012), *T. rhizomatosum* is most closely relative to *T. cordifolium* in the structure and color of inflorescence and it differs mainly from the latter in having the following: beige (vs. brick orange) appendix and creamy white (vs. dark yellow) staminodes. The two species are difficultly distinguished based on morphological characteristics, especially in the flower structure. Murata et al. (2010) noted that an adventitious bud appears at the mature leaf blade apex or sometimes at the top of the sheath in Thai specimens of *T. cordifolium* but this characteristic was neither mentioned in the protologue of *T. rhizomatosum*. In fact, a recent phylogenetic *Typhonium* study based on the whole plastome with samples by Galloway (Low et al., 2021) has shown that *T. rhizomatosum* and *Typhonium violaefolium* form a group that diverged from *T. cordifolium* about ten million years ago. Therefore, the synonymization by Nguyen et al. (2022) is not phylogenetically supported.

Since 2017, we have noted a plant that grows in ornamental pots, parks and uncultivated areas in Ho Chi Minh City and some provinces of southern Vietnam, such as Vinh Long, Dong Thap, Long An and Ba Ria-Vung Tau. The plant morphologically matches well with *T. rhizomatosum*. In this paper, we report our molecular analysis to confirm its identity.

MATERIALS AND METHODS

Sampling

Voucher specimens of *T. rhizomatosum* were collected from plants growing in ornamental pots in Ngai Tu ward, Tam Binh district, Vinh Long province (*Nga Nguyen-Phi H.T.Van 147*, approximately 9º58’23”N, 105º54’40”E) using conventional methods guided by the Royal Botanic Gardens, Kew (Bridson & Forman, 1999) and deposited in the herbaria of Southern Institute of Ecology (SGN) and the University of Science, Vietnam National University, Ho Chi Minh City (PHH), Vietnam. Detailed photographs and descriptions of taxonomically important characteristics were taken of fresh materials in the field using a digital camera. Fresh leaf was taken for molecular analysis.

Molecular analyses

Total genomic DNA was extracted from fresh leaf material of *T. rhizomatosum* using the GeneJET Genomic DNA Purification Column & Collection Tube (Thermo Fisher Scientific, USA). Sequences of the chloroplast loci of the new taxon were amplified and sequenced using the protocol described in Van et al. (2020). The used primers are shown in Table 1.

The DNA data of the *trn*L-F and *mat*K gene regions of *T. rhizomatosum* deposited in GenBank (https://www.ncbi.nlm.nih.gov/genbank/) under accession number MT884872 are

used in the genetic comparison. The pairwise alignment using the global alignment method between the DNA sequences of the two species was used in BioEdit software (Hall, 1999).

Table 1. Primers used in the present study

Primers (*)	Region	Sequence (5'--3')	References
A (F)	*mat*K	ACCCAGTCCATCTGGAAATCTTGGTTC	Fazekas et al. (2012)
B (R)	*mat*K	CGTACAGTACTTTTGTGTTTACGAG	
C (F)	*trn*L-F	CGAAATCGGTAGACGCTACG	Taberlet et al. (1991)
D (R)	*trn*L-F	ATTTGAACTGGTGACACGAG	

Notes: (*) direction of primer F = forward, R = reverse.

RESULTS AND DISCUSSION

The final lengths of the *trn*L-F and *mat*K sequences of our plant (*H.T.Van 147*) were 817 and 726 bp, which are aligned in comparison with those of *T. rhizomatosum* (GenBank accession number MT884872) in Figure 1 and Figure 2, respectively. There is no gap between their *trn*L-F sequences with 817 match positions and two mismatches (red arrows) at positions 103 and 735 and no gap in their *mat*K sequences with 371 match positions and one mismatch (red arrows) at position 17. The percent identity is 99,75% (*trn*L-F) and 99,86 % (*mat*K), respectively.

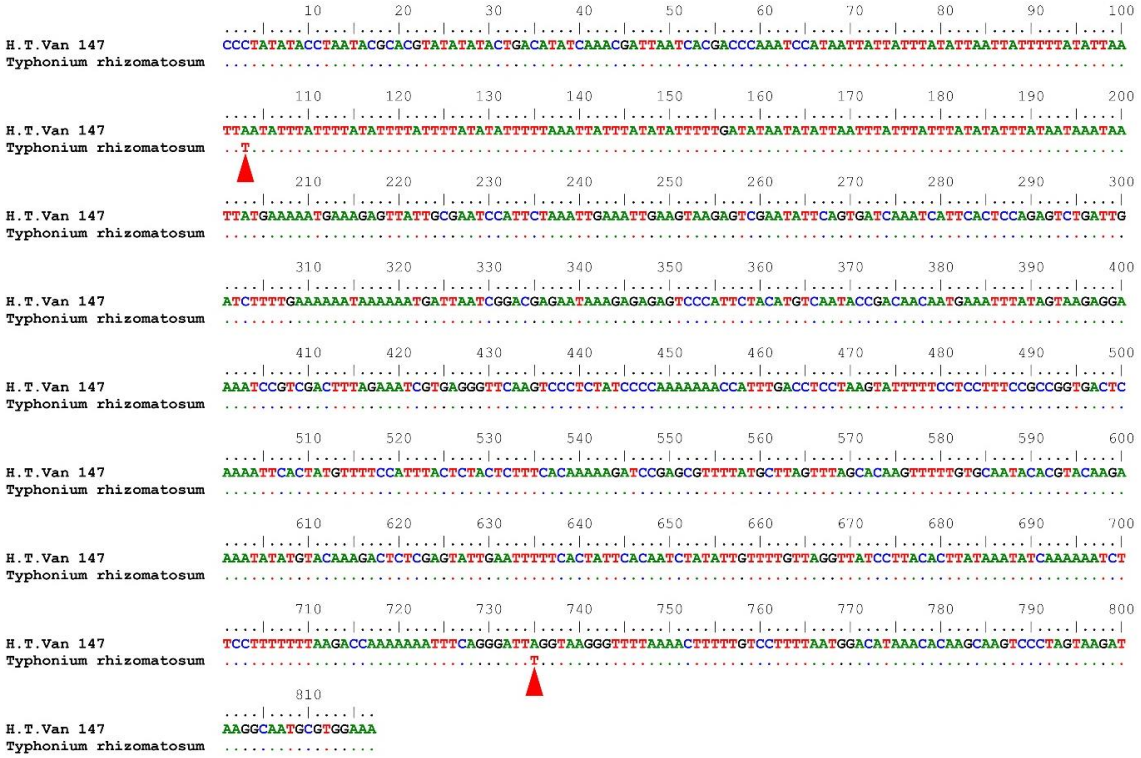

Figure 1. The pairwise alignment of the *trn*L-F region between our plant (*H.T.Van 147*) and *Typhonium rhizomatosum*. The homologous positions (matches) are shown by the dots (.). The positions of mismatches are shown by the red arrows

The obtained results show obviously that our plant is not significantly genetically different from *T. rhizomatosum* as their percent identity is less than that for different

collections in other *Typhonium* species. For example, the sequences of tRNA-Lys (*trn*K) and maturase K-like (*mat*K) of the GenBank accessions EU886571.1 and KC434102.1, respectively, of *Typhonium trilobatum* contain up to 21 mismatches out of total 2,474 nucleotides (percent identity = 99.19%). In another case, the GenBank accessions MH748876.1 and AM920630.1 of *Typhonium blumei* have a percent identity of 99.61%, i.e. 3 mismatches in a total of 771 nucleotides compared.

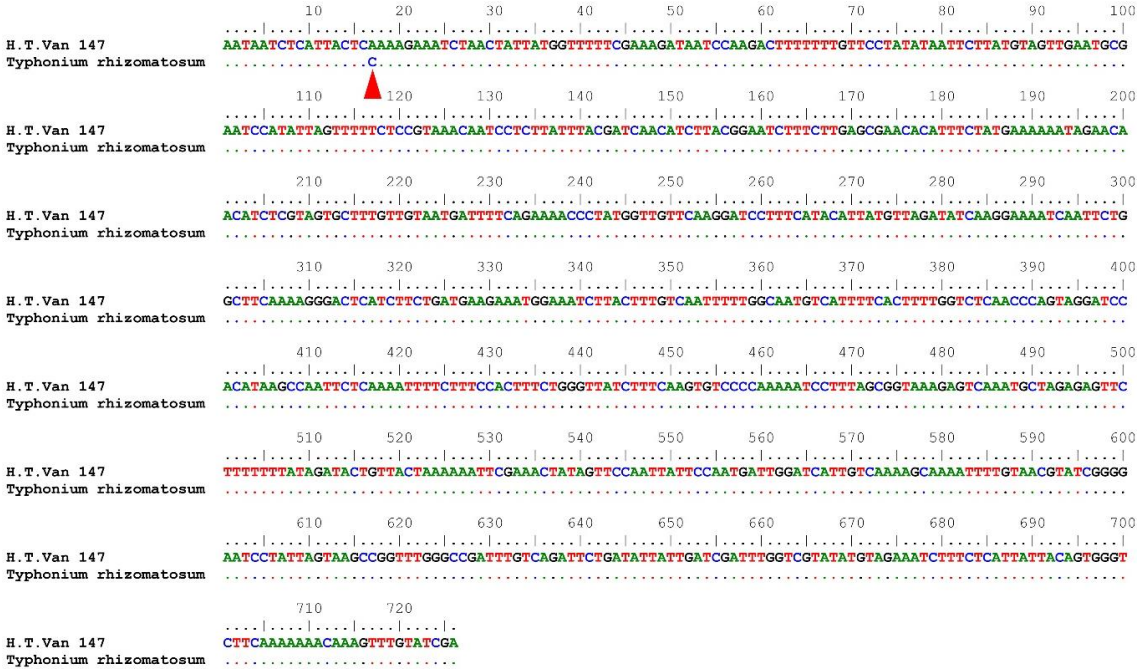

Figure 2. The pairwise alignment of *mat*K region between our plant (*H.T.Van 147*) and *Typhonium rhizomatosum*. The homologous positions (matches) are shown by the dots (.). The position of the mismatch is shown by the red arrow

Morphologically, the Vietnamese plant shares all key taxonomic characteristics of *T. rhizomatosum* as described below. Although our plant has narrower spathe limb (0.9–1.5 cm vs. 2–2.5 cm wide in *T. rhizomatosum*) and flatter and yellow staminodes (vs. slightly flat and creamy staminodes in *T. rhizomatosum*), these differences should be considered as intraspecific variation.

CONCLUSION

Both molecular and morphological evidences confirm that our plant belongs to *T. rhizomatosum*. This is the first time the taxon has been recorded in Vietnam. Its often appearance in artificial habitats may indicate that it has been dispersed in Vietnam via the transport of ornamental works and become locally naturalized. It is described below based on the fresh Vietnamese collection.

Typhonium rhizomatosum A.Galloway & P.Schmidt. Aroideana 35: 59. (Fig. 3)

Herb, tuber globose to subglobose, ca. 1.5–2 cm in diameter, ca. 1.4 cm high, producing rhizomatous offsets ca. 2–3 mm in diameter and many filiform roots. Leaves 2–3 (–4), petiole smooth, slender, 6–16.5 cm long, ca. 2–3 mm in diameter, pale green. Leaf blade ovate to elliptical–ovate, 5.5–15.5 cm long, 4–9.5 cm wide, dark green above, pale green beneath, base cordate, asymmetrical when mature; midrib impressed adaxially and prominent abaxially, lateral veins 5–7, collective veins at 2–5 mm from the margin. Inflorescences solitary; proceding the leaves,

peduncle subterranean, pale green to white, ca. 1.5 cm long, ca. 2–3 mm in diameter, spathe 8–10 cm long, spathe base subglobose, convolute, ca. 1 cm long, ca. 6 mm in diameter, outside bright pale green with brown longitudinal veins, inside brown to pale green, separated from the limb by a constriction; spathe limb lanceolate, 7–8.5 cm long, ca. 0.9–1.5 cm wide, straight or sometimes curved backward, pale dirty green with purplish brown outside, dark reddish purple inside; spadix shorter than spathe, 7–8.5 cm long, female zone shortly conical, ca. 1.5–2 mm high, ca. 4 mm in diameter, with 3 rows of crowded pistils, creamy white; ovary elongate obovate, ca. 1.5 mm high, ca. 0.5 mm in diameter, cream to pale yellow–white, style absent; stigma disciform, 0.2 mm diameter, cream to pale yellow–white, ciliate; sterile zone above female zone, ca. 7 mm long, upper part naked, dark pink, lower part covered with staminodes ca. 2.5 mm high, ca. 4.5 mm in diameter; staminodes densely arranged, yellow, claviform, flattened, surface echinate, apex obtuse, 2–3 mm long, 0.5 mm in diameter, perpendicular to the spadix axis; male zone cylindrical, ca. 3.5–4 mm long, ca. 2–3 mm wide, stamens densely arranged, light yellow, thecae opening apically by oval pore; appendix sessile, 5–6 cm long, conical, base truncate, top acute, surface smooth, beige. Fruits not seen.

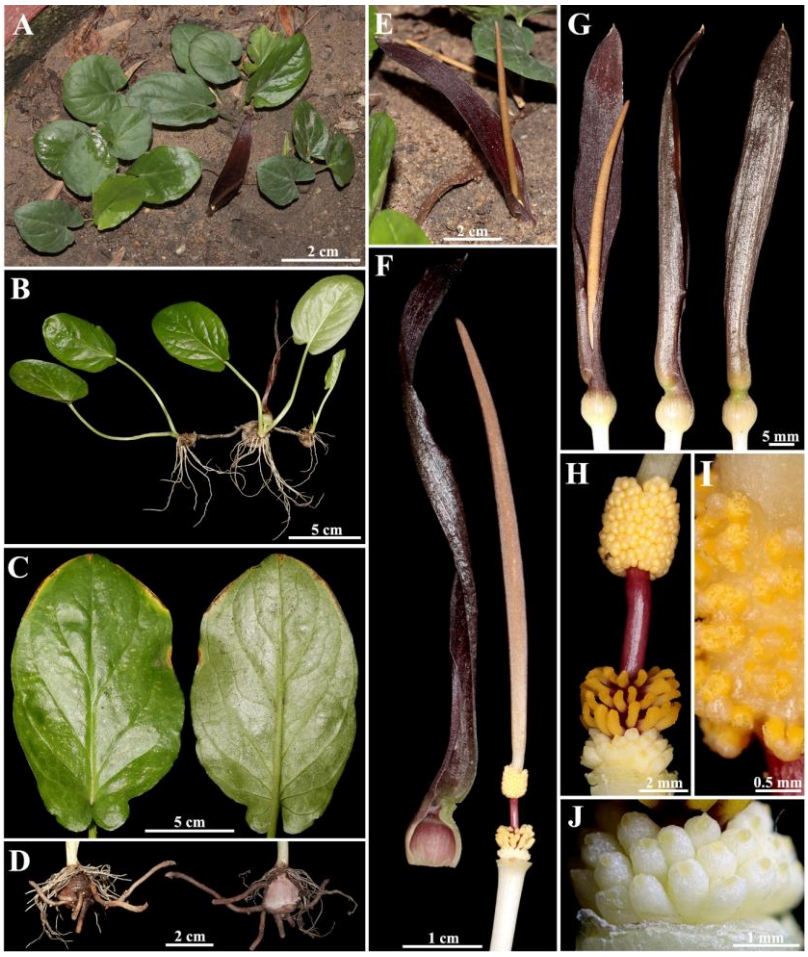

Figure 3. Typhonium rhizomatosum. A. Habit; B. Whole plant; C. Leaves; D. Tubers; E. Inflorescences; F. Spadix; G. Spathe, different views; H. Female, sterile and male zones; I. Stamens with open anthers; J. Female flowers

Type: *Galloway AGA-1326-01-T* (holotype, QBG, spirit collection).

Studied specimens: *Nga Nguyen-Phi H.T.Van 147* (SGN! & PHH!), Ngai Tu Ward, Tam Binh District, Vinh Long province, approximately 9º58'23"N, 105º54'40"E.

Ecology: The plant appears to adapt to a cultivated environment. In Vietnam, they are found growing under the ornamental plants in pots or parks. They often form large colonies on fertile soil under shaded areas thanks to rhizomatous offsetting.

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