

# A reclassification of *Sauromatum* Schott and new species of *Typhonium* Schott (Araceae)

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## ABSTRACT

The generic status of *Sauromatum* is discussed and as a result it is merged into *Typhonium*, resulting in two new combinations. Additionally, two new species of *Typhonium* are described.

## INTRODUCTION

Recently a revision of the genus *Typhonium* Schott was published (Sriboonma *et al.*, 1994) in which the genus *Sauromatum* was compared to *Typhonium* and kept separate from it on one character only, *viz.* the leaves developing from the underground tuber only after the inflorescence has developed, whereas in *Typhonium* species inflorescence and leaf (leaves) are said to develop simultaneously. This distinction is only partly true since *Sauromatum* (*S. brevipes* (Hook.f.) N.E. Br. behaves exactly like *Typhonium* *s.s.*) while in *Typhonium* some species flower before the leaves develop. In Mayo *et al.* (1997) the genera *Sauromatum* and *Typhonium* ("except *Typhonium hirsutum*", see p. 87, key) are kept separate solely on the basis of the spathe base being connate (*Sauromatum*) or convolute (*Typhonium*). The genus *Lazarum* A. Hay (Hay, 1992) was kept separate from *Typhonium* on the same basis and one additional, then unique, character (septate spathe base) but was later (Hay, 1997) merged with it, thus underlining the relative taxonomic unimportance of the spathe-base closure in separating genera in this alliance (*cf.* the

situation in *Biarum* Schott). Nevertheless Wang & Li (1999) used the spathe base connation character combined with flowering behaviour to indicate the generic status of their new species *Sauromatum gaoligongense* Wang & Li.

## SAUROMATUM AND TYPHONIUM

### Historical background

Schott (1832) proposed *Sauromatum* as a new genus based on *Arum guttatum* Wallich (1831, *non* Salisbury 1796) and *Arum pedatum* Link. It was classified in his subtribe *Euaroideae* together with *Arum* L., *Biarum* and *Typhonium*. From the first two genera it was separated by having staminodes only grouped below the male flowers and not also above the male flowers (as in *Arum* and some *Biarum*). Schott separated *Sauromatum* from *Typhonium* by the connate spathe base, distant staminodes, the ovaries possessing two rather than one ovule, the leaf appearing after the inflorescence and being pedate rather than entire and the peduncle being very short. To Schott's species (*S. guttatum* and *S. pedatum*) many were added in subsequent years but mostly reduced again to *S. venosum* (Dryand. ex Aiton) Kunth, with the exception of *S. brevipes*. *Sauromatum horsfieldii* Miq. was transferred to *Typhonium* by van Steenis (1948). Recently, Wang & Li (1999) published *Sauromatum gaoligongense*, a species found in Yunnan. As a result three

species remain in *Sauromatum*, viz. *S. venosum*, *S. brevipes* and *S. gaoligongense*.

Since Schott's time the genus *Typhonium* has been expanded to a total of ca. 40 species (Sriboonma *et al.*, 1994) but numerous new species from Thailand (Hettterscheid & Sookchaloem, in prep.) and elsewhere await publication.

### What are the differences?

Brown (1903) transferred Hooker's *Typhonium brevipes* to *Sauromatum* stating that Hooker had overlooked the connate spathe base "the distinctive character of *Sauromatum*", whereas the spathe base in *Typhonium* is convolute. Apparently Brown did not consider the relative timing of flowering and leaf development important. Hooker (1904) brought the latter character to attention when discussing *S. brevipes* in relation to *Typhonium* and states that the simultaneous flowering and leaf development in this species "suggests the expediency of the two genera being united". As a result *Sauromatum* and *Typhonium* could at that time only be separated by this single spathe base character. Surprisingly no subsequent author considered the taxonomic value of this character in both genera, although Murata & Mayo (1991) suggested that this problem needed to be looked into when *Typhonium* would be revised. This suggestion was brought about by the finding of the remarkable *Typhonium hirsutum* (S.Y. Hu) Murata & Mayo, which exhibits a partly connate spathe base but otherwise shows all the "classic" characters of *Typhonium*. Recently Hay (1997) merged the genus *Lazarum* (Hay, 1992) with *Typhonium*, thereby including yet another species with a closed spathe-base.

A revision of *Typhonium* has been undertaken recently by Sriboonma *et al.* (1994) but despite Murata & Mayo's (1991) suggestion, *Sauromatum* was not included in this revision nor extensively commented upon. The authors consider that *Sauromatum* should remain separate from *Typhonium* on the basis of the former's flowering behaviour judging from their

statement on p. 277 that *Sauromatum horsfieldii* Miq. "is not *Sauromatum*, in which the inflorescence always precedes the leaves, but a species of *Typhonium*, . . . "It is remarkable therefore that *S. brevipes*, which evidently follows the *Typhonium* flowering behaviour, is not included at all in any discussion by the authors, although it was originally described as a species of *Typhonium* (Hooker, 1893). Equally remarkable is the fact that no species of *Sauromatum* is involved in their phylogenetic analysis, whereas it seems unavoidable that at least one such analysis should have been performed using *Sauromatum* as an outgroup. Instead, only *Arum* is used as an outgroup, which seems a debatable choice since at the higher level of subfamily *Aroideae* this evokes quite a number of unnecessary hypotheses of paralellism between *Sauromatum* and *Typhonium*.

*Typhonium* shows quite a remarkable pattern of variation in spathe and spadix morphology. The spadix of *Sauromatum venosum* (Fig. 1) shows all the typical *Typhonium* characters and bears a remarkable resemblance to that of *T. giganteum* (Fig. 2) and *T. hirsutum* (Fig. 3). *Sauromatum brevipes* is morphologically very similar to *T. horsfieldii*, as is *S. gaoligongense*.

Species of *Typhonium* usually flower alongside the developing leaves. In several species however (*T. hirsutum*, *T. brevopilosum*, several undescribed species from Thailand and Vietnam) the leaves are still very immature when the plants flower. In others [*T. mirabile* (A. Hay) A. Hay, *T. praetermissum* (A. Hay)] the inflorescences develop before the leaves, or both states occur in the same species (two new, as yet undescribed species from Thailand, *T. roxburghii* Schott (Fig. 4), *T. circinnatum*). These observations indicate that flowering before the leaves is not a sufficient character to separate genera from *Typhonium*.

A few preliminary phylogenetic analyses of a character matrix including all *Typhonium* and *Sauromatum* species (62 species and 12 morphological characters)



Fig. 1. *Typhonium venosum*: spadix base (spathe cut lengthwise). Photo: B. v.d. Zwaan.



Fig. 2. *Typhonium giganteum*: spadix base (spathe cut lengthwise).

consistently show a group of species well-nested in *Typhonium*. This group consists of *T. (S.) venosum*, *T. (S.) brevipes*, *T. (S.) gaoligongense*, *T. hirsutum*, *T. brevipilosum*, *T. borsfieldii* and *T. giganteum*. Characters used in this analyses were:

1. shape of underground parts
2. shape of leafblade
3. presence/absence of indumentum
4. closure of spathe base
5. shape of spathe limb
6. shape of appendix
7. types of staminodes
8. shape of lower staminodes
9. morphological change from lower to upper staminodes (when different)
10. shape of upper staminodes in comparison to lower ones
11. spathe base presence during fruiting
12. temporal development of leaf in relation to inflorescence

In several personal communications we

have learned from Dr. V. Soukup (USA) that a chemical difference exists between *T. (S.) venosum* and other species of *Typhonium*. His chemical analyses of acid content of seeds of *Typhonium* species show that *T. (S.) venosum* curiously lacks a certain acid that is present in all other species of *Typhonium* that have been screened. However, since this character seems to be an autapomorphy for *T. venosum*, it is uninformative in phylogenetic matters at this level of comparison between *Sauromatum* and *Typhonium*.

On the basis of what has been said above, *Sauromatum* should not retain its generic status but should be merged with *Typhonium*. This requires the following nomenclatural changes:

***Typhonium brevipes*** Hook. f., Fl. Brit. Ind. 6: 511 (1893)—*Sauromatum brevipes* (Hook. f.) N.E. Brown, Gard. Chron. III, 34(2): 93 (1903); Hook. f., Bot. Mag. t. 7940 (1904); Engler,



Fig. 3. *Typhonium hirsutum*: spadix base (spathe cut lengthwise).

Pflanzenr. IV.23F (Heft 73): 127 (1920). Syntypes: Darjeeling, 7,500 ft., Clarke 26708 (K!); Jore Pokri, 7600 ft, Gammie s.n. (K!).

***Typhonium gaoligongense*** (Wang & H. Li) Hett. & P.C. Boyce **comb. nov.** Basionym: *Sauromatum gaoligongense* Wang & H. Li., Acta Bot. Yunn., suppl. 11: 61 (1999). Type: China, Yunnan prov., Boashan Xian, *Li Heng & G. Ruckert 11309A* (KUN).

***Typhonium venosum*** (Dryand. ex Aiton) Hett. & P.C. Boyce **comb. nov.** Basionym: *Arum venosum* Dryand. ex Aiton, Hort. Kew. 3: 315 (1789); Willd., Spec. 4: (1805) 497—*Desmesia venosum* (Dryand. ex Aiton) Raf., Fl. Tellur. 3: 63 (1837)—*Sauromatum venosum* (Dryand. ex Aiton) Kunth, Enum. Pl. 3: 28 (1841)—*S. guttatum* (Wall.) Schott var. *venosum* (Ait.) Engl., Pflanzenr. IV.23F (Heft 73) (1920) 125—Type: Plant of unknown origin introduced into cultivation at



Fig. 4. *Typhonium roxburghii*: flowering before leaf development.

Kew by William Malcolm in 1774 (BM, holo $\dagger$ ).

*Arum fugax* Salisb., Prodr. Stirp. Chap. Allerton: 260 (1796), *nom. illeg.*

*Arum pedatum* Willd., Enum. Pl., Suppl. 54 (1814)—*Sauromatum pedatum* (Willd.) Schott in Schott & Endl., Melet. Bot.: 17 (1832)—*Alocasia pedata* (Willd.) Raf., Fl. Tellur. 3: 64 (1837)—*S. guttatum* (Wall.) Schott var. *pedatum* (Willd.) Engl., Pflanzenr. IV.23F (Heft 73): 125 (1920).

*Arum pedatum* Fisch. Ex Spreng., Syst. Veg. 3: 769 (1826), *non* Willd. (1814), *nom. illeg.*

*Arum clavatum* Desf., Tabl. École Bot., ed.3: 385 (1829).

*Arum guttatum* Wall., Plant. Asiat. Rar. 2: 10, t. 115 (1831)—*Sauromatum guttatum* (Wall.) Schott in Schott & Endl., Melet. Bot.: 17 (1832), *nom. illeg.* based on *Arum guttatum* Wall. *non* Salisb.



Fig. 5. *Typhonium brevipilosum*: habit.

*Arum sessiliflorum* Roxb., Fl. Ind., ed.1832, 3: 507 (1832)—*Sauromatum sessiliflorum* (Roxb.) Kunth, Enum. Pl. 3: 28 (1841) — *S. guttatum* (Wall.) Schott var. *sessiliflorum* (Roxb.) Engl., Pflanzenr. IV.23F (Heft 73): 125 (1920).

*Sauromatum abyssinicum* Schott, Syn. Aroid.: 25 (1856).

*Sauromatum nubicum* Schott, Syn. Aroid.: 25 (1856).

*Sauromatum punctatum* K. Koch, Wochenschr. Gärtnerei Pflanzenk. 1: 263 (1858).

*Sauromatum simlense* Schott, Oesterr. Bot. Z. 8: 349 (1858)—*S. guttatum* (Wall.) Schott var. *simlense* (Schott) Engl., Pflanzenr. IV.23F (Heft 73): 125 (1920).

*Sauromatum pulchrum* Miq., Ann. Mus. Bot. Lugduno-Batavi 1: 221 (1864)—*S. guttatum* (Wall.) Schott var. *pulchrum* (Miq.) Engl., Pflanzenr. IV.23F (Heft 73): 125 (1920).

*Sauromatum angolense* N.E. Br.in Oliver, Fl. Trop. Afr. 8: 142 (1901)—*S.*



Fig. 6. *Typhonium brevipilosum*: spadix base (spathe cut lengthwise).

*nubicum* Schott var. *angolense* (N.E. Br.) Engl., Pflanzenr. IV.23F (Heft 73): 126 (1920).

*Jaimenostia fernandopoana* Guinea & Gómez Mor. In E. Guinea, Ensayo Geobot. Guin. Continent. Espan.: 248 (1946).

#### NEW SPECIES OF *TYPHONIUM*

*Typhonium brevipilosum* Hett. & Sizemore **sp. nov.** a *Typhonio hirsuto* spatha laevi nec hirsuta, folio perfecte pedato foliolis plus quam quinque habenti, appendice minus robusta differt. Typus: Indonesia, Sumatera, West Sumatera, near Aeksah, *Hetterscheid H.AR.097-T* (orig. coll. *Sizemore s.n.*) flowered in cult. in Leiden Bot. Garden, 29 November 1999 (holotypus L, spirit coll.). Figs. 5, 6.

Tuber depressed globose, to ca. 6 cm in diam., to ca. 4 cm high, developing several seasonal offsets, these broadly and shortly fusiform and covered with strong, nearly

woody scales. Leaf solitary or paired; petiole to 50 cm long, 1 cm in diam., pale green with or without indistinct greyish spots, surface more or less densely set with short (ca. 0.5 mm) hairs; leaf-blade deeply pedatisect; leaflets elliptic lanceolate, to 30 cm long, to 10 cm in diam., acute, bright pale green, upper and lower surface covered with short hairs. Inflorescence solitary, developing alongside young, immature leaf (the latter maturing after flowering), short pedunculate, base covered by three rather large, visible cataphylls; cataphylls broadly triangular-ovate, the largest 10 cm long, 4 cm in diam. at the base, outside dark greyish brown, covered with acute, translucent, sometimes acicular hairs. Peduncle very short, subterranean, ca. 0.5 cm long, ca. 0.8 cm in diam., pale green, covered with hairs as on the cataphylls. Spathe elongate elliptic, 20–23 cm long, 9–10 cm in diam., base and limb separated by a strong constriction, base ovate, ca. 4 cm long, ca. 2.5 cm in diam., outside pale green, smooth, inside grooved, glossy pale purple, upwards near the constriction turning pale green; limb 19 cm long, oblique, acute, outside smooth, glossy pale green with a purple flush, inside smooth, dull purplish brown, near the base pale green. Spadix shorter than spathe, ca. 18 cm long; female part conical, ca. 0.7 cm long, ca. 1.1 cm in diam., flowers congested; sterile part between female and male part 4 cm long, the lower 0.5–1 cm with staminodes, the remainder naked, white, longitudinally grooved; male part cylindrical, ca. 2 cm long, ca. 0.8 cm in diam., base and top oblique, flowers congested; appendix very shortly stipitate, elongate cylindrical-conical, ca. 11 cm long, ca. 1 cm in diam. at the base, top obtusish, base truncated, surface shallowly, irregularly furrowed, pale reddish brown, producing a strong, unpleasant smell at female anthesis and warming up. Ovaries elongate, cylindrical, 3 mm long, 1.4 mm in diam., subangulate, white with a faint purple flush near the top, unilocular, with one or two basal ovules; stigma sessile, large, depressed-hemispheric, 1–1.5 mm diam., ca. 1 mm high, densely

verruculate, white. Stamens 1.5–2 mm long, pale yellow; thecae fusiform. Staminodes straight or slightly curved, fusiform conical, to ca. 1 cm long, 3 mm in diam., top sometimes laterally compressed, purplish, acute or subacute.

Notes—this species is closely related to *T. hirsutum* from N. Thailand and Yunnan. The leaf of *T. brevipilosum* bears a remarkable resemblance to that of *T. (Saurromatum) venosum*, except for the hairs being absent in the latter and a different colour pattern on the petiole. A considerable geographic gap exists between the alleged sister-species *T. brevipilosum* and *T. hirsutum*.

***Typhonium circinnatum* Hett. & J.**

Mood **sp. nov.** ab omnibus speciebus ceteris generis *Typhonii* folio superficie superiore clare cinereo-virenti, limbo spathae valde circinatim resiliendi, staminodiis pergrandibus irregulariter conicus vel cubiformis distinguibilis. Typus Vietnam, Dak Lak, Dray Sup area, secondary forest, 1990, *Hetterscheid H.AR.258-T* (orig. coll. *Adams s.n.*) flowered in cult. in Leiden Bot. Garden, (holotypus L, spirit coll.). Figs. 7, 8, 9.

Underground part a short tuberous rhizome, ca. 2 cm long, 1.5 cm in diam. Petiole to 6 cm long, 0.4 cm in diam., smooth, pale green; lamina elliptic ovate, to 15 cm long, to 10 cm in diam., base cordate, margins overlapping, top acute, upper surface with impressed venation, bright greyish blue-green. Inflorescence appearing before or simultaneous with the leaves; peduncle hidden in the soil, 1–2 cm long, ca. 0.3 mm in diam., pale green; spathe 10–23 cm long, base and limb separated by a constriction, base broadly ovate, 1.3–2.5 cm long, 1–1.5 cm in diam., outside glossy pale green, inside as outside but dull, limb lanceolate, acute, base widened to ca. 1.5 cm, upper part tapering to the top, acute, very strongly circinnately recoiled over the entire length, outside glossy bronze coloured, inside lower part dull purple, upper part silvery bronze. Spadix as long as the



Fig. 7. *Typhonium circinnatum*: habit.



Fig. 8. *Typhonium circinnatum*: inflorescence.



Fig. 9. *Typhonium circinnatum*: spadix base (spathe cut lengthwise).

spathe, sessile; female zone cylindrical, 2–3 mm long, ca. 3 mm in diam., consisting of only 2 “rows” of flowers, these congested; sterile part 1.5–2.5 cm long, base with a few distant or more congested staminodes, remaining part naked, smooth; male zone cylindrical, ca. 3 mm long, ca. 3 mm in diam., flowers congested; appendix filiform, slightly attenuate at the base, top acute, ca. 8–20 cm long, 2 mm in diam., smooth, creamy yellow. Ovaries elongate, 1.4 mm long, 0.8 mm in diam., unilocular, uni-ovulate, top tapering to the stigma, whitish green; stigma sessile, depressed, ca. 0.2 mm high, ca. 0.5 mm in diam., rugulose. Male flowers butterfly-shaped in cross-section, truncate, pinkish orange, connective not raised. Staminodes clavate, lower part thin, stalk-like, sometimes dichotomous, to ca. 1 mm long, ca. 0.3 mm in diam., dark purple, upper part hugely swollen, conical, angulate-ovate or cubic, base truncated, top truncate or subacute, 2–3 mm long, ca. 2 mm in diam., surface shallowly rugulose, greyish brown. Berries elliptic, 7 mm long, 4 mm in diam., one-seeded; seeds orbicular or slightly cordate, laterally flattened, 3 mm long, 2.5–3 mm in diam., blackish.

Note—a most remarkable species because of the highly ornamental greyish blue-green upper leaf surface, the uniquely circinnately recoiled spathe-limb and the large staminodes. The flowering behaviour (with or without leaves) is an intermediate situation between “typical” *Typhonium* (leaf and inflorescence simultaneous) and what is found in e.g. *T. (Sauromatum) venosum* [flowering before the leaf (see above)].

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