

THE GENUS *TYPHONIUM* (ARACEAE–AREAE) IN AUSTRALASIA

A. HAY

Royal Botanic Gardens, Mrs Macquarie's Road, Sydney 2000, Australia

SUMMARY

The genus *Typhonium* (Araceae–Areae) is revised for Australasia. Fourteen species are recognised. Two are introduced. Of the twelve indigenous, eleven are endemic to the region. Six are new to science. *Typhonium millarii* F.M. Bailey is reduced to synonymy with *T. angustilobum* F. Muell. Illustrations and distribution maps are provided. Keys are given to the genera of geophytic Aroideae in Australasia and to the species of *Typhonium*. Apparent affinity between two new Australian *Typhonium* species and the Indian genus *Theriophonum* is noted. It is suggested that Australasian representation of Areae is mostly autochthonous and ancient rather than immigrant and comparatively recent in origin.

INTRODUCTION

Typhonium Schott is a genus of about 40 species of rhizomatous and cormous saproentomophilous geophytes distributed through southern, southeastern and eastern Asia, Malesia and Australia. Biogeographically its interest lies in its fairly strong representation in Australia as well as mainland Asia, compared with its weak representation in the intervening Malesian Archipelago, where there are apparently only three endemic species, *T. fultum* Ridley, *T. filiforme* Ridley (both Peninsular Malaysia) and *T. horsfieldii* (Miq.) Steenis (Sumatra, Java) (Van Steenis, 1948). It is the only aroid genus to show this pattern, and the only polytypic aroid genus better represented in Australia than in New Guinea. The tribe to which it belongs, Areae (sensu Grayum, 1990; = Arinae sensu Engler, 1920), is one of the most widely distributed of the family, occupying an area from Macaronesia, Norway and Japan, to Angola, Sri Lanka and South East Australia. *Typhonium* is its largest genus. The recent discovery of a new genus of Areae, *Lazarum* A. Hay, endemic to Australia, has led Hay (1992a) to propose a Gondwanan origin for the tribe, in spite of its mainly boreal distribution. In consequence, it is also proposed that the species of *Typhonium* endemic to the Australasian region may be autochthonous rather than the new arrivals necessitated by the idea that the Areae are both boreal and comparatively recent in origin [a similar case has been made for the Araceae-Lasiinae in Malesia (Hay, 1992b)]. The discovery of two new species in northwestern Australia which bear distinct similarity to members of the Indian genus *Theriophonum* may also support the contention that Areae are Gondwanan in origin and that *Typhonium* is autochthonous in Australasia (see under *T. nudibaccatum* A. Hay). The other genera in the tribe are *Arum*, *Biarum*, *Dracunculus*, *Eminium*, *Helicodiceros* and *Sauromatum*.

TAXONOMY

Among the Asian species, some problems are encountered in separating the genus from *Sauromatum* Schott (see Murata, 1990; Murata & Mayo, 1991; Hay, 1992a). *Typhonium* includes about as much diversity as the rest of the Araceae together, and is possibly paraphyletic. No attempt is made here to erect a formal infrageneric classification, as the Asiatic species, which are more numerous and which manifest a different and possibly greater range of diversity, are presently under review by Murata. Murata (1990) has already shown Engler's (1920) infrageneric system for *Typhonium*, which was based on the shape of the sterile organs of the spadix, to be inadequate.

Features not previously used in the classification of *Typhonium* include orientation of the pistils (acroscopic vs plagioscopic; see Key to the species below) and the persistence or otherwise of the lower part of the spathe in infructescence. The importance of shoot architecture, affirmed here, has been highlighted by Murata (1990) and Murata & Mayo (1991). Form of the stem (which is at least partly independent of shoot architecture *per se*), falling into three categories in the Australasian members of the genus (globose-cormous; creeping-rhizomatous; irregular cormous and stoloniferous) also appears to be of importance.

In this account the species are informally grouped according to perceived affinities within the Australasian region. The groups are:

- 1) The 'Spathulati group' characterised by flattened sterile organs and a stoloniferous rootstock. One species, *T. flagelliforme*, the most widespread species in the genus, found from Indomalaysia to tropical Australia.
- 2) The 'Nudibaccati group' characterised by distally swollen sterile organs, acroscopic pistils, wholly withering spathes and globose-cormous rootstock. Two species endemic to tropical northwestern Australia.
- 3) The 'Brownii group' characterised by globose-cormous or rhizomatous rootstock, leaves produced before (but accompanying) the inflorescence, plagioscopic pistils, the sterile interstice bearing filiform sterile organs basally and either naked or with papillate sterile organs above, the lower part of the spathe (where known) persistent in fruit. Eight species, all but two tropical, all but one endemic to Australia.
- 4) The 'Liliifolii group' similar to the preceding one but apparently producing, after dormancy, both inflorescence and foliage simultaneously, and having linear-lanceolate leaf blades. A single species endemic to tropical northwestern Australia.

Literature citations, both for the genus and the species, are restricted to those relevant to the region. Likewise features in the generic description do not fully take into account diversity in Asiatic species. Confusion surrounding the taxonomy and nomenclature of four of the commonest species, of which three are present in Australasia, has been clarified by Nicolson & Sivadasan (1981).

In the Australasian region the genera of Araceae most closely allied to *Typhonium* (i.e., other deciduous geophytes of the subfamily Aroideae sensu Grayum, 1990; Bogner & Nicolson, 1991; Hay & Mabberley, 1991) are *Lazarum* (see Hay, 1992a) and *Amorphophallus* (see Hay, 1988, 1990), the latter in the Thomsonieae.

KEY TO THE GENERA OF GEOPHYTIC AROIDEAE IN AUSTRALASIA

- 1a. Leaf solitary, highly compound, not accompanying flower or fruit; male and female zones of spadix contiguous; seed exalbuminous **Amorphophallus**
- b. Leaves paired to clustered, simple and entire to deeply trilobed, accompanying flower and/or fruit; male and female zones of spadix separated by a zone of naked spadix axis and/or a zone of sterile organs; seed copiously albuminous 2
- 2a. Inflorescence appearing without leaves; spathe tubular in lower part, septate within
Lazarum
- b. Inflorescence accompanying leaves; spathe convolute in lower part, not septate
Typhonium

TYPHONIUM

Typhonium Schott, Wiener Z. Kunst 3 (1829) 732; Aroideae 2 (1855) 11; Syn. Aroid. (1856) 18; Prod. Syst. Aroid. (1860) 105; Benth., Fl. Austral. 7 (1878) 153; Engler in DC., Monogr. Phanerog. 2 (1879) 609; Bailey, Synopsis Qld. Fl. (1883) 569; Moore & Betche, Handb. Fl. N. S. W. (1893) 428; Bailey, Qld. Fl. 5 (1902) 1694; Engler in Engler, Pflanzenreich 73 (IV. 23F) (1920) 108; Harris, Wildfl. Austral. (1947) 177; Evans, Contrib. N. S. W. Nat. Herb. Flora Series 22 (1962) 12; Beadle et al., Handb. Vasc. Pl. Sydney Dist. & Blue Mts (1963) 452; Fl. Sydney Region ed. 2 (1973) 553; ed. 3 (1982) 553; Hay in Johns & Hay, Stud. Guide Monoc. Papua New Guinea 1 (1981) 83; Nicolson & Sivadasan, Blumea 27 (1981) 487; Beadle, Stud. Fl. NE N. S. W. 6 (1987) 969; Stanley in Stanley & Ross, Fl. SE Qld. 3 (1989) 272; Hay, Aroids of Papua New Guinea (1990) 94. — Lectotype: *T. trilobatum* (L.) Schott (*Arum trilobatum* L.), selected by Nicolson (1967).

Arum auct. non L.: R. Br., Prod. Fl. Nov. Holl. (1810) 336.

Heterostalis Schott, Oesterr. Bot. Wochenbl. 7 (1857) 261; Gen. Aroid. (1858) t.18; Prod. Syst. Aroid. (1860) 109.

Deciduous or evergreen geophytes; stem a tuberous, sometimes branching, often proliferating rhizome or well-defined hemispherical corm, rarely stoloniferous; leaves few to several together, produced before the inflorescence (simultaneously in *T. liliifolium*?); blades very narrowly lanceolate to elliptic to hastate with broad to linear segments; venation reticulate, often with 2 or 3 submarginal veins present; inflorescence solitary, accompanied by and usually directly subtended by leaves, sometimes directly subtended by cataphylls; peduncle short, usually barely exerted from among the leaf bases; spathe convolute below into a usually swollen, mostly greenish, sometimes ribbed basal portion housing female and sterile organs, separated by a constriction from a narrowly lanceolate to very broad, flag-like, more or less spreading to coiled, often deep purple-brown withering limb; spadix bearing pistils basally, then a contiguous zone of spatulate to filiform neuter organs, then, usually separated from the neuter organs by a naked zone, a staminate zone, then a sometimes stipitate appendix; pistils unilocular, with 1 or 2 basal orthotropous ovules; male flowers 1–5-staminate, with the thecae opening by slits or pores; fruit a berry, usually orange-red, 1- or 2-seeded, usually housed within the enlarged persistent spathe base; seed albuminous, orthotropous, with the coat usually minutely verruculose and longitudinally channelled.



Fig. 1. *Typhonium flagelliforme* (Lodd.) Blume (Hay & Taylor 7061). a. Rootstock; b. flowering shoot; c. spadix; d. pistil; e. male flower. - Scale: bar to a, b = 2 cm; to c = 0.8 cm; to d, e = 0.2 cm.

'Spathulati group'

1. *Typhonium flagelliforme* (Lodd.) Blume – Fig. 1

Typhonium flagelliforme (Lodd.) Blume, Rumphia 1 (1837) 134; Nicolson & Sivadasan, Blumea 27 (1981) 489, f. 2; Hay, Aroids of Papua New Guinea (1990) 95. — *Arum flagelliforme* Lodd., Bot. Cab. 4 (1819) t. 396. — *Heterostalis flagelliformis* (Lodd.) Schott, Oesterr. Bot. Wochenbl. 7 (1857) 261. — Type: Lodd., Bot. Cab. 4 (1819) t. 396!

Cormous herb forming small colonies by the emission of subterranean stolons; corm c. 2 cm diam.; petiole c. 15–30 cm long, sheathing in lower c. 2/3, often faintly mottled with purple; blade dull mid green above, paler below, elliptic to ovate with the base acute to auriculate to cordate to hastate, c. 6–25 cm long to c. 5 cm wide, the posterior lobes, if present, spreading, up to c. 3 cm long; anterior costa raised abaxially, bearing 2 or 3 primary lateral veins on each side, diverging at an angle of c. 40°; peduncle slender, very short, rarely lifting the inflorescence away from the leaf bases; spathe base longitudinally keeled, greenish white and pinkish, to c. 3.5 cm long; limb narrowly lanceolate, sometimes long-acuminate, 10–25 cm long, spreading, recurved or coiled, greenish abaxially, purplish brown to white adaxially; spadix equalling the spathe, the lowest c. 0.5 cm pistillate, the next c. 2 cm sterile, bearing spreading spatulate black or purple-tipped sterile organs c. 0.6 × 0.2 cm in the lower half, ± narrowly pyramidal to filiform, c. 0.3 cm long in the upper half; the

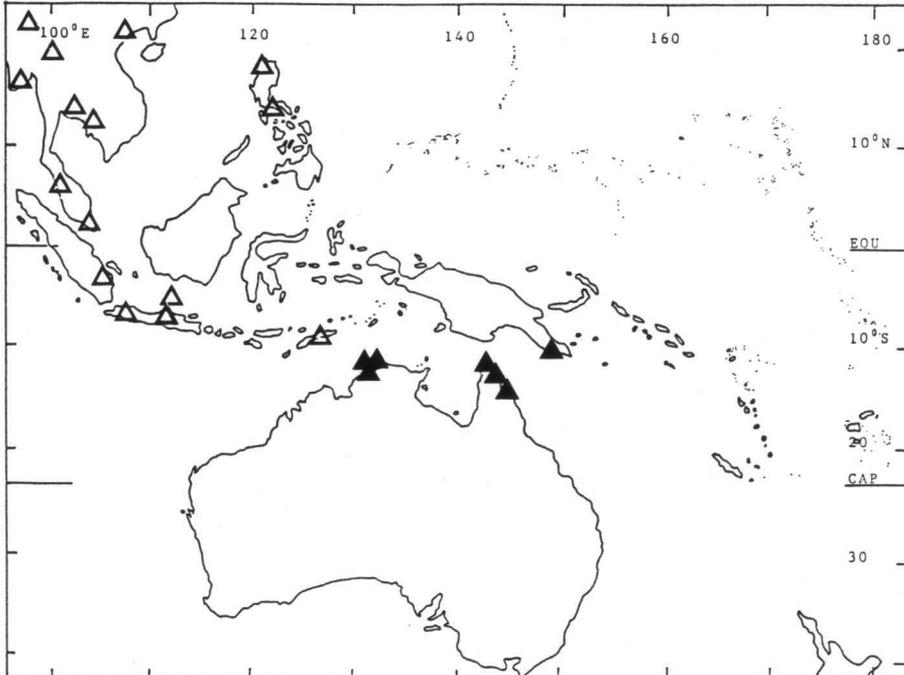


Fig. 2. Distribution of *Typhonium flagelliforme* (Lodd.) Blume; (△) from Nicolson & Sivadasan (1981); (▲) from specimens examined. Additional localities in India, Sri Lanka and Bangladesh.

spadix then staminate for c. 0.5 cm, male flowers unistaminate, the stamens yellow with the connective beaked; appendix sessile, to c. 20 cm long, usually rather less, yellowish green, deeply ridged and channelled, usually tapering from the base, rarely stouter about one third along its length.

Distribution – Sri Lanka to Indochina, South Malesia, northern Philippines, southern New Guinea and northern Australia. This species has wide ecological amplitude, occurring from the undergrowth of swamp forest to open monsoonal savannah and eucalypt woodland. It is restricted to the lowlands. – Fig. 2.

Note – *Typhonium flagelliforme* is easily identified by its keeled spathe base, grooved yellowish or greenish appendix and the flattened, purple-tipped lower sterile organs.

Other specimens seen:

PAPUA NEW GUINEA. Central Province: c. 18 mi from Port Moresby along Brown River Rd, NGF 30832, fl. (LAE).

AUSTRALIA. Northern Territory: Port Darwin, Howard Springs, 8/10/24, *Bleeser 84*, fl. (B) & Port Darwin, 1925, *s.n.*, fl. (MEL) & 1/1928, *s.n.*, fl. (DNA, NSW); Black Jungle, Humpty Doo area, 4/12/80, *Dunlop 5629*, fl. (DNA); cult. Berrimah Research Farm ex Brogden Point, 25/11/86, *Gallen 83*, fl. (DNA); Black Jungle, 24/7/91, *Hay & Taylor 7061*, fl. (NSW); Port Darwin, 1890, *Holtze 1036*, fl. (MEL); Black Jungle swamp, 4/2/84, *Jones 1326*, fl. (DNA); Brogden Point, Murganella area, 10/2/84, *Jones 1380*, fl. (DNA); Sand Dunes Littoral Rainforest, Murganella area, 10/2/84, *Jones 1390*, fl. (DNA); Black Jungle, 9/12/84, *Jones 1708*, fl. (DNA); Melville Island, 6 km SE Three Ways, 22/1/88, *Russell-Smith 4567*, fl., fr. (DNA); Black Jungle, 25/4/88, *Russell-Smith 5944* (DNA); nr Koolpinyah Station, 22/1/90, *Russell-Smith 8178*, fl. (DNA); NE Arnhemland, edge of Peter John R. floodplain, 22/1/89, *Russell-Smith 8179*, fl. (DNA); 8 km S of Koolpinyah Station, 10/5/91, *Taylor 59*, fl. (DNA); Howard Springs, *RW 921* (no date) (DNA). — Queensland: Cape York, Iron Range, 24/6/48, *Brass 19314*, fl. (A, BRI); Mutee Head, 2/2/80, *Hyland 10256*, fl. (QRS); Cooktown, edge of Botanic Garden on way to Finch Bay, 2/1985, *Scarth-Johnson 1618A*, fr. (BRI); Cape York, Bamaga Dist., Long Scrub, 2/5/62, *Webb & Tracy 5973*, fl. (BRI).

'Nudibaccati group'

2. *Typhonium nudibaccatum* A. Hay, *spec. nov.* – Fig. 3

Ab aliis speciebus Australasicis cognitis *Typhonii* infructescentia nuda differt; a *T. jonesii* appendice cylindrica sessili differt. — Typus: Australia, Western Australia, North Kimberley, Mitchell Plateau, Camp Creek, c. 1.5 km S of CRA mining camp, *K. Kenneally 7938*, 24/1/82, fl., fr. (PERTH!, holo).

Cormous herb; corm subglobose, c. 2.5 cm diam.; leaves c. 4–7 together, petiole to c. 27 cm long, sheathing in the lower half to one third; blade deeply trilobed with linear segments to hastate or auriculate, rarely elliptic; in the deeply lobed form the anterior lobe c. 8 × 0.5 cm, the posterior lobes c. 3.5 × 0.2 cm or in broad-leaved forms the anterior lobe c. 7 × 3.5 cm and the posterior lobes ± absent to c. 2 × 1 cm; anterior costa with c. 3 primary lateral veins on each side, diverging at an angle of c. 10–30°; inflorescence solitary; peduncle c. 5–10 cm, mostly or entirely below ground; spathe c. 7–11 cm long, the lower c. 1 cm forming a slightly swollen chamber housing the pistils and sterile interstice, separated from the limb by a weak constriction; limb narrowly oblong-lanceolate, to c. 1.6 cm wide, purple adaxially, greenish brown abaxially; spadix 5–9 cm long, the lower c. 0.2 cm pistillate, the insertion

of the pistils virtually basal with the stigmas facing up (as opposed to along the axis of the spadix and facing \pm out); sterile interstice 0.8–1 cm, the lower third to two thirds occupied by rather stout blunt-tipped sterile organs; male zone c. 0.7 cm, cylindrical; male flowers 1–2-staminate; appendix \pm sessile, cylindrical, purple, 4–5 cm diam. at base, c. 3–5 cm long; fruit not accompanied by a persistent spathe base, in a hemispherical to subglobose head, ovoid.



Fig. 3. *Typhonium nudibaccatum* A. Hay (a–f: Kenneally 7560; g: Dunlop 5327). a. Whole plant; b. venation; c. spadix; d. pistils; e. part of sterile interstice; f. male flower; g. infructescence. — Scale: bar to a, f = 1 cm; to b = 0.5 cm; to c = 0.7 cm; to d = 0.1 cm; to e = 0.05 cm.

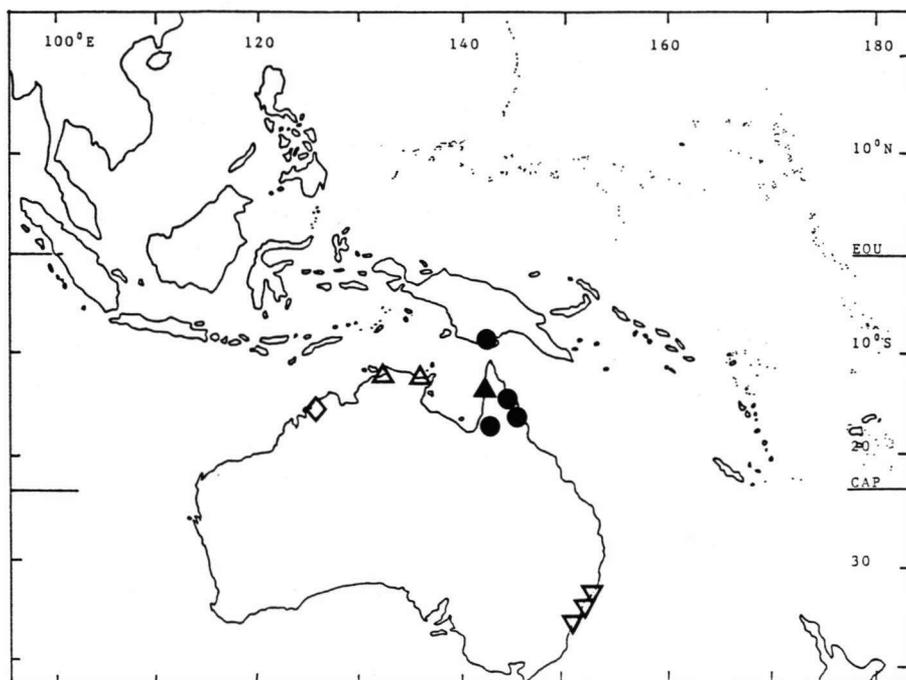


Fig. 4. Distribution of *Typhonium nudibaccatum* A. Hay (◇), *T. weipanum* A. Hay (▲), *T. eliosurum* (Benth.) O.D. Evans (▽), *T. cochleare* A. Hay (△), and *T. angustilobum* F. Muell. (●).

Distribution – Western Australia on the Mitchell Plateau (N Kimberley) in open woodland on ridges and near creek beds, in lateritic soils over basalt. – Fig. 4.

Note – The fruit developing without the protection of a persistent spathe base is unique in the genus in Australasia, as far as is known. However, the spathe base of tropical Asiatic *T. trilobatum* is not persistent (Boyce, pers. comm.), nor is that of Thai '*Arisaema*' *hirsutum* S.Y. Hu (1968: t. XI) [= *T. hirsutum* (S.Y. Hu) Murata & Mayo, though peripheral in this genus and perhaps nearer *Sauromatum*]. This character is also shared by the very closely allied Indian and Sri Lankan satellite genus *Theriophonum* (Sivadasan & Nicolson, 1982). Furthermore, *T. nudibaccatum* also shares the acroscopic pistils of that genus. While it lacks the characteristic apical and basal placentation of *Theriophonum*, it is nevertheless noteworthy that this species occurs in a part of Australia once nearly contiguous with India at the break-up of Gondwana. The pistils of the following species, *T. jonesii*, are also acroscopic, and, while unknown as yet in fruit, it also may be expected not to show a persistent spathe. It is geographically fairly proximate to *T. nudibaccatum*.

Other specimens seen:

AUSTRALIA. Western Australia: N Kimberley, Mitchell Plateau, Heliport, *Beard* 8456, 27/2/79, fl. (PERTH); N Kimberley, Mitchell Plateau, mining camp, *Dunlop* 5327, 28/2/90. fr. (DNA, PERTH); cult. Perth ex Mitchell Plateau, *Kenneally* 7560, 25/4/81, fl. (PERTH); N Kimberley,



Fig. 5. *Typhonium jonesii* A. Hay (Jones 1684). a. Whole plant; b. alternate leaf form and venation detail; c. spadix with spathe partially removed; d. female zone and sterile interstice; e. pistils; f. sterile flower; g. male flowers. — Scale: bar to a, b = 1.8 cm; to c = 1.5 cm; to d = 0.8 cm; to e = 0.1 cm; to f, g = 0.2 cm.

Mitchell Plateau, Camp Ck, c. 1.5 km S of CRA mining camp, *Kenneally 7939*, 24/1/82, fl. (PERTH); NW Kimberley, Mitchell Plateau, tributary of Lawley R., 5 km E of Amax basecamp, *Smith s.n.*, 20/2/79, fl. (PERTH).

3. *Typhonium jonesii* A. Hay, *spec. nov.* – Fig. 5

Ab aliis speciebus Australasicis cognitis *Typhonii* interstitio spadiceis tessellato, floribus sterilibus truncatis, pistillis acroscopicis, appendice conoidea breve stipitata differt. — Typus: Australia, Northern Territory, Melville Island, Hanguana Jungle, *D.L. Jones 1684*, 6/12/84, fl. (DNA!, holo).

Cormous herb; corm subglobose, c. 2.5 cm diam.; leaves c. 4 together, petiole to c. 27 cm long, sheathing in the lower half to one third; blade deeply trilobed with linear segments to hastate or auriculate, rarely elliptic; in the deeply lobed form the anterior lobe to 14 × 1 cm, the posterior lobes to 5.5 × 0.7 cm or in broad-leaved form the anterior lobe c. 7 × 3.5 cm and the posterior lobes ± absent; anterior costa with c. 3 primary lateral veins on each side, diverging at an angle of c. 10–30°; inflorescence solitary; peduncle c. 5–10 cm, mostly or entirely below ground; spathe c. 7–11 cm long, the lower c. 1 cm forming a slightly swollen chamber housing the pistils and sterile interstice, separated from the limb by a weak constriction; limb narrowly lanceolate, to c. 1.6 cm wide, purple within, greenish brown without; spadix 5–9 cm long, the lower c. 0.2 cm pistillate, the insertion of the pistils virtually basal with the stigmas facing up (as opposed to along the axis of the spadix and facing ±

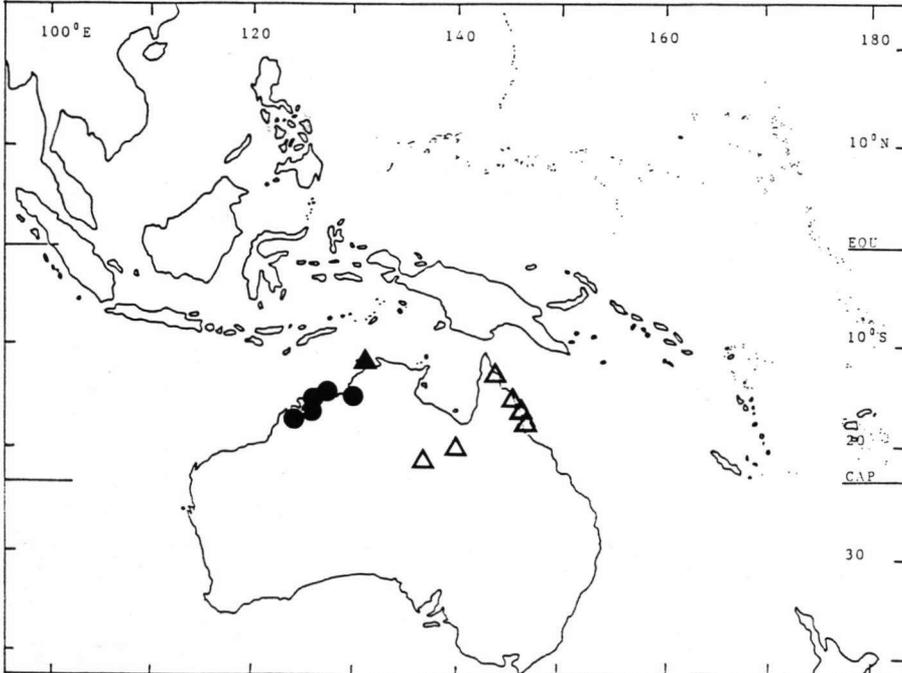


Fig. 6. Distribution of *Typhonium jonesii* A. Hay (▲), *T. alismifolium* F. Muell. (△), and *T. liliifolium* F. Muell. (●).



Fig. 7. *Typhonium weipanum* A. Hay (Morton 1142e). a. Whole plant; b. spadix with part of spathe cut away; c. pistils; d. part of sterile interstice; e. male flowers. — Scale: bar to a = 2 cm; to b = 1 cm; to c, e = 0.1 cm; to d = 0.3 cm.

out); sterile interstice 0.8–1 cm, the lower third to half occupied by stout flat-tipped sterile organs, the rest with a tessellate pattern of flat rudiments; male zone c. 0.7 cm, cylindrical, with the male flowers unistaminate; appendix stipitate, the base transversely truncate, tapering to a point, purple, 0.4–0.5 cm diam. at base, c. 3–5 cm long.

Distribution – Australia: Northern Territory; known only from the type locality in open forest on a lateritic ridge and from Bathurst Island on a dry rocky hill. – Fig. 6.

Note – The tessellate pattern on the sterile interstice appears to be unique in the genus. It becomes more or less undiscernible in dry material. This species is evidently closely related to *T. nudibaccatum*. It is named for D.L. Jones, Australian National Botanic Garden, Canberra, who made a number of valuable collections of *Typhonium* in the Northern Territory in 1984.

Other specimens seen:

AUSTRALIA. Northern Territory: Bathurst Island, Ngaru, *Fensham 1062*, 13/12/91, fl. (DNA); Melville Island, Hanguana Jungle, *Jones 1683*, 6/12/84, fl. (DNA).

'Brownii group'

4. *Typhonium weipanum* A. Hay, *spec. nov.* – Fig. 7

A *T. eliosuro* inflorescentia mascula longiore graciliore, appendice brevior differt. — Typus: Australia, Queensland, Cook District, Weipa, site of power line for new township, West of Trunding Ck, *A. Morton 1142e*, 25/2/81, fl. (BRI!, holo).

Rhizomatous herb; rhizome tuberous, creeping, c. 2 cm diam.; leaves three together; petiole c. 20 cm, sheathing in the lower 11 cm; wings of sheath purplish; blades hasto-sagittate, the posterior lobes ± equalling the anterior; anterior lobe narrowly ovate, c. 7–8.5 × 6 cm; posterior lobes c. 6–8.5 × 0.9–3.4 cm; anterior costa with c. 7–9 primary lateral veins on each side, diverging at c. 40°; peduncle 11.5 cm; spathe purple, 9.5 cm long, the lower 2 cm forming an ovoid inflated portion separated from the limb by a constriction; limb narrowly ovate, 7 × 3.5 cm; spadix 6.5 cm long, the lower 0.5 cm bearing pistils; sterile interstice 1.6 cm with crowded filiform organs in the lower 0.6 cm and scattered shorter ones in the rest; male zone long and narrow, 1.5 × 0.2 cm, the male flowers 2-staminate; appendix sessile, cylindrical, 2.5 × 0.2 cm; fruit and seed unknown.

Distribution – Australia, northern Queensland; known only from the type collection made on the edge of open *Eucalyptus tetradonta* woodland. – Fig. 4.

Note – This species is evidently close to *T. eliosurum* (q.v.) with which it shares the sterile interstice of the spadix bearing sterile organs throughout, and the creeping rhizome. It is readily distinguished by the differently shaped male portion and the shorter appendix. It is widely disjunct from *T. eliosurum* geographically.

5. *Typhonium eliosurum* (Benth.) O.D. Evans - Fig. 8

Typhonium eliosurum (Benth.) O.D. Evans, *Contrib. N. S. W. Nat. Herb.* 3 (1961) 86, f. 1; *Contrib. N. S. W. Herb. Flora Series* 22 (1962) 13; Beadle et al., *Handb. Vasc. Pl. Sydney & Blue Mts* (1963) 452; *Fl. Sydney Region* ed. 2 (1973) 554; ed. 3 (1982) 554; Leigh et al., *Extinct and En-*



Fig. 8. *Typhonium eliosurum* (Benth.) O.D. Evans (*Betche s.n.*) a. Whole plant; b. spadix with part of spathe cut away; c. pistil; d. male flowers. — Scale: bar to a = 2 cm; to b = 1 cm; to c = 0.12 cm; to d = 0.15 cm.

dangered Pl. Austral. (1984) 150; Beadle, Stud. Fl. NE N. S. W. 6 (1987) 969. — *Typhonium brownii* Schott var. *eliosorum* F. Muell. ex Benth., Fl. Austral. 7 (1878) 154. — Type: Australia, New South Wales, Manly Beach, Nov. 1863, *C. Wilhelmi* s.n., fl. (K!, holo; MEL!, iso).
Typhonium brownii auct. non Schott: Harris, Wildfl. Austral. (1947) 178, pl. 47.

Rhizomatous herb; rhizome tuberous, creeping, to c. 12 cm long, c. 2 cm diam.; leaves several together; petiole to c. 40 cm long, sheathing in the lower third to two thirds; lamina hastate to deeply trifid with linear lobes; anterior lobe c. 10–20 × 2–8 cm; posterior lobes to c. 13 × 1.5–5 cm; spathe to c. 22 cm long; the lower convolute part ovoid, separated from the limb by a rather weak constriction; limb lanceolate, ± canoe-shaped, attenuate, greenish outside, purplish brown within; spadix equalling the spathe; pistillate in the lower c. 1 cm, then a sterile zone c. 2–4 cm long with filiform sterile organs next to the female zone and more sparsely distributed much shorter sterile organs extending up to the male zone; male zone c. 1–1.5 × 0.7 cm; male flowers 2- or 3-staminate; appendix narrowly tapering, c. 7–14 cm long, purplish black.

Distribution – Australia, New South Wales Central and South Coast in damp places in or near rain forest or in creek banks. – Fig. 4.

Notes – This species is listed in Leigh et al. (1984) as being in serious risk of disappearing from the wild state. Chromosome numbers as high as 168 have been recorded (Evans, 1962; Petersen, 1989) representing an undetermined but clearly very high level of ploidy in a genus where 'n' is more usually in the region of 8 to 13. Similar numbers are found in *T. brownii* (q.v.), another temperate species, which is also very similar in vegetative form.

The inflorescence emits an odour of pig faeces.

Other specimens seen:

AUSTRALIA. New South Wales: Wyong Ck, 10/1893, *Betche* s.n., fl. (NSW); Hawkesbury R., Patonga Ck, 14/12/1924, *Blakely* s.n., fl. (NSW); Bulahdelah District, Crawford R., 10/1902, *Cheel* s.n., fl. (NSW); Hawkesbury R., 29/6/1912, *Cleland* s.n., fl. (AD); Currumbene Ck, 6.5 mi S of Nowra, 13/12/1960, *Constable* s.n., fl. (MEL, NSW); cult. Roy. Bot. Gard. Sydney ex South Coast, 10/1961, *Evans* s.n., fl. (NSW); cult. *ibid.* ex Mathies Ck, 25 mi S of Nowra, 10/1962, *Evans* s.n., fl. (BRI, NSW); cult. *ibid.* ex Currumbene Ck, 6.5 mi S of Nowra, 10/1962, *Evans* s.n., fl. (NSW); cult. *ibid.* ex Mt Coolangatta, ENE of Nowra, 10/1962, *Evans* s.n., fl. (BRI, MEL, NSW); Stanwell Park, 10/1910, *Hamilton* s.n., fl. (NSW); cult. Roy. Bot. Gard. Sydney ex Seal Rocks, 10/1968, *Rodd* s.n., fl. (NSW); Wootton, nr Port Stephens, 11/1923, *Rodway* 9149, fl. (NSW); Boolambayte, nr Bulahdelah, 10/1923, *Rupp* s.n., fl. (MEL); Bulahdelah, 21/11/1923, *Rupp* s.n., fl. (NSW); Goffs Gulley, *Stuart* 329, fl. (MEL); nr junction of Kangaroo and Shoalhaven Rivers, 5/12/1965, *Whaite* 2995, fl. (NSW).

6. *Typhonium wilbertii* A. Hay, *spec. nov.* – Fig. 9

A *Typhoniis weipano eliosuroque* cormo subgloboso, appendice stipitata ad basin truncata ad apicem obtusa differt. — Typus: Australia, Queensland, Mt Molloy, Weatherby Rd, *R. Collins* 20130, 16/3/1981, fl. (QRS!, holo).

Cormous herb; corm subglobose to flattish, somewhat irregular, c. 4 cm diam. (to c. 15 cm according to Bailey), 1.5–2.5 cm high; leaves to six together; petioles c. 15–50 cm long, purplish brown at base or throughout; blade hastate with the posterior lobes somewhat raised, greyish green; anterior lobe to c. 20 × c. 7 cm; posterior lobes to c. 14 × c. 4.5 cm; peduncle much shorter than petioles; spathe c. 12.5–33

cm long, convolute in the green lower part into an ovoid chamber reaching the top of the sterile interstice of the spadix, separated from the limb by an abrupt constriction; limb broadly ovate, slightly reflexed, c. 8.5–30 cm long, somewhat convolute in the lower part, greenish suffused with brown abaxially with the midrib whitish, deep purple adaxially; spadix somewhat to much shorter than the spathe, c. 9 cm long; female zone basal, c. 1 cm long, the pistils whitish, maroon in the upper part, plagioscopic; sterile interstice c. 2.5 cm long, c. 0.3 cm diam., bearing blackish purple filiform sterile organs in the lower c. 0.5 cm, the rest occupied by shorter subpyramidal sterile organs of the same colour; male zone equalling the sterile zone, c. 0.5 cm diam., the male flowers 2–5-staminate, whitish, maroon near the pores; appendix shortly stipitate, narrowly conical, obliquely truncate at the base, blunt-tipped, c. 3.5 × 0.8 cm, deep purple-black; fruiting spathe base persistent; berries orange; seed solitary, onion-shaped, brown, minutely verruculose.

Distribution – Northeastern Queensland in eucalypt and she-oak woodland. – Fig. 10.

Notes – This species is named for Dr Wilbert Hetterscheid (Aalsmeer, The Netherlands), an authority on the related genus *Amorphophallus*, who was instrumental in bringing the existence of this species to light.

Typhonium wilbertii can be distinguished from broad-leaved forms of *T. angustilobum*, which it most strongly resembles and which also occurs in tropical Queens-

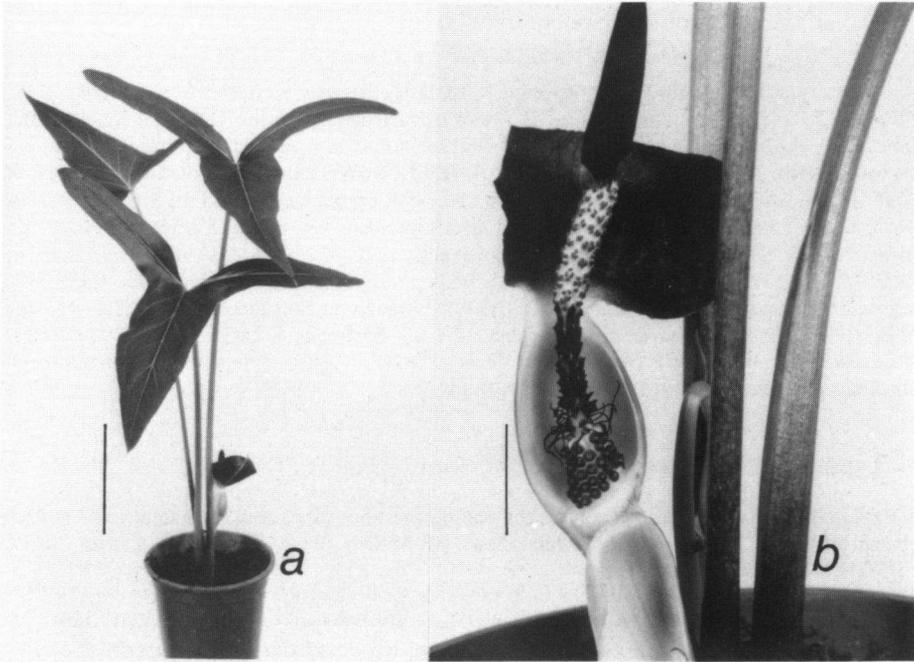


Fig. 9. *Typhonium wilbertii* A. Hay (Hetterscheid AR 033). a. Whole plant; b. inflorescence with part of spathe removed. – Scale: bar to a = 14 cm; to b = 2 cm.

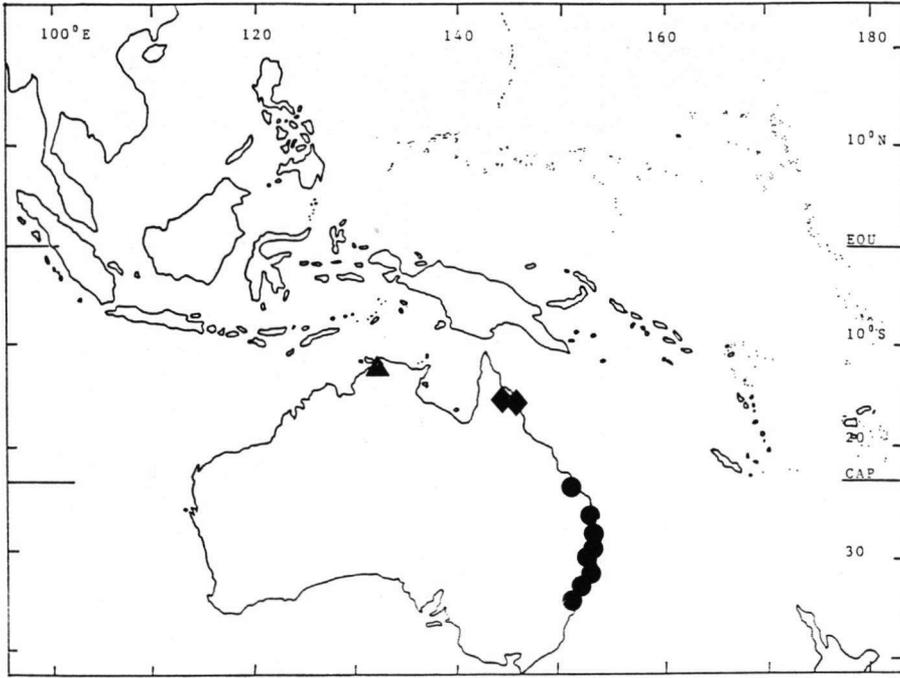


Fig. 10. Distribution of *Typhonium wilbertii* A. Hay (◆), *T. brownii* Schott (●), and *T. russell-smithii* A. Hay (▲).

land, by the presence of sterile organs throughout the interstice between the male and female zones of the spadix. In *T. angustilobum* there are clustered filiform sterile organs only at the base of the interstice, which is otherwise naked. The stipitate and somewhat obliquely truncate-based blunt-tipped appendix, and the flattish (irregularly) subglobose corm distinguish this species from *T. eliosurum* and *T. weipanum*, species which share with *T. wilbertii* the presence of sterile organs throughout the interstice.

Other specimens seen:

AUSTRALIA. Queensland: Restoration Island 1 km S of Cape Weymouth, 29/2/80, *Clarkson* 2955, fl. (BRI, QRS); Palm Cove, N of Cairns, 12/7/91, *Hay & Dearden* 7045, fr. (NSW); Atherton Tableland, Kuranda, 12/7/91, *Hay & Dearden* 7046, fr. (NSW); cult. Aalsmeer, The Netherlands, ex Palm Cove, 7/92, fl., *Hetterscheid* AR 033 (NSW).

7. *Typhonium brownii* Schott – Fig. 11

Typhonium brownii Schott, *Aroideae* 2 (1855) 11, t. 15; *Syn. Aroid.* (1856) 18; *Prod. Syst. Aroid.* (1860) 107; *F. Muell., Fragm. Phytogr. Austral.* 8 (1874) 187; *Hook. f., Bot. Mag.* 101 (1875) t. 6180; *Benth., Fl. Austral.* 7 (1878) 154; *Engler in DC., Monogr. Phan.* 2 (1879) 613; *Bailey, Syn. Qld. Fl.* (1883) 569; *Maiden, Useful Pl. Austral.* (1889) 66; *Moore & Betche, Handb. Fl. N. S. W.* (1893) 428; *Bailey, Qld. Fl.* 5 (1902) 1694; *Domin, Bibl. Bot.* 22, Heft 85 (1912)

504; Engler in Engler, *Pflanzenr.* 73 (IV. 23F) (1920) 116, f. 17A, B; Evans, *Contrib. N. S. W. Nat. Herb.* 3 (1961) 85, f. 2 & *Contrib. N. S. W. Nat. Herb. Flora Series* 22 (1962) 12; Beadle et al., *Fl. Sydney Region* ed. 2 (1973) 554; Williams, *Native Pl. Qld.* (1979) 276; Beadle, *Stud. Fl. NE N. S. W.* 6 (1987) 969, f. 425A; Stanley in Stanley & Ross, *Fl. SE Qld.* 3 (1989) 272.

— Type: Australia, New South Wales, Port Jackson, *R. Brown* 5800, fl. (BM! holo; K!).

Arum orixense auct. non Roxb. ex H.C. Andrews: *R. Br., Prod. Fl. Nov. Holl.* (1810) 336.



Fig. 11. *Typhonium brownii* Schott (Hay 4097). a. Whole plant (sterile); b. inflorescence with part of spathe removed; c. pistil; d. male flower. — Scale: bar to a, b = 2 cm; to c, d = 0.1 cm.

Rhizomatous herb tending to form colonies; rhizome to c. 15 cm long, c. 2–3 cm diam., creeping and proliferating; leaves several together; petioles 10–25(–70) cm long; blade hastate to ternatifid; anterior lobe to c. 20 × 12 cm; posterior lobes to c. 12 × 5 cm, rarely almost linear; inflorescences sometimes several in succession and often shifted into a seemingly lateral position; spathe to 20 cm long, convolute in the lower part into an ovoid-globose to broadly globose chamber housing the female zone and sterile interstice, separated from the limb by an abrupt constriction; limb broadly ovate, spreading, acuminate, greenish abaxially, deep purple adaxially; spadix markedly shorter than spathe; female zone basal, 1–2 cm long, then a zone c. 0.5 cm long of filiform sterile organs, then a naked zone to c. 3 cm long; male zone c. 1–1.5 × 0.5 cm, the male flowers 2- or 3-staminate; appendix conical, obliquely truncate at the base, to c. 5 × 2 cm, blackish purple; fruiting spathe persistent.

Distribution – Southeastern Queensland and New South Wales in or near areas supporting rain forest, in creek banks and often near waterfalls in spray zone. – Fig. 10.

Note – Chromosome numbers as high as 160 are recorded for this species (Evans, 1962; Petersen, 1989). Armstrong (1979) noted pollination by dung beetles attracted to faecal odour produced on a single evening corresponding to female anthesis. At that time the spathe is held erect. By the next day the odour is gone, the spathe limb is horizontal, and pollen has been dropped onto a site through which, it is presumed, leaving beetles must pass.

Other specimens seen:

AUSTRALIA. Queensland: Rockhampton, *Bailey s.n.* (BRI); Herberts Ck, fl., *Bowman s.n.* (MEL); Frenchman's Ck, 17/1/1863, *Dallachy 218*, fl. (MEL); Flinders Peak, 8/3/1959, *Everist s.n.*, fr. (BRI); Mt Tambourine, 1/1916, *Geissman s.n.*, fl. (BRI); Mt Perry, *Keys s.n.* (BRI); Campbell Pocket via Dayboro, 28/1/1960, *Kidston s.n.*, fl. (BRI); Burnett R., 11/1856, *von Mueller s.n.*, fl. (MEL); Logan R., 1881, *Scortechini 121* (MEL); Mt Tambourine, 11/1916, *Simmonds s.n.*, fl. (BRI); Rockhampton, *Thozet 43* (MEL); Mt Nebo, 6/12/1960, *Trapnell s.n.*, fl. (BRI); Stockyard Ck, National Park, 1/1919, *White s.n.*, fl. (BRI); Macpherson Range, 1/1919, *White s.n.*, fl. (BRI, NSW). — New South Wales: Capertee Valley, 1/1/1912, *Barnes 38*, fl. (NSW); Hastings R., *Beckler s.n.* (MEL, NSW); Nepean R., 1/1931, *Birt s.n.*, fl. (NSW); Pt Macquarie, 3/1898, fl., *Boorman s.n.* (NSW); Georges Ck via Kempsey, 1/1907, fl., *Boorman s.n.* (AD, BRI, NSW); Wilson R. nr Ballengarra State Forest NW of Pt Macquarie, 2/2/1960, *Borger s.n.*, fl. (NSW); Warners Ck c. 7 mi E of Yarowitch, *Borger s.n.*, fl. (NSW); Ellenborough Falls, 2/2/1960, *Borger s.n.*, fl. (NSW); Walcha, 12/1898, *Campbell s.n.*, fl. (NSW); Murwillumbah, 12/1912, *Campbell s.n.*, fl. (NSW); Comboyne, 12/1924, *Chisholm s.n.*, fl. (NSW); Bowraville, 2/1954, *Churchill s.n.*, fl. (NSW); 'Maudeville', Gloucester R., c. 20 mi WSW of Gloucester, 28/12/1968, *Coveny 719*, fl. (NSW); 12.4 km NE along Culoul Range towards Colo R. Gorge, NW of Windsor, 12/2/1977, *Coveny 9160*, fl. (NSW); Moona, Walcha, 2/1885, *Crawford 502*, fl. (MEL); Strathfield, 14/3/1949, *Dwyer s.n.*, fl. (NSW); cult., Roy. Bot. Gard. Sydney ex North Coast, 6/4/1961, *Evans s.n.*, fl. (NSW); Bonalbo Estate, 3/1918, *Fleurton s.n.*, fl. (NSW); Capertee, 3/1913, *Gallagher s.n.*, fl. (NSW); Menangle, 29/2/1896 & 21/3/1896, *Harper s.n.*, fl. (NSW); Tweed R. district, 2/1902, *Harrison s.n.*, fl. (NSW); Ellenborough Falls, 11/1985, *Hay 4097*, fl. (NSW); Culoul Range, Hollow Rock, 19/2/1978, *Hind 2212*, fl. & 8/4/1978, 2242, fr. (NSW); Rowlands Ck via Murwillumbah, 2/12/1969, *Irvine s.n.*, fl. (NSW); Tunstall, 4/1911, *Janner s.n.*, fl. (NSW); Glendon, Hunter R., 1843, *Leichhardt s.n.* (NSW); Nambucca R., 2/1909, *Mahieson 706*, fl. (NSW); Cabbage Tree Island off Pt Stephens, 4/1967, *Robinson s.n.* (NSW); Culoul Range, 2 mi E of Wollemi Ck-Colo R. confluence, 5/2/67, *Rodd 361 & 361a*, fl. (NSW); Wollombi Falls, 22/11/73, *Rodd 2454*, fl. (NSW); Lismore, 31/12/1906, *Rothwell s.n.*, fl. (NSW); Sandilands Range, W of Casino, 2/1918, *Steetz 822*, fl. (NSW); Goffs Gulley, *Stuart 329* (MEL); Alstonville district, *Tomlins s.n.* (NSW); Coneac district, c. 15 mi NW of Gloucester, 3/2/1937, *Vickery s.n.*, fl. (NSW).

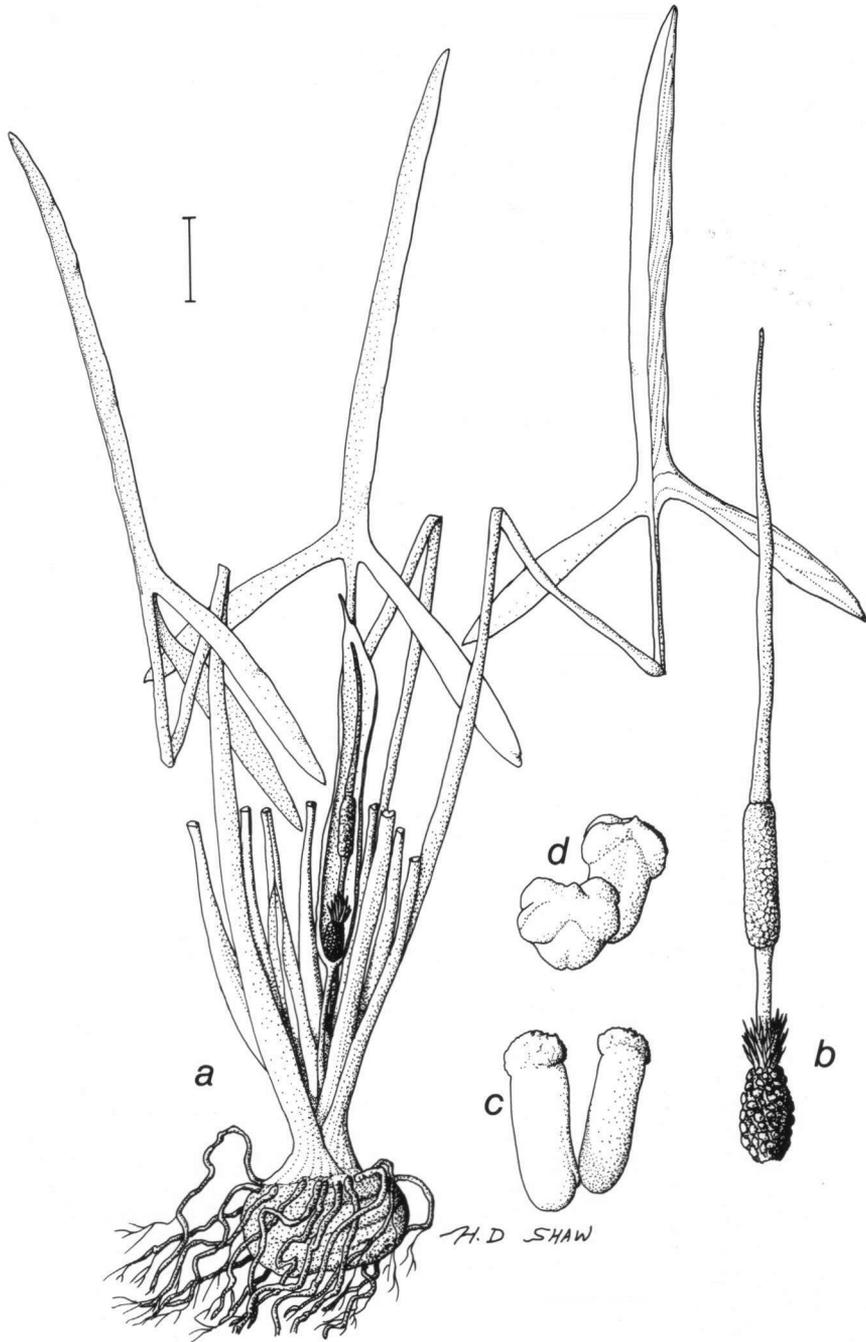


Fig. 12. *Typhonium russell-smithii* A. Hay (Russell-Smith 1074). a. Whole plant with most leaves removed; b. spadix; c. pistils; d. male flowers. — Scale: bar to a = 1.7 cm; to b = 0.6 cm; to c, d = 0.06 cm.

8. *Typhonium russell-smithii* A. Hay, *spec. nov.* – Fig. 12

A. T. alismifolio spatha vix contracta, spathae lamina lanceolata, folii lobis posticis basicopicis differt. — Typus: Australia, Northern Territory, Kakadu National Park, Cannon Hill, 1/2/84, fl., *J. Russell-Smith 1074* (DNA!, holo).

Cormous herb; corm subglobose, c. 3 cm diam., leaves rather numerous, c. 11 together; petiole c. 20 cm long, sheathing in the lower third; blade deeply and narrowly trilobed with (in the pressed specimen) the posterior lobes basicopic, the anterior lobe erect; anterior lobe to c. 15 × 0.6 cm with the primary lateral venation subparallel to the midrib; posterior lobes to c. 8 cm long, 0.4 cm wide; inflorescence solitary on a peduncle c. 4 cm long; spathe 6.5 cm long, narrowly lanceolate, very weakly constricted at c. 1 cm from the base; spadix c. 5 cm long, the lower 5 cm cylindrical and pistillate, then a 0.2 cm long zone of ± erect filiform sterile organs, then a naked interstice c. 1 × 0.1 cm; male zone c. 0.9 × 0.2 cm, the male flowers 2-staminate; appendix slender, sessile, tapering to a point, c. 2.5 cm long; fruit unknown.

Distribution – Known only from the rather damaged type collection, though several other sterile specimens from this area may be attributable to this species. It was collected from sandy colluvium at the base of an escarpment outlier in eucalypt forest. – Fig. 10.

Note – *Typhonium russell-smithii* is named for Dr Jeremy Russell-Smith, who has in recent years contributed greatly to the knowledge of flora and vegetation of the ‘Top End’ of the Northern Territory.

9. *Typhonium cochleare* A. Hay, *spec. nov.* – Fig. 13

A. T. alismifolio appendice spatham superanti valde attenuata ad basin abrupte expansa, floribus sterilibus bene confertis gracillimis numerosissimis differt. — Typus: Australia, Northern Territory, Kapalga, 13/12/1984, *D.L. Jones 1732*, fl. (DNA!, holo).

Cormous herb; corm subglobose, c. 2 cm diam.; leaves c. 5–8 together; petiole c. 11 cm long, sheathing in the lower third to half; blade very variable in shape, elliptic with an obtuse base (c. 7 × 4 cm) to hastate to very deeply and narrowly trilobed with the anterior lobe c. 10 × 0.4 cm and the posterior lobes c. 5.5 × 0.4 cm, the latter slightly ascending and ± acroscopic; anterior costa with c. 5 primary lateral veins diverging at an angle of c. 35° to subparallel; peduncle c. 7 cm long, considerably thicker than the petioles, c. 0.6 cm diam.; spathe to c. 17 cm long, inflated in the lower c. 1.5 cm into a ± ovoid-cylindrical, rather thick-walled, internally minutely hairy chamber separated by an abrupt constriction from the membranous limb; limb ovate, long-acuminate, spreading below, twisted above, brown-purple; spadix somewhat exceeding the spathe, to 22 cm long; basal female zone ± pyramidal, then a c. 0.5 cm long zone of very fine and crowded filiform sterile organs, then a c. 2 cm long × 0.2 cm longitudinally ridged naked interstice; male zone c. 1.5 × 0.5 cm, the top oblique at c. 45°, the male flowers unistaminate; appendix very slender and attenuate, but the base expanded into an oblique cap like the bowl of a spoon inverted over a short stipe; spathe base persistent in fruit.

Distribution – Australia, Northern Territory from Darwin to Arnhemland, mostly in open forest. – Fig. 4.

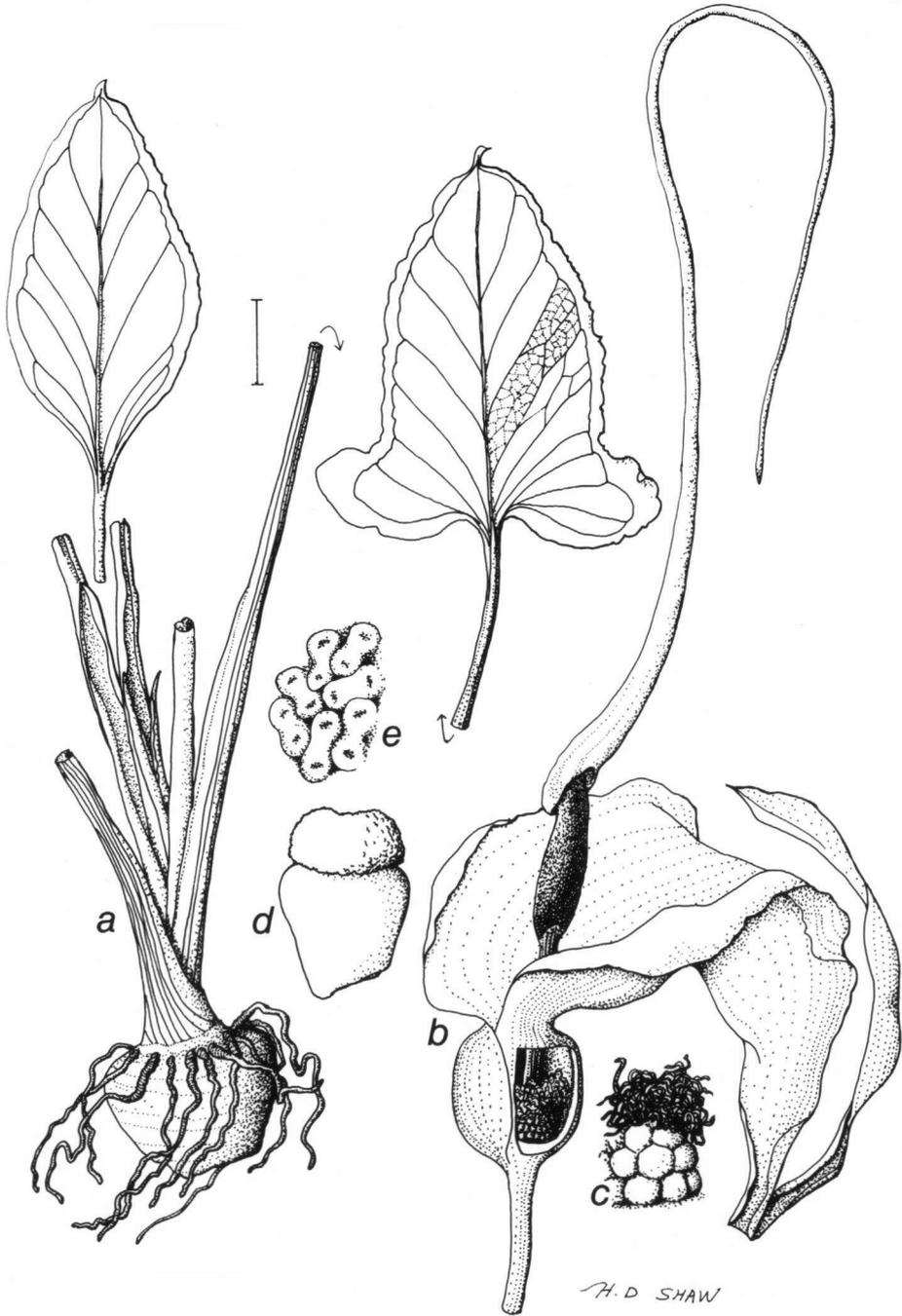


Fig. 13. *Typhonium cochleare* A. Hay (Jones 1732). a. Plant, leaves and inflorescence cut away; b. inflorescence with part of spathe removed; c. part of female zone and sterile interstice; d. pistil; e. male flowers. — Scale: bar to a = 1.8 cm; to b = 1 cm; to c = 0.6 cm; to d, e = 0.1 cm.

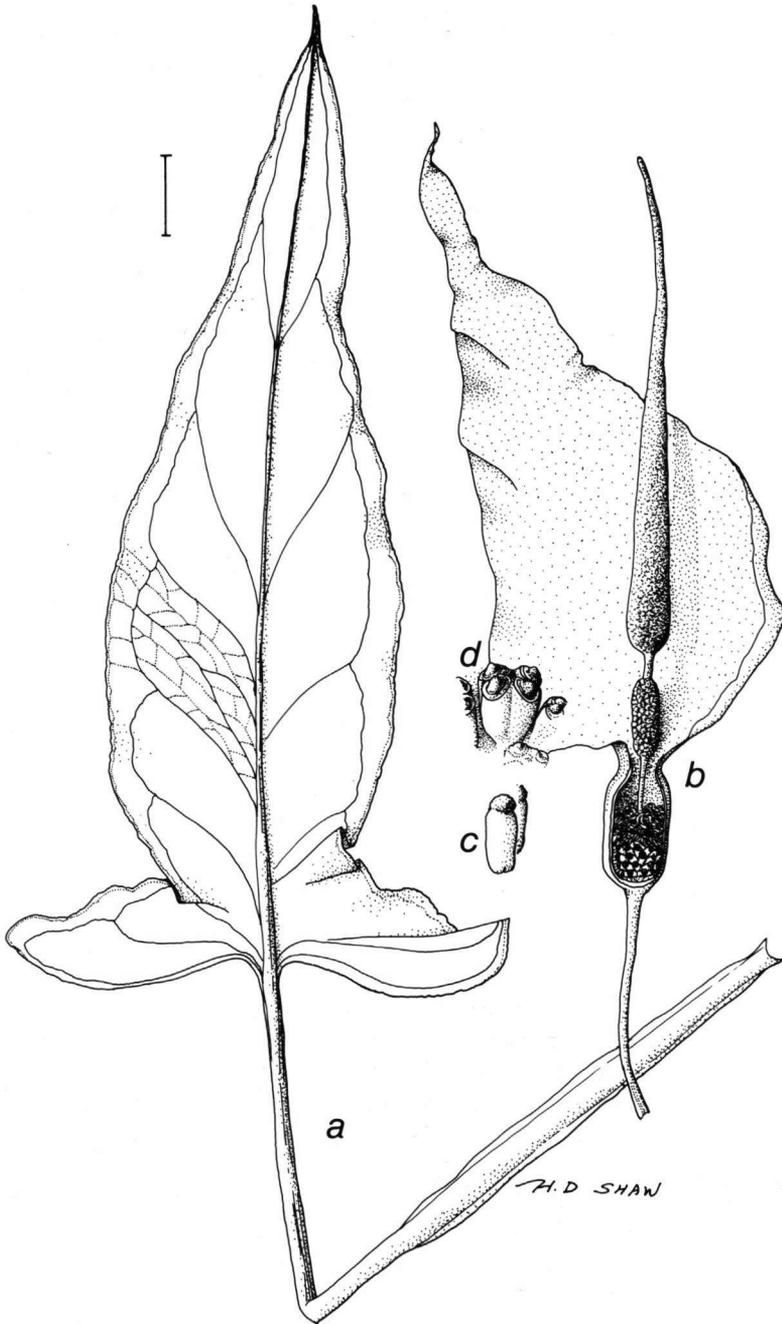


Fig. 14. *Typhonium alismifolium* F. Muell. (Thomas 2360). a. Leaf; b. inflorescence with part of spathe cut away; c. pistils; d. male flowers. – Scale: bar to a, b = 2 cm; to c = 0.25 cm; to d = 0.13 cm.

Notes — *Reeve & Banygarra 597* (NSW) record that the corm is said to be edible but somewhat indigestible and not given to very old or very young people. The corms are beaten with a stone before roasting in ashes and are then beaten again after cooking. Emus are said to eat the inflorescences.

The specific epithet alludes to the spoon-like insertion of the appendix.

Other specimens seen:

AUSTRALIA. Northern Territory: Milingimbi Island, 6/1/76, *Dunlop 4101*, fr. (DNA); Spring Vale, Port Darwin, *Giles s.n.*, fl. (BRI); East Coast Rd, Murganella area, 10/2/84, *Jones 1384*, fr. (DNA); *Wightman 1075*, 9/2/84, fr. (DNA); Darwin (?), 12 mile, *Mackinlay s.n.*, fl. (MEL); Nangalala, 20 mi S of Milingimbi Island on the Goyder R., 12/72, *Reeve & Banygarra 597, 598, 600, 601* fl., 602 (all NSW).

10. *Typhonium alismifolium* F. Muell. — Fig. 14

Typhonium alismifolium F. Muell., *Fragm. Phytogr. Austral.* 8 (1874) 186; Benth., *Fl. Austral.* 7 (1878) 153; Engler in DC., *Monogr. Phan.* 2 (1879) 610; Bailey, *Syn. Qld. Fl.* (1883) 569; Qld. *Fl.* 5 (1902) 1694; in Engler, *Pflanzenr.* 73 (IV. 23F) (1920) 121. — Type: Australia, Queensland, Rockingham's Bay, Mt Macallister, *Dallachy s.n.*, 11/1/1869, fl. (MEL!, holo; K!, iso).

Cormous herb; corm to c. 5 cm in diam., subglobose; leaves c. 4 together; petiole c. 20 cm to over 40 cm long, sheathing in the lower quarter to three quarters; blade variable in shape, oblong-elliptic with the base obtuse to hastate to deeply trifid with linear lobes; anterior lobe c. 10 × 0.5 cm to 25 × 10 cm; posterior lobe ± lacking to c. 6 × 0.4 cm, distinctly shorter than the anterior lobe; spathe to c. 25 cm long, the lower part convolute for up to c. 4 cm, the limb usually rather narrowly ovate, spreading and gradually tapering, brownish-purple; spadix very slightly shorter than the spathe, female in the lower 0.5–1 cm, then a c. 0.5 cm long zone of crowded filiform sterile organs, then a naked zone c. 2 cm long; male zone c. 2 cm × 0.8 cm, the male flowers 2- or 3-staminate; appendix shortly to conspicuously stipitate, with the base obtuse, very narrowly conical; fruit unknown.

Distribution — Tropical Queensland to Central Australia. There is little or no data on habitat. — Fig. 6.

Note — This species is evidently very closely related to *T. angustilobum*, differing mainly in the shape of the leaf blade (mostly with reduced posterior lobes in *T. alismifolium*), of the spathe (narrower in *T. alismifolium*), and of the appendix (longer and more slender in *T. alismifolium*). The following specimens show intermediate states: *Harte s.n.* has the appendix shorter than the spathe (cf. *T. angustilobum*) but of the narrow form of *T. alismifolium*. *Nelson s.n.* has an obliquely truncate-based (cf. *T. angustilobum*) but long and tapering (cf. *T. alismifolium*) appendix. *MEL 115391* has linear lamina lobes and a broadly ovate spathe limb, but an appendix typical of *T. alismifolium*. These specimens, it would seem, could be used to form a case for reducing *T. angustilobum* to synonymy with *T. alismifolium*. However, I have not seen plants corresponding to either of these species in the living or pickled state and feel that it would be premature to combine them on the basis of the (rather scant) dried herbarium material alone. Doubtless the two species, as circumscribed here, would repay study in the field, with the emergence either of better circumscribed (or further) taxa or of a more concrete case for combining them.

Other specimens seen:

AUSTRALIA. Queensland: Hodgkinson R., ? *Bulls s.n.* (MEL 115391), fl. (MEL); Mt Molloy, 2/3/1938, *Carr 29*, fl. (BRI); 40 km S of Urandangi, 16/4/1988, *Harris 237*, fl. (BRI); Tumoulin, 4/1913, *Harte s.n.*, fl. (BRI). — Northern Territory: Larapulla Waterhole, 20 mi N of Utopia Homestead, Central Australia, 7/1/65, *Nelson s.n.*, fl. (DNA, MEL); Tobermorey Station, 6 km W of homestead, junction of Plenty Highway and Urandangi Rd, 4/5/88, *Thomson 2360*, fl. (BRI, DNA, K).

11. *Typhonium angustilobum* F. Muell. — Fig. 15

Typhonium angustilobum F. Muell., *Fragm. Phytogr. Austral.* 10 (1876) 66; *Benth., Fl. Austral.* 7 (1878) 154; Engler in DC., *Monogr. Phan.* 2 (1879) 615; Bailey, *Syn. Fl. Qld.* (1883) 569; *Qld. Fl.* 5 (1902) 1695; *Comp. Cat. Qld. Pl.* (1913) 576, f. 556; Engler in Engler, *Pflanzenr.* 73 (IV. 23F) (1920) 121; Evans, *Contrib. N. S. W. Nat. Herb.* 3 (1961) 87; Hay, *Aroids of Papua New Guinea* (1990) 96. — Type: Australia, Queensland, Gilbert River, *Armitage 413*, fl. (MEL, holo; K!, iso).

Typhonium millarii F.M. Bailey, *Qld. Ag. Bull.* 7 (Bot.) (1891) 20; *Qld. Fl.* 5 (1902) 1695. — Type: Australia, Queensland, Walsh, *T. Barclay-Millar s.n.*, 1/1891, fl. (BRI lecto, selected here).

Cormous herb; corm subglobose to irregular and flattish, 4–10 cm wide; leaves several, very variable in shape; petiole to c. 35 cm; blade slightly glaucous, hastate (anterior lobe c. 16 × 9 cm; posterior lobes c. 11 × 6 cm) to deeply trifid with linear lobes (anterior lobe c. 16 × 0.5 cm to 19 × 1.5 cm; posterior lobes 10 × 0.4 cm to 14 × 1 cm), the posterior lobes tending to be held above the horizontal; peduncle short; spathe to c. 22 cm long, the lower 3–5 cm forming a globose to ovoid chamber, the limb very broadly ovate, greenish abaxially, purplish-brown adaxially; spadix (often much) shorter than the spathe; female zone c. 0.8 cm, then a zone 0.5 cm long of filiform sterile organs, then a naked interstice some 2 cm long; male zone 0.8–2 × 0.3–6 cm, male flowers 2- or 3-staminate; appendix rather variable in size and shape, fairly broadly conical and oblique-truncate based, c. 2 × 0.3 cm to 6 × 1.5 cm wide at base, stipitate, purple-black; spathe base persistent in fruit.

Distribution — Southern New Guinea and Northern Queensland, mostly in fairly open woodland vegetation. — Fig. 4.

Notes — In the damaged lectotype specimen (the fertile one of the syntypes) of *T. millarii* the appendices are missing, but the spathes are identical to that of *T. angustilobum*, and the sterile interstice of the spadix is naked except for a short zone of filiform sterile flowers contiguous with the female zone. Bailey described the rest of the interstice of *T. millarii* as being 'bare' and, in contradiction, 'covered by papillae'. What he meant by the latter is not clear to me, as he referred specifically to the fresh state and I have not seen living or spirit material of this species. No papillae are visible in the dried specimen. However, it is clear that whatever the structures are to which he referred, they are not the somewhat papillate sterile organs found in the interstice of the otherwise rather similar *T. wilbertii*. These remain easily visible in dry specimens. The type of *T. millarii* also shows rather crowded male flowers, unlike the more distant ones in *T. wilbertii*. Leaves were not preserved with the lectotype, though a sterile syntype, *Barclay-Millar 2*, from the same locality and collected in March 1891 is reserved at BRI. The leaves are broad-lobed, with the posterior ones well developed and these, from Bailey's description and the way the specimen

has dried, show the somewhat upward directed posture typical of *T. angustilobum*. A series of intermediates link the very narrowly trifid leaves of the type of *T. angustilobum* to the rather broadly hastate leaves of the syntype of *T. millarii*. Bailey described the stem of *T. millarii* as a flattish rhizome of irregular shape (it was not preserved), while the stem of *T. angustilobum* is generally a well-defined subglobose



Fig. 15. *Typhonium angustilobum* F. Muell. (a: Brass 8632; b–d: Hinton 29). a. Whole plant; b. spadix; c. pistils and part of sterile interstice; d. male flowers. — Scale: bar to a = 2 cm; to b = 1 cm; to c = 0.1 cm; to d = 0.2 cm.

corm. However, older plants, or ones in which the apex has been damaged, may develop an irregular shape to the corm.

In addition to the specimens cited below, there are several sterile collections from the Northern Territory which are possibly ascribable to this species. However, they are not cited, as the majority of tropical Australasian *Typhonium* species exhibit forms with narrowly linear leaf blade lobes and it is not usually possible to identify sterile dried material with certainty.

Other specimens seen:

PAPUA NEW GUINEA. Western Province: Upper Wassi Kussa R., 1/1937, *Brass 8632*, fl., 8744, fl. (both BRI).

AUSTRALIA. Queensland: Kamerunga, *Cowley 64D*, fl. (BRI); Jowalbinna, c. 20 mi SW of Laura, 1/1978, *Hinton 29*, fl. (BRI); Endeavour R., 1878, *Perseitz 195*, fl., 1882, 215, fl., 1883, 269, fl. (all MEL); Cooktown, 2/1985, *Scarth-Johnson 1619A*, fl. (BRI); Gilbert R., 2/1922, *White 1455*, fl. (BRI).

'Liliifolii group'

12. *Typhonium liliifolium* F. Muell. – Fig. 16

Typhonium liliifolium F. Muell. in Schott, *Bonplandia* 7 (1859) 103; *Prod. Syst. Aroid.* (1860) 107; F. Muell., *Fragm. Phytogr. Austral.* 8 (1874) 187; Benth., *Fl. Austral.* 7 (1878) 153; Engler in DC., *Monogr. Phan.* 2 (1879) 610; Ewart & Davies, *Fl. N. Territory* (1917) 65; Engler in Engler, *Pflanzenr.* 73 (IV. 23F) (1920) 121. — Type: Australia, Northern Territory, Victoria River, 12/1855, F. von Mueller s.n., fl. (K!, holo; MEL!, iso).

Typhonium angustilobum auct. non F. Muell.: Fitzgerald, *Proc. Roy. Soc. W. Austral.* 3 (1918) 24.

Cormous herb, corm subglobose, to 5 cm diam.; leaves few together; petiole to 30 cm long, sheathing in the lower half to two thirds; blade very narrowly lanceolate, c. 30 × 3 cm to 30 × 8 cm, with to c. 6 primary lateral veins on either side of the midrib diverging at c. 25° or less; posterior lobes of lamina completely lacking; margin of blade often undulate; inflorescence solitary, on a very short peduncle, directly subtended by cataphylls; spathe 10–24 cm long, the tube separated from the blade by an abrupt constriction c. 3–4 cm from the base; blade broadly ovate to 20 × 11 cm, con-volute in the lower part; spadix to c. 10 cm long, the female zone 0.5–0.8 cm long, then a 0.5 cm zone of filiform sterile organs, then a 1.2–4 cm naked zone; the male zone 1.5 × 0.5 cm, with the male flowers 2- or 3-staminate; appendix ± sessile, truncate to obtuse-based, not reaching the tip of the spathe, narrowly conical, blackish; spathe base persistent in infructescence.

Distribution – North Kimberley region of Western Australia and Victoria River area of the Northern Territory, in savannah woodland and open scrub. – Fig. 6.

Notes – The authority and protologue for *T. liliifolium* are commonly cited as F. Muell. in Hook., *J. Bot.* (Kew Miscell.) (1856) 321. However, this species is only alluded to by generic name (on p. 329) in a published letter from Mueller to Sir W.J. Hooker (beginning on p. 321) in that volume. It was Schott (l.c.) who validated the name appearing in Mueller's labels on the type specimens (Muir & Sinkora, 1976).

The stem architecture of this species appears to differ from that in all other Australasian *Typhonium* species, and bears a greater resemblance to that described by Murata



Fig. 16. *Typhonium liliifolium* F. Muell. (Kenneally 7170). a. Whole plant; b. venation; c. spadix; d. pistil; e. male flowers. — Scale: bar to a = 2 cm; to b, c = 1 cm; to d, e = 0.15 cm.

(1990) for Chinese *T. giganteum* Engler. Current season's growth appears to consist of an inflorescence belonging to a previous sympodial module and simultaneously produced foliage belonging to the subsequent module. I have not seen living material.

Other specimens seen:

AUSTRALIA. Western Australia: N Kimberley, Mitchell Plateau, 23/2/1979, *Beard 8389*, fl. (PERTH); Kalamburu, 30/12/73, *Crawford 11*, fl. (PERTH); Kings Sound, 1888, *Froggat 152*, fl. (NSW); cult. Perth ex N Kimberley, Mitchell Plateau, nr Port Warrender, 8/1/80, *Kenneally 7170* (PERTH); NW Kimberley, Mitchell Plateau, Lawely R. Headwaters, 9/12/78, *Smith s.n.*, fl. (PERTH). — Northern Territory: 3 km E of Bulla, 10/11/87, *Smith 944*, fl. (DNA).

INTRODUCED SPECIES

13. *Typhonium roxburghii* Schott

Typhonium roxburghii Schott, Aroid. 2 (1855) t. 17; Nicolson & Sivadasan, *Blumea* 27 (1981) 492, f. 3; Hay, *Aroids of Papua New Guinea* (1990) 95, f. 39. — Type: Ceylon, *Thwaites 3764* (K) lecto, selected by Nicolson & Sivadasan, l.c.; BM, PDA, isolecto).

Typhonium trilobatum auct. non (L.) Schott: Hay in Johns & Hay, *Stud. Guide Monoc. Papua New Guinea* 1 (1981) 79, f. 33.

Cormous herb; corm subglobose, c. 3 cm diam., proliferating; petioles to c. 30 cm long (often less), sheathing in the lower third; blade shallowly trilobed, at least as broad as long, c. 9 × 9 cm; inflorescence on a short peduncle; spathe to c. 30 cm long, constricted at c. 3 cm from base, the lamina spreading, ovate and long-acuminate, the acumen usually recoiled, deep glistening purple; spadix about equalling the spathe, the lower c. 0.5 cm pistillate, then a c. 1 cm long zone of sterile organs, these stiffly down-turned, then a naked interstice c. 1.5 cm long; the male zone c. 1 cm long, coral pink; appendix shortly stipitate, long attenuate, obliquely somewhat swollen at base, smooth, reddish black; spathe base persistent in infructescence.

Distribution — Very widely and sporadically distributed in the tropics, but probably indigenous in southern India, Sri Lanka and South and Central Malesia (Nicolson & Sivadasan, 1981). In Australasia recorded only from Lae, Papua New Guinea where it is considered to have escaped after introduction to the National Botanic Garden.

Other specimen seen:

PAPUA NEW GUINEA. Morobe Province: Lae Botanic Garden, 12/11/61, *Nicolson 1399* (LAE).

14. *Typhonium blumei* Nicolson & Sivadasan — Fig. 17

Typhonium blumei Nicolson & Sivadasan, *Blumea* 27 (1981) 494, f. 4. — Type: Probably (vide Nicolson & Sivadasan, l.c.) Japan, Kyushu, Nagasaki, c. 1826, *Bürger & von Siebold s.n.* (L, holo & iso, n.v.).

Stem an irregularly shaped corm (virtually a tuberous rhizome) bearing copious fusiform bulbils; leaves several together, deep bright green, ?evergreen; petioles to c. 20 cm long, rather slender; blade membranous, mostly sagittate, c. 12 × 5 cm, the posterior lobes abruptly narrowing on the inside toward the sinus; inflorescence usually displaced from the centre of the crown by continued vegetative growth after its incep-

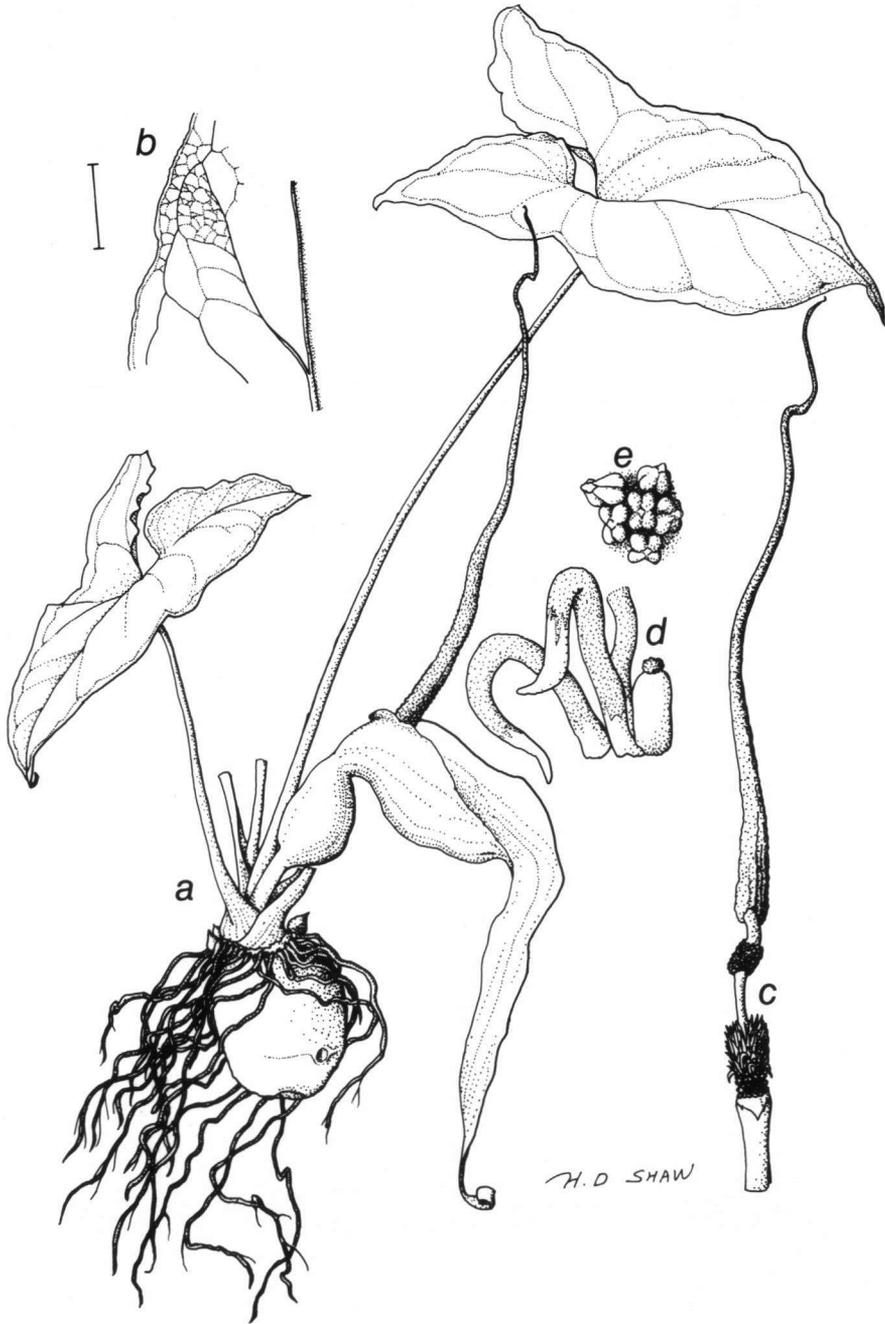


Fig. 17. *Typhonium blumei* Nicolson & Sivadasan (Hay 7047). a. Whole plant; b. venation; c. spadix; d. pistil and sterile flowers (on side); e. male flowers. — Scale: bar to a = 2 cm; to b, c = 1.8 cm; to d = 0.15 cm; to e = 0.3 cm.

tion, solitary or in vigorous specimens two or three among the leaves, on short peduncles; spathe to c. 20 cm long, the lower convolute portion small, c. 1.5–3 cm long, elliptic, greenish brown outside, the limb spreading, to c. 18 cm long, 6 cm wide, broadly ovate and long-acuminate, the distal portion often twisted, the whole limb glistening velvety purple adaxially, greenish brown abaxially; spadix about equalling the spathe, female zone c. 0.8 cm long, then a c. 1 cm zone of crowded filiform sinuous sterile organs, then a naked interstice c. 2 cm long; male zone to 1.2 cm, the male flowers unistaminate with the connective beaked; appendix to c. 15 cm long, narrowly tapering, faintly swollen at the oblique base, rough to verruculose, purple-black.

Distribution – Nicolson & Sivadasan (1981) conclude that this species, while now virtually pantropical, is native to China and Japan. It is apparently becoming established as a nursery weed in Northern Queensland, and to have escaped here and there. Doubtless it will spread owing to the abundant production of bulbils.

Note – I have not seen this species in fruit. However, after anthesis in unfertilised inflorescences the lower part of the spathe persists for some time after the limb has withered. The inflorescence emits a zoo-like aroma of urine on straw. The plants appear to be evergreen.

Specimen seen:

AUSTRALIA. New South Wales: cult. Royal Botanic Gardens Sydney ex Queensland, Mossman Valley, Whyanbeel Rd, 12/7/91, *Hay 7047*, fl. (NSW).

ACKNOWLEDGEMENTS

The Nissan Motor Company (Australia) generously loaned a four-wheel-drive vehicle which made field work possible in northern Australia in July 1991. The Curators and Directors of the following herbaria made herbarium material available: A, AD, B, BM, BRI, DNA, K, L, LAE, MEL, NSW, PERTH, QRS. The botanical drawings were made by Haei Dong Shaw. I am grateful to Dr Arden Dearden, Clyde Dunlop and Steven Taylor for invaluable help in the field. Kevin Kenneally (PERTH) supplied useful photographs of Western Australian species. Dr Wilbert Hetterscheid (Aalsmeer, The Netherlands) supplied the photographs in Figure 9. Cait Richards provided splendid accommodation in Cairns. Peter Boyce (K), Dr Jin Murata (Tokyo), Dr Dan Nicolson (US) and Karen Wilson (NSW) kindly found time to read and comment on earlier drafts of the typescript. Dr David Mabberley advised on the formulation of some specific epithets.

REFERENCES

- Armstrong, J.A. 1979. Biotic pollination mechanisms in the Australian Flora – a review. *New Zeal. J. Bot.* 17: 467–508.
- Bogner, J., & D.H. Nicolson. 1991. A revised classification of the Araceae with dichotomous keys. *Willdenowia* 21: 35–50.
- Engler, A. 1920. Araceae–Aroideae und Araceae–Pistioideae. *Pflanzenreich* 73 (IV. 23F). Engelmann, Leipzig.
- Evans, O.D. 1962. Araceae. *Contrib. N. S. W. Nat. Herb. Flora Series* 21/22: 6–13.
- Grayum, M.H. 1990. Evolution and phylogeny of the Araceae. *Ann. Missouri Bot. Gard.* 77: 628–697.
- Hay, A. 1988. *Amorphophallus* (Araceae) in Australasia. *Aroideana* 11: 14–19.
- Hay, A. 1990. Aroids of Papua New Guinea. Christensen Research Institute, Madang.

- Hay, A. 1992a. Tribal and subtribal delimitation and circumscription of the genera of Araceae tribe Lasieae. *Ann. Missouri Bot. Gard.* 79: 184–205.
- Hay, A. 1992b. A new genus of Australian Araceae with notes on generic limits in and biogeography of the Areae. *Bot. J. Linn. Soc.* 109: 427–434.
- Hay, A., & D.J. Mabberley. 1991. 'Transference of Function' and the origin of aroids: their significance in early angiosperm evolution. *Bot. Jahrb. Syst.* 113: 339–428.
- Hu, S. Y. 1968. Araceae. Studies in the Flora of Thailand 41. *Dansk Bot. Ark.* 23: 411–457.
- Leigh, J., R. Boden & J. Briggs. 1984. *Extinct and endangered plants of Australia*. Macmillan, Melbourne.
- Muir, T. B., & D. Sinkora. 1976. The correct citation for *Typhonium liliifolium*. *Muelleria* 3: 208.
- Murata, J. 1990. Diversity of shoot morphology in *Typhonium* (Araceae). *Amer. J. Bot.* 77: 1475–1481.
- Murata, J., & S.J. Mayo. 1991. A new combination in *Typhonium* (Araceae). *Kew Bull.* 46: 129–131.
- Nicolson, D.H. 1967. Selection of lectotype species for genera of the family Araceae. *Taxon* 16: 514–519.
- Nicolson, D.H., & M. Sivadasan. 1981. Four frequently confused species of *Typhonium* (Araceae). *Blumea* 27: 483–497.
- Petersen, G. 1989. Cytology and systematics of Araceae. *Nordic J. Bot.* 9: 119–166.
- Sivadasan, M., & D.H. Nicolson. 1982. A revision of *Therioiphonum* (Araceae). *Kew Bull.* 37: 277–290.
- Steenis, C.G.G.J. van. 1948. *Typhonium horsfieldii* (Miq.) Steen. *Bull. Jard. Bot. Buitenzorg III*, 17: 403.