

Typhonium (Araceae) in Thailand

DUANGCHAI SOOKCHALOEM*

Small perennial herb, usually with thickened rhizome or tuber. Cataphyll distinct or indistinct. Leaves (foliage) 1–2 (–3) per sympodial unit, petiolate; petiole with vaginate sheath in the lower part; blade simple and roundish or sagittate, hastate, trilobed or pedately dissected. Adventitious bud rarely on leaves. Peduncle shorter than petiole, occasionally below ground. Spathe tube usually persistent, convolute, apically constricted; blade incurved, spreading or recurved, widely ovate, ovate to lanceolate, acute to long acuminate, usually green or purplish. Spadix usually equaling to or shorter than spathe; basal female part with congested male flowers; interstice between male and female parts subcylindrical, partly or entirely covered with sterile flowers, upper male part with congest male flowers, rarely with staminodes above; appendix sessile or stipitate, basically cylindrical, sometimes tapered to apex. Male flowers with occasionally 2–3 united, subsessile, laterally flattened; stamens, anther laterally dehiscent to slits or apically short dehiscent to pores. Female flowers with unilocular ovary; stigma sessile, hemispheroidal; ovules 1 to few, orthotropus, erect from basal placenta. Sterile flowers on interstice capitate, clavate, subulate, or filiform, variously curved. Inflorescence usually surrounded by persistent spathe tube; fruits with one or two seeds. Seed spheroidal, albuminose.

About 40 species in tropical, subtropical Asia and Australia. In Thailand 14 species are recorded.

A Key to the Taxa of *Typhonium* in Thailand

- 1. Leaves completely pedate
 - 2. Plant hirsute. Sterile male flowers absent. Sterile flowers clavate **1. *T. hirsutum***
 - 2. Plant glabrous. Sterile male flowers present above fertile male flowers **2. *T. horsfieldii***
- 1. Leaves simple
 - 3. Male flowers sparsely arranged. Spathe white. Spadix appendix long exerted from spathe **3. *T. albispathum***
 - 3. Male flowers congested. Spathe colored. Spadix appendix nearly as long as or shorter than spathe
 - 4. Interstice (inflorescence axis between female flowers and male flowers) without distinct naked portion **4. *T. flagelliforme***
 - 4. Interstice with distinct naked portion

* The Forest Herbarium, Royal Forest Department, Bangkok 10900, THAILAND.

- 5. Sterile flowers cylindrical, subulate or clavate, almost straight. Spathe blade widely linear to narrowly deltoid ovate, or small and less than 5 cm long
- 6. Spadix appendix distinctly thickened oblong
 - 7. Plant glandular hairy excepting inflorescence **5. T. gagnepainii**
 - 7. Plant glabrous **6. T. sagitariifolium**
- 6. Spadix appendix very slender, narrowly cylindrical to flagellate
 - 8. Spadix appendix abruptly expanded at the base, stipitate **7. T. filiforme**
 - 8. Spadix appendix not expanded at all
 - 9. Sterile flowers subclavate to clavate, obtuse or subtruncate. Leaf with adventitious buds
 - 9. Sterile flowers subulate, acuminate. Leaves usually without adventitious buds **8. T. violifolium**
 - 10. Leaf blade usually coriaceous, usually lanceolate to oblong. Sterile flowers narrowly obconical **9. T. laoticum**
 - 10. Leaf blade herbaceous, cordate or trilobed. Sterile flowers clavate
 - 11. Leaf blade trilobed into narrow lobes, or ovate and cordate at base. Main part of spadix (from base to top of male part) less than 2 cm long **10. T. acetosella**
 - 11. Leaf blade broadly ovate, cordate at base. Main part of spadix more than 2 cm long **11. T. albidinervum**
- 5. Sterile flowers slender cylindrical or filiform, variously curved. Spathe blade large, more than 8 cm long, ovate to widely triangular ovate
 - 12. Anther thecae laterally dehiscent to slits **12. T. roxburghii**
 - 12. Anther thecae dehiscent by apical short slit to pores
 - 13. Spathe blade ovate to triangular ovate and long acuminate, sterile flowers yellowish, simply curved **13. T. inopinatum**
 - 13. Spathe blade broadly ovate. Sterile flowers whitish, curled **14. T. trilobatum**

1. *Typhonium hirsutum* (S.Y. Hu) J. Murata et Mayo in Kew Bull. 46: 129. 1990.— *Arisaema hirsutum* S.Y. Hu in Dansk Bot. Arkiv 23(4): 454. t.11, figs 1–5. 1968. Type: Thailand, Chiang Mai, Doi Suthep, 1130 m, July 8, 1958. Sørensen, Larsen and Hansen 3939 (C holotype, BKF isotype). Figure 12.

Seasonally dormant herb covered with single cell, 0.5 mm long hairs. Tuber subglobose, 1.5–2.5 cm wide. *Cataphylls* 4–5, the innermost one largest up to 10 cm long. *Leaves* 1–2; petiole 20–25 cm long, basal sheath 1.5 cm long, encircling peduncle; blade completely pedate, 5–7 foliolate, expanding somewhat after flowering, leaflets almost sessile; terminal leaflet elliptic, caudate at apex, 7–16 cm long, 2.5–6.2 cm wide at flowering, 16–31 cm long, 9–10 cm wide when fruiting; lateral leaflets elliptic but oblique at base, outermost one ca $\frac{2}{3}$ of the length of the terminal one. *Peduncle* very short, 1–1.5 cm long. *Spathe* reddish-purple and smooth inside, greenish and hirsute outside: tube 4 cm long, 2 cm wide, slightly constricted at the mouth, the upper 3 cm with free margins, the basal 1 cm with fused margins, blade triangular ovate to lanceolate-ovate, laterally incurved, 8–13 cm long, 5–8 cm wide. *Spadix*: basal female part 6.5 cm long; interstice 2.5–3.5 cm long, lower ca 1 cm densely covered with sterile flowers, upper 1.5–2.5 cm naked; male part 1–1.7 cm long; appendix subsessile, 3–10.5 cm long, 6–8 cm wide at the base. *Female flower* a uniloculate subcylindrical pistil with disc-shaped stigma; ovule 2–3 per locule, locule filled with jelly-like material. *Sterile flowers* purplish, clavate, apex obtuse, 7 mm long. *Infructescence* exposed, globose, immature fruit 1 cm long, 0.5 cm wide, persistent style 1 mm long.

Thailand.—NORTHERN: Chiang Mai.

Distribution.—Endemic.

Ecology.—In dry evergreen forest, 1130 m alt. Flowering and fruiting during April–May.

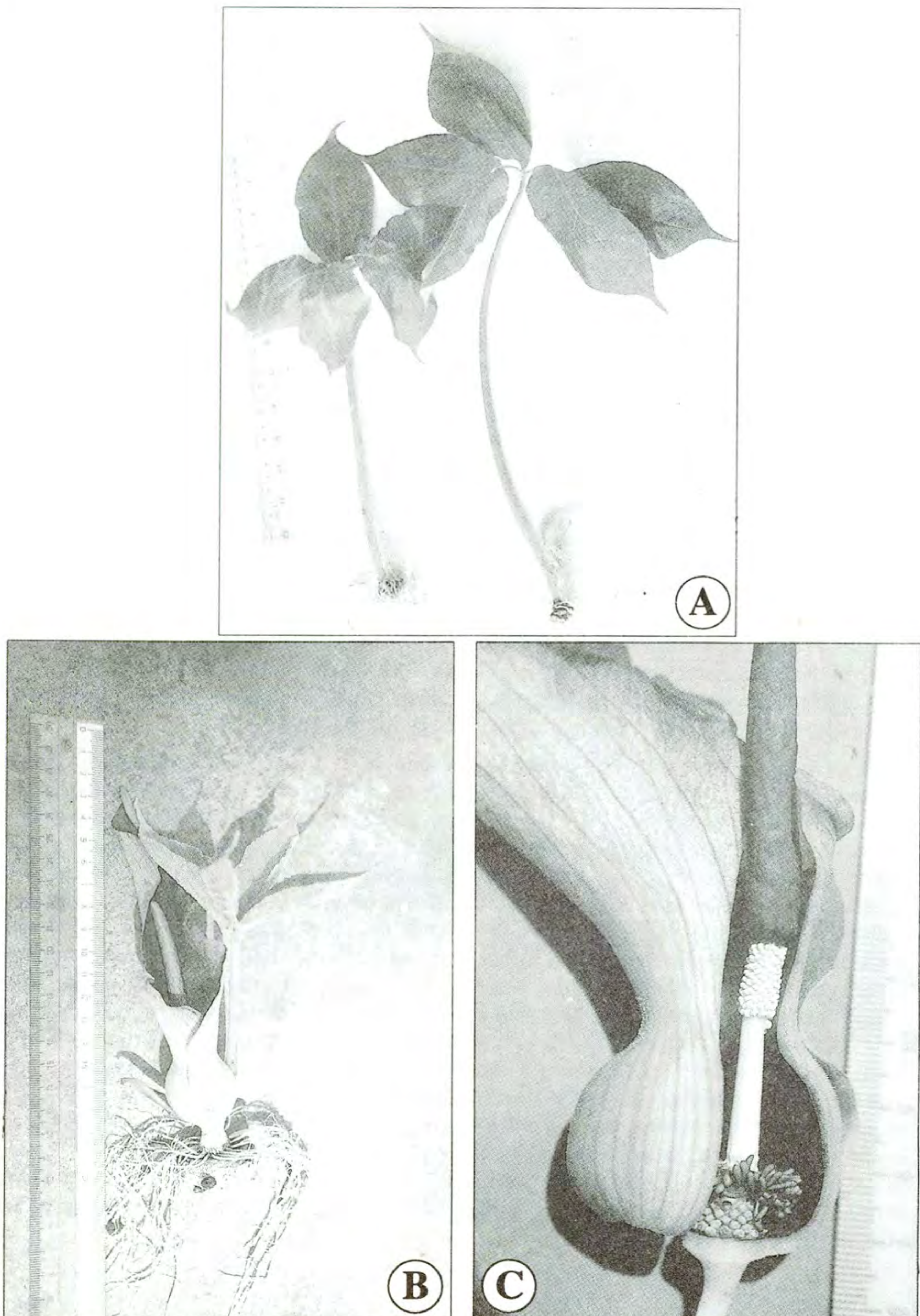


Figure 12. *Typhonium hirsutum* (S.Y. Hu) J. Murata et Mayo
A and B : Habit; C : Spadix showing male part and female part.

Specimens examined.— Chiang Mai, Doi Suthep, dry evergreen forest, 1130 m alt., 8 July 1958, Sørensen, Larsen and Hansen 3939 (C, BKF); R. Pooma s.n. (BKF); collected from Chiang Mai and cultivated at Botanical Gardens, University of Tokyo, April 26, 1993, D. Sriboonma 93-12 (TI); and April 27, 1993, D. Sriboonma 93-13 (TI).

2. *Typhonium horsfieldii* (Miq.) v. Steenis in Bull. Bot. Gard. Buitenz., Ser. 3. 17: 403. 1948. Figure 13.

— *Sauromatum horsfieldii* Miq., Fl. Ned. Ind. 3: 196. 1855; Engl. in A. DC., Monogr. Phan. 2: 571. 1879; Koorders, Exkurs. —Fl. Java 1: 265. 1911 Type: Java, Opden Oengaran, Horsfield s.n. (K holotype, BM isotype).

— *T. pedatum* Schott in Oesterr. Bot. Wochenbl. 7: 262. 1857; Schott, Prodr. Syst. Aroid.: 108. 1860; N.E. Br. in J. Linn. Soc. Bot. 18: 260. 1860; Hook.f., Fl. Brit. Ind. 4: 511. 1893. Type: Burma, Pegu, Mc.Lelland (K holotype).

— *Heterostalis pedata* Schott in Ann. Mus. Lugd. Bat. 1: 278. 1864.

— *T. fallax* N.E. Br. in J. Linn. Soc. Bot. 18: 260. 1880; Koorders, Excurs. —Fl. Java 1: 264. 1911.

— *T. pedatum* (Schott) Engl., in DC., Monogr. Phan. 2: 613. 1879, (comb. illegit., non Schott. 1857). Type: Indonesia, West Java, Papadagan (L holotype).

— *Arisaema submonoicum* Gagnap. in Not. Syst. 11: 128. 1941. Type: Thailand, Chiang Mai, Doi Angka, E slope, foot of Pa Kampang, 1750 m, May 26, 1928, Garrett 527 (K holotype).

— *T. kerrii* Gagnep., Lecomte, Fl. Gen. Indo-China 6: 1179. 1942. Type: Thailand, Kanchanaburi, Saiyok, cultivated in Bangkok, Nov. 24, 1928, Put s.n. (K lectotype selected in the present study); Saraburi, Muak Lek, cultivated in Bangkok, Oct. 7, 1928, Kerr 16109 (K syntype).

— *T. larsenii* S.Y. Hu in Dansk Bot. Arkiv 23: 448. 1968. Type: Thailand, Chiang Mai, Doi Suthep, Jul. 7, 1958, Sørensen, Larsen and Hansen 3931 (C holotype, A isotype).

— *T. kunmingense* H. Li in Acta Phytotax. Sin. 15(2): 104. 1977; H. Li, Fl. Reipub. Pop. Sin. 13(2): 108. 1979. Type: China, Yunnan, (collected in Huize, Dahai), cultivated in Kunming Botanical Garden, B.Y. Qin 58944 (KUN holotype).

— *T. calcicolum* C.Y. Wu ex H. Li, Y. Shiao et S.L. Tseng in Acta Phytotax. Sin. 15(2): 104. 1977; H. Li, Fl. Reipub. Pop. Sin. 13(2): 108. 1979. Type: China, Yunnan, Xichou, S.Z. Wang 731 (KUN holotype).

Tuber depressed globose, occasionally oblong. *Cataphylls* coriaceous. *Petiole* 35–45(–60) cm long, sheathing at base. *Leaf* pedately 7–13 dissected; leaflets sessile, narrowly lanceolate to oblong lanceolate, acute to acuminate, entire or occasionally crenate; lateral leaflets gradually decrease in size; terminal leaflet 7–22 cm long, 1.2–6 cm wide; outermost leaflet 2–9.1 cm long, 1–2.7 cm wide; rachis 2.5–10 cm long. *Peduncle* 4.5–15(–20) cm long. *Spathe* tube ovate, (2.5–)3–4 cm long; blade ovate to ovate-oblong when open, boat-shaped, apex acuminate to caudate, 6–17 cm long. *Spadix* shorter than spathe, basal female part 4–10 mm long, 4–8 mm wide; interstice narrowly conical, 2–6 cm long, 3–7 mm wide at base, covered by sterile flowers; male part 6–10 mm long, 2–7 mm wide, with staminodes above; appendix subsessile, cylindrical, slightly tapering to apex, attenuate at base, 1.5–4.5 cm long, (2–)3–6 mm wide. *Anther* thecae apically dehiscent; staminode capitate and/or filiform, mostly erect. *Sterile flowers* on interstice dimorphic; lower ones clavate, curved upward,

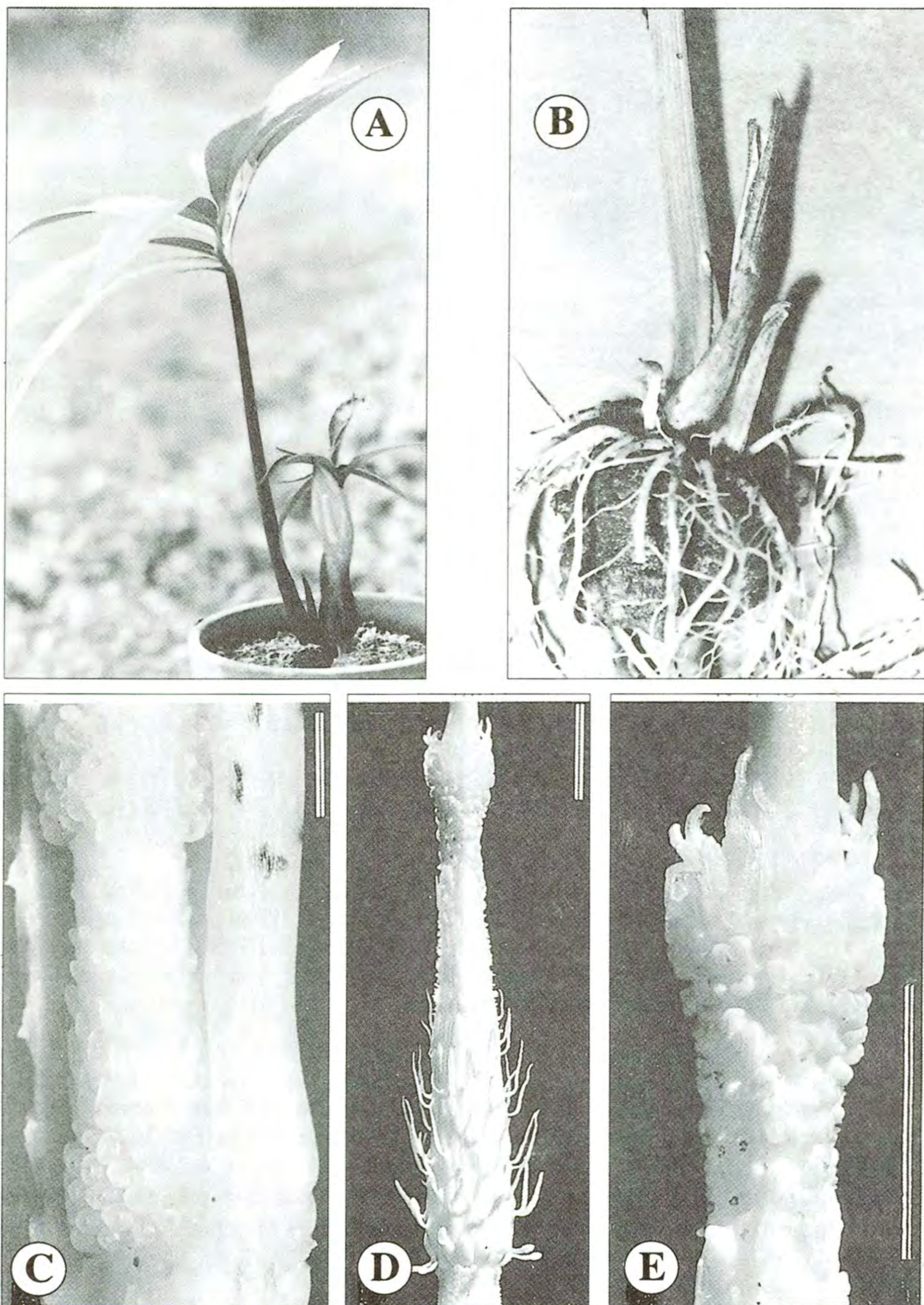


Figure 13. *Typhonium horsfieldii* (Miq.) v. Steenis (= *T. larsenii*)

A and B : Habit; C : Immature spadix. The lower round organs - female flowers, the middle triangular ones - sterile flowers and the upper larger ones - male flowers; D : Mature spadix of the same individual; E : Enlarged staminodes. Scale = 1 mm in C, 1 cm in D and E.

6–8 mm long; upper ones filiform, gradually shorter and smaller toward male zone. *Female flowers* oblong to ovate-oblong, sessile, with 1 or 2 erect ovules. *Fruit* berry, obovoid to ellipsoid.

T h a i l a n d.—NORTHERN: Chiang Mai, Lampang; CENTRAL: Nakhon Nayok, Saraburi; SOUTH-WESTERN: Kanchanaburi.

D i s t r i b u t i o n.—Indonesia, China (Yunnan, Guizhou) and Burma.

E c o l o g y.—In evergreen forest, alt. 700–1750 m. Flowering and fruiting during May–October.

Specimens examined.—Chiang Mai, Chiang Dao, 700 m, May 30, 1921, Kerr 5523 (BK, BKF, K); Chiang Mai, Doi Angka, face of Pa Kampang, May 26, 1928, Garrett 527 (K); Chiang Mai, Doi Suthep, Jul. 7, 1958, Sørensen, Larsen and Hansen 3931 (A, C) and 4928 (C); collected from Chiang Mai, Doi Suthep, cultivated in Botanical Gardens, University of Tokyo, Tokyo, April 19, 1985, J. Murata 30790 (TI) and Apr. 25, 1985, J. Murata 17939 (TI); Collected from Lampang, Ngao, cultivated in Bangkok, Aug. 27, 1931, Kerr (BKF, K); Cultivated in Bangkok, Oct. 7, 1929, Kerr (BK, K); Nakhon Nayok, Nang Rong Waterfalls, Sept. 16, 1972, J.F. Maxwell 72–371 (BK); Nakhon Nayok, Nang Rong Waterfall, July 29, 1959, Smitinand 6108 (BKF); Collected from Saraburi, Muak Lek, cultivated to Bangkok, Oct. 7, 1928, Kerr 16109 (BK, K) and Aug. 25–Nov. 3, 1929, Kerr 17582 (K); Collected from Saraburi, cultivated in Bangkok, Kerr 24269 (BK); cultivated in Bangkok, collected from Saiyok, Kanchanaburi, Nov. 24, 1928, Put s.n. (K).

3. *Typhonium albispalum* Bogner in *Aroideana* 10(2): 27. 1987. Type: Thailand, Peninsular, Phangnga, Khao Phota Luang Kaeo, 9 20 N, 97 40 E, evergreen hillside forest, 1000–1300 m, May 7, 1974, K. Larsen 33700 (AAU holotype, M isotype) Figure 14.

Tuber depressed globose, 1 cm long, 1.5 cm wide. *Petiole* 9–14 cm long, 1.5–2 mm wide, green, sheathing in the lower 23 cm. *Leaf* broadly ovate, 10–14 cm long, 8–11 cm wide, base cordate and overlapping, apex short acuminate, green, somewhat glaucous. *Peduncle* 9–15 cm long, 1.5–2 mm wide. *Spathe* 3–4.5 cm long, ovate-lanceolate, convolute at base, open sideward, acuminate to apex, white, purple inside at base. *Spadix* 9.5–14.5 cm long, lowest female part 2 mm long; interstice short, sparsely covered with 2–3 rows of sterile flowers; male part ca 7 mm long, sparsely covered with male flowers consisting of 1 stamen; appendix filiform, 8.5–13.5 cm long, 1 mm wide, violet. *Anther* thecae laterally dehiscent to slits. *Female flowers* 1–1.2 mm long, ovary oblong-ellipsoid, 0.8 mm long and 0.5–0.6 mm wide, ovule 1. *Sterile flowers* subclavate, elliptic, 1–1.2 mm long. *Fruit* berry, ellipsoid, 3.5–4 mm long, 2.5 mm wide, greenish, seed 1, ovoid, 2 mm long and 1.5 mm wide.

T h a i l a n d.—PENINSULAR: Phangnga.

D i s t r i b u t i o n.—Endemic.

E c o l o g y.—Evergreen hillside forest; alt. 1000–1300 m.

Specimen examined.—K. Larsen 33700 (BKF)

4. *Typhonium flagelliforme* (Lodd.) Blume in Rumphia 1: 134. 1837; H. Li., Fl. Reip. Pop. Sin. 13(2): 107. 1979; Nicolson & Sivadasan in Blumea 27: 489. 1981; A. Hay in Blumea 37: 350. 1993.—*Arum flagelliforme* Lodd., Bot. Cab. 4: t. 396. 1819. For detailed synonyms and literatures see Nicolson & Sivadasan (1981). Type: Lodd., Bot. Cab. 4: t. 396. (1819). Figure 15.

Tuber depressed globose, to 2 cm wide. *Petiole* 10–45 cm long, distinctly sheathing in lower $\frac{2}{3}$. *Leaf* extremely variable, typically narrowly hastate with spreading basal lobes but sometimes elliptic; anterior lobe 6–25 cm long, 1–4 cm wide; posterior lobes horizontally spreading, 4–5 cm long, 3–5 mm wide. *Peduncle* to 25 cm long. *Spathe* basically yellowish-green, tube ovate, longitudinally keeled, 1.5–3.5 cm long; blade narrowly triangular-lanceolate, 15–30 cm long, 5–8 cm wide,

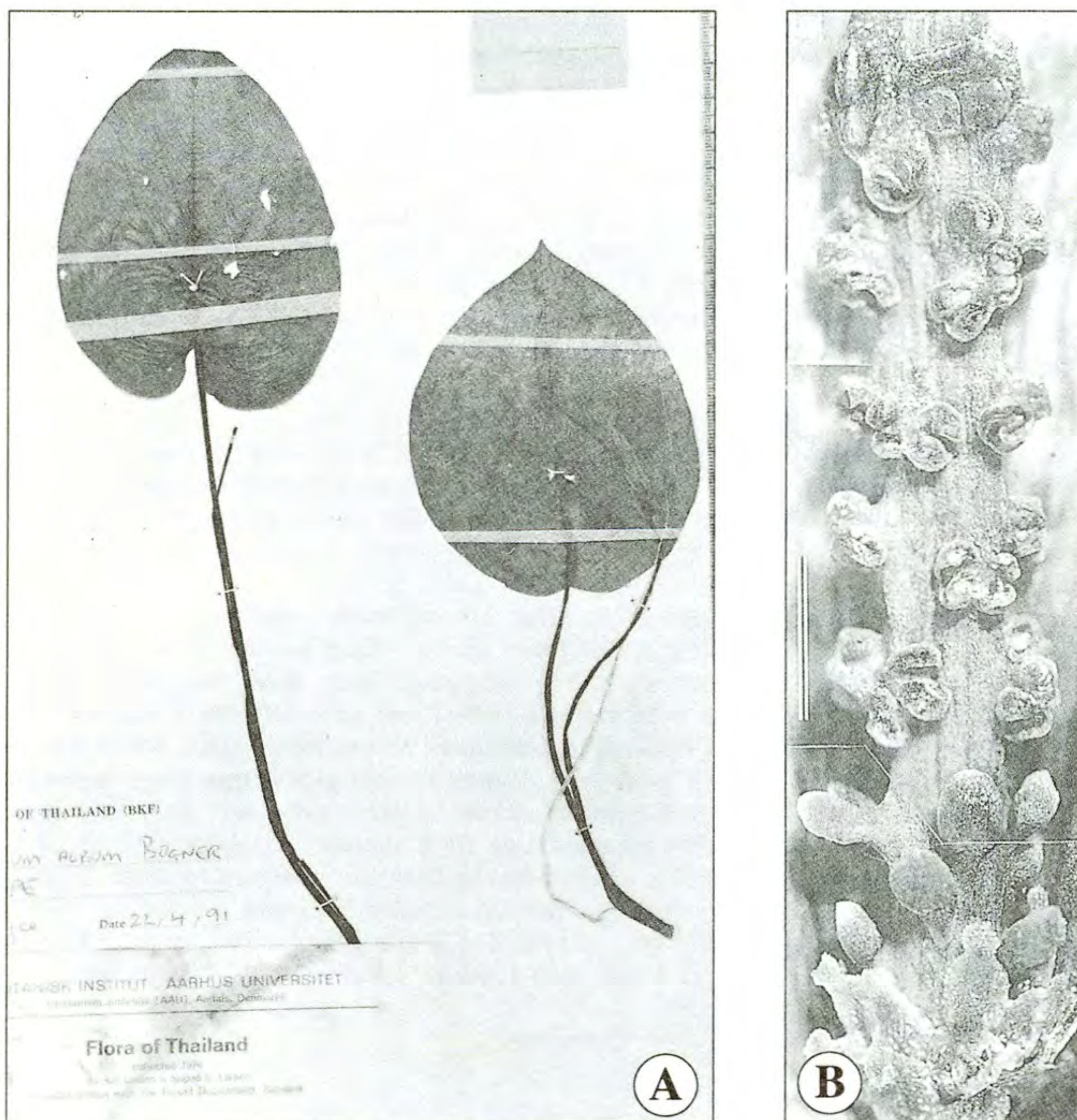


Figure 14. *Typhonium albispalum* Bogner
A : Habit; B : Enlarged spadix, scale = 1 mm.

recurved and spreading at base. *Spadix* as long as spathe; female part ca 5 mm long; interstice ca 2 cm long, covered with sterile flowers up to male part; male part ca 5 mm long; appendix narrowly conical, subsessile, greenish-yellow, to 20 cm long. *Sterile flowers* dimorphic, on the lower part of interstice spatulate, incurved, dark tipped, ca 6 mm long, but those on the upper part smaller, filiform and spreading to deflexing. *Infructescence* surrounded by persistent spathe tube.

Thailand.—NORTH-EASTERN: Loei.

Distribution.—Indo-China, Tropical Asia, East Malesia to Australia.

Ecology.—In open forest; alt. 200–300 m. Flowering and fruiting during January–July.

Specimens examined.—Loei, Wang Saphung, Sithan, 300 m, July 14, 1959, Smitinand & Floto 24352 (BKF); Sikiu, Korat, ca 200 m, Jan. 20, 1931, Kerr 19907 (BKF).

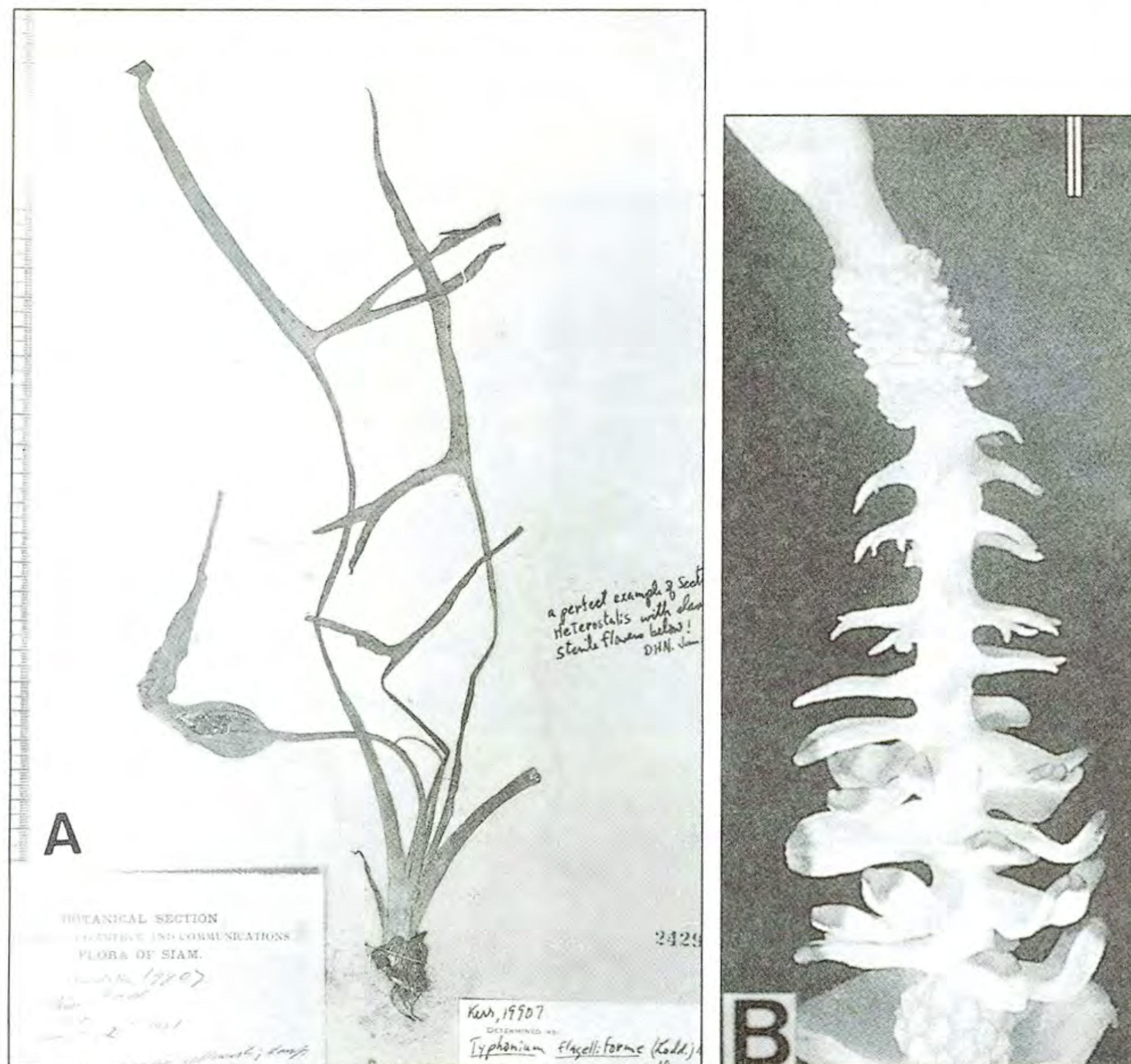


Figure 15. *Typhonium flagelliforme* (Lodd.) Blume
A : Habit; B : Enlarged spadix, scale = 5 mm.

5. *Typhonium gagnepainii* Nicolson ex Sriboonma et J. Murata, stat. et nom. nov.—*T. divaricatum* Decne. var. *minutum* Gagnep. in Lecomte, Fl. Gén. Indo-Chine 6: 1181. 1942; Nicolson & Sivadasan in Blumea 27: 497 (addendum) 1981. Type: Thailand, Pumaro, Mukdahan, ca 200 m, May 19, 1932, Kerr 21442 (K lectotype chosen in the present study, BK isoelectotype): Cambodia, 1883–1885. Couderc (P. syntype). Figure 16.

Tuber obovate, 1.2–1.8 cm long, 0.7–1.3 cm wide. *Petiole* covered with minute glandular hairs, 12–30 cm long. *Leaf* triangular, distinctly hastate, veins covered with glandular hairs beneath, anterior lobe ovate to widely ovate, apex acute, 4–10 cm long, 4–11 cm wide; posterior lobe ovate triangular to widely lanceolate, 4–9 cm long, 1.5–6 cm wide. *Peduncle* 1–5 cm long. *Spathe* tube ovate, 7–9 mm long, 5–6 mm wide; blade oblong-lanceolate, 1.7–3 cm long, open and recurve. *Spadix* nearly as long as spathe; female part ca 2 mm long, with several rows of pistils; interstice 7–12 mm long, lower 1 mm covered with sterile flowers, naked above; male part 7–10 mm long, appendix narrowly conical, 6–10 mm long, short stipitate. *Anther* thecae dehiscent to pores. *Sterile* flowers clavate, apex subtruncate, ca 2 mm long.

Thailand.—NORTH-EASTERN: Mukdahan.

Distribution.—Cambodia.

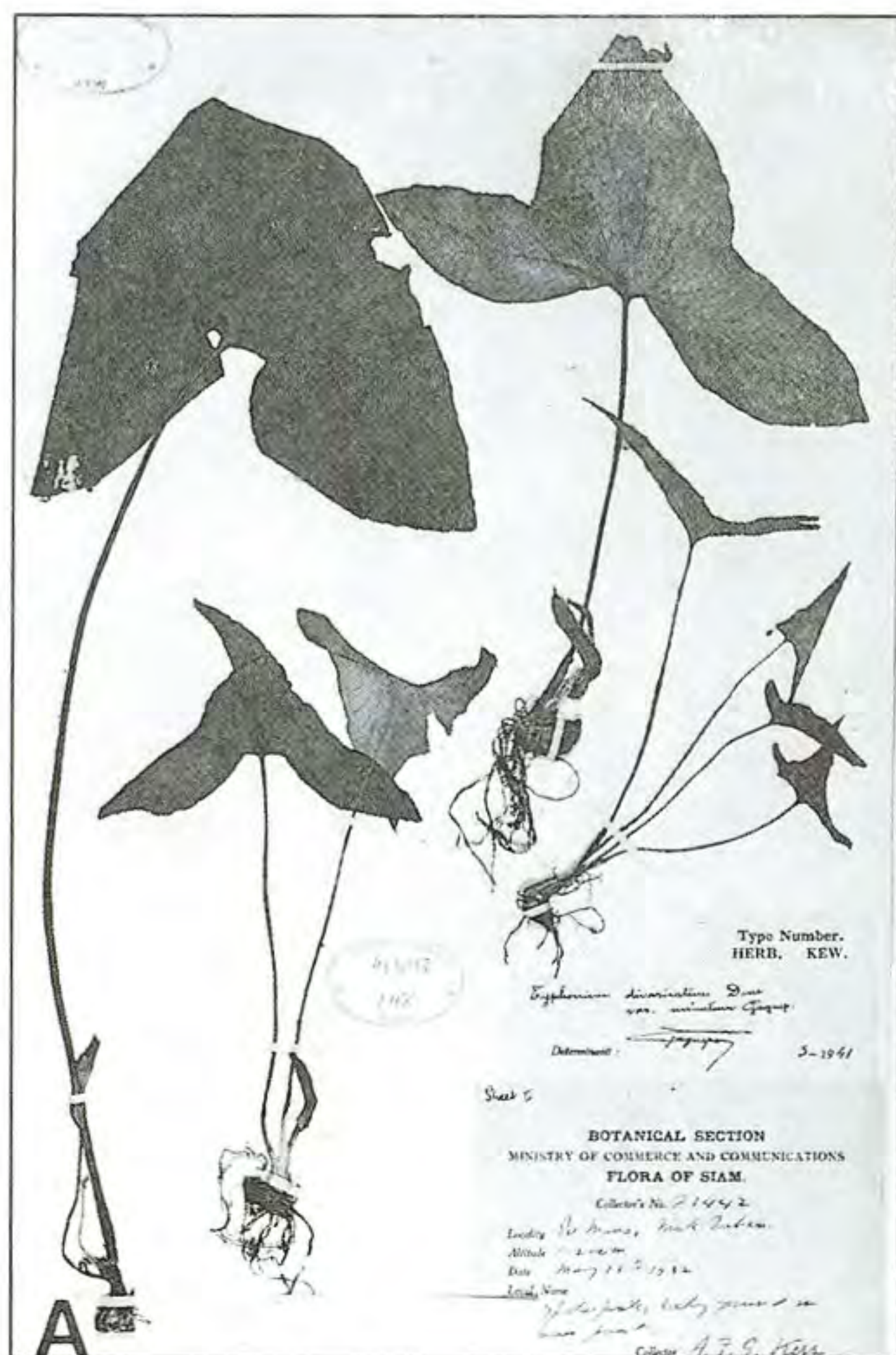


Figure 16. *Typhonium gagnepainii* Nicolson ex Sriboonma et J. Murata
A : Habit; B : Sterile flowers, scale = 2 mm.

E c o l o g y.— On rocky ground in deciduous forest, alt. 200 m. Flowering and fruiting in May.

Specimens examined.— Mukdahan, Kerr 21442 (BK, K).

6. *Typhonium sagittariifolium* Gagnep. in Lecomte, Fl. Gen. Indo-Chine 6: 1179. 1942. Type: Collected in Thailand, Saraburi, Chai Badan, Apr. 19, 1924, Kerr 10696a (K holotype). Figure 17.

Tuberous herb, 20–30 cm high. *Petiole* slender, up to 30 cm long, vaginate in the basal 3–8 cm. *Leaf* trilobed, sagittate, lobes narrowly lanceolate 5–9 cm long. *Spathe* greenish-purple with reddish spots; tube ovate-oblong, apically constricted, 10–13 mm long, 5–7 mm wide; blade triangular ovate 2.5–3.5 cm long, acuminate; blade ovate-lanceolate, acuminate, 25–32 mm long. *Spadix* 32–35 mm long; female part 2–4 mm long; interstice 13 mm long, densely covered with sterile flowers near base, upper part naked; male part 5–7 mm long; appendix red, narrowly conical, obtuse, 8 mm long, short stipitate. *Anther* thecae dehiscent into pores. *Female flowers* 1.5 mm long; style absent; ovule 1. *Sterile flowers* yellow, papillose, subulate, ca 5 mm long, recurved.

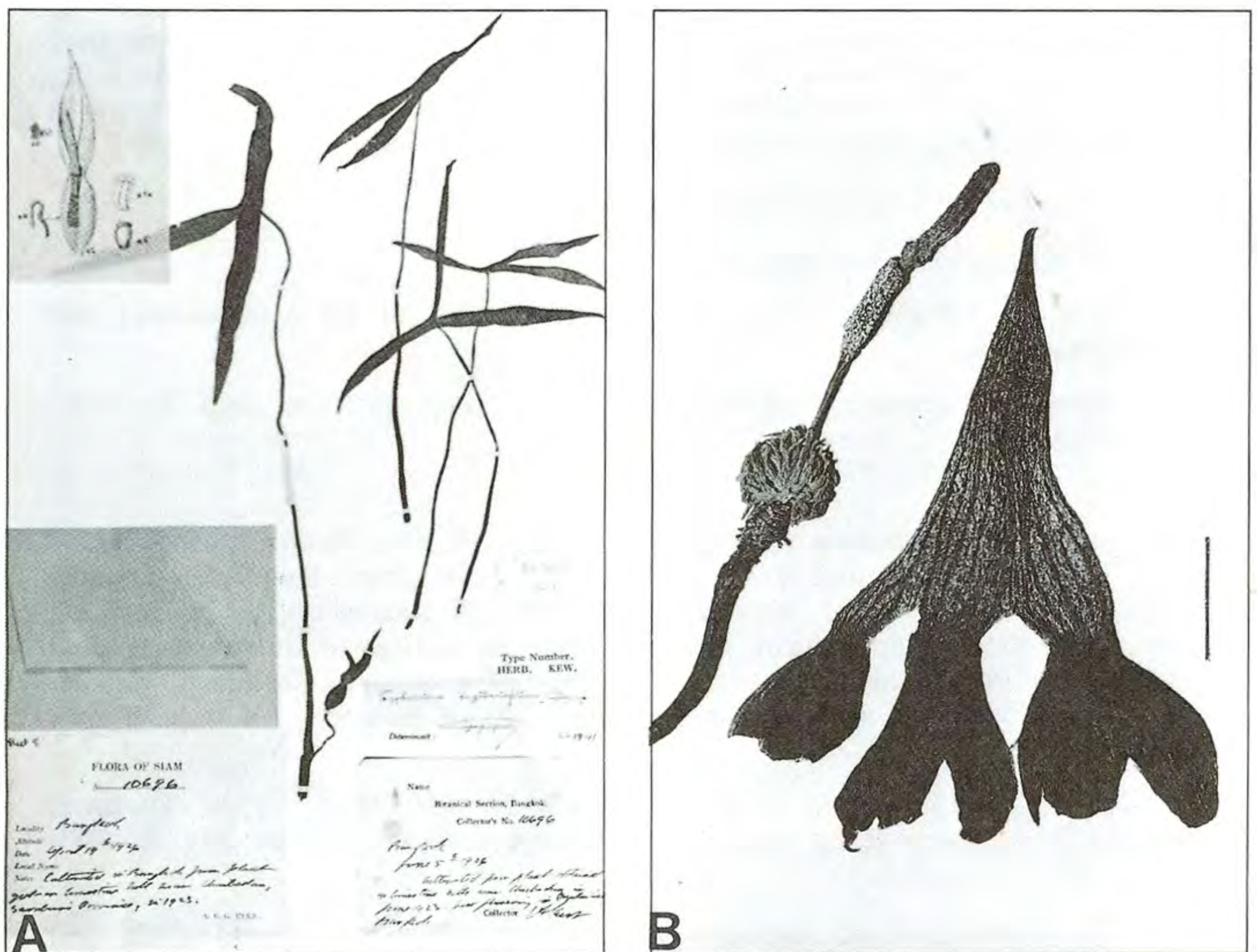


Figure 17. *Typhonium sagittariifolium* Gagnep.
A : Habit; B : Spadix and spathe (scale = 1 cm.)

Thailand.—CENTRAL: Lop Buri, Saraburi.

Distribution.—Endemic.

Ecology.—In limestone hills. Flowering and fruiting during April–July.

Specimens examined.—Cultivated in Bangkok from plant obtained in limestone hills near Chai Badan, Lop Buri, Apr. 19, 1924, Kerr 10696a (K); June 5, 1924, Kerr 10696b (K); July 19, 1924, Kerr 10696c (K); Aug. 14, 1924, Kerr 10696d (K); Collected from Saraburi, Muak Lek, cultivated at Botanical Garden Aberdeen, July 29, 1928, Kerr 177 (K).

7. *Typhonium filiforme* Ridl. in J. Straits Branch Roy. Asiat. Soc. 41: 45. 1903; Engl., Pflanzenr. Ht. 73 (IV-23F): 121. 1920. Type: Malaysia, Perak, Kwala Dipang, Ridley 9620 (SING holotype, K isotype). Figure 18.

Tuber subglobose, 5–8 mm wide. *Petiole* 6.5–12 cm long. *Leaf* ovate triangular, distinctly hastate, acuminate, anterior lobe 4–8.5 cm long, 3.5–4.5 cm wide; posterior lobe 2–4.7 cm long, 1.2–2 cm wide. *Peduncle* 1(–3) cm long. *Spathe* tube elliptic, 6–7 mm long, olive green; blade linear, expand at base, involute at apex, 7–10 cm long, yellow, red spotted. *Spadix* slender, 7–8 cm long; female part very short, with one to two rows of pistils; interstice ca 7 mm, covered with sterile flowers near base, upper part naked; male part ca 4 mm long, appendix filiform, 7–10 cm long, abruptly expanded near base, stipitate, yellow. *Sterile flowers* subulate, recurved in the upper part. *Infructescence* covered with persistent spathe tube.

Thailand.—SOUTH-WESTERN: Kanchanaburi.

Distribution.—Malaysia.

Ecology.—In evergreen on limestone hills, alt. 50 m. Flowering and fruiting in August.

Specimens examined.—Kanchanaburi, Khao Tong, ca 50 m, Aug. 31, 1930, Kerr 19628 (BK).

8. *Typhonium violifolium* Gagnep. in Lecomte, Fl. Gen. Indo-Chine 6: 1177. 1942, including var. *&* and *B*. Type: Thailand, Phetchaburi, Kao Zoi, cultivated in Bangkok, July 15, 1931, Kerr 20574 (K syntype); Ratchaburi, 50 m, July 17, 1924. Kerr 9013 (BK syntype); Found growing in crevices of limestone rocks at Phetchaburi and cultivated in Bangkok, Kerr 11045 (BK syntype); Ko Samui, May 24, 1927. Put 677 (BK, K syntype); Ko Samui, Put 723 (K lectotype, BK isotype). Figure 19.

T. cordifolium Hu in Dansk Bot. Arkiv 23: 446. 1968. Type: Thailand, Kanchanaburi, Thung Kang Yang, mixed evergreen forest, 350 m, July 7, 1963, Larsen 10577 (C holotype).

Small tuberous herb, with adventitious bud at petiole top, and/or middle part (at top of sheath) of petiole, and/or leaf blade apex. Tuber subglobose, erect, 4–8 mm wide. *Petiole* slender, 3.5–11 cm long, leaf ovate to elliptic, 3.5–11 cm long, 2–5 cm wide, apex acuminate to obtuse, slightly to distinctly cordate at base. *Peduncle* short,

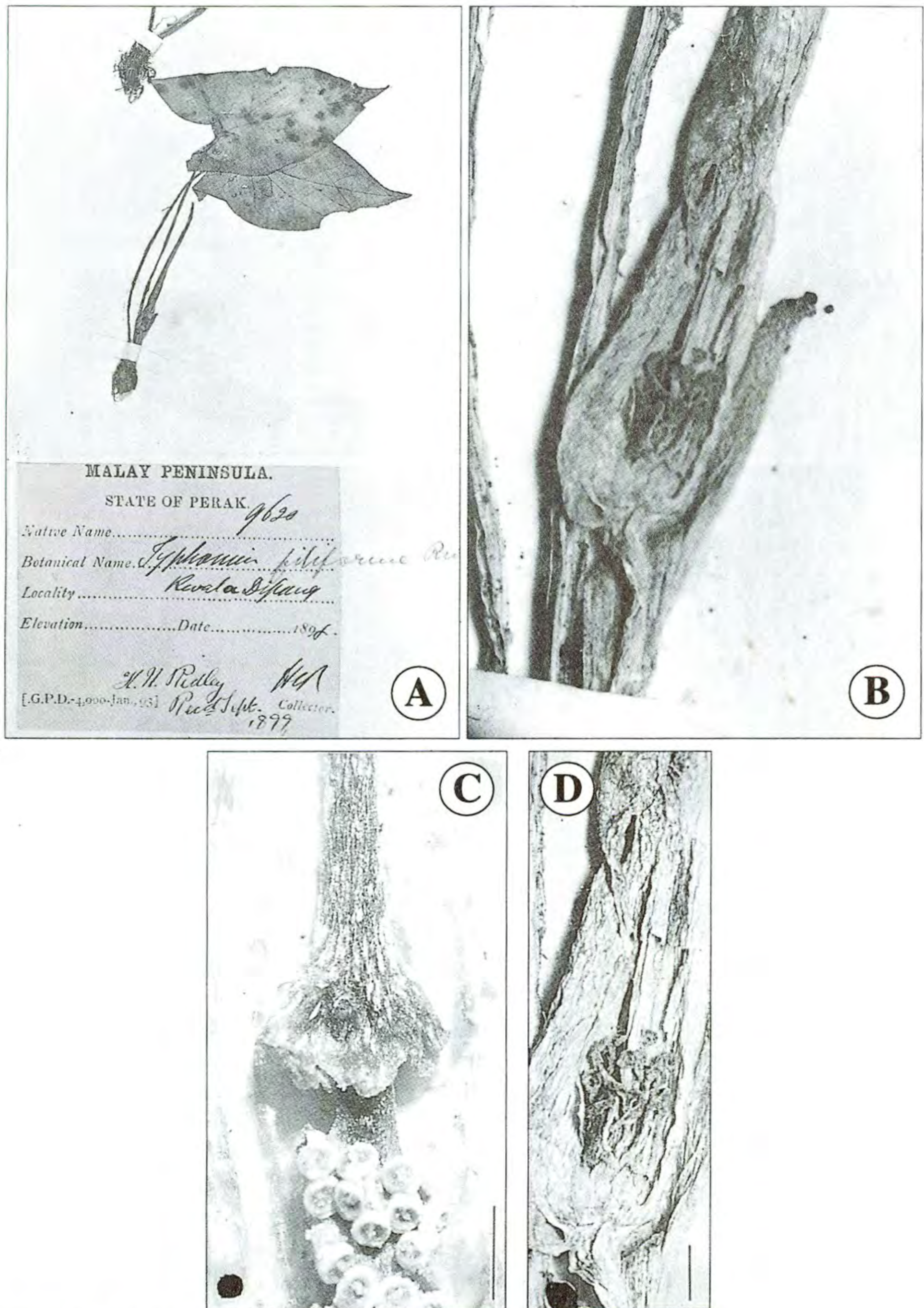


Figure 18. *Typhonium filiforme* Ridl.

A : Habit; B : Enlarged spadix; C : Sterile flower with scale = 1 mm; D : Stipe of spadix appendix and male flower, scale = 1 mm.

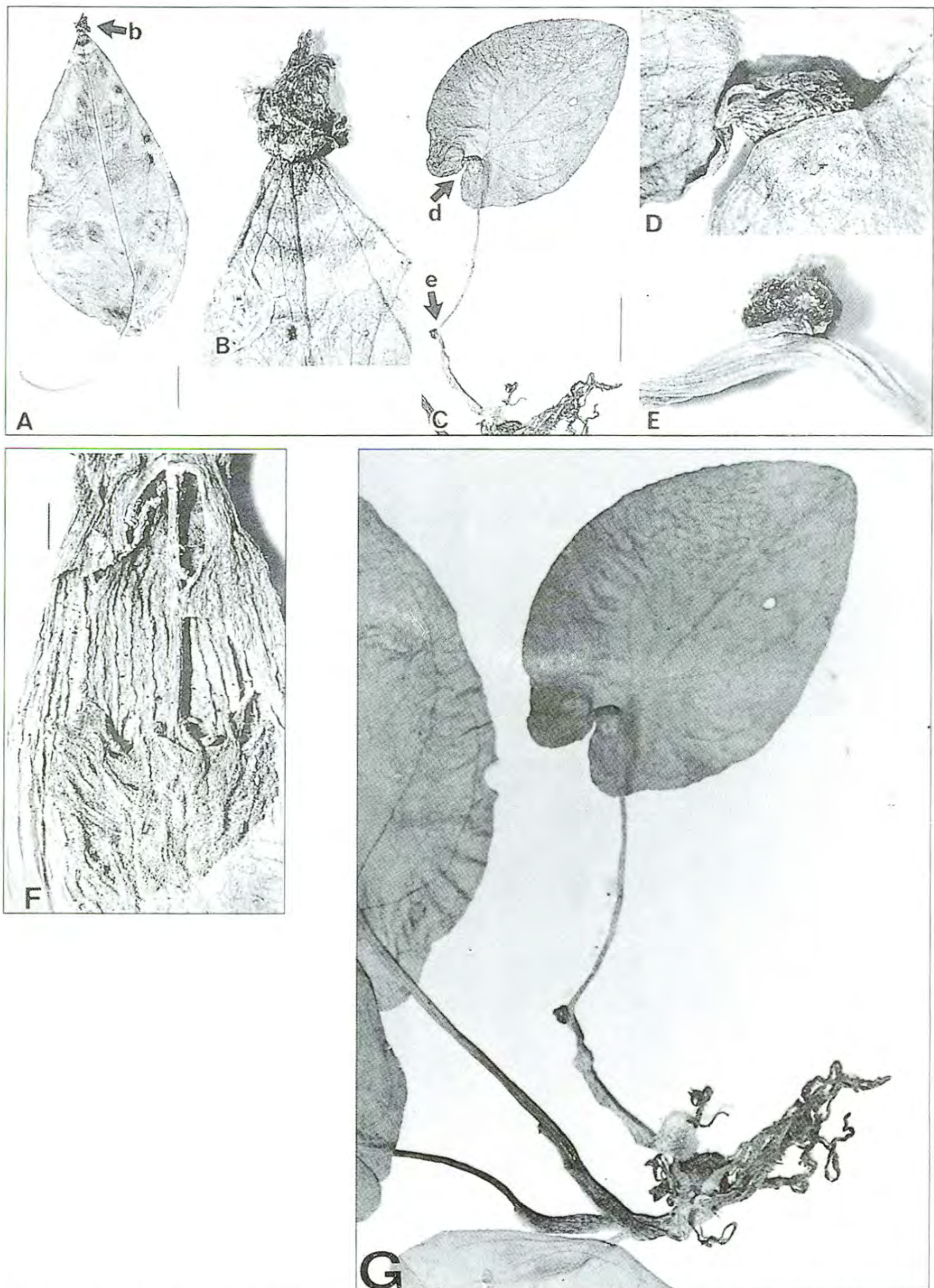


Figure 19. A, C : Leaves of *Typhonium violifolium* Gagnep. with adventitious buds at leaf apex (b = B) and/or at the top of the petiole (d = D) and/or at the top of the petiole sheath (e = E), scale = 1 cm; F : Lower part of spadix (showing sterile flowers), scale = 1 mm; G : Habit.

up to 2 cm long. *Spathe* 7–13 cm long, purplish; tube ovoid, 8 mm long, 5 mm wide; blade narrowly lanceolate, 6–12 cm long, 8–10 mm wide near base. *Spadix* as long as spathe, green; female part very short, with 2–3 rows of pistils; interstice 5–8 mm long, densely covered with sterile flowers in the lower part, upper part naked; male part subglobose, ca 2–4(–5) mm long; appendix filiform, 5–10 cm long. *Sterile flowers* subulate, suberect, 2–4 mm long.

Thailand.—SOUTH-WESTERN: Phetchaburi, Ratchaburi.

Distribution.—Endemic.

Ecology.—On limestone rocks, mixed evergreen forest, alt. 50–350 m. Flowering and fruiting during May–July.

Vernacular.—Waan taphit lek (ว่านตะพิดเล็ก) (Surat Thani).

Specimens examined.—Phetchaburi, Kao Zoi, June 10, 1931, Put 3949 (K); Kerr 20574 (K), Kerr 11045 (BK); Kanchanaburi, Larsen 10577 (C); Ko Samui, Put 677 (K), Put 723 (K); Plant brought from Ko Tao, flowering in Bangkok, June 8, 1928, Kerr s.n. (K); Ratchaburi, Kerr 9013 (BK).

9. *Typhonium laoticum* Gagnep. in Lecomte, Fl. Gén. Indo-Chine 6: 1176. 1942. Type: Thailand, Nakhon Phanom, Mukdahan, ca 100 m. May 14, 1932, Kerr 21453 (K lectotype selected in the present study, BK isoelectotype); Thailand, Nakhon Phanom, Mukdahan, ca 200 m, May 30, 1932, Kerr s.n. (K syntype). Figure 20.

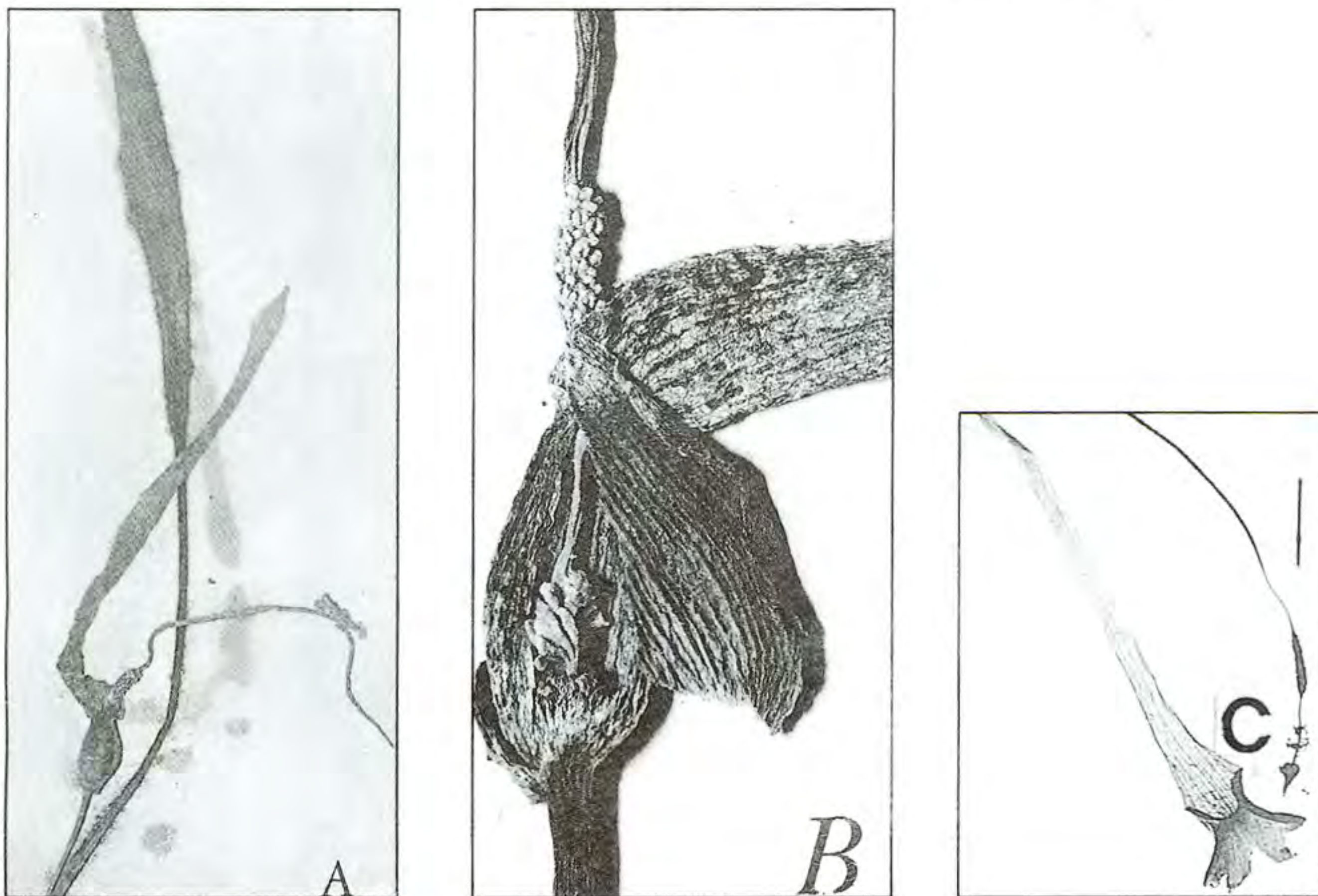


Figure 20. *Typhonium laoticum* Gagnep.

A : Habit; B : enlarged spadix; C : spathe and spadix, scale = 1 cm.

Tuber globose, to 1 cm wide. *Petiole* 3–12 cm long, vaginate in the lower $\frac{1}{3}$. *Leaf* lanceolate to elliptic, 4–9 cm long, 0.6–4 cm wide, acute to acuminate, ovate and cordate at base, usually coriaceous. *Peduncle* 1.7–3 cm long. *Spathe* 6.5–7.5 cm long, rose, tinged with brown; tube ovoid, 10–13 mm long; blade linear, expanded at base, acute to obtuse 5.5–7 cm long, 4–8 mm wide, recurved. *Spadix* ca 7 cm long; female part very short, with several rows of pistils; interstice 7–10 mm long, with sterile flowers at base, male part ca 7 mm long; appendix cylindrical, 5 cm long, 0.5–1.5 mm wide. *Sterile flowers* clavate, subtruncate, suberect, 2–3 mm long. *Anther* thecae dehiscent into pores; connective shining white probably due to concentration of natorium oxalate.

Thailand.—NORTH-EASTERN: Mukdahan, Nakhon Phanom.

Distribution.—Laos.

Ecology.—On paddy field, alt. 100–200 m. Flowering and fruiting during May–June.

Specimens examined.—Nakhon Phanom, Mukdahan, Kerr s.n. (K) and Kerr 21453 (K).

10. *Typhonium acetosella* Gagnep. in Lecomte, Fl. Gen. Indo-Chine 6: 1177. 1942. Type: Thailand, Nakhon Phanom, Don Tan, ca 100 m alt. Kerr 21525 (K lectotype selected in the present study, BK isoelectotype); Cambodia. 1883–1885, Couderc s.n. (P syntype). Figure 21.

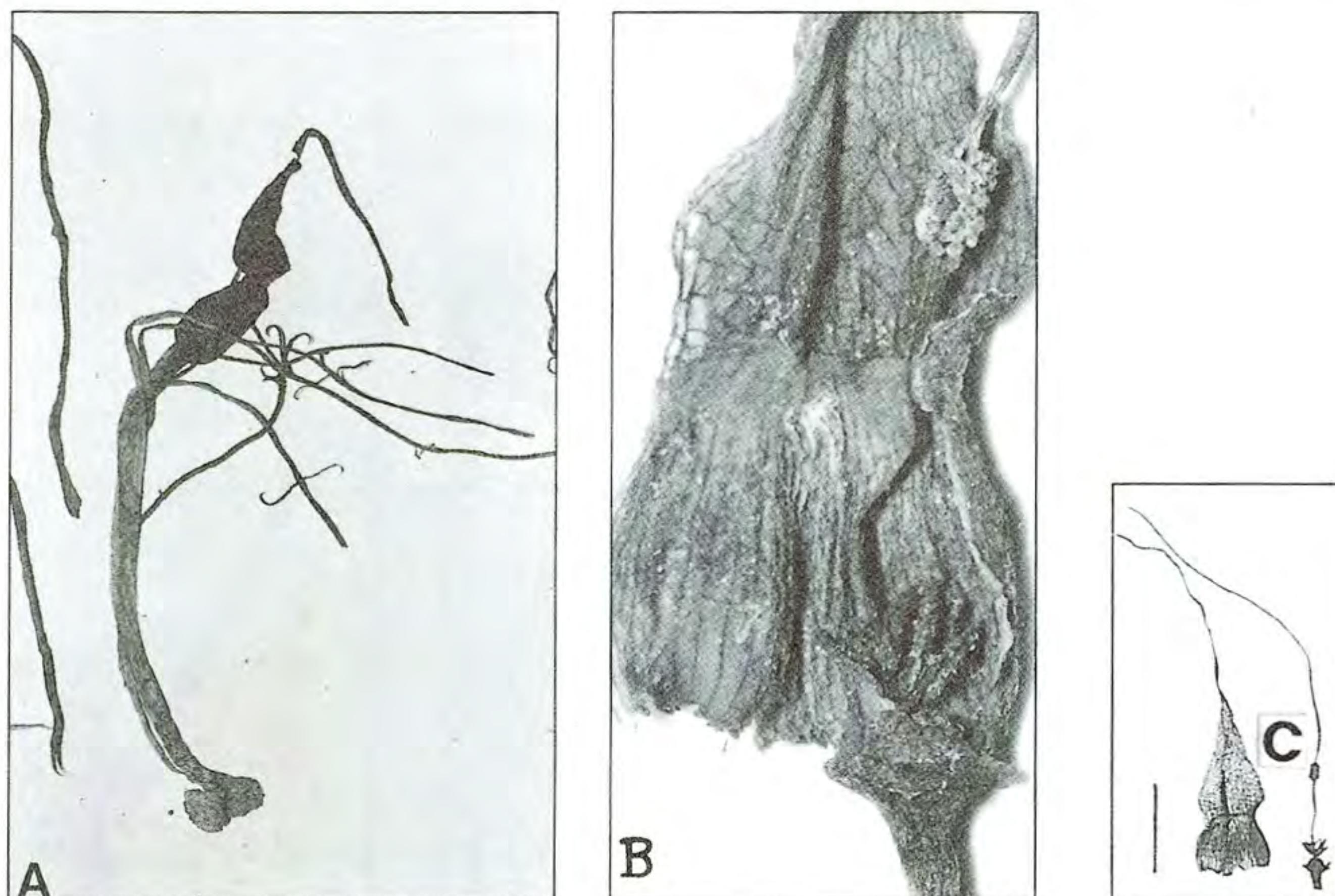


Figure 21. *Typhonium acetosella* Gagnep.

A : Habit; B : Enlarged spadix; C : Spathe and spadix, scale = 1 cm.

Small tuberous herb; tuber subglobose 5–10 mm wide. *Petiole* 5–7(–14) cm long, vaginate in the lower part. *Leaf* herbaceous, ovate and cordate at base, (1–)2–6 cm long, (0.7–)1–3.5 cm wide, or trilobed into narrow lobes, anterior lobe linear, acuminate, 4–7 cm long, 1–1.5(–7) mm wide, posterior lobes 1.5–3.5(–15) mm long; 1.0–1.5(–5) mm wide. *Peduncle* 1.5–7 cm long. *Spathe* 4.5(–15) cm long, tube ovate, 0.7–2 cm long, 4–7 mm wide; blade ovate to ovate-lanceolate at base, rather abruptly narrowed into long filiform apex, totally 3.5–6(–18.5) cm long. *Spadix* exceeding spathe, 6–11(–16) cm long; female part ca 2 mm long, with 3–4 rows of pistils; interstice 5(–15) mm long, with 2–3 rows of sterile flowers near base, naked above; male part subglobose, 1–2.5 mm wide, to 5 mm long; appendix filiform, 5–10(–13) cm long. *Anther* thecae dehiscent to pores. *Sterile flowers* clavate, 2–5 mm long.

Thailand.—NORTH-EASTERN: Nakhon Phanom, Roi Et.

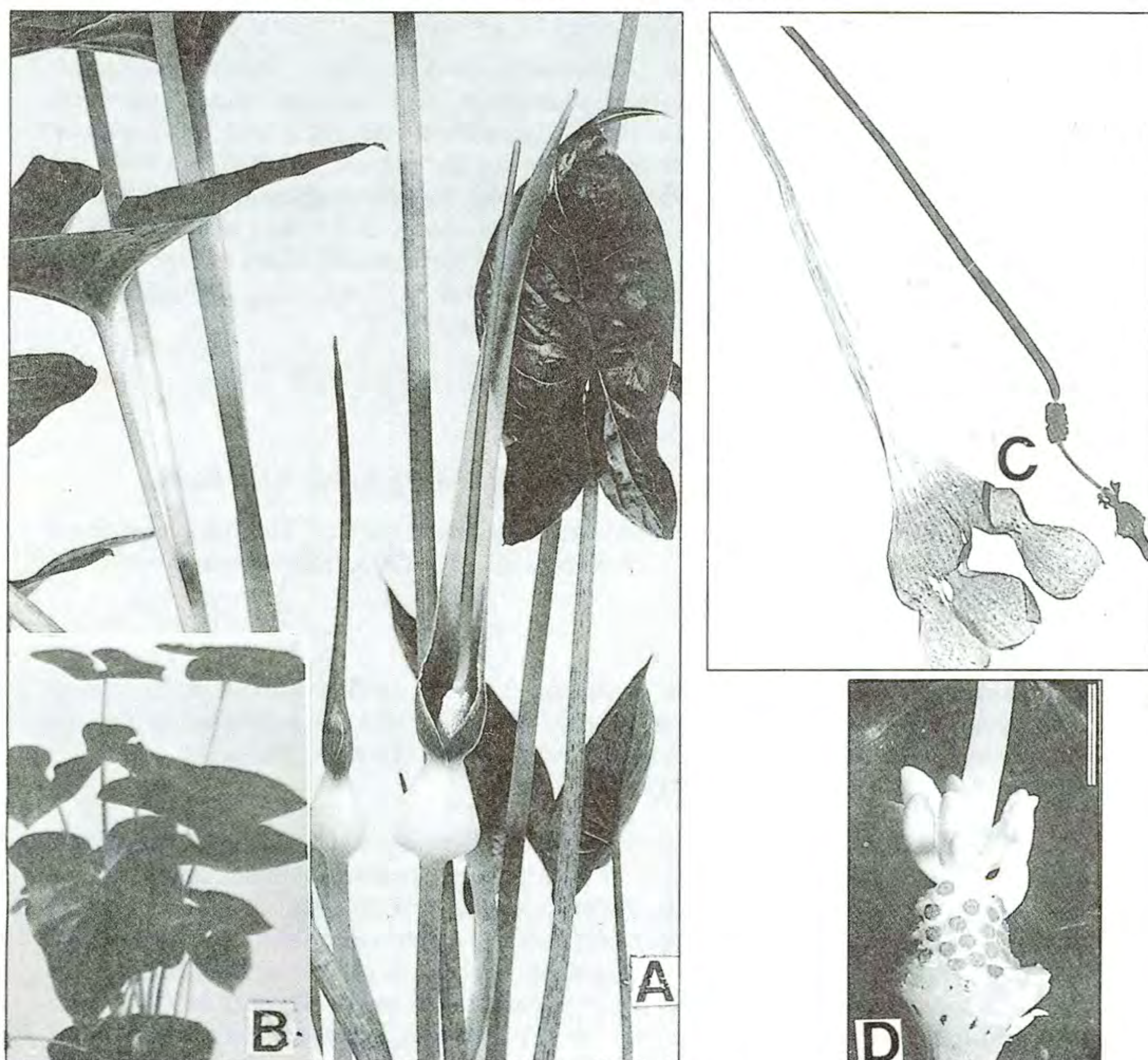


Figure 22. *Typhonium albidinervum* C.Z. Tang et H. Li ex H. Li

A, B : Habit; C : Spathe and spadix, scale = 1 cm; D : Enlarged sterile flower, scale = 5 mm.

Distribution.— Cambodia and Vietnam.

Ecology.— In shallow soil on open rocky ground; alt. 100 m. Flowering and fruiting during May–June.

Specimens examined.— Nakhon Phanom, Don Tan, Kerr 21525 (BK, K); Roi Et, Kaset Wisai, Ban Nam Om, June 9, 1982, Paisooksantivatana and Sutheesorn y1026–82 (BK); Roi Et, Selaphum, June 22, 1969, Smitinand 10757 (BKF).

11. *Typhonium albidinervum* C.Z. Tang et H. Li ex H. Li, Y. Shiao et S.L. Tseng in *Acta Phytotax. Sin.* 15(2): 105. 1977; H. Li, *Fl. Reipub. Pop. Sin.* 13(2): 110. 1979. Type: China, Guangdong, Choughau, Z.Z. Tang 853 (KUN holotype). Figure 22.

Tuberous, subglobose, 2 cm wide, with tubercles. *Petiole* 15–25 cm long. *Leaf* herbaceous, ovate to broadly ovate, 4–9(–13) cm long, 3.5–8 cm wide, occasionally trilobed, acute, cordate. *Peduncle* (2–)4–5 cm long. *Spathe* tube ovate, 1.5–1.8 cm long, 1–1.2 cm wide, yellowish-green, with reddish-stripes and dots; blade ovate-lanceolate, purple inside at base, narrowed into linear and dusty yellow apex, totally 9–15 cm long. *Spadix* as long as spathe; female part 3–4 mm long, ca 4 mm wide; interstice 1.3–2.5 cm long with sterile flowers near base, naked above; male part subglobose, occasionally elliptic, 5–6 mm long, 2–3.5 mm wide; appendix narrowly cylindrical, 9–16 cm long, tapering toward apex, sessile, deep brown. *Anther* thecae dehiscent to slits, yellow. *Sterile flowers* clavate, 3–4 mm long. *Infructescence* obconical, 6 mm long, surrounded by persistent spathe tube.

Thailand.— NORTHERN: no precise locality.

Distribution.— China and Laos.

Ecology.— Along stream. Flowering and fruiting during June–August.

Specimens examined.— Collected from Northern part of Thailand, cultivated at Botanical Gardens, University of Tokyo, June 21, 1993, Sriboonma 93–14 (TI) and Aug. 1, 1993, Murata s.n. (TI).

12. *Typhonium roxburghii* Schott, *Aroideae*: 2, t. 17. 1855; Nicolson & Sivadasan in *Blumea* 27: 492. 1981; A. Hay in *Blumea* 37: 373. 1993. For detailed synonyms and literature see Nicolson & Sivadasan. 1981. Type: Ceylon, Thwaites, c.p. 3764 (K lectotype, BM, PDA isotype). Figure 23.

Tuber, subglobose, up to 3.5 cm wide. *Petiole* up to 30 cm long, basal part sheathing. *Leaf* shallowly to deeply 3-lobed; lobes ovate-lanceolate, anterior lobe 6–12 cm long, posterior lobes smaller. *Peduncle* usually to 4 cm long. *Spathe* 10–17(–22) cm long; tube oblong, 2–3 cm long; blade ovate to ovate-lanceolate, long acuminate, dark red to purple inside, usually twisting at tip. *Spadix* as long as spathe; female part ca 5 mm long; interstice 2–2.5 cm long, covered with sterile flowers in the lower, 5–10 mm long, naked above; male part 7(–12) mm long; appendix narrowly conical, 8–15 cm long, with stipe of 1 cm long, dark purple. *Male flower* coral pink. *Sterile flowers* weakly papillose, yellowish to reddish, ca 5 mm long, curved downward. *Berry* 1–2 seed.

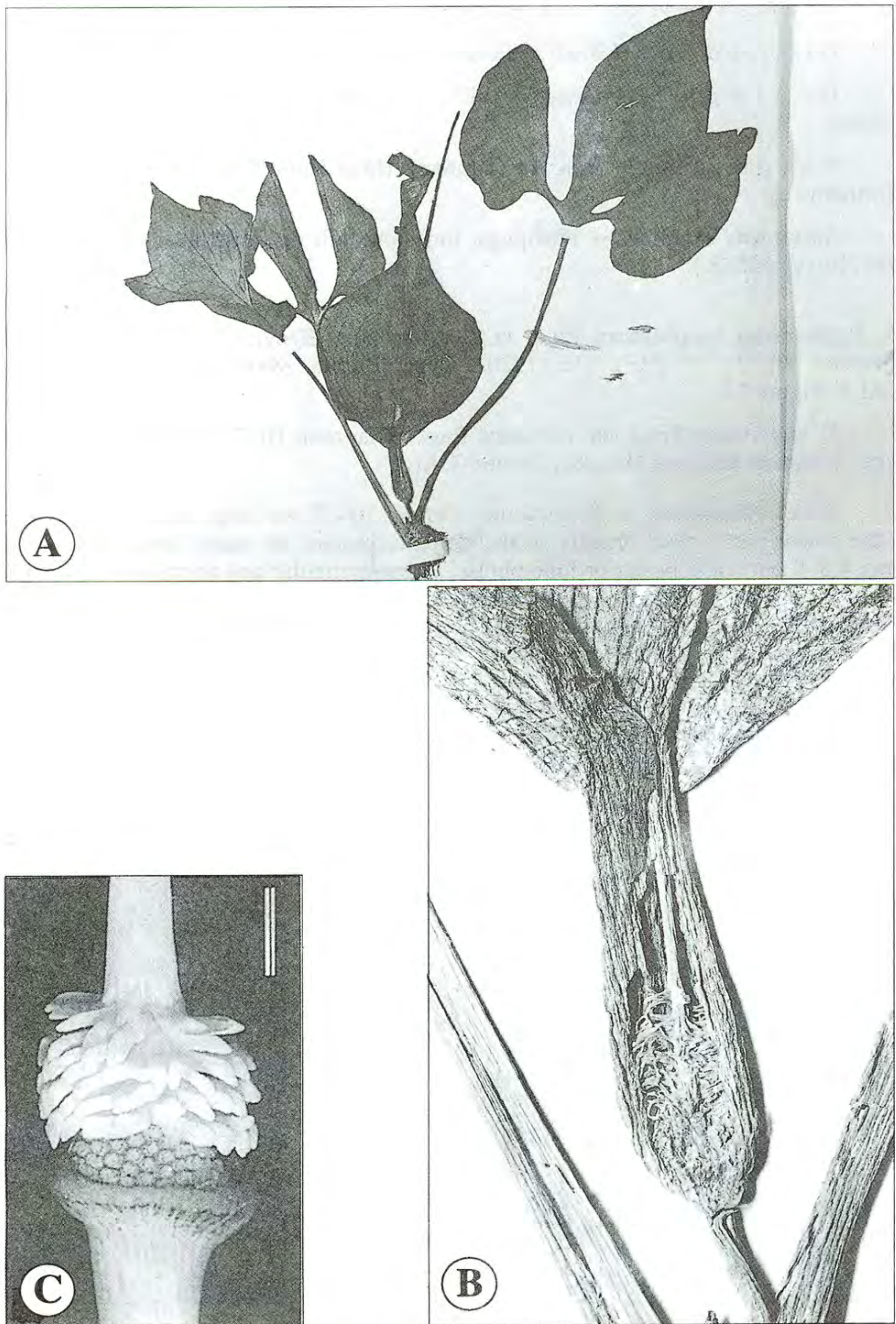


Figure 23. *Typhonium roxburghii* Schott
A : Habit; B : Spadix; C : Enlarged sterile flower, scale = 5 mm.

Thailand.—PENINSULAR: Phangnga.

Distribution.— South and central Malesia, South India and Sri Lanka.

Ecology.— On limestone hills. Flowering and fruiting during August–October.

Vernacular.— Bon doi (บอนดอย), (Mae Hong Son); bon baeo (บอนบัว) (Northern).

Specimens examined.— Phangnga, limestone hill on outskirts of town, Oct. 18, 1991, Boyce 645 (K).

13. *Typhonium inopinatum* Prain in J. Asiat. Soc. Bengal 67: 301. 1898; Engl., Pflanzenr. Ht. 73 (IV-23F): 116. 1920. Type: Burma, Myitkynia, King's collector (CAL). Figure 24.

T. inopinatum Prain var. *trisectum* Engl., Pflanzenr. Ht. 73 (IV-23F): 117. 1920. Type: Botanical Gardens Calcutta, Davies (CAL).

Tuber subglobose, to 3 cm wide. *Petiole* 10–17 cm long, distinctly sheathing in the lower part. *Leaf* broadly ovate, cordate, hastate, or rarely triparted, 6–8 cm long, 4.5–8 cm wide, posterior lobe obtuse, or subtriangular and acuminate. *Peduncle* 3–7 cm long. *Spathe* tube ovate, 2–2.5 cm long, 1.2–1.5 cm wide; blade ovate-lanceolate, 9–12 cm long, 4 cm wide, outside brownish-purple, inside dark purple. *Spadix* shorter than spathe; female part 3–4 mm long, 7 mm wide interstice 2–2.5 cm long, covered with sterile flowers in lower part, naked above; male part ca 1 cm long; appendix short stipitate, base truncate, 6–7 mm thick, attenuate to narrow obtuse apex, 4–5 cm long. *Anther* apically dehiscent into pores; sterile flowers filiform, horizontally spread and slightly curved 3–4 mm long.

Thailand.— SOUTH-WESTERN: Kanchanaburi.

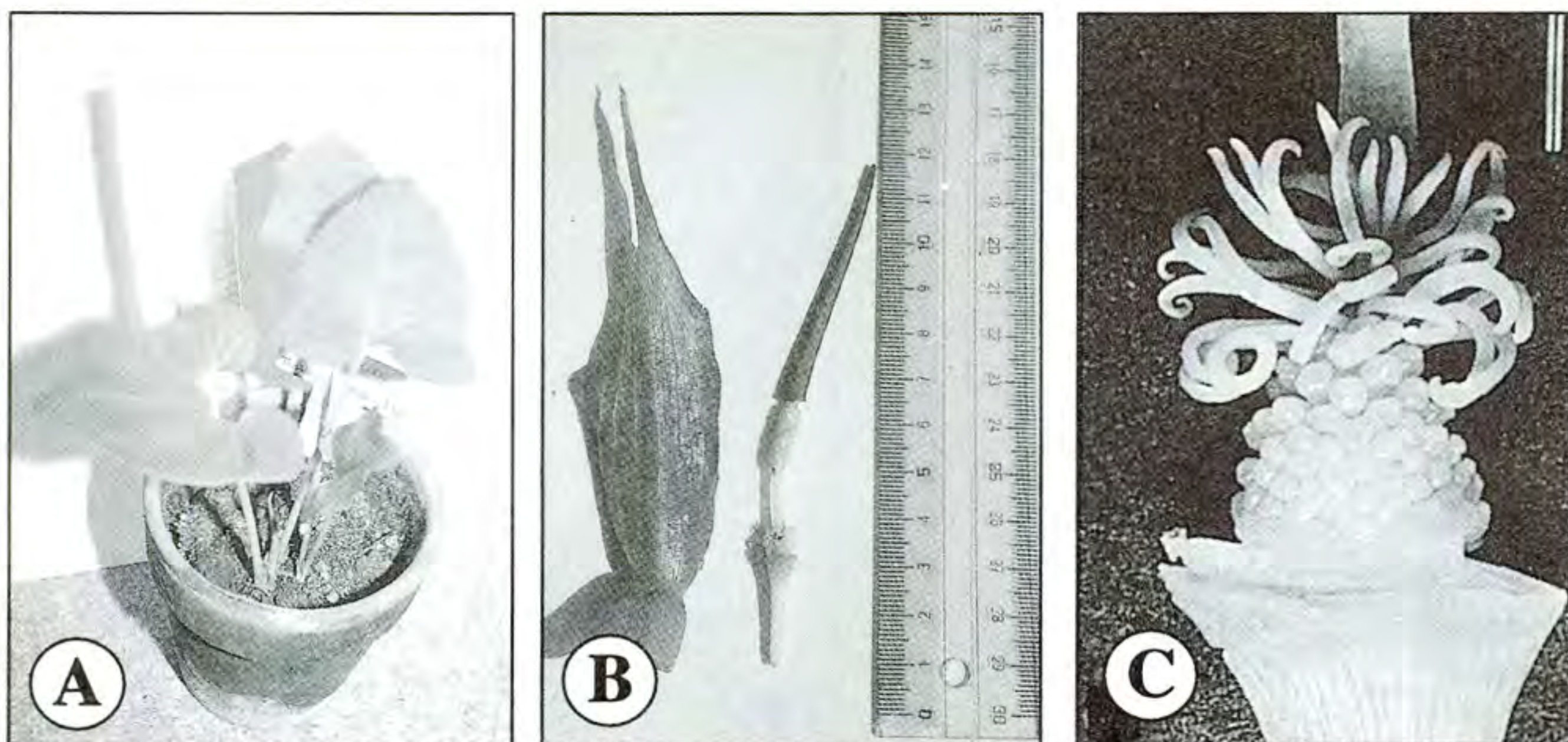


Figure 24. *Typhonium inopinatum* Prain

A : Habit; B : Spathe and spadix; C : Lower part of spadix, scale = 5 mm.

Distribution.— India and Burma.

Ecology.— On the plain. Flowering and fruiting during August–September.

Specimens examined.— Collected from Kanchanaburi, cultivated in Botanical Gardens, University of Tokyo, Sept. 3, 1992, Sriboonma 93–6 (TI); August 30, 1992, Sriboonma 93–4 (TI); Sept. 12, 1992, Sriboonma 93–8 (TI).

14. *Typhonium trilobatum* (L.) Schott in Wien. Zeitschr. 3: 72. 1829; Nicolson & Sivadasan in Blumea 27: 488 (1981); Hay in Blumea 37: 373. 1993. For detailed synonyms and literatures see Nicolson & Sivadasan. (1981). Type: Sri Lanka, Herm. Icon. 177 [BM lectotype chosen by Nicolson & Sivadasan. (1981)]. Figure 25.

Tuber subglobose, erect, up to 5 cm wide. *Petiole* up to 70 cm long, sheathing in the basal part. *Leaf* blade usually deeply trilobed, united for about $\frac{1}{3}$ – $\frac{1}{4}$ of the length of anterior lobe; anterior lobe ovate to lanceolate-ovate, up to 20 cm long, 10 cm wide; posterior lobe slightly smaller than anterior lobe. *Peduncle* up to 5 cm long. *Spathe* up to 30 cm long; tube elliptic, 2–5 cm long; blade dark red inside, greenish outside, ovate to broadly ovate, gradually tapering from the middle. *Spadix* erect, shorter than spathe; female part ca 1 cm long, pinkish; interstice 2–3 cm long, densely covered with sterile flowers in the lower part; upper 1–2.5 cm, naked; male part 1.5–2 cm long; appendix dark red, narrowly conical, 5–10 cm long, base truncate, with short stipe. *Male flowers* pink with coral-colored pollen. *Sterile flowers* filiform, whitish, curled. *Infructescence* surrounded by persistent spathe tube.

Thailand.— CENTRAL: Bangkok, Thon Buri; SOUTH-EASTERN: Chanthaburi, Chon Buri, Trat; SOUTH-WESTERN: Kanchanaburi; PENINSULAR: Nakhon Si Thammarat, Trang.

Distribution.— W. Africa, SE. China, Philippines, Malaysia, Sri Lanka West Borneo, Singapore and Neotropic.

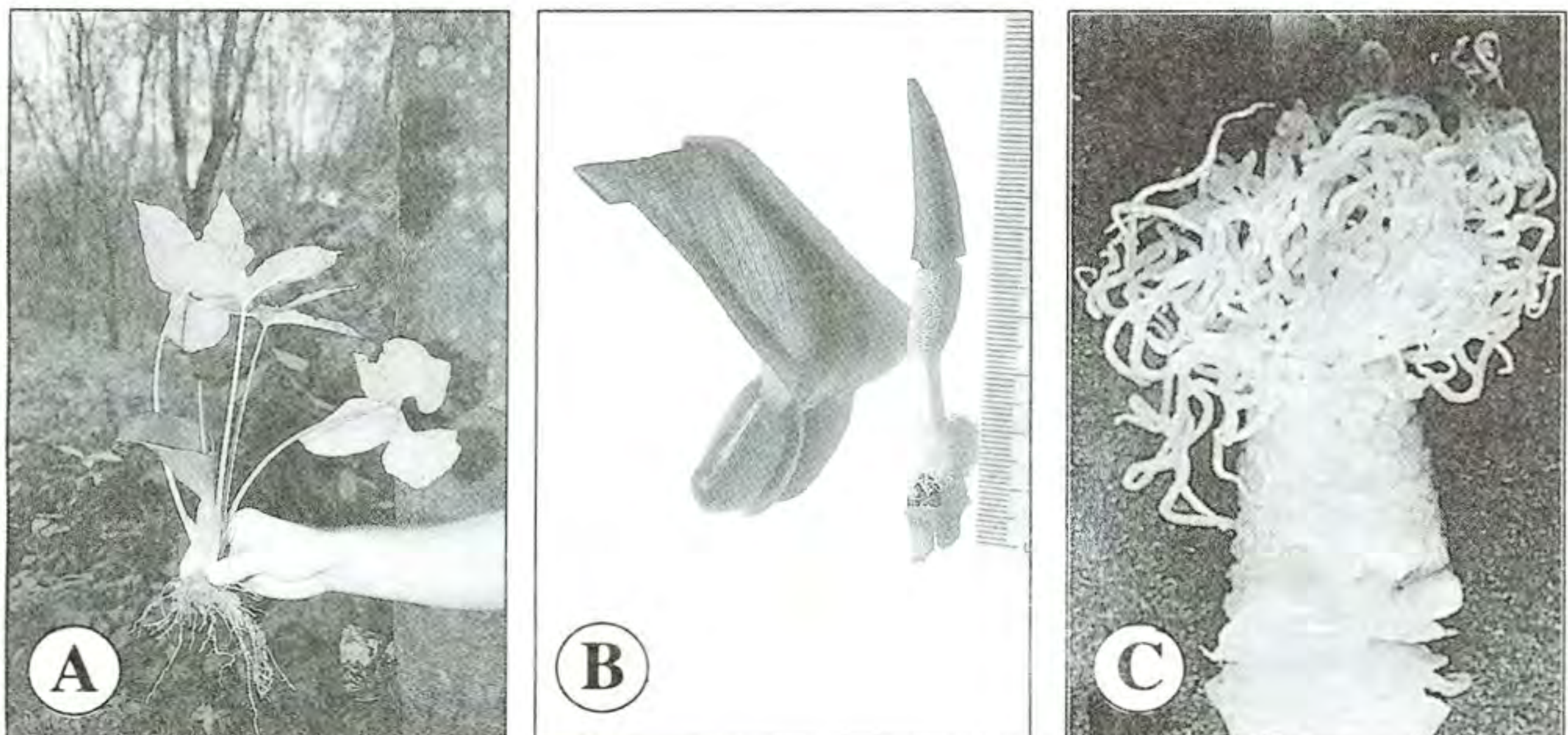


Figure 25. *Typhonium trilobatum* (L.) Schott.

A : Habit; B : Spathe and spadix; C : Enlarged lower part of spadix, scale = 5 mm.

E c o l o g y.— Open area, disturbed mixed deciduous forest on limestone. Flowering and fruiting during May–July.

V e r n a c u l a r.— Ma-ho-raa (มะโหรา) (Chanthaburi); uttaphit (อุตพิต) (Central).

Specimens examined.— Bangkok, 19 May 1984, Eryl Smith 114; Thon Buri, Khlong San, Close to sea level, shaded thickets and woods, 26 July 1970, J.F. Maxwell 70–57; Chanthaburi, Pong Daeng, Pong Namron, 160 m alt., 9 May 1956; T. Smitinand 3365; Chon Buri, Sattahip, Toong Brong, shaded, sandy thicket, 21 Nov. 1969, J.F. Maxwell s.n. (BK); Trat, Ko Chang, Mai Dan Villages, 18 December 1961, D.H. Nicolson 1613 (BK); Kanchanaburi, Si Sawat, Disturbed mixed deciduous forest on limestone, slope of river-valley, 2 July, 1973, R. Geesink & C. Phengklai 6059; Nakhon Si Thammarat, near hot spring, Khao Luang National Park, open and partly shaded, limestone bed rock, 3 June 1986, J.F. Maxwell 86–340; Trang, roadside in moist places, Krabi–Ranong Road, 19 May 1984, WN. 515.

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