

Taxonomic revision of *Arisaema* (Araceae) sect. *Sinarisaema* in India

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Abstract: History and status of the section *Sinarisaema* Nakai in India are discussed. The present study is a result of intensive field trips across the country from 2010 to 2019. Twenty three species are recognized from the country based on the morphological data procured from live samples as well as herbarium specimens deposited in various herbaria in India and abroad. Two species, viz. *A. fischeri* Manudev & Nampy and *A. subulatum* Manudev & Nampy are newly described while lectotypes are designated for four names currently treated as synonyms. Detailed description and photographic images are provided for each taxon. A taxonomic key is given for the easy identification in the field. The conservation status of five species is assessed based on the criteria laid out by IUCN.

Keywords: *Arisaema*, Endemism, North-East India, Sect. *Sinarisaema*, Western Ghats.

Introduction

Arisaema Mart., commonly called Cobra lilies, is one of the largest genera of the family Araceae. Of the 220 taxa worldwide, 208 are reported from Asia, mainly distributed in India, China and Japan (Govaerts *et al.*, 2019). With fifty species and six varieties, *Arisaema* becomes the largest genus of Aroid family in India, primarily distributed in the forest outskirts of Western Ghats and temperate Himalayan Mountains. Several authors classified the genus *Arisaema*: Schott (1860), Engler (1920), Hara (1971), Murata (1984), Gusman and Gusman (2002, 2006), Murata (2011) and Murata *et al.* (2013). According to Murata *et al.* (2013), the genus is divided in to 13 sections viz. Sect. *Arisaema*, Sect. *Attenuata* (Engl.) H.Li, Sect. *Clavata* (Engl.) H. Ohashi & J.Murata, Sect. *Decipientia* (Engl.) H.Li, Sect. *Dochafa* (Schott) H.Hara, Sect. *Flagellarisaema* (Nakai) H.Hara, Sect. *Franchetiana* (Engl.) H.Hara, Sect. *Nepenthoidea* (Engl.) Gusman & L.Gusman, Sect.

Odorata J.Murata ex J.Murata, Sect. *Pistillata* (Engl.) Nakai, Sect. *Sinarisaema* Nakai, Sect. *Tenuipistillata* (Engl.) H.Hara and Sect. *Tortuosa* (Engl.) Nakai. Nine sections are found to occur in India among which Sect. *Sinarisaema* Nakai is the largest with 23 taxa.

Section *Sinarisaema* was originally established by Nakai (1950) to accommodate species with radiate leaves, caudate limb and clavate spadix appendix. Hara (1971) included 10 species, most of them from India and opined that *A. murrayi* be included in this section. In addition, he also recognized a monotypic section *Exappendiculata* to accommodate *A. exappendiculatum* H.Hara, characterised by the absence of a spadix appendix and annular anthers. Murata (1984) and Gusman and Gusman (2006) treated Sect. *Exappendiculata* as a subsection under *Sinarisaema*. Li *et al.* (2010) abandoned the sectional and subsectional status of *Exappendiculata* and merged it under Sect. *Sinarisaema*. The same is followed in the latest circumscription of this section by Murata *et al.* (2013).

Section *Sinarisaema* is characterised by radiate leaves with prominent pseudostems, caudate to acuminate spathe limb and clavate spadix appendix, just projecting from the mouth. Sometimes, as in a few south Indian taxa, the spadix appendix is rugose or knobbed at the apex. This section currently includes 38 species and two infraspecific taxa in the world. The section diversified in India and forms the largest section with 23 taxa including the two new species described here. Of the 23 taxa, 18 are endemic and 15 are confined to the Western Ghats.

Arisaema* sect. *Sinarisaema Nakai, J. Jap. Bot. 25: 6. 1950; Hara, Fl. E. Himal. 347. 1971; Gusman & L.Gusman, Gen. *Arisaema*, ed. 2. 349. 2006; Li *et al.* in Zhu *et al.*, Fl. China, 23: 65. 2010; Murata *et al.*, J. Jap. Bot. 88: 44. 2013. *Type: Arisaema formosanum* (Hayata) Hayata.

Received: 08.05.2019; Revised & Accepted: 24.06.2019

Published Online: 30.06.2019

Arisaema sect. *Radiatisecta* Schott, Prodr. Syst. Aroid. 26 & 42. 1860, *nom. nud.*

Arisaema [unranked] *Radiatisecta* Engl. in A.DC. & C.DC., Monogr. Phan. 2: 550. 1879. *Type*: Not designated.

Arisaema [sect. *Radiatisecta*] [unranked] (*§§a.) *Indica* Schott, Prodr. Syst. Aroid. 26 & 44. 1860. *Type*: Not designated.

Arisaema sect. *Peltatisecta* Schott, Prodr. Syst. Aroid. 27 & 48. 1860, *nom. nud.*

Arisaema sect. *Exappendiculata* H.Hara, Univ. Mus. Univ. Tokyo Bull. 2: 353. 1971.

Arisaema subsect. *Exappendiculata* (H.Hara) J.Murata, J. Fac. Sci. Univ. Tokyo. Sect. III 13: 475. 1984.

Arisaema subsect. *Exappendiculata* (H.Hara) Gusman, Gen. *Arisaema*, ed. 2. 351. 2006, *nom. superfl.* *Type*: *A. exappendiculatum* H.Hara.

Dioecious, deciduous, perennial herbs. Subterranean stem a tuberous corm, white, cream, green to purplish inside, sometimes stoloniferous. Psuedostem prominent, almost the half the length of petiole. Leaves usually single, rarely 2; leaflets 5–25, radiate, sessile, sometimes petiolulate. Spadix appendix subsessile, very rarely stipitate, clavate or cylindrical, with smooth or rugose or sometimes with a knobbed apex; fruiting peduncle usually erect, sometimes nodding.

Key to the species of section *Sinarisaema*

1. Spathe limb cucullate or galeiform2
1. Spathe limb not cucullate or galeiform.....6
2. Tube of spathe 3-angled; limb apex gradually tapering and curved to a parrot like beak *A. psittaccus*
2. Tube of spathe cylindrical; limb apex not curved to a parrot-like beak3
3. Spadix appendix stipitate; spathe limb ending in a terminal, ovate or obovate, hanging lobe.... 4
3. Spadix appendix not stipitate; spathe limb not ending in a terminal hanging lobe5
4. Mouth of tube widely auriculate; limb obovate; spadix appendix purplish to green, truncate at apex *A. nilamburensis*
4. Mouth of tube not auriculate; limb ovate; spadix appendix whitish, attenuate at apex *A. sarracenioides*
5. Male flowers with fused, annulate anthers, spathe limb ending in a long caudate tail *A. agasthyanum*
5. Male flowers with free anthers; spathe limb does not ending in a long caudate tail ..*A. translucens*
6. Fruiting peduncles nodding at maturity; leaflets linear to oblong or oblong-elliptic, apex prolonged in to a slender tail.....7
6. Fruiting peduncles erect at maturity; leaflets ovate-elliptic, elliptic, elliptic-lanceolate, lanceolate, oblong or oblanceolate, apex not ending in a tail 8
7. Leaflets 7–12, not ending in a drooping tail; spathe limb purplish-brown to carmine, with conspicuous white to pale green stripes along the veins ending in an anastomosis; corms stoloniferous*A. ciliatum*
7. Leaflets > 15, ending in a drooping tail; spathe limb greenish, devoid of stripes, corms proliferous*A. consanguineum*
8. Corms purplish inside*A. concinnum*
8. Corms white, cream, yellow to green inside . 9
9. Spathe limb invariably greenish, not striped.....10
9. Spathe limb green, yellowish or purplish, variously striped.....11
10. Leaflets caudate at apex, pale green below; spathe limb caudate at apex, spadix appendix rugose at apex; corms producing bulblets *A. caudatum*
10. Leaflets acuminate at apex, glaucous beneath; spathe limb acuminate at apex; spadix appendix smooth at apex; corms stoloniferous *A. fraternum*
11. Spadix appendix cylindrical, terete or club-shaped, stipitate or nearly so12
11. Spadix appendix slender, filiform or nearly so, sessile.....20
12. Spathe limb acute-acuminate, not tapering to a long tail (rarely with a tail); spadix appendix stipitate or nearly so13

12. Spathe limb narrowly acuminate, tapering in to a tail; spadix appendix sessile17
13. Mouth margins auriculate, sometimes recurved; spathe limb arching forward or drooping; spadix appendix cylindrical, truncate or round at apex, very rarely pointed.....14
13. Mouth margins not auriculate, not recurved; spathe limb usually erect; spadix appendix fusiform, ending in a warted knob at apex..... *A. barnesii*
14. Spadix appendix echinate at apex..... 15
14. Spadix appendix smooth, rarely rugulose16
15. Spathe dull-white, densely streaked with irregular purple blotches.....*A. arunachalense*
15. Spathe green or purple with white parallel stripes..... *A. echinatum*
16. Male spadix with subulate neuters.....
..... *A. peerumedense*
16. Male spadix without subulate neuters
.....*A. leschenaultii*
17. Mouth margins auriculate, sometimes recurved
.....*A. subulatum*
17. Mouth margins not auriculate, not recurved.....
.....18
18. Spadix appendix with a knobbed apex *A. fischeri*
18. Spadix appendix not ending in a knobbed apex.... 19
19. Spathe tube narrowing in the upper third, then flaring again at mouth; spathe limb dull orange-yellow with pale pink stripes, drooping downward*A. siangense*
19. Spathe tube cylindrical or funnel-shaped; spathe limb bright green to yellowish green or brownish, white striped, erect when young then drooping.....*A. peltatum*
20. Margins of the mouth widely auriculate; limb base narrower than the mouth, margins curved back forming a neck like constriction.....*A. madhuanum*
20. Margins of the mouth not widely auriculate; limb base as wide as the mouth, margins not curved back21
21. Plants *c.* 30 cm tall; spathe limb ovate, green without a white patch at the base; spadix

appendix terminating in a distinct, minutely warted knob..... *A. tylophorum*

21. Plants above 40 cm tall; spathe limb triangular or elongate-lanceolate, green with a large white patch at the base; spadix appendix gradually tapering into a filiform apex without a knob.....
.....*A. attenuatum*

Arisaema agasthyanum Sivad. & C.S.Kumar, Aroideana 10(4): 19. 1987; Mohanan & Sivad., Fl. Agasthyamala 756. 2002; Gusman & L.Gusman, Gen. Arisaema, ed. 2. 357. 2006; Kottaim. & R.Ganesan, Ethnobot. Leaflets 12: 388. 2008. *Type*: INDIA, Kerala, Thiruvananthapuram district, Agasthyamala, 1869 m, 15.05.1985, *Sathish Kumar* TBG & RI-1350 (K).

Fig. 1

Deciduous, dioecious, succulent, perennial herbs, 50–65 cm tall. Subterranean stem a tuberous corm, subglobose, *c.* 3.5 cm diam., 2–3 cm tall, cream to light green. Roots many arising from the upper side of the corm, extensively long with secondary rootlets; tuberlets often present, surrounding the pseudostem. Cataphylls 3, rarely 4; outer *c.* 1.5 cm long, acute-obtuse at apex, often degenerated, decidedly mucronate, pale coloured; middle 5–7.5 cm long, rose to dull green towards the distal end; inner 12–18 cm long, dark coloured with faint greenish brown marks; often a degenerated outer cataphyll also present. Leaf solitary, radiatisect; petiole slender, *c.* 65 cm long, light green with faint dull green marks formed of vertical streaks; leaflets (3–5)–7–10, sessile, obovate-elliptic, 10.5–17 cm long, 3.5–5 cm wide, acuminate, margins slightly undulate, minutely praemorse, with a greenish dorsal border, dark green ventrally, pale-glaucous beneath, lateral veins up to 18 pairs, mid-vein flesh coloured mottled with minute rose-purplish spots. Inflorescence dioecious, not exceeding the height of the leaf; peduncle slender, 27–30 cm long, 0.6–0.8 cm long thick, exerted by about 6–12 cm from the sheathing pseudostem, more or less completely enclosed in the petiole in male plants, light green with dull green marks formed of vertical streaks, often pale green without mottling. Spathe *c.* 25 cm long; tube of spathe cylindrical, slightly funnel-shaped towards the mouth region, 5.5–6 cm long, 1.5–2 cm wide, striped with white and purple; margins of the mouth with auricular extensions; limb *c.* 19 cm long, *c.* 6 cm wide, galeiform, expanded in the middle, tapering to a purple caudate tail, white

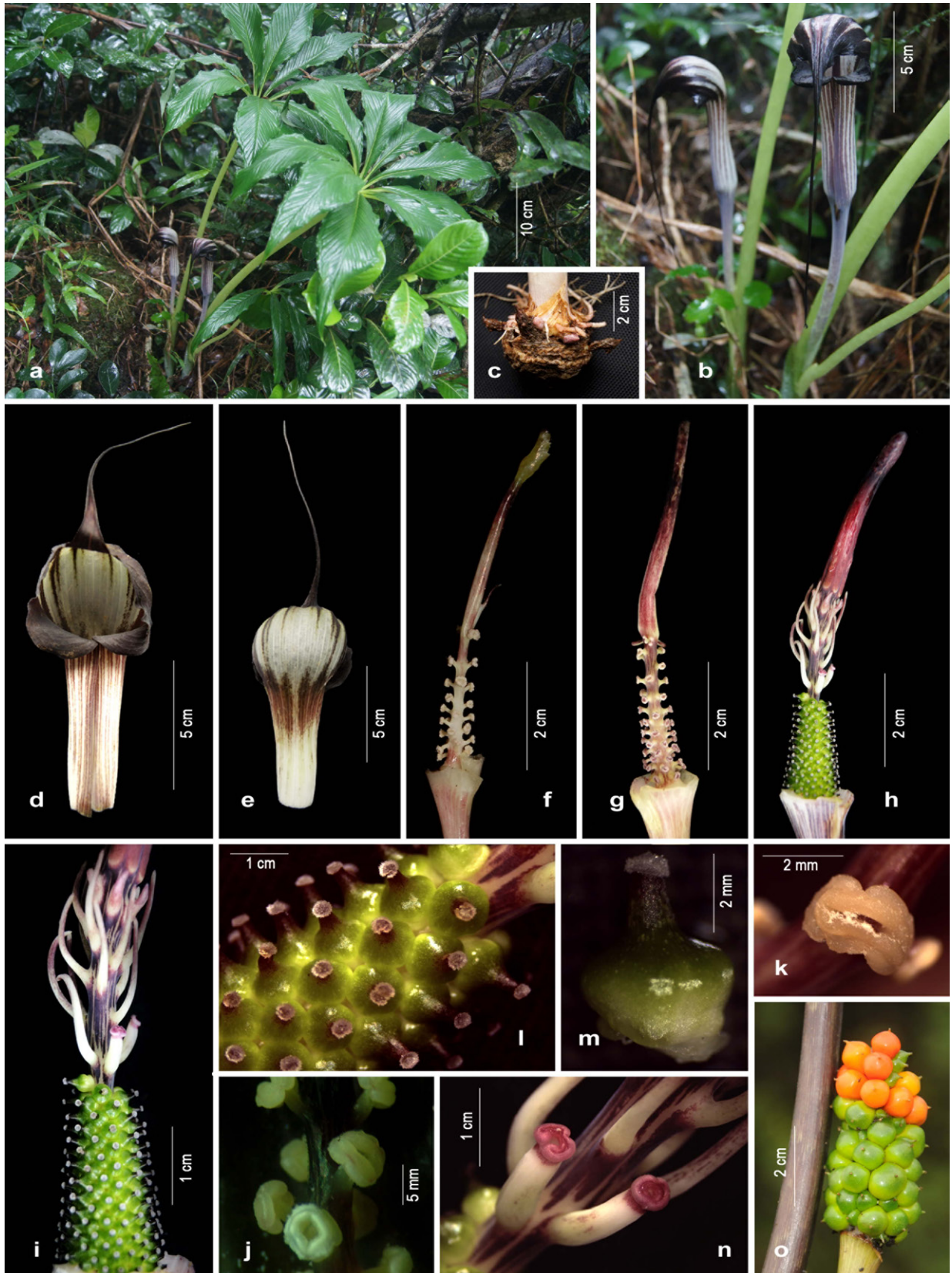


Figure 1. *Arisaema agasthanum* Sivad. & C.S.Kumar: **a.** Habit; **b.** Inflorescence; **c.** Corm; **d.** Spathe-front view; **e.** Spathe-back view; **f & g.** Male spadix; **h.** Female spadix; **i.** Female floriferous region; **j & k.** Male flowers-enlarged view; **l & m.** Female flowers-enlarged view; **n.** Neuters with aborted anthers; **o.** Fruiting spike.

towards the base, dark purple distally. Female spadix sessile, 7–7.5 cm long, *c.* 0.5 cm wide, just reaching to the mouth of the tube; female fertile region 2–2.5 cm long; pistils many, compactly arranged, bottle-shaped, green; ovules 4–6; style short; stigma papillose, white to hyaline; neuters subulate, few, 1.5–2 cm long, scattered below the barren appendix up to 2 cm, upcurved, light green; appendix sub-cylindric, irregularly truncate and shortly stipitate, slightly swollen distally, warted on ageing, purple to green. Male spadix sessile, slender, naked or sometimes one or two neuters present; male fertile region 2–3 cm long; male flowers stipitate, scattered, 1–3-anded; anthers sessile, cream-white, forming an annular structure with rounded or circumscissile dehiscence, rarely anthers become free. Fruiting spike cylindrical, *c.* 5 cm long, *c.* 2.5 cm wide, borne on an upright peduncle; receptacle cream coloured; berries compactly arranged, green when young, orange-red at maturity, apex muticulate, 3–6-seeded.

Flowering & fruiting: May–August.

Habitat: In grasslands, among bushes at an elevation above 1800 m, along with *Adiantum* sp. (Adiantaceae), *Canthium* sp., *Hedyotis travancorica* Bedd., *Psychotria sohmeri* Kiehn. (Rubiaceae), *Memecylon* sp. (Memecylaceae) and *Liparis* sp. (Orchidaceae).

Distribution: India (southern Western Ghats), endemic.

Specimens examined: INDIA, Kerala, Thiruvananthapuram district, Agasthyamala, 22.05.1901, C.A. Barber 2910 (CALI!); *ibid.*, Athirumala, *c.* 1200 m, 24.06.1993, N. Mohanan 11452, 11453 (TBGT!); Pongalappara, 1400–1600 m, 15.05.1988, N. Mohanan 9807, 9808 (TBGT!); *ibid.*, *c.* 1560 m, 11.06.2011, Manudev 4451 (CALI!); *ibid.*, 05.06.2014, Manudev & Arunkumar 138922 (CALI!); *ibid.*, 07.06.2015, Arunkumar & Manudev 144919 (CALI!); *ibid.*, 06.07.2015, in fruiting, Arunkumar & Rajeevan 144916 (CALI!); *ibid.*, 06.07.2015, in flowering, Arunkumar & Rajeevan 144918, 144919 (CALI!); *ibid.*, 01.08.2015, in fruiting, A.J. Robi *s.n.*

Notes: Similar to *A. translucens* C.E.C.Fisch., but can be distinguished by its galieform, expanded limb and annulate staminate flowers. Other than this species, annulate staminate flowers are seen

only in *A. exappendiculatum* H.Hara, a species endemic to Nepal.

Conservation status: The population size at the type locality, Pongalappara is very low, consisting of hardly 20 plants. Based on ‘Extent of Occurrence’ (EOO < 100 km²; Criterion B1), ‘Area of Occupancy’ [Criterion B2: AOO < 10 km² with Extreme fluctuations in number of subpopulations [sub-criterion ‘c (iii)’], and number of mature individuals (Criterion D), *A. agasthyanum* has been assessed here as ‘CRITICALLY ENDANGERED’ [CR: B1, B2b(iii & iv), B2c(iii) & D] according to IUCN’s guidelines (IUCN SPS, 2017).

Arisaema arunachalense A.Nangkar, A.P.Das & H.Tag, (as *A. arunachalensis*), Pleione 11(2): 482. 2017. *Type:* INDIA, Arunachal Pradesh, East Siang District, Pasighat, 560 m, 08.05.2015, A. Nangkar & Hui Tag 026 (ASSAM). **Fig. 2**

Dioecious, perennial herbs, *c.* 70 cm tall. Subterranean stem a corm, 1–2.2 cm long, 2.5–4.3 cm diam., depressed globose. Roots many, from the top of the corm; stolons absent. Cataphylls 2, to 18 cm long, one short and other long. Leaves 1, held above the inflorescence; petiole 10–70 cm long, terete, white, generally pinkish towards the base, mottled with purple patches and spots; leaflets 5–9, radiate, 14–34 cm long, 3–9.5 cm wide, broadly obovate-lanceolate, long-acuminate (*c.* 2 cm long) at apex, base gradually attenuate; slightly unequal in size, pale green above, whitish below, marginal veins extending from base to tip. Sheathing pseudostem *c.* 18 cm long, mottled as in petiole. Inflorescence arises just above the cataphylls, 12–18 cm above from the corm; peduncle much shorter than petiole, 25–34 cm long, exerted by 7–10 cm long from the pseudostem, mottled as in petiole, nodding at fruiting. Spathe dull-white on both surfaces; tube of spathe cylindric, funnel-shaped towards mouth, 20.3–23.2 cm long, dull-white with purple longitudinal lines on both surfaces, slightly constricted at the mouth, margins of the mouth dilated to a revolute auricular extension; limb wider than the tube, sagittate-ovate, caudate-acuminate at apex, forming a slender tail (*c.* 5 cm), dull white, densely purple-blotched, sometimes blotches coalescing. Female spadix sessile, 9.5–11.2 cm long, cylindric with a narrow fertile

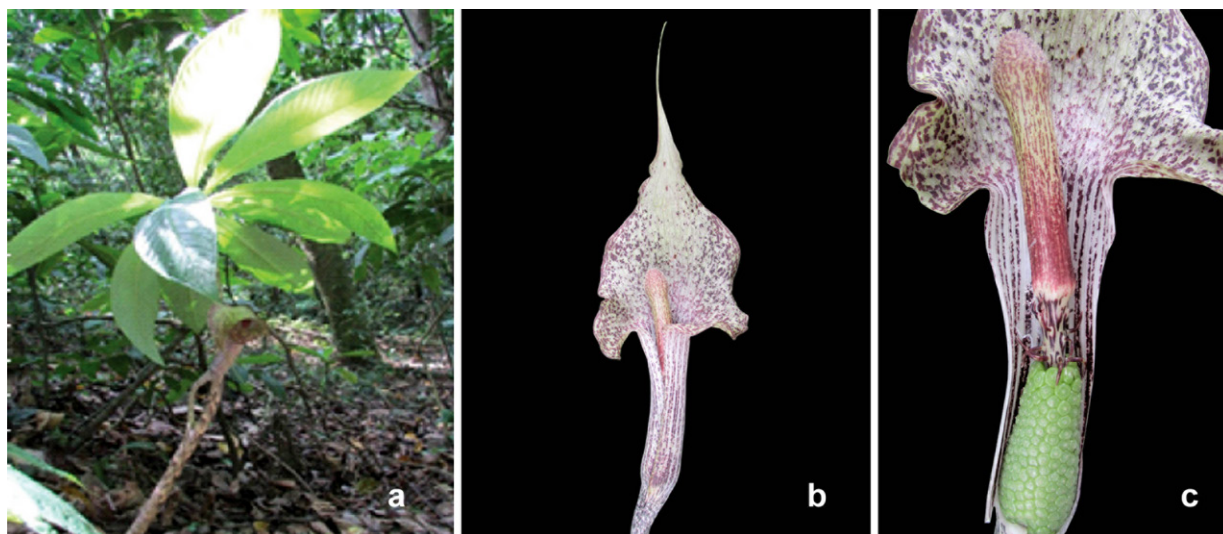


Figure 2. *Arisaema arunachalense* A.Nangkar, A.P.Das & H.Tag: **a.** Habit; **b.** Inflorescence; **c.** Female spadix (Images A.P.Das).

region, mottled with purple blotches, sterile zone with 14–17, dark purple subulate neuters; appendix stipitate, cylindrical with swollen apex (looks like the tip of drum-stick), dark purple and white mottled, exceeding the mouth of the tube; pistils many, sessile, compactly arranged, ovoid, green, stigma short, continuous, whitish. Male spadix smaller than female, with many pistillodes towards the base, neuters absent, sterile male flowers at the middle and fertile male flowers above; male flowers sessile, scattered at the middle, crowded distally, consisting of 4 or 5 dark purple anthers. Fruiting spike not seen.

Flowering & fruiting: April–October.

Habitat: On the floor of dense evergreen forests with thick humus at an elevation of 500–700 m.

Distribution: India (North-East Himalayas), endemic.

Notes: *Arisaema arunachalense* is close to *A. echinatum* (Wall.) Schott in having an echinate spadix appendix but can be distinguished by its longer pseudostem, densely purple blotched spathe limb and swollen tip of appendix as opposed to very short pseudostem, white striped green or purple spathe limb and obtuse apex of spadix appendix in the latter. This species thrives in tropical or subtropical evergreen forests at elevations 500–700 m whereas *A. ciliatum* grows above 2500 m. Authors used the epithet ‘*arunachalensis*’ in the protologue. The genus name being in neuter gender, the epithet should be corrected to ‘*arunachalense*’.

The description provided here is taken from the protologue.

Arisaema attenuatum E.Barnes & C.E.C.Fisch., Bull. Misc. Inf. Royal Gard. Kew 1936(4): 275. 1936; Chatterjee, Bull. Bot. Soc. Bengal 8: 121. 1955; Manilal, Fl. Silent Valley 331. 1988; Sivad. in Manoharan *et al.*, Silent Valley-Whispers of Reason. 233. 1999. *Type:* INDIA, Kerala, Idukki district, Munnar, *s.d.*, E. Barnes 1193 (K000203014 digital image!).

A. leschenaultii *auct.* Gusman & L.Gusman, Gen. Arisaema ed. 2. 392. 2006, *pro parte, non* Blume 1836.

Fig. 3

Deciduous, dioecious, succulent, perennial herbs, 40–65 cm tall. Subterranean stem a tuberous corm, subglobose, 3–5 cm diameter, 2–3 cm tall, smooth or wrinkled, tuberlets often present, surrounding the pseudostem. Roots arising from the upper side of the corm. Cataphylls 3 or 4, acute-obtuse at apex, slightly keeled towards tip, decidedly mucronate; outer 2–3 cm long, pale coloured; middle *c.* 9 cm long, light green with brownish-purplish and flesh coloured patches; inner *c.* 21 cm long similar to middle-one, dark coloured; often a degenerated outer cataphyll also present. Leaf solitary, radiatisect, emerging after the inflorescence; petiole slender, up to 65 cm long, light green mottled with brownish-purple patches; leaflets 7–9, sessile, oblong-lanceolate, sometimes oblanceolate, 15–21 cm long, 3.5–4.2 cm wide, narrowly acute to tapering, margins minutely praemorse, with a purplish dorsal border,

dark green ventrally, pale dorsally, midvein often mottled with purplish spots. Pseudostem 25–30 cm long, mottled as in petiole. Inflorescence held below the leaf; peduncle slender, 30–35 cm long, exerted by about 4–5 cm from the sheathing pseudostem, dark purplish or green-greenish white. Spathe 6.5–12 cm long; tube of spathe cylindrical, slightly funnel-shaped towards the mouth, 6.5–7 cm long, 1–1.5 cm wide, white or greenish white basally and greenish towards the distal end with purplish-brown bands along the length of the tube, bands lighter outside, darker inside; purple bands often absent in male plants where it is replaced by green bands outside; margins of the mouth decidedly revolute; limb, short, triangular, elongate-lanceolate, narrowly acuminate to tapering, 2–5 cm long, 1.5–2.5 cm wide, green with a large roundish white patch at base with radiating stellate arms, few purplish markings at the junction of the green and white, tail erect or arching forward and pointing downwards. Female spadix sessile, 8–10 cm long, 0.2–0.3 cm thick, exceeding the tube and arching forward; female fertile region 2–2.5 cm long; pistils many, crowded, sessile, subglobose, green; ovules 2 or 3; style short or absent; stigma papillate, stellate, often with a dark bluish neck; neuters subulate, few, 2–3 mm long, scattered over a distance of 2–3 cm, upcurved, completely purple or off-white with a purple tip; appendix slender or filiform, tapering distally, green or purplish buff towards the base, becomes greenish towards the distal end, often with a warty, purple tip. Male spadix sessile, slender, similar to female, 5.5–8.7 cm long, 0.3–0.5 cm thick; male fertile region 2–3 cm long; male flowers scattered over or crowded at the base, distant above, 2–4-anded; anthers sessile, purple, dehisce by an apical pore; pollens spherical, slightly echinate, purple; neuters usually absent, rarely 1 or 2 present. Fruiting spike not seen.

Flowering: May–June.

Habitat: In grasslands and in shola forests at an elevation above 1200 m, together with *A. peltatum*, *A. leschenaultii* and *A. tortuosum*.

Distribution: India (southern Western Ghats), endemic.

Specimens examined: INDIA, Kerala, Idukki district, Devikulam, c. 1800 m, 27.07.1982, N. Sasidharan 4173, 4178 (KFRI!); Lockhurt gap, Munnar-

Poopara road, 23.05.2011, Manudev & Santhosh Nampy 4430, 4431 (CALI!); *ibid.*, 25.05.2012, Anisha & Manudev 4563 (CALI!); Mathikettan shola, Aduvizhuntha kudi, 22.11.2014, Syam Radh & Rajeevan, 137822, 137824 (CALI!); Checkpost to Onnam Thodu, Mathikettan, 22.05.2015, Manudev & Syam Radh 138959 (CALI!); Choondal, Mathikettan, 23.04.2016, Syam Radh & Arunkumar 149117 (CALI!); Ettukalichelamaram to Check post, 22.05.2015, Manudev & Syam Radh 138957 (CALI!); Onnamthode, Mathikettan, 08.05.2016, Syam Radh 137976, 137979 (CALI!); Pallivasal, 24.05.2011, Manudev & Santhosh Nampy 4438 (CALI!); Sivan Para, Mathikettan, 23.08.2014, Syam Radh & Prashob 143502 (CALI!); Pothamedu, c. 1100 m, 25.07.2013, Manudev 135307 (CALI!). **Tamil Nadu**, Coimbatore district, Anamalai hills, 26.06.1973, R.N. Kayal & H.N. Tribedi 569 (CALI!).

Notes: *Arisaema attenuatum* was described by Fischer (1936) from the collections of Professor Edward Barnes from Munnar High ranges. Gusman and Gusman (2006) treated this species as a synonym of *A. leschenaultii*, a common species distributed throughout the Western Ghats showing significant variation. However, it is distinct from the latter in having shorter spathe limb with a basal white spot and slender spadix appendix.

Conservation status: The population size of *A. attenuatum* thriving at the Devikulam and Lockhurt Gap is very scanty with about less than 10 mature individuals; while at the Pallivasal, 25 mature individuals were observed and at the Mathikettan shola National Park about 65 individuals. There are a few specimens at CAL collected from Anamalai hills of Tamilnadu region, not far away from the type locality. Based on 'Extent of Occurrence' (EOO < 100 km²; Criterion B1), 'Area of Occupancy' [Criterion B2: AOO < 10 km² with extreme fluctuations in number of subpopulations [sub-criterion 'c (iii)'], and number of mature individuals (Criterion C), *A. attenuatum* is assessed here as 'CRITICALLY ENDANGERED' [CR: B1, B2b(iii), B2c(iii) & C2b.] according to IUCN's guidelines (IUCN SPS, 2017). This species is threatened due to habitat loss mainly by the conversion of forest areas in to tea plantations in Munnar regions.

Arisaema barnesii C.E.C.Fisch., Bull. Misc. Inform. Kew 1933: 342. 1933; Gamble, Fl. Madras

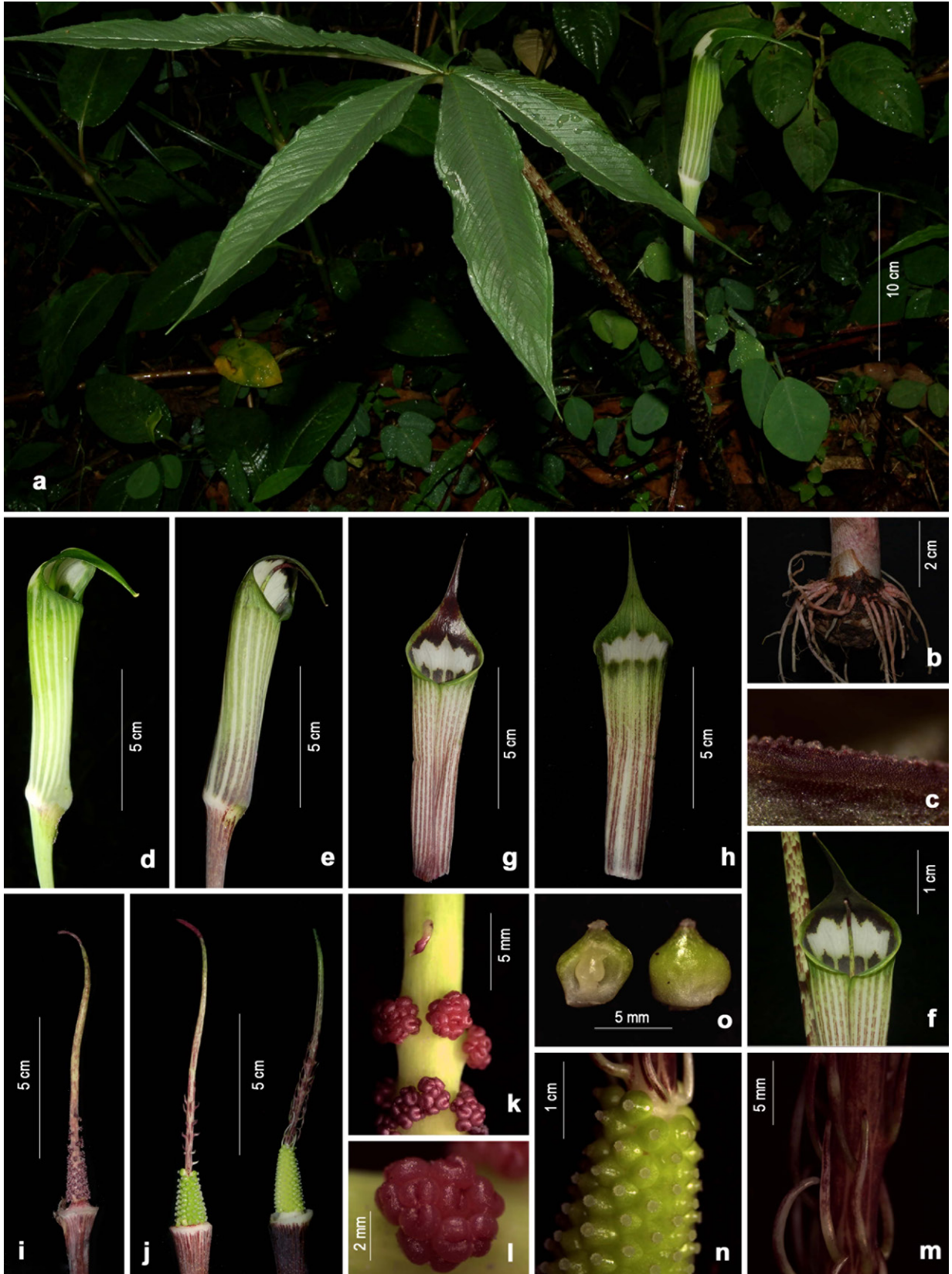


Figure 3. *Arisaema attenuatum* E.Barnes & C.E.C.Fisch.: **a.** Habit; **b.** Corm; **c.** Leaf margin-enlarged view; **d.** Male inflorescence; **e.** Female inflorescence; **f.** Mouth of the spathe tube; **g.** Spathe-front view; **h.** Spathe-back view; **i.** Male spadix; **j.** Female spadices; **k.** Male floriferous region; **l.** Male flower-enlarged view; **m.** Neuters; **n.** Female flowers; **o.** Pistils.

3(11): 1891. 1936; Manilal, Fl. Silent Valley 331. 1988; Sivad. in Manoharan *et al.*, Silent Valley-Whispers of Reason. 233. 1999; N.Mohanan & Sivad., Fl. Agasthyamala 756. 2002. *Type*: INDIA, **Tamil Nadu**, Nilgiris district, Kotagiri, Longwood Shola, 20.05.1932, *E.Barnes* A.R.3b & c (K, digital images!) Fig. 4

Deciduous, dioecious, succulent, perennial herbs, about 40–65 cm tall. Subterranean stem a tuberous corm, subglobose, 3–7 cm diam., 2–5 cm tall, cream to greenish white inside, tuberlets often present, surrounding the pseudostem. Roots arising from the upper side of the tuber. Cataphylls 3 or 4, acute-obtuse at apex: outer 2–3 cm long, slightly keeled towards the tip, decidedly mucronate, pale coloured; middle *c.* 9 cm long, light green with brownish-purplish and flesh coloured patches; inner *c.* 21 cm long similar to middle-one, dark coloured; often a degenerated outer cataphyll also present. Leaf solitary, radiatisect, emerging after the inflorescence; petiole slender, up to 65 cm long, light green mottled with brownish-purple patches; leaflets 7–9, shortly petiolulate, oblong-lanceolate, sometimes oblanceolate, 15–21 cm long, 3.5–4.2 cm wide, narrowly acute to tapering, margins minutely praemorse, with a purplish dorsal border, dark green ventrally, pale dorsally, midvein often mottled with purplish spots. Pseudostem 25–30 cm long, mottled as in petiole. Inflorescence dioecious, held below the level of leaf; peduncle slender, 30–35 cm long, exerted by about 4–5 cm from the sheathing pseudostem, dark purplish or green-greenish white. Spathe 6.5–12 cm long; tube of spathe cylindric, slightly funnel-shaped towards the mouth region, 6.5–7 cm long, 1–1.5 cm wide, purplish brown basally and greenish towards the distal end with white or greenish white stripes along the length of the tube, dark purplish inside; margins of the mouth slightly revolute; limb ovate, 3.5–6 cm long, 2.5–3.5 wide, horizontal, or sometimes erect, tapering in to a filiform tail, sometimes terminated by a minute knob, green outside with white stripes, dark carmine, dark purple or green inside with 5 white stripes at the base. Female spadix sessile, *c.* 7 cm long, 0.2–0.3 cm thick; female floriferous region 2.5–3 cm long; pistils crowded, sub-globose, green; style short; stigma papillose; appendix narrowly fusiform, widest at the middle, tapering to a short tail with a small minutely warted apical knob, dark-

purple or pale below and the apex dark purple, the basal portion with a few narrow ridges; neuters subulate, on the lower third of the appendix, a few laminate ridges above these up to halfway. Male spadix similar to female, slender, 5–6 cm long, male floriferous region 2–3 cm long; male flowers scattered over or crowded at the base and distant above, 2–7-anded; anthers sessile, purple, dehisce by an apical pore. Fruiting spike not seen.

Flowering & fruiting: March–September.

Habitat: In shola forests and in evergreen forests at an elevation above 1000 m, associated with *A. leschenaultii*, *A. tortuosum*, *A. tylophorum*, etc.

Distribution: India (southern Western Ghats), endemic.

Specimens examined: INDIA, **Kerala**, Kannur district, Aralam wild life sanctuary, 03.03.2014, flowered in garden, *Alfred & Manudev* 4388 (CALI!). Palakkad district, Dhoni hills, 07.07.2012, *Prabhu kumar & Alfred* 5078 (CALI!). Thrissur district, Sholayar, 01.05.2011, *Manudev & Alfred* 4404, 4412 (CALI!). Wayanad district, Chandanathode, on the way, near Seminary villa, 625 m, 03.05.1979, *V.S. Ramachandran* 62222 (CAL!); Mandanmala, Vythiri, 29.04.2011, *Manudev & Nikhil Krishna* 5254 (CALI!); Vellarimala, 05.04.2013, *Robi Jose & Manudev* 135201 (CALI!). **Tamil Nadu**, Coimbatore district, *c.* 1005 m (3300 ft), 30.05.1910, *C.E.C. Fischer* 1957 (DD!). Nilgiris District, *s.loc.*, *s.d.*, *Perottett* 1813 (P017050542, digital image!). Longwood shola, Kotagiri, 21.06.2011, *Manudev, Prabhu kumar & Sreeraj* 4483 (CALI!). Tirunelveli district, Naterikad, *c.* 1220 m (4000 ft), 13.02.1913, *D. Hooper & M.S. Ramaswami* 38527 (CALI!).

Notes: This species is closely related to *A. peltatum* and *A. leschenaultii*, from them it can be distinguished by its petiolulate leaflets and narrowly fusiform appendix widest at the middle, tapering to a short tail with a small minutely warted apical knob and a ridged basal portion.

Conservation status: This species is known to occur in Nilgiris Biosphere Reserve and adjacent regions. However, not more than 10 mature individuals are observed in each population. Due to the large-scale conversion of forests in to tea and cardamom plantations, gradual decline of the quality of habitat has led to a faster decline of this

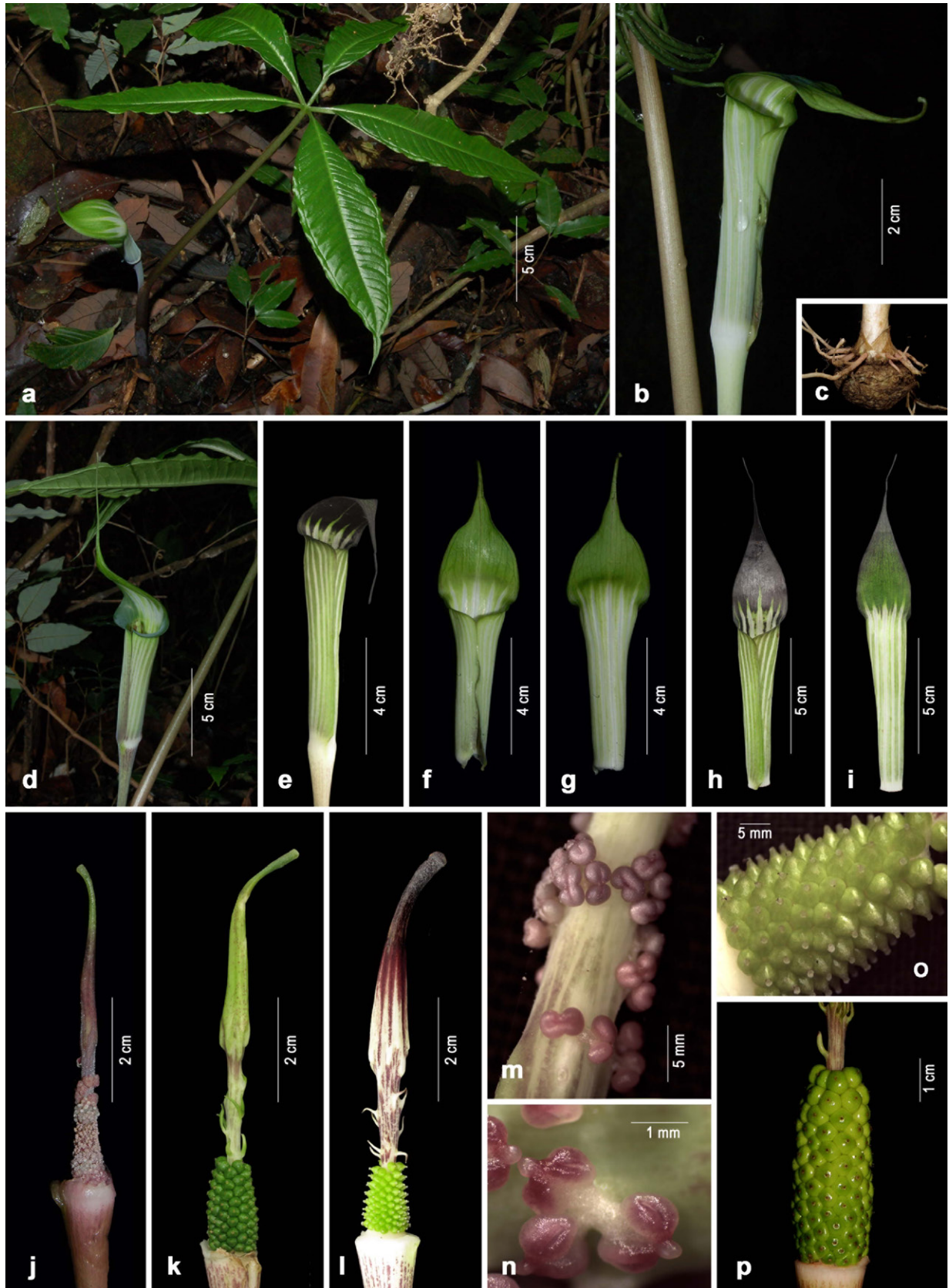


Figure 4. *Arisaema barnesii* C.E.C.Fisch.: **a.** Habit; **c.** Corm; **b, d & e.** Inflorescences; **f–i.** Spathe (**f & h.** front view; **g & i.** back view); **j.** Male spadix; **k & l.** Female spadices; **m.** Male floriferous region; **n.** Male flowers-enlarged view; **o.** Female flowers-enlarged view; **p.** Young fruiting spike.

species. Based on Extent of Occurrence (Criterion B1: EOO >5000 km²), continued decline in area of occupancy, quality of habitat (sub-criterion b(ii) & b(iii), 'Reduction in population size' (Criterion A1: suspected population size reduction of ≥ 70), decline in area of occupancy, extent of occurrence and/or quality of habitat (sub-criterion '1b'), the effects of introduced taxa and pollutants (sub-criterion 'e'), *A. barnesii* is assessed here as ENDANGERED [EN: A1, 1b & e; B1, B2b(ii, iii), B2c(ii, iii, iv) & D] according to IUCN's guidelines (IUCN SPS, 2017).

Arisaema caudatum Engl. in A.DC. & C.DC., Monogr. Phan. 2: 559. 1879; Hook.f., Fl. Brit. Ind. 6: 507. 1893; Woodrow, J. Bombay Nat. Hist. Soc. 13(3): 428. 1901; T.Cooke, Fl. Bombay 1: 821. 1903; Engl., Pflanzenz. IV. 23F(73): 183. 1920; Blatt., J. Asiatic Soc. Bengal 26: 364. 1931; J. Bombay Nat. Hist. Soc. 35: 19. 1931; Chatterjee, Bull. Bot. Soc. Bengal 8: 129. 1955; R.S.Rao & K.K. Ahuja, Bull. Bot. Surv. India 11(3-4): 450. 1969; Sandhya Deshpande et al., Fl. Mahabhaleshwar 2: 615. 1995; S.R.Yadav & Sardesai, Fl. Kolhapur Dist. 517. 2002. *Type*: INDIA, Concan, s.d., *Stocks s.n.* (P01750624 digital image!).

A. longicaudatum Blatt., J. Asiatic Soc. Bengal 26: 362. 1931; J. Bombay Nat. Hist. Soc. 35: 20. 1931; Chatterjee, Bull. Bot. Soc. Bengal 8: 128. 1955. *Type*: INDIA, Maharashtra, Mahabhaleshwar, 07.1925, *Blatter* P10 (BLAT).

A. leschenaultii auct. Gusman & L.Gusman, Gen. Arisaema ed. 2. 392. 2006, *pro parte, non* Blume, 1836. Figs. 5 & 6

Deciduous, dioecious, succulent, perennial herbs, c. 70 cm tall. Subterranean stem a tuberous corm, subglobose, 2–2.5 × 3–3.5 cm, wrinkled, cream-white, few tuberlets often surrounding the pseudostem. Roots many, from the upper side of the corm. Cataphylls 3 or 4, obtuse-orbicular at apex, slightly keeled and mucronate; outer 3.5–6 cm long, pale-brown to purple-brown with faint brown-reddish mottling; middle 7.3–12 cm long, completely enclosing the pseudostem, green, sometimes cylindrical below up to 3 cm long; inner 15.2–29 cm long, dark brown mottled, cylindrical below, up to 12 cm long; sometimes a pale coloured outer cataphyll c. 2.5–3 cm long may be present together with another degenerated cataphyll. Leaf

solitary, rarely 2, radiatisect, opens usually before inflorescence or emerges together; petiole up to 68 cm long, green, pale-brown mottled; leaflets 5–8, sub-sessile or petiolulate, elliptic, ovate-obovate, 15–18 cm long, 6.2–9.5 cm wide, base cuneate, long caudate, 3–9 cm long, margins entire, dark green ventrally, pale dorsally. Pseudostem 21–43 cm long, 1–3 cm thick, mottled as in petiole. Inflorescence matures after the emergence of leaf, held below or at the level of leaf; peduncle 36.5–64 cm long, pale to dark brown mottled, greenish distally, sometimes green all over without any mottling, exerted by 11–21 cm long from the pseudostem. Spathe 20–29 cm long; tube of spathe cylindrical, slightly funnel-shaped towards the mouth, 6–8 cm long, 1.2–2 cm wide, slightly constricted at the distal end before the mouth, green with white-faint lines along the veins, whitish towards the mouth; margins of the mouth dilated, revolute; limb, ovate-lanceolate, 13.5–21 cm long, 3.5–4.5 cm wide, narrowly acuminate to caudate, tapering in to a slender tail up to 11–15 cm long, green-dull green all over with white to pale stripes along the veins, arched over and drooping. Female spadix sessile, 7–8 cm long, 0.4–0.8 cm thick; fertile region narrow of 2–2.5 cm long, followed by very few neuters; appendix decidedly stipitate with a slight constriction at the base after neuters, reaching the mouth of the tube or just exceeding, blunt at apex, slightly swollen and rugose, green to light green; neuters subulate, sometimes forked, very few, 2–3 mm long, scattered, upcurved, green; pistils many, compactly arranged, globose or urn-shaped with rhomboid margins, green; ovules 6–14, white; stigma papillate, stellate, sessile; often a few sterile male flowers also seen. Male spadix sessile, similar to female, slender, c. 7 cm long, 0.3–0.5 cm thick; fertile region narrow, 2–2.5 cm long; male flowers scattered over or crowded at the base and distant above, sessile or decidedly stipitate, consisting of 2–5-anded; anthers sessile, cream-white or pale purple with a terminal mucro, dehiscence by an apical pore; neuters very few, subulate-echinate, 2–3 cm long, often forked, pale green. Fruiting spike cylindrical, c. 6 cm long, c. 3 cm wide; borne on an upright peduncle; receptacle cream; berries globose, compactly arranged, green, turns yellow to red at maturity, 5–8-seeded.

Flowering & fruiting: June–October.

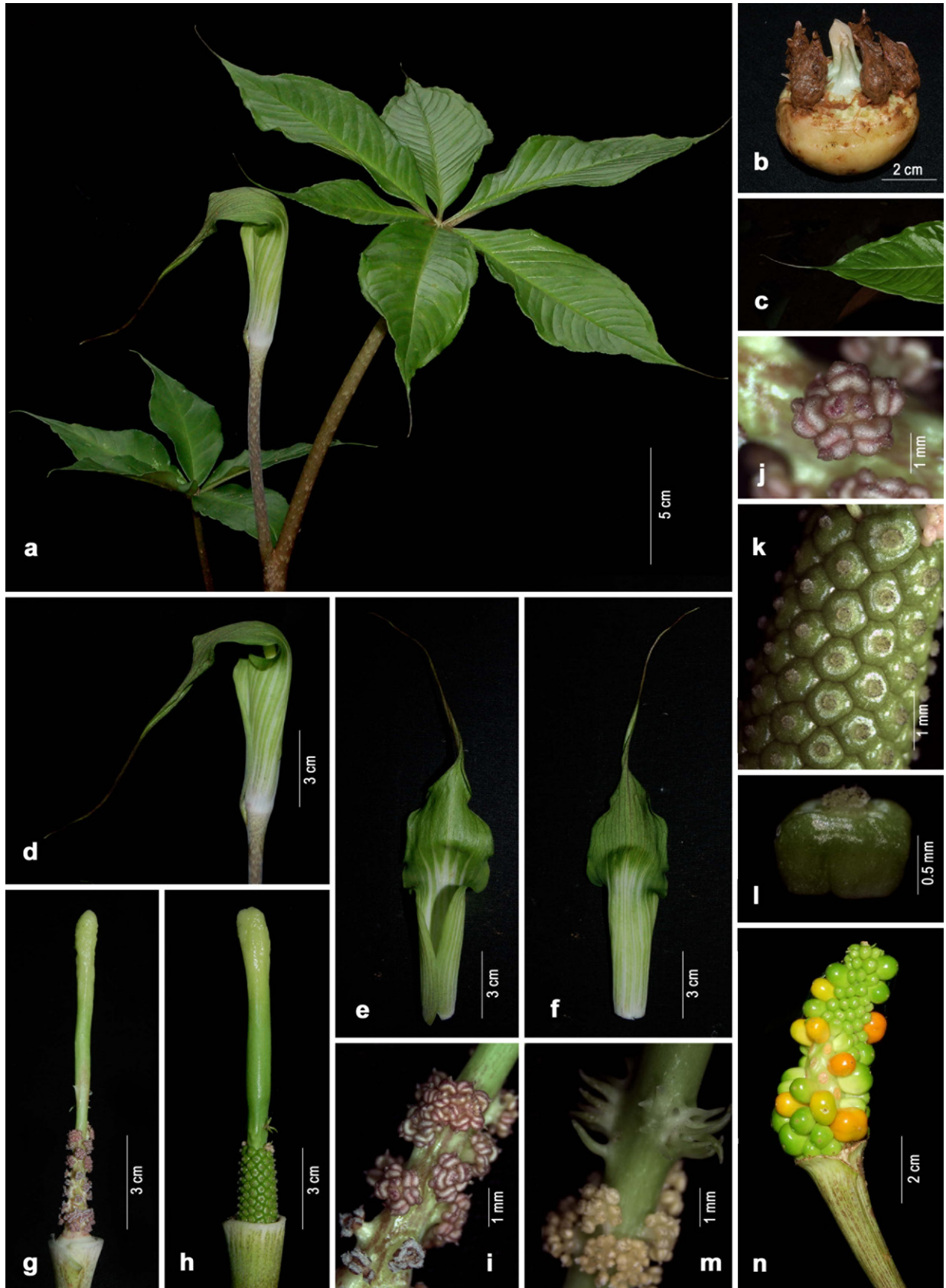


Figure 5. *Arisaema caudatum* Engl.: **a.** Habit; **b.** Corm; **c.** Leaf tip; **d.** Inflorescence; **e.** Spathe-front view; **f.** Spathe-back view; **g.** Male spadix; **h.** Female spadix; **i.** Male floriferous region; **j.** Male flowers-enlarged view; **k.** Female floriferous region; **l.** Pistil; **m.** Neuters with aborted anthers; **n.** Fruiting spike.



Figure 6. Holotype of *Arisaema caudatum* Engl. [Stocks s.n. (P01750624)] © Muséum National d'Histoire Naturelle, Paris.

Habitat: In semi-evergreen forests, near grasslands at an elevation above 300 m, along with *A. murrayi*, *A. ghaticum*, *A. sahyadricum*, *A. sivasanii* and *A. tortuosum*.

Distribution: India (northern Western Ghats), endemic.

Specimens examined: INDIA, **Maharashtra**, Satara district, Kas, 08.1992, *M.P. Bachulkar & Cholekar* 3215 (SUK!). Sindhudurgh district, Amboli-Chaukul road (cultivated in St. Joseph's College Botanical Garden), 07.07.2012, *Manudev & Santhosh Nampy* 5010A (CALI!); *ibid.*, 07.07.2012, *Manudev & Santhosh Nampy* 5008A (CALI!); *ibid.*, 27.06.2012, *Manudev & Santhosh Nampy* 5031A, B (CALI!).

Notes: This species was described from a badly dried specimen, as said by Engler (1879) himself in his *Monographiae Phanerogamarum*. Hooker (1893) gave a description based on an illustration of Stocks who had seen this plant from Concan regions. Though incomplete, the descriptions of Hooker and Engler were adopted by the subsequent workers. Subsequently, Blatter (1931) described another species, *A. longicaudatum*, from Mahabaleshwar in Maharashtra. Rao and Ahuja (1969), proposed a neotype for *A. caudatum*, and merged *A. longicaudatum* as a synonym. However, the original sheet used by Engler to describe this taxon was relocated during the present study from Muséum National d'Histoire Naturelle, Paris, hence supersedes this neotype. *Arisaema caudatum* is closely related to *A. leschenaultii*, but can easily be identified by its caudate leaves and long tailed spathe limb.

Arisaema ciliatum* H.Li var. *liubaense Gusman & Gouda, *Blumea* 44: 39. 1999; *Manudev et al.*, *Pleione* 9(1): 229. 2015. *Type:* Originally from CHINA, **Szechuan** (Sichuan) Province, near Liuba, area of Mt. Minya Konka, 3600 m, *C. Teune* 369, subsequently raised by Gusman, 09.05.1989 (U, digital images!).

Fig. 7

Deciduous, dioecious, succulent, perennial herbs, *c.* 55 cm tall. Subterranean stem a tuberous corm, globose to subglobose, 2–3 cm diam., 1.5–2.5 cm tall, cream-white, stoloniferous. Roots many, from the upper side of the corm, white. Cataphylls 2 or 3, obtuse-orbicular at apex, mucronate; outer *c.* 2.5 cm long, pale to white or purplish distally; middle

8–12.5 cm long, pale to white below, pink to purplish above; inner 17–30 cm long, pale purple or pink, brown or greenish brown, not mottled. Leaf solitary, radiatisect, usually unfolds with the emergence of inflorescence; petiole up to 55 cm long, 0.5–0.7 cm thick, pale to dark greenish brown, greenish distally, not mottled; leaflets 7–12, sessile, narrow, linear to oblong-elliptic, 7–19.5 cm long, 2–3.8 cm wide, long acuminate at apex and prolonged in to *c.* 3.5 cm long tail, base gradually cuneate, margins entire, often wavy or undulate, pale-dark green ventrally, glaucous dorsally. Pseudostem 27.5–40 cm long, 0.7–1.5 cm wide, coloured as in petiole. Inflorescence held below the leaf; peduncle 32–45 cm long, green or pale to dark brownish green, exerted by *c.* 5 cm from the pseudostem. Spathe 17–25.5 cm long with a tail up to 15 cm long; tube of spathe cylindrical, funnel-shaped towards the mouth, 5–6 cm long, 1–2 cm wide, pale green to brownish green, pale to white striped along the veins; margins of the mouth strongly recurved, not ciliate; limb ovate-lanceolate, 5.5–6 cm long, 4.5–5.7 cm wide, wider than tube, acute-acuminate and prolonged in to a slender tail, 5–15 cm long, purplish-brown to carmine, with conspicuous white to pale green stripes along the veins ending in an anastomosis, horizontal, arched over and curved down with tails drooping. Female spadix sessile, 6.5–7.5 cm long, cylindrical, well exerted from the tube; fertile region narrow, 2–2.5 cm long, followed by a few neuters; appendix cylindrical, 4–5.5 cm long, 0.6–0.8 cm thick, constricted or truncate at the base after neuters, rounded and smooth at apex, green to light green; neuters subulate, a few, 0.3–0.5 cm long, upcurved, green; pistils many, sessile, compactly arranged, ovoid or bottle-shaped, green; ovules 1–4, white; style short; stigma papillate, stellate, white. Male spadix similar to female, slender, 5–6.5 cm long, 0.6–0.7 cm thick; fertile region narrow 1.8–2 cm long, pale green to green; neuters usually absent; male flowers scattered over or crowded at the base and distant above, stipitate, 2–4-anded; anthers cream, dehisce by an apical round to oblong pore. Fruiting spike cylindrical, *c.* 6.5 cm long, *c.* 2.5 cm wide, borne on a nodding peduncle; receptacle cream coloured; berries compactly arranged, green when young, orange-red at maturity, 1–4 seeded.

Flowering & fruiting: May–July.

Habitat: As an under growth in evergreen forests or

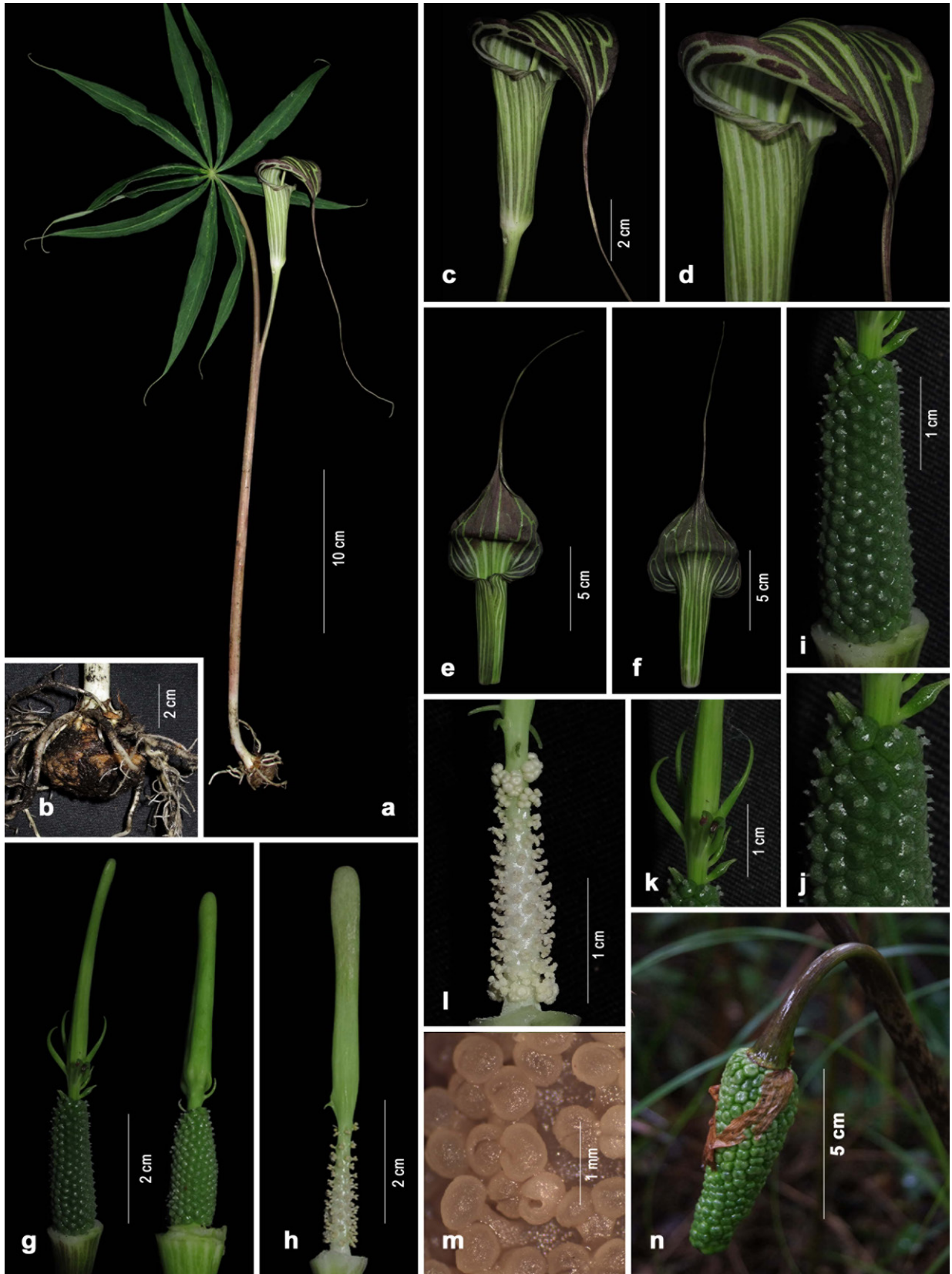


Figure 7. *Arisaema ciliatum* H.Li var. *liubaense* Gusman & Gouda: **a.** Habit; **b.** Corm; **c.** Inflorescence; **d.** Mouth portion enlarged; **e.** Spathe-front view; **f.** Spathe-back view; **g.** Female spadices; **h.** Male spadix; **i.** Female floriferous region; **j.** Female flowers-enlarged view; **k.** Neuters; **l.** Male floriferous region; **m.** Male flowers-enlarged view; **n.** Fruiting spike.

on the edges, in humid semi-shady conditions or along streams, often found along with *A. fraternum*, *A. nepenthoides*, *Cautleya spicata* (Smith) Baker (Zingiberaceae), etc.

Distribution: India (North-East Himalayas) and China (Sichuan).

Specimens examined: INDIA, **Meghalaya**. East Khasi Hills district, Laitryngew, on the way to Cherrapunjee, 1684 m, 10.05.2013, in flowering, *Manudev & Santhosh Nampy* 135220 (CALI!); *ibid.*, 22.07.2014, in fruiting, *Manudev* 139883 (CALI!).

Notes: Manudev *et al.* (2015) recently reported this species from India. Gouda and Gusman (1999) described var. *liubaense* based on the plants grown from the corms received from Michael Hoog (Dutch Gardener), which was originally supplied by Carla Teune, who collected it from Liuba (China) in 1981. Though collected from a Dutch nursery, in the protologue, authors cited the location and collection date as near Liuba, area of Mt. Minya Konka (Gonga Shan) Szechuan (Sichuan) Province, China, at 3600 m elevation on 15.09.1981. The information on the type specimen also reiterates the same. Dr. Kanchi N. Gandhi (Nomenclatural Registrar, Harvard University, personal communication) opined that the collection details provided in the protologue by Gouda & Gusman (*l.c.*) had to be clarified since the type specimens were actually raised in the author's garden.

Arisaema ciliatum var. *liubaense* is closely related to *A. consanguineum* in general morphological features but can be distinguished by stoloniferous corms and purple-brown or carmine spathe limb with conspicuous white to greenish-white stripes along the veins ending in an anastomosis as opposed to a proliferous corm and usually greenish spathe limb without white stripes. This variety is also allied to *A. erubescens* but can be readily distinguished by an erect fruiting peduncle and a pink spathe limb that is shorter than the tube, with an acuminate apex without a long drooping tail.

Arisaema concinnum Schott, *Bonplandia* 7: 27 (1859), *Prodr. Syst. Aroid.* 50. 1860; Oliv., *Curtis's Bot. Mag.* 97: t. 5914. 1871; Engl. in A.DC & C.DC, *Monogr. Phan.* 2: 555. 1879; Hook.f., *Fl. Brit. India* 6: 505. 1894; N.E.Br., *J. Linn. Soc., Bot.* 18: 254. 1881; Chatterjee, *Bull. Bot. Soc. Bengal*

8: 122. 1955; H.Hara, *Fl. East. Himal.* 350. 1971; A.S.Rao & D.M.Verma, *Bull. Bot. Surv. India* 18: 17. 1976(1979); Gusman & L.Gusman, *Gen. Arisaema* ed. 2. 365. 2006. *Type:* INDIA, **Sikkim**, 6000–10000 ft, *s.d.*, *J.D. Hooker s.n.* (K000203005 digital image!; iso CAL!).

A affine Schott, *Bonplandia* 7: 27. 1859; *Prodr. Syst. Aroid.* 51. 1860. *A. concinnum* var. *affine* (Schott) Engl. in A.DC. & C.DC., *Monogr. Phan.* 2: 557. 1879. *Lectotype* (designated here): INDIA, Sikkim, 6000–10000 ft, *s.d.*, *J.D. Hooker s.n.* (K000203008 digital image! excluding the pistils).

A. alienatum Schott, *Bonplandia* 7: 26. 1859, *Prodr. Syst. Aroid.* 45. 1860. *A. concinnum* var. *alienatum* (Schott) Engl., *Pflanzenr.*, IV, 23F: 178 (1920). *Lectotype* (designated here): INDIA, Uttarakhand, Garwahl, June 1845, *T. Thompson s.n.* (K000203002A digital image!)

Figs. 8–11

Deciduous, dioecious, succulent, perennial herbs, *c.* 95 cm tall. Subterranean stem a tuberous corm, depressed globose-subglobose, 2–5.4 cm diam., 1–3.5 cm tall, smooth or wrinkled, cream-white or brownish, stoloniferous. Roots many, pale brown to rose, from the upper side of the tuber. Cataphylls 3 or 4, acute or obtuse at apex, mucronate; outer *c.* 2.5–7.5 cm long, pale to white often blushed with rose; middle 5.5–15 cm long, pale brown to pale rose, faintly mottled; inner 16–30 cm long, enclosing the pseudostem, pale rose, pale to dark brown, faintly mottled, sometimes cylindrical below; often an outer pale-hyaline cataphyll 1–3 cm long also seen. Leaf solitary, radiatisect, usually unfolds completely before the emergence of inflorescence or together; petiole 38–95 cm long, 0.5–1.5 cm thick, pale green to greenish white above, rose to brown tinged below, not mottled; leaflets 5–8, sessile, elliptic-oblongate, 15.5–28.5 cm long, 3–6.8 cm wide, long-acuminate, margins entire, often wavy or undulate, dark green ventrally, pale dorsally. Pseudostem 13.5–29 cm long, 1.5–2.5 cm wide, wrapped by cataphylls, pale to dark green. Inflorescence held below the level of leaf; peduncle 29–63 cm long, light green, pale green, not mottled, exerted by 13–15.5 cm long from the pseudostem; Spathe 16–24.5 cm long; tube of spathe cylindrical, funnel-shaped towards the mouth, 6–8.5 cm long, 1.5–2 cm wide, pale green-green, or pale purple with white-pale stripes along the veins; margins of the mouth slightly dilated to a revolute auricular

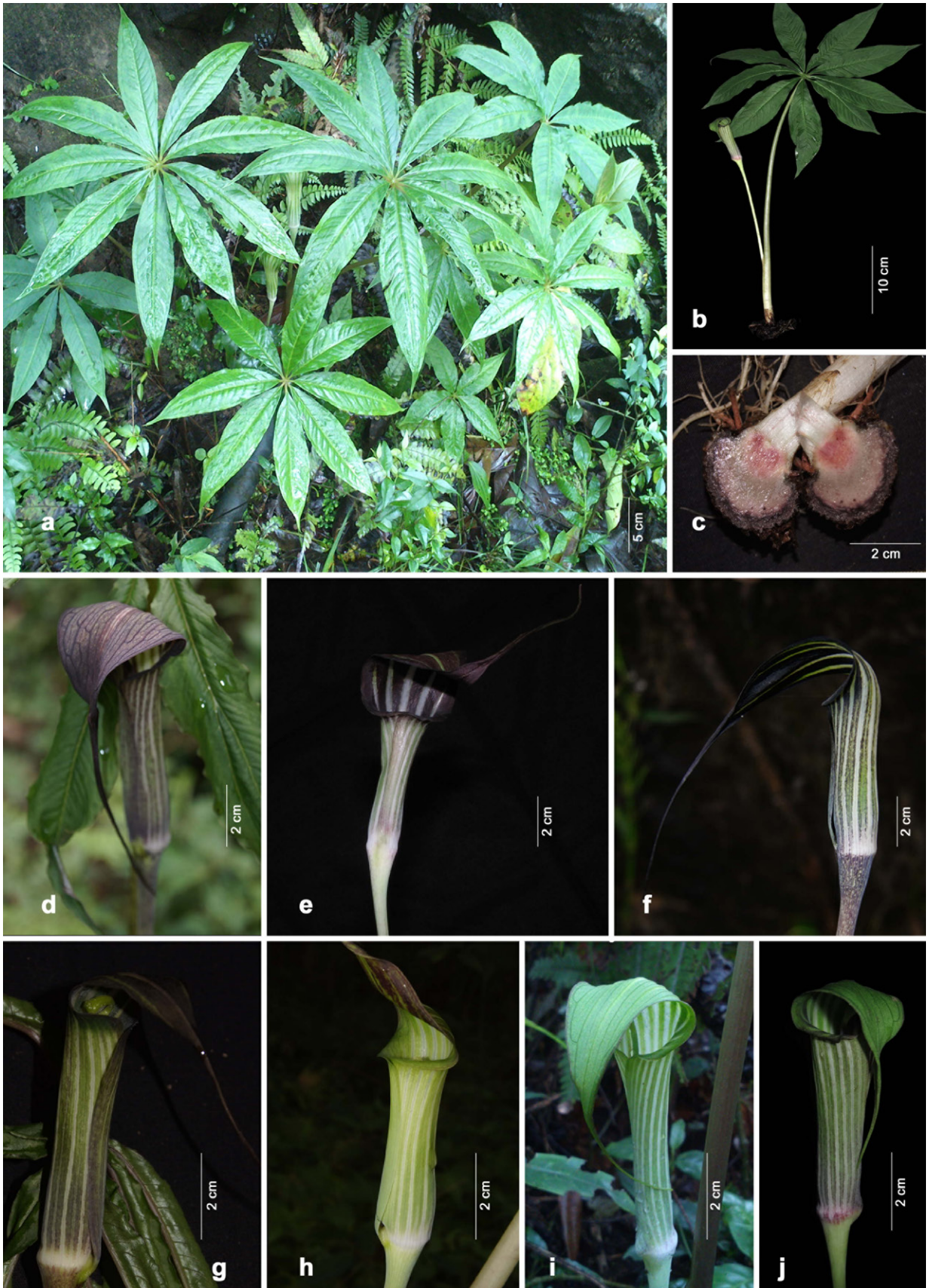


Figure 8. *Arisaema concinnum* Schott.: a & b. Habit; c. Corm. d-j. Inflorescences showing variations in their colour

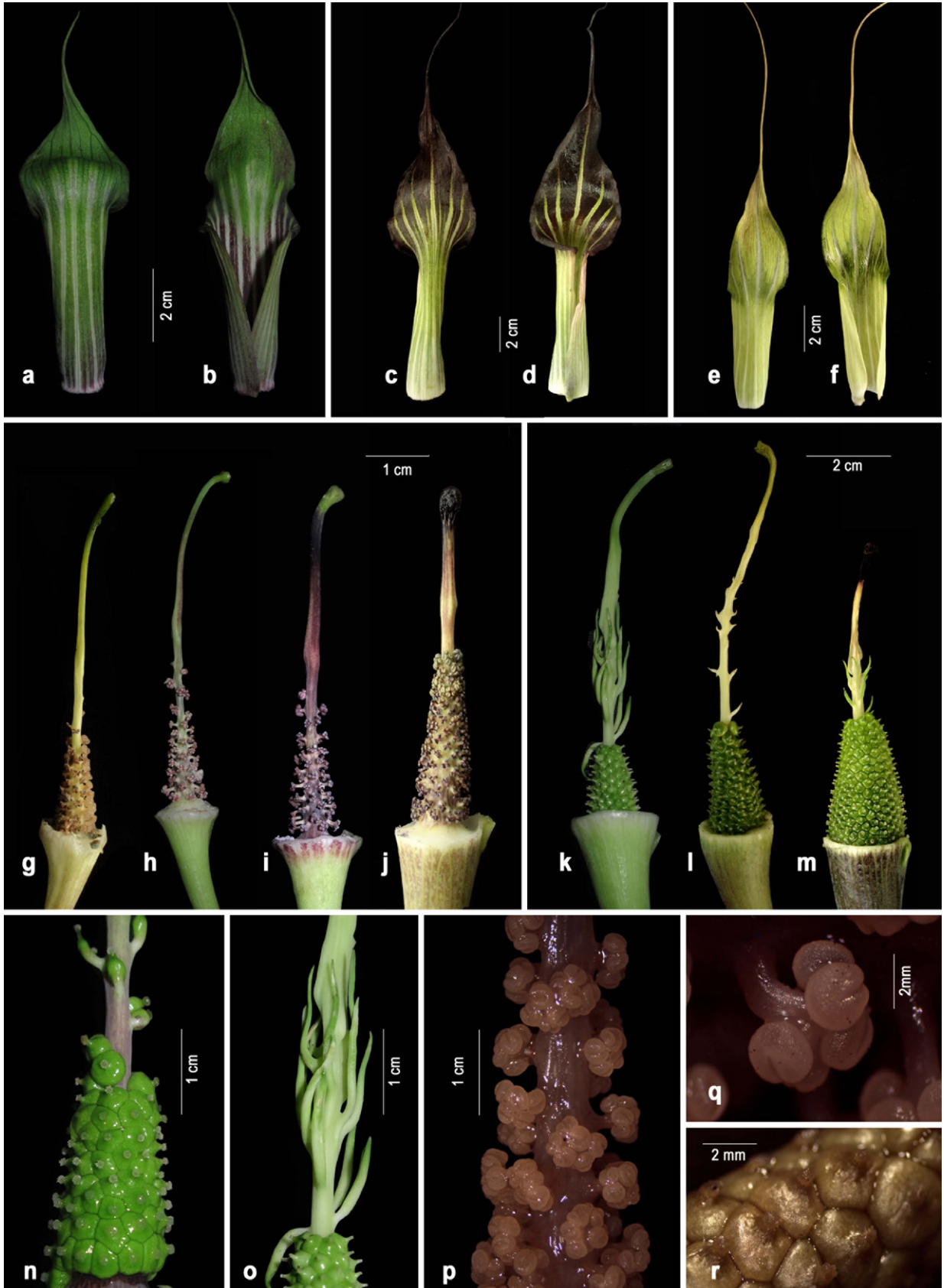


Figure 9. *Arisaema concinnum* Schott: **a–f.** Spathes (**a,c, e** back view; **b,d,f** front view); **g–j.** Male spadices; **k–m.** Male spadices; **n.** Female floriferous region; **o.** Neuters; **p.** Male floriferous region; **q.** Male flowers-enlarged view; **r.** Female flowers-enlarged view.



Figure 10. Lectotype of *Arisaema affine* Schott [J.D. Hooker s.n. (K000203008)] © The Board of Trustees of the Royal Botanic Gardens, Kew.



Figure 11. Lectotype of *Arisaema alienatum* Schott [T. Thompson s.n. (K000203002)] © The Board of Trustees of the Royal Botanic Gardens, Kew.

extension; limb, ovate-lanceolate, 10–16 cm long, 3.3–5.2 cm wide, acuminate with a long tail 5–9 cm long, green, purple to dark brown all over with white to pale greenish white stripes along the veins, arched over and drooping. Female spadix sessile, c. 10 cm long, 0.3–0.4 cm thick, slender, unevenly angled with a fertile region of 2–4 cm at the base, followed by a few neuters; pistils many, sessile, compactly arranged, globose, sometimes angled owing to the compact arrangement, green; ovules 3–5; style short; stigma papillate, stellate, peltate; neuters subulate, a few, 0.5–1.5 cm long, scattered, upcurved, green; appendix decidedly stipitate with a slight thickening at the base after neuters, reaching the mouth of the tube or just exceeding, slender and gradually tapering, green to light green, apex blunt-truncate, often subcapitate-capitate and purplish-dark brown. Male spadix sessile, similar to female, 4.5–7 cm long, 0.3–0.4 cm thick; fertile region narrow, 1.5–2.5 cm long; neuters usually absent or very few, as small protuberance; male flowers scattered over or crowded at the base and distant above, sessile or stipitate, 2–4-androus; anthers sessile, purple, dehisce by an apical pore. Fruiting spike cylindrical, c. 8.5 cm long, 3–4 cm wide, borne on an upright peduncle; berries compactly arranged, rounded at apex; receptacle cream, 3–5 seeded.

Flowering & fruiting: May–September.

Habitat: In evergreen and semi-evergreen forests, among pine woods at an elevation above 1500 m, associated with *Arisaema galeatum*, *A. speciosum* and *A. tortuosum*.

Distribution: India, China, Bhutan and Nepal.

Specimens examined: INDIA, **Aruanchal Pradesh**, Lohit district, Hayuliang, along Dalai river, 14.01.1970, *J. Joseph* 48945 (ASSAM!). Upper Dibang Valley district, *s.loc.*, 1700 m, 15.04.2001, *M. Bhaumik* 3817 (CALI!); Mayudia to Anini, 1865 m, 09.05.2015, *Arunkumar & Salim* 144847 (CALI!); Roing–Mayudia, 1125 m, 09.05.2015, *Arunkumar & Salim* 144834 (CALI!). West Kameng district, Bomdila, Thungri Nalla, 13.10.2015, in fruiting, *Arunkumar & Salim* 144941, 144942 (CALI!). **Manipur**, Senapati district, Kujeree Forest, Maram Side, 18.04.2006, *A.A. Mao & R. Gogoi* 111178 (ASSAM!). **Meghalaya**, East Khasi Hills district, Cherrapunjee, Mowsmai

Cave, 1300 m, 10.05.2013, *Manudev & Santhosh Nampy* 135225 (CALI!); *ibid.*, 22.07.2014, in fruiting, *Manudev* 139895 (CALI!); Mowmluh Cave, 4500 ft., 22.04.1943, *N.L. Bor* 187, 188 (BSD!); Shillong peak, 6000 ft, 23.05.1943, *N.L. Bor* 17346 (BSD!). **Nagaland**, Kohima district, Dzuko Valley, 03.06.2005, *A.A. Mao* 109039, 109040 (ASSAM!). **Sikkim**, East Sikkim district, Baluwakhani, Gangtok, 1800 m, 25.04.1980, *P. Chakrabarthy* 135 (BSHC!); Chandmari, Nathula Road, Gangtok, 2100 m, 07.05.2014, *Manudev* 138870 (CALI!); Fambong la Rest House to Kawlakhola, 17.07.1992, *S.K. Rai* 20853 (BSHC!); Hanuman Tok, 07.05.2014, 2200 m, 138865, *Manudev & Syam Radh* 138865 (CALI!); Meriang, way to Bhusuk Basty, 09.05.1984, *S. Singh* 2956 (BSHC!); Pangthang, near Spices Board, way to Mangan, 1900 m, 04.05.2014, *Manudev & Syam Radh* 138848 (CALI!); near Pangthang, 1951 m, 04.05.2014, *Manudev & Syam Radh* 138857 (CALI!); Raj Bhavan Compound, Gangtok, 24.04.1984, *D. Banerjee* 2906 (BSHC!); *ibid.*, 25.04.1980, *P. Chakrabarthy* 134 (BSHC!); Rangrang to Sangtang, 1800 m, 04.05.2014, *Manudev & Syam Radh* 138854 (CALI!); Sangthang, near waterfall, way to Mangan, 1900 m, 04.05.2014, *Manudev, Syam Radh & Prashob* 138850 (CALI!). North Sikkim district, Kabi Sacred groves, 11.06.1997, *S.S. Dash & S.K. Rai* 17225 (BSHC!); *ibid.*, 15.06.1999, *S.S. Dash* 20760 (BSHC!); Singhik towards Mangan, 24.04.1988, *R. Seshagiri Rao* 92 (ASSAM!). South Sikkim district, Sada, on the way, 11.05.1991, *R.C. Srivastava* 13188 (BSHC!); Tendong R.F., 07.06.2000, *B.K. Shukla* 23527 (BSHC!). West Sikkim district, Khecheopalri Lake surroundings, 11.05.1986., *S.K. Rai* 5420, 5421 (BSHC!); *ibid.*, 1875 m, 14.05.1994, *G.P. Sinha* 16087 (BSHC!); *ibid.*, 18.05.2002, *D. Maity & N. Pradhan* 23469 (BSHC!); Varsey to Okhrey, 03.06.2004, *S.K. Rai* 14277 (BSHC!); Yuksom, 19.05.2002, *D. Maity & N. Pradhan* 23489, 23492 (BSHC!). **Uttarakhand**, Almora district, Dafia Dhura, 01.08.1972, *C.M. Arora* 49546 (BSD!). Chamoli district, Anusuya Devi temple, 1750–2000 m, *s.d.*, *B.D. Naithani* 44036 (BSD!); Dewalikhhal to Karanprayag, 24.06.1979, *B.D. Naithani* 68077 (BSD!); Kachula Khark, above Mandal, Chamoli, 26.06.1993, *H.B. Naithani* 1860 (BSD!). Pithoragarh district, Bogdiyar, on the way, 06.1986, *Bipin Balodi* 77549 (BSD!); Dhani Kholta, 12.09.1983, fruiting, *Bipin*

Balodi 75042 (BSD!); Rungling forest, 2000–2800 m, 17.06.1960, *T.A. Rao* 11929 (BSD!). Tehri-Garhwal district, Gohna-Ramun, Garhwal, 2500m, 10.06.1959, *M.A. Rau* 10086 (BSD!); Govana, 1400 m, 29.05.1979, *A.K. Goel* 67727 (BSD!); Urni-Jhala, Tehri, 28.09.2000, fruiting, *Uniyal & Pundir* 96983 (BSD!). Kumaon, 4000 m (12000 ft.), *Strachy* 13 (CAL!). **Uttar Pradesh**, Sitapur district, Sitapur, 1600 m, 22.05.1972, *B.D. Naithani* 47928 (BSD!). **West Bengal**, Darjeeling district, Algarh, near Balwagani, way to Lava, 1761 m, 30.04.2014, *Manudev* 138830 (CALI!); *ibid.*, 1700 m, 30.04.2014, *Manudev & Syam Radh* 138825 (CALI!); Darjeeling, *s.d.*, *Talbot* 3339 (BSI!); *ibid.*, 1875, 7000 ft, *J.S. Gamble* 1276B, 1276D (BSD!); *ibid.*, 05.1880, *J.S. Gamble* 8074 (BSD!); *ibid.*, 05.1882, *J.S. Gamble* 10324 (BSD!); *ibid.*, 10.05.1895, *Talbot* 3363 (BSI!); Jorebunglaw, 2 km towards Sonada, 26.04.2014, *Manudev* 138812 (CALI!); Lava, 02.06.13, *Manudev* 02061311 (CALI!); way to Lava, 02.06.13, *Manudev* 02061302; Maneybhanjang to Sundekphu, 04.05.2015, *Arunkumar* 144806 (CALI!); Mirik, 1900 m, 30.04.2014, *Manudev & Syam Radh* 138833 (CALI!); Rangiroom, near Forest Beat Office, 1650 m, 16.07.2014, in fruiting, *Manudev & Abdul Kabeer* 139850 (CALI!); Rangiroom to Mungpoo, 1617 m, 16.07.2014, *Manudev* 139853 (CALI!); Rishap, near Lava, 2211 m, 30.04.2014, *Manudev* 138840 (CALI!).

Notes: This species is closely related to *A. leschenaultii* Blume in having greenish to purple spathe and stoloniferous tuber but can be differentiated by more slender spadix appendix with a rugose, subtruncate to sub-capitate tip. It was Schott (1859) who described this species along with *A. affine* Schott and *A. alienatum* Schott from the collections of Hooker from Sikkim. Both *A. affine* and *A. alienatum* were subsequently synonymised under this taxon by later workers (Hooker, 1893; Engler, 1920).

Typification: Schott (1859) described *A. affine* based on the collections of Hooker from Sikkim. There are two sheets at Kew (K000203007 and K000203008), both marked as type specimen by Schott. However, both of these sheets are part of different collections that are evident from the altitude shown in the field tickets. Since a proper type was not designated, the sheet no. K000203008 is chosen here as the lectotype conforming to the

latest code, excluding the pistils at the left.

Schott (1859) described *A. alienatum* from the collections of Thompson from Garhwal and Griffith from Bhutan. There are two sheets collected by Griffith, one each at K (*Griffith* 2630, K000203003) and BM (*Griffith* 2629, BM000958547) and one sheet collected by Thompson from Garhwal at K (*Thompson s.n.*, K000203002). The sheets at K were mentioned by Schott as the type and therefore a lectotype must be selected. The sheet by Griffith has a single plant mounted on it but with a deformed spathe and the sheet by Thompson has two plants with intact spathes. The sheet K000203002, has two specimens which is marked here as A and B. Among them, A is the best representative of the name and selected here as the lectotype.

Arisaema consanguineum Schott, Bonplandia 7: 27. 1859, Prodr. Syst. Aroid. 52. 1860; N.E.Br., J. Linn., Bot. 18: 242. 1880; Hook.f., Fl. Brit. India 6: 505. 1893; Engl. in Diels, Bot. Jahrb. Syst. (36)82: 11. 1905; Pamp., Boll. Soc. Bot. Ital. 9: 289. 1911; Craib, Bull. Misc. Inform. Kew 10: 397. 1912; Dunn & Tutcher, Bull. Misc. Inform. Kew, Addit. Ser. 10: 288. 1912; Engl. in Diels, Notes Roy. Bot. Gard. Edinburgh 6: 276. 1912; Engl. *et al.* in Limpricht, Repert. Spec. Nov. Regni. Veg. 12: 313. 1912; Hayata, Icon. Pl. Formosan. 5: 241. 1915; Engl., Pflanzenr. IV.23F(73): 175. 1920; Hand.-Mazz., Symb. Sin. 7: 1365. 1936; Gagnep., Fl. Indo-Chine 6(9):1188. 1942; Chatterjee, Bull. Bot. Soc. Bengal 8: 122. 1955; H.Hara, Fl. E. Himalaya, Sec. Rep., Bull. 348. 1971; J.C.Wang, Bot. Bull. Acad. Sin. 37(1): 77. 1996; Gusman, Bull. Jard. Bot. Natl. Belg. 67: 221. 1999; Gusman & L.Gusman, Gen. Arisaema, ed. 2. 371. 2006. *A. erubescens* (Wall.) Schott var. *consanguineum* (Schott) Engl. in A.D.C. & C.D.C., Monogr. Phan. 2: 558. 1879. *Lectotype* (designated by Manudev & Nampy, 2016): INDIA, Sikkim, *s.d.*, *J.D.Hooker s.n.* (CAL0000001307!).

A. tatarinowii Schott, Bonplandia 7: 27. 1859, Prodr. Syst. Aroid. 53. 1860; Engl. in A.D.C. & C.D.C., Monogr. Phan. 2: 559. 1879; Engl., Bot. Jahrb. Syst. 29: 236. 1901. *Type:* Not seen.

A. vituperatum Schott, Bonplandia 7: 28. 1859, Prodr. Syst. Aroid. 54. 1860. *A. erubescens* (Wall.) Schott var. *vituperatum* (Schott) Engl. in A.D.C. & C.D.C., Monogr. Phan. 2: 558. 1879. *Type:* NEPAL, *s.loc.*, *s.d.*, *Wallich* Cat. No. 8915

A. giraldii Baroni, Boll. Soc. Bot. Ital. 1893: 515. 1893. *Type*: Not seen.

A. davidianum Engl., Bot. Jahrb. Syst. 25: 27. 1898.

A. consanguineum var. *davidianum* (Engl.) Engl., Pflanzenr., IV, 23F: 177. 1928. *Type*: Not seen.

A. tatarinowii Schott f. *latisecta* Engl., Bot. Jahrb. Syst. 29: 236. 1901. *A. consanguineum* Schott f. *latisectum* (Engl.) Engl., Pflanzenr., IV, 23 F: 176. 1920. *Type*: Not seen.

A. brevipes Engl., Bot. Jahrb. Syst. 36(82): 11. 1905. *Type*: Not seen.

A. consanguineum Schott var. *giganteum* Pamp., Bull. Soc. Tosc.ortic. 16(7): 227. 1911. *Type*: Not seen.

A. consanguineum Schott f. *alpestre* K.Krause, Repert. Spec. Nov. Regni Veg. Beih. 12: 313. 1922. *Type*: CHINA, Sichuan, on top of Wan fu Ding, Limpricht (?)

A. undulatum K.Krause, Repert. Spec. Nov. Regni Veg. Beih. 12: 313. 1922. *Type*: Not seen

A. kerrii Gagnep., Notul. Syst. 9: 125. 1941, *nom. illeg.*

A. erubescens auct. Ma & H.Li, Aroideana 40(3): 120. 2017. *non* Schott 1832.

Fig. 12

Deciduous, dioecious or very rarely monoecious, succulent, perennial herbs, *c.* 1 m tall. Subterranean stem a tuberous corm, globose to subglobose, 3–6 cm diam., 2–4 cm tall, cream-white; tuberlets often present in mature corms, a few, surrounding the pseudostem. Roots many, from the upper side of the corm, white. Cataphylls 2 or 3, obtuse-orbicular at apex, mucronate; outer *c.* 2 cm long, pale to white; middle 5.5–12 cm long, pale to pink, pale to dark brown mottled; inner 9–20 cm long, pale green to brown, with faint or dark rose-pink to brownish mottling. Leaves 1 or rarely 2, radiatisect, usually unfolds with the emergence of inflorescence; petiole 22–110 cm long, 0.3–1.5 cm thick, pale to dark green, not mottled; leaflets 9–21, sessile, narrow, linear to oblong, 7.5–23 cm long, 1.6–5.2 cm wide, long acuminate at apex and prolonged in to a greenish to brown tail, base gradually cuneate, margins entire, often wavy or undulate, pale-dark green ventrally, glaucous dorsally. Pseudostem 20–45 cm long, 1–2.5 cm thick, wrapped by cataphylls, mottled as in petiole. Inflorescence held below the leaves; peduncle

16–55 cm long, shorter than petiole, green, pale to dark brownish green or purple, exerted by 7–10 cm long from the pseudostem. Spathe 7–20 cm long with a long tail up to 25 cm long; tube of spathe cylindric, slightly funnel-shaped towards the mouth, 5–9 cm long, 2–3.5 cm wide, pale green to green or rarely purple stained, sometimes with faint inconspicuous lines along veins; margins of the mouth dilated to a revolute auricular extension; limb ovate, 6–10 cm long, 3.2–5.5 cm wide, wider than tube, acute-acuminate and prolonged in to a slender tail, 10–25 cm long, green all over, sometimes purple blotched, arched over and curved down. Female spadix sessile, 8–10.2 cm long, 0.4–0.8 cm thick; fertile region 2.7–3.7 cm long, followed by few neuters along *c.* 0.5 cm; pistils many, sessile, compactly arranged, ovoid or bottle-shaped, green; ovules 4–6, white; style short; stigma papillate, stellate, sessile; neuters subulate, a few, 0.3–0.5 cm long, scattered, curved, green; appendix cylindric, decidedly stipitate with a slight constriction at the base after neuters, reaching the mouth of the tube or just exceeding, cylindric, rounded and smooth at apex, green to light green. Male spadix sessile, similar to female, slender, 5.5–6.2 cm long, 0.3–0.5 cm thick; fertile region *c.* 1.5–2 cm long, pale green to green; neuters usually absent; male flowers scattered over or crowded at the base and distant above, sessile or decidedly stipitate, 2–4-anded; anthers cream, dehisce by an apical round to oblong pore. Fruiting spike cylindric, 4–6 cm long, 2.5–4 cm wide, borne on a nodding peduncle; receptacle cream; berries ovoid compactly arranged, 4–6 seeded.

Flowering & fruiting: April–June.

Habitat: In evergreen and semi-evergreen forests, grasslands, under pine woods at an elevation above 1300 m, associated with *A. concinnum* and *A. tortuosum*.

Distribution: India, Bhutan, China, Nepal, Myanmar and Thailand.

Specimens examined: INDIA, Arunachal Pradesh, Lower Dibang Valey district, Athunli, 960 m, 01.05.1998, M. Bhaumik 1518 (CAL!); West Kameng district, Dum, on the bank of river Dirang, fruiting plant, 24.09.1964, J. Joseph 40292 (ASSAM!). Manipur, Senapati district, Mao (Mao to Kegwing), *c.* 1830 m (6000 ft), 02.05.1882,

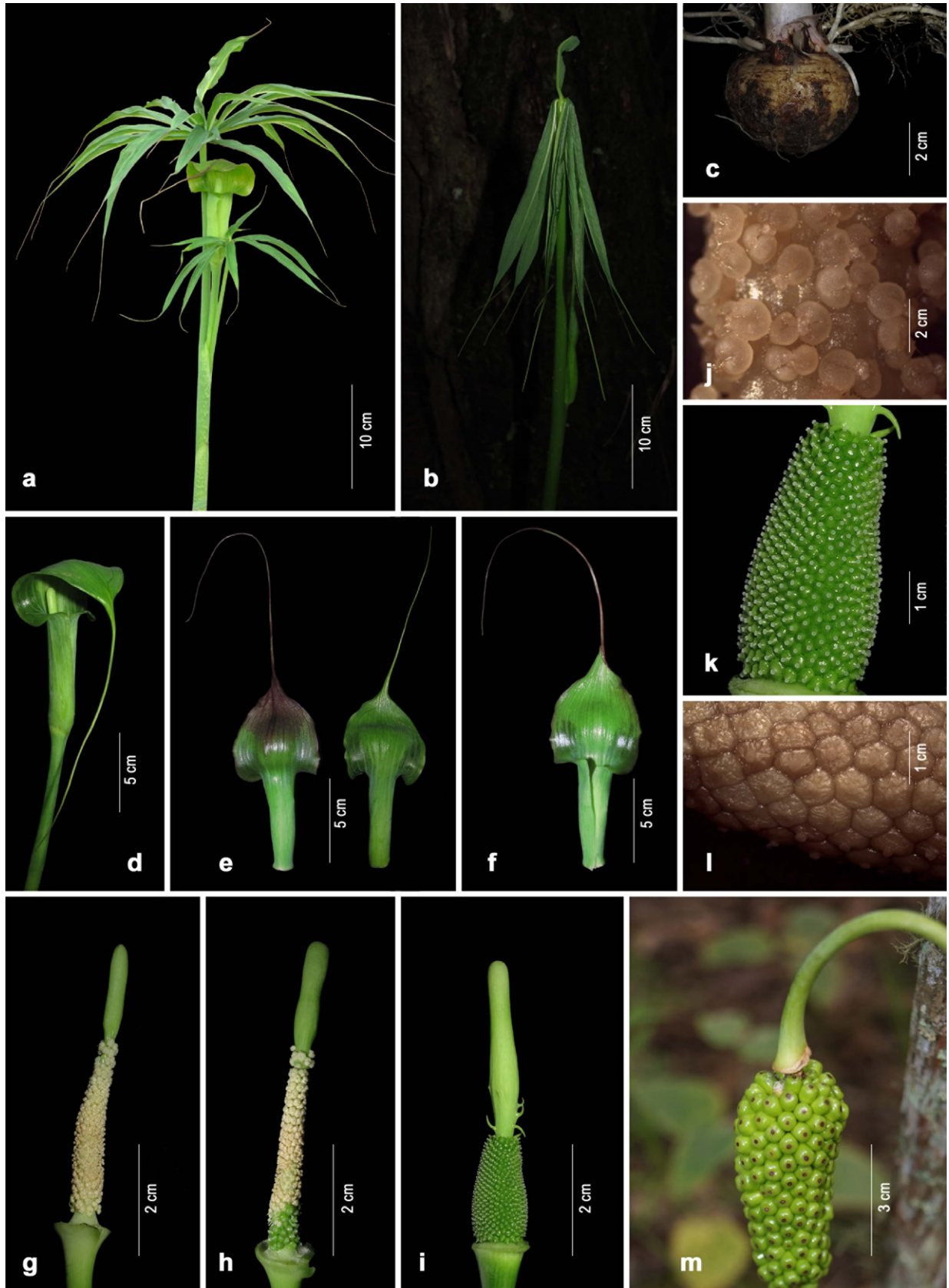


Figure 12. *Arisaema consanguineum* Schott: **a.** Habit; **b.** Leaf emergence; **c.** Corm; **d.** Inflorescence; **e.** Spathe-back view; **f.** Spathe-front view; **g.** Male spadix; **h.** Bisexual spadix; **i.** Female spadix; **j.** Stamens-enlarged view; **k.** Pistils; **l.** Pistils-enlarged view; **m.** Fruiting spike.

G. Watt 6861 (CAL!). **Meghalaya**, East Khasia Hills district, Dumpep, 30.05.1911, *I.H. Burkill & S.C. Banerjee* 34249 (CAL!); *ibid.*, 16.04.1969, *A.S. Rao* 47420 (ASSAM!); *ibid.*, c. 1920 m (6300 ft), 30.05.1911, *I.H. Burkill & S.C. Banerjee* 34258 (CAL!); Jowai, 07.05.1961, *D.B. Deb* 24425 (ASSAM!); Laitlyngkot, fruiting plant, 16.07.1946, *G.K. Deka* 22262; Mawphalang, sacred forest, 31.05.1973, *PK. Hajra* 51932 (ASSAM!, CAL!), 51933 (ASSAM!); Mukhla, near Jowai, 14.05.2013, *Manudev & Santhosh Nampy* 135247 (CAL!); Myllem towards north, 29.05.1911, *I.H. Burkill & S.C. Banerjee* 104 (CAL!); Nongstoin, 10.05.2013, *Alfred & Manudev* 135231 (CAL!); Nongstoin to Shillong, 10.05.2013, *Alfred & Manudev* 135232 (CAL!); Sangpung-Raliang, on the way from Jowai to Barapani, 23.05.1965, *A.S. Rao* 42539 (ASSAM!, CAL!); Shillong, c. 1530 m (5000 ft), 01.06.1885, *C.B. Clarke* 38224 (CAL!); *ibid.*, c. 1500 m (4900 ft), 26.05.1911, *I.H. Burkill & S.C. Banerjee* 37 (CAL!); *ibid.*, 27.05.1911, *I.H. Burkill & S.C. Banerjee* 68 (CAL!); *ibid.*, 29.05.1911, *I.H. Burkill & S.C. Banerjee* 51 (CAL!); *ibid.*, 05.1918, *H.G. Carter* 826, 840 (CAL!); Shillong, woodlands Camp (new colony), 04.06.1960, *V.N. Naik* 18181 (ASSAM!, CAL!); Shillong near Cantonment, 10.05.2013, *Manudev & Santhosh Nampy* 135214; Shillong, BSI woodlands, fruiting plant, 02.08.1967, *D.M. Verma* 35667; Shillong Peak, 17.06.1967, *D.M. Verma* 35638 (ASSAM!); *ibid.*, 1800 m, 17.06.1956, *R.S. Rao* 2741 (CAL!); Khasia hills, 06.1876, *s.coll.* 280 (CAL496077!); *ibid.*, *s.d.*, *J.D. Hooker & T. Thomson s.n.* (CAL496093!); *ibid.*, *s.d.*, *Griffith s.n.* (CAL496091!). **Nagaland**, Mokokchung district, Mokokchung, Naga Hills, 05.1895, *s.coll.* 11696 (CAL!). **Sikkim**, North Sikkim District, Singhik, 14.05.1945, *Dr. K. Biswas* 6802 (CAL!); Chungthang, 15.05.1945, *Dr. K. Biswas* 6825 (CAL!). *s.loc.*, *s.d.*, *R. Seshagiri Rao* 342 (CAL!). **Uttarakhand**, Pithoragarh district, Pangu, Kumaon, 1800 m, 10.06.1960, *T.A. Rao* 11710 (CAL!). **West Bengal**, Darjeeling district, Darjeeling, c. 2130 m (7000 ft), 04.1882, *J.S. Gamble* 10327 (CAL!); Rangbee, 12.05.1877, *Griffith* 5975 (CAL!); *ibid.*, 12.05.1877, *J.L. Lister s.n.* (CAL496067!); Senchal, 05.1878, *G. King s.n.* (CAL!); Senchal WLS, 26.05.2007, *A.K. Ghosh* 41623A (CAL!); Batasia to Palmajura, 08.05.1956, *D. Chatterjee* 44 (CAL!).

Notes: This species is close to *A. fraternum* but can be easily identified by its linear-oblong

leaflets with a long tailed apex and spathe with an acuminate tip extending in a long tail as opposed to oblong-lanceolate leaflets without a tail at apex, and strongly drooping spathe limb without a tail.

Arisaema echinatum (Wall.) Schott in Schott & Endl., Melet. Bot. 17. 1832; Blume, Rumphia 1: 94. 1836; Kunth, Enum. Pl. 3: 16. 1841; Schott, Syn. Aroid. 1: 30. 1856; Prodr. Syst. Aroid. 49. 1960; Engl. in A.DC. & C.DC., Monogr. Phan. 2: 555. 1879; Hook.f., Fl. Brit. India 6: 596. 1893; Engl., Pflanzenr. IV.23F(73): 181. 1920; Hand.-Mazz., Symb. Sin. 7: 1361. 1936; Chatterjee, Bull. Bot. Soc. Bengal 8: 124. 1955; H.Hara, Fl. East. Himalaya, Sec. Rep. 351. 1971; U.C.Pradhan, Himal. Cobra Lilies 90. 1990; Hajra & D.M.Verma, Fl. Sikkim Monocot. 1: 188. 1996; Sasikala & Vajravelu, J. Bombay Nat. Hist. Soc. 98(3): 495. 2001; Gusman & L.Gusman, Gen. Arisaema, ed. 2. 374. 2006. *Arum echinatum* Wall., Pl. Asiat. Rar. 2: 30. t. 136. 1831. *Lectotype* (Step I. designated by Chatterjee 1955: 124; Step II. designated by Manudev & Nampy, 2017): NEPAL, Sheopore?, June 1821, *Wallich* 8916 (K001131834, excluding the *Arisaema* species at lower right corner and the *Typhonium* plant at the base; iso K000203000, K000950293, K001131831 excluding plants of *Arisaema erubescens* (Wall.) Mart. and *A. exile* Schott). *Epitype* (designated by Manudev & Nampy, 2017): *Icone of Arum echinatum* Wall. (Pl. Asiat. Rar. 2: t. 136. 1831)

Fig. 13

Deciduous, dioecious, perennial herbs, c. 70 cm tall. Subterranean stem a tuberous corm, globose, 4–7 cm diam., 2–4.5 cm tall, proliferating. Roots many, from the upperside of the corm, branched. Cataphylls 3, obtuse at apex, green or red. Leaves 1, rarely 2, radiatisect, emerges with the inflorescence; petioles 15–60 cm long, light green or purple, elongates after the spathe unfolds; leaflets 7–11, subsessile, broadly ovate, base cuneate, margins slightly serrate and undulate, apex mucronate, green above, glaucous beneath. Sheathing pseudostem c. 10 cm long, green, wrapped by cataphylls, mottled as in petiole. Inflorescence held near the ground level; peduncle much shorter than the petiole, 5–10 cm long, green; spathe c. 27 cm long including the apical tail; tube of the spathe cylindrical, slightly funnel-shaped towards mouth, 3–5 cm long, 2–2.5 cm wide, outside green or purple with white stripes along the veins, inside with purple dotted stripes,



Figure 13. *Arisaema echinatum* (Wall.) Schott: **a.** Habit (Image, Guy Gusman, Belgium).

constricted near the mouth; margins recurved; spathe limb lanceolate-ovate, 3–7 cm long, 3–5 cm wide, bright green outside, carmine inside, margins carmine, acuminate at apex, prolonged in to a long tail, tail 5–15 cm long, green or carmine. Female spadix 4–5 cm long, 0.4–0.6 cm thick, cylindrical, slightly exserted from the tube; fertile region 1–2 cm long; pistils compactly arranged, ovoid, angular, green; style short; stigma cream; neuters absent; appendix cylindrical, 3–4 cm long, 0.4–0.6 cm thick, stipitate, stipe *c.* 0.7 cm long, white with purple dotted, longitudinal lines, rugose and pale green or purple distally, apex orbicular, covered with thin, white and short prickly hairs; Male spadix slender, similar to female; male flowers scattered, stipitate, 3–4-anded; anthers purple, dehisce by a rounded or oblong pore, pollens white. Fruiting spike cylindrical, 5–5.5 cm long, 2.5–3 cm wide, borne on an upright peduncle; berries vermilion red, flat and lobulate at apex, 3-seeded.

Flowering & fruiting: May–October.

Habitat: In forests, among *Rhododendrons*, above 2400 m.

Distribution: India, Bhutan, China and Nepal.

Specimens examined: INDIA, **Sikkim**, North Sikkim district, Lachen, 3000 m, 07.06.1999, *D. Maity* 21328 (BSHC!); Talloom surroundings, 25.07.1986, *DCS Raju & S. Singh* 6214 (BSHC!); Zemu Valley, *c.* 2438 m (8000 ft.), 09.07.1909, *Smith & Cave* 1011 (CAL!).

Notes: This species is near to *A. echinoides*, a Chinese species, from which it can be distinguished by a stoloniferous subterranean stem and spathe limbs dark carmine inside with a few greenish white veins, anastomosing near the margin.

***Arisaema fischeri* Manudev & Nampy, sp. nov.**

Closely allied to *Arisaema barnesi* C.E.C.Fisch., from which it can be distinguished by cylindrical and smooth spadix appendix with a curved apex as opposed to a narrowly fusiform appendix, widest in the middle, tapering to a short tail with a small minutely warted apical knob and a ridged basal portion in the latter.

Type: INDIA, **Kerala**, Thiruvananthapuram district, Agasthyamala Biosphere reserve, Athirumala to Pongalappara, in flowering, 05.06.2014, *Manudev & Arunkumar* 138933 (holo CALI!, iso MH!) **Fig.14**

Deciduous, dioecious, perennial herbs, *c.* 1 m tall. Subterranean stem a tuberous corm, globose to depressed globose, 2.5–6.5 cm diam., 1.5–4.5 cm tall, greenish-yellowish inside, producing elongate cormlets upon maturity. Roots many, arising from the upper side of corm. Cataphylls 3, rarely 4, purplish to brownish green or pale white, sometimes purple mottled, acute to obtuse at apex, wrapping the pseudostem; outer 2–4 cm long, usually pale white, or brownish green towards apex; middle 4.5–14 cm long; innermost dark coloured, 16–37 cm long, sometimes an outer fourth cataphyll *c.* 1–2 cm present. Leaf single, rarely 2, radiatisect, unfolding with the inflorescence; petioles 43–101 cm long, 0.5–1.6 cm thick, purplish to brownish green or pale green to whitish green, often mottled with purple or brown, sometimes glaucous; leaflets 7–9, petiolulate, elliptic to oblong-obovate, 15–31 cm long, 3.5–8.5 cm wide, cuneate at base, gradually tapering or narrowly acuminate at apex, margins slightly undulate, dark green above, pale beneath, sometimes glaucous. Pseudostem 21–62 cm long, 1–3.5 cm thick, coloured as in petiole.



Figure 14. *Arisaema fischeri* Manudev & Nampy *sp. nov.* **a & b.** Habit; **c.** Corm; **d & e.** Inflorescences; **f.** Spathe-front view; **g.** Spathe-back view; **h–j.** Female spadices; **k & l.** Male spadices; **m.** Female florerous region; **n.** Male florerous region; **o.** Male flowers; **p.** Fruiting spike.

Inflorescence held below the leaf; peduncle 37–88.5 cm long, 0.4–1.4 thick, pale-brownish green, faintly mottled, exerted by 12–40 cm long from the sheathing pseudostem. Spathe 13–17 cm long; tube of spathe cylindrical, funnel-shaped towards the mouth, 6–9.5 cm long, 1.2–2.2 cm wide, purple-greenish outside, dark purple inside, white striped along the veins; mouth margins straight or slightly recurved; spathe limb ovate, 4–9.5 cm long, 3–3.5 cm wide, usually shorter than the tube, gradually tapering in to a tail *c.* 3–5 cm long at the apex, green or yellowish-green, white striped at the base, turns yellow after anthesis, erect or horizontal, sometimes arching forward. Female spadix 9–13 cm long, cylindrical, sessile; female floriferous region conical, 2–3.5 cm long, 0.7–1.3 cm wide; pistils compactly arranged, green; style absent; stigma papillose, white; ovules 2–5; neuters subulate, 0.5–0.8 cm long, upcurved, scattered along 3–4.5 cm along the base of appendix, purplish to green; appendix sessile, cylindrical or terete, gradually tapering to a blunt, curved apex, purplish basally, green distally, exerted from the tube. Male spadix similar to female, slender, 7–7.5 cm long; floriferous region conical below, cylindrical above; male flowers sessile, densely arranged below and scattered above, 2–6-anded; anthers reniform, purple, sessile, dehisce through an apical oblong pore; neuters usually absent, rarely very few, subulate. Fruiting spike cylindrical, *c.* 6 cm long, 2–3 cm wide, borne on an erect peduncle; receptacle cream; berries obovoid, 2–5-seeded.

Flowering & fruiting: May–October.

Habitat: In evergreen forests, shola margins and under bamboo reeds, in humus rich soil and rock crevices. A total of 65 plants in flowering were observed in 2014, along the trek path from Athirumala to Pongalappara at an elevation above 1200 m, in association with *A. tortuosum* and *A. leschenaultii*.

Distribution: India (southern Western Ghats), endemic.

Etymology: This taxon is named after Cecil Ernest Claude Fischer (1874–1950), British Botanist who described several species of *Arisaema* from southern India and completed *Flora of Presidency of Madras* after the demise of J.S. Gamble.

Specimens examined: INDIA, Kerala,

Thiruvananthapuram district, Agasthyamala Biosphere reserve, Athirumala to Pongalappara, in flowering, 11.06.2011, Manudev & Santhosh Nampy 4448 (CALI!).

Notes: This species is also close to *A. attenuatum* in having a sessile and cylindrical spadix appendix. However, the latter can be distinguished by a short triangular spathe limb with large roundish white patch at the base with radiating stellate arms.

Arisaema fraternum Schott, Bonplandia (Hannover) 7: 26. 1859; Prodr. Syst. Aroid. 45. 1860; Hook.f., Fl. Brit. India 6: 507. 1893; Engl., Pflanzenr. IV.23F(73): 178. 1920; Chatterjee, Bull. Bot. Soc. Bengal 8: 118. 1955; A.S.Rao & D.M.Verma, Bull. Bot. Surv. India 18: 17. 1976 (1979); Gusman & L.Gusman, Gen. Arisaema ed. 2. 387. 2006. *Lectotype* (designated here): INDIA, Meghalaya, Khasia Hills, *s.d.*, Griffith 11 (K000400615 digital image!).

A. leschenaultii auct. Engl. in A.DC. & C.DC., Monogr. Phan. 2: 552. 1879, non Blume 1836, *pro parte*.

Figs. 15 & 16

Deciduous, dioecious, succulent, perennial herbs, up to 56 cm tall. Subterranean stem a tuberous corm, depressed globose to subglobose, 2–4.5 cm diam., 2–2.8 cm tall, cream-white, stoloniferous. Roots many, from the upper side of the corm, white to pink. Cataphylls 2 or 3, obtuse-orbicular at apex, mucronate; outer *c.* 2 cm long, pale to white; middle 5.5–12 cm long, pale green to brownish green, pale rose to dark brown mottled; inner 9–21 cm long, enclosing the pseudostem, pale green to greenish brown, with faint or dark rose-purple to brownish mottling. Leaf solitary, radiatisect, usually unfolds completely after the emergence of inflorescence; petiole 27.5–133 cm long, 0.3–1.5 cm thick, dark green, purplish to brownish green, often mottled; leaflets 7–11, sessile, elliptic to lanceolate or oblong-lanceolate, 7.5–23 cm long, 1.6–5.2 cm wide, acute at apex, base cuneate, margins entire, often wavy or undulate, dark green ventrally, glaucous dorsally. Pseudostem 9–30 cm long, 1–2.5 cm thick, wrapped by cataphylls, mottled as in petiole. Inflorescence matures after the emergence of leaf, held below or at the level of leaf; peduncle 16–42 cm long, green, pale to dark brownish green or purple mottled, exerted by 7–12 cm long from the pseudostem. Spathe

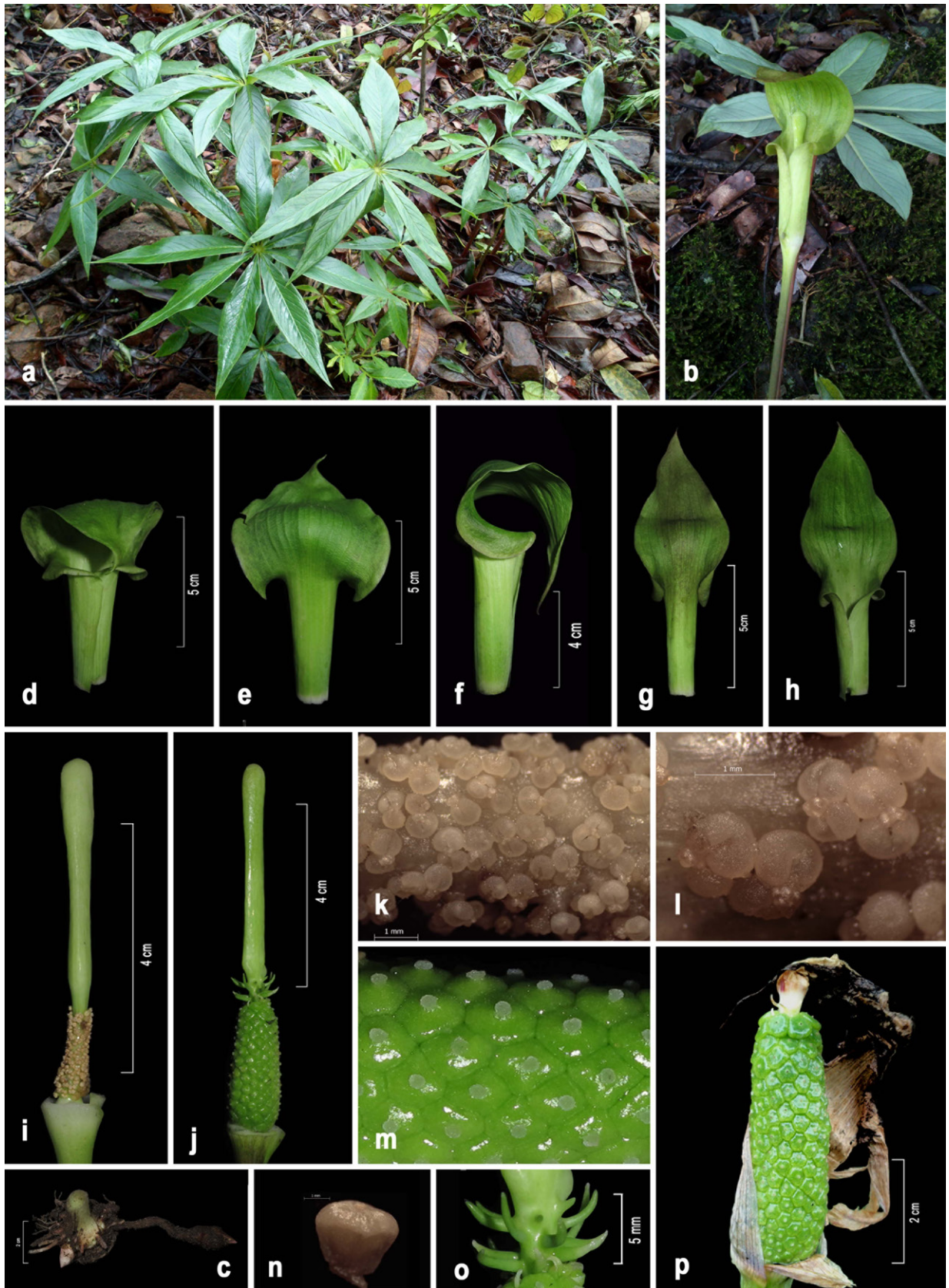


Figure 15. *Arisaema fraternum* Schott.: **a & b.** Habit; **c.** Corm; **d–h.** Spathes (**d & h.** front view; **e & g.** back view; **f.** Side view); **j.** Male spadix; **k.** Female spadix; **l.** Male floriferous region; **m.** Male flowers-enlarged view; **n.** Female flowers-enlarged view; **o.** Neuters; **p.** Pistil; **q.** Fruiting spike.



Figure 16. Lectotype of *Arisaema fraternum* Schott [Griffith s.n. (K000400615)] © The Board of Trustees of the Royal Botanic Gardens, Kew.

7–16 cm long; tube of spathe cylindric, slightly funnel-shaped towards the mouth, 3.5–4 cm long, 1–2 cm wide, pale green to green, sometimes with faint inconspicuous lines along veins; margins of the mouth dilated to a revolute auricular extension, 0.7–1.5 cm wide; limb ovate, oblong-ovate, widely ovate or ovate-lanceolate, 6–9.5 cm long, 3.2–6.2 cm wide, acute-acuminate, green all over, arched over and strongly curved down. Female spadix sessile, 8–10.2 cm long, 0.4–0.8 cm thick, reaching the mouth of the tube or just exceeding; fertile region 2.7–3.7 cm long, followed by few neuters along *c.* 0.5 cm; pistils many, sessile, compactly arranged, rhomboid, 5 or 6-angled owing to its compact arrangement, green; ovules 4–6, white; stigma papillate, stellate, sessile; appendix cylindric, decidedly stipitate with a slight constriction at the base after neuters, blunt at apex, sometimes decidedly flattened, green to light green; neuters subulate, a few, 0.3–0.5 cm long, scattered, upcurved, green. Male spadix sessile, similar to female, slender, 5.5–6.2 cm long, 0.3–0.5 cm thick; male fertile region 1.5–2 cm long, pale green to green; male flowers scattered over or crowded at the base and distant above, sessile or decidedly stipitate, 1 or 2-anded; anthers cream, dehisce by an apical oblong pore; neuters absent. Fruiting spike cylindrical, *c.* 5 cm long, *c.* 2.5 cm wide, borne on an upright peduncle; berries compactly arranged, rhomboid, 5 or 6-angled, green when young, turns red upon maturity, 5–6-seeded.

Flowering & fruiting: April–June.

Habitat: In evergreen and semi-evergreen forests, near grasslands, riverbanks at an elevation above 1300 m, associated with *A. album*, *A. concinnum* and *A. tortuosum*.

Distribution: India (North-East India), endemic.

Specimens examined: INDIA, Meghalaya, Khasia & Jaintia hills district, Cherrapunjee, 10.05.1940, G.K. Deka 22309 (ASSAM!); Mowsmi, near cave, plant, 10.05.2013, Manudev & Santhosh Nampy 135226 (CALI!). Pyrunusula, 29.04.1940, R.N. Dr. 21864 (ASSAM!); Tissy Jarwa, way to Nongthymmai, Cherrapunjee, 10.05.2013, Manudev 135219 (CALI!); Nongthymmai, on river banks, 10.05.2013, Manudev & Santhosh Nampy 135222 (CALI!); Nohsngithiang, Forest patch before Seven Sister Falls, 10.05.2013, Manudev &

Santhosh Nampy 135229 (CALI!).

Notes: It is close to *A. consanguineum*, but can be easily differentiated by its oblong-lanceolate leaflets, glaucous on the ventral side, and completely green, ovate-widely ovate, acute and strongly drooping spathe limb as opposed to linear, long caudate leaflets without a glaucous base and green-purple, ovate-lanceolate, long caudate spathe limb.

Typification: Schott (1859) while describing *A. fraternum* cited Khasia hills in Meghalaya as the locality but without mentioning the collector. Subsequently, in his *Prodromus Systematis Aroidearum* (1860), he gave the details of collector as “Khasia-Griffith- *v.s* in *Herb. Hooker*” indicating that he based his descriptions on collections of Griffith from Khasia that are deposited in Hooker’s herbarium (now K). There are two sheets by Griffith at K (K000400614 & K000400615). The specimen K000400614 was collected from Cherrapunjee and the date of collection is written March 1831 on the field ticket appended. There is a Kew distribution label attached to the right side of the sheet indicating the name of the collector as Griffith with the field number as 5978. The other sheet (K000400615) does not have a Kew distribution label but has a field ticket attached to the lower part of the sheet with a number (No.11). There is no indication of the date of collection and locality except for an annotation “Assam, Griffith” and the locality is corrected later as Khasia, striking off ‘Assam’. So technically these two sheets serve as the syntypes of this species. Hence, K000400615 with a determination slip attached by Schott on this sheet indicating it as the type specimen, is selected here as the lectotype.

Arisaema leschenaultii Blume, Rumphia 1: 93. 1836; Kunth, Enum. Plant. 3: 16. 1841; Schott, Prodr. Syst. Aroid. 51. 1860; Engl. in A.DC. & C.DC., Monogr. Phan. 2: 552. 1879, excl. syn. *A. fraternum* Schott; Hook.f., Fl. Brit. Ind. 6: 507. 1894; Hook.f. in Trimen, Handb. Fl. Ceylon 4: 352. 1898; Woodrow, J. Bombay Nat. Hist. Soc. 13(3): 427. 1901; T.Cooke, Fl. Bombay 1: 821. 1903; Fyson, Fl. Nilgiri Pulney Hill-tops 1: 426, t. 271. 1915; Engl., Pflanzenr. IV.23F(73): 162. 1920; C.E.C.Fisch. in Gamble, Fl. Madras 3: 1585. 1931; Blatt. & McCann, J. Bombay Nat. Hist. Soc. 35: 19. 1931; Chatterjee, Bull. Bot. Soc. Bengal 8: 127. 1955; K.M.Matthew, Ill. Fl. Tamil Nadu Carnat.

t. 765. 1982; Sivad. & Nicolson in K.M. Matthew, Fl. Tamil Nadu Carnat. 3(2): 1688. 1983; P.V. Bole & M.R. Almeida, J. Bombay Nat. Hist. Soc. 83(3): 596. 1986; Manilal, Fl. Silent Valley 332. 1988; Nicolson in Dassan. & Fosberg, Rev. Handb. Fl. Ceylon 6: 71. 1988; K.M. Matthew, Fl. Palni Hills 1369. 1999; Sivad. in Manoharan *et al.*, Silent Valley-Whispers of Reason. 235, figs. 9, 10. 1999; N. Mohanan & Sivad. Fl. Agasthyamala 756. 2002; Gusman & L. Gusman, *Arisaema* ed. 2. 392. 2006, *pro parte*. *Lectotype* (Step I. designated by Nicolson, 1988: 71; Step II. designated by Manudev & Nampy, 2017): INDIA, Tamil Nadu, Nilgiris (as Nelligerry), *s.d.*, *Leschenault* 69 (P00390539 digital image!; isolectotype P00390538 digital image!)

A. huegelli Schott, Syn. Aroid. 27. 1856. *Type*: Not seen.

A. papillosum Steud. ex Schott, Syn. Aroid., 31. 1856, Prodr. Syst. Aroid. 46. 1860; Thwaites, Enum. Pl. Zeyl. 335. 1864; Hook., Bot. Mag. 91: t. 5496. *Lectotype* (designated here): INDIA, Tamil Nadu, Nilgiris (in montibus Nilagiri), Althikarhattii, June, *Hohenacker* 1300 (P1750545 digital image!).

A. pulchrum N.E.Br., J. Linn. Soc. Bot. 18: 252. 1881; Hook.f., Fl. Brit. India 6: 505. 1894; C.E.C. Fisch. in Gamble, Fl. Pres. Madras 3: 1585. 1931. *Type*: INDIA, Sispara Ghats, West Nilgiris (sent by R.H. Beddome, cultivated in Kew), 03.1878, *W. Bull s.n.* (K000499493 digital image!) **Figs. 17 & 18**

Deciduous, dioecious, succulent, perennial herbs, *c.* 62 cm tall. Subterranean stem a tuberous corm, depressed globose to subglobose, 2–7 cm diam., 1–5 cm tall, wrinkled, cream-white, tuberlets often present in mature corms, a few, surrounding the pseudostem, often stoloniferous. Roots many, from the upper side of the corm. Cataphylls 3 or 4, acute or obtuse-orbicular at apex, mucronate; outer *c.* 1–4.5 cm long, pale to white often blushed with rose; middle 5.5–12 cm long, pale white-green or purple, pale rose to greenish brown mottled; inner 14.5–44 cm long, enclosing the pseudostem, pale green to greenish brown, with faint or dark rose, purple to brownish mottling, sometimes cylindrical below; often an outer pale-hyaline cataphyll *c.* 1–3 cm long can be seen. Leaf solitary, rarely 2, radiatisect, usually unfolds completely after the emergence of inflorescence; petiole 35–

90 cm long, 0.5–1.3 cm thick, light green to dark brownish green, pale-brown to purplish-brown mottled; leaflets 6–11, sessile, elliptic-obovate or oblanceolate, 9–30 cm long, 3–10 cm wide, cuneate at base, acute-acuminate, margins entire, often wavy or undulate, dark green ventrally, pale dorsally. Pseudostem 17–54 cm long, 1–2 cm thick, wrapped by cataphylls, mottled as in petiole. Inflorescence held below the leaves; peduncle 29–69 cm long, light green, pale to dark brown or purple mottled, always greenish distally, sometimes green all over without any mottling, exerted by 10–25 cm long from the pseudostem. Spathe 11–20 cm long; tube of spathe cylindrical, slightly funnel-shaped towards the mouth, 5–8 cm long, 1.5–2 cm thick, greenish white, pale green-green, greenish brown or pale purple with white-pale stripes along the veins; margins of the mouth slightly dilated to a revolute-auricular extension; limb ovate-lanceolate, 6.5–14 cm long, 3–6 wide, acute-acuminate, light to dark green, purplish or greenish brown all over with white to pale stripes along the veins, arched over and drooping. Female spadix sessile, 7–10.5 cm long, 0.4–0.8 cm thick; fertile region 2–3 long, followed by few neuters; pistils many, sessile, compactly arranged, globose, green; ovules 3–5, white; stigma papillate, stellate, sessile-subsessile, often with a dark blue neck; neuters subulate, few, 0.5–1 cm long, scattered, upcurved, green, sometimes bulbous based; appendix cylindrical, decidedly stipitate with a slight constriction at the base after neuters, reaching the mouth of the tube or just exceeding, cylindrical and gradually tapering with a blunt apex, sometimes flattened, green to light green. Male spadix sessile, similar to female, slender, 5–8 cm long, 0.3–0.5 cm thick; fertile region 2–2.5 cm long; male flowers scattered over or crowded at the base and distant above, sessile or decidedly stipitate, 3–4-anded; anthers sessile, purple, dehisce by an apical pore; neuters very few or usually absent, subulate, 1–2 cm long, pale green. Fruiting spike cylindrical, *c.* 8 cm long, 4–5 cm wide; borne on an upright peduncle; berries globose, compactly arranged, green, 3–5-seeded.

Flowering & fruiting: April–October.

Habitat: In evergreen and semi-evergreen forests, near grasslands and shola forests at an elevation above 1000 m, associated with *A. attenuatum*, *A.*

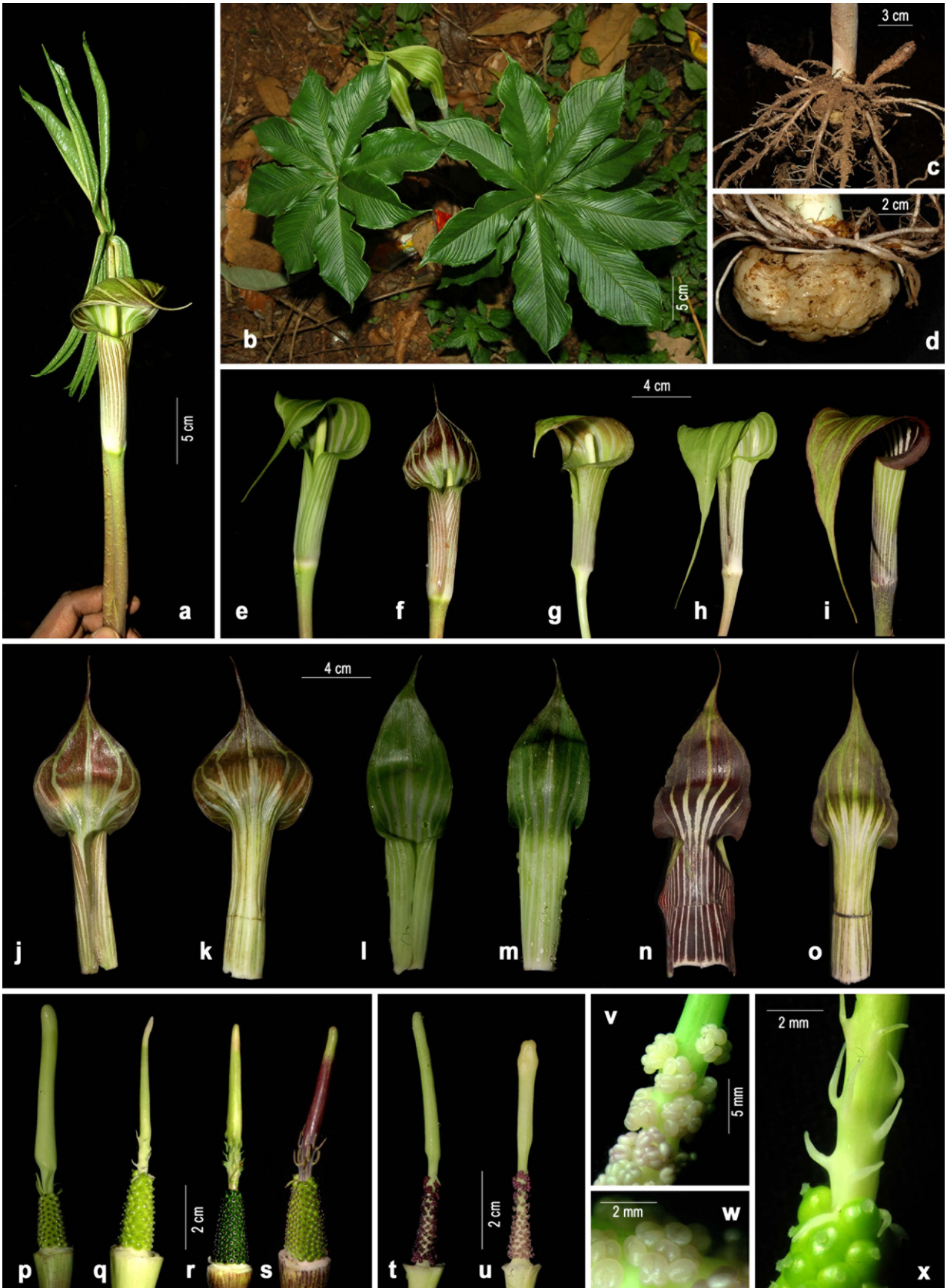


Figure 17. *Arisaema leschenaultii* Blume: a & b. Habit; c & d. Corm; e–i. Inflorescences; j–o. Spathe (j, l, n. front view; k, m, o. back view); p–s. Female spadix; t & u. Male spadix; v. Male floriferous region; w. Male flowers-enlarged view; x. Female flowers and neuters.

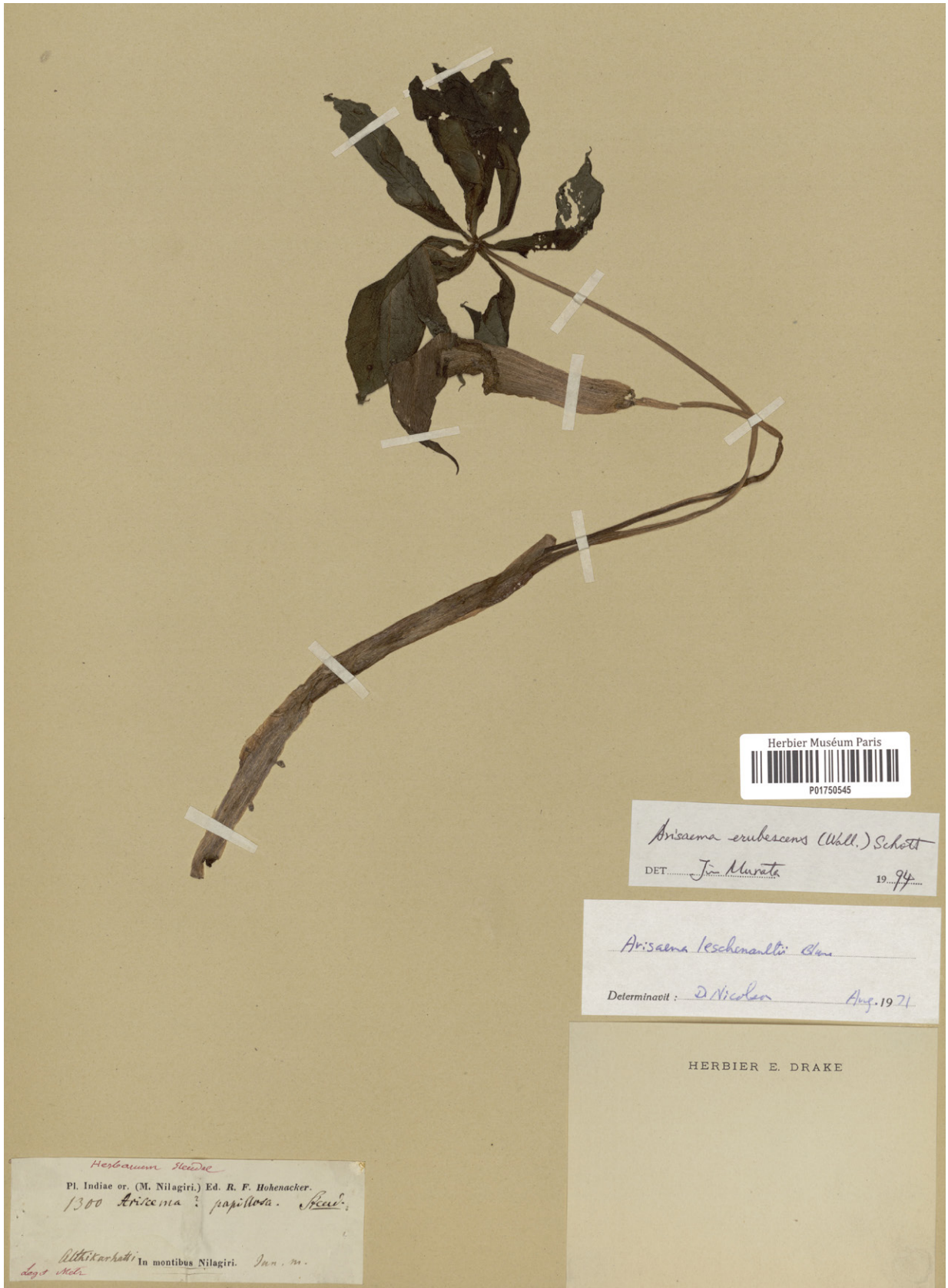


Figure 18. Lectotype of *Arisaema papillosum* Steud. ex Schott [Hohenacker 1300 (P1750545)] © Muséum National d'Histoire Naturelle, Paris.

barnesii, *A. peltatum*, *A. tuberculatum*, *A. tylophorum* and *A. tortuosum*.

Distribution: India (southern Western Ghats) and Sri Lanka.

Specimens examined: INDIA, Kerala, Idukki district, Chunduvarrai to Mannavan Shola, 12.04.2013, Manudev & Robi 135202, 135204 (CALI!); Eravikulam National Park, 19.07.1997, V. Abdul Jaleel & Bobby Thomas 109 (CALI!); Kundala Dam to Mannavan Shola, 23.05.2015, Manudev 138962 (CALI!); Mannavan Shola, 23.05.2015, Manudev & Syam Radh 138968 (CALI!); Munnar-Poopara road, 03.09.2010, Manudev 4129 (CALI!); Peerumedu, 24.05.1997, V. Abdul Jaleel & Bobby Thomas 60 (CALI!); Vallakadavu, Periyar Tiger Reserve, 17.11.1998, A. Johny 17955 (CALI!). Palakkad district, Kaikatty, Nelliampathy, 07.05.1997, V. Abdul Jaleel & Bobby Thomas 41 (CALI!); Minnampara, Nelliampathy, 14.08.1977, V. Abdul Jaleel & Bobby Thomas 120 (CALI!); Silent Valley, 01.06.1977, M. Sivadasan CU19182 (CALI!); Vengoli peak, south to Thunakkadavu dam, 28.04.1976, M. Sivadasan CU13149 (CALI!). Thiruvananthapuram district, Attayar, way to Athirumala, 07.06.2014, Manudev & Arunkumar 138943 (CALI!); Agasthyamala, way to Athirumala, 11.06.2011, Manudev 4457; *ibid.*, 07.06.2014, Manudev & Arunkumar 138945 (CALI!); way to Pongalappara, Agasthyamala, 11.06.2011, Manudev 4466 (CALI!); Chemungi, 18.05.1979, ±900 m, M. Mohanan 61854 (CAL!). Tamilnadu, Dindigul district, Pulneys, banks of mountain streams, 1858, *Beddome* 115 (CAL!). Kanyakumari district, Muthukuzhivayal, 1450 m, 27.07.1977, A.N. Henry 49417 (CAL!); Nilgiris, *s.loc., s.d.*, Perottett 1813 (P017050544); *ibid.*, 06.1883, J.S. Gamble 11996 (CAL!); Nilgiris district, Coonoore, 31.07.1878, G. King *s.n.* (CAL!); Naduvattom, 06.1884, J.S. Gamble 14549 (DD!); Naduvattom, way to Ooty, near T.R. Bazar, 1795 m, 22.07.2012, Manudev 5277; Naduvattom to Ooty road, 2000 m, 22.07.2012, Manudev & Santhosh Nampy 5279 (CALI!); Ooty, summit of Doddabeta peak, 12.05.2011, Manudev 4418 (CALI!); Rockland, Kundah-Coonor road, 1885 m, 22.07.2012, Manudev & Renab 5285 (CALI!); T.R. Bazar, near Naduvattom, Ooty, 12.05.2011, Manudev 4419 (CALI!); Yellakandy, Ooty-Avalanche road, 2104 m, 22.07.2012, Manudev 5284 (CALI!); Ootacamund (Ooty),

12.09.1878, G. King *s.n.* (DD!); *ibid.*, 05.1883, J.S. Gamble 11456 (CAL!); *ibid.*, 06.1897, Bourdillon *s.n.* (CAL!). Telangana, Rangareddy district, Rudaram R.F., 21.08.1994, M. Silar Mohammed 12716 (SKU!).

Typification: Schott (1856) published *A. huegelli* Schott, based on the collections of Huegel possibly from southern India. He also published another species *A. papillosum* Steudel ex Schott, by validating the name by Steudel. Both the species, characterized by a cylindrical to clavate appendix, found to be conspecific and were recognized as synonyms of *A. leschenaultii* Blume by Engler (1879), in his treatment of Araceae in de Candolle's *Monographiae Phanerogamarum*.

Arisaema papillosum was legitimately published by Schott (1856) in his *Synopsis Aroidearum*, based on the specimens from Steudel's personal herbarium. In fact, Schott wrote "*A. papillosum* Steudel (*in Scheda*)" means he had seen this name on the label of a sheet in Steudel's Herbarium. Schott did not cite any other details of the specimens in his protologue except for the type locality as "India Orientalis". Later he gave details of the specimens in the account of this taxa in his *Prodromus Systematis Aroidearum* as "*Montes Nilaghireses- Steudel- V. Specim. authentica*" indicating the precise locality of the type as Mountains of Nilgiris in South India.

Ernest Gottlieb von Steudel (1783–1856) was a German botanist and physician who collected only few plants himself and the majority of the plants in his herbarium were collected by others. There is no evidence that Steudel visited South India but he sometimes identified specimens for series of exsiccatae distributed by R.F. Hohenacker (German missionary, botanist and plant collector, 1798–1874) who explored South India and collected plants for sale in Europe. There are four sheets of Hohenacker under two collection numbers [No.1300 (3 sheets) and one sheet of No.1301] at Paris Herbarium (P). All these sheets are part of Steudel's herbarium as indicated in the field ticket attached in red ink. A lectotype is selected here (*Hohenacker* 1300, P1750545) conforming to the latest code of nomenclature (Turland *et al.*, 2018)

Arisaema madhuanum Nampy & Manudev, *Edinburgh J. Bot.* 71 (2): 269–273. 2014. *Type*: INDIA, Tamil Nadu, Coimbatore District,

Valparai, Oosimala Top, 1344 m, 10°18.546 N 76°59.987 E, 10.07.2012, *Manudev & Santhosh Nampy* 5092 (holo CALI!; iso MH!). **Fig. 19**

Deciduous, dioecious, perennial herbs, *c.* 115 cm tall. Subterranean stem a tuberous corm, depressed globose or subglobose, 3–4.5 cm diam., 2–3 cm tall, brownish, wrinkled, cream inside; offsets *c.* 8, surrounding the pseudostem, purplish or dark brown-black, globose, sometimes one or two below the roots slightly elongated. Roots many, on top of the corm surrounding the pseudostem, rose-tinged. Cataphylls 3, rarely 4 (fourth one usually disintegrated); outer 1.8–3 cm long, pale brown, apex acute-obtuse, mucronulate, slightly keeled; middle 12–16 cm long, brown-purple with greenish-white or cream mottling/lesions, apex obtuse or orbicular, mucronate; inner 30–39 cm long, brown-purple with greenish white or cream mottling, obtuse or orbicular at apex, mucronate. Leaf single, radiatisect, probably emergin with or after the inflorescence; petiole 38–50 cm long, 0.5–2 cm thick, pale green with brown mottling formed of vertical streaks; leaflets 7–10, sessile, obovate-spathulate, 13–40 cm long, 2.2–11 cm wide, subequal, gradually cuneate at base, acuminate at apex, margins entire, undulate, bright green above, pale beneath, lateral veins up to 25 pairs, intra-marginal vein *c.* 0.5 cm apart from the margins. Pseudostem 35.5–50 cm long, pale green with brown mottling, ligule not prominent. Inflorescence held below the leaf; peduncle 33.5–66 cm long, 0.5–0.7 cm thick, mottled as in petiole, pale purple towards the distal end, exerted by 5–17 cm from the pseudostem. Spathe 18–20 cm long including the limb portion; tube of spathe cylindrical, funnel-shaped towards the mouth, 8–9 cm long, 1–2.5 cm wide, pale to purple basally, greenish distally, dark purplish within, with white longitudinal stripes along the veins; mouth open, wide, margins dilated into a prominent auricular extension about 1 cm wide, margins of auricle slightly revolute, *c.* 4.5 cm wide in the mouth region and suddenly narrowing into the limb; limb oblong-lanceolate, 10–11 cm long, 2–2.5 cm wide, yellowish-green with 5 white to hyaline longitudinal stripes along the veins, two paler stripes flanking three larger stripes in the middle, margins curved back at the base of the limb forming a neck-like constriction immediately after the mouth, apex acuminate with a slightly

swollen tip, erect and arching forward at the distal end. Female spadix not seen. Male spadix sessile, just reaching the mouth, 8–9 cm long, slender, terete; fertile region 2.5–3.3 cm long at the base; male flowers sessile or shortly stipitate towards the distal end of the fertile zone, 2–9-anded; stipe to *c.* 1 mm long; anthers reniform, purple, dehisce through an apical pore; neuters 8–9, subulate, 2–6 mm long, scattered along the basal 1–1.5 cm of the appendix, curved down, often paired from the base, purplish-green; appendix sessile, base slightly thickened, *c.* 0.3–0.5 cm wide, gradually tapering to a filiform often curved distal portion, purplish basally and greenish distally to a filiform apex. Fruiting spike cylindrical, 4–6 cm long, 2.5–3.5 cm wide, borne on an upright peduncle; berries ovoid to globose, compactly arranged, green when young, 2-seeded.

Flowering & fruiting: Probably from the onset of monsoon; flowers and young fruits observed in July.

Habitat: Grows along the margins of evergreen forests near tea plantations at Oosimala Top, above 1300 m. A population of 31 plants was observed at the type locality, including two fruiting female plants. One of the infructescences had remnants of the spathe tube as well as a dried filiform appendix at the apex. The female plants were robust and larger than the male plants.

Distribution: India (southern Western Ghats), endemic.

Specimen examined: Kerala, Idukki district, Eravikulam National Park, 18.07.1997, *V. Abdul Jaleel & Bobby Thomas* 107 (CALI!).

Notes: *Arisaema madhuanum* is morphologically close to *A. attenuatum* and *A. tylophorum*, both endemic to the southern Western Ghats, in having a slender to almost filiform appendix. However, the new species can be easily distinguished from both of them by having a wide-mouthed spathe tube, and by the erect to arching limb with a narrow base.

Arisaema nilamburensis Sivad. in Sivad. & Nicolson, *Aroideana* 6: 37. 1983; Manilal, *Fl. Silent Valley* 332. 1988; Sivarajan & Mathew, *Fl. Nilambur* 753. 1997; Sivad., in Manoharan *et al.*, *Silent Valley- Whispers of Reason* 237. 1999;

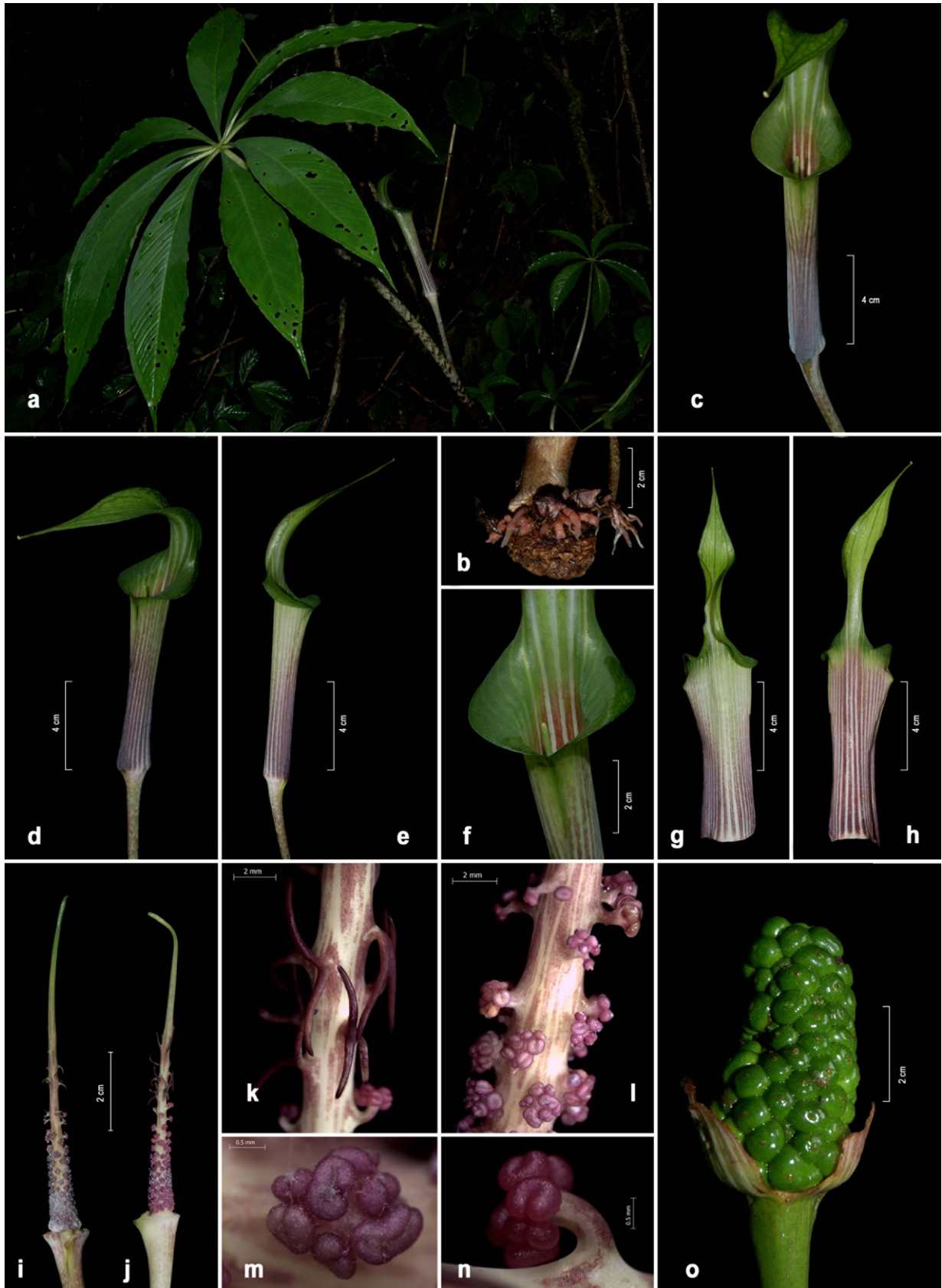


Figure 19. *Arisaema madhuanum* Nampy & Manudev: **a.** Habit; **b.** Corm with cormlets; **c.** Male inflorescence-front view; **d–e.** Male inflorescence-side views; **f.** Mouth of the spathe tube; **g–h.** Spathe; **l.** Male spadix; **j.** Neuters; **k.** Male fertile region; **l & m.** Male flowers. **n.** Fruiting spike.

Gusman & L.Gusman, Gen. *Arisaema*, ed. 2. 395. 2006. *A. auriculatum* E.Barnes, Kew Bull. 1946: 44. 1946; Chatterjee, Bull. Bot. Soc. Bengal 8: 121. 1959, *non* Buchet (1911), *non* Smith 1914, *non* Kishida 1931. *Lectotype* (designated by Sivadasan & Nicolson, 1983): INDIA, Kerala, Nilambur Ghat, Nilgiri, Wayanad, 2500 ft, July 1940, *Barnes* 2285 (K000499459 digital image!). **Fig. 20**

Deciduous, dioecious, succulent, perennial herbs, 50–90 cm tall. Subterranean stem a tuberous corm, globose-subglobose 3.5–5 cm diam., 2–3 cm wide, white-cream, wrinkled, stoloniferous. Roots arising from the upper side of the corm, white to flesh coloured. Cataphylls 3 or 4, rarely 5: outer 4.5–5 cm long, acute-obtuse at apex, slightly mucronate, rose coloured; middle 9.5–13 cm long, rose to flesh coloured; inner 20–27 cm long, rose-brown, with white or awful white dots, almost reaching to the length of pseudostem; often a fourth outer cataphyll may also present, c. 2 cm, rose to pale coloured and sometimes with a fifth degenerated one. Leaf solitary, radiatisect, emerging after the inflorescence; petiole slender, c. 90 cm long, green with rose to brownish patches, often glaucous; leaflets sessile, 5–7 or rarely 3 in vegetative plants, obovate-oblongate, sometimes elliptic, 13.5–25 cm long, 4–10 cm wide, cuneate at base, acute-acuminate or caudate, margins minutely praemorse, with a white or hyaline dorsal border, dark green ventrally, glaucous beneath, lateral veins 15–20 pairs. Inflorescence not exceeding the height of the leaf, usually held below; peduncle slender, 30–45 cm long, exerted by c. 8 cm from the sheathing pseudostem, light green-greenish white, often glaucous. Spathe 14–16 cm long; tube of spathe cylindrical at base, slightly funnel-shaped towards the mouth region, 6.5–8 cm long, 1.2–1.5 cm wide, white with purplish-brown bands along the length of the tube, bands are lighter outside, darker inside; margins of the mouth dilated in to a notably revolute, rounded auricle; limb, slightly cucullate at the base, obovate or widely obovate, 7–8.5 cm long, 3–5 cm wide, narrowly acuminate or caudate at apex, brownish green with basal white bands; nerves brown to purplish, anastomosing, with an intra marginal vein; margin slightly undulate with a purple band; distal half of the limb arched over and drooping. Female spadix sessile, c. 9 cm long, c. 1 cm thick; female

fertile region c. 3 cm long, followed by neuters; pistils many, compactly arranged along c. 2.5 cm long, subglobose, green; ovules 2 or 3, stigma papillate, stellate, nearly sessile; neuters echinate, few, 2–3 mm long, scattered over a distance of c. 1 cm, upcurved, white or purplish buff often with purplish spots; appendix stipitate with a swollen base after neuters, tapering to distal end and just reaching the mouth of the tube, arching forward at the apex, green with purplish discontinuous bands or dots, smooth or glabrous except the rugose, distal curved portion with purple spots. Male spadix stipitate, similar to female but slender, 7–7.5 cm long, 0.4–0.7 cm thick, naked or sometimes with few short echinate neuters; flowers scattered over or crowded at the base and distant above, sessile or decidedly stipitate, 2 or 3-anded; anthers purple-bluish, dehisce by an apical pore. Fruiting spike cylindrical or conical, c. 9 cm long, c. 4 cm wide, borne on an upright peduncle; berries ovoid compactly arranged, green when young, orange to bright red upon maturity, 2 or 3-seeded.

Flowering & fruiting: May–June.

Habitat: In grasslands, shola forests and evergreen forests, between 500–1200 m, usually found in clumps, as well as in soil pockets of wet rocks near the streams.

Distribution: India (southern Western Ghats), endemic.

Specimens examined: INDIA, Kerala, Kozhikode district, Muthappanpuzha, way to Olichuchattom, 08.05.2011, *Manudev & Santhosh Nampy* 4414 (CALI!). Malappuram district, Karimpuzha, 06.08.1983, *Philip Mathew* 34206 (CALI!). Palakkad district, Silent Valley, Dam site, 26.05.1982, *Sathish Kumar* 10587 (CALI!). Kottayam district, Vagamon, Kurisumala, 17.08.2013, in fruiting, *Manudev & Robi Jose* 135330 (CALI!). Wayanad district, Kurichiarmala, 28.10.2013, in fruiting, *Arunkumar & Santhosh Nampy* 142284 (CALI!); *ibid.*, 27.11.2014, in fruiting, *Santhosh Nampy & Manudev* 139982 (CALI!); Vythiri, Thalamala, 29.05.2011, *Manudev & Santhosh Nampy* 4441 (CALI!).

Notes: This species was first described by Barnes in 1946 under the name *A. auriculatum* owing to the auriculate nature of spathe, a character found

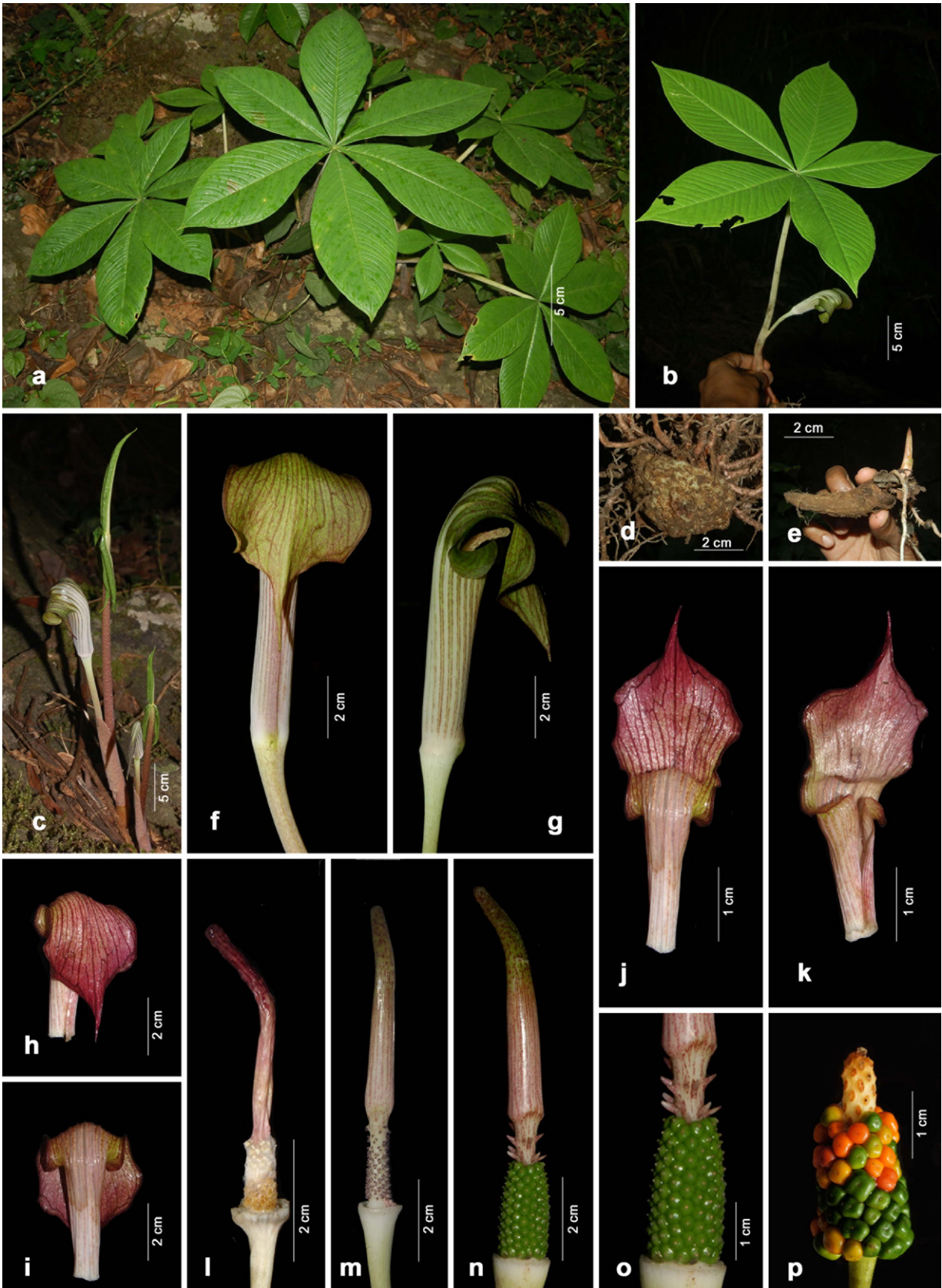


Figure 20. *Arisaema nilamburensis* Sivad.: a–c. Habit; d. Corm; e. Stolon; f & g. Inflorescences; h–k. Spathe (h & k. front view; i & j. back view); l & m. Male spadices; n. Female spadix; o. Female floriferous region; p. Fruiting spike borne on an erect peduncle.

in many species of *Arisaema*, which was served as the basis for naming as many as three taxa previously (2 from China and 1 from Japan). Since the epithet ‘*auriculatum*’ was preoccupied, Sivadasan and Nicolson (1983) renamed this species as *A. nilamburensis* Sivad., after the type locality, Nilambur. A lectotype was also selected from the collections of Barnes from Nilambur Ghats (*Barnes* 2285).

Arisaema peerumedense J.Mathew, *Ann. Bot. Fennici* 54: 29. 2017. *Type*: INDIA, Kerala, Idukki district, Peerumedu, tract to Parunthumpara, 1350

m, 14.06.2015, *J. Mathew* 4824 (holo TBGT; iso SESH).

Fig. 21

Dioecious, perennial herbs, to 1.75 m tall. Corms globose to subglobose, 3–5 diam., 2–2.5 cm tall, cream-white, stoloniferous. Cataphylls 3 or 4: outer *c.* 3.5 cm long, acute-obtuse at apex, pale rose to white coloured; middle 8–10 cm long, rose to flesh coloured; inner 19–20 cm long, rose-brown, with white or purplish dots, almost reaching to the length of pseudostem; often a forth outer cataphyll may also present, *c.* 1.5 cm, rose to pale coloured.

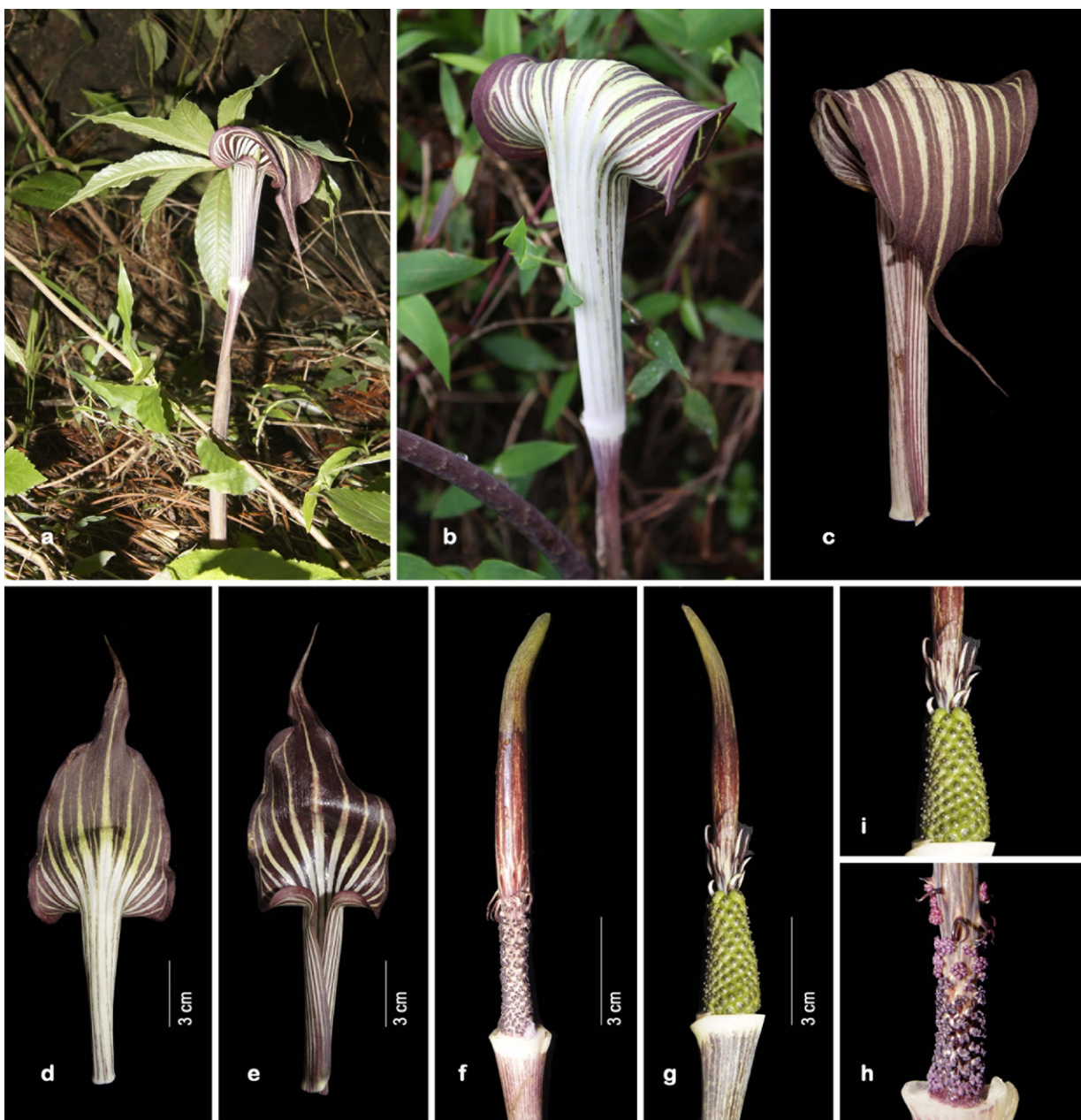


Figure 21. *Arisaema peerumedense* J.Mathew: **a.** Habit; **b.** Inflorescences; **c–e.** Spathe (**c & d.** front view; **e.** back view); **f.** Male spadix; **g.** Female spadix; **h.** Male floriferous region; **i.** Female floriferous region.

Leaf solitary, rarely 2; petiole *c.* 125 cm long, petiole slender, *c.* 125 cm long, 1–2.5 cm thick, brownish green mottled with pink; leaflets radiatisect, 8–12, 22–35 cm long, 5–9 cm wide, lanceolate, base cuneate, narrowly acuminate, margins entire, wavy, bright green above, pale beneath, margins greenish to hyaline, lateral veins up to 25 pairs, intra marginal vein *c.* 0.5 cm apart from the margins. Spadix dioecious, not exceeding the height of the leaf; peduncle slender, 100–142 cm long, 1.5–3.5 cm long thick, exerted by 7–18 cm from the sheathing pseudostem, greenish purple. Spathe 20–30 cm long; tube of spathe cylindrical towards base, funnel-shaped distally, 5–11 cm long, 1.5–2.5 cm broad, light purple towards the base, pale purple distally, dark purple within with greenish-white bands over the veins; margins of the mouth auriculate, dilates in to a prominent auricular extension *c.* 2.5 cm wide; limb oblong-lanceolate, purple with greenish white bands, 24–26 × 8–9 cm, narrowly acuminate at apex, tapering in to a slender tail, arching forward, thus reaching the tip almost to the base of the tube. Female spadix sessile, *c.* 11.5–15 cm long, 1–2 cm wide; fertile region of 3.5–4 cm, followed by neuters along *c.* 2 cm; pistils many, sessile, compactly arranged, globose, green; ovules 3–5, white; stigma papillate, stellate, sessile-subsessile, often with a dark neck; neuters subulate, few, 0.5–1 cm long, scattered, upcurved, white to purple, appendix, cylindrical-fusiform, broader at middle, tapering to both sides, reaching the mouth of the tube or just exceeding, blunt at apex, slightly curved distally, green to light green, purplish below. Male spadix sessile, similar to female, slender, *c.* 13 cm long, 1–1.5 cm thick; fertile region *c.* 4 cm long, male flowers scattered over or crowded at the base and distant above, sessile, 3–5-anded; anthers sessile, purple, dehisce by an apical pore; neuters few, subulate, *c.* 1 cm long, purplish. Fruiting spike cylindrical, borne on an upright peduncle; berries globose, compactly arranged, *c.* 3-seeded.

Flowering & fruiting: June–July.

Habitat: Grows in shola evergreen forests, under shaded conditions at an elevation above 1350 m.

Distribution: India (southern Western Ghats), endemic.

Specimen examined: INDIA, Kerala, Idukki district, Peerumedu, 30.06.2016, Arunkumar 149282 (CALI!).

Notes: *A. peerumedense* is closely related to *A. leschenaultii* Blume but can be distinguished by its sessile, distally curved, cylindrical-fusiform spadix appendix. The authors have also encountered intermediates between these two taxa in southern Western Ghats which render the identification of these two taxa dubious.

Arisaema peltatum C.E.C.Fisch., Bull. Misc. Inf. Royal Gard. Kew 1936(4): 277. 1936; Chatterjee, Bull. Bot. Soc. Bengal 8: 130. 1955; Manudev & Nampy, ENVIS News Lett. 20(1): 4. 2015. *Type:* INDIA, Kerala, Idukki district, Munnar, 12.06.1935, E. Barnes 1147 (K000203012 digital image!).

A. leschenaultii auct. Gusman & L. Gusman, *Arisaema* ed. 2. 392. 2006, *pro parte, non* Blume 1836. **Fig. 22**

Deciduous, dioecious, succulent, perennial herbs, 38–130 cm tall. Subterranean stem a tuberous corm, globose, 2.5–4.5 cm diam., 1–2 cm wide, smooth or wrinkled, stoloniferous. Cataphylls 2 or 3, acute-obtuse at apex; outer 2–6.5 cm long, pale coloured, often mottled with brownish streaks in mature plants; middle 6–13.6 cm long, mottled with brownish patches or streaks; inner 17–45 cm long, strongly mottled, darker. Leaf solitary, radiatisect, emerging after the inflorescence; petiole slender, 38–65 cm long, 0.8–1 cm thick, light green mottled with brownish streaks; leaflets 5–10, oblong-oblong-lanceolate, 15–34 cm long, 2–10 cm wide, cuneate at base, narrowly acute to acuminate, margins greenish to hyaline, praemorse, strongly undulate (appears to be serrate), darker above, glaucous or whitish beneath, lateral veins up to 26 pairs, intra marginal vein 0.4–0.6 cm apart from the margins. Inflorescence not exceeding the height of the leaf; peduncle slender, 25–90 cm long, 1.5–3.5 cm long, exerted by 8–14 cm from the sheathing pseudostem, light green with purplish mottling towards the distal portion. Spathe 13–30 cm long, glossy in texture; tube of spathe cylindrical towards base, funnel-shaped distally, 5–11 cm long, *c.* 2.5 cm broad, purple to brownish towards the base, greenish distally with white bands over the veins; margins of the mouth revolute; limb ovate-lanceolate, 8.5–19 cm long, 3–6 cm wide, greenish with white bands; bands wider towards the base and narrower towards the apex, narrowly acuminate at apex, tapering in to a slender tail, arching forward and upcurved with erect tip or



Figure 22. *Arisaema peltatum* C.E.C.Fisch.: a. Habit; b. Corm; c–f. Inflorescences (c & d. Purple form; e & f. Green form); g & h. Mouth of the tube with straight margins; i–k. Male spadices..

often drooping (probably after anthesis), thus reaching the tip almost to the base of the tube. Female spadix sessile, *c.* 12.6 cm long, 0.6–0.7 cm thick; female fertile region *c.* 4 cm long, followed by neuters along *c.* 4 cm; pistils many, compactly arranged, green; ovules up to 5, white; stigma papillose, stellate, sessile; neuters subulate, many, 0.7–1.2 cm long, scattered, upcurved, pale to purplish; appendix cylindrical, reaching the mouth of the tube or just exceeding, blunt at apex, slightly curved distally, green to light green, purplish below. Male spadix sessile, slender, slightly tapering to a blunt tip, 4.5–6.5 cm long, not exceeding the tube or just reaching the mouth; appendix sessile, slightly thickened at the base and appears to be stipitate, 2.5–3.5 cm long; male flowers scattered over 2–3 cm along the spadix, sessile or subsessile, 3–4-anded; anthers, purple, dehisce by an apical pore; neuters absent. Fruiting spike not seen.

Flowering: May–July.

Habitat: In grass lands and shola forests at an elevation above 1200 m above sea level.

Distribution: India (southern Western Ghats), endemic.

Specimens examined: INDIA, Kerala, Idukki district, Munnar-Poopara road, 23.05.2011, Manudev & Santhosh Nampy 4432 (DEV!); Kundala to Mannavan Shola, on the way, 23.05.2015, Manudev & Syam Radh 138961; Munnar-Pallivasal, 12.05.1935, E. Barnes 1146 (K digital image!, CALI!); Mannavan Shola National Park, on the way to Kanthallur, 23.05.2015, Manudev & Syam Radh 138964, 138967 (CALI!); Travancore, few miles above Munnar, *s.d.*, E. Barnes 1115(3) (K paratype, digital image!).

Notes: This species is recently rediscovered by Manudev and Nampy (2015) and is characterized by radiate leaflets, flagellate-caudate limb and rounded clavate spadix appendix, often with neuters at the base. However this species shows some deviation from the typical characters of the Sect. *Sinarisaema*-spadix appendage being slender and slightly tapering towards the apex, neuters present along the half way of appendix. Gusman and Gusman (2006) assigned this species as a synonym of *A. leschenaultii* Blume along with few other species from southern India and Sri Lanka, considering the latter as a polymorphic species.

However, this species is quite distinct and can be distinguished from the latter by its sessile, narrow leaflets with strong wavy margins and glaucous underneath; hyaline to white-stripped, yellowish-green limb tapering into a slender tail and sessile, slender, spadix appendix with neuters along half the length.

Arisaema psittacus E. Barnes, Hooker's Icon. Pl. 35: t. 3405. 1940; Chatterjee, Bull. Bot. Soc. Bengal 8: 131. 1955; Gusman & L. Gusman, Gen. Arisaema, ed. 2. 397. 2006. *Type:* INDIA, Kerala, Idukki district, Mannavan Shola, 1937, E. Barnes 1576 (K000499328 digital image!) **Fig. 23**

Deciduous, dioecious, succulent, perennial herbs, *c.* 1 m tall. Subterranean stem a tuberous corm, 2.5–5 cm diam., 2–2.5 cm tall, stoloniferous, greenish yellow inside. Roots many, from the upper side of the corm, white to pale pink. Cataphylls 2 or 3 rarely 4, obtuse-orbicular at apex; outer *c.* 1–2 cm long, pale to white; middle 3–28 cm long, purplish to greenish brown, dark brown mottled with longitudinal streaks, sometimes pale white without any mottling; inner 7–69 cm long, enclosing the pseudostem, purplish to greenish brown, dark brown mottled with longitudinal streaks, sometimes pale white without any mottling, cylindrical below. Leaf solitary, radiatisect, usually unfolds with the emergence of inflorescence; petiole 22–56 cm long, 0.3–1.2 cm wide, dark green, brownish green, dark brown mottled with longitudinal streaks, sometimes pale white to green without any mottling; leaflets 7–13, sessile, obovate, 7–35 cm long, 2–8 cm wide, base cuneate, acute at apex, margins serrulate, often wavy or undulate, dark green ventrally, pale dorsally. Pseudostem 8–77.5 cm long, 1–2.5 cm thick, wrapped by cataphylls, mottled as in petiole. Inflorescence held below the leaf; peduncle 21–92 cm long, mottled as in petiole, exerted by 12–14 cm from the sheathing pseudostem. Spathe 13–28 cm long; tube of the spathe funnel-shaped, 3-angled, 5.5–9 cm long, 1.2–3 cm, green, pale green or brownish green with white stripes along the veins; mouth margins straight or slightly recurved; limb cucullate, 7.5–19 cm long, 2.5–5.5 cm wide, green or brownish green with *c.* 5 wide, translucent or white stripes, gradually acuminate apex ending in a tail 4–10 cm long, drooping downward and curved like a parrot beak. Female spadix sessile, 8–10.5 cm long,

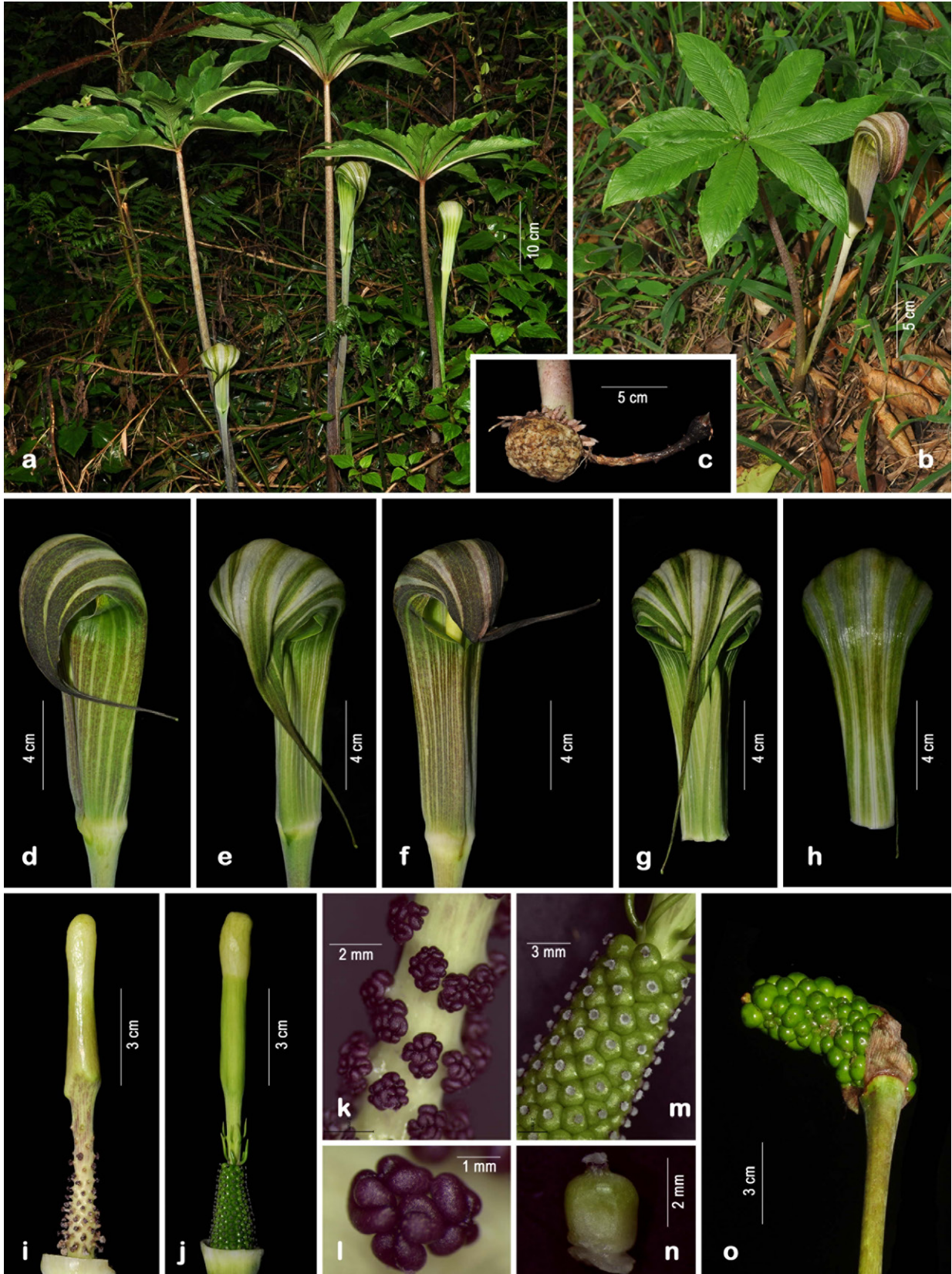


Figure 23. *Arisaema psittacus* C.E.C.Fisch. **a & b.** Habit; **c.** Corm with stolon; **d–f.** Inflorescences; **g.** Spathe-front view; **h.** Spathe-back view; **i.** Male spadix; **j.** Female spadix; **k.** Male floriferous region; **l.** Male flower-enlarged view; **m.** Female floriferous region; **n.** Female flower-enlarged view; **o.** Fruiting spike borne on an erect peduncle.

0.9–1.5 cm thick; female fertile region 2.2–2.7 cm long, followed by few neuters; pistils many, sessile, compactly arranged, bottle-shaped, green; stigma papillose and white with black neck; neuters few, subulate, 0.5–1 cm long, upcurved, green; appendix cylindrical, slightly longer than the tube, inserted inside the spathe, 8–8.5 cm long, 0.5–1 cm thick, greenish-yellow, constricted in the middle, ending in a knobby ovoid, verruculose, and yellow apex. Male spadix sessile, similar to female, slender, 6.5–8 cm long; fertile region narrow, 2–2.5 cm long, green-yellow; male flowers scattered over or crowded at the base and distant above, shortly stipitate with 3–4-androus; anthers purplish, dehisce by an elliptic pore; neuters absent. Fruiting spike cylindrical to conical, *c.* 13.5 cm long, 3.5–5 cm wide, borne on an upright peduncle; berries orange-red, compactly arranged, 3–6-seeded.

Flowering & fruiting: May–September.

Habitat: Grows under shades in wet evergreen forests, in moist humus rich soil.

Distribution: India (southern Western Ghats), endemic.

Specimens examined: INDIA, **Kerala**, Idukki district, Mannavan Shola, 05.1937, *E. Barnes* 1579, 1680 (MH!); *ibid.*, 23.05.2015, *Manudev & Syam Radh* 138963 (CALI!); *ibid.*, towards Kanthallur, 23.05.2015, *Manudev & Syam Radh* 138966 (CALI!).

Notes: This species is close to *A. leschenaultii* from which it can be easily distinguished by its cucullate spathe with a curved tail, dilated ovoid, verruculose spadix appendix with a constriction in the middle.

Arisaema sarracenioides E. Barnes & C.E.C.Fisch., *Hooker's Icon. Pl.* 34: t. 3307. 1936; Chatterjee, *Bull. Bot. Soc. Bengal* 8: 135. 1955; Gusman & L.Gusman, *Gen. Arisaema*, ed. 2. 398. 2006. *Type:* INDIA, **Kerala**, Idukki district, Munnar, Naimakad gap, *c.* 6500 ft, *E. Barnes* 1092 (K000400314 digital image!) Fig. 24

Deciduous, dioecious, succulent, perennial herbs, *c.* 70 cm tall. Subterranean stem a tuberous corm, depressed globose to subglobose, 2.5–4 cm diam., 2–3 cm tall, yellow to greenish yellow inside, offsets often present in mature corms, a few, surrounding the pseudostem. Roots many, from

the upper side of the corm. Cataphylls 3, acute or obtuse-orbicular at apex, mucronate; outer 1.5–2.5 cm long, pale to white often blushed with rose; middle *c.* 7 cm long, pale white-green or brownish, faintly brown mottled; inner 15–16 cm long, enclosing the pseudostem, pale green to greenish brown, with faint or dark rose, purple to brownish mottling. Leaf solitary, radiatisect, usually unfolds completely after the emergence of inflorescence; petiole 40–70 cm long, 0.5–1.3 cm thick, light green to dark brownish green, pale-brown to purplish-brown mottled; leaflets 5–7, petiolulate, elliptic-obovate or oblanceolate, 14–30 cm long, 4–9 cm wide, cuneate at base with a petiolules 1–1.5 cm long, acute-acuminate at apex, margins entire, undulate, serrulate, dark green ventrally, pale dorsally. Pseudostem 17–19 cm long, 1–2 cm wide, wrapped by cataphylls, mottled as in petiole. Inflorescence held below the leaf; peduncle 22–26 cm long, much shorter than petiole, light green, pale to dark brown or purple mottled, always greenish distally, sometimes green all over without any mottling, exerted by 5–9 cm long from the pseudostem. Spathe 18–22 cm long; tube of spathe cylindrical below, funnel-shaped towards the mouth, 6–8 cm long, 1.5–3 cm wide, white with longitudinal purple stripes along the veins; margins of the mouth recurved; limb cucullate, with a narrow opening, 6–8 cm long, *c.* 4 cm wide, white purple stripes, ending in a terminal, ovate, hanging lobe; lobe green outside with purple veins, dull purple or green and purple inside, *c.* 6.5 cm long, 5–6 cm wide, ending in a short tail. Female spadix sessile, 10.5–11.5 cm long, 0.8–1 cm thick, conical with a narrow fertile region of 2–2.5 cm at the base, followed by few neuters; appendix stipitate, 8–9 cm long, cylindrical, exerted from the spathe tube, fusiform with 0.5–0.8 cm thick at base and gradually tapering to a verrucose apex, white or white with purple markings; neuters subulate, few, 0.5–1 cm long, upcurved, white; pistils many, sessile, compactly arranged, globose, green; ovules 3–5, white; stigma papillose, white, sessile-subsessile, often with a dark blue neck. Male spadix sessile, similar to female, slender, 8–10 cm long; fertile region *c.* 2.5 cm long; male flowers scattered over or crowded at the base and distant above, stipitate, 4–6-androus; anthers sessile, purple, dehisce by an elliptic pore; neuters absent. Fruiting spike cylindrical, borne on an erect peduncle; berries



Figure 24. *Arisaema sarracenioides* E. Barnes & C. E. C. Fisch.: **a** & **b**. Habit; **c**. Corm; **d–f**. Inflorescences; **g**. Spathe-back view; **h**. Spathe-front view; **i**. Male spadix; **j**. Female spadix; **k**. Male floriferous region; **l**. Female floriferous region.

globose, compactly arranged, red, 2–4-seeded.

Flowering & fruiting: May–October.

Habitat: In evergreen forests, shola margins, among bushes, in humus rich soil at an elevation above 1500 m, in association with *A. attenuatum*, *A. psittacus* and *A. leschenaultii*.

Distribution: India (southern Western Ghats), endemic.

Notes: This species is close to *A. translucens* in its cucullate spathe limb from which it can be easily distinguished by the presence of a terminal hanging ovate lobe at the spathe apex.

Specimens examined: INDIA, Kerala, Idukki district, Devikulam, Lockhart gap, 23.05.2011, Manudev & Santhosh Nampy 4433 (CALI!); Eravikulam National Park, Nymakad, 20.07.1997, V. Abdul Jaleel & Bobby Thomas 112 (CALI!); Mathikettan Shola National Park, Chekpost to Onnamthodu, 22.05.2015, Manudev & Syam Radh 138958 (CALI!); Choondal, Mathikettan, 23.04.2016, Syam Radh & Arunkumar 149114, 149115, 149116, 149118, 149119 (CALI!); Sivan Para, on the way to Mathikettan, 26.06.2016, Syam Radh 149160 (CALI!).

Arisaema siangense Gusman, Syst. Geogr. Pl. 76: 229. 2006. *Type:* INDIA, Arunachal Pradesh, Siang District, c. 1300 m, July 1997, Gusman GG97144 (holo BR849801 digital image!; iso CAL! & BM!).

Fig. 25

Deciduous, dioecious, perennial herb, to 1.85 m tall. Subterranean stem an annulate tuberous corm, subglobose or elongated, c. 6–12 cm diam., 5–14 cm tall, brown outside, offsets elongate and pyriform. Roots thick, pink to white. Cataphylls usually 3, 5–50 cm long, similar in colour to the pseudostem. Leaf solitary, radiatisect, emerging with the inflorescence; petiole 50–60 cm long, 1.5–2 cm thick, smooth, olive-green with carmine stripes; leaflets to 11, elliptic-ovovate, 25–40 cm long, 7–9 cm wide, base cuneate or decurrent, subsessile or with a green petiolule, up to 10 mm long, apex long acuminate, margins undulate, green, entire or serrate, shiny green with deeply impressed veins above, underside glaucous with strongly prominent veins. Pseudostem 30–60 cm long, 3–4 cm wide, olive-green or pale red-brown with transverse vermillion markings and/or carmine stripes. Inflorescence held below the foliage; peduncle shorter than the petiole, 5–20 cm long, c. 6–1 cm thick, red-brown, with a mottling



Figure 25. *Arisaema siangense* Gusman. a. Habit; b. Corm; c. Male spadix; d. Female spadix; e. Male floriferous region (Images, Guy Gusman, Belgium).

similar to the pseudostem. Spathe 18–33 cm long including tail; tube of spathe subcylindrical, 6–10 cm long, *c.* 1.5 cm wide above, narrowing in the upper third, *c.* 0.8 cm across, then flaring again at mouth, dark pink outside with faint paler stripes becoming olive-green near the spathe mouth, white-yellow inside with dotted purple stripes mainly in the lower half; mouth-margins straight to slightly recurved and olive-green; limb horizontal, ovate-lanceolate, 4–8 cm long (not counting the tip); 3–5 cm wide, shorter than the tube, outside and inside dull orange-yellow with pale pink stripes; acuminate at apex, prolonged into a tail, 8–15 cm long, olive-green turning pink at the end. Female spadix 6–10 cm long; pistils densely arranged; pistils many, bottle-shaped, sessile yellow-green; style short or absent; stigma white and penicillate; appendix subcylindrical, usually hardly exerted from the spathe tube, erect, 4–7 cm long, exceptionally extremely short, ending in a clavate, knobby and light carmine apex, middle part white-yellow with pink stripes, smooth, 0.2–0.4 cm wide, lower part white-yellow, pink striped; neuters stiff, short and upcurved, 1–3 mm long, white-yellow, few in number; male fertile zone slightly conical, 1.5–3 cm long and 7–10 mm wide; male flowers loosely arranged, 2–4- androus; anthers pink, subsessile, dehisce through an elongated pore; pollens cream; neuters absent. Fruiting spike conical, 7–14 cm long and 3–6 cm wide, borne on an upright peduncle; receptacle cream-coloured; berries rounded, upper part flat, densely packed, bright red 1–3-seeded.

Flowering & fruiting: May–December.

Habitat: Grows at the base of deciduous trees, among bamboos and ferns, in clay, near streamlets and in bogs, at *c.* 1300 m elevation. *A. siangense* thrives along roads, often near riverbanks and among shrubs. Some specimens were over 1.80 m tall and this species might be the tallest in Sect. *Sinarisaema*.

Distribution: India (North-East Himalayas), endemic.

Specimens examined: INDIA, **Arunachal Pradesh**, Upper Siang district, Yingkyong, 3 km east on Hills, 12.03.2004, *Ritesh Kumar Choudhary* 16242 (ARUN!). Upper Dibang Valley district, Amboli, 08.05.1999, *M. Bhaumik* 2310 (CAL!); Punli,

30.04.1998, *M. Bhaumik* 1502 (CAL!).

Notes: This species is close to *A. concinnum* and one can easily misidentify this species when dried. However, it can be distinguished by its huge annulate corms, spathe tubes narrowed at middle, orange coloured spathe limbs and spadix appendix not knobbed as in the former.

***Arisaema subulatum* Manudev & Nampy, sp. nov.**

Closely similar to *A. leschenaultii* Blume, from which it is distinguished by petiolulate leaflets and sessile, cylindrical spadix appendix, rugulose at apex, with subulate, upcurved neuters, scattered along the base.

Type: INDIA, **Kerala**, Thiruvananthapuram District, Athirumala, on slopes, Agasthyamala, 06.06.2014, *Manudev & Arunkumar* 138939 (holo CALI!; iso MH). **Fig. 26**

Deciduous, dioecious, perennial, succulent herbs, *c.* 1.3 m tall. Subterranean stem a tuberous corm, globose-depressed globose, 4.5–8 cm diam., 3–5.5 cm tall, greenish inside. Cataphylls 3, rarely 4, pale or purplish to flesh coloured or rose, greenish towards apex, rose-pinkish mottled, obtuse at apex, mucronulate; outer 3–8 cm long, flesh coloured or rose; middle 6–16 cm long, pale coloured with rose mottling, slightly greenish towards distal end; inner 20–46 cm long, green in colour with rose or pinkish mottling, wrapping the pseudostem; sometimes an outer fourth cataphyll 2–2.5 cm present. Leaf single, radiatisect, unfolding with the inflorescence; petiole *c.* 130 cm long, 1.3–3.5 cm thick, green with purplish or rose coloured spots; leaflets 6–10, petiolulate, obovate-spathulate; 26–40 cm long, 7–11 cm wide, cuneate at base, acute to acuminate at apex, margins slightly undulate, dark green above, pale beneath. Pseudostem *c.* 75 cm long, 2–3.5 cm thick, mottled as in petiole. Inflorescence emerges with and held below the leaf; peduncle *c.* 90 cm long, 1.5–2 cm thick, green, faintly mottled with purple, exerted by *c.* 14 cm long from the sheathing pseudostem. Spathe 16–30 cm long; tube of spathe cylindrical, slightly funnel-shaped towards the mouth, 6–11 cm long, 2–2.5 cm wide, purple-greenish outside, dark purple inside, white striped along the veins; mouth margins auriculate, recurved; spathe limb ovate-lanceolate, 9–11 cm long, 5–6 cm wide, gradually tapering in to tail 3–9 cm long at the apex, margins slightly

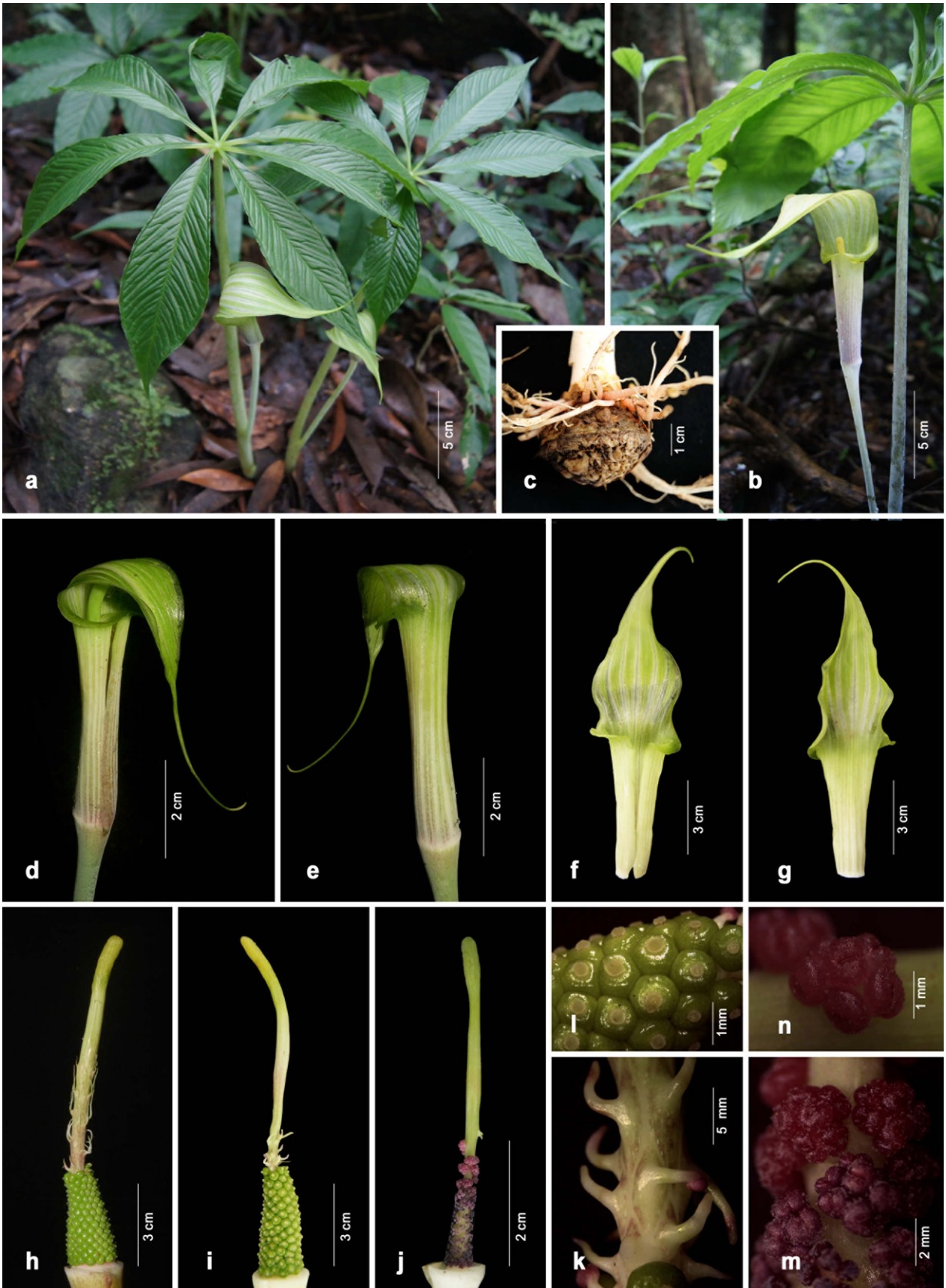


Figure 26. *Arisaema subulatum* Manudev & Nampy: **a & b.** Habit; **c.** Corm; **d & e.** Inflorescences; **f.** Spathe-front view; **g.** Spathe-back view; **h & i.** Female spadix; **j.** Male spadix; **k.** Neuters with aborted anthers; **l.** Female floriferous region; **m & n.** Male flowers-enlarged view.

revolute, yellowish-green, hyaline to white striped, erect and arching forward to a horizontal position, drooping downwards after anthesis. Female spadix 10–13 cm long, cylindrical, sessile; female floriferous region conical 3–4 cm long; pistils compactly arranged, globose, green; style absent; stigma papillose, white; ovules 5; neuters subulate, 0.6–1.2 cm long, upcurved, scattered, 2–5 cm along the base of appendix, pale to green or purplish; appendix sessile, cylindrical or terete, *c.* 9 cm long, 0.6–0.7 cm thick, green, purplish towards base, yellow-green at apex, slightly curved, rugulose and blunt at apex, exerted *c.* 1.5 cm from the tube. Male spadix similar to female, slender, 5.5–6 cm long; floriferous region cylindrical, 2–2.5 cm long, *c.* 0.5 cm wide; male flowers sessile, densely arranged below and scattered above, 4–7-anded; anthers reniform, purple, sessile, dehisce through an apical oblong pore; neuters usually absent, rarely very few, subulate. Fruiting spike not seen.

Flowering & fruiting: May–October.

Habitat: In evergreen forests and shola margins, in humus rich soil and rock crevices.

Etymology: This taxon is named after the subulate neuters scattered along *c.* 5 cm at the base of spadix appendix.

Distribution: India (southern Western Ghats), endemic.

Specimen examined: INDIA, **Kerala**, Thrissur Dist., Sholayar to Malakkapara road, 09.07.2012, Manudev 5085 (CALI!).

Notes: This species is very close to *A. leschenaultii* Blume, and is likely to get confused as a variant of the latter. However, it can be distinguished by its sessile spadix appendix which is rugulose at apex (*vs.* stipitate spadix appendix with smooth apex) with subulate upcurved neuters, scattered along the base (*vs.* neuters restricted below the stipe). It is also close to *A. peerumedense* from which it can be distinguished by the presence of petiolulate leaflets (*vs.* sessile leaflets), yellowish greenish spathe limb (*vs.* pale to dark purple limb) and a cylindrical or terete spadix appendix with rugulose apex (*vs.* cylindrical-fusiform appendix with smooth apex).

Arisaema translucens C.E.C.Fisch., Bull. Misc. Inf., Kew 1933 (7): 344. 1933; in Gamble, Fl. Pres. Madras 3(11): 1891. 1936; Chatterjee, Bull. Bot.

Soc. Bengal 8: 136. 1955; Gusman & L.Gusman, Gen. Arisaema ed. 2. 409. 2006; Prabhukumar *et al.*, Phytotaxa 306: 85. 2017. *Type:* INDIA, **Tamil Nadu**, Nilgiris district, Carrington Tea Estate, near Thia shola, 1820 m, *E. Barnes* AR.4 (K000499314 digital image!; iso MH!)

Deciduous, dioecious, perennial herbs, *c.* 35 cm tall. Subterranean stem a tuberous corm, subglobose, 1–5 cm. diam., white. Roots many from the upper side of the corm. Cataphylls 3, *c.* 9 cm long, rounded at apex, pinkish-purple, outermost becoming chaffy. Leaf solitary, radiatisect; petiole *c.* 35 cm. long, pinkish-purple with brown and pink markings or pink with brown and white markings; leaflets 9–11, sessile, narrowly elliptic-oblongate, 9–14 cm long, 1.7–3 cm wide, cuneate at base, finely acuminate, margins revolute, erose, dull velvety green above, slightly glossy below, midrib and numerous primary lateral nerves prominent below. Inflorescence held below the leaf; peduncle *c.* 20 cm long, slender, resembling the upper part of the petiole. Spathe *c.* 7 cm long; tube of spathe cylindrical, slightly widened to the mouth, 3.5–4.3 cm long, 1–1.3 cm wide, green and purple with a few white stripes; limb cucullate, *c.* 2.5 cm. long, leaving a narrowly obcordate, opening from the apex of which depends a filiform tail 2.5–3 cm long with an upcurved tip, purple with broad translucent bands. Female spadix nearly cylindrical, 4–5.4 cm long; floriferous region narrow, 1–1.5 cm long; pistils crowded, subglobose, 1.5–2 mm diam.; style very short; stigma minutely papillose; ovules 4; neuters a few, scattered, subulate, *c.* 5 mm long, rarely with an aborted anther at the tip; appendix narrowly clavate, slightly narrowed and rounded at the apex, green with faint purple stripes, the apical quarter white. Male spadix similar to female, slender; floriferous region narrow, *c.* 2 cm long; male flowers scattered, shortly stipitate, 2–6-anded; anthers purple, dehisce by an elliptic pore; neuters absent. Fruiting spike not seen.

Flowering: June.

Habitat: In grasslands, under pine woods at an elevation above 1300 m above sea level.

Distribution: India (southern Western Ghats), endemic.

Specimens examined: INDIA, **Tamil Nadu**, Nilgiris district, Pykara, under shade, 05.1889, *J.S. Gamble*

20514 (CAL!); Thaishola, beyond Carrington estate, towards Kakkamalai, 10.06.1933, *E. Barnes* 333 (MH!); *ibid.*, Kakkamalai, 10.06.1933, *E. Barnes* 336 (MH!).

Notes: Fischer (1933) described this narrow endemic species from the collections of Barnes from Nilgiris, Tamil Nadu. Closest ally of this taxon is *A. agasthyanum*, another narrow endemic species from southern Western Ghats. Both species are smaller in size and a purple, cucullate or almost galeate spathe limb with translucent–whitish bands are peculiar in this species. Recently Prabhu Kumar *et al.* (2017) rediscovered this taxon from its type locality.

Arisaema tuberculatum C.E.C.Fisch., Bull. Misc. Inform., Kew 1935(1): 66. 1935; in Gamble, Fl. Madras 3(11): 1890. 1935; Chatterjee, Bull. Bot. Soc. Bengal 8: 137. 1955; Sivad. in Manoharan *et al.*, Silent Valley–Whispers of Reason 236. 1999; V.S.Ramach. & Paulraj, J. Bomabay Nat. Hist. Soc. 105(2): 228. 2008; Gusman & L.Gusman, Gen. Arisaema, ed. 2. 398. 2006; Prabhukumar *et al.*, Phytotaxa 306: 89. 2017. *Arisaema convolutum* C.E.C.Fisch., Bull. Misc. Inform., Kew 1934(4): 167. 1934, *non* Nakai 1929. *Type:* INDIA, Tamil Nadu, Nilgiris district, Pennant Shola, Parson's Valley, 2133–2286 m (7000–7500 ft), May–June, *E. Barnes* AR7(a–h) (K digital images!). **Fig. 27**

Deciduous, dioecious, succulent, perennial herbs, up to 95 cm tall. Subterranean stem a tuberous corm,

depressed globose to subglobose, 2–5.4 cm diam., 1–3.5 cm tall, cream–white or brownish, offsets often present in mature corms, a few, surrounding the pseudostem. Roots many, pale brown to rose, from the upper side of the corm. Cataphylls 3 or 4, acute or obtuse at apex, mucronate; outer *c.* 2.5–7.5 cm long, pale to white often blushed with rose; middle 5.5–15 cm long, pale brown to pale rose, faintly mottled; inner 16–30 cm long, enclosing the pseudostem, pale rose, pale to dark brown, faintly mottled, sometimes cylindrical below; often an outer pale–hyaline cataphyll *c.* 1–3 cm long also seen. Leaf solitary, radiatisect, usually unfolds completely before the emergence of inflorescence or together; petiole 38–95 cm long, 0.5–1.5 cm thick, pale green to greenish white above, rose to brown tinged below, not mottled; leaflets 5–8, sessile, elliptic–ob lanceolate, 15.5–28.5 cm long, 3–6.8 cm wide, long–acuminate, margins entire, often wavy or undulate, dark green above, pale below. Pseudostem 13.5–29 cm long, 1.5–2.5 cm thick, wrapped by cataphylls, pale to dark green. Inflorescence matures before the emergence of leaf in male plants often over and decomposing by the time leaf has fully expanded; peduncle 29–63 cm long, light green, pale green, not mottled, exerted by 13–15.5 cm long from the pseudostem. Spathe 16–24.5 cm long; tube of spathe cylindrical, funnel–shaped towards the mouth, 6–8.5 cm long, 1.5–2 cm wide, pale–green to green, or pale–purple with white–pale stripes along the veins; margins of the mouth slightly dilated to a revolute auricular extension; limb ovate–lanceolate,



Figure 27. *Arisaema tuberculatum* C.E.C.Fisch.: **a.** Habit; **b.** Inflorescence–side view; **c.** Inflorescence–front view; **d.** Male spadix (Images A.J. Robi).

10–16 cm long, 3.3–5.2 cm wide, acuminate with a long tail, 5–9 cm long, green, purple to dark brown all over with white to pale greenish white stripes along the veins, arched over and drooping. Female spadix sessile, *c.* 10 cm long, 0.3–0.4 cm thick; fertile region 2–4 cm long, followed by a few neuters; pistils many, sessile, globose, compactly arranged, sometimes angled owing to the compact arrangement, green; ovules 3–5, white; style short; stigma papillate, stellate, peltate; neuters subulate, a few, 0.5–1.5 cm long, scattered, upcurved, green; appendix decidedly stipitate with a slight thickening at the base after neuters, unevenly angled, reaching the mouth of the tube or just exceeding, slender and gradually tapering, green to light green, apex blunt-truncate, subcapitate-capitate and purplish-dark brown. Male spadix sessile, similar to female, *c.* 4.5 cm long, 0.3–0.4 cm thick; fertile region narrow, *c.* 1.6 cm long; male flowers scattered over or crowded at the base and distant above, sessile or shortly stipitate, 2–4-anded; anthers sessile, purple, dehisce by an apical pore; neuters usually absent or very few, as small protruberance. Fruiting spike not seen.

Flowering: May–June.

Habitat: In evergreen forests, growing in leaf mould, also on horizontal branches, in forks and on the roots of trees.

Distribution: India (southern Western Ghats), endemic.

Specimens examined: INDIA, **Tamil Nadu**, Nilgiris district, Pennant Shola, Parson's Valley, 20.05.1933, *E. Barnes* 677 (MH!). **Kerala**, Palakkad district, Sispara, Silent Valley National park, *c.* 2250 m, 09.03.2016, *Robi Jose* 22335 (KFRI).

Notes: This species is closely allied to *A. leschenaultii* but can be distinguished by long-caudate spathe limb and spadix appendix with a convolute apex.

Conservation status: *Arisaema tuberculatum* is endemic to Tamil Nadu. The species is very rare and collected from the wild only once after its description (Ramachandran & Paulraj, 2008). This species has been spotted recently from Sispara in Silent Valley (Palakkad district of Kerala) with an unusual flowering period. However these two collections are from localities within 100 km diameter from the type locality. Based on the

'Extent of Occurrence' (EOO < 100 km²; Criterion B1) and 'Area of Occupancy' [Criterion B2: AOO < 10 km² with number of location = 1 (sub-criterion 'a'), projected decline in area and extent and/or quality of habitat [sub-criterion 'b (iii)'], *A. tuberculatum* may be considered as 'CRITICALLY ENDANGERED' [CR: B1, B2a, b(iii)] according to IUCN's guidelines (IUCN SPS, 2017).

Arisaema tylophorum C.E.C.Fisch., Bull. Misc. Inform., Kew 1933(7): 346. 1933; in Gamble, Fl. Pres. Madras 3(11): 1891. 1936; Chatterjee, Bull. Bot. Soc. Bengal 8: 137. 1955; Sivad. in Manoharan *et al.*, Silent Valley–Whispers of reason 241. 1999.

Type: INDIA, **Tamil Nadu**, Nilgiris district, Thaishola, 1828 m, 16.06.1932, *E. Barnes* AR6c (K000950304 digital image!).

A. barnesii auct. Gusman & L. Gusman, *Arisaema* ed. 2. 357. 2006, *pro parte, non* Fischer 193.

Fig. 28

Deciduous, dioecious, perennial herbs, *c.* 30 cm tall. Subterranean stem a tuberous corm, globose, 1–2 cm diam.. Roots many, from the upper side of the corms, red. Cataphylls 3, apex rounded, innermost up to 13 cm long, mottled with brown, becoming chaffy. Leaf solitary, radiatisect; petiole 19–26 cm sheathing below the middle, light-green marbled with brown and pink; leaflets 5–7, petiolulate, elliptic-lanceolate to elliptic-oblongate, 5.3–26 cm long, 1.6–9 cm wide, cuneate at base, acuminate or caudate-acuminate at apex, margin erose, dark-green above with a waxy lustre, bright green and very glossy below; petiolules 1–1.8 cm long. Inflorescence held below the leaf; peduncle slender, *c.* 18 cm long, coloured as the petiole. Spathe 5–7 cm long; tube of spathe cylindrical or very narrowly funnel-shaped, 2.5–4.5 cm long, 1–1.2 cm wide at the mouth, white with vertical purple stripes within; limb ovate, slightly galeate, abruptly caudate, 1.5–2.5 cm long, bright-green, overarching, the filamentous tail 0.8–2 cm long, upcurved at the apex and terminated by a distinct small spherical or clavate knob. Female spadix 4.5–6.5 cm long; floriferous region 0.8–2 cm long; pistils ovoid, compactly arranged, sometimes lax with a few anthers between, green; ovules 4–6; style short; stigma minutely papillose; neuters a few, subulate, *c.* 0.5 cm long, rarely forked, green or white; appendix nearly cylindrical or slightly

angled, slender, narrowed and curved near the apex, terminating in a distinct, minutely-warted knob. Male spadix similar to female, 4–5.5 cm long; floriferous region narrow conical, 1.2–1.7 cm long; male flowers laxly arranged, sessile, 2–4-androus; anthers purple, sessile, dehisce through an oblong pore, sometimes with few pistils below; neuters usually absent, sometimes few above the male flowers, subulate. Fruiting spike not seen.

Flowering: May–June.

Habitat: In wet shola forests and in cinchona plantations at an elevation above 1800 m.

Distribution: India (southern Western Ghats), endemic.

Specimens examined: INDIA, Tamil Nadu, Nilgiris district, Thiashola, near Carrington estate, c. 2185 m, 03.06.2019, Manudev & Arunkumar 144888, 144892 (CALI!); Avalanche, way side, c. 2100 m, 04.06.2019, Manudev & Arunkumar 144893, 144894 (CALI!).

Notes: This species is one of the smallest species occurring in southern Western Ghats. Gusman and Gusman (2006) treated it as conspecific to *A. barnesii* C.E.C.Fisch. but it can be easily identified by its slightly galeate spathe limb with abruptly caudate apex terminating to a small knob. This species also similar to *A. attenuatum* C.E.C.Fisch., in its shorter spathe limb with a whitish spot at the base and a slender spadix appendix but can be



Figure 28. *Arisaema tylophorum* C.E.C.Fisch.: a. Habit; b. Corm; c & d. Inflorescences; e. Mouth with knobbed spadix appendix; f. Spathe-front view; g. Spathe-back view; h. Spathe-side view; i. Female spadix; j. Male spadix with pistils at base and neuters above; k. male spadix.

distinguished by the presence of a distinct knob at the tip of the caudate spathe limb and spadix appendix.

Conservation status: *Arisaema tylophorum* is very rare and collected from the wild only once after its description (Sivadasan, 1999). Based on 'Extent of Occurrence' (EOO < 100 km²; Criterion B1) and 'Area of Occupancy' [Criterion B2: AOO < 10 km² with number of location = 1 (sub-criterion 'a'), projected decline in area and extent and/or quality of habitat [sub-criterion 'b (iii)'], *A. tylophorum* may be considered as 'CRITICALLY ENDANGERED' [CR: B1, B2a, b(iii)] according to IUCN's guidelines (IUCN SPS, 2017).

Acknowledgements

Authors are thankful to the Directors/in-charges and Curators of ASSAM, BLAT, BSD, BSI, CAL, CALI, DD, DEV, JCB, MH, RHT, & TBGT for permission to consult the herbarium; forest departments of Arunachal Pradesh, Karnataka, Kerala, Maharashtra, Meghalaya, Sikkim, and Tamil Nadu for permissions; Pascal Bruggeman (Netherlands) for providing the literature input, photographs and discussions on various *Arisaemas* in his personal collection; Dr. K.N. Gandhi (Registrar, Harvard University) for discussions on nomenclature; Guy Gusman (Universite Libre de Bruxelles) and Dr. A.P. Das (Rajiv Gandhi University, Arunachal Pradesh), Dr. Robi Jose, BAM College, Pathanamthitta for photographs. Authors are also thankful to SERB for financial assistance.

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