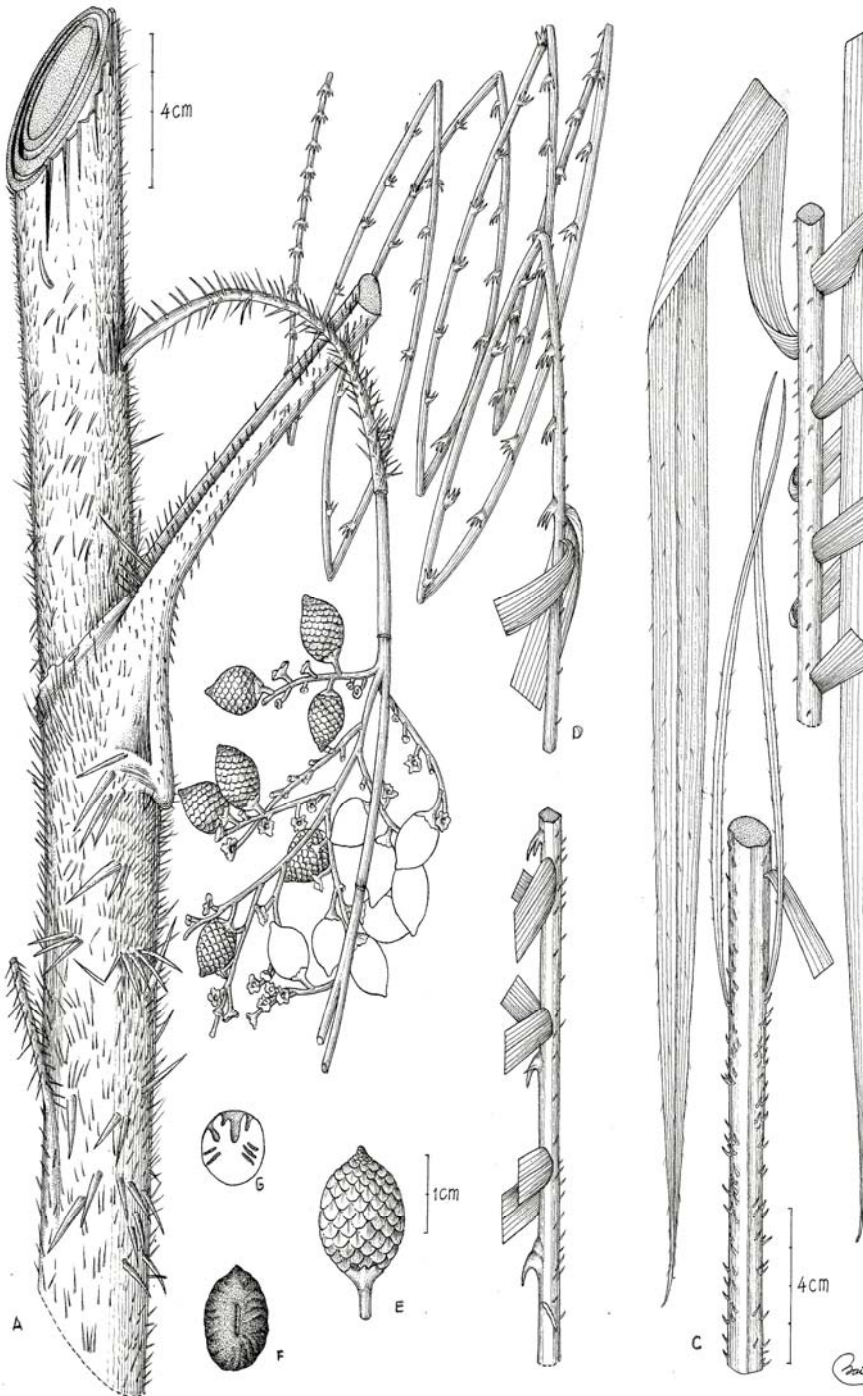




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THE GENUS *AMORPHOPHALLUS* BLUME EX DECAISNE (ARACEAE – THOMSONIEAE) IN JAVA

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YUZAMMI

Centre for Plant Conservation – Bogor Botanic Gardens, LIPI. Jl. Ir. H. Juanda No. 13 Bogor 16122, Indonesia.
E-mail: yuzammi@yahoo.co.id

ABSTRACT

YUZAMMI. 2009. The genus *Amorphophallus* Blume ex Decaisne (*Araceae* – *Thomsonieae*) in Java. *Reinwardtia* 13 (1): 1–12. — An Alpha-taxonomic account of *Amorphophallus* Blume ex Decaisne in Java including key identification to the species is presented. Eight species are recognized in Java, of which five species are endemic. Full description as well as the usages of some species as source of starch are presented.

Key words. *Araceae*, *Amorphophallus*, description, Java.

ABSTRAK

YUZAMMI. 2009. Marga *Amorphophallus* Blume ex Decaisne (*Araceae* – *Thomsonieae*) di Jawa. *Reinwardtia* 13(1): 1–12. — Studi alfa taksonomi *Amorphophallus* Blume ex Decaisne di pulau Jawa dipaparkan berikut kunci identifikasi jenisnya. Ditemukan ada delapan jenis *Amorphophallus*, lima diantaranya endemik. Pertelaan lengkap serta kegunaannya sebagai sumber pati disajikan.

Kata kunci. *Araceae*, *Amorphophallus*, pertelaan, Jawa.

INTRODUCTION

The genus *Amorphophallus* (*Araceae* – *Thomsonieae*) comprises 170 species world wide (Mayo *et al.*, 1997), of which 25 species (14.2 %) occur in Indonesia. About 18 species (68 %) are endemic to Indonesia: eight species in Sumatera, five species in Java, three species in Kalimantan and one species in Sulawesi (Hettterscheid & Ittenbach, 1996).

The genus *Amorphophallus* was fully revised by Engler (1911). Following Engler's, several authors, namely Bogner *et al.* (1985); Hettterscheid (1994), Hettterscheid and Ittenbach (1996), have partly reviewed or discussed the genus and have added some new species and their descriptions.

This genus *Amorphophallus* was established by Blume (1836–1837). Subsequently, Schott erected many new genera based on Blume's work: *e.g.* *Brachyspatha* Schott, *Conophallus* Schott, *Corynophallus* Schott, *Allopythion* Schott, *Hansalia* Schott, *Hydrosme* Schott, *Plesmonium* Schott, *Rhaphiophallus* Schott and *Synantherias* Schott. However, these genera are considered as synonyms of *Amorphophallus*. The first two are listed above, *Brachyspatha* Schott, *Conophallus* Schott, are his predecessors from Java.

Making of *Amorphophallus* herbarium specimens is difficult, due to their gigantic size, and the fact that inflorescences and leaves tend to be present

at different stages. Therefore, existing collections of *Amorphophallus* are inadequate. Sterile specimens are usually impossible to determine, although few species have distinctive vegetative characters: *e.g.* *A. muelleri* with bulbils on the upper surface of the lamina. In this study no attempt has been made to provide a key based only on vegetative characters.

Amorphophallus konjac, with tuber rich of mucilages, mainly glucomannans, is cultivated in Japan and is an important food source (Mayo *et al.*, 1997). In tropical Asia, particularly India, the starchy tubers of *A. paeoniifolius* (elephant yam) are commonly used as food (Bogner, 1987).

AMORPHOPHALLUS Blume ex Decaisne

Amorphophallus Blume ex Decaisne, in Nouv. Ann. Mus. Hist. Nat. 3 (1834) 366; Blume, Rumphia 1 (1837) 138; Hassk., Cat. Hort. Bot. Bogor. (1844) 54; Koord., Fl. Tjibodas 6 (1922) 34; Bold., Zakfl. Java ed. 6 (1932) 36; Engl., in Engl. & Prantl, Nat. Pflanzenfam II, 3 (1889) 126; Alderw., Bull. Jard. Bot. Buitenzorg III, 1 (1920) 363; Steenis, Den Hoed, Bloemb. & Eyma, Fl. Scholen Indonesia (1949) 129; Koord., Exkurs. Fl. Java 1 (1911) 256; Bakh.f., in Backer, Bekn. Fl. Java 17 (1957) 24; Engl., Bot. Jahrb. Syst. 25 (1898) 16; Kunth, Enum. Pl. 3 (1841) 31; Backer & Bakh. f., Fl. Java 3 (1968) 111; Miq., Fl. Ind. Bat. 3 (1856) 201; Schott, Syn Aroid. (1856) 37; Schott, Prod. Syst. Aroid. (1860) 130; Engl.,

in AC. & DC., Monogr. Phan. 2 (1879) 308; Hook.f., Fl. Brit. India 6 (1893) 513; Schott, Gen. aroid. (1858) 31; Engl., in Engl. Pflanzenr. 48 (IV.23C) (1911) 61; Backer, Trop. Natuur. 9 (1920) 21; Hett. & Ittenbach, Blumea 19 (1996) 8; Mayo *et al.*, Gen. Arac. (1997) 235; Mayo *et al.*, in Kubitzki (ed.), Fam. & Gen. Vascular Plants, Monocot. 4 (1998) 64. — TYPE: *Amorphophallus campanulatus* Decaisne [= *A. paeoniifolius* (Dennstedt) Nicolson].

Brachyspatha Schott, Syn. Aroid. (1856) 35; Schott, Prod. Syst. Aroid. (1860) 126. — TYPE: *Brachyspatha variabilis* (Blume) Schott [= *A. variabilis* Blume] (lecto, selected by Nicolson, Taxon 16 (1967) 514–519).

Conophallus Schott, Syn. Aroid. (1856) 34; Miq., Fl. Ind. Bat. 3 (1856) 198; Miq., Bot. Zeitung (Berlin) 14 (1856) 563; Schott, Prod. Syst. Aroid. (1860) 127; Schott, Ann. Mus. Bot. Lugduno-Batavum 1 (1863) 124. — TYPE: *Conophallus bulbifer* (Roxb.) Schott [= *A. bulbifer* (Roxb.) Blume] (lecto, selected by Nicolson, Taxon 16 (1967) 514–519).

Small to giant terrestrial herbs, tuberous, rarely rhizomatous (not in Java) or stoloniferous (not in Java); tuber usually depressed-globose, sometimes irregularly ± elongate-cylindric (not in Java), napiform (not in Java) or carrot-shaped (not in Java); leaves usually solitary, rarely 2–3 in adult plants, sometimes 2–3 in seedlings; petiole usually long, smooth, rarely verrucose to sagittar, usually conspicuously spotted and marked in a variety of patterns; lamina more or less circular in outline, compound, divided into 3 primary leaflets palmately arranged, one anterior and two posterior, all equal or anterior shorter than posteriors, highly divided or dichotomously further divided, sometimes bearing bulbils at junction of rachises; leaflets oblong-elliptic to linear, with acuminate sometimes caudate apex, decurrent at the base, entire or with undulate margin; terminal leaflets larger; primary veins pinnate, forming a distinct submarginal collective vein; higher order venation reticulate; inflorescence solitary, preceded by cataphylls, usually flowering without leaves, rarely with the leaves; peduncle similar to petiole, elongating at fruiting; spathe variously coloured, marcescent and finally falling off, boat-shaped, not or clearly differentiated into lower spathe and limb, sometimes constricted between them; lower spathe convolute, rarely connate, campanulate to cylindrical or ventricose, inner surface smooth or longitudinally ribbed, near base rough to warty or densely covered with scale- or hair-like processes (not in Java) or smooth; limb erect to spreading, smooth, ribbed or variously undulate or frilled at margins; spadix sessile or stipitate, shorter to much longer than spathe; female zone shorter, equalling or longer than male zone; pistils usually closely packed, sometimes distant; ovary sub-globose to ovoid or obovoid, 1–4 locular; ovule 1 per locule,

anatropous, placenta axile to basal; style absent to very long, conoid to cylindric; stigma variable in shape, entire and sub-globose, 2–4 lobed or stellate, sometimes large and brightly coloured; sterile zone absent or present (not in Java), if present consisting of staminodes, sometimes partly or entirely naked; male zone cylindric, ellipsoid, conoid or obconoid, usually contiguous with female; stamens free or sometimes connate in basal flowers or throughout male zone up to 0.4 cm long (in Java), short; filaments absent or distinct; thecae obovoid or oblong, opposite, opening through apical, rarely lateral, pores or transverse slits; pollen monad, inaperturate, subsipolar to apolar, boat-shape, mostly ellipsoid to ellipsoid-oblong, bilateral or radiosymmetric, mean 53 μ m., range 34–82 μ m.; excise striate, striate-reticulate, psilate, scabrate, areolate, fossulate, sagittari-foveolate, verrucate, or spinate (Grayum, 1992); appendix usually present, erect, rarely horizontal or pendent, contiguous with male zone or separated by a constriction or short stipe, very variable in shape, usually sub-conic or sub-cylindric, sometimes sub-globose (not in Java), usually smooth or bearing staminode-like structures near base or entirely covered with staminodes, sometimes grooved or densely to sparsely hirsute (not in Java), sometimes irregularly wrinkled; fruit a berry 1 to few seeded, orange to red, rarely blue (not in Java) or white (not in Java); seed ellipsoidal with smooth, thin testa; embryo large, somewhat green superficially; endosperm absent; chromosome numbers mostly $2n = 26$ (Petersen, 1989).

Distribution. About 170 spp. Ranging from tropical Africa and Madagascar to tropical Asia, the Malay Archipelago, Melanesia and Australasia (Mayo *et al.*, 1997).

Habitat. Most of this genus occurred in tropical humid forest, seasonal forest and open woodland. Rarely found in limestone. Sometimes it grows in waste places or areas of human habitation (Mayo *et al.*, 1977).

Etymology. Based on Greek: *amorphous* means deformed and *phallus* means penis.

Key to the species in Java

1. a. Peduncle shorter than, or more or less equal to spathe.....2
 - b. Peduncle distinctly longer than spathe3
2. a. Spathe cup-like, lower spathe and limb differentiated.....5. *A. paeoniifolius*
 - b. Spathe cylindrical, lower spathe and limb not clearly differentiated6. *A. sagittarius*
3. a. Male zone of spadix with a disc-like expansion in the middle3. *A. discophorus*

- b. Male zone of spadix without a disc-like expansion4
4. a. Style less than 10 mm long to almost absent5
- b. Style more than 10 mm long, always present6
5. a. Appendix strongly rugulose, pale purple, ovaries purple7. *A. spectabilis*
- b. Appendix near smooth and minutely pitted, white, ovaries pink or red4. *A. muelleri*
6. a. Peduncle smooth8. *A. variabilis*
- b. Peduncle rugulose, at least near the base7
7. a. Female zone three times as long as male zone2. *A. decus-silvae*
- b. Female zone almost as long as male zone1. *A. annulifer*

1. AMORPHOPHALLUS ANNULIFER Hett.

Amorphophallus annulifer Hett., Blumea 39 (1994) 243; Hett. & Ittenbach, Blumea 19 (1996) 36. — TYPE: Cultivated in Hort. Bot. Leiden, 3 Jan 1991, ex West Java, Lengkong, ca. 750 m altitude, (orig. coll. van Balgooy s.n.), W. Hetterscheid H.A.M. 119-T (L, holotype).

[*Amorphophallus muelleri* sensu Beumée, Trop. Nat. 8 (1919) 96; Alderw., Bull. Jard. Bot. Buitenzorg III, 1 (1920) 365; Backer, Trop. Natuur. 9 (1920) 25; Bakh.f. in Backer, Bekn. Fl. Java 17 (1957) 27; Backer & Bakh.f., Fl. Java 3 (1968) 113, non Blume (1837)].

Tuber subglobose, up to 10 cm in diam., dark brown, no offset development; leaf solitary; petiole ca. 90 cm long, ca. 2 cm in diam., background a complex marbling of shades of blackish green, mid-green and paler green, grading upwards into dark brown and mid-green shades, the upper half bearing white spots, scattered, oval to elongate-elliptic with brown marbling in the centre, basal part with many small, rigid verrucae; lamina ca. 100 cm in diam., rachises only narrowly winged in the distal parts; leaflets elliptic to elliptic-lanceolate, 8–15 cm long, 4–5 cm wide, apex long acuminate to caudate, mid-green adaxially; inflorescence solitary; peduncle as petiole in colour, 66–156 cm long; spathe ovoid to triangular ovoid, 13–29 cm long, 14–25 cm diam., not constricted; lower spathe deeply convolute, outside pale greenish background and large and small brown spots and numerous, small white spots, inside pale greenish, smooth or furrowed with small muricate warts at base; limb erect, broadly acute, outside as lower spathe with strongly brownish-purple tinge near the margin, inside dark maroon; spadix sessile, longer than spathe, 22–56 cm long; female zone somewhat cylindrical, slightly tapering to the top, 3–8 cm long, 1.7–2.7 cm diam., with an oblique base; pistils closely packed; ovaries depressed, angulated,

0.3–0.5 cm in diam., 0.25–0.35 cm high, bilocular, lower part whitish-green, upper part dark maroon; style ca. 0.2 cm long, ca. 0.5 mm in diam., dark maroon, very obvious; stigma ca. 0.1 cm in diam., ca. 0.1 cm high, shallowly bilobed, lobes conic, reddish brown; sterile zone absent; male zone cylindrical, gradually widening toward the apex, 3–3.5 cm in diam.; male flower 3–4 stamens; stamens ca. 0.3 cm long; filaments ca. 0.15 cm long; anthers ca. 0.15 cm long, ca. 0.2 cm in diam., truncate, pale yellow; connective pale greyish green; thecae opening through elongated apical pores; appendix elongated fusiform-conic, inflated, hollow, thin-walled, granulate, off-white, 16–44 cm long, slightly or more prominently laterally compressed, with or without a strong ring-like expansion near the base, thickest ca. 1/3 from the base; fruit unknown.

Distribution. Western Java, Mount Karang and Lengkong (Sukabumi) area (Hetterscheid & Ittenbach, 1996).

Habitat. Lowland to lower montane, secondary forest; 200–1000 m altitude.

Notes. Since Beumée (1919) first used the name *A. muelleri* (non Blume) for this species it has been consistently misnamed in herbaria. (see *A. muelleri* for explanation).

The taxon epithet *annulifer* was used by Hetterscheid to emphasize the unique ring-like structure found at the base of the appendix. However, the structure may not be present in small specimens.

Other specimens seen. West Java: Goea Gadjah, near Klappa Noenggal, Buitenzorg, 400–500 m altitude, 23 Dec 1912, Backer 5906 (BO); ca. 200 m altitude, 24 Dec 1912, Backer 23406 (BO).

2. AMORPHOPHALLUS DECUS-SILVAE Backer & Alderw.

Amorphophallus decus-silvae Backer & Alderw., Bull. Jard. Bot. Buitenzorg III, 1 (1920) 369; Backer, Trop. Natuur. 9 (1920) 25; Alderw., Bull. Jar. Bot. Buitenzorg III, 4 (1922) 164; Bakh.f., in Backer, Bekn. fl. Java 17 (1957) 26; Backer & Bakh.f., Fl. Java 3 (1968) 112; Hett. & Ittenbach, Blumea 19 (1996) 59. — TYPE: West Java, Nusa Kambangan, Mt. Kletjer, Kornasi s.n. (BO, holo; L, iso - n.v.).

Seasonally dormant herb; tuber ca. 40 cm in diam.; leaf solitary; petiole 200–350 cm long, 13–20 cm in diam., greyish to greyish green with numerous small scattered dark-brown spots that sometimes fuse, and large elongate whitish spots centred by greenish-brown spots, with surface rough at base, otherwise smooth; lamina 3–4 m wide; leaflets

(narrowly) elliptic, 9–32 cm long (dry), 3–10 cm wide (dry), with acuminate to caudate tip 1–4 cm long (dry); primary veins 7–19 on each side, joining with intramarginal vein, slightly raised both adaxially and abaxially, diverging at 40°–55°; submarginal vein present; secondary veins flush with lamina; inflorescence solitary; peduncle as petiole in colour, 105–300 cm long; spathe campanulate, erect, broadly ovate, (50–)70–75 cm long, 45–50 cm in diam., olive–green or greyish purple with large and small pale to dark green spots outside, purple with numerous small ridge–like warts at base inside, grading to pale green at the middle, and becoming purple toward apex; spadix sessile, (50–)105–120 cm long, (sub–)equalling or exceeding the spathe; female zone cylindrical, 3–4 times the length of male zone; ovary subglobose, 0.3–0.4 cm high (dry), 0.3–0.5 cm in diam (dry); style *ca.* 0.4 cm long (dry); stigma inconspicuously bilobed; sterile zone absent; male zone obconical, yellow; stamen *ca.* 0.1 cm long (dry); thecae opening through apical pores; appendix *ca.* 90 cm long, *ca.* 125 cm in diam. at the base, reddish to pale yellow, attenuate, bearing irregular elongated staminodes; fruit unknown.

Distribution. West Java: endemic.

Habitat. Secondary forest.

Notes. *Amorphophallus decus–silvae* is the tallest species found in Java. It is a rare species, restricted to West Java, where it has been recorded from localities such as Mount Karang (Pandeglang) and Lengkung forest (Sukabumi). The species is newly recorded from Mount Halimun National Park, based on a photograph taken by a ranger. It was initially collected by Kornasi from Nusa Kambangan (a small island near Cilacap) and grown in the Bogor Botanic Garden, from where the type was described. Unfortunately, the plant no longer survives, having died in November 1949.

According to Hettterscheid (*pers. comm.*) herbarium and spirit specimens of the cultivated material were lodged as types at Herbarium Bogoriense (holo) and Leiden (iso). Unfortunately, during my last short visit to Herbarium Bogoriense, I failed to find them. Further searches need to be made in the collections of cultivated material or at the Bogor Botanic Gardens Herbarium.

Amorphophallus decus–silvae is closely related to *A. gigas*, an endemic Sumatran species. Both of these taxa have a similar habit, having very long peduncles but are distinct on reproductive characters. *A. decus–silvae* has much smaller stigmas, longer and more slender styles, shorter stamens, anthers with very obtuse angles, rounded rather than elongated pores, connectives flat and ungrooved and pollen fossulate. (Hettterscheid, *pers. comm.*)

Other specimens seen. Java: *Zippelius s.n.* (L, barcode L 0235637–40), *Junghuhn s.n.* (L, barcode L 0235636); West Java, Sukabumi, Dinewatie, 24 Jan 1938, *Wiersma s.n.* (BO, herb. sheet no. 100983–84).

3. AMORPHOPHALLUS DISCOPHORUS Backer & Alderw.

Amorphophallus discophorus Backer & Alderw., Bull. Jard. Bot. Buitenzorg III, 1 (1920) 371; Backer, Trop. Natuur. 9 (1920) 23, fig. 5&6; Bakh.f., in Backer, Bekn. fl. Java 17 (1957) 25; Backer & Bakh.f., Fl. Java 3 (1968) 112. — SYNTYPES: East Java, Mount Wilis, 11–15 Feb 1914, *Backer 11463bis* (BO), *11470* (BO – *n.v.*), *11563* (BO – *n.v.*).

Tuber depressed–globose; leaf solitary; petiole 80–120 cm long, green with dark brown and greyish spots, the basal part rugose; lamina 100–150 cm in diam.; terminal leaflets elliptic or oblong–lanceolate, up to 20 cm long, *ca.* 6 cm wide, with caudate tip, base abruptly narrowing and long decurrent; inflorescence solitary; peduncle 80–150 cm long, as petiole in colour; spathe ovate, not constricted, 15–20 cm long, 7.5–14 cm in diam., with acute to obtuse tip, sometimes shortly apiculate tip; lower spathe convolute, dull dark green with scattered whitish dots outside, dirty greyish–purple with scattered faint paler dots in the upper part, the margin darker, inside pale yellowish–green in lower 1/3, with tiny conical warts at the base, deep purple toward apex, with narrow greyish waxy zone in between; limb erect, glossy dark–maroon on both surfaces; spadix sessile, shorter to slightly longer than spathe, 14–20 cm long; female zone sub–cylindrical, 3–4 cm long, 1.5 cm in diam.; pistils closely packed; ovaries depressed to obovate, *ca.* 0.2 cm long, 0.3–0.4 cm in diam., depressed in the centre, lower half yellowish green, upper half blackish purple with ridged surface, 2 locular with 1 ovule each; placenta basal; style 0.1–0.2 cm long, *ca.* 0.1 cm in diam., dark purple; stigma conoid, *ca.* 0.1 cm high, *ca.* 0.1 cm in diam., bright yellow or brown, shallowly 2–lobed; male zone 2–2.5 cm long, orange, swollen near the middle, disc–like; male flowers with 3–4 stamens; stamens *ca.* 0.25 cm long; filaments *ca.* 0.15 cm long, connate; anthers truncate or slightly rounded, yellow, *ca.* 0.1 cm long, 0.1–0.2 cm in diam.; thecae opening through apical pores; appendix spreading at base, tapering toward apex with obtuse tip, 10–15 cm long, 2–3.5 cm in diam. in middle part, granulate, cream to yellowish green or dirty purple, producing heavy scent of decay during female anthesis; fruit unknown.

Distribution. East Java: endemic at Mount Wilis.

Habitat. Secondary forest, 900–1300 m altitude.

Notes. Of three syntypes cited in the protologue, only specimens of *Backer 11463 bis* (three of six sheets) have been found. Unfortunately, the male zone of the inflorescence, which provides important diagnostic characters, is damaged.

It is interesting to note that possibly Backer collected several specimens from the same locality (11–15 Feb 1914, as in the protologue) but initially gave them only one number, thinking they were all the same taxon. The *bis* may have been added later if this was found to be incorrect, with the other three herbarium sheets filed with another species. These sheets have not been found.

The remaining syntypes (*Backer 11470* & *Backer 11563*), presumed lodged at BO, are still an enigma. They are probably located together with other specimens of cultivated plants from the garden, which are kept separately or at the Bogor Gardens Herbarium. Further searches for and work on the syntypes are required before lectotypification or epitypification can be done.

Amorphophallus discophorus strongly resembles *A. annulifer*, but can be readily distinguished by its swollen disc-like male zone (Hettterscheid, pers. comm.).

4. AMORPHOPHALLUS MUELLERI Blume

Amorphophallus muelleri Blume, Rumphia 1 (1837) 143; Kunth, Enum. pl. 3 (1841) 33; Regel, Gartenflora 24 (1875) 291; Engl., in A. & CA. DCA., Monogr. Phan. 2 (1879) 311; Engl., in Engl., Pflanzenr. 48 (IV.23C) (1911) 86; Koord., Exkurs.–Fl. Java 1 (1911) 257; Hett. & Ittenbach, Blumea 19 (1996) 102. — *Brachyspatha muelleri* (Blume) Schott, Syn. Aroid. (1856) 35; Miq., Fl. Ind. Bat. 3 (1856) 200; Schott, Prod. Syst. Aroid. (1860) 127. — TYPE: West Java, Bantam, *J.C.A. van Hasselt s.n.* (L, inca. drawing in icon coll. – *n.v.*).

Amorphophallus oncophyllus Prain, J. Asiat. Socia. Bengal. Pt. 2, Nat. Hist. 62 (1893) 80; Hook.f., Bot. Mag. 49 (1893) t. 7327; Hook.f., Fl. Brit. India 6 (1893) 516; Engl., in Engl., Pflanzenr. 48 (IV.23C) (1911) 98; Alderw., Bull. Jard. Bot. Buitenzorg III, 1 (1920) 365; Backer, Trop. Natuur. 9 (1920) 29; Koord., Exkurs.–Fl. Java 4 (1923) 188, fig. 383; Toxopeus, in Van Hall & Van Kooper, Landbouw Ind. Archip. 3 (1950) 711. — TYPE: Cocos Island, *D. Prain s.n.* (CAL, K – *n.v.*).

[*Conophallus blumei* Schott, Ann. Mus. Bot. Lugduno-Batavum 1 (1863) 124. — *Amorphophallus blumei* (Schott) Engl., in A. & CA. DCA., Monogr. phan. 2 (1879) 316; Bakh.f., in Backer, Bekn. fl. Java 17 (1957) 28; Backer & Bakh. f., Fl. Java 3 (1968) 113. *nom. superfl. pro A. muelleri* Blume].

Seasonal herb; tuber globose or depressed-globose, dark brown, yellow or orange inside, to 28

cm in diam., no annual offsets; leaf solitary, occasionally two on one tuber; petiole 40–180 cm long, 1–8 cm in diam. at base, smooth, olive to brownish green or almost black, with numerous pale green elongate-elliptic, rhomboid shaped or stripe-like spots, sometimes with many small rounded pale green dots; lamina highly dissected, 75–200 cm in diam., bearing epiphyllar bulbils on centre and distal rachises; leaflets lanceolate or elliptic lanceolate with acuminate tip, and strongly and broadly decurrent base, 10–40 cm long, 4–15 cm in wide, pale green abaxially, green or dark green adaxially with a dirty white or pinkish-red marginal line, which may be very pronounced in seedling; primary veins prominent abaxially, slightly sunken adaxially; bulbils depressed, rounded or elongated, greyish brown, 0.5–6 cm in diam., 1–40 per leaf; inflorescence solitary; peduncle as petiole in colour, 30–60 cm long, 0.5–3 cm in diam. at base; spathe broadly triangular or transversely elliptic, coriaceous, marcescent, 7.5–27 cm long, 6–27 cm in diam.; lower spathe deeply convolute, slightly or clearly constricted at the lower limit of the male zone of the spadix, dark pink or pale yellowish pink inside, grading upwards to purplish or brownish with dirty pale-greenish and dirty pale brown, transversely elongated spots, smooth or with numerous elongated small warts at the base, pale green or pale dirty pinkish outside, usually with transversely elongated, whitish spots and occasional small blackish-green dots, grading upward to brownish purple, or dark greyish-green, with large white spots; limb sub-erect or spreading, with reflexed margin, similar in colour to lower spathe on both surfaces; spadix 8–30 cm long, (sub)sessile or stipitate; stipe, if present, 0.1–1.5 cm long; marcescent in fruiting stage; female zone (dry) cylindrical, 4–8 cm long; ovaries (dry) sub-globose; stigma (dry) disc-like, almost as broad as ovary, 3–4 lobed; style *ca.* 0.1 cm long; male zone (dry) gradually widening toward upper warts, sub-equal or shorter than female zone, 4–6 cm long; anthers (dry) *ca.* 0.1 cm wide; thecae opening through apical pores; appendix (dry) ovate to elongate-ovate, 7–13 cm long; fruit a berry, oblong, slightly sunken at apex, bright red, usually 2 seeded.

Distribution. Andaman Islands through Myanmar, northern Thailand, Sumatera, Java, Flores and Timor (Hettterscheid & Ittenbach, 1996).

Habitat. Thickets, disturbed areas, forest edges and village groves; *ca.* 900 m altitude.

Notes. The epithet *muelleri* was applied by Zippeilius (unpublished as *Arum “mulleri”* based on material from Kuhl & Van Hasselt), in honour of the zoologist Salomon Müller. Blume (1836–1837)

published the binomial *Amorphophallus "mulleri"* without considering the spelling. Subsequently, Schott (1856) created another combination, *Brachyspatha mülleri*. Following article 60.6 of the Vienna Code (MacNeill *et al.*, 2006), which state that diacritical signs have to be modified; the epithet becomes *muelleri*.

In previous literature the name *Amorphophallus muelleri* has often been misapplied to *A. annulifer* (see Hetterscheid, 1994) while *A. muelleri* Blume has frequently been called *A. blumei* (Beumée, 1919; Alderwerelt van Rosenburgh, 1920; Backer, 1920; Bakhuizen van den Brink, 1957; Backer & Bakhuizen van den Brink, 1968). *A. muelleri* and *A. annulifer* are distinguished by the former having a stigma almost as wide as the ovary and a style *ca.* 0.1 cm long, whereas in the latter the stigma is much narrower than the ovary and the style is *ca.* 0.2 cm long.

Amorphophallus muelleri is the only Javan species of *Amorphophallus* bearing bulbils on the lamina, making it easy to recognise in the vegetative state. Furthermore, the lamina of the seedling is an extremely beautiful, deep bronze-green with bright pink or white margins (Hetterscheid & Ittenbach, 1996).

Sastrapradja *et al.* (1984) recorded that tubers of *A. muelleri* (cited as '*A. blumei*') have been collected from the wild in Blitar, East Java, they have been exported to Japan for the extraction of polysaccharides containing mannose.

Other specimens seen. Java, Pogal [= Tegal], 600–700 m. altitude, *Mousset 594* (BO); Feb 1915, *Ridley s.n.* (SING, herb. sheet no. 071765). West Java: Preanger, Tjikirai, near Panjindangan, Halte Tjibadak, Halimoun, *ca.* 600 m. altitude, 8 Jan 1920, *Bakhuizen van den Brink 3217* (BO, L); Trogong [= Tarogong], Garoet, 19 Feb 1915 *Koorders 41237b* (K, L); Tjibodas, *Sapiin 2385* (BO). Central Java, Lebak Barang, Pekalongan, 100–575 m altitude, 12 Jan 1918, *Backer 23279* (BO, K, L, SING); Tegal, Bumiajoe, 17 Mar 1919, *Mohr s.n.* (L, barcode L 0235649). East Java: Mount Idjen, Besoeki, near Kayumas, *ca.* 700 m altitude, 19 Apr 1920, *Backer 30795* (BO); W. Baloeran, *ca.* 450 m. altitude, 23 Mar 1949, *Rappard s.n.* (L, barcode L 0235647).

5. AMORPHOPHALLUS PAEONIIFOLIUS (Dennst.) Nicolson — Fig. 1.

Amorphophallus paeoniifolius (Dennst.) Nicolson, *Taxon* 26 (1977) 338; Hett. & Ittenbach, *Blumea* 19 (1996) 107. — *Dracontium paeoniifolium* Dennstedt. "*paeoniaefolium*", *Schluessel Hort. Malab.* (1818) 13, 21, 38. — TYPE: *Mulen-Schena* Rheede, *Hort. Malab.* 11 (1692) pl. 19.

Amorphophallus campanulatus Blume in *Decaisne,*

Ann. Mus. Natl. Hist. Nat. 3 (1834) 366; Blume, *Rhumpia* 1 (1837) 139; Kunth, *Enum. pl.* 3 (1841) 32; Hassk., *Cat. hort. bot. bogor.* (1844) 54; Miq., *Fl. Ind. Bat.* 3 (1856) 201; Schott, *Syn. Aroid.* (1856) 38; Schott, *Prod. syst. Aroid.* (1860) 130; Engl., in *A. & CA. DCA., Monogr. phan.* 2 (1879) 309; Bisschop, *Pl. Nederlandsh Ind.* (1883) 776; Hook.f., *Fl. Brit. India* 6 (1893) 513; Engl., *Bot. Jahrb. Syst.* 25 (1898) 16; Engl., in Engl., *Pflanzenr.* 48 (IV.23C) (1911) 76; Koord., *Exkurs. Fl. Java* 1 (1911) 257; Backer, *Trop. Natuur.* 9 (1920) 22; Alderw., *Bull. Jar. Bot. Buitenzorg III,* 4 (1922) 163; Koord., *Exkurs. Fl. Java* 4 (1923) 184–186, Fig. 378–380; Ochse, *Veg. Dutch E. Ind.* (1931) 48; Bold., *Zakfl. Java* (1932) 36; Bakh.f., in Backer, *Bekn. Fl. Java* 17 (1957) 24; Backer & Bakh.f., *Fl. Java* 3 (1968) 111. — TYPE: Timor, *CA. Gaudichaud-Beaupré s.n.* (P, holo – *n.v.*).

[*Arum campanulatum* Roxb., (*nom. nud.*) *Hort. Bengal.* (1814) 65; Roxb., *Pl. Coast Coromandel* 3 (1820) 68; Hook., *Bot. Mag.* 55 (1828) t. 2812; Roxb., *Fl. Ind.* 3 (1832) 509 (*nom. illeg.*)].

Amorphophallus rex Prain, *J. Asiat. Soca. Bengal, Pt. 2, Nat. Hist.* 62 (1893) 79; Hook.f., *Fl. Brit. India* 6 (1893) 514; Engl., in Engl., *Pflanzenr.* 48 (IV.23C) (1911) 75. — TYPE: Narcondam Island (Andaman Islands), *D. Prain 111* (K – *n.v.*).

Tuber depressed-globose, to 30 cm in diam., *ca.* 20 cm high, dark brown, root scars prominent, annulate, forming offsets every season; leaf mostly solitary, sometimes two; petiole to 2 m long, *ca.* 20 cm in diam., rough to nearly smooth, pale to dark green or blackish-green background, with large and small pale blotches and numerous tiny dark dots; lamina highly dissected, to 3 m in diam.; leaflets rounded, oval, ovate or obovate to elliptic or elliptic-oblong, 3–35 cm long, 2–12 cm wide, with acuminate tip, mid-green adaxially, mid-green or pale-green abaxially; inflorescence solitary; peduncle 3–20 cm long, 1–8 cm in diam., elongating during anthesis; spathe campanulate, broader than long, 10–40 cm long, 15–60 cm in diam., somewhat constricted; lower spathe variable in colour, yellowish-green to dark-brown background with small and large pale blotches outside, lower half deep-maroon with numerous warts and upper half pale-yellow or whitish or very pale-pinkish inside; limb erect at first, becoming reflexed, spreading, strongly undulate, dark-red or maroon outside, dark-maroon and glossy inside; spadix sessile, shorter or longer than spathe, 7–70 cm long; female zone cylindrical, usually longer than male zone, 5–22 cm long; ovary subglobose; style 0.8–1.6 cm long, dark purple; stigma distinctly 2–3 lobes, yellowish or yellowish-orange; male zone gradually wider toward apex, 5–9 cm long; stamens 0.2–0.4 cm wide; anther *ca.* 0.1 cm long from above; thecae opening through apical

pores; appendix dark-maroon, pyramidal, wrinkled with many folds and grooves, 8–30 cm long; fruit a berry, oblong, 1–1.5 cm long, 0.5–0.8 cm in diam., orange to red, 2(–3) seeded.

Distribution. Madagascar, eastward via India to Malesia, Thailand, Indochina, southern China, Polynesia and northern Australia (Hettterscheid & Ittenbach, 1996). It is found throughout Java.

Habitat. Secondary forest, forest edges, teak-forest, village groves, thickets, highly disturbed areas, in part shade or fully exposed areas; up to 800 m altitude (Backer & Bakhuizen van den Brink, 1968; Hettterscheid & Ittenbach, 1996).



Fig. 1. *Amorphophallus paeoniifolius*

Notes. The name *Amorphophallus campanulatus* was usually applied to this species before Nicolson (1977) who provided an excellent clarification of this taxon which now is called *A. paeoniifolius*. The epithet *campanulatus* was initially used by Roxburgh (1814) but was a *nomen nudum*. His subsequent publication (Roxburgh 1820) was illegitimate because he included Rheede's plate 19, which had been used by Dennstedt (1818) to erect a new name, *Dracontium paeoniifolius*. Later Blume (in Decaisne 1834) created a new combination based on the Roxburgh binomial, *Amorphophallus campanulatus*. Nicolson (1977, p. 338) erroneously cited the basionym of *A. paeoniifolius* as "*Arum paeoniifolium* Dennstedt" in his protologue instead of *Dracontium paeoniifolius* Dennstedt; he had previously cited it correctly several times in the same

paper. This error does not affect the legitimacy of this new combination (Vienna Code (MacNeill *et al.*, 2006), Art. 33.5, ex. 14).

Backer, (in Backer and Bakhuizen van den Brink 1968), described the Javan material of *A. paeoniifolius* ('*campanulatus*') as two forms, '*forma sylvestris*' and '*forma hortensis*', based on petiole surfaces. He noted that the former has very rough petioles, grows wild and the tubers are not edible, whereas the latter has an almost smooth petiole, is cultivated and the tubers are eaten. Widjaja and Lester (1987) report electrophoresis of leaf and tuber proteins, chromatography of phenolic compounds and morphology can be used to distinguish wild and cultivated forms.

Engler (1911) also used characters such as size of inflorescence, relative length of spadix and spathe, and roughness of the petiole to distinguish various species now considered synonymous with *A. paeoniifolius*. Nicolson (1977) considers these character variations relate to maturity of the plant, sunlight exposure, or tuber size.

Amorphophallus paeoniifolius is a common species in Java. It is frequently cultivated for its edible tubers, especially in Central and East Java, where it is mostly served as a snack. In order to remove oxalate crystal, Javanese people treat the tubers by leaving them outside (after slicing) in the sun and rain for several days before cooking.

Other specimens seen. Java, *Spanoghe s.n.* (K); *Zippeilius s.n.* (L, barcode L 0235654); *Blume s.n.* (L, barcode L 0235651–52); *Blume s.n.* (BO, herb. sheet no. 1264270); *Horsfield Aroid 17* (K). West Java: Kebajoran, Batavia, Nov 1904, *Backer s.n.* (L, barcode L 0235653). Central Java: Oengaran, ca. 800 m altitude, 20 Oct 1913, *Leeuwn-Reijnvaan 2105* (BO). East Java: Djatiroto, ca. 20 m altitude, *Backer 7967* (L); Poeger, ca. 10 m altitude, 28 Dec 1914, *Backer 18223* (BO); Kepoeh near Pasoeroean, ca. 40 m altitude, 2 Jan 1915, *Backer 18374* (BO); Gadungan, Pare, *Koorders 41662b* (BO); Kediri, Gadungan, Pare, ca. 400 m altitude, 25 Nov 1916, *Koorders 43171b* (BO, L).

6. AMORPHOPHALLUS SAGITTARIUS Steenis — Fig.2.

Amorphophallus sagittarius Steenis, Acta. Bot. Neerl. 2, 3 (1953) 302; Bakh.f., in Backer, Bekn. Fl. Java 17 (1957) 26; Backer & Bakh.f., Fl. Java 3 (1968) 112; Hett. & Ittenbach, Blumea 19 (1996) 116. $\frac{3}{4}$ TYPE: West Java, Buitenzorg, Tjisadea, ca. 1000 m. altitude, 8 Nov 1941, *L. V. D. Pijl 889a* (BO, Holo).

Tuber subglobose, yellowish brown, 4–5 cm high, ca. 6 cm in diam., weighing up to 120 g; leaf

solitary; petiole smooth, slender, turgid, 30–40 cm long, *ca.* 1 cm in diam. at base, grading from mid-green at the base to dark-green with bright-green spots surrounded by whitish and blackish-green edges; lamina 60–80 cm in diam.; rachises not winged; leaflets elliptic-lanceolate, acuminate, 6–23 cm long, 2.5–9 cm wide, moderately glossy-green adaxially, greyish-green abaxially; primary veins sunken adaxially, slightly prominent abaxially; inflorescence solitary, subtended by *ca.* 5 membranous cataphylls; peduncle 12–21 cm long, 0.5–0.8 cm in diam., as petiole in colour; spathe erect, 13–19 cm long, 9–10 cm in diam.; lower spathe convolute, narrowly oblong, pale brown or light yellow outside with large or small, pale green or white spots that are often partially fused, whitish-green or off-white inside with many small warts at the base; limb erect, somewhat twisted near the top, ovate or ovate-lanceolate, obtuse or acute tip, glossy maroon on both surfaces; spadix shorter or equalling the spathe, sessile, 13–15.5 cm long; female zone cylindrical 1.3–2 cm long, 0.8–1 cm in diam.; pistils closely packed or slightly separated; ovary globose to subglobose, 0.2–0.4 cm in diam., 0.15–0.25 cm long, pale green, sometimes maroon near the style, unilocular, uniovulate, with basal placenta; style to 0.5 mm long, *ca.* 0.1 cm in diam., maroon or green; stigma 0.1–0.15 cm in diam., variable, often obliquely inserted on the style and strongly zygomorphic, flat, disc-form or with a variously folded margin, often 3 lobed; sterile zone absent; male zone subcylindric, slightly obconic, *ca.* 4 cm long, 0.8–1.3 cm in diam.; stamens subtruncate, 0.2 cm long; filaments 0.1 cm long, basally connate; anthers polygonal in cross-section, 0.1 cm long, 0.1–0.2 cm in diam., pale yellow or pale purplish-violet; thecae opening through apical pores; appendix elongate, acute, 7–9.5 cm long, 1–1.8 cm in diam. (near base), off-white to light pale-yellow, surface minutely or distinctly verrucate; fruit unknown.

Distribution. Java: endemic.

Habitat. Secondary forest on slopes.

Notes. *Amorphophallus sagittarius* differs from *A. variabilis* in its short peduncle up to 21 cm (*cf.* up to 120 cm in the latter) and the spadix subequalling the spathe (*cf.* mostly twice the length of the spathe in the latter).

Other specimens seen. West Java, Situ Gunung, Curug Sawyer, Hay & Yuzammi 14005, cult. At the Royal Botanic Gardens, Sydney, Acc. No. 970540.



Fig. 2. *Amorphophallus sagittarius*

7. AMORPHOPHALLUS SPECTABILIS (Miq.) Engl.

Amorphophallus spectabilis (Miq.) Engl., in A. & CA. DCA., Monogr. Phan. 2 (1879) 316; Engl., in Engl., Pflanzenr. 48 (IV.23C) (1911) 109; Koord., Exkurs.-Fl. Java 1 (1911) 258; Alderw., Bull. Jard. Bot. Buitenzorg III, 1 (1920) 364; Backer, Trop. Natuur. 9 (1920) 25; Koord., Fl. Tjibodas 6 (1922) 34; Bakh.f., in Backer, Bekn. Fl. Java 17 (1957) 25; Backer & Bakh.f., Fl. Java 3 (1968) 112. — *Conophallus spectabilis* Miq., Bot. Zeitung (Berlin) 14 (1856) 564; Miq., Fl. Ind. Bat. 3 (1856) 199; Schott, Prod. syst. Aroid. (1860) 128. — LECTOTYPE: Java, collector not specified (L, sheet no. 898.87–213 – *n.v.*) (proposed by Hetterscheid in manuscript, see notes below).

Tuber up to 20 cm in diam.; leaf solitary; petiole almost smooth, dark green with grey and brown spots, 100–150 cm long; lamina 100–150 cm in diam.; anterior and posterior primary rachises naked at the junction, narrowly winged distally; leaflet at terminal branches lanceolate or elongate-elliptic, 13–30 cm long, 3–12 cm wide, with acuminate tip 2.5–4 cm long and narrowly decurrent base; inflorescence solitary; peduncle as petiole in colour, 120–220 cm long; spathe erect, 34–60 cm long, 15–25 cm in diam.; lower spathe oblong, deeply convolute,

olive green outside with pale green spots, paler at the edge of the spots, sometimes also larger whitish areas, becoming purple upwards, dark–purple inside in the lower half with scattered warts at the base, pale whitish–green in the upper half; limb narrowly ovate with acute tip, undulate margin, glossy blackish–purple outside, darker at the edges, glossy dark–maroon inside; spadix sessile, much shorter than spathe, 25–40 cm long; female zone cylindrical, 2.5–8 cm long, 1–2 cm in diam.; pistils not closely packed; ovary sub–globose, 0.1–0.2 cm high, 0.2–0.4 cm in diam., yellowish green, sometimes purple in the upper part, unilocular, uniovulate, with placenta basal; style 0.3–0.5 mm long, 0.1 cm in diam., purple; stigma conic, asymmetric with one large peripheral lobe with a deep, semi–circular groove at the base, 0.1–0.2 cm high, 0.1–0.2 cm in diam.; male zone gradually widening towards apex, 2–9 cm long, 1.5–4 cm in diam. at widest part; stamens 0.2–0.3 cm long, 0.1–0.2 cm in diam.; anthers dumbbell shape (dry), 0.7–2 mm wide (dry), much shorter in lowermost zone, glossy dark–purple; connectives broad, sometimes elevated; thecae opening by apical or sub–lateral pores; filament 0.8–1.3 mm long, basally connate to entirely connate; appendix somewhat expanded at the base (not obvious when dry), narrowly fusiform conic, tapering toward apex with obtuse, acute or subacute tip, pale brownish–purple or yellowish–brown, 10–23 cm long, 2.5–6 cm in diam., densely covered with small elongate warts; fruit a berry, sub–oblong, orange–red, 1–seeded.

Distribution. West Java: endemic.

Habitat. Montane forests; 800–1800 m altitude.

Notes. In the protologue of *Conophallus spectabilis*, Miquel (1856) did not cite any collector's name that could be used to link to typification. The only evidence is that he used Javan material to describe his name. Engler (1879) transferred the name into *Amorphophallus* based on Miquel's work. A problem arises because Bull has used the same name, *A. spectabilis*, for an African species (appeared in one of his horticulture catalogues – *n.v.*) that he described from a poor specimen that was sterile and scientifically inadequate. However, Bull's name is earlier than Engler's (Hettterscheid, *pers. comm.*).

Referring to Vienna Code (MacNeill *et al.*, 2006) Art. 53.1, *A. spectabilis* (Miq.) Engl. becomes illegitimate because it is a homonym. To deal with this problem there are two alternatives: 1) Establishing a *nomen novum* for the Javan species

or 2) Conserve the name *A. spectabilis* (Miq.) Engl. against *A. spectabilis* Bull, because Bull's name has apparently never been used for an African species and also is not listed in Index Kewensis. On the contrary, Engler's name has been applied to the Javan entity up to now. In this case, lectotypification is required. It has been suggested (Hettterscheid, *pers. comm.*) that a specimen of an anonymous collector (L, sheet no. 898.87–213), the specimen from Java, be designated because it agrees with the protologue. It is also annotated with Miquel's handwriting as *A. spectabilis*. Other material of *A. spectabilis* (a Junghuhn specimen) bearing Miquel's handwriting could not be used because it is labelled '*Conophallus giganteus* Schott'.

Other specimens seen. Java, *Korders 40976b* (BO). West Java: Mount Tikoekoer, near Telaga Patengan [=Patenggang], ca. 1700 m altitude, 31 Mar 1914, *Backer 12887* (BO); Mount Patoeha, near Telaga Patengan [=Patenggang], ca. 1650 m altitude, 31 Mar 1914, *Backer 12886* (BO); Pasir Limoes, Boerangrang, ca. 1200 m altitude, 23 Jul 1920, *Bakhuizen van den Brink 4384* (BO); Batavia, 13 Jun 1922, *Bakhuizen van den Brink 5537* (BO); Tjinjirioan [=Cianjur], ca. 1600 m altitude, 24 May 1915, *van Leeuwen 2322* (BO); Mount Patoeha, Telaga Patenggang, ca. 1700 m altitude, *Backer 12742 bis* (BO); Mount Tikoekoer, ca. 1700 m altitude, *Backer 12887 bis* (BO).

8. AMORPHOPHALLUS VARIABILIS Blume — Fig.3.

Amorphophallus variabilis Blume, Rumphia 1 (1837) 146; Kunth, Enum. pl. 3 (1841) 33; de Vriese, Pl. Junghuhn. (1851) 100; Hassk., Cat. hort. bot. bogor. (1844) 54; Engl., in A. & CA. DCA., Monogr. Phan. 2 (1879) 313; Engl., in Engl., Pflanzenr. 48 (IV.23C) (1911) 80; Koord., Exkurs.–Fl. Java 1 (1911) 257; Alderw., Bull. Jard. Bot. Buitenzorg III, 1 (1920) 367; Backer, Trop. Natuur. 9 (1920) 28; Alderw., Bull. Jard. Bot. Buitenzorg III, 4 (1922) 166; Koord., Exkurs.–Fl. Java 4 (1923) 187, Fig. 382; Bold., Zakfl. Java (1932) 36; Steenis, Den hoed, Bloemb. & Eyma, Fl. Scholen Indonesie (1949) 129; Bakh.f., in Backer, Bekn. Fl. Java 17 (1957) 28; Backer & Bakh.f., Fl. Java 3 (1968) 113; Hett. & Ittenbach, Blumea 19 (1996) 124. — *Brachyspatha variabilis* (Blume) Schott, Syn. Aroid. (1856) 35; Schott, Prod. syst. Aroid. (1860) 127; Miq., Fl. Ind. Bat. 3 (1856) 200. — TYPE: Rumphia 1 (1837) plate 35, 37h.

Amorphophallus variabilis Blume var. *immaculatus* Hassk., Flora 25 (2), Beibl. 1 (1842) 8; Hassk., Cat. Hort. Bot. Bogor. (1844) 54. — TYPE: not designated – see below.

Seasonal herb; tuber depressed–globose, ca. 8 cm high, ca. 15 cm in diam., white, with numerous small spindle–like offsets 1–1.5 cm long; leaf soli-

tary or occasionally two; petiole *ca.* 120 cm long, *ca.* 3.5 cm in diam. at base, smooth or slightly rough at base, extremely variable in colour, from entirely green to olive-green or greyish-green or dark brown, with rounded, oval or elongated blotches of dark green, white, greyish green, dark brown and blackish dots; lamina *ca.* 125 cm in diam.; primary main branches naked; leaflets elliptic to elliptic-lanceolate, 4–34 cm long, 2–12 cm wide, with acuminate to long-acuminate tip, mid green adaxially, pale green abaxially; inflorescence solitary; peduncle smooth, colour as petiole, 8–120 cm long, 0.4–3 cm in diam. at base; spathe erect, elongate triangular, acute, slightly constricted at the level of male zone of the spadix, 6–23 cm long, 3–20 cm in diam.; lower spathe convolute, yellowish-green outside suffused with brown at margin, with scattered whitish and dark brown spots, numerous tiny dark brown dots, and pale reddish-brown longitudinal lines, pale yellowish-green to reddish-brown inside with small flattened yellow warts at base; limb erect then slightly reflexed, broadly triangulate with acute tip, as lower spathe outside, ivory to pale green or pale reddish brown inside; spadix sessile, usually much longer than spathe, more or less twice the length of the spathe; female zone *ca.* 1 cm long; pistils sub-globose, green, closely packed; ovary *ca.* 0.3 cm high, *ca.* 0.2 cm in diam., green, 2-locular, each with 1 ovule; placenta basal; style *ca.* 0.5 mm long; stigma 2 lobed, bright yellow; sterile zone absent; male zone cylindrical, *ca.* 2 cm long, usually twice length of female zone, pale apricot; male flower 2–3-merous; anther dumbbell-shape from above; stamen truncate, *ca.* 0.1 cm long, *ca.* 0.1 cm in diam.; thecae opening through apical pores; appendix pale yellow, at least twice length of male plus female zones, granulate, tapering toward apex; fruit a berry, bright orange-red, 1–2 seeded (Backer & Bakhuizen van den Brink, 1968).

Distribution. Java, Madura and Kangean Islands.

Habitat. Teak forest, Rasamala (*Altingia*) forest, in disturbed forest, in village gardens; near sea level to 700 m altitude.

Notes. *Amorphophallus variabilis* is a common species in Java. The petiole and the peduncle are very variable in colour, as also is the size of the inflorescence. Hasskarl (1842), segregated var. *immaculatus* on the basis of petiole and peduncle colour. Since this species exhibits considerable plasticity in the characters used by Hasskarl, it was decided that it was not useful to recognise varieties any longer. He mentioned that he had seen material. Presumably

this was a cultivated or wild growing specimen at the Bogor Botanic Gardens, but no material has been found.



Fig. 3. *Amorphophallus variabilis*

Other specimens seen. Java, *Blume s.n.* (L, barcode L 0235660–1); *Kulh & Van Hasselt s.n.* (L, barcode L 0235657); *Lobb s.n.* (K); *Zollinger 585* (K). West Java: Batavia, Kramat Sentiong, *ca.* 15 m altitude, 27 Sep 1902, *Backer 32844* (BO); Tjidadap, Tjibeber, *ca.* 625 m altitude, 9 Sep 1917, *Backer 2911* (BO); Tjiapus bij Tjiomas, *ca.* 500 m altitude, 6 Jun 1920, *Backer 3686 & 3687* (both BO); Buitenzorg, 11 Feb 1889, *Boerlage s.n.* (L, barcode L 0235659); Buitenzorg, Kota Batoe, Tjidani, 13 Mar 1893, *Hallier 545 c.* (BO); Buitenzorg, *Hallier 545a* (BO, L), *Hallier 545b* (BO), *Leeuwen s.n.* (BO, sheet no. BO–0034769); Buitenzorg, Empang, *Meonchy s.n.* (BO, herb. sheet no. BO–102301); Cult. Bot. Gard. Bogor, Gard. no. XV K C VI 15 (cult. by Dr. Olah), 8 Mar 1956, *Jacobs s.n.* (BO, herb. sheet no. BO–0034426); Cult. RBG Kew (Acc. No. 409–82.08085), ex Java, near Djakarta, Bondok [=Pondok], (orig. coll. Sato & T. Abe s.n.), *Mayo s.n.* (K); Cult. RBG Kew (Acc. No. 408–82.04584), ex West Java, Bogor, Jasinga, (orig. coll. *Widjaja 887*), *Widjaja s.n.* (K); Cult. RBG Kew (Acc. No. 408–82.04585), ex West Java, Sukabumi (orig. coll. *Hambali s.n.*), *Widjaja s.n.* (K). Central Java: N.W. Moeria, Petjangan, *ca.* 300 m. altitude, 11 Oct 1912, *Leeuwen 949* (BO); N. Moeria, *ca.* 600 m altitude, 13 Oct 1912, *Leeuwen 967* (BO); Semarang, Bangkong, 29 July 1915, *Leeuwen s.n.* (BO, herb. sheet no. BO–1264283). East Java: Soerabaya, 20 Sep 1922, *Dorgelo 939* (L);

Soerabaya, G. Lawang – G. Kembangan, 31 Aug 1923, *Dorgelo 2091* (L); Modjokerto, Segoeneng Dampak, ca. 700 m. altitude, 7 Oct 1917, *Winckel 603b* (BO).

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DOUBTFULLY JAVAN TAXA

AMORPHOPHALLUS PUNCTULATUS Blume

Amorphophallus punctulatus Blume, Rumphia 1 (1837) 148; Koord., Exkurs.–Fl. Java 1 (1911) 258; Kunth, Enum. pl. 3 (1841) 34; Engl., A. & CA. DCA., Monogr. phan. 2 (1879) 318. — *Conophallus punctulatus* Schott, Syn Aroid (1856) 35; Miq., Fl. Ind. Bat. 3 (1856) 199; Schott, Prod. syst. Aroid. (1860) 129. — TYPE: *A. Zippelius s.n.* (?L – n.v.).

This species was initially described by Blume (1837) putatively on Javan material, but no specimens have been located in Blume's collections at Leiden. Neither do any of the Javan *Amorphophallus* so far unknown agree with Blume's description (Hettterscheid, pers. comm.).

AMORPHOPHALLUS GIGANTEUS Blume

Amorphophallus giganteus Blume, Rumphia 1 (1837) 144; Hassk., Cat. hort. bot. bogor. (1844) 54; de Vriese, Pl. Junghuhn. (1851) 100; Koord., Exkurs.–Fl. Java 1 (1911) 257; Koord., Exkurs.–Fl. Java 4 (1923) 187, Fig. 381; Kunth, Enum. pl. 3 (1841) 33; Engl., in A. & CA. DCA., Monogr. Phan. 2 (1879) 315; Engl., in Engl., Pflanzenz. 48 (IV.23C) (1911) 83; Backer, Trop. Natuur. 9 (1920) 26. — *Conophallus giganteus* Schott, Syn. Aroid. (1856) 34; Miq., Fl. Ind. Bat. 3 (1856) 198; Schott, Prod. syst. Aroid. (1860) 128.

Blume's illustration of *Amorphophallus giganteus* shows a leaf and a tuber resembling *A. paeoniifolius*, whereas the inflorescence does not agree with any presently known Javan specimens. Comparisons have yet to be made to determine whether it matches any non-Javan species.

Specimen seen: Java: *Meijer 1370* (BO); bij Kampong Bendrong, *Mousset 977* (BO).

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