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NOTES ON THE GENUS AMORPHOPHALLUS (ARACEAE) 1. THREE NEW SPECIES FROM TROPICAL ASIA

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SUMMARY

Of the genus *Amorphophallus*, three new species from tropical Asia are described, viz. *A. asterostigmatus*, *A. hottae*, and *A. palawanensis*.

INTRODUCTION

The genus *Amorphophallus* is currently being monographed by the second author together with other taxonomic specialists of the family Araceae. The confusing character combinations found in *Amorphophallus* species will be evaluated in order to assess phylogenetic relationships in the genus using cladistic methodology. This will also serve to elucidate the direction of proposed transformations of characters, so as to illustrate morphological evolution in the genus. This paper is the first in a series, in which, among other topics, new species of *Amorphophallus* will be described preliminary to the publication of the monograph.

DESCRIPTIONS

Amorphophallus asterostigmatus Bogner & Hetterscheid, *spec. nov.* – Figs. 1–3.

Tuber depresso-globosum. Nervi laterales foliolorum approximati (2–3 mm distantes). Spadix spatha brevior, appendix basi staminodiis rhombicis ferens. Stigma magnum, capitatum, ad instar asteris. — Type: *Bogner 2096* (L, holo, spirit; iso at K, M), Thailand, s. loc. (living tubers bought in the flower-market in Bangkok; flowered in cultivation in the Munich Botanic Garden and in the private collection of H. Koerper, 1989 and 1990).

Tuber depressed-globose, 5–7 cm diam. and 3–4 cm deep, dark brown, with a few short rhizomatous offsets. Petiole 60–70 cm long, 1.8 cm in diam. at base, 0.8 cm in diam. above, smooth, greyish-reddish to greenish with some dark reddish-brown spots. *Leaf blade* c. 50 cm in diam., divided into three main parts; leaflets more or less elliptic, 6–19 cm long, 2–4.7 cm wide, long decurrent on the rhachis, base cuneate, apex acuminate, upper side dark green, lower side lighter green, rhachis and lower side of main veins coloured as petiole, main vein very strong, primary and secondary lateral veins not prominent, quite close to each other and only

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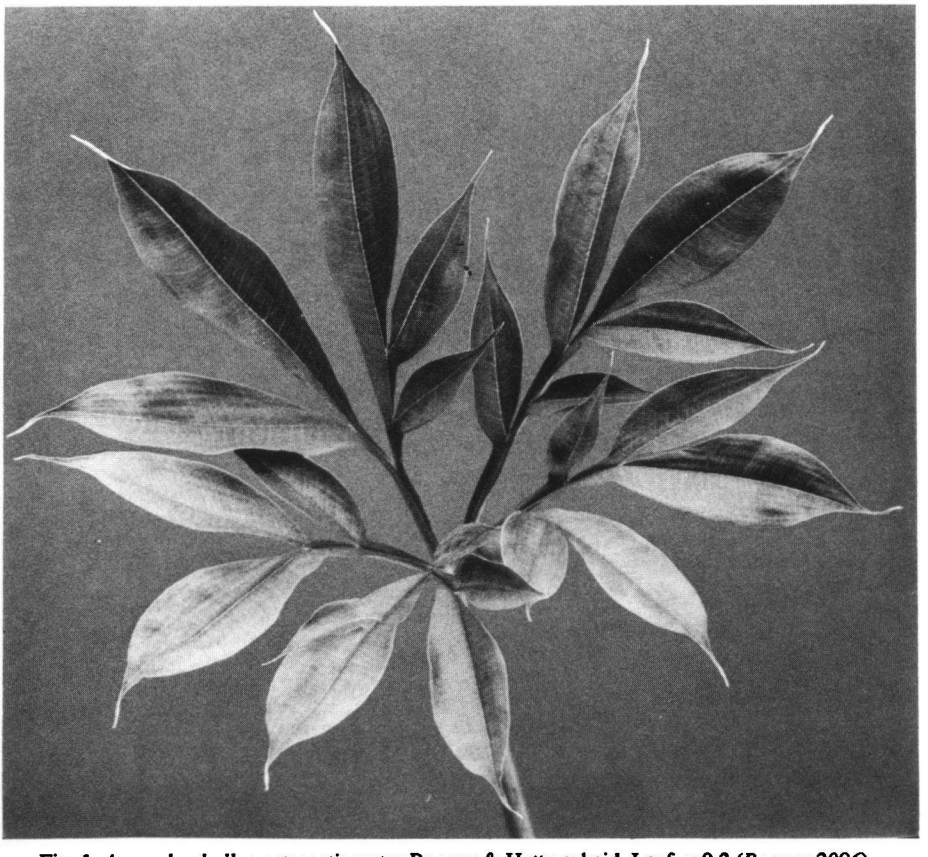

Fig. 1. *Amorphophallus asterostigmatus* Bogner & Hetterscheid. Leaf, × 0.2 (*Bogner 2096*).

2–3 mm distant, inner collecting vein c. 2–3 mm distant from the margin. *Inflorescence* preceded by four membranous cataphylls, 4–25 cm long. Peduncle 35–42 cm long, 1.3 cm in diam. at base, 0.7–0.9 cm in diam. above, greenish to greyish mauve with a few darker spots. *Spathe* erect, as long as or longer than spadix, base convolute, length 15–18 cm, width 7–8 cm., apex more or less cuspidate with a c. 3 mm long tip, outside greenish with a faint reddish tinge, inside cream, greenish towards the base; base inside smooth. *Spadix* subsessile (lowermost 1.5–3 mm devoid of flowers), 11–12.5 cm long; female part 1.0–2.8 cm long, 1.5–1.6 cm in diam.; male part 2.7–3.5 cm long, c. 1.3 cm in diam.; appendix elongate-conic with a rounded apex, 6.0–7.5 cm long, at base c. 1.3 cm in diam., smooth, yellowish to cream-coloured, the basal 1.5 cm with inconspicuous, irregularly elongate-rhombic, flat, sterile structures (staminodes), these 3–5 mm long and 2–3 mm wide. *Female flowers* c. 4 mm long; ovary depressed-globose, 3.5–4.0 mm in diam., height 2.0–2.5 mm, light green, unilocular; style curved towards the spadix apex, c. 1.5 × 1.5 mm, golden yellow; stigma large, 2- to 4-lobed, but mostly 3-lobed, irregularly star-shaped, c. 2.5 mm diam., papillate, yellow. *Male flowers* consisting of 1–3 stamens,

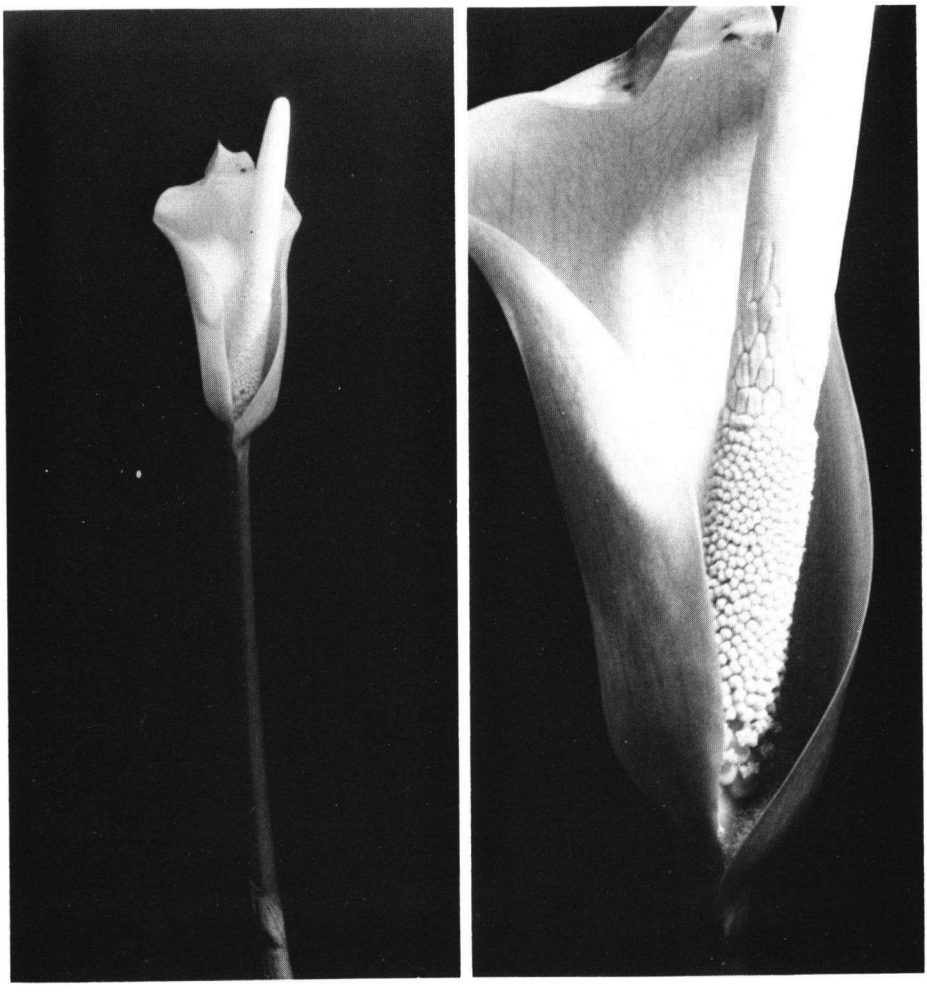

Fig. 2. *Amorphophallus asterostigmatus* Bogner & Hetterscheid. Inflorescence, c. × 0.3 (left); detail of the inflorescence, c. × 1.2 (right) (*Bogner 2096*).

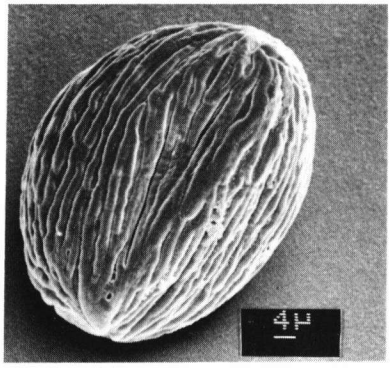

Fig. 3. *Amorphophallus asterostigmatus* Bogner & Hetterscheid. Pollen grain (*Bogner 2096*).

entirely yellowish or with a reddish tinge at the apex; stamens broadly elliptic-oblong, 1.3–1.6 cm long and 1.0–1.2 mm broad. *Thecae* opening with a slit-like apical pore. Pollen grains inaperturate, ellipsoid, 56–60 × 40–43 µm, exine striate.

Chromosome number – 2n = 26.

Distribution – Thailand (without locality), known only from the type collection.

Etymology – The specific epithet refers to the star-shaped stigma.

Notes – The inflorescence of *A. asterostigmatus* is most similar to that of *A. longituberosus* (Engl.) Engl. & Gehrm., but the latter has 2-, 3-, or 4-locular ovaries, lateral pores, and a 2-, 3-, or 4-lobed stigma. Another conspicuous difference between both species is the shape of the tuber: depressed-globose in *A. asterostigmatus* but elongate in *A. longituberosus*.

The erect, often cymbiform, mostly greenish to whitish spathe and the rather undifferentiated, smooth, elongate-fusiform appendix are shared with species like *A. longituberosus*, *A. macrorhizus* Craib, *A. sutepensis* Gagnep., and *A. brevispathus* Gagnep., all from Thailand. *Amorphophallus asterostigmatus* is distinguished by its large star-shaped stigmas and the presence of apparently staminodial, rhombic structures at the appendix-base. The latter character is also found in *A. konjac* Koch, *A. hohenackeri* (Schott) Engl. & Gehrm., and *A. hewittii* v.A.v.R.

Amorphophallus hottae Bogner & Hetterscheid, *spec. nov.* – Figs. 4, 5.

Tuber depresso-globosum. Foliola plerumque brevipetiolata, nunquam in rhachidi decurrentia. Spathae tubus convolutus, longus, limbus angustus, basi intus papillatus. Spadix spatha multo longior, appendice gracillima erecta. Pistillum lageniforme, stigma trilobatum lobis conicis. — Type: *Kokawa & Hotta 2527* (KYO, holo; iso at K), Malaysia, Sabah, Tenom, along Sungai Malatut, about 15 km north of Tenom, alt. 300–450 m, Dec. 22, 1968.

Tuber depressed-globose, 2.0–3.5 cm in diam, c. 2 cm deep (in sicco!), brown. *Leaf* preceded by cataphylls, up to 30 cm long. Petiole 40–45 cm long, at base 0.4–0.5 cm in diam., above 0.25–0.3 cm in diam.; leaf-blade divided into three main parts; leaflets nearly sessile to shortly petiolulate, never decurrent, base cuneate, always oblique, 6–15 cm long and 2.5–6 cm wide, apex acuminate, acumen 1.5–2 cm long, main vein strong, 6–10 primary lateral veins on each side, collective vein 2–4 mm distant from the margin. *Inflorescence* very slender. *Cataphylls* 4, 1–23 cm long. Peduncle 17–36 cm long, at base 0.4 cm in diam., above 0.2–0.3 cm in diam. *Spathe* narrow, 7.5–12 cm long, 0.7–1.0 cm wide, base convolute for 3.5–5 cm of its length, forming a long tube, limb erect, apex acute, base papillate within. *Spadix* slender, 19–21 cm long; female part 0.5–1.0 cm long and c. 0.35 cm in diam., flowers not very densely arranged, styles and stigmas pointing upwards; male part 2.5–3.0 cm long and c. 0.35 cm in diam., flowers congested; appendix slender, elongate, c. 17 cm long, at base 0.2–0.35 cm in diam. *Pistils* lageniform, 2.2–2.5 mm long, ovary 0.8–1.4 mm in diam., unilocular, ovule basal; style 0.8–1.0 mm long, narrowing towards the stigma, stigma 0.6–0.9 mm in diam., 3-lobed, lobes conic. *Male flowers* consisting of 1 or 2 (3) stamens; stamens 1.0–1.1 mm long and 0.5–0.7 mm broad, relatively flat, pores very broadly elliptic. *Pollen grains* inaperturate, ellipsoid, 40 × 34 µm, exine striate-reticulate. *Infructescence* c. 2 cm long, with remains of the dried spathe. *Berries* 1-seeded, ellipsoid, 0.9–1.0 cm long and

Fig. 4. *Amorphophallus hottae* Bogner & Hetterscheid. Holotype (*Kokawa & Hotta 2527*, KYO).

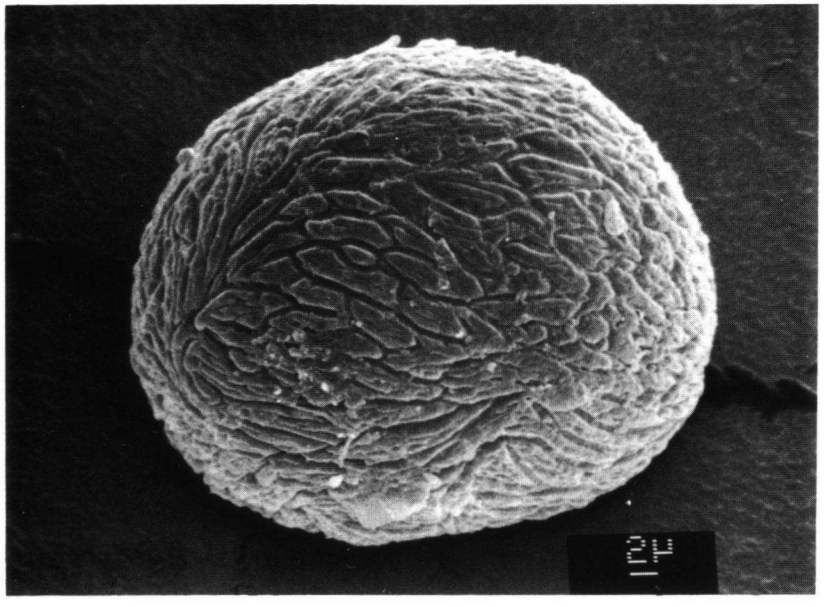

Fig. 5. *Amorphophallus hottae* Bogner & Hetterscheid. Pollen grain (prepared from *Kokawa & Hotta 2527*, KYO).

0.6–0.7 cm in diameter, with the old style and stigma persisting. *Seeds* ellipsoid, c. 0.8 × 0.6 cm, testa smooth.

Distribution – Sabah and Sarawak (Malaysia). Besides the type collection, also *Burtt & Woods 2244* (E), Sarawak, 4th Div., Gunung Mulu National Park, 4° 5' N, 114° 50' E, Melinan Gorge pathway, pockets of limestone, 23 June, 1962, "Red purple spathe and dull, somewhat paler appendix."

Etymology – Named in honour of Dr. Mitsuru Hotta, a distinguished aroid researcher.

Notes – The species is unique for its very narrow spathe combined with a very long, exserted, thin spadix.

In Leiden a specimen exists with the type number which consists of an infructescence and a leaf carrying an intercalary bulbil in its centre. This type of bulbil is different from that in *A. bulbifer* (Sims) Blume, in which the bulbil is clearly epiphyllar. The bulbil in the specimen at Leiden consists of the entire swollen petiole joint where the three main leaf-divisions part. Until living plants have been studied, it remains uncertain whether this specimen actually belongs to *A. hottae*. Similar bulbils are found in *A. sparsiflorus* Ridley (Malaysia), *A. coaetaneus* Liu & Wei (China), *A. hirsutus* Teijsm. & Binnend. (Indonesia), and an as yet unidentified species from Sandakan (Malaysia), which is cultivated by the second author and has already regenerated from this petiole-part after separation by abscission from the rotting remains of the old leaf when the plant goes dormant.

Amorphophallus palawanensis Bogner & Hetterscheid, *spec. nov.* – Figs. 6, 7.

Herba parva, tuber depresso-globosum, folia gracilia, segmentis elliptico-lanceolatis, acutis vel acuminatis. Spatha utrinque purpurea, marginibus sub anthesi reflexis, basi convoluta, intus laevis, leviter constricta. Spadix spatha brevior. Flores feminei pauci, plerumque verticillo solitario dispositi, stigma parvum in stylo non angustiore positum. Flores masculini laxe dispositi, 2 vel 3 (4)-staminati. — Typus: *Bogner 2109* (M, holo), Philippines, Palawan (West), Underground River, Piedras Point, Cliffs Head, 0–40 m alt., growing in humus deposits on limestone; living tubers originally collected by O. Riegler, cultivated plants flowered in Munich Botanic Garden, 1991. Paratype: *Hetterscheid H.AM. 124* (L), same origin as holotype.

Tuber globose or depressed-globose with semi-globose vegetative outgrowths and a deep central depression, 4–6 cm in diam. and c. 5 cm deep, light brown, roots strong, 2–2.5 mm thick. Petiole 30–50 cm long, diam. 0.9–1.8 cm at base, 0.4–0.9 cm above, pale green, smooth. *Leaf-blade* divided into three main parts, 35–100 cm in diam., leaflets ± elliptic-lanceolate, decurrent, often oblique, the proximal ones smaller than the terminal ones, 5–21.5 cm long, 1.0–3.9 cm wide, acute to acuminate (apex c. 2 cm long), upper side green; venation reticulate, main vein strong, 5–10 primary lateral veins on each side, two collecting veins, the outer one very near the margin (c. 0.5 mm), the inner one c. 3 mm distant from the margin. *Inflorescence* with three membranaceous cataphylls, these whithering soon and turning brown, 1.5–7.0 cm long, rounded at the top and apiculate. Peduncle c. 27 cm long, 0.5 (base) to

Fig. 6. *Amorphophallus palawanensis* Bogner & Hetterscheid. Leaf, c. × 0.28 (*Bogner 2109*).

Fig. 7. *Amorphophallus palawanensis* Bogner & Hetterscheid. Detail of inflorescence (left, c. × 1); spadix with the spathe cut open (right, c. × 1.2) (both taken from *Bogner 2109*).

0.4 (above) cm in diam., pale green. *Spathe* c. 8 cm long, purple on both sides, the veins and the inner basal surface slightly darker, lower part convolute for c. 3 cm, upwards slightly constricted, margins somewhat reflexed, inside smooth also at the base, limb apex acute. *Spadix* c. 4.5 cm long; female zone more or less consisting of only one whorl of pistils; male part cylindric, c. 2 cm long and 0.5 cm in diam., cream; appendix conical-acute, constricted near the base and ± stipitate, pale purple, c. 2.3 cm long. *Pistils* bright green, c. 3 mm high, ovary depressed-globose, c. 2.5–3.0 mm in diam., c. 1.5 mm high, unilocular with one ovule, locule c. 0.8 mm in diam.; ovule c. 0.5 mm long, funicle very short; style c. 1 mm long, c. 0.7 mm thick in the middle, narrowing towards the stigma; stigma discoid, flat, not prominent, not broader than style, c. 0.5 mm diam., whitish. *Male flowers* consisting of 2 or 3 (4) stamens, the latter always distinctly grouped and leaving the reddish axis of the spadix partly visible; stamens sessile, 1.0–1.2 mm high, apex rounded, subrectangular in horizontal section, 1.8–2.5 × 0.9–1.1 mm; thecae opening with a nearly rounded pore. *Pollen grains* ellipsoid, inaperturate, 45–55 × 30–38 μm, exine striate, striae 8–18 μm long, variously anastomosing.

Chromosome number – 2n = 26.

Distribution – Philippines (Palawan). Known only from the type collection.

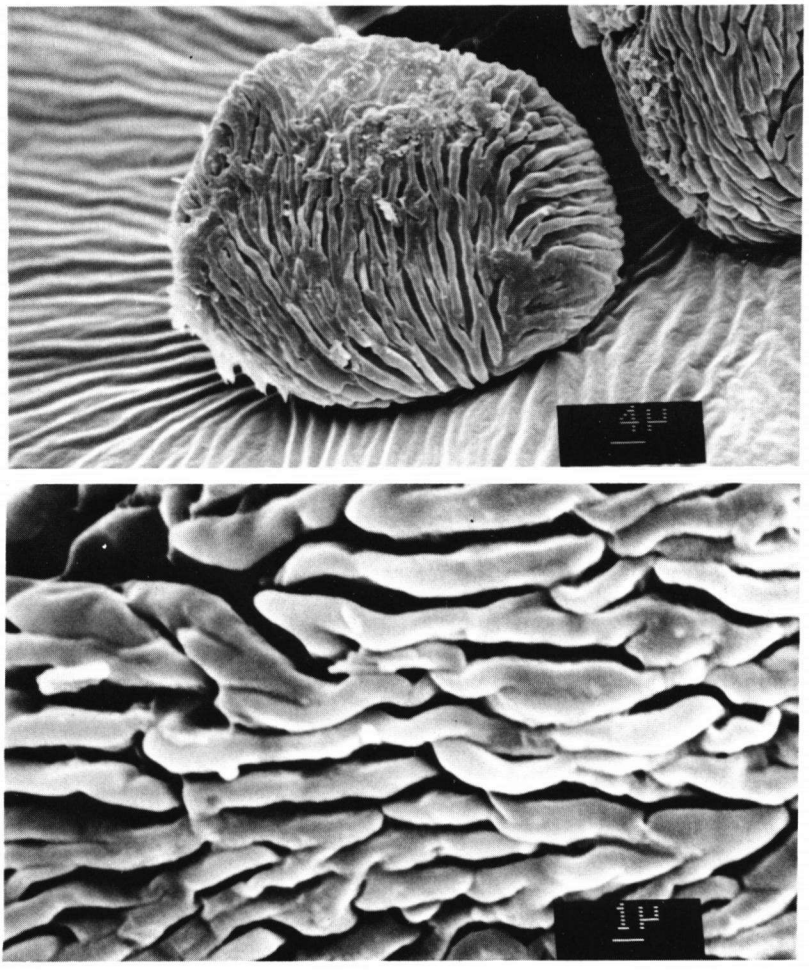

Fig. 8. *Amorphophallus palawanensis* Bogner & Hetterscheid. Pollen grain (above) and detail of exine (below) (both taken from *Bogner 2109*).

Etymology – The specific epithet refers to Palawan Island in the Philippines.

Note – The species is easily recognized by the following character combination: small dimensions, spathe brownish-purple on both sides, very few female flowers, small stigma, and laxly disposed male flowers.

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