

## New Taxa of Araceae

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### Abstract:

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The present paper comprises descriptions of three new species of Araceae (*Spathantheum intermedium* Bogner, *Zomicarpella amazonica* Bogner and *Asterostigma cryptostylum* Bogner) from South America and two new varieties of Araceae (*Ulearum sagittatum* Engl. var. *viridispadix* Bogner and *Nepthytis afzelii* Schott var. *graboensis* Bogner & Knecht) from South America and Africa, respectively. The relationship of all new taxa is discussed.

### Zusammenfassung:

Drei neue Arten von Araceae (*Spathantheum intermedium* Bogner, *Zomicarpella amazonica* Bogner und *Asterostigma cryptostylum* Bogner) aus Südamerika und zwei neue Varietäten von Araceae (*Ulearum sagittatum* Engl. var. *viridispadix* Bogner und *Nepthytis afzelii* Schott var. *graboensis* Bogner & Knecht) aus Südamerika bzw. Afrika werden beschrieben. Die Verwandtschaft aller neuen Taxa wird diskutiert.

There are several new species of Araceae illustrated in line drawings and/or color photographs in the forthcoming book “The Genera of Araceae” by MAYO et al. (1997). In order to have only validly published names in this book, I am describing three new species from South America and two new varieties, one from South America and the other from Africa, herewith.

### *Spathantheum intermedium* Bogner, spec. nov.

Holotypus: Peru, Dep. Cuzco, Prov. Urubamba, Habaspampa, 3000 m, XII.1973, Vargas 22521 (US 2830621).

Fig.: 1.

Illustration: MAYO, S.J. et al.: t. 43 K–P, pl. 10 A.

Differt a *Spathantheum orbignyanum* lamina rubromarginata; spatha purpurea; parte mascula spadiceis libera; synandrio apice appendice stigmatoidea 3–6-(plerumque 4-) partita partis horizontaliter patentibus apicibus incrassatis praedito.

Tuberous herb with a dormant period. Tuber depressed-globular, 7–12 cm in diameter and 4–6 cm thick, light brown, sometimes with a few tubercles for vegetative propagation, these 1.5–2.5 cm in diameter; the roots appearing around the apex of the tuber. Leaf solitary,

appearing after the inflorescence; with 3–6 cataphylls at the base, to 37 cm long, the first one the shortest (ca. 1 cm), the last the longest (but always shorter than the petiole), purplish to reddish. Petiole (16)21–70 cm long, below 0.8–3.0 cm and above 0.3–1.8 cm in diameter, terete, mid-green; sheath very short. Leaf-blade pinnatifid (ovate in outline), (12)25–55 cm long and (9.5)17–45 cm wide, 4–7 lobes on each side of the blade, middle green, margin red-edged (dark colored in herbarium specimens); dissection of blade variable, 3.5–6.0 cm deep dissected from the margins to very deeply dissected down to 1.5–3.0 cm from the midrib, lower lobes always somewhat deeper dissected than the upper ones; lobes ovate to elongate oblong, (3.5)6–30 cm long and 2–8 cm wide, apex acute to cuspidate; mid-lobe at apex of the blade the broadest, especially in slightly pinnatifid leaf-blades (in large leaf-blades the lower most lobes sometimes with a small side lobe(s)); venation reticulate, midrib very strong, 0.3–1.5 cm thick at base and becoming thinner towards apex, with 5–7 strong primary lateral veins on each side going into the lobes, there giving rise to lateral veins of second order ascending upwards to lobe tip, veins of third and fourth order becoming thinner and then anastomosing. Juvenile leaf-blade entire, ovate. Inflorescence usually solitary, rarely two in a floral sympodium (only in large specimens); flowering before the leaf appears. Peduncle 20–38 cm long and 0.3–0.8 cm in diameter, terete, purple, enclosed at base by 4–6 cataphylls, these more or less purplish, especially towards apex, from (1)3–21 cm long (otherwise like those on the petiole). Spathe boat-shaped, 11–17 cm long and 3.0–5.5 cm wide in the middle, dark purple to purplish outside, lighter colored inside and greenish purple to olive green, apex obtuse with a 2–5 mm long point; spathe completely open at anthesis. Spadix shorter than spathe, fertile to apex, obtuse, 7.5–12.0 cm long and 0.8–2.3 cm in diameter; female part of spadix adnate to spathe, 2–4 cm long, male part free, 3.5–8.0 cm long. Flowers unisexual, naked. Male flowers densely arranged on the upper part of spadix; 3–4 stamens connate into an elongate synandrium; synandrium subcylindric, only slightly narrowing towards apex and long stipitate, (4)5–9 mm long and 0.6–1.6 mm in diameter; stipe (3)4–7 mm long, purplish to reddish, with 6–8(10) thecae near the apex; theca ellipsoid, 0.8–1.1 mm long and 0.4–0.5 mm wide or nearly globose, purple, opening by a broad slit; pollen extruding in strings, light yellow; apex of synandrium with a stigmatoid appendage, the stigmatoid divided in 3–6 (mostly 4) parts, these curved outwards and orientated more or less horizontally, yellowish, each part 1.8–2.2 mm long and 0.5–0.6 mm thick, apex swollen and 0.9–1.0 mm thick. Pollen grains inaperturate, ellipsoid, 36–46 × 28–36 µm, exine psilate to verrucose. Sometimes with a few bisexual flowers between the female and male flowers. Female flowers with several (8–10) staminodes surrounding the ovary; staminodes clavate, 2.0–2.5 mm long and ca. 0.5 mm thick, at base ca. 0.25 mm thick (for ca. 0.5 mm), reddish to purplish at base (thinner part) and light yellow to cream-colored above. Pistil bottle-shaped, 6–8 mm long. Ovary more-or-less globular, 3.0–3.5 mm in diameter, light green to greenish, 6–8-locular, each locule usually with 2 ovules, rarely 1 or 3; ovule orthotropous, 1.0–1.1 mm long, elongate ovoid, with short funicle attached at the base of the septum; placentation axile; style conoid (narrowing towards stigma), ca. 3 mm long and 1.0–1.3 mm thick at base, purple. Stigma star-like, flat, concave centrally, 1.5–1.8 mm in diameter, purple (dark yellow after anthesis), with 6–8 lobes, each lobe 0.4–0.5 mm long. Fruit unknown. Chromosome number: 2n = 34.

Specimens seen:

Peru. Dep. Cuzco: Prov. Urubamba, Habaspampa, 3000 m, XII.1973, *Vargas* 22521 (US 2830621; 2830622). – Prov. Cuzco, bei Pancartambo, ca. 3000 m, III.1996, *Aichinger s.n.* (M). – Without exact locality (flowering in cultivation, 29.9.1991), *Munn* 148 (K).

*S. intermedium* grows on stony ground in loamy soil in open, mountainous area.

C. Vargas reported on the herbarium sheet that the leaf and tuber have a bad odor. At

anthesis the inflorescence smells like the flowers of *Berberis vulgaris* L.

The leaf-blade of *S. intermedium* is similar to that of *S. orbignyianum* Schott, but in the former it is always red edged. The pinnatifid leaf-blade is quite variable in both species, from only slightly to deeply pinnatifid; further, *S. orbignyianum* can have a completely entire blade in the adult stage, in which it is flowering or fruiting (Bogner 900, M). The most distinguishing characters of *S. intermedium* are the free male part of the spadix, the peculiar stigmatoid appendage on the apex of the synandrium, further the purple spathe. In *S. orbignyianum* the spadix is completely adnate to the spathe, the apex of the synandrium more inconspicuous and knob-like, and the spathe green. The ovules of both species are clearly orthotropous and distinguish them from the genus *Taccarum* Brongn. ex Schott, which has always anatropous ovules. For further details of how to distinguish the closely related genera of the Spathicarpeae please refer to MAYO et al. (1997).

The specific epithet *intermedium* was chosen for its resemblance of the inflorescence in certain *Taccarum* species, especially of the free male part of the spadix; on the other hand the leaf-blade has the typical shape of the genus *Spathanthemum* Schott. From the first collection by C. Vargas, two herbarium specimens, it was difficult to establish the exact structure of the ovules because the ovaries were very strongly flattened by pressing. For this reason, suggestions of a new species of *Taccarum*, *Gorgonidium* Schott, *Synandrospadix* Engl. and *Spathanthemum* was proposed by various authors. Only living and pickled material revealed the true relationship of this new species.

***Asterostigma cryptostylum* Bogner, spec. nov.**

Holotypus: Brazil, Goiás, in forest remnants near Goiânia, 28.11.1976, *Bogner 1237* (INPA; Iso: K, M).

Illustration: MAYO, S.J. et al.: t. 39 A–G.

Differt a *Asterostigma riedelianum* synandrodio pistillum circumdante ovarium et stylum totum includente (itaque stigma tantum visibile est), superficie synandrodii verrucosa; synandrio plano.

Tuberous herb with a dormant period, leaf usually solitary, flowering with the leaf. Tuber globose to subglobose, 2–3 cm in diameter, brown. Petiole terete, 50–65 cm long and 2.5–5.0 mm in diameter, reddish or reddish brown spotted; sheath very short; enclosed at base by a few cataphylls, these membranaceous, up to 26 cm long, soon drying and becoming light brown. Leaf-blade pinnatisect, only the lower most pinnae usually each divided further in 1–4 pinnae, 4–5 leaflets (pinnae) on each side of the rachis, ending in a terminal leaflet, leaflets becoming smaller towards leaf tip; whole blade 15–25 cm long and up to 30 cm wide, dark green; leaflets (pinnae) very narrow elliptic to elliptic-oblong, 8–15 cm long and 2.3–3.0 cm wide, apex cuspidate to acuminate, base cuneate, upper leaflets sessile and decurrent on one side and lower ones shortly petiolate, petiolule 0.5–2.0 cm long; venation reticulate, middle vein strong, 6–7 primary lateral veins on each side, veins of second and third order thinner. Inflorescences 1 or 2. Peduncle 30–40 cm long and 1.5–2.0 mm in diameter, same color as petiole, enclosed at base by cataphylls (up to 15 cm long). Spathe 7.5–12.0 cm long, not constricted (at least not conspicuously), outside reddish tinged and more or less slightly spotted. Spadix 5.5–7.0 cm long, female part adnate to spathe for a length of 1–2 cm; female and male part contiguous; male part 3–5 cm long and 0.35 cm in diameter, usually fertile nearly to the apex, only uppermost (2.0–7.0 mm length) part ending in a sterile tip. Flowers unisexual, naked. Male flower consists of 2–4 stamens, which are connate into a synandrium; synandrium flat, irregularly elliptic in view from above, ca. 3 × 2 mm; thecae situated at the

margin of the synandrium, theca globular, 0.6–0.7 mm in diameter, opening by a pore. Pollen grains inaperturate, ellipsoid, medium-sized (ca. 36  $\mu\text{m}$  in diameter), exine psilate. **Female flower** surrounded by completely connate staminodes (= synandrodium), upper surface somewhat warty. **Pistil** flat, ca. 3  $\times$  2 mm. **Ovary** and style completely hidden within the synandrodium and only the stigma is visible (on fresh or pickled material); ovary depressed-globular, 3–4-locular, ovules anatropous, 1 per locule, funicle short; placentation axile, ovules attached at base of septum; style very short. **Stigma** star-like, divided in 3–4 (mostly 4) lobes, ca. 1.5 mm in diameter, sometimes each lobe slightly bilobed. **Fruit**: a depressed-globular berry. Seed ovoid, ca. 5  $\times$  4 mm, testa smooth, somewhat transparent, embryo conoid, endosperm copious. **Chromosome number**:  $2n = 34$ .

#### Specimens seen:

**Brazil**. Edo. Goiás, in forest remnants near Goiânia, 28.11.1976, *Bogner 1237* (INPA, K, M). No other material has been seen, but specimens of this species maybe filed under *Asterostigma lividum* (Lodd.) Engl. in Brazilian herbaria and elsewhere.

*A. cryptostylum* grows on the forest floor in deep shade.

*A. cryptostylum* belongs to the section *Rhopalostigma*, hitherto containing two species (*A. riedelianum* (Schott) O.Kuntze and *A. cubense* (A.Rich.) K.Krause ex Bogner) only.

*A. cryptostylum* is characterized by female flowers where the pistil is surrounded by a more or less urceolate synandrodium (= connate staminodes) and usually a simple 2–4 lobed stigma (single lobes usually not bilobed). *A. cryptostylum* differs mainly from *A. riedelianum* by the ovary and style which are completely hidden within the synandrodium with only the stigma visible, hence the chosen specific epithet *cryptostylum*, the warty surface of the synandrodium and the flat synandrium, whereas in *A. riedelianum* the style and upper part of the ovary is well visible, the surface of the synandrodium is smooth and the synandria are rounded apically. *A. cubense* has a slightly lobed synandrodium around the pistil, was only once collected in the last century and only one inflorescence is known, certainly did not come from Cuba as the specific epithet suggests, but is probably native to Brazil (BOGNER 1969); the genus *Asterostigma* F.E.L.Fischer & C.A.Meyer has never been found north of the Amazon River.

#### *Zomicarpella amazonica* Bogner, spec. nov.

**Holotypus**: Brazil, Edo. Amazonas, Rio Javari, near Atalaia do Norte, 10.10.1989, *Bogner 1985* (INPA; Iso: K, M).

Illustration: MAYO, S.J. et al. 1997: t. 59 C–M, pl. 13 D.

Differt a *Zomicarpella maculata* spatha constricta, spadice brevior quam spatha; pistillo depresso lageniformi, ovario 3–6-ovulato; lamina hastato-sagittata.

Plant with anastomosing laticifers and clear latex. Rhizome creeping, 4–7 cm long and ca. 0.5 cm in diameter, dark brown, with buds; with 1–3 leaves and a dormant period; roots 2.0–2.5 mm in diameter. Petiole 10–15 cm long and 3–4 mm in diameter, terete and slightly canaliculate on upper part (towards leaf-blade), dark green and sometimes reddish tinged; sheath short, 1.0–1.5 cm long. **Leaf-blade** hastate-sagittate, 10–15 cm long and 6–9 cm wide, plain dark green or variegated with pale green blotches on upper surface, somewhat glossy, lighter green on lower surface; basal lobes obtuse, apex cuspidate; venation reticulate, midrib strong, 3–4 primary lateral veins on each side and mostly arising at the petiole insertion, the lower pair running into the basal lobes, veins of second order thinner, the primary lateral veins

forming a submarginal collective vein 3–5 mm distant from the margin, a second thinner collective vein close (0.5–1.0 mm) along the margin. 1–2 inflorescences in each floral sympodium, appearing with the leaves. Peduncle 5–14(17) cm long and (1.8)2–3 mm in diameter, whitish and spotted with small elongate red to red-brown blotches; enclosed at base by a few cataphylls, these up to (3)4–5 cm long, whitish and red spotted. Spathe constricted, 4–6 cm long; tube convolute; blade expanded, erect at first and then reflexed, ca. 1.7 cm wide in the middle, apex acute; spathe outside whitish and spotted with small elongate red to red-brown blotches (as peduncle), inside cream-colored to whitish. Spadix shorter than spathe, 3.2–4.5 cm long; female part adnate to spathe, 0.7–1.4 cm long and 3.0–3.5 mm in diameter; male part free, cylindric, 1.0–1.5 cm long and 1.8–2.0 mm in diameter, cream-colored; male and female flowers contiguous; appendix slender, 1.2–1.6 cm long and ca. 1 mm in diameter, smooth, whitish and spotted with very small red to red-brown blotches, apex blunt. Flowers unisexual, naked. Male flower 1-androus; stamens free, subsessile, densely arranged, ca. 0.5 mm long; filament very short, but distinct; connective inconspicuous; thecae opposite, subglobose, ca. 0.3 mm in diameter, opening by apical pore. Pollen extruding in strings, cream-colored; pollen grains inaperturate, globular, 18–20  $\mu\text{m}$  in diameter, exine spinose, spines 2.2–2.5  $\mu\text{m}$  long. Pistil depressed-bottle-shaped. Ovary depressed-globular and somewhat compressed laterally, ca. 1 mm in diameter, whitish to very pale green, unilocular with 3–6 (mostly 4) ovules on basal placenta; ovules anatropous, funicle quite short; style short, tapering towards stigma, 0.20–0.25 mm in diameter below stigma, brownish to red-brown. Stigma small (not broader than style), discoid, 0.20–0.25 mm in diameter, slightly papillose, brownish to red-brown. Infructescence with persistent lower part of spathe, this red-colored then. Fruit: a depressed-globular berry, 5–7 mm in diameter, whitish and somewhat reddish apically, with style and stigma remnant, 1–3-seeded. Seed irregularly ellipsoid, somewhat compressed laterally, 4–5  $\times$  2–3 mm, raphe conspicuous; testa thin, smooth, whitish; hilum somewhat sunken and deep purple around; usually connected with the swollen and enlarged soft funicle; embryo ellipsoid to pear-shaped, small, ca. 0.7 mm long; endosperm copious, white. Chromosome number:  $2n = 26$ . The size ranging from 2–7  $\mu\text{m}$ , one pair of the chromosomes is smaller (ca. 2  $\mu\text{m}$ ) than the others (ca. 4.5–7.0  $\mu\text{m}$ ).

#### Specimens seen:

**Brazil.** Edo. Amazonas, Rio Javari, near Atalaia do Norte, in rainforest on “terra firme”, 10.10.1989, *Bogner 1985* (INPA, K, M). – Edo. Amazonas, Benjamin Constant, sub mata; vernacular name: “Tajazonho”; 24.10.1945, *Murça Pires & Black 986* [= IAN 17973]; only photograph seen.

*Z. amazonica* is the second species of a hitherto monotypical genus. The type species of the genus *Zomicarpella* N.E.Br., *Z. maculata* N.E.Br., was collected more than a hundred years ago probably in Colombia and was cultivated by Linden in Belgium, where it flowered. Linden sent one inflorescence and one leaf to N.E. Brown in Kew, who described it in the year 1881. Unfortunately this species has never been found again and may be very rare. *Z. amazonica*, is well distinguished, but clearly belongs to this genus.

All four genera of the Zomicarpaceae (*Zomicarpa* Schott, *Zomicarpella*, *Ulearum* Engl. and *Filarum* Nicolson) have been studied anatomically recently (J. French, R. Keating, partly unpubl.) and all have anastomosing laticifers. This was unknown in Engler’s time and he placed the Zomicarpaceae therefore in his subfamily Aroideae, whereas all aroids with anastomosing laticifers were grouped in the subfamily Colocasioideae (sensu Engler). On the other hand, some authors have suggested a close relationship of *Calloopsis volkensii* Engl. (a monotypical genus from East Africa and placed in its own tribe Calloposideae) to the Zomicarpaceae, especially to *Ulearum*. However, *C. volkensii* has simple laticifers and differs also in

other characteristics. Another suggestion was that *Calloopsis* Engl. is closely related to the Old World Nephthytideae (distributed in tropical Africa and one species in Sarawak), but this view was not supported by DNA analysis (FRENCH et al. 1995) and cladistics based on morphology and anatomy (MAYO et al., in press). Therefore it seems that *C. volkensis* is somewhat isolated and is best placed in its own tribe.

*Z. amazonica* grows in the rainforest in "terra firme" in loamy soil, covered with leaf litter. It was found scattered on the forest floor in deep shade. The plant were flowering and fruiting during my visit in October 1989, but the male flowers of the spadix were always eaten by insects. It is possible that small beetles were visiting the inflorescences and eating the pollen, maybe these are also the pollinators. *Z. amazonica* has a dormant period, although it grows in the tropical rainforest. Cultivated plants in the Munich Botanical Garden kept in a stove house also have a dormant period followed by a growing period in an approximately yearly rhythm. Plants with plain green and spotted leaf-blades grow together in the natural population.

The underground organs of *Z. maculata* are still unknown, but a rhizome may be expected, because *Z. amazonica* has such a shoot. The other genus of the tribe Zomicarpeae with a rhizome is *Ulearum*, whereas the remaining two genera, *Zomicarpa* and *Filarum*, have tubers. *Z. amazonica* is mainly distinguished from *Z. maculata* by hastate-sagittate leaf-blades, a shorter spadix than the spathe, a constricted spathe, a depressed-bottle-shaped pistil and an ovary with 3–6 ovules, whereas *Z. maculata* has cordate-sagittate leaf-blades, a much longer spadix than the spathe, a non-constricted spathe, an ellipsoid-oblong pistil and a uniovulate ovary. The peduncle is always somewhat shorter than the petiole(s). The male and female flowers are contiguous and no sterile flowers have been observed. The appendix is always slender. Interesting in mature seeds is a swollen and enlarged funicle, which usually breaks off on the placenta and remains on the seed; the funicle has a soft texture. The same swollen funicle connected with the mature seed was excellently illustrated by H.W. Schott in the genus *Zomicarpa* in the last century and I have recently observed the same on mature seeds of *Zomicarpa riedeliana* Schott. It must be assumed that such seeds are distributed by ants.

***Ulearum sagittatum* Engler var. *viridispadix* Bogner, var. nov.**

Holotypus: Brazil, Edo. Acre, Rio Moa, VII.1988, *Bogner 1947* (INPA; Iso: K, M).

Illustration: MAYO, S.J. et al. 1997: pl. 14 A.

Differt a *Ulearum sagittatum* var. *sagittatum* inflorescentiis brevioribus (i.e. foliis aequilongis vel brevioribus); floribus femineis paucioribus (1–6); floribus sterilibus inter flores femineos et flores masculos inferiores omnibus cylindricis; lamina inter nervos tota argenteo-colorata solum margine et prope insertionem petioli viridi.

*U. sagittatum* var. *sagittatum* is a more robust plant, the inflorescences are always longer than the leaves, the inflorescence has more (10–15) female flowers, the sterile flowers between the female zone of the spadix and the lower sterile male flowers are cylindric and depressed-globular, the leaf blades are completely green or maculate, but then the blades have silvery patches between the primary lateral veins and are green along them.

The chromosome numbers of both varieties were counted by PETERSEN (1989) and are  $2n = 14$ , the lowest number within the Araceae.

*Nepthytis afzelii* Schott var. *graboensis* Bogner & Knecht, var. nov.

Holotypus: Ivory Coast, near Grabo, 12.6.1981, *Knecht s.n.* (M).

Illustration: KNECHT, M. 1983: 77 e; MAYO, S.J. et al. 1997: pl. 16 A.

Differt a *Nepthytis afzelii* var. *afzelii* floribus masculis sterilibus albidis inter partem femineam et partem masculam spadicis locatis.

The new variety, *N. afzelii* var. *graboensis*, differs mainly by the whitish, sterile male flowers between the female zone and the fertile male zone of the spadix. The fertile male flowers are more or less greenish (especially when young) and the sterile male flowers are also well distinguished by the whitish color. The spathe is upright at first and becomes reflexed later, 6–7 cm long and ca. 2 cm wide, green (as in all other known species). Further, the petioles and the peduncle are laxely scattered with small spines. Usually the petioles and peduncles are smooth in *N. afzelii* var. *afzelii* (and the other species of this genus), but there are also populations of the typical variety in the Ivory Coast where the petioles and the peduncles are scattered with small spines. The presence of such spines is a further evidence that the genus *Nepthytis* is closely related to the genus *Anchomanes* Schott. The female and male flowers of the spadix are always contiguous in *N. afzelii* var. *afzelii* and this is also the case in all other known species of this genus.

I like to thank very much Dr. H. Roebler, München, for the translation of the diagnoses into Latin, Dr. Gitte Petersen, Copenhagen, for counting the chromosomes, Prof. J. French, Piscataway, New Jersey (U.S.A.) and Prof. R. Keating, St. Louis, Missouri (U.S.A.), for anatomical data.

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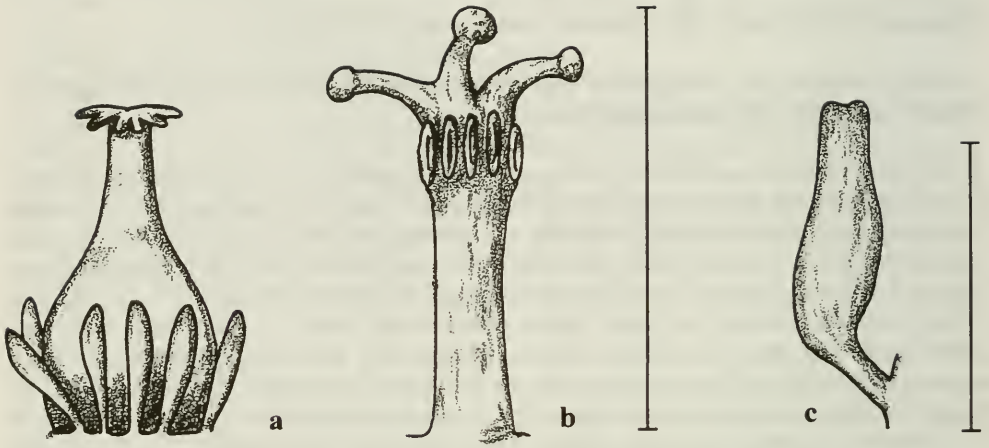


Fig. 1: *Spathantheum intermedium* Bogner

a: pistil with staminodes; b: synandrium; c: ovule. All from *Munn 148*.

Scale bars: a, b: 1 cm; c: 1 mm.



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