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NEW SPECIES OF RAFFLESIA (RAFFLESIACEAE)

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SUMMARY

Five new species of *Rafflesia* (Rafflesiaceae) are described, while attention is drawn to a sixth, possibly also new one. A key to all recognized species is given.

INTRODUCTION

During a long-time study of *Rafflesia* R. Br. and through a number of expeditions in recent years I have been able to obtain extensive first-hand knowledge of the genus, which I hope to present soon in a full-fledged revision. However, an article in the National Geographic Research is shortly to appear in which all known 13 (or 14) species will be discussed, and it seemed therefore necessary to publish the 5 (or 6) new taxa before that time. The identities of *R. ciliata* Koord. and *R. witkampii* Koord. are presently uncertain.

For convenience's sake a key to all presently known species is given below. The species here newly described have been numbered.

KEY TO THE SPECIES

1a. Ramenta short, more or less pustulate, only a few mm long, sometimes clavate . 2
b. Ramenta slender, more than 4 mm long 4
2a. Flowers at least 25 cm in diameter. Anthers 20–40 3
b. Flowers 15–20 cm in diameter. Diaphragma relatively narrow, leaving most of the central disk of the flower exposed to view from above. Anthers c. 15. Luzon
R. manillana Teschenm.
3a. Flowers up to 30 cm in diameter. Anthers c. 20. NE. Kalimantan
R. borneensis Koord.

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b. Flowers (15–)30–60 cm in diameter. Anthers (25–)32–40. Java. S. Sumatra. (Incl. *R. zollingeriana*) ..... *R. patma* Bl.

4 a. Diaphragma opening relatively large compared to the size of the flower, all processi visible from the outside 5

b. Diaphragma opening angular, relatively very small compared to the size of the flower, 3–9 cm in diameter, too small to be able to count the c. 15 processi. Ramenta often branched and apices of branches globular, swollen. Sumatra (Aceh) ..... **4. R. micropylora** Meijer

5 a. Apices of the ramenta either more or less distinctly swollen or crateriform . 6

b. Apices of the ramenta not distinctly swollen 10

6 a. Disk with 10 to more processi and with a raised rim. Anthers 20–40 7

b. Disk with 0(–8) processi and with a flat rim. Anthers 15–20. W. Java *R. rochussenii* Teijsm. & Binnend.

7 a. Flowers 40–52 cm in diameter. White warts on the perigone lobes covering more space than the red-coloured part 8

b. Flowers c. 70 cm in diameter. White warts on the perigone lobes covering less space than the red-coloured part. – Anthers (20?–)24–30. Peninsular Thailand ..... **3. R. kerrii** Meijer

8 a. White warts across the base of the perigone lobes 7–12 9

b. White warts across the base of the perigone lobes very large, 4 or 5 only. – Ramenta slender, apices swollen. Anthers c. 20. Sumatra (W. coast) *R. hasseltii* Suringar

9 a. White warts across the base of the perigone lobes 10–12. Some ramenta with swollen, others with crateriform apices. Anthers c. 30. Sumatra (W. coast) **1. R. gadutensis** Meijer

b. White warts across the base of the perigone lobes 7–9. Ramenta slender, all with swollen apices. Anthers 20–25. Malaya .... *R. cantleyi* Solms-Laubach

10 a. White warts tangentially across the middle of the perigone lobes more than 10 11

b. White warts tangentially across the middle of the perigone lobes 5 or 6(–10) 12

11 a. Larger white blots on perigone lobes not or very sparsely interspaced with numerous smaller ones. Sumatra (Benkulu to N. Sumatra), W. Kalimantan, Sarawak ..... *R. arnoldii* R. Br.

b. Larger white blots on perigone lobes interspaced with numerous small ones. Sabah ..... **2. R. keithii** Meijer

12 a. Flowers up to c. 80 cm diameter. Lower face of the diaphragma with ramenta. Anthers 26–38. Mindanao ..... *R. schadenbergiana* Goeppert

b. Flowers 25–37 cm in diameter. Lower face of the diaphragma without ramenta. Anthers 20. Sabah ..... **5. R. pricei** Meijer

1. Rafflesia gadutensis Meijer, *spec. nov.*

R. arnoldii auct. non R. Br.: Olah, Bull. Torrey Bot. Club 87 (1960) 411, f. 12, 13.
R. spec.: Hotta et al., Forest ecology and flora of G. Gadut (1984).

Flores 40–46 cm in diam. Lobi perigonii verruculis R. arnoldii similibus sed minus quam 12 in serie basali. Ramenta ramosa vel lobata apicibus aut tumidis aut crateriformibus. Flos mas antheris ca. 30. – Typus: *Meijer 17003* (BO, holo; MO, iso), Sumatra, W. Coast, Ulu Gadut, North of Indarong near Padang, 21 Oct. 1981.

Flowers 40–46 cm in diameter. Perigone lobes 9.5–17 cm long and 15–22 cm wide, with 10–12 warts along the base, largest blots 2 by 1 cm, some merged and up to 5 cm broad. Flower tube at insertion of diaphragma 21–22 cm wide. Opening in diaphragma 9–17 cm wide. Lower face of diaphragma with 5 concentric rings of white blots, the two rings closest to the perigone tube with a flat or somewhat crateriform oval fringed apex, about 8 by 9 mm across, on 1–2(–6) mm long stalks, making them look like toadstools. Also between the ramenta on the inner side of the perigone tube occur some scattered protuberances like this, with stalks only 1–2 mm long. Ramenta near the diaphragma branched or lobed, some crateriform at apex, other apices only swollen, up to 2–3 mm in cross-section, stalks about 1 mm across and 6–8(–9) mm long. Neck of column about 5 cm in diameter. Disk with a raised rim. Processi 17–30. Male flowers with about 30 anthers.

Distribution. Sumatra, W. Coast: Ampu (Ophir Dist.: De Kock s.n., Sept. 1918), Rimbo Datar (Meijer s.n., Dec. 1954, coll. lost), Padang Tinggi (Olah s.n., Dec. 1955), Ulu Gadut (Hotta et al. s.n., end 1980), Batu Berjulang (Meijer 15858, 15867, 15876, 16014, 17002, 17003).

Chromosome number. n = 12 (Olah, 1960).

Notes. This species is in many respects intermediate between *R. arnoldii* R. Br. and *R. hasseltii* Suringar by the ornamentation of the perigone lobes, the size of the flowers, the form of the ramenta, and the number of anthers. It is possible that the *Rafflesia* from Padang Panjang reported by Ernst & Schmidt (Ann. Jard. Bot. Btzg II, 12, 1913, 1, t. 8, f. 8–16) belongs here and not to *R. hasseltii.*

2. Rafflesia keithii Meijer, *spec. nov.*

R. spec.: Corner in Luping et al., Kinabalu, summit of Borneo. Sabah Soc. Monogr. (1978) 136, 168, t. 14.

Flores gigantei, ca. 80 cm in diam. Lamina interior loborum perigonii verruculis multis majoribus minoribusque immixtis. Verruculi in pagina superiore diaphragmae distincti annulis atrofuscis cinctis. Ramenta 5–6 mm longa apicibus attenuatis, quadam ramosa. Flos mas antheris ca. 40. – Typus: *L. Madani s.n.* (SAN, holo, in spirit), Sabah, Sungai Melaut, along the Ranau–Tambunan road, date unknown.

Mature buds up to 25 cm in diameter. Flowers about 80 cm in diameter. Perigone lobes with rather dense, numerous white warts, smaller interspersed with larger, the larger about 10–12 across the greatest breadth of the lobes. Diaphragma with 5 con-

centric rings of white warts, each surrounded with a dark-red brown margin. Lower face of diaphragma with 6 rings of white blots, those of the ring closest to the opening for a large part confluent. No toadstool warts as far as visible on my photographs (Keningau, 1981, SAN, MO). The inside of the perigone tube densely covered with ramenta, which are 5–6 mm long near the diaphragma and often fascicled (in bushels), only a few branched, apices not swollen. Disk at least 11 cm in diameter. Processi 38–42, flattened. Annulus interior in a bud of 22 cm in diameter 2 mm wide, annulus exterior flat, 5 mm wide and grooved. Male flowers with about 40 anthers, and with dense bristles on the lower face of the crest of the disk and around the anther cavities. Female flowers show a swollen ring along the lower rim of the crest of the disk, about 3 mm high and broad.

Distribution. Sabah: Crocker Range, Keningau–Kimanis Road (Meijer & Aban s.n., 1981), Tambunan (photo by Keith, K); south of Ranau (SAN 17828 (Nicholson), unfortunately destroyed by the Sandakan fire, 1961), possibly as far south as Tenom (Lamb, oral comm.), Kinabalu, B. Kulong (Meijer), Kampong Nalumad (Meijer), Poring (see Corner, 1978; photos by Ogisu, K).

Vernacular name. Kuku anga (Kadazan).

Notes. A strong argument against the assumption that this species is the same as *R. ciliata* Koord. is that so far during all the intensive botanical exploration of the forests of the Eastern Lowlands of Sabah during the last 30 years no *Rafflesia* of this size and texture has been found. One small-flowered decayed *Rafflesia* seen about 1965 N. of the Labuk River E. of Telupid, an area now logged over, comes to memory.

The site at Poring is now almost trampled to death by a tourist trail. Only one rotten female bud could be found in 1983. Because of lack of boundary demarcation and uncontrolled trampling by tourists its survival is not guaranteed at all in the Kinabalu Park.

3. Rafflesia kerrii Meijer, *spec. nov.*

Flores gigantei, ca. 70 cm in diam. Lobi perigonii ad 20 cm longi 24 cm lati verruculis dispersis minutis circularibus quorum ad circa 15 et transverse per latitudinem maximam et per longitudinem loborum. Diaphragma ca. 30 cm in diam. 6 cm lata superne his verruculis in annulis concentricis 5, inferne maculis albis, in annulis concentricis 7, apertura ca. 20 cm in diam. Tubus perigonii ramentis confertis longe pedicellatis apicibus vix tumidis dense obtectus. Flos mas antheris (20–)24–30 (?), fossis antheriferis per carinas binas secundarias tripartitis. Annulus interior distinctus, 2–3 mm latus, exterior minute convexus, 0.5–1 cm latus. – Typus: *Kerr 16980* (K, holo; BM, iso), Peninsular Thailand, Phuket, Ranong, Khao Pawta Luang Keo (ca. 9° 37′ N, 98°37′E), 12 km North of Kapor, 1600 m alt., 3 Feb. 1929.

Flowers up to 70 cm in diameter. Cupula of mature flowers about 8–9 cm across, scales around the flower 13–16 cm long, with 12–14 veins. Perigone lobes up to about 20 cm long and 24 cm wide, with scattered tiny (compared to *R. cantleyi* Solms-Laubach), circular warts which occupy less space than the tissue between them (on Kerr's photo), about 15 warts across the greatest width of the lobes and as many over the greatest length. Diaphragma about 30 cm in diameter, about 6 cm broad,

with about 5 concentric rings of warts, which are about the same size as those on the perigone lobes. Central opening of diaphragma 20 cm across, on lower face with 7 concentric rings of white blots, which are maximally about 7 mm across. Ramenta in dried specimens only slightly swollen at apex, 10 mm long near the diaphragma and 5 mm near the base of the tube. Central disk at apex 15–16 cm in diameter, rim raised, processi 32–40, each about 2–2.5 cm long, flattened. Neck of column 6.5–7 cm in diameter. Anthers (20–)24–30 (?), as inferred from partial sections, about 4 mm wide and long, cavities ciliate, about 15–17 mm long and 7–8 mm apart, with 3 weak ridges of about 3 mm in upper part of their walls. Base of column widened towards the annulus interior, which is about 8.5 cm in diameter and 2–3 mm wide and 2 mm thick. Base of perigone tube and annulus interior covered by short papillae, about 0.25 mm or less long. Annulus exterior flattened, about 0.5–1 cm broad, with some radial groves, not very clearly separated from the annulus interior by a sulcus, less papillose. Fruits still unknown.

Distribution. Peninsular Thailand: Ranong, Tan Tieng (Kerr 11781), Panta Chongdong (Kerr 16805), Khao Pawta Luang Keo (Kerr 16980), Surat Thani, Khao Sok Nature Reserve (Meijer s.n., 27 May 1983, Smitinand 12139, Somthop s.n., Jan. 1958).

Notes. Although this species was collected already by Kerr in 1927 and 1929 the genus was not included in the revision of the family by Hansen (Fl. Thailand 2, 2, 1972). It seems closely related to *R. cantley* from the Malay Peninsula but is distinct by the larger average size of the flowers, the different pattern of the blots on the perigone lobes, and the less swollen apices of the ramenta.

4. Rafflesia micropylora Meijer, *spec. nov.*

R. cf. atjehense Koord.: De Wilde, WOTRO-Jaarboek (1972) 38, fig.
Rafflesiacea spec. 3: Koord., Bot. Overz. Raffles. (1918) 109.

Flores 30–60 cm in diam., in amplitudine inter R. arnoldii et R. hasseltii. Apertura diaphragmae minuta 3–9 cm in diam. sex- vel heptangulata interdum paulo lobata. Ramenta ramosa apicibus clavatis lobularis. – Typus: *Koorders 44211* (coll. *Badings s.n.*) (BO, holo), Sumatra, Aceh, Lokop, Oct. 1918.

Flowers 30–60 cm in diameter, perigone lobes 16–18 cm long, diaphragma about 20–25 cm in diameter with a small, only about 3–9 cm wide, sexangular or heptangular opening, which is sometimes weakly lobed, surrounded by 3–5 concentric circles of circular red-margined blots, lower side of diaphragma with flat circular knobs, about 10 mm in diameter and on 5 mm high stalks, towards the upper rim of the perigone tube, grading into ramenta which are branched and with swollen apices. These ramenta are about 12 mm long, while those towards the base of the perigone tube are only 5–7 mm long and unbranched. Processi about 15. Male flowers with 40 anthers.

Distribution. North Sumatra: Aceh, Jernih R. (Brewer s.n., 1914, sketch by Baptist, 1916, in BO, Roos s.n., 1917), Lokop (Koorders 44175 (Badings), 44210 (Badings), 44211 (Badings)), Ketambe, Gunung Leuser Nature Reserve (De Wilde &

De Wilde-Duyfjes 13954, 13959, 16519, 16566), Lawu Mawas R. (Meijer s.n., 14 May 1981), Kuala Kompas (Wind, oral comm.).

Notes. This species stands in its average size between *R. arnoldii* and *R. hasseltii*. The small, angular, or even slightly lobed opening in the diaphragma and the distinctly swollen apices of the ramenta make it easy to recognize.

Koorders (1918) because of insufficient material mentioned it only as *Rafflesiacea spec. 3.* He did get more material later, but he unfortunately died before he could publish his manuscript name *R. gibbosa.*

5. Rafflesia pricei Meijer, *spec. nov.*

R. schadenbergiana auct. non Goeppert: Meijer, Kosmos 5 (1982) 60, fig.

R. tuan-mudae auct. non Beccari: Anderson, Bioscience 26, 10 (1976) cover; Weber, Sabah Soc. J. 3 (1967) 111, t. 1, 2; Yong, Magnificent Pl. (1981) 2, fig.

R. spec.: Dorst, Avant que nature meurt (1965) 153, t. 10; Price, Proc. Cotteswold Nat. Field Club 35 (1968) 93; Morley, Wild flowers of the world (1970) t. 117-C; McKinnon, Borneo (1975) 22, fig.; Bellamy, Botanic Man (1978) 60, fig.; Ayensu, Jungles (1980) 49; Beaman & Jumaat, Sabah Soc. J. 7 (1984) 208.

Diaphragmae lamina superior et laminae interiores loborum perigonii ordinatione verruculorum illa R. schadenbergianae similissima, sed floribus tantum 25–37 cm in diam., antherisque ca. 20, et absentia ramentorum in pagina inferiore diaphragmae differt. – Typus: *Price s.n.* (K, holo; depicted in Morley, 1970; Bellamy, 1978), Sabah, Mt Kinabalu, Mamut Copper Mine, 1300 m alt., 4 May 1967.

Mature buds about 25–26 cm in diameter. Flowers 25–37 cm across, tube about 14 cm wide, perigone lobes 7–10 cm long and 6.5–14 cm wide, with 6–8(–10) warts at base and 5 or 6 halfway tangentially, many wider in tangential than in radial direction, some confluent. Opening of diaphragma about 5 cm diameter slightly angular and with a white rim surrounded by a darkbrown margin. Upper face of diaphragma with four concentric rings of warts, those in the third ring from the centre sometimes linear, in the second ring more circular and especially in these two rings surrounded by darkbrown margins. Lower face of diaphragma with 4 or 5 concentric rings of white warts, without ramenta. Disk with 23–28 flattened processi, about 16 in the outer ring. Male flowers with 20 anthers. Ramenta slender, near the diaphragma in fascicled groups, only slightly widened at apex, 4–6 mm long near the insertion of the perigone lobes and 6–7 mm at the base of the tube.

Distribution. Sabah, Mt Kinabalu, Pinosok Plateau above Kundasang (locality destroyed), Mt Alab near Sinsuran, Crocker Range (Jumaat s.n., 1983; Meijer s.n., 3 Aug. 1983). There are not many collections, but the species is already of international fame because some photos of it have become widespread, e.g. the one made by Ding Hou, shown in Van Steenis-Kruseman (Fl. Mal. I, 8, 1974, xlvii).

Notes. The Philippine *R. schadenbergiana* Goeppert comes very close (see also Corner in Luping et al., Kinabalu, summit of Borneo, 1978, 136) in the texture of the blots on the perigone lobes and the diaphragma. This species has larger flowers, ramenta at the underside of the diaphragma, and more anthers (26–38). *Rafflesia*

pricei may be regarded more or less as the Bornean vicariant of the more variable Philippine species. It is remarkable how on Mount Kinabalu and the Crocker Range this species intermingles with *R. keithii* without showing any signs of hybridization. Possibly *R. pricei* prefers higher altitudes than the other species. Various older collections made of *Rafflesia* near Bundu Tuhan and the Colombon River (such as Clemens 32422) can only partly be identified, because the two species have practically identical types of ramenta and in no case were whole flowers preserved or even perigone lobes dried in toto.

6. Rafflesia *? nov. spec.*

Field workers should be aware of the fact that there still might occur one more species of *Rafflesia* in the mountains near Brastagi and in the Leuser National Park. Palm (Acta Horti Gotob. 9, 1934, 148) reported *Rafflesia* from the Sibayak, *R. rochussenii* according to him (very unlikely). Van Steenis (Tijdschr. Kon. Ned. Aardr. Gen. II, 55, 1938, 771, t. 20) in his report on the expedition to the Gajolands published a picture of what he thought to be *R. hasseltii*, found at 1800 m altitude on the G. Lembu. A specimen was collected (Van Steenis, verbal comm.) but could not be traced. This could have been an undescribed species. A few years ago *Rafflesia* was seen by a local entomologist in the Leuser National Park above Brastagi. When he brought me in 1983 to the site it was destroyed by logging. Nearby splendidly virginal montane forest was logged in 1983.

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