XII. ON THE MORPHOLOGY OF THE FEMALE FLOWER OF RAFFLESIA TENGKU-ADLINII AND NOTES ON THE STATUS OF R. BORNEENSIS (RAFFLESIACEAE)

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SUMMARY

The morphology of the female flower of *Rafflesia tengku-adlinii* is described and a comparison with *R. borneensis* is made.

INTRODUCTION

In 1989 Mat-Salleh & Latiff described *Rafflesia tengku-adlinii*, the sixth species of the genus *Rafflesia* known to occur in Borneo (Mat-Salleh & Latiff, 1989). It was based on a collection from the eastern slopes of Trus Madi Range, Sabah. Despite all possible efforts to save this population, the type locality was destroyed by loggers soon after its discovery. Subsequently, the publicity campaign through local media and state government agencies has led to the formation of the State Action Committee for Rafflesia Conservation (Ismail, 1988). More follow-up surveys were conducted in that area as well as in other areas since then and two other populations were found.

At the same time, the Sabah Foundation had also organized the Meliau Basin Expedition, an area which covers Gunung Lotung in South-central Sabah, close to Kalimantan (Indonesia) in the West. Members of the expeditions brought back two *Rafflesia* collections which were made available for our investigation. Although we have positively identified the specimens as the same as *R. tengku-adlinii*, this new finding also has prompted some other naturalists in Sabah to believe that this could be a rediscovery of *R. borneensis* Koord., which was previously known from Kutai in northeastern Kalimantan (Regis & Marsh, 1989).

MORPHOLOGY OF THE FEMALE FLOWER OF RAFFLESIA TENGKU-ADLINII

In describing *Rafflesia tengku-adlinii*, Mat-Salleh and Latiff (1989) had used the male flower. Subsequently, female flowers of the species were collected (*Jum Rafiah s.n.*, May 1988, G. Lotung, Melian Basin, Sabah) and as far as we know this is the only collection of the kind, as the rest of our collections consist of male flowers. It should be stressed here that flowers of both sexes are similar in terms of general appearance as well as the sizes, shapes, and occurrence of ramenta. The only differences observed on them are the lack of anthers on the inner side of the disc and the absence on anther grooves in the central column of the female flower. There is also the tendency in female flowers to produce fine brown hairs on the edge of the disc, which are absent in male ones.

Mature buds up to 8 cm diameter. Flowers on average about 20 cm in diameter (only two records). Perigone lobes up to c. 2.5 by 7 cm, warts as in male flowers. Perigone tube with ramenta, unbranched near the base of the tube, c. 7.5 mm long, those near the diaphragm c. 5 mm long, branched near the swollen tip. Diaphragm c. 2 cm in diameter with a central opening about 5 cm across. Processi 18.

NOTES ON RAFFLESIA BORNEENSIS

It should be remembered that *Rafflesia borneensis* Koord. was described on a single and very fragmentary collection. Due to the scarcity of preserved materials, Koorders (1918) himself admitted that he could not describe certain parts of the specimen and that this had made it very difficult to distinguish it from the other Bornean species. The specimen was collected by H. Witkamp on 28 September, 1907, in the Sekerat Mountains of Northeast Kalimantan, and was deposited in the Herbarium Bogoriense (BO). There are no other collections of *R. borneensis* available in other herbaria. Beside *R. borneensis*, two other Bornean species, *R. ciliata* and *R. witkampii*, were collected in the same locality in April, 1907, and also described by Koorders. Although both species were treated as imperfectly known by Meijer (1984) and also in the Flora Malesiana treatment, Meijer has retained *R. borneensis* as a good species in the latter.

Koorders (1918) gave the following short Latin diagnosis of the species:

> "Flos femin.: Annuli circa basin columnae bini. Annulus exterior interiori subaequatus. Discus columnae apice processibus styliformibus numerosis obsitus, extus annulo distincto circ. 4 mm lato et 1–2 mm alto munitus. Tubus perigonii subapplanato- patelliformis, intus proparte subglaber, pro parte verruculis minutis 1/3 mm, proparte ramentis brevissimis (vix 1/2 mm longis) dissitis obtectus. Antherae rudimentae circ. 20. Flores masc. et fructus ignoti."

"Female flower: Annulus around the base of the column paired. Exterior annulus subequal to the interior one. Columnar disc beset by many styliform processes, outside provided with a distinct annulus, about 4 mm wide and 1–2 mm high. Tube of the perigone somewhat flattened and dish-shaped, inside partly subglabrous, partly covered by small warts, 1/3 mm (long), partly by very short well-spaced ramenta (scarcely 1/2 mm long). Anthers rudimentary, approximately 20. Male flowers and fruits not known."

Furthermore, Koorders added in German (here roughly translated):

"Female flower (presumably very damaged during transport), all parts ink-black. Cupule flat bowl-like, distally c. 7 cm in diameter, basally inserted on an only 0.75 cm thick root. Bracts (scales) thin, numerous, imbricate. Tube of the perigone flat bowl-like, 13 cm in diameter; 3.5 cm wide, 0.75 cm thick. Outside shiny, smooth, with tiny, horizontal, close-set, short lines; inside with dispersed, minute, 0.25–0.5 mm long, apically acute tubercles and dispersed, very short, rarely up to 1 mm long, apically acute (not apically distended) ramenta, which usually stand alone and usually are un-

branched. The inner side of the perigone tube shows moreover closely set, vertical, very fine ribs and grooves. In the upper part the inner side of the perigone tube is nearly without ramenta, and therefore nearly smooth (subglaber). Perigone lobes: all broken. One of the largest fragments is 6 cm long, 4 cm wide, and partly 7 mm thick and partly 2 mm thick, outside coal-black, shiny and with numerous small irregular superficial cracks; ?inside coal-black, dull, and without distinct warts and without grooves. Diaphragm: not clearly present. One fragment, that perhaps has broken off the diaphragm is 7.5 cm 'long' and 3 cm wide and 3–4 mm thick; outside it is shiny coal-black and more or less smooth; inside dull black, without warts. Column 7 cm in diameter at base; from base to apex of the processes 3 cm tall, distally (at the narrowest part) 4 cm in diameter. Columnar disc (very damaged) 8 cm in diameter, circular. The protruding margin is 2 cm wide. The disc is more or less flat above, with numerous conical or plank-like, 0.5–0.75 cm long processes, and on the outer margin above with a weakly outward directed, notched, up to 0.75 cm high crest. Close below the insertion of the crest, on the outer side of the steep slope of the columnar disc there is a distinct, somewhat thickened annular thickening. The outer wall of the columnar disc as well as the annular thickening just mentioned are completely glabrous and smooth outside. On the lower surface of the disc there is a very short-hairy, not very clear stigmatic annular zone. At the basis of the column there are two well-developed rings, of which the inner one is directed upwards, outside with a steep and inside with a weak slope, while the outer ring is so sharply distinct only towards the inside, and more gradually developed towards the outside. Both these rings have no radial grooves and both are granularly scabrous. The stigmatic annular surface of the female flower is indistinct, outwards surrounded by a 4 mm wide and 1 mm high glabrous annular thickening; on its inner margin in small depressions showing the c. 20 small (nearly 1 mm wide) globose anther rudiments. The lateral sides of the column are covered by numerous (c. 20), wide, parallel, only descending to 0.33 of the height, sparsely granular scabrous, glabrous indistinct thickenings, each of which corresponds tot the shallow anther grooves. Male flower, fruit and seed unknown.

The description above is based on a single female flower only, which has been collected by the mining engineer Witkamp in Northeast Borneo, Kutai, and conserved in spirit. This flower is present in a very damaged condition in the Herbarium Bogoriense. On the outer label of the only bottle that contains the remnants of this flower the following is written: 'Rafflesia spec. – N.O. Borneo, Koetei. – Leg. Witkamp.' On the old label inside, which has become partly illegible because of the black-violet discolouration similar to ink (NOT reddish brown as with so many other species of *Rafflesia*), was among others written: 'Rafflesia spec. affinis R. Patma Bl. – N.O. Borneo, Koetei. – Leg. Witkamp 28 Sept. 1907 ... ' 'Det. Val(eton) 1908.'

Probably because of the transport during its travel the perigone lobes have broken into small pieces and are presently represented only by ink-black fragments the size of a few centimetres, while among this debris remnants of the diaphragm could not be recognized by me with adequate certainty.

Notwithstanding these damages of the perianth, it was fortunate that the column with the disc turned out to be relatively little damaged. Because of this it was possible to me to concluded with certainty that this flower originated from a new species that

only superficially resembles *Raff. Patma* Blume, but sharply differing from this and also from all other *Rafflesia* species thus far known. The fact is, that this new species, named *Rafflesia borneënsis* by me, is distinct among others from *R. Patma* by the possession of a distinct, thick ring around the outer wall of the columnar disc, while in *R. Patma* such a ring is totally absent. Furthermore, the perigone tube of this new species from Borneo is much more flatly extended than in the Javanese *R. Patma*. Moreover, *R. borneënsis* has only about 20 anther rudiments, while this number is 30–38 in *R. Patma*."

As Koorders' description was based on the female flower and that of *R. tengku-adlinii* is now available for comparison the identity of the former may at last be confidently ascertained. The diaphragm, the most important part of the flower, was not available and could not be compared with our material. As it could be inferred, the underside of the diaphragm of all known Bornean species has got very distinct white spots (called 'windows' by Beaman et al., 1988) which serve to attract the pollinators, except for *R. tengku-adlinii* which has no spots, and the ramenta are present right up to the central opening or aperture. The ramenta described by Koorders are also shorter than those in *R. tengku-adlinii,* and never apiculate, nor is the upper section of the perigone tubes subglabrous. It is not quite clear what Koorders meant by "without distinct warts and without grooves" on the perigone lobes, but all of them are clearly and fully covered by gold-coloured 'warts' in *R. tengku-adlinii*. Based on those differences, we have no doubt that *R. tengku-adlinii* is not conspecific with *R. borneensis* and we maintain that the collections made in Gunung Lotung are *R. tengku-adlinii*.

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