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A new calcicolous variety of *Cryptocoryne nurii* Furtado (Araceae) from Pahang, Peninsular Malaysia.

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Abstract: A new aroid variety, *Cryptocoryne nurii* var. *raubensis* is described and illustrated in colour. The new variety differs from var. *nurii* in the always short spathe tube, a relative long kettle, and a peduncle which adjusts its length to the water level so that the spathe acts as a floating buoy in order to ensure that the opening is always above the water surface with an open entrance and exit for the pollinating insects. The distribution and calcicolous ecology are briefly discussed.

Keywords: aroids, *Cryptocoryne nurii* var. *raubensis*, ecology, taxonomy

INTRODUCTION

During the last 10 years a somewhat odd looking *Cryptocoryne* from the vicinity north of Raub, Pahang, Peninsular Malaysia, has attracted attention. The first collection from 1970 passed on unnoticed. The second from 1985 was puzzling with a yellow spathe limb and its identity was not clarified, but was a continuous reminder of an unsolved problem. It was only after collections (with red-black spathe limbs) from 2002 and 2007 came into cultivation that the pattern became more evident, and after the recent collections from 2011, the interpretation became clear, that we were dealing with a special long peduncled aquatic limestone plant which is here referred to as a variety of *Cryptocoryne nurii* Furtado (Furtado, 1935).

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Cryptocoryne nurii Furtado var. ***raubensis*** Ganapathy & Siow **var. nov.**

Diagnosis: Leaves from dark olive green, darker and lighter mottled, to all green; blade ovate to narrowly ovate, veins prominent, sometimes lighter to reddish, 4–7 (10) cm long, 2–4 cm broad with a more or less cordate base. Spathe 3-6 cm long, peduncle 2-15 (to more than 30) cm long, kettle 2-3 cm long; tube less than 1 cm long; limb 1.5–2 cm long, cordate, with a tail-like appendage, deep red to dark purple to yellow, irregularly transversely wrinkled with conspicuous, large, irregular protuberances along the margin; a rather narrow funnel-shaped, vertical opening into the tube, collar distinct.

Type: Rumah Pam Galak l, Tersang, Raub, Pahang, Malaysia. Stream crossing a road in a cut down oil palm plantation (new oil palms planted), stream 4-6 m wide. Big patches on sand banks where the water runs quickly. March 26th, 2011. Collector & No: Rosazlina Bt Rusly et al., RR 11/32 [= NJM 11-63], holotype: KEP, isotypes C, L, Herbarium Universiti Sains Malaysia, Penang.

Leaves more or less dark olive green, distinctly darker and lighter mottled to more green mottled to all green, the lower surface red to pale green; blade more or less smooth to grooved at the veins, more or less ovate to narrowly ovate with 2–3 pairs of prominent veins, sometimes lighter to reddish, 4–7 (10) cm long, 2–4 cm broad with a more or less cordate base, margin sometimes crenulate; petiole 5–15 cm long, longest in deeply buried specimens.

Spathe 3-6 cm long, peduncle 2-15 (to more than 30) cm long, towards the upper part more brownish-purplish tinged on the outside; the unopened spathe with characteristically half-round, recurved limb abrupt narrowing into a tail-like appendage; kettle 2-3 cm long, tube less than 1 cm long; limb leathery like, 1.5–2 cm long, cordate, with a tail-like appendage, dark purple-black to deep red to brown to yellow (Taman Negara), irregularly transversely wrinkled with conspicuous, large, irregular protuberances along the margin; a rather narrow funnel-shaped, vertical opening into the tube, collar distinct.

Spadix with 5-7 light greenish female flowers, with ovate stigmas; olfactory bodies irregularly rounded, light yellow to greenish; male flowers 25–40, smooth.

Infructescence ovoid, with a rough surface; seeds brownish, smooth, 3–4 mm long; endosperm present, embryo cone-shaped, with an undifferentiated plumule. Chromosome number 2n = 34.

Distribution: Peninsular Malaysia, Pahang, north of Raub and Jerantut, in tributaries to the Sg. Pahang. It may be assumed that it occurs in other places in the limestone region too.

Habitat/ecology: On clayey to sandy or gravel bottom in streams and rivers, in slowly to more quickly running water. Luxuriant stands may be found in places with very rapidly running water, where they seem to build up sand-gravel banks. In larger streams and rivers the plants seem to be submersed most of the time, producing long peduncled spathes, while plants from places with low water may become emerged, with shorter peduncles. In all cases observed, the spathe itself has a total length of 3-6 cm with the characteristic long kettle, while it is the length of the peduncle that varies in length.

Under natural conditions var. *raubensis* would probably grow in more or less shaded places, but in places where the forest has been cut they can also thrive in full sunlight, provided they are submerged. If dried out, the deeply buried rhizomes will provide a basis for a renewed growth when the water rises again.

Var. *raubensis* is found in limestone areas in central peninsula where we usually find *Cryptocoryne affinis* Hook.f. In Sg. Yong in the Taman Negara, var. *raubensis* was observed growing together with *C. affinis*.

Var. *nurii* is a plant from the more acid rainforest found in the south and south eastern part of Peninsular Malaysia (Othman et al. 2009), but is also found in Indonesia on the islands of Bintan, Lingga, Singkep and Sumatera (Bastmeijer, 2013)

In var. *nurii* the leaf shape varies from nearly lanceolate to cordate, and often with short red lines spread over the leaf surface (especially in Peninsular Malaysia). The main characteristic for var. *nurii* is that the surface of the limb is more or less covered with irregularly branched protuberances, the density and shape of which may vary, as well as the basic colour of the surface may vary from yellow to light red to dark red and almost black. Generally the whole surface of the spathe is covered with protuberances, but in e.g. plants from Bintan they are rather few and small. The shape of the limb varies from broadly cordate to narrowly ovate-lanceolate, recurved to flat open. But none of them have the prominent transversally wrinkled surface of the limb with the marginal protuberances as in var. *raubensis*.

History: The first known (unidentified) collection of *C. nurii* var. *raubensis* was made in Taman Negara at the base of Gua Peningat (a limestone peak, 714 m), in river beds of the Sg. Kalau at Kuala Negaran, by Loh Hoy Shing (H.S. Loh) on July 16th, 1970.

In March 1985 Laura Hastings (Kew Botanical Garden) found it in Sg. Yong (March 2 nd) and Ulu Sg. Nerus (March 4 th) both near Bukit Guling

Gendang, Taman Negara (near Kuala Tahan). This plant had over the years had the working name: "yellow *nurii*" due to its distinctly yellow limb of the spathe. Besides the yellow limb of the spathe the plant had rather distinct dark green leaves that were broadly ovate with pallid "dotted" veins.

In 2002 Herman Bernard Ganapathy collected var. *raubensis* in an area north of Raub, and sent pictures to Bastmeijer for identification. The pictures of the limb of the spathe were difficult to interpret as the structures of the limb were not clear: the limb was almost all black, and thus the plant was difficult to identify! We guessed/suggested *Cryptocoryne nurii* due to the recurved limb of the spathe, the distinct protuberances and the narrow collar.

In May 2007 Ganapathy and Siow (Siow, 2013, (blog date August 5th , 2008)) visited the site again and provided some very good pictures of the locality and the plants found there, even though the structure of the limb of the spathe was still somewhat puzzling: these pictures were the first good ones showing the exact structure of the spathe. From this trip collected plants came into cultivation, and upon flowering they confirmed the information provided by Siow: something related to *C. nurii*.

In 2008 Ganapathy found another locality near Jerantut where the stream was 1-2m wide with a sandy to rocky bottom. Most of the var. *raubensis* were found carpeting the stream flowing through a village and a rubber estates and this dense growth, cound be due to the nutrient-rich run-offs from the rubber estates and the lack of canopy cover which permits almost direct sunlight during some periods during the day. This was also observed near Raub in the primary forest where there was very little light and nutrient run offs, and here the stands were rather scares and small. Whereas the moment the same stream came out from the forest and into the oil palm plantation, the population became more dense and luxuriant.

During a field trip to the region north of Raub in 2011, we had the opportunity to see the plants in their natural habitat at two localities, and could again confirm Ganapathy's and Siow's information.

In 2011 we also visited Sg. Yong in the Taman Negara and saw populations in two places in the river. The first place was a 6-8 m broad river where var. *raubensis* was found with immature spathes which upon opening revealed that the limb in one case was yellowish and in another case reddish. It was not possible to ascertain the exact colour of the limbs, but is assumed that it upon opening the yellowish one could become pretty close to that found by Hastings in 1985. Interesting enough var. *raubensis* was found growing together with *C. affinis* (with bullate, green to brownish leaves), partly in separate stands, but the two were also growing intermingled. The leaves of var. *raubensis* were in different shades of mottled brown and green. At the second site several hundred meters away in Sg. Yong we only saw var. *raubensis*, and here the leaves were in different shades of marbled green.

Notes: Plants with different leaf colours may grow separate or they may grow mixed together: to some extent the different leaf colours are genetically constant, i.e. they are maintained in cultivation under uniform cultivation circumstances.

At the type locality north of Raub, it was remarkable to see that even though the plants were deeply rooted in the sandbanks the spathes on long peduncles protruded above the leaves and were bent sideways by the running water. The long flexible peduncle with an air-filled young spathe seemed to provide a versatile vehicle, a buoy, to cope with quickly running water and varying water depths and being able to keep the spathe limb at the water surface. Only *C. noritoi* Wongso (Wongso et al. 2005) from the lime stone springs in eastern Kalimantan, which also has a short spathe tube, has a comparable length of the peduncle: spathe 3-4 cm long, peduncle 1-5-10 cm, but no information is available as to a maximum length of its peduncle. In other cases within the genus *Cryptocoryne*, long spathe tubes rather than long peduncles are found (e.g. *C. cordata* Griff. var. *cordata*, and *C. crispatula* Engl. var. *balansae* (Gagnep.) Jacobsen (see e.g. Bastmeijer, 2013). This may be advantageous where they grow in the lowland rainforest, but at little higher altitudes in the limestone region the velocity of the water current, may be so, that the chance of successful flowering may be better with the spathe anchored to the bottom with a floating device, rather than having a long maybe more vulnerable tube emerging up through the water. Some other species of *Cryptocoryne* may also have long peduncles (*C. usteriana* Engl. (Kettner, pers. com.) but they then have long spathe tubes. Again other species of *Cryptocoryne* may also have short spathes with short tubes, but then other factors come into consideration, such as never really high water (e.g. *C. thwaitesii* Schott, Sri Lanka; Jacobsen, 1987), or that they live in inner mangrove areas (e.g. *C. ferruginea* Engl., Borneo; Jacobsen, 1980).

Siow (Siow, 2013; blog entry of December 22nd, 2008) reported some different looking leaves found in var. *raubensis* at the type locality, i.e. with conspicuous whitish veined leaves and sometimes most of the leaf blade was whitish. The cause of this phenomenon is not clear.

Cultivation: As var. *raubensis* is a plant from limestone areas, it is generally easy to grow in an aquarium and under not too acid conditions in mineral soil. It will also grow in mineral soil with some leaf peat added, and even in only leaf peat. It flowers easily in cultivation, and in aquaria under differences in water depth it clearly exhibits its characteristic: *raubensis*, as peduncles of a length of more than 30 cm have been observed, with the limb protruding above the water.

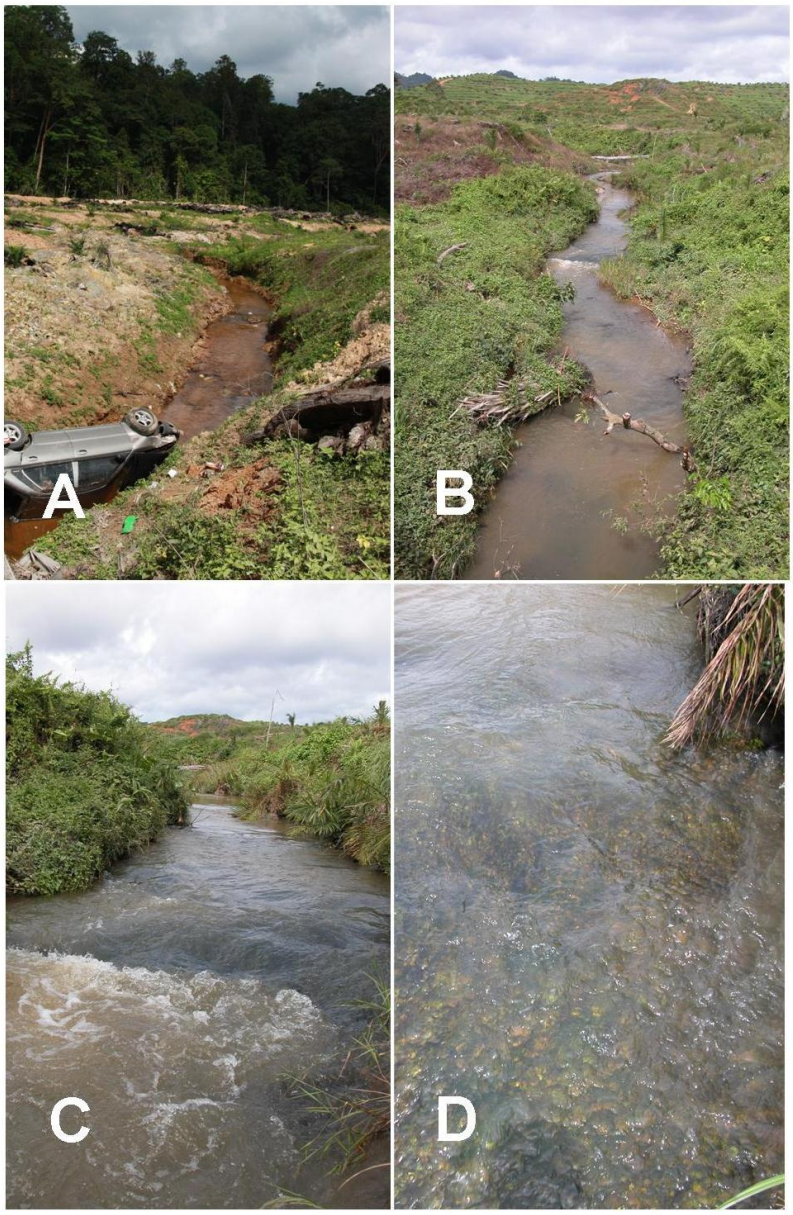

Figure 1. *Cryptocoryne nurii* var. *raubensis.* Type locality (A) after cutting of the oil palm plantation (Photo J.S. 12.12.2009). Note the rain forest in the background; (B) after cutting of the oil palm plantation in 2009. Note that the rainforest in the background of (A) has also been cut; (C) showing a small rapid with a dense stand of plants; (D) showing the dense stand of plants just above the small rapid (Photos B-D, N.J. 26.3.2011).

Figure 2. *Cryptocoryne nurii* var. *raubensis.* Type locality (A) in 2007 (before the cutting of the oil palm plantation in 2009) showing H.B.Ganapathy and a stand of plants with green leaves (Photo J.S. 16.3.2007); (B) an emergent stand of green leaved plants in 2008 (Photo J.S. 21.12.2008); (C) specimens of to become part of the type collection: RR 11/32 (Photo R.R. 26.3.2011).

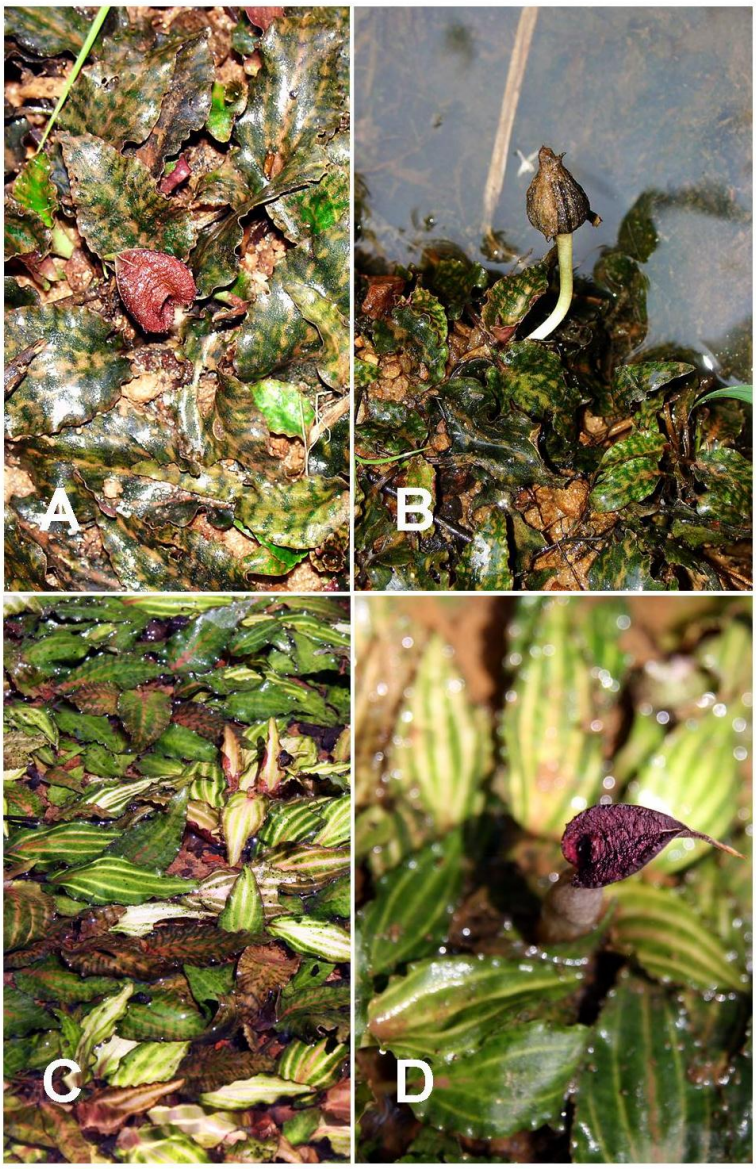

Figure 3. *Cryptocoryne nurii* var. *raubensis.* (A) at the type locality; (B) fruiting specimen (Photos A-B, J.S. 16.3.2007); (C) plants with normal and whitish veined leaves; (D) flowering plant with whitish veined leaves (Photos C-D, J.S. 21.12.2008).

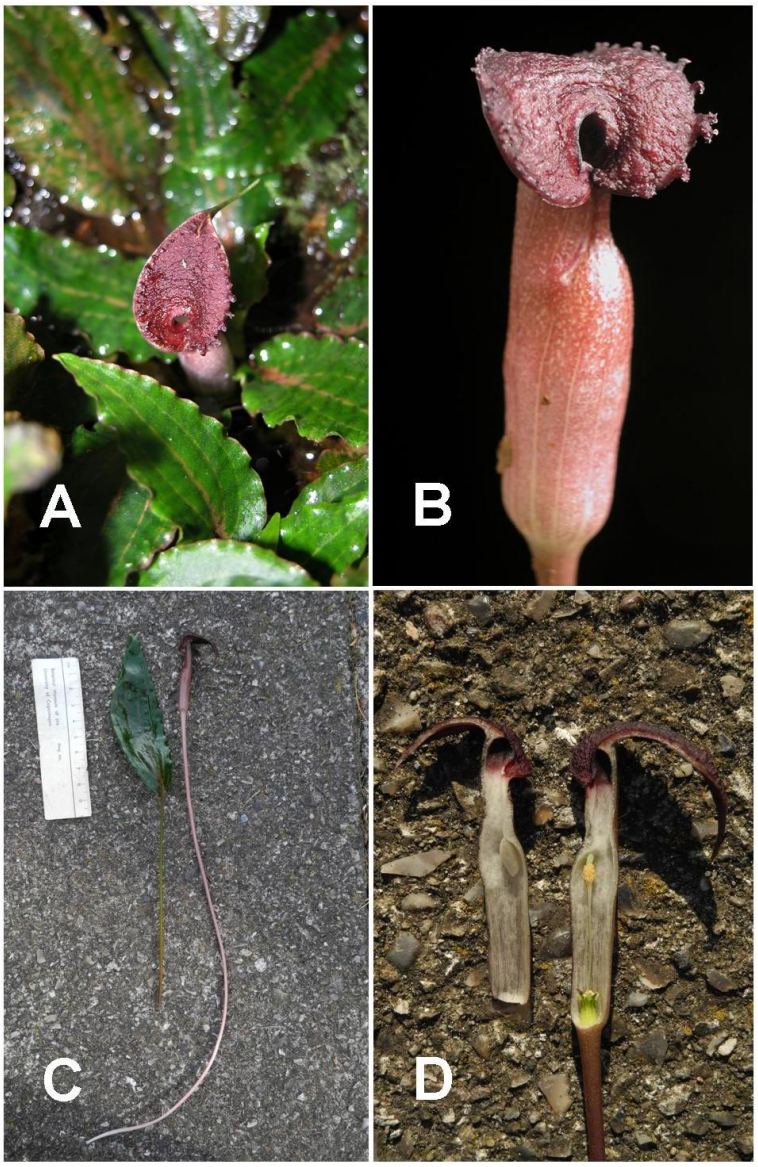

Figure 4. *Cryptocoryne nurii* var. *raubensis.* Flowering specimens in cultivation from the type locality: (A) in a tank low water (Photo N.J. 7.10.2010); (B) spathe showing the short tube (Photo J.D.B. 26.6.2010); (C) long peduncled spathe from a tank with deep water; scale 10 cm; (D) close up of the spathe in (C) in longitudinal section (Photos C-D, N.J. 19.5.2012).

Characteristics: *C. nurii* var. *raubensis* is characterized by the more rounded leaves with a more or less cordate base, often variously mottled, and without the short, red lines characteristic for many var. *nurii*; spathe leathery with a characteristically recurved, mostly deep red to dark black purple limb with conspicuously, large, irregular protuberances along the margin, collar of the same colour as the limb.

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