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Abstract

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A new hybrid species, *Cryptocoryne* ×*batangkayanensis* Ipor, Ørgaard & N. Jacobsen (*C. cordata* var. *grabowskii* (Engl.) N. Jacobsen × *C. ferruginea* Engl. var. *ferruginea*), from the Batang Kayan basin, Sarawak, Malaysia, is described and illustrated. It is compared with the parent species and an artificial hybrid of the same parentage.

Additional key words: aroids, taxonomy, relationships

Introduction

Cryptocoryne species have for a long time been relatively well known from Sarawak due to the works of Engler (1879), Schulze (1971), Jacobsen (1985) and Ipor & al. (2007–2008). Presently 12 species of *Cryptocoryne* are recognized from Sarawak.

When several species of *Cryptocoryne* inhabit the same and adjacent stream and river systems, it is not unlikely that hybridization will occur. Natural hybrids between species of *Cryptocoryne* are not uncommon; they have previously been reported from Sri Lanka (Jacobsen 1981, 1987), Thailand (Jacobsen 1980; T. Idei unpublished), Lao P. D. R. (T. Idei unpublished), Peninsular Malaysia (Othman & al. 2009), Singapore (Bastmeijer & Kiew 2001) and Kalimantan (Jacobsen & al. 2002; Bastmeijer & al. 2013). A molecular study of *C.* ×*purpurea* Ridl. (*C. cordata* Griff. × *C. griffithii* Schott) in Peninsular Malaysia, Sarawak and Kalimantan, presented by Ipor & al. (2010), showed that it was possible to distinguish between hybrid populations. The study also showed that it was possible to separate the Peninsular Malaysian populations (with diploid *C. cordata* var. *cordata* as one of the parents) from the Bornean populations (with tetraploid *C. cordata* var. *grabowskii* (Engl.) N. Jacobsen as one of the parents).

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Results

During a *Cryptocoryne* field trip in 2004, I.B.I. brought us to a site west of Bau (some 55 km west of Kuching), in the eastern part of the Batang Kayan catchment area. In small forest-ditch pools we saw a green-leaved *Cryptocoryne* population which according to I.B.I.'s information produced a spathe with a purple limb. The plant was taken into cultivation as accession *NJS 04-07* and indeed soon proved to have a purple limb, thereby resembling *C.* ×*purpurea* nothovar. *purpurea* of Peninsular Malaysia (*C. cordata* var. *cordata* × *C. griffithii*, 2*n* = 34), and the South Kalimantan counterpart *C.* ×*purpurea* nothovar. *borneoensis* N. Jacobsen & al. (*C. cordata* var. *grabowskii* × *C. griffithii*, 2*n* = 51; Jacobsen & al. 2002; Othman & al. 2009).

Ipor & al. (2008), in their treatment of the ecology and distribution of the *Cryptocoryne* species in Sarawak, pictured and assigned the Batang Kayan plant with uncertain status under *C.* ×*purpurea* nothovar. *borneoensis*.

Although the Batang Kayan plant resembled the hybrid *Cryptocoryne* ×*purpurea*, there was a problem: one of the parental species of this hybrid, *C. griffithii*, has only been reported from the southern part of Kalimantan, Peninsular Malaysia and some of the nearby Riau islands. This fact left some uncertainty as to the Batang Kayan plant belonging to *C.* ×*purpurea*.

Fig. 1. *Cryptocoryne* ×*batangkayanensis* – A: habitat of type locality; B: habitat close up. – Both photographs taken on 29 Nov 2004 by N. Jacobsen.

The other parental taxon of *Cryptocoryne* ×*purpurea* nothovar. *borneoensis*, viz. *C. cordata* var. *grabowskii*, is widespread on Borneo, including Sarawak, and has been found in Sungai Stunggang, also in the Batang Kayan basin (less than 20 km north of the Batang Kayan locality), as well as in the adjacent Sungai Sarawak basin toward the east.

Another parent candidate with a purple spathe limb within the region would be *Cryptocoryne ferruginea* Engl. var. *ferruginea*, which has been found some 20 km east of the Batang Kayan locality at Sungai Salalang (north of Bau) within the neighbouring Sungai Sarawak catchment basin.

The relatively small Sungai Salalang and its tributaries lies toward the eastern border the Batang Kayan basin some 15 km east of the Batang Kayan locality; this rather short distance to the hybrid locality makes a hybridization event possible, especially since the intervening area has not been investigated for *Cryptocoryne* populations. Moreover, even though at the present time the two catchment areas have separate runoffs, they had combined runoffs during the last glaciation and until about 13 000 BP (Voris 2000; Sathiamurthy & Voris 2006).

Fig. 2. *Cryptocoryne* ×*batangkayanensis* (2*n* = 85) – A: limb of spathe; B: opened kettle showing female and male flowers. – Photographs by N. Jacobsen.

Sarawak *Cryptocoryne* species have been included in crossing experiments performed over the years at the University of Copenhagen. One of the successful combinations is CyCy 447, i.e. *C. ferruginea* var. *ferruginea* (female) × *C. cordata* var. *grabowskii* (male), 2*n* = 51, reported here [*C. ferruginea* var. *ferruginea*: Malaysia, Sarawak, Samarahan Div., Balai Ringin, *Waser SK 05-02*, 2*n* = 34 × *C. cordata* var. *grabowskii*: Malaysia, Sarawak, Sri Aman Div., Sungai Semawak, *IBI 05-1*, 2*n* = 68]. The hybrid CyCy 447 has a longer spathe limb, but otherwise the colour and surface of the spathe limb matches rather well the Batang Kayan plants.

The Batang Kayan population has proved to have a chromosome number of 2*n* = 85. This is not a straightforward number, although an explanation could be that it evolved from a hybridization between an unreduced gamete from *Cryptocoryne cordata* var. *grabowskii* (68 chromosomes) and a normal reduced gamete from *C. ferruginea* var. *ferruginea* (17 chromosomes), that is 68 + 17 = 85.

Usually hybrids are somewhat intermediate between the parents, and if the parents have different chromosome numbers, e.g. diploids and tetraploids, the parent that contributes the most chromosomes gives rise to a genetic dosage effect in the resulting morphology of the hybrid. This phenomenon is well known, and has been shown in hybridization experiments in, e.g., *Hordeum* L. (barley) (Bothmer & Jacobsen 1986) and *Crocus* L. (Ørgaard & al. 1995). The morphological differences between the Batang Kayan population (2*n* = 85) and the artificial hybrid CyCy 447 (2*n* = 51) can therefore be explained by genome dosage effects.

Unpublished results of an AFLP study of the Malesian cordate-leaved species of *Cryptocoryne* also show that the Batang Kayan plants are genetically closest to CyCy 447, and secondly to *C. cordata* var. *grabowskii*. Additionally, the Batang Kayan plants group with neither *C. cordata* var. *cordata*, nor *C. griffithii*, nor *C.* ×*purpurea*.

We conclude that the Kampong Stungkor Baru population in the Batang Kayan basin represents an interspecific hybrid between *Cryptocoryne cordata* var. *grabowskii* and *C. ferruginea* var. *ferruginea* (alphabetically ordered).

Cryptocoryne* ×*batangkayanensis Ipor, Ørgaard & N. Jacobsen, **nothosp. nov.** – Fig. 1 & 2.
Holoype: Malaysia, Sarawak, Kuching Div., Batang Kayan basin, near Kampong Stungkor Baru, *I. B. Ipor & N. Jacobsen NJS 04-07* (SAR; isotypes: B, C, L).

Description — *Leaves* 15–25 cm long; *blade* ovate, 3–10 cm long, 2–6 cm wide, surface smooth to somewhat irregular, lower surface ± purplish, upper surface bright green to somewhat purplish mottled, sometimes brownish on midvein, base cuneate to ± cordate. *Spathe* 8–20 cm long; *kettle* 1.5–2 cm long, inside purple in upper part, spotted into tube; *tube* whitish, 5–12 cm long; *limb* bright shining red-purple (fading with age), ovate, 2–6 cm long, slightly rugose with scattered regular small bumps, apex acuminate; *collar* absent, collar zone dark red to reddish, more whitish toward tube opening, broad. *Spadix* with 5–7 *female flowers*, white to brownish in upper part; *stigmas* elliptic; *olfactory bodies* dark yellowish, rounded; *male flowers* 40–60; *appendix* whitish to slightly purple spotted; pollen fertility 0–5%. *Infructescence* unknown.

Chromosome number — 2*n* = 85, reported here.

Distribution — Only known from the type locality area.

Ecology — Formerly secondary forest and partly abandoned rubber farm. Muddy bottom of a small drainage ditch after the establishment of a diversion stream. Presently most parts of the habitat have been cleared for oil palm planting.

Conservation status — The area where *Cryptocoryne* ×*batangkayanensis* is found is within a partly abandoned rubber plantation in secondary forest, and it is foreseeable that the area will be cleared in the near future, although small populations in the vicinity, surprisingly enough, seem to be self-sustainable in oil palm planting areas.

Fig. 3. Artificial hybrid: CyCy 447 (2*n* = 51): *Cryptocoryne ferruginea* var. *ferruginea* × *C. cordata* var. *grabowskii* – A: plant in cultivation; B: limb of spathe; C: opened kettle showing female and male flowers. – Photographs by N. Jacobsen.

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Fig 4. Parents of CyCy 447: A & B: *Cryptocoryne ferruginea* var. *ferruginea*, Malaysia, Sarawak, Sri Aman Div., Balai Ringin, *Waser SK 05-02*, 2*n* = 34; C & D: *C. cordata* var. *grabowskii*, Malaysia, Sarawak, Sri Aman Div., Sg. Semawak, *IBI 05-1*, 2*n* = 68. – Photographs by N. Jacobsen.

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