

## A New *Cryptocoryne* Hybrid (Araceae) from the Bukit Timah Nature Reserve, Singapore

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### Abstract

A *Cryptocoryne* from the Bukit Timah Nature Reserve, Singapore, identified for many years as *C. griffithii* Schott, is recognized to be a new hybrid species: *Cryptocoryne xtimahensis* Bastmeijer. It is difficult to accurately determine its parents, but good candidates are *C. nurii* Furtado and *C. cordata* Griff., both native to Johore, Peninsular Malaysia.

### Introduction

The first collections of *Cryptocoryne* from Singapore were made in 1890 by H.N. Ridley (1904, 1907, 1925), the first director of the Botanic Gardens Singapore. Two species were recorded: *C. griffithii* Schott from several freshwater localities and *C. ciliata* (Roxb.) Schott from tidal areas. Today, *C. griffithii* is still present in the MacRitchie Reservoir and Nee Soon swamp forest but *C. ciliata* is reported to have disappeared from Singapore (Tan, 1995). The latter is, however, a widespread species, occurring from India to Papua New Guinea, while *C. griffithii* is a rather narrow endemic being known from the south of Peninsular Malaysia (Malacca and Johore), as well as in Singapore. However, today there may be only a few localities left in southern Johore of the Malaysian population.

The main interest in *Cryptocoryne* is as an ornamental plant for aquascaping. This hobby of cultivating tropical plants and keeping fish in aquaria has become very popular in Europe, the USA, and Japan. From the 1950s, Singapore was the main port for shipping wild collected plants to these regions, and plant nurseries developed to satisfy this demand.

The attention of the first author was drawn to the problem of the identity of the Bukit Timah plant by a photograph of *C. griffithii* on the website of the Singapore Science Centre from an article by Tan *et al.*

(1994). The photograph presented there of *C. griffithii* did not match the European idea of *C. griffithii* very well. The same photograph appeared in Foulis *et al.* (1998). In June 1999, there was an opportunity to study the plant in question more closely in the Bukit Timah Nature Reserve. We found the plant flowering abundantly and collected some specimens for further investigations.

### A Short History of *Cryptocoryne griffithii* Schott

The identity of the real *C. griffithii* has been in dispute, especially because of the erroneously named drawing in Hooker (1900). Ridley (1904) pointed out that the drawing actually represented his newly described *C. purpurea* Ridl.. In 1920, Engler gave a good description of both species. De Wit (1961) pointed to this problem again, and he was fortunate to get live plants from Malacca, from where Griffith had originally collected his plants. A detailed description of the true *C. griffithii* together with a nice drawing by Ike Zewald is found in De Wit (1961, 1971, 1990) and which closely matches Schott's unpublished drawing in Vienna (W) of *C. griffithii*.

One of the first commercial collectors of *C. griffithii* from Singapore was Y.W. Ong (*pers. comm.*), who collected the plants in the reservoirs and shipped them to Europe as far back as 1948. However, all publications in Europe on this plant in the hobby magazines we could find refer to *C. purpurea*. At that time there was also much confusion about *C. cordata* Griff., which was not well understood, see for example Hoedeman (1948), Wendt (1952), Oskam & Van Ramshorst (1954) and De Wit (1951, 1958a, b). The reason for the lack of notes on *C. griffithii* is probably very simple: the species is very difficult to grow and neither hobbyists nor professionals were able to grow them at that time. But from 1961 onwards, *C. griffithii* was at last a well-known species.

Around the 1970s, taxonomy in *Cryptocoryne* seemed to be resolved (De Wit, 1971), but in the following years the opposite became true. Jacobsen (1982, 1987) suggested a hybrid nature for *C. purpurea*. Jacobsen & Bogner (1986, 1987) gave a detailed review on the *Cryptocoryne* of the Malay Peninsula. Today, with more collections available and many experiments on cultivation, it appears that within some groups there is a near continuous variation, making it in some extreme examples, more or less a matter of taste how to interpret a newly imported plant. Furthermore, polyploidy and natural hybrids have proved to be rather common in *Cryptocoryne*. Today we know a couple of *C. griffithii*-like plants that show some variation. A recent review on *C. griffithii* and *Cryptocoryne* in general is found in Bastmeijer (2000).

With the variation of *C. griffithii* now understood, it is possible to be certain that the Bukit Timah plant is a distinct new hybrid differing, among other characters, from *C. griffithii* in its narrowly ovate leaves, the long apex of the spathe and large, irregular protuberances of the limb. The fact that its pollen fertility was less than 10% and that it had never been found in fruit strongly suggests that it is a hybrid.

**Cryptocoryne xtimahensis** Bastmeijer notosp. nov. (Araceae)

Lamina spathae protuberationibus irregularibus obtecta, longicaudata (in *C. griffithii* brevicaudata et dense verrucosa), basis laminae plus minusve auriculata (similiter in *C. nuri*), color laminae flavus protuberationibus atrorubis, fauce modice angusta (similiter in *C. nuri*). Folia eis speciei *C. cordata* simillima (sed *C. cordata* differt lamina spathae levi tota flava) – Typus: Singapore, Bukit Timah Nature Reserve, Jungle Fall Stream. 18 January 2001, dammed pools. Alt. c. 120 m., *R. Kiew, S. Saifuddin, S. Teo & A.T. Gwee RK 5127*. (holo SING; iso C, K).

Rhizome creeping, 0.4–0.8 cm diam., stoloniferous, loosely rooted in the mud or firmly fixed in gravel. Leaves in a rosette; petiole (2.5–)10–15 cm (depending on water depth), dark green, sheathed in the lower part for nearly one fifth of its length; leaf blade ovate, 4.5–8 cm long and 2–4 cm wide, base rounded, margin flat to slightly undulate, apex acute, upper surface dark green, sometimes with dark purple transverse markings, or submerged leaves brownish green; pale green or sometimes tinged reddish beneath.

Peduncle 2–4 cm long. Spathe 10–15 cm long; limb of the spathe 4–5 cm long and c. 1.5 cm wide, apex long caudate, base auriculate and margins reaching each other, upper surface pale yellow with distinct dark red irregular protuberances; collar distinct with a rim and forming a narrow opening to the tube; tube 3–6 cm long and c. 0.5 cm in diameter, outside and inside white; kettle 2–2.5 cm long, and c. 0.7 cm in diameter, outside white, inside white without purple markings. Spadix usually with 6 female flowers at the base, these pale green; stigmas white, more or less elliptic; olfactory bodies small, yellow; naked axis between male and female flowers c. 0.5 cm long, white; male part cylindrical, yellow, male flowers 50–60, each male flower usually consisting of two stamens; appendix cone shaped, c. 2 mm long, white; flap above the male flowers white. Fruit and seeds not known.

Emersed cultivated plants much smaller; leaves c. 10 cm long; peduncle c. 1 cm long; spathe c. 6 cm long.



1a. Dammed pools on the Jungle Fall Stream in the Bukit Timah Nature Reserve, Singapore.

photo Bastmeijer



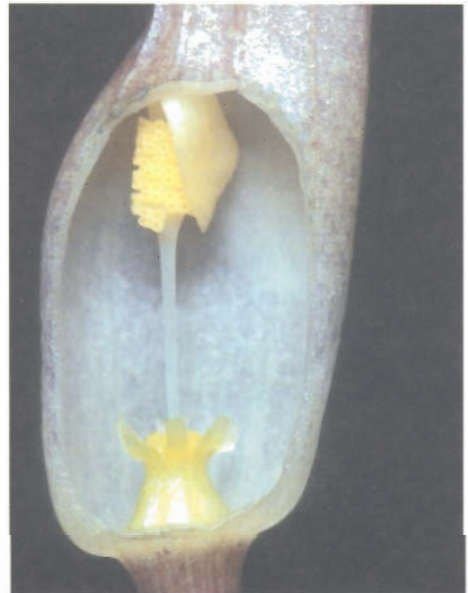
1b. Limb of the spathe of *Cryptocoryne xtimahensis*.

photo Bastmeijer



1c. Cultivated plant of *Cryptocoryne xtimahensis*.

photo van Wijngaarden



1d. Opened kettle showing the female (bottom) and male flowers (top).

photo van Wijngaarden

Figure 1. A new *Cryptocoryne* hybrid from the Bukit Timah Nature Reserve, Singapore

Chromosome number:  $2n = 54$ . Pollen fertility  $< 10\%$ . Vouchers at Copenhagen (C).

*Other collections examined:* All from Bukit Timah in Jungle Fall Valley – the type and J. Bastmeijer 807 (L), P. Blanc 91-1 (SING), K.S. Chua 333 (SINU), D. Nicolson 1367 (US) and J. Sinclair 5200 (E).

## Discussion

While plants identified as *Cryptocoryne griffithii* are known from several localities from Singapore, this new hybrid has only been collected from Bukit Timah. (There is just one collection, Ridley s.n. 1892 (SING), from Bukit Timah that may be *C. griffithii*). All collections of *C. xtimahensis* are from the Jungle Fall Valley, where the plant grows in two pools formed up- and down-stream by an artificial dam in the tiny stream (Fig. 1a). Constructed during the Japanese Occupation, it is currently silted up. The hybrid appears to be restricted to these pools.

The first systematic analyses of pollen fertility and chromosome numbers in *Cryptocoryne* were made by Jacobsen (1977) and Arends *et al.* (1982). With pollen fertility near zero for this plant, we are no doubt dealing with a hybrid. In addition, compared with *C. griffithii* in Singapore, for which half the herbarium specimens were collected in fruit, none of the herbarium specimens of this Bukit Timah population have fruits nor have fruits been observed in the field.

The hybrid status is not, however, unique for *Cryptocoryne*. The popular aquarium species *C. xwillisii* Reitz from Sri Lanka forms a complex of hybrids in which *C. parva* De Wit is one of the parents, the other parent may be *C. beckettii* Trimen, *C. walkeri* Schott or *C. undulata* Wendt (Jacobsen 1981a,b). Another example is found in Tasek Bera, Peninsular Malaysia, where a very big population of *C. purpurea* grows (often erroneously ascribed to *C. griffithii*), which also has a pollen fertility of about zero and is today regarded as a hybrid between *C. cordata* and *C. griffithii* (Jacobsen 1987).

In classifying *Cryptocoryne* species, the main characters used are those of the limb of the spathe. *C. xtimahensis* has large, irregular, red protuberances on the limb of the spathe, the collar is very pronounced and the base of the limb is cordate (Fig. 1b). These characters are distinct from those of *C. nurii*, where the limb of the spathe is rather elongated and has a yellow background, characters shared by *C. cordata*.

In addition, the leaves of *C. xtimahensis* are narrowly ovate with a rounded to cordate base and an acute tip as are those of *C. cordata*. The

transverse markings on the upper leaf surface of most plants of *C. xtimahensis* (Fig. 1c) are also a character of *C. nurii*.

The combination of these characters makes *C. griffithii* less likely as one of the parents. The limb of *C. griffithii* is verrucose with small, regular bumps, although the collar is very pronounced too. However, the leaves of *C. griffithii* are broadly ovate. Both *C. nurii* and *C. cordata* grow in the southern part of Johore, Peninsular Malaysia but have never been recorded from Singapore. An artificial cross between these two species would be very interesting but would be very difficult to perform, because neither of the species is easy to cultivate. DNA analysis should be able to elucidate the exact parentage.

Base chromosome numbers in *Cryptocoryne* are  $x = 10, 11, 14, 15, 17$  and 18. Polyploidy is rather common in *Cryptocoryne* and even rather long polyploid series exist (Arends *et al.*, 1982). The chromosome number of this new hybrid,  $2n = 54$ , is remarkable because it could indicate that this plant is of triploid origin with base number 18. This number is known only from three Sri Lankan species, the *C. crispatula*-group from mainland Asia, and the tidal species *C. lingua* Engl. from Sarawak. All known species from the Malay Peninsula have base number 17, except for the distinct *C. longicauda* Becc. *ex* Engl. (also known from Sumatra and Borneo), which has base number 15 and the tidal species *C. ciliata*, which has base number 11. The number  $2n=54$  may be explained as originating from a triploid number with  $2n = 51$  after which a second generation of aneuploid segregation may have occurred (Ørgaard *et al.* 1995).

### **The Future of *Cryptocoryne* Habitats in Singapore**

The status of the Bukit Timah Nature Reserve provides a safe habitat for this plant. However, *C. xtimahensis* occupies a very restricted area c. 10 m long and 3 m wide. It is therefore extremely vulnerable to any hydrological changes to this one particular stream. *C. griffithii* seems to be rather common in the reservoirs (Chan, 2000), and provided there is no change in land use will not be threatened.

*C. ciliata*, the other native *Cryptocoryne* of Singapore, is said to have been re-introduced with material originating from southern Johore.

On the other hand, several species of *Cryptocoryne* have been introduced in the past, for example *C. wendtii* De Wit, *C. xwillisii* Reitz from Sri Lanka, and *C. lingua* from Sarawak (Chan, 2000). They probably 'escaped' by accident from the numerous nurseries, which produced - from the 1960's onwards - large quantities of these popular plants for aquascaping, mainly for export. It will be interesting to investigate the flora of Singapore in this respect.

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