

Stories from the Mekong, part 3. *Cryptocoryne* (Araceae) habitats in the Kok River, Chiang Rai Province, Northern Thailand

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ABSTRACT

The *Cryptocoryne* populations and their habitats in the Kok River, flowing from Myanmar into northernmost Thailand and discharging into the Mekong are described. The distribution of *C. crispatula* var. *albida* is extended much to the north of what was previously known, while the occurrence of *C. crispatula* var. *yunnanensis* is within the expected from its type location in southernmost Yunnan.

KEY WORDS: *Cryptocoryne crispatula*, Araceae, habitats, distribution, new combination

INTRODUCTION

The second part of the ‘Stories from the Mekong’ dealt with the *Cryptocoryne* from the main course of the Mekong bordering Laos

at the Chiang Khan District in the Loei Province north-eastern Thailand (Idei et al. 2017). The present 3rd report deals with the Kok River (Nam Mae Kok), one of the northern Mekong tributaries with a total length of around 285 km, in the northern part of Thailand in the Chiang Rai Province (**Figure 1**). The water catchment areas are from the Daen Lao Range, Shan State, Myanmar, and the Khun Tan Range on the Thai side. More than half of river length is located on the Myanmar side, and it is the only river which flows into Thailand from Myanmar, while the rivers Moei River (Maenam Moei) and Pai River (Maenam Pai) further to the south flow from Thailand into Myanmar and into the Salween River. This present investigation was carried out in the north-western part of the Chiang Rai Province, Northern Thailand in February 2019. Two *Cryptocoryne* varieties belonging to *C. crispatula* Engl. (**Figure 7 – 10**) were

observed with abundant spathes. One was referred to *C. crispatula* var. *yunnanensis* (H.Li) H.Li & N.Jacobsen (Code: Idei TRK-YU) and a new northernmost area for *C. crispatula* var. *albida* (Parker) N.Jacobsen, Maneean. & T.Idei*** in the typical form with a broad, backwards recurved spathe limb more or less densely spotted (Code: Idei TRK-RS) and a newfound form with yellowish white limb without spots (Code: Idei TRK-YW).

Most of the known *C. crispatula* var. *albida* habitats are found in Myanmar and Peninsular Thailand in the rivers which flow into the Andaman Sea (Jacobsen et al. 2012), and this extended distribution of *C. crispatula* var. *albida* in Northern Thailand is now confirmed for the Kok River. It is therefore reasonable to consider that the Kok River previously has flown into the Myanmar side as part of the Salween River basin in former times, and it is presently flowing into the Mekong by later land upheaval. A conclusion can therefore be that the investigation area is a “contact section” between the Myanmar originating *C. crispatula* var. *albida* and of the Mekong originated *C. crispatula* var. *yunnanensis*.

There was a report of a *C. crispatula* var. *albida* said to come from the Chiang Khan region in 2017, based on plants from Jens Kühne communicated by Jochen Degrell. As *C. crispatula* var. *albida* was not observed in our elaborate investigations from the Chiang Khan region (Idei et al. 2017), we expressed some doubt as to the locality. With the present report we can conclude that our previous doubts were unfounded. *C. crispatula* var. *albida* can of course be dispersed downstream from the Kok River, and it was not observed in the investigations at Chiang Khan (Idei et al., 2017).

Cryptocoryne crispatula var. *yunnanensis* (H.Li & N.Jacobsen 2010) was described as *C. yunnanensis* H.Li (Li et al. 1977) based on plants from Meng-la, Xishuangbanna prefecture in the province of Yunnan. The description was accompanied by a drawing of the whole plant and the spathe peculiarities, a drawing which was better reproduced in Flora Yunnanica 2, plate 221 (1979). Characteristics are the short spathe tube, and a short, spirally coiled spathe limb where the upper surface has many small red spots, and the margin seems recurved also

FOOTNOTE***For some time, we have been aware that what has been called *C. albida* Parker was closely related to *C. crispatula* Engl., and a molecular study of the narrow-leaved *Cryptocoryne* of Mainland Asia (Jacobsen & al., 2015) showed that *C. albida* was nested quite within the other *C. crispatula* from southern Thailand, and thus to be regarded as a variety of *C. crispatula*, which is hereby done.

***Cryptocoryne crispatula* var. *albida* (Parker) N.Jacobsen, Maneean & T.Idei, comb. & stat. nov. ≡ *Cryptocoryne albida* Parker, Kew Bulletin p. 44 (1931). Type: *Parker 2735* (K, holotype), Myanmar, Mergui Distr., Yanggwa klong, 1 March 1927.**

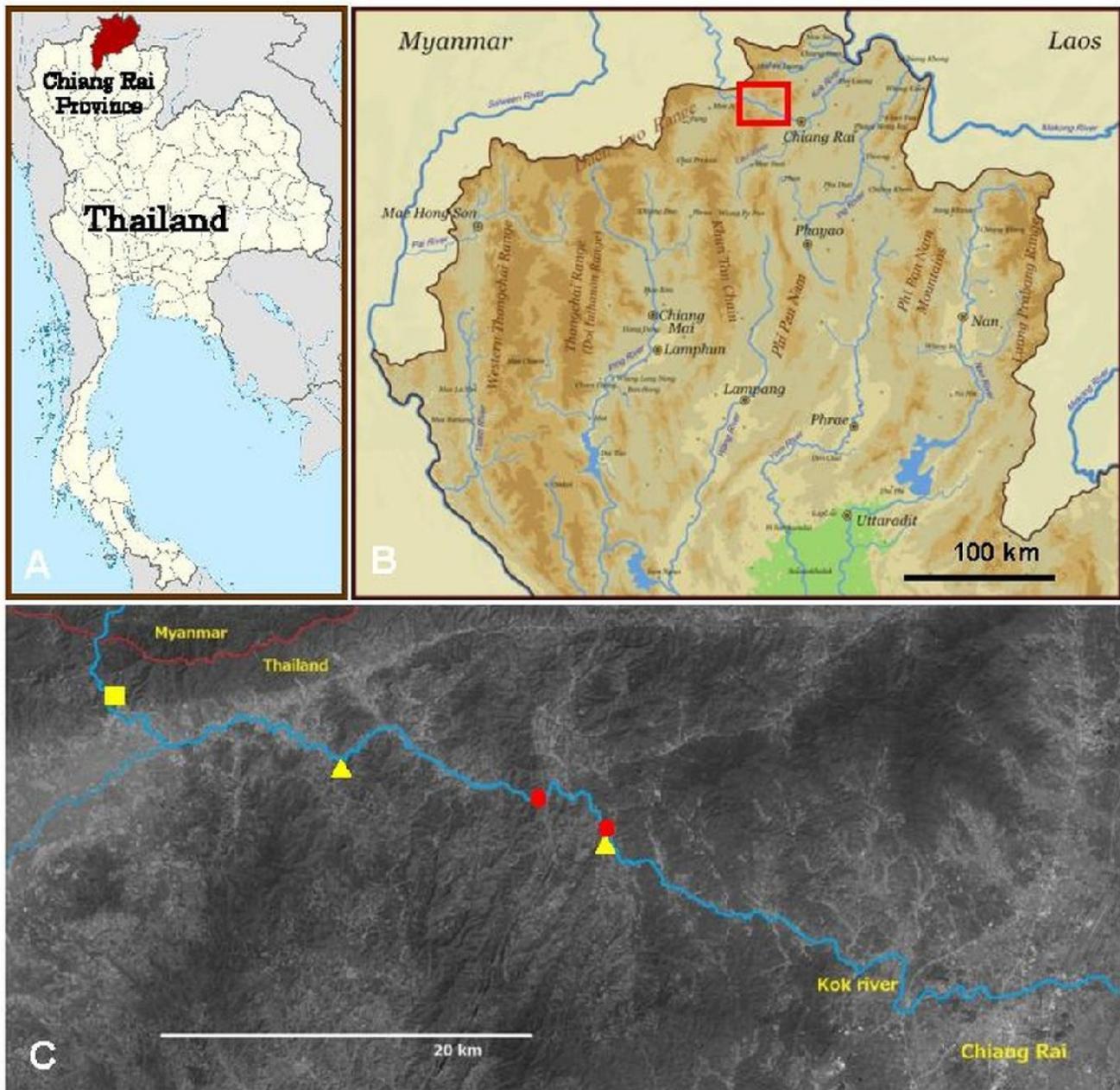


Figure 1. **A.** The location of the Chiang Rai province in N Thailand; **B.** Northern Thailand showing main mountain ranges and rivers and an indication of the investigated area of the Kok River; **C.** Investigated part Kok River coming from Myanmar. The *Cryptocoryne* are distributed along a stretch of the Kok River of about 23 km (between two yellow-triangle marks). *C. crispatula* var. *albida* was seen in all the investigated sections, while *C. crispatula* var. *yunnanensis* was seen only in the downstream portion (between two red-round marks). *C. crispatula* var. *albida* was also observed closer to the Myanmar border (yellow square). It is along the Daen Lao Range and the topography is steeper. A from https://commons.wikimedia.org/wiki/File:Thailand_Chiang_Rai_locator_map.svg; B. from https://upload.wikimedia.org/wikipedia/commons/0/01/Topography_of_northern_Thailand.png; C from Google Earth.



Figure 2. Kok River locations. **A.** Downstream view of the Kok River with rheophyte shrubs anchored in the bedrock; **B.** *Cryptocoryne* were observed in the outcrop bedrock zone with the scrub thicket of rheophytes in places with a relatively swift flow. All photographs are by T. Idei.



Figure 3. Kok River locations. **A.** Rock formation in the river with rheophyte shrubs anchored in the bedrock; **B.** Rapid river flow section. *Cryptocoryne* was found by the riverbank on both riverbanks.



Figure 4. Kok River habitats. **A.** *Cryptocoryne* patch situated on the riverbank with ferns, below a steep slope. Temporal shade was provided from the hill behind; **B.** Typical *Cryptocoryne* habitat situation. A majority of the plants were situated between the rocks with the rheophyte canopy cover.



Figure 5. Kok River habitats. **A.** *Cryptocoryne* patch without the rheophyte canopy cover, under the direct sunlight was also often seen; **B.** *Cryptocoryne* patch situated in a relatively flat riverbed. The cracked stones of various sizes have accumulated above the bedrock.



Figure 6. Kok River habitats. **A.** *Cryptocoryne* which have begun to grow with the narrow terete leaves and young leaves with an undulating margin in submerged condition. Mobile sand has covered the bedrock riverbed; **B.** *Cryptocoryne* situated in bedrock cracks beside the rapid flow as linear patches. Also, to be found were the narrow terete leaves and young leaves with an undulating margin in submerged condition.



Figure 7. Kok River habitats. **A.** Patch of *C. crispatula* var. *albida* (TRK-YW) with a yellowish white limb without spots situated beside the rapid flow. They often seem to be in portions with a relatively swift flow; **B.** Patch of *C. crispatula* var. *albida* (TRK-RS) with the spotted limb.



Figure 8. Spathe limb variation of *C. crispatula* var. *albida*. **A—C.** Yellowish white limb without spots (TRK-YW), and a more or less brownish-reddish margin. Each of these colors may be seen as characteristic of each patch. A and B were common, and C was minority; **D—F.** (TRK-RS). **D.** Clear red spots; **E.** Spreading, suffused red spots; **F.** Lacking red spots. Each of these colors were seen as characteristic of each patch. D and E were common, F was a rare case.



Figure 9. Spathe limb variation. **A—D.** Variation in what has been assigned to *C. crispatula* var. *yunnanensis*, characteristic is the short, forward twisted limb and the dense, often elongate, irregular markings, somewhat different from spotted patterns found in Yunnan; **E—F.** Two spathe limbs with an open spiral and with spots, possibly indicating a hybrid origin, or back crossings to var. *albida* or var. *yunnanensis*.

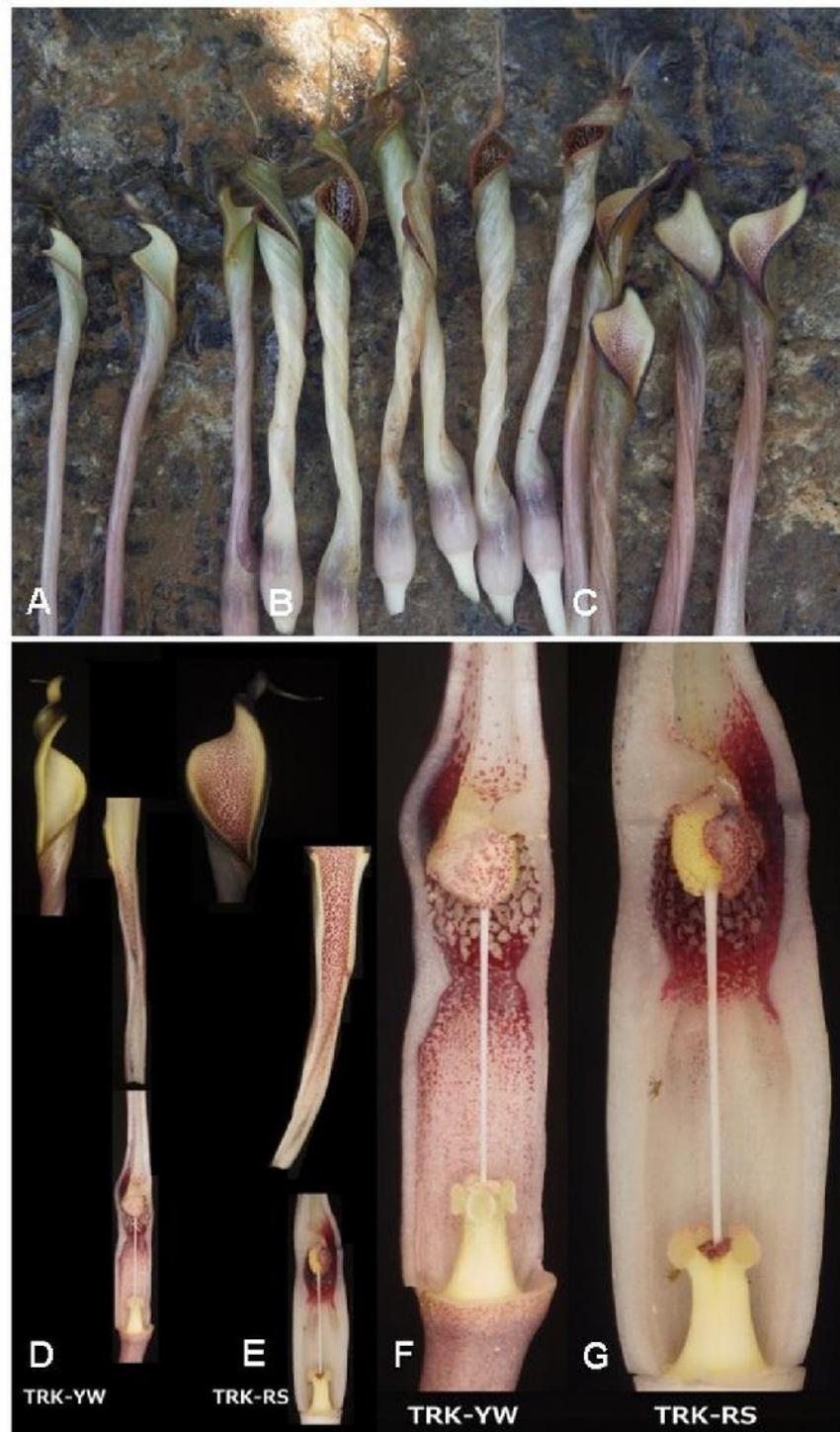


Figure 10. Spathe limb variation. A. Spathes of *C. crispatula* var. *albida*, yellowish white limb without spots; B. *C. crispatula* var. *yunnanensis* C. *C. crispatula* var. *albida* with spots., These three spathe types were collected in one of mixed patch; D—G. Opened spathes of *C. crispatula* var. *albida* yellowish white limb without spots and with spots. These two show the extreme variation found in *C. crispatula* var. *albida*.

with red spots. The plants from the Kok River which we have referred to *Cryptocoryne crispata* var. *yunnanensis* differ from the Xishuangbanna plants in having the spots on the limb surface more like irregular lines, although there were spathes with a short limb twist that were spotted.

Climate

The catchment area of the Kok River is located in a tropical savanna climate. February, which was the investigated period, is the 2nd coldest month during the middle of the dry season. In the investigated area, the average maximum temperature is about 30 °C, average minimum temperature is about 12 °C. The water level in February is still going down with a relatively gentle flow, and the water temperature was measured to be around 19 °C.

Distribution of *Cryptocoryne* in the Kok River

The investigated area is located in the northernmost region of Khun Tan Range. The *Cryptocoryne* were distributed scattered in the “bedrock section” with large boulder groups, mainly in a river stretch of about 23 km located in the northern margin of Huai Chomphu Sub district, Mueang Chiang Rai District (**Figure 2**). The width of the river is from about 30 m to 140 m which includes the middle outcrop zone, and the altitude difference is from 420 m to 445 m. The proper bedrock situation for the *Cryptocoryne* habitat does not exist downriver from this

section due to excess mobile sand accumulation. *C. crispata* var. *albida* was seen at the upriver side at the bedrock zone on the front of the Myanmar border, and it suggests the broader distribution of *Cryptocoryne* in Myanmar with more bedrock locations (**Figure 1**). The coexistence of the normal *C. crispata* var. *albida* with a spotted spathe limb and *C. crispata* var. *albida* with yellowish white limb without spots was seen in almost every location, while *C. crispata* var. *yunnanensis* was seen only in the downstream portion and here coexisting with both types of *C. crispata* var. *albida*.

Habitat

The majority of *Cryptocoryne* were observed in the scrub thicket of rheophytes (mainly *Homonoia riparia* Lour., Euphorbiaceae) which was situated above the outcrop bedrock zone with large boulders on the riverbank or in the middle of the river (**Figure 3**). In the flow section where the stream gradient was notable, these habitats were situated in the portion with a relatively swift flow, and they were situated even beside the rapid flow in the valley section (**Figure 3**). Therefore, every habitat zone is under the torrent during high water, in which period the leaves disappear, and only submerged, small terete leaves are present. Many *Cryptocoryne* patches were situated at the margin rather than interior of the rheophyte scrub thicket. The canopy cover provides the temporal shade to a patch during solar movement, and further shade is provided by being situated behind a hill or a steep slope (**Figure 4**). However, patches

continuously under direct sunlight were also seen (**Figure 5**). Although a relatively flat habitat with semi-mobile stones accumulated was often seen in the habitats of other varieties of the *C. crispatula* group, it was seen only in a few cases in the Kok River. The majority of the patches were situated densely between the rocks-boulders or in the cracks of bedrock, and the narrow substrate space consists of deposited silt or sand-gravel (**Figure 6**). During the dry season submerged plants of *Cryptocoryne* were often observed in the situation shallower than the depth of 50 cm, and that highest (shallowest) position was observed on the riverbank with lowest limit habitat of ferns. Difference between the varieties regarding these habitat situations was not observed, *C. crispatula* var. *albida* TRK-YW seems to be in portions with a relatively swift flow and a dark part. A reduction of these habitats is expected due to the riverbank revetment work for a road expansion.

Plants

Although these two *Cryptocoryne* mainly grow leaves and flower during the emergent situation, it was seen that the plants had begun to grow with the narrow terete leaves and young leaves with an undulating margin in a submerged condition (**Figure 6**). The colour of the younger submerged leaves often appears somewhat reddish. Typical submerged leaves like those found in e.g., *C. crispatula* var. *balansae* (Gagnep.) N.Jacobsen were not found. The leaf length, excluding extremely long leaved plants, is around 40

cm, and length difference between the two varieties was not observed.

The majority of the *Cryptocoryne* were situated as separate patches of each variety. However, intermingled patches formed by runner propagation were frequently observed, and there were situations where the spathe of the two varieties were observed as a mosaic.

Even in such a mosaic situation, plants which could be hybrids were not immediately recognized. But according to the observations at Chiang Khan and Don Khon in the Champasak Province in southern Laos (Idei et al. 2017; Jacobsen et al. 2016), hybrids should no doubt there, but either they were not observed, or we have been unable to distinguish them as hybrids.

The investigation was not focused on spotting possible hybrids, and the plants were assigned to either var. *albida* or var. *yunnanensis*, but a checking of the photographs taken during the investigation indicates that hybrids may very well have been present, but without being recognized at first glance. The spathe pictured in **Figure 9 E & F** may represent such hybrids with a var. *yunnanensis* coiled spathe limb but with var. *albida* spotting on the limb surface. As hybrids between the *C. crispatula* varieties are fertile, backcrosses and the eye-catching red-purple markings may have blurred our vision.

REFERENCES

- Idei, T., J.D. Bastmeijer & N. Jacobsen 2017. Stories from the Mekong, part 2: The *Cryptocoryne* (Araceae) habitats in the Chiang Khan district, Loei province, Thailand. - Thai Forest Bulletin (Botany) 45(1): 58–78. DOI: <https://doi.org/10.20531/tfb.2017.45.1.10>
- Jacobsen, N., J.D. Bastmeijer, C. Christensen, T. Idei, C.A. Lange, J. Orabi, D. Sookchaloem, F. Toneato & M. Oergaard 2015. The use of AFLP markers to elucidate relationships within *Cryptocoryne* (Araceae). *Aroideana* 38E(1): 186–193.
- Jacobsen, N., J.D. Bastmeijer, J. Bogner, H. Budianto, H.B. Ganapathy, T. Idei, I.B. Ipor, T. Komala, A.S. Othman, R. Rosazlina, J. Siow, S. Wongso & M. Ørgaard 2016. Hybrids and the Flora of Thailand revisited: Hybridization in the Southeast Asian genus *Cryptocoryne* (Araceae). Thai Forest Bulletin (Bot.) 44(1): 53–73. <https://li01.tci-thaijo.org/index.php/ThaiForestBulletin/article/view/53374>
- Jacobsen, N., T. Idei, & D. Sookchaloem 2012, '11. *Cryptocoryne*', In: Boyce, P, D. Sookchaloem, W.D.A. Hettterscheid, G. Gusman, N. Jacobsen, T. Idei, & N.V. Du 2012, 'Flora of Thailand, Acoraceae & Araceae', Vol. 11, 2, s. 218–232 & Plates XLV-LVIII.
- Li, H., Y. Shiao & S. Tseng 1977. Claves diagnosticae et taxa nova Aracearum Sinicarum. *Acta Phytotaxonomica Sinica* 15(2): 87–109, plates 6 & 10.
- Li, H. 1979. Araceae, pp. 733–838. In CY. Wu, ed., *Flora Yunnanica* 2. Sci. Press, Beijing.
- Li, H. & N. Jacobsen 2010. *Cryptocoryne*. In: CY Wu & PH Raven, ed. *Flora of China* vol. 23: 20–22. Sci. Press, Beijing.