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## *Cryptocoryne sivadasanii* (Araceae), a new species from India

### Abstract

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Plants from Kerala and Karnataka, SW India, which have been identified hitherto as *Cryptocoryne consobrina*, are recognized as a distinct, unique new species. It is described as *C. sivadasanii*, illustrated and its relationship is discussed.

### Introduction

The genus *Cryptocoryne*, with about 50 species, is distributed in tropical mainland Asia and the Malesian Archipelago (Mayo & al. 1997). In India five species have been recognized hitherto. The genus is characterized by a small spadix included in the basal tubular portion of the spathe, called a kettle. The female flowers are few in number and arranged in a single whorl, forming a syncarp. The male flowers have two horn-like tubular projections at the top of the anther.

During the course of the revisionary study of the *Araceae* of India in general and a detailed taxonomic survey of the genus *Cryptocoryne* of S India in particular, some specimens were collected from the Kerala and Karnataka states, which have been referred to *C. consobrina* Schott (Sivadasan 1985, Jacobsen & al. 1989). Observed differences from typical *C. consobrina* were thought to be due to environmental factors. Later Bhat (2003) identified the plants from Karnataka as *C. crispatula* Engl., of which they differ, however, in several characters. The dispute about the taxonomy of the S Indian plants prompted their detailed study, which finally revealed that the plants in question represent a new species so that India now has six species of *Cryptocoryne*.

### *Cryptocoryne sivadasanii* Bogner, **sp. nova**

Holotypus: India, Kerala, Malappuram Distr., stream-bed in Vallamthodu (south of the Calicut University Campus), 2.2.2004, *Sivadasan & Kiran Raj CU 21595* (CAL; isotypi: K, M, MH) – Fig. 1-3.

Differt a *Cryptocoryne consobrina* laminis foliorum angustissimis linearibus, 40-130 cm longis et 0.3-0.6 cm latis (in *C. consobrina* 1.5-2.5 cm latis), lamina spathae torta et recurva cum collo, stigmatibus sessilibus, corpusculis odoriferibus obconicoideis supra applanatis, seminibus plusminusve ellipsoideis, testa plusminusve laevi vel leviter punctata.

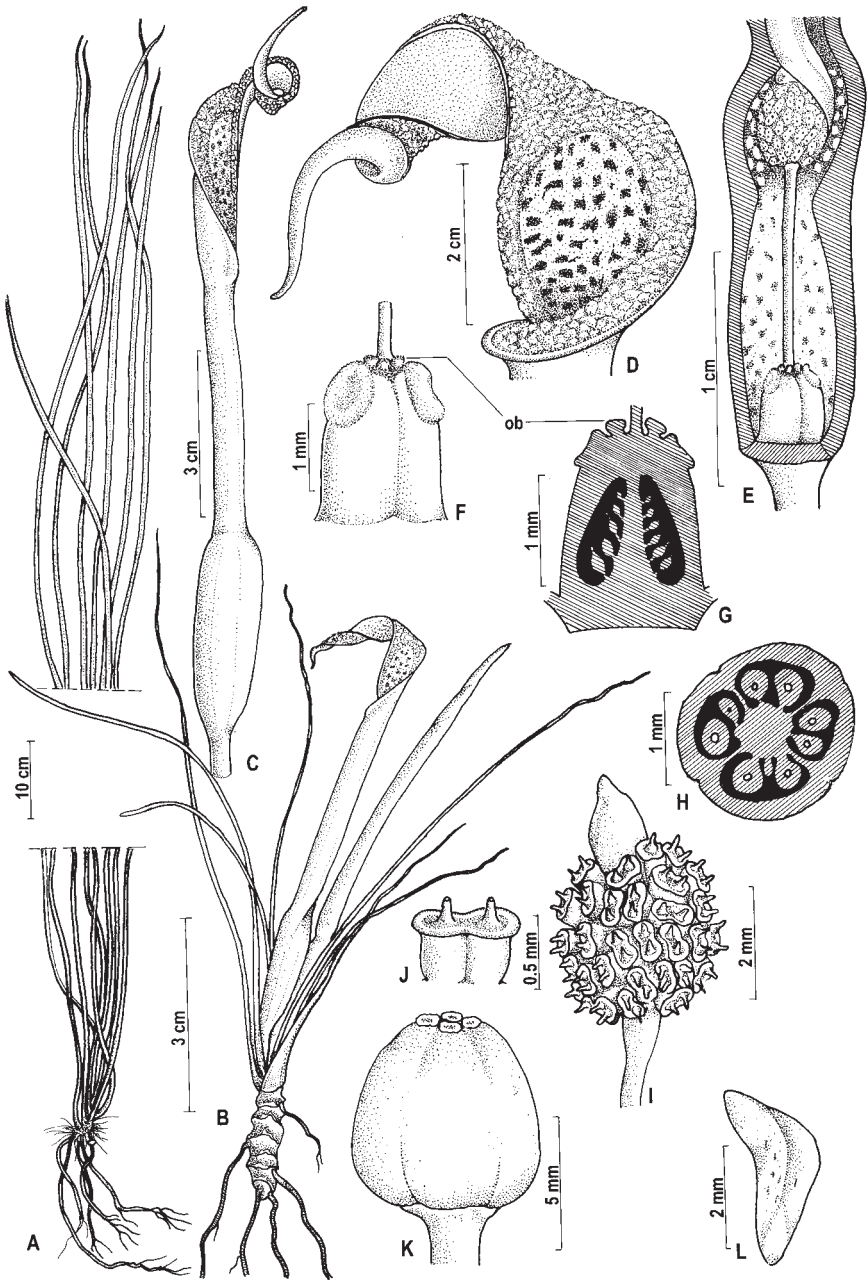


Fig. 1. *Cryptocoryne sivadasanii* – A: habit of submerged plant with long slender leaves; B: habit of emerged plant with reduced leaves and inflorescences; C: inflorescence; D: limb of spathe showing collar; E: kettle of the inflorescence with spathe partly removed showing the spadix and the alveolae in the upper part of the kettle; F: female flowers; G: longitudinal section of syncarp with olfactory bodies (ob) surrounding the base of the sterile interstice; H: cross section of syncarpium; I: male portion of the spadix with appendix; J: single male flower; K: infructescence; L: seed.

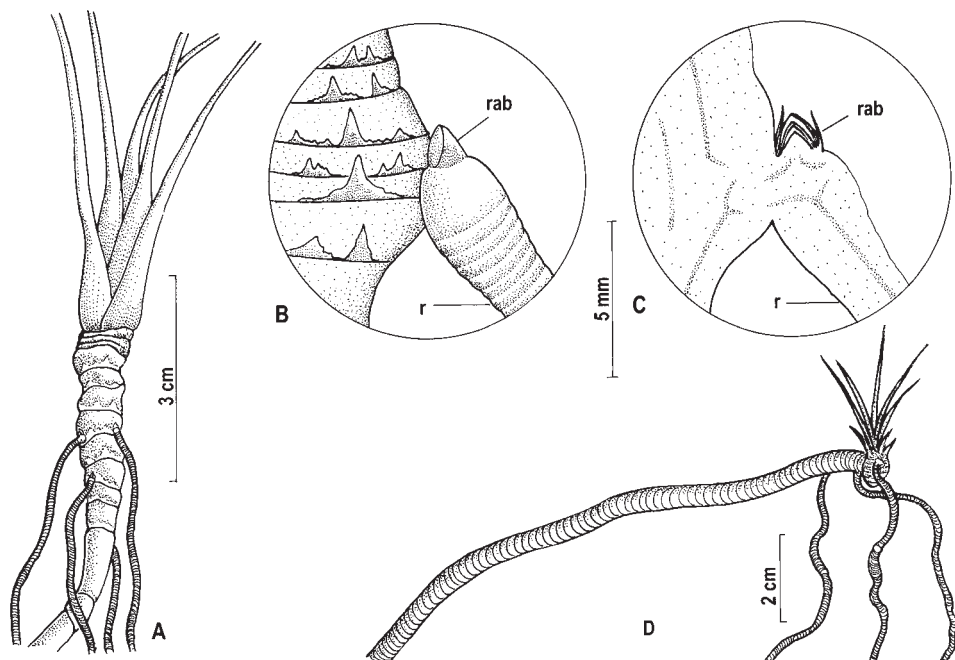


Fig. 2. *Cryptocoryne sivadasanii* – A: basal portion of a plant showing contractile roots; B: part of a rhizome with intravaginal squamules and of a root (r) with root-associated accessory bud (rab); C: longitudinal section through part of a rhizome and a root with root-associated accessory bud; D: part of a contractile root with a plantlet produced from the root-associated accessory bud.

Rhizomatous perennials, rhizome 3–8 cm long and 0.4–0.7 cm in diam., up to 8 cm deep in the soil, often with transverse nodal ridges; roots of first order 2–3 mm in diam., second order roots thinner, 0.2–0.6 mm in diam. *Leaves* several, the submerged ones very long, the emerged ones short without normal blades; petiole 10–32 cm long and 0.12–0.2 cm in diam., sheath 3–10 cm long, lower part (below soil) white, upper part green; leaf blade (30–)40–130 cm long and (0.3–)0.4–0.6 cm wide, linear, tip apiculate, margin entire, sometimes (when not fully submerged) undulate to wavy, olive to purplish green, without clear demarcation between blade and petiole; midrib light green, not very pronounced, lateral veins inconspicuous, 2–3 on each side of the midrib. *Peduncle* 0.5–2(–4) cm long and 0.25–0.35 cm in diam. *Spathe* (4–)7–14.5 cm long; kettle 1.5–2.8 cm long and 0.6–0.8 cm in diam., somewhat constricted below the male portion, white at base and purplish above inside, with small depressed translucent pits (alveolae) around the male portion; tube between kettle and limb (1.5–)2.8–6 cm long and (0.3–)0.4–0.6 cm in diam., with purplish spots inside; limb (1.5–)2.5–4.5 cm long and 0.8–1 cm broad at base, ovate, acuminate, tip spirally twisted and recurved, warty inside, its colour varying from yellowish green to purplish, reddish brown, bluish green or cream, mostly with purple spots; collar present at base of the limb, warts present on the limb above the collar (collar not discernible when dry). *Spadix* 15–28 mm long, the basal female portion 4–5 mm long, the naked slender interstice (axis of spadix) 5–10 mm long, the male portion ellipsoid to globular, 2–4 mm long and 2–2.2 mm in diam., with (40–)54–80 male flowers, the terminal, short elongate-conoid appendix 1.25–1.5 mm long. *Flap* elliptic, c. 3 mm long and 2 mm wide, whitish. *Male* flowers consisting of one stamen only, c. 0.5 mm long and 0.3–0.4 mm wide (viewed from above), with a conspicuous rim at the top and two bilocular thecae, each with a tubular horn, opening apically by a small pore. *Female* flowers 3–4(–6), c. 4 mm high, connate in a whorl; stigma sessile, 0.6–0.8 mm in diam., round, with slight depression in the centre, covered

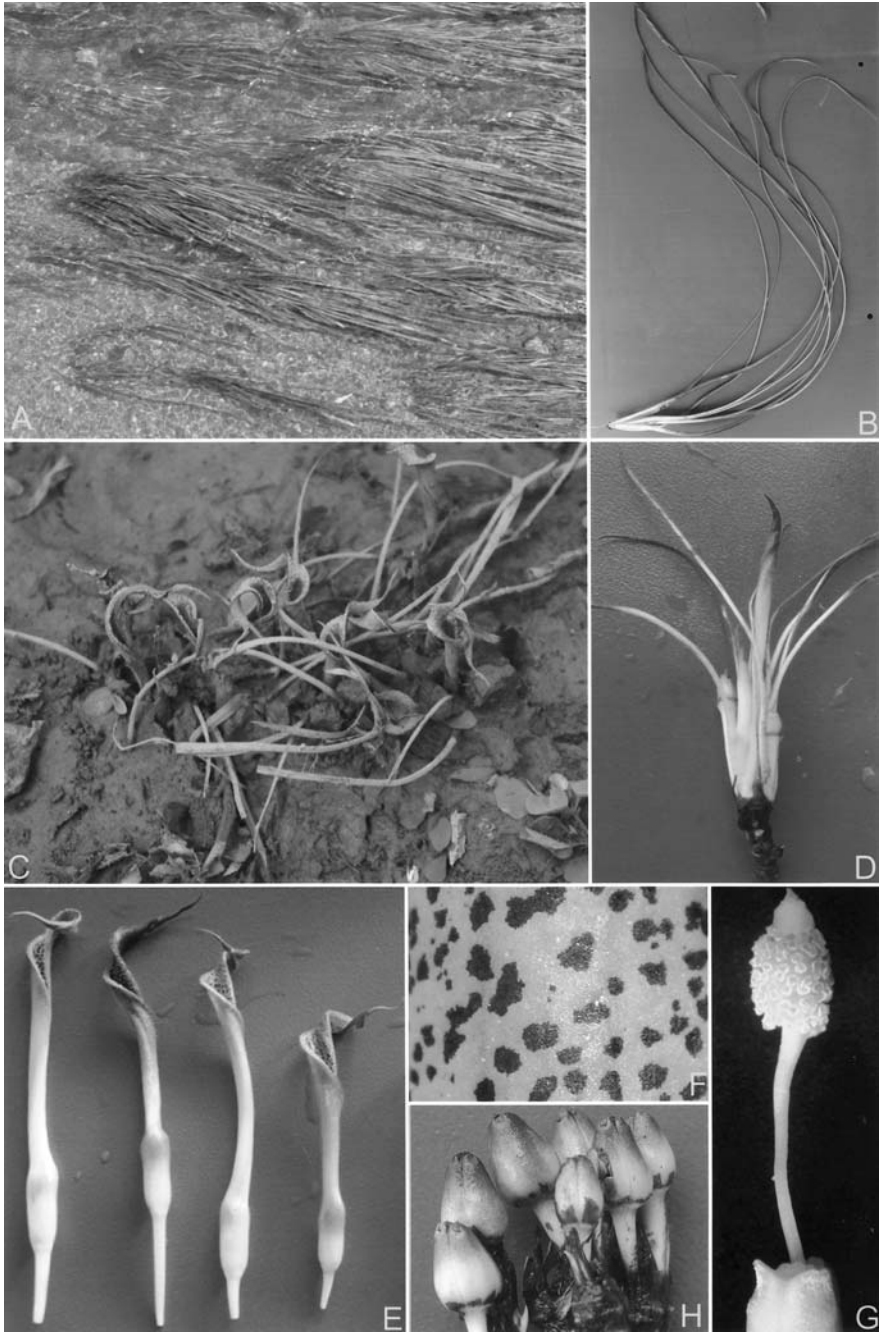


Fig. 3. *Cryptocoryne sivadasanii* – A: habit of submerged plants in a stream; B: single submerged plant taken out; C: dry stream bed with inflorescences and reduced leaves; D: plant with inflorescence and two young infructescences; E: inflorescences showing variation in size and form of the spathe limb; F: portion of the inner wall of the upper spathe tube showing purple spots; G: spadix; H: infructescences (not fully mature).

with short papillae; each ovary with 10-14 ovules; olfactory bodies usually 4, rarely to 6, obconoid with a rough and flat top, each 0.3-0.4 mm long and 0.5-0.75 mm in diam., situated just above the female flowers and alternating with the stigmas. *Infructescence* ovoid, 10-18 mm long and 9-12 mm in diam. *Seeds* 5-8 per ovary, more or less ellipsoid, somewhat irregularly angled by pressure of the neighbouring seeds, 3.5-4 mm long and 1.5-1.75 mm wide, brownish; testa more or less smooth or finely punctate, not ribbed; embryo elongate, 1.5-2 mm long and 0.3-0.4 mm in diam.; endosperm copious, white, c. 0.4 mm thick.

*Chromosome number.* –  $2n = 36$ , counts based on *Bogner 1846* (pers. comm. G. Petersen, Copenhagen).

*Distribution.* – Endemic to Kerala and southwestern Karnataka. Only few localities are known, some near the Calicut University Campus in Malappuram District, Kerala State, and one in Padubidri between Mangalore and Udupi in the southern Kanara District, Karnataka State.

*Further specimens examined.* – KERALA STATE: Malappuram Distr., Thenjhipalam, Vallamthodu on the southern side of the Calicut University Campus, 23.10.1976, *Sivadasan CU 19160* (vegetative with leaves only) (CALI); *ibid.*, 14.3.1981, *Sivadasan CU 21479* (with inflorescence) (CALI); *ibid.*, 14.3.1981, *Sivadasan CU 21480* (with inflorescence) (CALI); *ibid.*, 25.11.1986, *Bogner 1846* (B, K, M, US) [with leaves and only with buds of inflorescences]; Malappuram Distr., small stream 1 km south of Calicut University Campus, alt. c. 45 m, 22.12.1993, *C. D. K. Cook & M. Camenisch 5224* (Z); Malappuram Distr., small roadside stream, c. 6 km south of Calicut University Campus, alt. c. 20 m, 20.11.1993, *C. D. K. Cook & M. Camenisch 5222* (Z); Kozhikode Distr., Ramanattukara, near the junction of the National Highway-17 bye-pass and the road to Kondotty, near sea level, small stream with granite block walls and gravel or laterite base, 3.12.1993, *C. D. K. Cook & M. Camenisch 5321* (Z). — KARNATAKA STATE: S Kanara Distr., Padubidri (between Mangalore and Udupi), 30.1.2004, *Sivadasan CU 21594* (CALI).

*Pollination.* – Very small black flies (c. 0.9 mm long and c. 0.5 mm diam.) of the family *Sphaeroceridae* were observed as the pollinators of *Cryptocoryne sivadasanii*. The flies were captured in the kettles.

*Ecology.* – *Cryptocoryne sivadasanii* grows in lateritic soil with gravel in the running water of stream beds. The water at the type locality has a pH of 5-5.4. At Padubidri in Karnataka it grows in a sandy bed with gravel and in the Kozhikode District also in the crevices of granite blocks in the lateritic stream bed. Inflorescences are produced during the dry season only, when the water recedes and the stream bed runs dry. Flowering of the plants has been observed from December until March. Commonly associated species in the Calicut area are *Blyxa aubertii* Rich. and *Schoenoplectus articulatus* (L.) Palla.

*Eponymy.* – *Cryptocoryne sivadasanii* is named in honour of Prof. Dr M. Sivadasan from the Calicut University, Kerala, who discovered the species several year ago and made many valuable observations in the natural populations.

*Propagation.* – The propagation of the plants in normal mode is by seeds. Besides, in *Cryptocoryne sivadasanii* a peculiar mode of vegetative propagation has been observed and the details were described by Jacobsen & al. (1989) under *C. consobrina*. The root-associated accessory buds (Fig. 2B, C) are the propagules in this peculiar mode. When the roots become detached from the rhizome by mechanical means, the root-associated accessory bud located at the junction of the root with the rhizome will also get detached. If these roots along with the accessory buds become dispersed to new locations with favourable conditions, the buds start growing and may get established as a new plant.

Usually *Cryptocoryne* species have vegetative propagation by subterranean stolons. But in *C. sivadasanii* stolons are only rarely seen. Another unusual vegetative propagation has been noted in *C. elliptica* Hook. f. from Malay Peninsula where buds are present at the base of easily breaking off leaf petioles, but this species is not related to the new species described here (Jacobsen & al. 1989).



*Relationship.* – *Cryptocoryne sivadasanii* is related to *C. retrospiralis* (Roxb.) Fisch. ex Wydler and *C. consobrina*. These three species, plus *C. crispatula* Engl., *C. albida* R. N. Parker and probably *C. cruddasiana* Prain belong to one group. *C. retrospiralis* has a wide distribution in India and *C. crispatula* from Thailand, Laos and Vietnam to S China; *C. albida* is known from Thailand and Myanmar (Burma), while *C. cruddasiana* only from N Myanmar.

*Cryptocoryne sivadasanii* has previously been referred to *C. consobrina* based on the similarities in inflorescence characters. The latter species, however, differs in several characters. The flowers of *C. consobrina* appear contemporarily with the leaves, and the leaves are dimorphic, with linear-lanceolate, 16-20 cm long emerged leaf blades and up to 40 cm long submerged ones (Fischer 1936, Wit 1983, 1990). With the onset of the monsoon after the streams are flooded, in *C. sivadasanii* leaves appear that are linear and reach a length of c. 160 cm with blades up to 130 cm long. The inflorescences appear when the stream beds run dry during the summer and the leaves have been wilted. Contemporarily with the inflorescence then leaves develop that are rather inconspicuous, short, thick, bladeless, terete, with pointed tips and basal sheaths, and are best interpreted as cataphylls.

Among the above mentioned species, *Cryptocoryne sivadasanii* is the only one in which the flowering is not contemporary with the (normal) leaves and which has a dormant stage in the dry season after flowering. The others are, as usual in *Cryptocoryne*, evergreen. Only *C. nevillei* Hook.f. from Sri Lanka (Ceylon), which is not among the related species, also has a dormant stage, but it flowers at the beginning of the rainy season before the leaves appear or contemporarily with the first leaves.

*Cryptocoryne sivadasanii* has a distinct collar at the base of the spathe limb as is also the case in *C. consobrina*, and in both species the limb is warty on the surface. In *C. retrospiralis* the spathe is without a collar and the limb is smooth and spirally twisted many times, whereas only twisted once or twice and recurved in *C. sivadasanii*. Furthermore, the kettle is thickened just below the male portion and alveolar at the upper portion in *C. sivadasanii* and *C. retrospiralis*, but not thickened and not alveolar in *C. consobrina*. The stigma is completely sessile in *C. sivadasanii*, but subsessile with a very short, bent style in *C. consobrina*; a style is clearly present in *C. retrospiralis*. *C. consobrina* has multi-ovuled ovaries, *C. sivadasanii* 10-14 ovuled ovaries. It also seems that *C. sivadasanii* has fewer male flowers than the other two species mentioned above, but the number of male flowers is often variable. *C. sivadasanii* has the narrowest (not more than 6 mm wide) and longest leaf blades; *C. consobrina* and *C. retrospiralis* have broader and comparatively shorter leaf blades. Furthermore, *C. retrospiralis* produces reduced, terete leaves where the blade consists of the middle vein only at a certain period; this was also observed in certain *C. crispatula* varieties. In *C. cruddasiana* the spathe limb is also warty, the kettle is alveolar in its upper inner part and the leaf blade is linear (0.5-1 cm wide), but the olfactory bodies are irregularly lobed.

*Cryptocoryne sivadasanii*, *C. retrospiralis*, *C. crispatula* and *C. albida* all have a chromosome number of  $2n = 36$ . In addition, from *C. retrospiralis* tetraploid plants with  $2n = 72$  chromosomes, and from *C. crispatula* triploid plants with  $2n = 54$  are also known. The chromosome numbers may support a close relationship of these species. However, other, very different and not related species from Sri Lanka (e.g. *C. thwaitesii* Schott) and Sarawak (e.g. *C. lingua* Engl.) also have a chromosome number of  $2n = 36$  (Arends & al. 1982). The chromosome numbers of *C. consobrina* and *C. cruddasiana* are unknown; they have never been in cultivation and therefore were never counted.

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