301

Notes on Cryptocoryne of Sri Lanka (Ceylon)

Niels Jacobsen

Jacobsen, N. 1976 06 30: Notes on Cryptocoryne of Sri Lanka (Ceylon). *Bot. Notiser 129*: 179–190. Stockholm. ISSN 0006-8195.

Fourteen species of *Cryptocoryne* (Araceae), all endemic are known from Sri Lanka. The investigation of herbarium material at Peradeniya (PDA) and material available in Europe has led to the revision of the interpretation of *C. nevillii* Trim. ex Hook. f., *C. willisii* Reitz and *C. undulata* Wendt. Karyologically the species fall into two groups, one with 2n=28 or 42 and the other with 2n=36. A taxonomic grouping of the species is suggested, and the evolutionary aspects are briefly discussed.

Niels Jacobsen, Institute of Systematic Botany, University of Copenhagen, Gothersgade 140, DK-1123 Copenhagen K, Denmark.

Species of *Cryptocoryne* from Sri Lanka have been popular in Europe as aquarium plants for the past 70 years, and there is an ever-increasing demand for new plants for cultivation. The identification of these imported plants has always been problematic. Herbarium specimens of *Cryptocoryne* are few and are often in poor condition. Plants were exported to Europe and cultivated, sometimes for a period of years, before it was realized that they represented new species. For instance, the importation of two Sri Lanka species, *C. willisii* Reitz and *C. undulata* Wendt, to Germany around 1905 caused considerable confusion as they later proved to be new species. The number of species known to Sri Lanka continued to increase considerably in the course of the years. Schott (1857) described the first two species: *C. walkeri* and *C. thwaitesii*. Thwaites (1864) recognized two species: *C. spiralis* and *C. thwaitesii*. Hooker (1898) in Trimen, Handbook of the Flora of Ceylon, mentioned five species: *C. spiralis, thwaitesii, nevillii, walkeri,* and *beckettii*. In 1908 Reitz described *C. willisii* Reitz, a name that antedates the widely used *C. willisii* Engl. ex Baum (1909). The latter is in actual fact conspecific with *C. undulata* Wendt. Engler's conspectus in Das Pflanzenreich (1920) includes four species from Sri Lanka: *C. thwaitesii, walkeri, beckettii,* and *nevillii*. His descriptions of the last three species are based on plants cultivated at Peradeniya (RBGP). Engler's descriptions can only be interpreted with difficulty, but I am of the opinion that the plants described as *C. beckettii* and *C. nevillii* are in actual fact *C. undulata* and *C. willisii* Reitz respectively, whereas I am not able to refer the description of *C. walkeri* to any species I know. It is almost certain that the two species cultivated in the Botanical Garden in Berlin-Dahlem after 1905 (e.g. Baum 1909 b), viz. *C. willisii* Reitz and *C. undulata,* were collected by Engler on his travels in Asia in 1905. Petch (1928) treated the Sri Lanka species on the basis of live material seen by him. He was able to establish that five, possibly six, species had recently been collected, but found it difficult, with the exception of *C. thwaitesii,* to assign them to species previously described from the island. Alston (1931) described two new species, *C. petchii* and *C. lutea,* and one variety, *C. lutea* var. *minor*. Wendt (1955 a) described *C. undulata*. De Wit described five species during the period 1958–1975: *C. lucens, parva, wendtii, legroi,* and *alba*. De Wit 1971 is illustrated with drawings of all the species of *Cryptocoryne* rec-

ognized by him. Rataj (1975 a) revised the genus *Cryptocoryne* and described *C. bogneri* and four varieties of *C. wendtii.* Unfortunately he did not see the type material at Peradeniya. Rataj's statement that *C. walkeri, beckettii,* and *nevillii* were described on the basis of plants cultivated at Peradeniya is based on an incorrect translation of Engler's notes in Das Pflanzenreich. In all, 14 species and 5 varieties have been described from Sri Lanka.

During a stay in Sri Lanka in March, 1975, the author collected live specimens of *Cryptocoryne* and also studied the material in the Herbarium at Peradeniya (PDA). This, together with observations on material available in Europe, led to some nomenclatural and taxonomic revisions.

Data on each species are presented below in order of publication.

Cytological preparations were made from root tips according to Jacobsen (1957).

Voucher specimens of the chromosome counts are deposited at C. Photographs of the Peradeniya plants are also at C.

Cryptocoryne walkeri Schott – Fig. 3 B

Schott, Bonplandia 5: 221 (1857). Holotype: Walker 288 (K). Drawing at W.

C. lutea Alston var. *minor* Alston in Trimen, Handb. Fl. Ceyl. 6: 293 (1931. Type: Silva, Halloluwa 18.2. 1925 (PDA, 3 sheets).

The holotype of *C. walkeri* consists of a single spathe which is somewhat folded. Unless this is dissected it will not be possible to establish with certainty whether the interpretation by Petch (1928 p. 22, and pl. IV. fig. 5–8) and De Wit (1971 p. 202, Abb. 69 r) as well as in this paper is indeed correct. When describing *C. lutea* Alston apparently had not seen the type of *C. walkeri.* His concept of *C. walkeri* (Alston 1931, 1938) is based on one of his own collections (Alston no. 1386) which is actually *C. undulata.*

Rataj (1975 a) reduced *C. lutea* and *C. legroi* to varieties under *C. walkeri.* Obviously *C. lutea* and *C. legroi* are very close, whereas I believe that *C. walkeri* is more distantly related to these two. The collar of the spathe is small, distinct, and swollen in *C. lutea* and *C. legroi,* but there is a large and indistinct collar zone in *C. walkeri.* The type of *C. lutea* var. *minor* agrees with *C. walkeri* in this respect. When illuminated with ultraviolet light at 350 μm the broad collar zone of *C. walkeri* shows a dark, reddish-brown colour and the limb is yellowish. In *C. lutea* the collar and the limb show the same yellowish colour when illuminated with ultraviolet light at 350 μm.

The chromosome number is 2n=28 (vouchers: P 1965/337 cult.; NJ 2913 cult.).

Cryptocoryne thwaitesii Schott – Fig. 3 E

Schott, Bonplandia 5: 221 (1857). Holotype: Ceylon Plants (C.P.) 3464, sine loc. (K). Drawing at W. Two isotypes at PDA, one of them marked: C.P. 3464, May 1855, Singhe Raja Forest.

There are two other collections at PDA: Kottawa Forest, near Galle, April 1884; Alston, Kottawa Forest Reserve 17.8. 1926.

The interpretation of Petch (1928) and De Wit (1971) [excl. *C. dalzelii* Schott] is no doubt correct. De Wit (1971) and Sadilek (1969) show the limb as upright whereas in the plants I collected at Kottawa the limb was bent forward at an angle of 90° or more so that the tip reached the ground. Plants from Kottawa grown in Copenhagen sometimes developed spathes that failed to bend, curving only slightly like the one illustrated by De Wit. Rataj (1975 a, c) illustrates a spathe with an upright limb and twisted differently in the throat region and with far fewer red spots than in the plants from Kottawa. Rataj's specimen may in actual fact not belong to *C. thwaitesii* s. str. At Kottawa *C. thwaitesii* grew emersed along a small stream in deep shade.

Rataj's statment (1975 a, pp. 57–58) that *C. thwaitesii* is related to the Malaysian species is ill founded. There is a superficial resemblance to *C. johorensis* Engl. and *C. longicauda* Becc. ex Engl. (?=*C. caudata* N. E. Brown), but the texture of the leaf is quite different and the collar is lacking in *C. thwaitesii.* The chromosome number for *C. thwaitesii* is 2n=36 (voucher: NJ 14-1 Kottawa), the same as for *C. bogneri* and *C. alba,* whereas the Malaysian species probably belong to the 2n=34 group.

Cryptocoryne beckettii Thw. ex Trim. – Fig. 2 E

Trimen, Journ. Bot. 23 p. 269 (1885). Holotype: Beckett, Matale East, Feb. 1865. C.P. 3868, number not Beckett's (PDA).

There are 10 other sheets at PDA: Kailla 1.6. 1866; van Buuren, Gangaruwa Village 24.3. 1919 (maybe duplicate at K); RBGP 21.9. 1921 a. Gangaruwa "A"., b. Heedeniya "A"; Silva, Gangaruwa 29.1. 1925 (two sheets); Petch, brought from Gangaruwa "A" 11.2. 1925, cult. RBGP; Silva, Halloluwa 18.2. 1925; Alston 1384, brought from Halloluwa by H. L. van Buuren, cult. RBGP 5.10. 1925; Alston 1385, brought from Gangaruwa "A", cult. RBGP 11.5. 1926; Silva 206, Gangaruwa 3.12. 1927 (dupl. at K). Another sheet at PDA labelled *C. "beckettii"*, Kahata-ata-hela, Jan. 1888 is *C. wendtii*.

The interpretation of the holotype, one immature spathe, and one mature kettle, presents considerable difficulties. The leaves are large and of a kind which I have only seen in plants matching *C. beckettii* sensu Petch (1928). Petch's study was partly based on live material and his interpretation of *C. beckettii*, which was followed by Wendt (1953 b, 1955 b), De Wit (1971), and Rataj (1975 a), is probably correct.

The shape of the limb varies to some extent, as do the leaves cf. *C. petchii)*.

I have found this species at Kegalla and Halloluwa and in both places it grew in shady, sheltered places along the river.

The chromosome number is 2n= 28 (vouchers: NJ 23-19 Halloluwa; Jayasuriya 2246, Menik-Ganga, Ruhuna National Park).

Cryptocoryne nevillii Trim. ex Hook. f. – Fig. 1

Hook. f. in Trimen, Handb. Fl. Ceylon 4 pp. 346–347 (1898). Holotype: Grukamana Tank, Wawinni, Nov. 1885 (PDA). A fragment of the type is at K.

The holotype is a rather poor specimen with only a few leaves although four mature spathes exist. I have seen only one other specimen which I assign to this species: Kundu & Balakrishnan 185, Batticaloa 11.10. 1970 (PDA, US). Other specimens cited in various publications are mostly *C. willisii* Reitz, *C. parva* and *C. lucens*. The localities given by Rataj (1975 a) are thus erroneous. *C. nevillii* has only been found in the Eastern Province and has not yet been cultivated in Europe.

Two species of *Cryptocoryne* were brought from Sri Lanka to Europe around 1905 and have been cultivated ever since. Reitz (1908) referred one of them to *C. beckettii* and described the other as a new species, *C. willisii* Reitz. Baum (1909 a, b), who had probably seen the same material, unfortunately switched the names. Wendt (1958) does mention that Baum switched the names, but he is not aware of the publication of *C. willisii* Reitz. Unfortunately Reitz's publication was overlooked, and *C. willisii* Engl. ex Baum became established as the name of the species which must be called *C. undulata* Wendt Later on *C. willisii* Reitz (*C. beckettii* sensu Baum 1909 a, b) was referred to *C. nevillii* (Böhmer 1935, Wendt 1953 a, De Wit 1971 and Rataj 1975 a). A comparison between these "European *C. nevillii*" and the type of *C. nevillii* Trim. ex Hook. f. in PDA showed that they are different species. Petch (1928 p. 238) may partly be held responsible for the establishment of the erroneous interpretation of the cultivated plants. He illustrated some plants collected at Yatiellagala (=Kulugamman) and Halloluwa (Pl. V), and referred them to *C. nevillii*, later (p. 25), however, adding that "until the type has been matched by fresh specimens it is not certain that the recent Yatiellagala plant is *C. nevillii*". Petch did not succeed in obtaining fresh specimens from the type locality.

The material illustrated by Petch (1928 Pl. V) is heterogeneous. The specimens in Fig. 7 and 11 are apparently *C. parva* and those in Fig. 9 and 10 probably *C. willisii* Reitz or *C. lucens*.

The following description of *C. nevillii* Trim. ex Hook. f. is based on Kundu & Balakrishnan 185: Rhizome stout, branched, stolons absent in the herbarium specimens. Leaves 15–20 cm, green, apparently without purple; lamina up to 7×1.5 cm, lanceolate, broadest below the middle or obovate and then shorter; margin with a border of hyaline cells; petiole up to 10 cm, rather broad, flat, and whitish. Spathe very long, up to 23 cm; tube narrow, whitish; limb 3 cm, purple, bent somewhat backwards, more or less smooth; collar very prominent, 0.5 mm high, dark purple; kettle without alveolae in the wall. The exact shape and colour of the limb are difficult to ascertain. Male flowers 80–100, smooth. Female flowers 5–6, small, slender, with divergent ovate stigmas which are rather flat and not sunken in the centre.

The plant is characterized by the lanceolate leaves the lower ones of which are obovate, and by the spathe which far exceeds the leaves. The herbarium specimens suggest that the whole petiole has been subterranean. It is possible that this species withers during the dry Yala season (April–September) to emerge again and flower when the rains come. This may be the reason for the poor state of the holotype, which

may have been collected just at the beginning of the season when only a few leaves and some spathes had emerged. The note by Trimen cited by Hooker (1898 p. 347) "Only the tip of the spathe protruded above ground" may be entirely correct.

Professor De Wit, Wageningen, who has kindly read the manuscript, is of the opinion that *C. nevillii* Trim. ex Hook. f. and *C. willisii* Reitz are conspecific, and that the latter is a synonym of the former. At the present state of knowledge I believe, however, that they are best retained as separate species.

Cryptocoryne willisii Reitz non Engl. ex Baum – Fig. 2 A

Reitz, Wochenschrift für Aquarien- und Terrarienkunde, Sept. 29th 1908, p. 523. The name is typified by the description and the photograph on p. 523 and Fig. 4 left.

C. nevillii auct. non Trim. ex Hook. f.

There are two other sheets at PDA which may represent this species but they are sterile: van Buuren, Kulugamana no. 2 (Yatiellagala) 18.2. 1925; Silva, brought from Kulugamana (no. 2), cult. RBGP 10.10. 1925.

C. willisii Reitz has been cultivated in Europe under various names, and for the last 25 years as *C. nevillii* auct.

The following description is based on a plant received from Dansk Akvarieforening in 1914 and cultivated in the Botanical Garden in Copenhagen since then (P 1914/114): Leaves up to 20 cm long, lamina green, acutely ovate to lanceolate, 3–7 cm long and 1.0–1.5 cm wide; veins not prominent; petiole 6–12 cm long, green, often somewhat purple-brown at the base. Spathe 5–10 cm, densly speckled-blotched with red-brown; kettle 1 cm, mostly whitish; limb c. 2 cm, purple, papillose, upright and slightly twisted above; collar present, yellowish with a more or less purplish rim, towards the throat abruptly changing to purple. The yellowish collar can sometimes be purplish. Male flowers 40–60. Female flowers c. 5; stigma oval, sunken in the centre. Kettle wall alveolar in the upper half.

This is the same species as De Wit's (1971) illustrations and which he describes as *C. nevillii*.

The chromosome number is 2n=28 (vouchers: P1914/114 cult.; P 1966/353 cult.).

Cryptocoryne lutea Alston – Fig. 3 A

Alston in Trimen, Handb. Fl. Ceylon 6 p. 293 (1931). Lectotype (selected here): Silva, Kulugammana (Yatiellagala) no. 1, 2.10. 1925 (PDA).

At PDA there are five other specimens: van Buuren, Kulugammana no. 1, 18.2. 1925 (sterile); Silva, brought from Kulugammana no. 1, 5.10. 1925; Alston 1703, cult. RBGP 21.2. 1928; Alston 253, brought from Kulugammana no. 1, cult. RBGP 29.3. 1926 (dupl. at K) – erroneously indicated as isotype by Rataj (1975 a); RBGP cult. 18.1. 1928.

Alston (?) marked two sheets (PDA) *C. lutea* var. *minor:* Silva, Halloluwa 18.2. 1925. There is no doubt that these two sheets are part of the collection labelled *C. walkeri* by Petch (1928) and illustrated. One other sheet from the same collection, also labelled by Petch, has not been marked in any way by Alston. All three sheets are *C. walkeri*.

I do not share Rataj's opinion that *C. lutea* is a variety of *C. walkeri*. I have seen some specimens of *C. lutea* with a yellow limb and some with a green limb. and the tube can be yellow or densely purple-spotted.

This species grows along the river at Halloluwa in open sunny places as well as in shade, well sheltered from strong currents.

The chromosome number is 2n=28 (vouchers: NJ 2767 cult.; 1963/629 cult.; NJ 23-1 Halloluwa; NJ 23-6 Halloluwa).

Cryptocoryne petchii Alston – Fig. 2 F

Alston in Trimen, Handb. Fl. Ceylon 6 p. 293–294 (1931). Holotype: Petch, brought from Ratnapura by H. L. van Buuren, cult. RBGP 31.1. 1925 (PDA).

There are three other sheets at PDA: Alston 1387, brought from Ratnapura, cult. RBGP 2.2. 1926 (?); Alston 1388, brought from Ratnapura, cult. RBGP 29.3. 1926; Alston 1684, Hakkinda 14.11. 1927.

The plant described by Petch (1928 p. 22) as *Cryptocoryne* sp. was later established as a new species, *C. petchii,* by Alston.

This species is very variable and is at times difficult to separate from *C. beckettii*. I do not consider that the distinguishing characters between *C. beckettii* and *C. petchii* are constant. The colour of the limb varies from brown to green, and the denticulations at the edge are often lacking. The collar varies in shape from oval to round and in colour from light purple to blackish-purple. The leaves are also very

variable. Some forms of *C. petchii* flower often, others rarely.

C. petchii is probably best regarded as a triploid of *C. beckettii,* and I assume that the *beckettii-petchii* relationship is analogous to that between diploids and triploids in *C. wendtii* coll. In *C. wendtii* diploids and triploids are also found and in my experience the greatest variation seems to be found in the triploids.

The chromosome number is 2n=42 (vouchers: P 1963/631 cult.; NJ 2847 cult.).

Cryptocoryne undulata Wendt – Fig. 2 I

Wendt, Aquarienpflanzen in Wort und Bild, Lieferung 14, leaf 267/269 (1955). The name is typified by the photographs and the protologue.

C. willisii Engl. ex Baum, Gartenwelt 13: 5–7 (1909), nom. illeg.; *C. willisii* Engl. ex Baum, Blätter für Aquarien- und Terrarienkunde 20: 7 (1909), nom. illeg.; *C. axelrodii* Rataj, Revision of the genus Cryptocoryne 69–70 (1975), nom. illeg.

There are three sheets of this species at PDA: By the Mahaweli River, Gatembe, June 1888; Alston 1386, brought from Ganaruwa B (?). This latter sheet is probably responsible for Alston's establishment of *C. lutea,* as it was his interpretation of *C. walkeri* (Alston 1931, 1938). Another sheet (sterile) from Ganaruwa, 9.1. 1925 may be Alston's original collection of no. 1386.

The name *C. willisii* Engl. ex Baum has been used in many years for this species, but has proved to be a later homonym of *C. willisii* Reitz which is a different species.

In 1955 Wendt described *C. undulata* as a new species, differing from *C. willisii* Engl. ex Baum as interpreted by him. Wendt's descriptions are difficult to interpret but I am quite sure that *C. undulata* is conspecific with *C. willisii* Engl. ex Baum (not sensu Wendt, 1958).

At the Botanisches Museum, Berlin-Dahlem, there is a pickled specimen of *C. undulata,* no. 286, Cult., Hort. Berol. Another specimen *C.* cf. *cordata* Griff. no. 288, leg. A. Engler has the date January 1906, which implies that *C. undulata,* no. 286 was also preserved around 1906. There is also a pickled specimen of *C. undulata* (P 1911/59) at C, received from Akvarieforeningen, Copenhagen, in 1911 and cultivated in the Botanical Garden. The plants, which in illustrations by Reitz (1908) and Baum (1909 a, b) were called *C. beckettii* and *C. willisii* Engl. ex Baum, respectively, are probably from the same stock as the above-mentioned no. 286 and the specimen at C probably also comes from the same source.

If new evidence some day proves that *C. willisii* Engl. ex Baum and *C. undulata* are two different taxa this would invalidate the latter, as Wendt cited *C. willisii* Engl. ex Baum as a synonym of *C. undulata,* even though he later (1955 a, 1958) added "Dem Verfasser ist ebenfalls ein Irrtum unterlaufen . . .". We would then be faced with the situation of having two taxa and no legitimate names, *C. axelrodii* Rataj being a nomen ambiguum.

I consider that the plant illustrated by Wendt (1958) as *C. willisii* Engl. ex Baum is a different species which has not yet been named. It may be conspecific with a plant I have received from Kew (K.E. no. 305–70.03945) but until I have seen more material in flower I hesitate to describe it as a new species.

De Wit (1971 p. 206) was neither able to get material of *C. undulata* nor of *C. willisii* Engl. ex Baum from Wendt and is of the opinion that *C. undulata* is conspecific with *C. willisii* Engl. ex Baum.

Rataj (1975 a p. 69) is of the opinion that *C. willisii* Engl. ex Baum and *C. undulata* Wendt are not correctly described according to the International Code of Botanical Nomenclature, and proposed a new name, *C. axelrodii* Rataj. In a short paper Rataj (1975 b) gives the reasons for considering the two names illegitimate, but does not mention the fact that *C. willisii* Reitz antedates *C. willisii* Engl. ex Baum. However, none of the arguments are correct as they are based on misinterpretations and misquotations of the Code.

I have seen *C. undulata* growing in three places west of Kandy: at Kandekenna, where it grew submersed in a very small stream; at Udamulle where in one place it had purple leaves and grew submersed sheltered between rocks in a small stream, and in another emersed below a tree and exposed to currents at high water; and at Halloluwa where it also grew below a tree and exposed to currents at high water.

The chromosome number is 2n=28 (vouchers: NJ 22-1 Udamulle E of Kegalla, Mana Oya; Kandekenna, 7°23'N, 80°25'E; NJ 23-2 Halloluwa; NJ 2825 cult.).

Cryptocoryne wendtii De Wit – Fig. 2G, H

De Wit, Meded. Bot. T. Belmonte Arb. II, 4 pp. 97–101 (1958). Holotype: H. G. D. Zewald s. n., 20.9. 1958 (WAG).

At PDA there is one sterile sheet which undoubtedly belongs to this species: Kahata-ata-hela, near Nilgala, Uva, Jan. 1888. This specimen was referred to *C. beckettii* by Hooker (1898), Petch (1928) and Rataj (1975 a).

There is no doubt that this species is from Sri Lanka although it was originally described as coming from Thailand (cf. Rataj 1975 a).

The description is quite unambiguous despite the variability of the species. The colour of the limb varies from shades of light brown to red-brown, and the twist of the limb may also vary, partly in response to environmental conditions. These characters are difficult to describe in morphological terms.

Rataj (1975 a) distinguished five varieties of *C. wendtii*. The species is certainly very variable but the varieties are poorly defined and a much more detailed investigation is needed.

Two chromosome numbers have been found, 2n=28 and 42. There is much more variation in the triploids than in the diploids. I consider that the occurrence of two chromosome numbers and the variation within this species is analogous to the relationship between *C. beckettii* and *C. petchii* and between *C. lutea* and *C. legroi*. Vouchers of 2n=28: P 1964/281 cult.; P 1961/342 cult.; NJ 2779 cult. Vouchers of 2n=42: 1671/11a Mahauswera, Mi Oya, 19.2. 1973, Leg. Windeløv; NJ 2849 cult.; NJ 2855 cult.

Cryptocoryne lucens De Wit – Fig. 2 B

De Wit, Meded. Bot. T. Belmonte Arb. VI, 4 p. 92–94 (1962). Holotype: De Wit s. n., Martiis 1959 (WAG).

This species was described as being dioecious, a feature not found in the plants I collected at Halloluwa. Apparently, both monoecious and dioecious plants occur, resembling the situation found in *Arisaema*, e.g. van Steenis (1948) found different ratios between male and female flowers.

The illustration in Petch (1928 Pl. V, Fig. 9 and 10) may represent this species. The plant illustrated by Wendt (1953 a, 153/2) represents *C. lucens*.

Several of my collections from Halloluwa, provisionally referred to *C. lucens*, approach *C. willisii* Reitz, and further collections may show that it is not possible to distinguish these two species.

At Halloluwa this species occurs in more sheltered places than *C. parva*.

The chromosome number is 2n=28 (vouchers: NJ 23-4 Halloluwa; NJ 24-4 Peradeniya).

Cryptocoryne parva De Wit – Fig. 2 C

De Wit, Belmontia IV, 13 p. 279 (1970). Holotype: J. Schulze, 20.2. 1967 (WAG).

There are four sheets of this species at PDA: Silva, Halloluwa 18.2. 1925; Alston 1389, brought from Halloluwa 2.5. 1926; Alston 1390, Urugala 7.9. 1926; RBGP 18.1. 1928.

C. parva is very distinct morphologically and ecologically even though it certainly is related to *C. willisii* Reitz and *C. lucens*. It prefers somewhat exposed but stable river banks below the high-water mark, often between the roots of trees.

This species is illustrated in Petch (1928 Pl. V, Fig. 7 and 11) as *C. nevillii*.

The chromosome number is 2n=28 (vouchers: P 1974/23 Halloluwa; NJ 22-4 Hiriwadunna, NE of Kegalla).

Cryptocoryne legroi De Wit – Fig. 3 C

De Wit, Belmontia IV, 13 p. 279 (1970). Holotype: R. A. H. Legro (WAG).

The species is closely related to *C. lutea*, but differs in the much larger, brownish leaves, and the spathe which is greenish, rugulose-verruculose. The relation between *C. lutea* and *C. legroi* (diploid and triploid respectively) is probably parallel to that between *C. beckettii* and *C. petchii* and between cytotypes of *C. wendtii* coll.

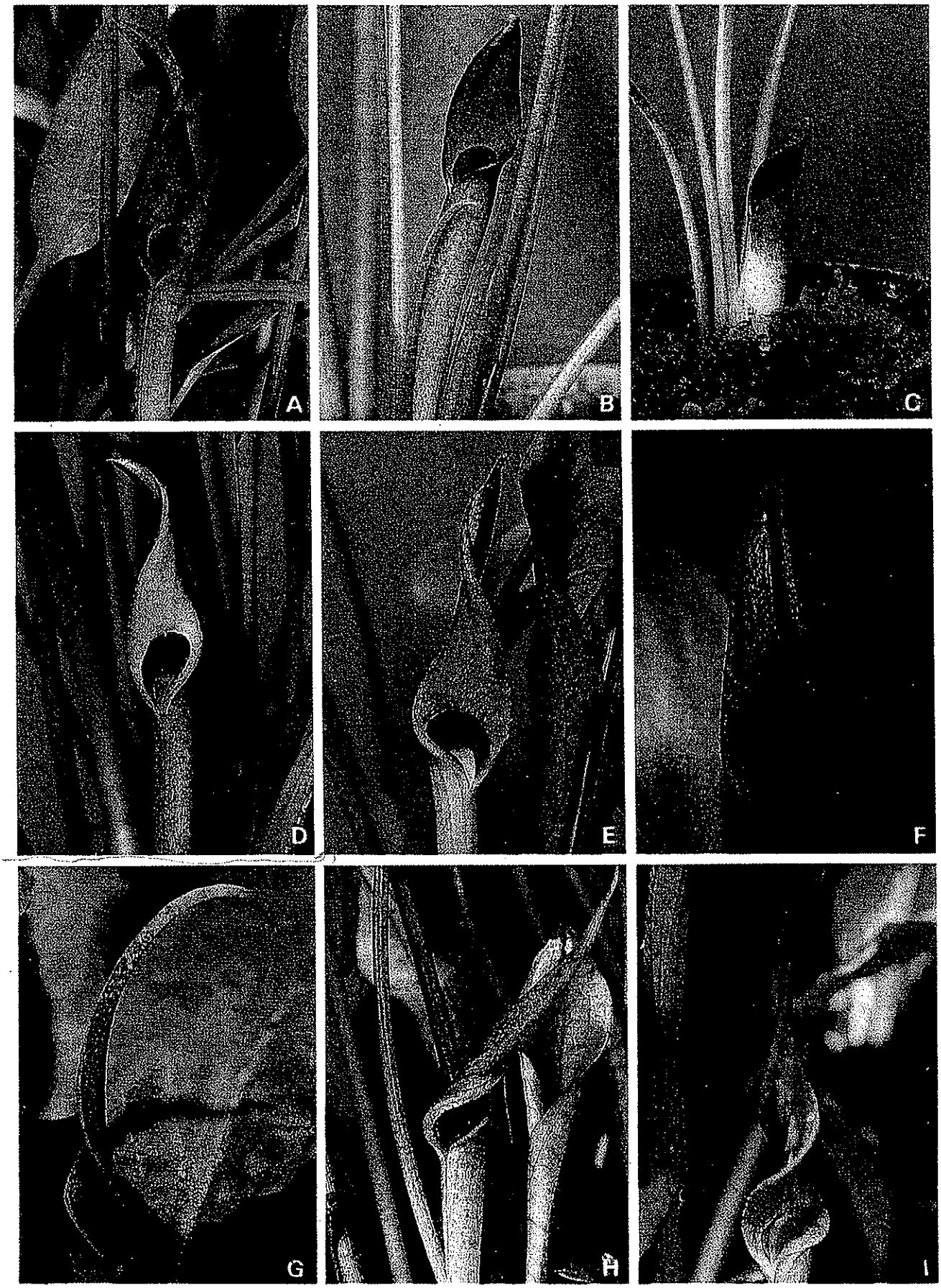
The specimen illustrated by Sadilek (1972) is probably *C. walkeri*.

The chromosome number is 2n=42 counted by Dr Legro (De Wit 1971).

Cryptocoryne bogneri Rataj – Fig. 4 A

Rataj, Revision of the Genus Cryptocoryne, ČSAV studie, č 3 p. 100 (May 1975). Holotype: Bogner 484, Atweltota (M).

Fig. 1. *Cryptocoryne nevillii* Trimen ex Hook. f. Plant drawn from Kundu & Balakrishnan 185, Batticaloa (US). – A: Habit. – B: Lower leaf with small lamina and broad sheathing petiole. – C: Limb showing the very prominent collar. – D: Kettle with part of wall removed. – E: Enlarged female flowers showing the stalked stigmas.


A
B
C
D
E
F
G
H
I

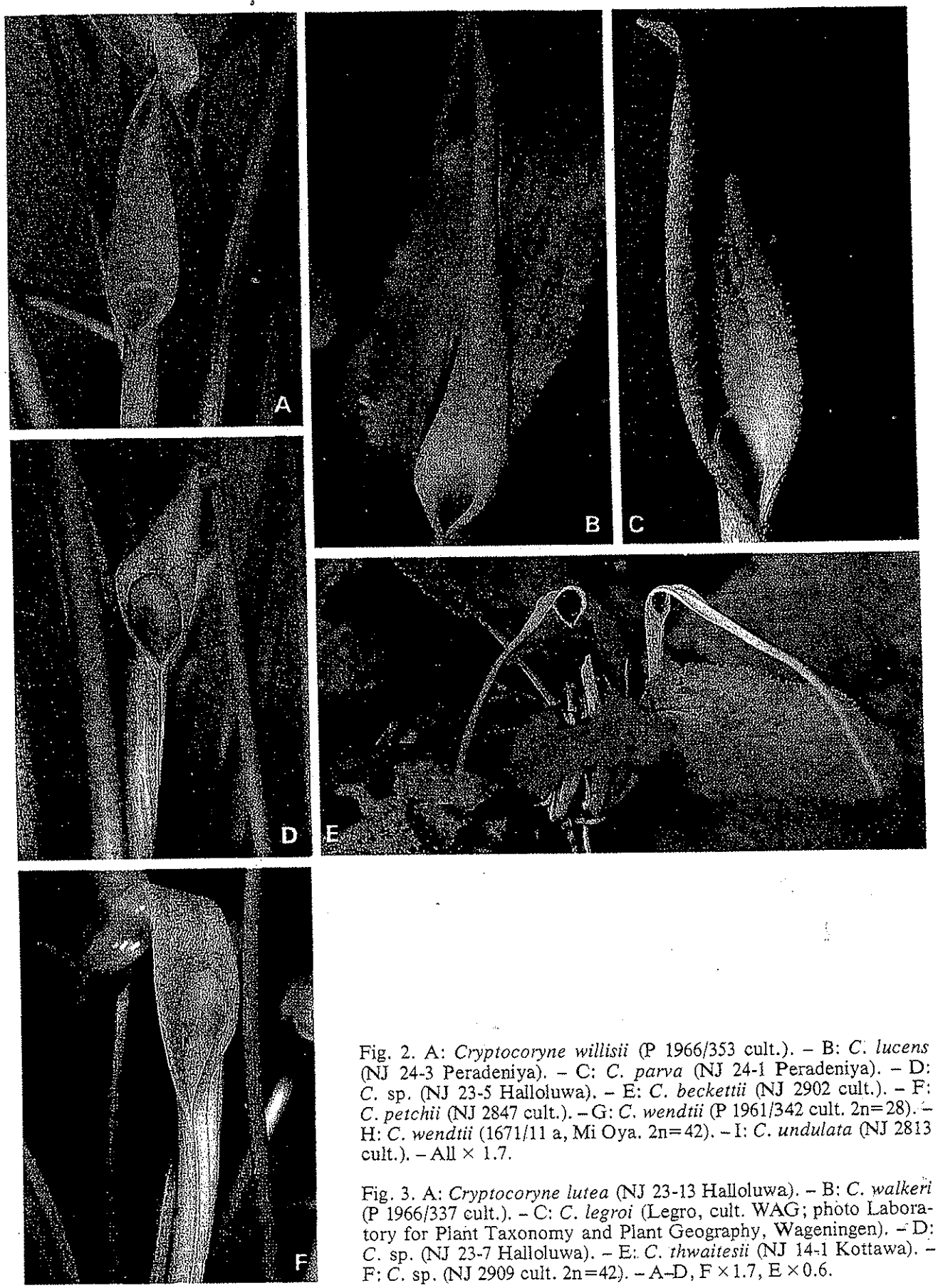


Fig. 2. A: *Cryptocoryne willisii* (P 1966/353 cult.). – B: *C. lucens* (NJ 24-3 Peradeniya). – C: *C. parva* (NJ 24-1 Peradeniya). – D: *C.* sp. (NJ 23-5 Halloluwa). – E: *C. beckettii* (NJ 2902 cult.). – F: *C. petchii* (NJ 2847 cult.). – G: *C. wendtii* (P 1961/342 cult. 2n=28). – H: *C. wendtii* (1671/11 a, Mi Oya. 2n=42). – I: *C. undulata* (NJ 2813 cult.). – All × 1.7.

Fig. 3. A: *Cryptocoryne lutea* (NJ 23-13 Halloluwa). – B: *C. walkeri* (P 1966/337 cult.). – C: *C. legroi* (Legro, cult. WAG; photo Laboratory for Plant Taxonomy and Plant Geography, Wageningen). – D: *C.* sp. (NJ 23-7 Halloluwa). – E: *C. thwaitesii* (NJ 14-1 Kottawa). – F: *C.* sp. (NJ 2909 cult. 2n=42). – A–D, F × 1.7, E × 0.6.

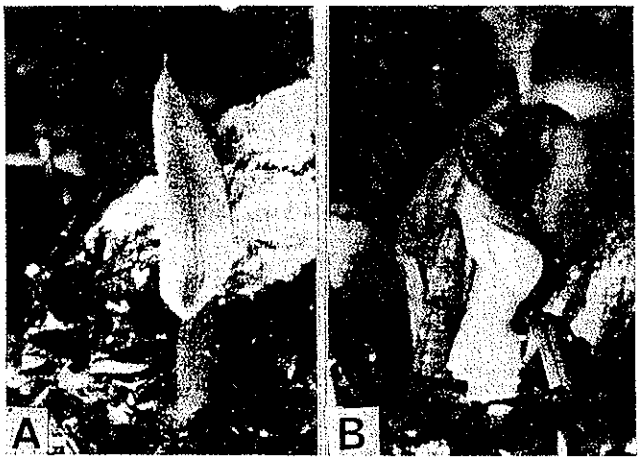


Fig. 4. A: *Cryptocoryne bogneri* (Bogner 484, Atweltota; photo J. Bogner, Botanische Garten, München). – B: *C. alba* (Hermsen s.n., Dehiwala; photo Laboratory for Plant Taxonomy and Plant Geography, Wageningen). – A × 1.0, B × 1.2.

C. bogneri De Wit, Het Aquarium 45: 326–327 (June 1975, issued July ?). Holotype: Bogner 484, Atweltota (WAG, isotype M).

Rataj published his description a few months before De Wit. Both descriptions were based on the same collection. The drawing in De Wit is very good.

Rataj's conclusion on p. 100 that *C. bogneri* belongs to sect. *Auriculatae* is rather doubtful as is the connection with *C. walkeri*. There is no doubt that even on morphological grounds, but particularly in view of the chromosome number 2n=36 (vouchers: NJ 2917 cult.; NJ 2934 cult.) this species is related to *C. alba* and *C. thwaitesii*. The species is readily recognizable by the limb that is smooth in the throat region and rough at the margin and towards the apex.

Cryptocoryne alba De Wit – Fig. 4 B

De Wit, Het Aquarium 45 p. 326–327 (1975). Holotype: Hermsen s.n. Dehiwala 11.9. 1974 (WAG).

The species is related to *C. thwaitesii*.

The chromosome number is 2n=36 counted in a specimen from the type collection kindly supplied by Prof. De Wit (voucher: NJ 2949 at C).

Cryptocoryne spiralis (Retz.) Fisch. ex Wydler

The species was reported from Sri Lanka by Thwaites (1864 p. 334). The report was based on a specimen collected by Walker, without doubt the same which had previously been described as *C. walkeri* Schott. An isotype of Koenig's collection of *C. spiralis* at BM bears the inscription "Ceylon" while the holotype at LD and the isotypes at C bear the inscription "Tranquebar" as does the protologue.

Mrs Walker (1840 p. 229) reported *Arum spirale* as frequent on the banks of the Ginderah River (Gin Ganga) south of Hiniduma, and Alston (1931 p. 294) assumed that the plant in question was the same as that collected by Walker and later described as *C. walkeri*. I think it is more probable that the plant in question is *Lagenandra ovata* (L.) Thw. or maybe *L. thwaitesii* Engl., the former being very common in the lower parts of the river and the latter common in the upper parts. *C. walkeri* probably does not occur in the southwestern lowlands. The true *C. spiralis* does not occur in Sri Lanka.

Additional collections

At Halloluwa I made two collections which do not match any of the species described, but a closer study of more material is needed. Both collections have 2n=28, and are as follows: NJ 23-5 (Fig. 2D) is similar to *C. lucens*, but the leaves are longer and wider and have a purple border. The collar is purple and the limb is greenish with small purple warts. NJ 23-7 (Fig. 3D) is similar to *C. lutea*, but has a brown ring at the edge of the collar which fades towards the centre; the limb is brownish-yellow.

A plant cultivated in Copenhagen NJ 2909 (Fig. 3 F) resembles *C. lutea*. It has a brownish-yellow, recurved limb, a yellow collar which is separated from the limb by a distinct brown line, and a purple-spotted throat. 2n=42.

Discussion

Several of the Sri Lanka species are known only from very few gatherings, and their present taxonomy must be regarded as preliminary. Rataj's treatment (1975 a) is somewhat inconsistent. He lumps together *C. walkeri, C. lutea* and *C. legroi* but following the same principles *C. beckettii* should also have been placed with *C. petchii* and *C. willisii* with *C. lucens*. Obviously a more detailed study by means of cultivation experiments is much needed.

Although the taxonomic status of some species is uncertain, the following grouping can be made (the chromosome number of *C. nevillii*

is unknown, but the species is placed in the first group for morphological reasons).

2n=28, 42

C. nevillii

C. willisii
C. lucens

C. parva

C. undulata

C. wendtii

C. beckettii
C. petchii

C. lutea
C. legroi

C. walkeri

2n=36

C. thwaitesii

C. alba

C. bogneri

It is a remarkable fact that in the Halloluwa locality at least five species grow in places within sight of one another. I made 22 collections of live plants in this locality. There are obvious niche preferences among the species even in this very limited area. There may also be differences in the flowering periods and in the type of insect visitor. It is interesting to note that the species smell quite differently.

The evolutionary situation in *Cryptocoryne* differs in several respects from that commonly found in aquatic plants. Species of *Cryptocoryne* are amphibious, are pollinated by insects and have seeds which germinate within one or two days and die if they dry out. Almost all species of *Cryptocoryne* have very small areas of distribution. Even within Sri Lanka, although the material is very limited, there seems to be definite patterns of distribution.

In the mountainous southwestern part with its radiating system of rivers, and in the eastern and northern parts with hills and isolated river systems, a genus like *Cryptocoryne* may undergo evolutionary radiation, adapting to the different local conditions and also differentiating at random. Well-adapted local populations can further become established by vegetative propagation. As the seeds are short-lived and the pollinating insects (mostly small flies) unable to travel over long distances gene exchange between populations of different river valleys is rare. Moreover, owing to the highly varied environmental conditions two separate populations are seldom in flower at the same time.

Ecological specialization and evolutionary radiation in small populations will thus produce a large number of local populations that differ slightly morphologically. A broad species concept may prove to be the most suitable in this situation but experimental studies at population level are badly needed.

Acknowledgements

My visit to Sri Lanka in March 1975 was supported by Vingresor, Arntstedt's Foundation and P. C. N. Friderichsen's Foundation, which is gratefully acknowledged. Mindelegatet for Brygger J. C. Jacobsen and Marcus Lorenzen's Foundation have most kindly made the printing of colour plates possible. Thanks are due to many colleagues for their help and for their interest in my work, to H. C. D. de Wit, Wageningen and to J. Bogner, München, for valuable discussions and information and for letting me publish their pictures of *C. alba, C. legroi* and *C. bogneri* and to A. Strid for critical comments on the manuscript. H. Windeløv kindly placed his large collection of *Cryptocoryne* at my disposal. I am also indebted to the Director and staff of the Herbarium, the Botanic Garden, Peradeniya. The Botanical Garden of the University of Copenhagen placed facilities at my disposal for the cultivation of *Cryptocoryne* species in the experimental hothouse.

References

Alston, A. G. H. 1931: *In* Trimen, *A handbook of the flora of Ceylon 6.* London.
– 1938: *The Kandy flora.* Colombo.
Baum, H. 1909 a: Neue Wasserpflanzen. *Die Gartenwelt 13:* 5–7.
– 1909 b: Neue Wasserpflanzen. *Blätter für Aquarien- und Terrarienkunde 20:* 1–7.
Böhmer, A. 1935: Die Cryptocorynen. *Wochenschrift für Aquarien- und Terrarienkunde 32:* 790–791, 804–807, 821–823.
Engler, A. 1920: *Das Pflanzenreich IV. 23. F. Araceae –Aroideae und Araceae–Pistioideae.* Leipzig.
Hooker, J. D. 1898: *In* Trimen, *A handbook of the flora of Ceylon IV.* London.
Jacobsen, P. 1957: The sex chromosomes in Humulus. *Hereditas 43:* 357–370.
Petch, T. 1928: Notes on Cryptocoryne. *Ann. Royal Bot. Gard., Peradeniya. XI, 1:* 11–26, 4 plates.
Rataj, K. 1975 a: *Revision of the genus Cryptocoryne Fischer.* Studie ČSAV, č. 3. Praha.
– 1975 b: Cryptocoryne axelrodii Rataj. *Tropical Fish Hobbyist 23:* 60–65.
– 1975 c: Cryptocorynen – etwas ausführlicher. *Die Aquarien- und Terrarien Zeitschrift 28:* 200–202.

Reitz, A. 1908: Neue und neuere Wassergewächse. *Wochenschrift für Aquarien- und Terrarienkunde 39:* 521–523, 537–539.

Sadilek, V. 1969: Neue Cryptocorynen V: Cryptocoryne thwaitesii Schott. *Die Aquarien- und Terrarien Zeitschrift 22:* 20–21.

– 1972: Neue Cryptocorynen IX: Cryptocoryne legroi De Wit. *Die Aquarien- und Terrarien Zeitschrift 25:* 87–89.

Schott, H. 1857: Cryptocorynenskizze. *Bonplandia 5:* 219–223.

Steenis, C. G. G. J. van 1948: The genus Arisaema in Java (Arac.). *Bull. Bot. Gard. Buitenzorg, Ser. III, 17:* 447–456.

Thwaites, G. H. K. 1864: *Enumeratio Plantarum Zeylaniae.* London.

Trimen, H. 1885: Notes on the flora of Ceylon. *Journ. Bot. 23:* 266–269.

Walker, A. W. 1840: Journal of a tour in Ceylon. *Journ. Bot. II:* 223–256.

Wendt, A. 1953 a: Cryptocoryne nevillii Trimen. *Aquarienpflanzen in Wort und Bild, Lief. 8.* Blatt 153. Stuttgart.

– 1953 b: Cryptocoryne beckettii Thw. ex Trimen. *Aquarienpflanzen in Wort und Bild, Lief. 6.* Blatt 116–117.

– 1955 a: Cryptocoryne undulata Wendt spec. nov. *Aquarienpflanzen in Wort und Bild, Lief. 14.* Blatt 267–269.

– 1955 b: Etwas über richtige und falsche Namen unserer Cryptocorynen. *Die Aquarien- und Terrarien Zeitschrift 8:* 236–240.

– 1958: Cryptocoryne willisii Engl. ex Baum. *Aquarienpflanzen in Wort und Bild, Lief. 17.* Blatt 333–334.

Wit, H. C. D. de 1958: Cryptocoryne wendtii sp. nov. *Meded. Bot. T. Belmonte Arb. II:* 97–101.

– 1962: Cryptocoryne lucens De Wit, sp. nov. *Meded. Bot. T. Belmonte Arb. VI:* 92–94.

– 1970: A key to the species of Cryptocoryne Fish. ex Wydl. (Arac.). *Belmontia IV:* 257–280.

– 1971: *Aquarienpflanzen.* Stuttgart.

– 1975: Cryptocoryne alba De Wit (nov. sp.) en Cryptocoryne bogneri De Wit (nov. sp.). *Het Aquarium 45:* 326–327.