

Notes on *Cryptocoryne*

BY

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WITH FOUR PLATES

The genus *Cryptocoryne* (*Araceae*) was established by Fischer for the reception of two Indian species, *Cryptocoryne spiralis* and *Cryptocoryne ciliata*, which had been described under *Ambrosinia* by Roxburgh. Additional species were described by Roxburgh, Schott, and other botanists, while in Beccari, Malesia, Engler described eleven new species from Borneo and gave a conspectus of twenty-four known species. In Flora British India, Hooker enumerated sixteen species, and in Flora of Ceylon, five species. The total number of species is now over thirty, confined to the Eastern Tropics.

For our knowledge of the structure of the flower we are indebted almost entirely to Griffith, who recorded the results of his examination of fresh specimens of *Cryptocoryne ciliata* in Trans. Linn. Soc., XX, pp. 263-276. The spadix is small, and it is not easy to determine the details of its structure from dried specimens. Consequently, very little has been added to Griffith's account, and a detailed examination of the living flower is still lacking in the case of the majority of the alleged species.

In Ceylon, *Cryptocoryne* has been considered very rare. *Cryptocoryne Thwaitesii* Schott, hitherto the best-known species, occurs in the wet low-country in the south-west of the Island. *C. Nevillii* Trimen was described from a single collection made by Nevill in the Eastern Province. *C. Beckettii* Thwaites was collected in 1865 in Matale East, and there are two subsequent collections assigned to this species in Herb., Peradeniya. The record of *C. spiralis* Fisch. is based on specimens in Herb. British Museum, said to have been collected by Koenig, who visited Ceylon in 1780 and 1781; while *C. Walkeri* Schott was described from specimens in Herb. Kew, collected in Ceylon by Walker (1830-38).

An investigation of the Ceylon species of *Cryptocoryne* was begun by the late Mr. H. L. van Buuren, his interest having been aroused during an endeavour to determine the identity of the Ceylon medicinal plant

known by the name Ati-udayan. In Ceylon, this name was supposed to indicate *Lagenandra lancifolia* Thw., while in Indian medical books it was said to be applied to both *Lagenandra lancifolia* and a *Cryptocoryne*. As *Lagenandra lancifolia* is a Ceylon endemic, it would appear that the latter statement combines both Indian and Ceylon information.

The name Ati-udayan was recorded by Moon for a Ceylon plant which he referred to *Arum minutum* Willd. Moon's plant has been taken to be *Lagenandra lancifolia* Thwaites, though I am not aware whether his specimen is in existence. Consequently, Ceylon marsh plants for which the name Ati-udayan has been given by the villager, have, if not in flower, been assigned to *Lagenandra lancifolia*. For many years, it has been customary to maintain, in the collection of marsh and water plants in the Royal Botanic Gardens, Peradeniya, a pot of plants, labelled *Lagenandra lancifolia*, but the plants were not observed to flower under those conditions. On making enquiries, Mr. van Buuren found that they died out periodically, a fresh supply being then obtained from a neighbouring village, and a visit to the stock locality resulted in the discovery of the flowers, which showed that the plant was *Cryptocoryne*. Subsequently, specimens of Ati-udayan were obtained from different localities in Ceylon, and these all proved to be *Cryptocoryne*.

In a mss. note, -no doubt the introduction to an intended account of his observations, -Mr. van Buuren wrote:-

"The writer has endeavoured to assemble together from various parts of the Island living plants that are commonly called Atiudayan. In no case has the writer been able to find any attempt at its cultivation, but a villager in the Kandy district can more or less point out a spot where Atiudayan may be found growing. It is customary to encourage any Atiudayan that may come up round and about a spring to grow there, and it is at the head of a spring that irrigates a paddy field that these plants might be found growing. The interesting point is that in all cases investigated up to date the plant commonly known as Atiudayan is a *Cryptocoryne*.

"*Lagenandra lancifolia* Thwaites on 'banks of streams and rivers in the moist low-country, common,' has never been found by the writer. On banks of streams and rivers, plants with leaves and a growth like *Lagenandra lancifolia* have been found very commonly by the writer, but in all cases, on transplanting them into pots with the aquatic plants in the R. B. G., Peradeniya, they have when flowered given the characters of *Cryptocoryne*. The *Cryptocoryne* spp. are not so rare as the notes in Trimen's Flora make them out to be. They flower generally once a year between December and February, and if found not in flower it has been

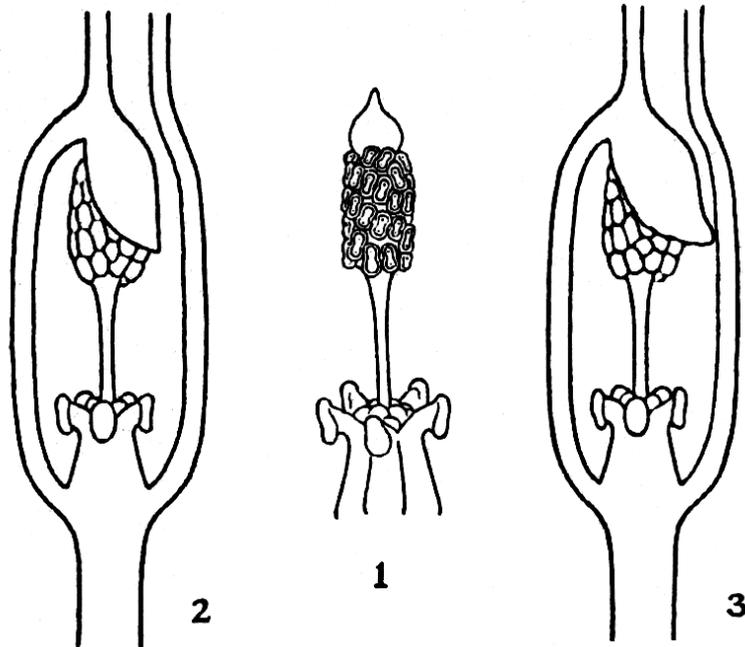
customary to regard them as identical with Thwaites' *L. lancifolia*; hence the record that this latter plant is common, when rather it should be noted as endemic and rare, if not very rare."

Mr. van Buuren's collection included four species at least. One of these, *Cryptocoryne Thwaitesii*, from Hinidun, soon died at Peradeniya, but three other species have survived. The chief object of the present note is to draw attention to certain characters of the spadix which are common to these three species and the available herbarium specimens of the species previously recorded from Ceylon.

The rootstock is crowned by, a rosette of leaves and the spathes arise singly in the axils of the leaves. The spathes are pedicellate, but as the rootstock is buried rather deeply in the mud, the bulb and the lower part of the tube are completely hidden. The spathe consists of a basal oblong-oval bulb, 1-1.5 cm. high, which passes somewhat abruptly into a tube, usually many times as long, and the latter terminates obliquely above in a limb of varying length. Occasionally the mouth is merely obliquely infundibuliform; more generally, the lower edge is recurved and the limb almost plane and spirally twisted. But in the same species, the larger examples may have the limb twisted, while in the smaller it is not. Round the mouth of the tube a crescentic area, broadest at the median line of the limb, is demarcated above by a raised line; this collar is usually more deeply coloured than the limb. The bulb is not symmetrical, being more inflated on the side opposite to the limb than the other. The interior of the tube is lined with close-set conical hairs, about 50 μ high, perpendicular to the wall; the wall of the bulb is lacunose on the interior surface.

The basal part of the spadix (Text figure 1) consists of a single whorl of five or six (rarely seven) coherent carpels, the apices of which are free and bend outwards as so many massive styles. These styles are laterally compressed, and are capped by peltate stigmas, directed oblique downwards. The stigmas are minutely papillose, oval, rounded at the margin, and either plane or very slightly depressed in the centre. In the Ceylon species, the stigma is not infundibuliform, as figured in Engler-Prantl for *C. spiralis*. The carpels are usually white and subtranslucent, but sometimes pale green, sometimes flecked with purple, while the stigmas are sometimes pale purple.

From the centre of the whorl of carpels there arises a very slender white column which expands above into a cylinder on which the sessile anthers are arranged more or less in spirals. Above the anthers the spadix terminates in a globose appendage which is drawn out to a point above and resembles the conventional dome of a mosque.



Bulb and spadix of *Cryptocoryne* x 6

From the junction of the bulb and the tube, an orbicular flap extends downwards into the bulb. This is united to the wall of the spathe by a comparatively narrow base above the more inflated side of the bulb. The spadix is situated beneath this flap, in the more inflated part of the bulb, and its apex is united to the wall of the spathe at the junction of the latter with the flap. Sometimes the apex ultimately separates from the wall. Very frequently the spadix is not vertical, but is pressed by the flap towards the more inflated side of the bulb.

When the spathe first opens (Text figure 2), the flap is closely applied to the spadix and forms a hood which shields the antheriferous part for about one-half or two-thirds of its length. The flap is then white, and its margin is straight and rather thick. When, or just before, the anthers open, the flap becomes more convex above and its margins recurves, and it now extends away from the spadix and closes the entrance to the bulb (Text figure 3). Later, the flap falls back into its original position. When extended across the tube the flap is pale yellow and translucent, and its margin appears thinner than before.

Flies have been observed in the bulb on several occasions. When the spathe opens, there is a clear passage between the flap and the wall

of the bulb, but when the anthers open, the flap extends across and closes the entrance of the bulb. Any flies then in the bulb will remain imprisoned until the flap returns to its first position, and during that period they may come in contact with the pollen, which is extruded from the anthers in a viscous fluid. But there is apparently nothing to prevent the escape of the flies before the anthers are ripe.

A spathe was collected in the evening, one side of the bulb cut open, and the flap observed to be closely applied to the unripe anthers. This flower was then placed on moist filter paper in a Petrie dish, and on the following morning it was found that the flap had extended across the entrance of the bulb and each anther was crowned by a viscid globule containing pollen.

The movement of the flap appears to be brought about by continued growth. It was at first thought that it might be caused by some alteration in size of the peculiar apex of the spadix; but the latter does not appear to alter, and, from its position, it could scarcely produce such an effect.

The angle between the recurved apices of the carpels and the slender column is filled by globose bodies, yellow to orange in colour, and slightly white pruinose when old. These accessory bodies may be equal in number to the carpels and alternate with the latter, or they may be up to twice as numerous. They are sometimes lobed, but usually simple, and are adherent to one another laterally (see later). They form a compact whorl, or a slightly elevated heap, which rarely rises above the level of the apices of the carpels. Because of their colour, they are very conspicuous in fresh specimens, but in dried specimens they are easily overlooked (Text figures 1-3).

Roxburgh, in *Coromandel Plants*, did not figure these accessory bodies in *Ambrosinia ciliata*. In *Flora Indica*, he did not mention anything of this nature in *A. ciliata*, *A. spiralis*, and *A. retrospiralis*, but he recorded that *A. unilocularis* had nectaries above the ovaries.

Blume, in *Rumphia*, did not figure accessory bodies in *Cryptocoryne spiralis*, nor describe them for *C. spiralis*, *C. ciliata*, or *C. ovata*.

Griffith, in *Trans. Linn. Soc.*, XX, did not figure accessory bodies in *C. ciliata*. In *Icones Plantarum Asiaticarum*, he did not figure them in *C. spiralis* or *C. alata*, but for *C. cordata* Griff. his figure shows an inner whorl of clavate bodies, and in *Notulae*, p. 138, he stated of that species, "Corpusculae late clavatae, uniseriatae, ovaria supra pedunculi partis nuda basin ambiunt." Further, with regard to *C. Griffithii* Schott. he wrote (p. 139), "Space round base of the naked attenuated filiform part of the spadix rather flat, occupied by the lobed, yellowish, papillose bodies in number six, alternating with the ovaria."

Wight, in *Icones Plantarum Indiae Orientalis*, did not figure accessory bodies in *C. retrospiralis*, *C. unilocularis*, or *C. ciliata*.

Engler, in *Mon. Phanerog.*, II, described *Cryptocoryne* as having "Inflorescentia feminea saepius pauciflora, floribus monocyclus, vel dicyclus illis cycli superioris abortivis, illis cycli inferioris inter se connatis", and he stated that *C. cognata* had "ovariis fertilibus 6, cum sterilibus totidem alternantibus."

In *Flora British India*, Hooker, in the generic description of *Cryptocoryne*, gave "female inflorescence a single whorl of connate one-celled many-ovules ovaries with a few neuters," but he did not record the presence of neuters in any of the sixteen species there described. In the *Flora of Ceylon*, he described *C. Nevillii* as having " ovaries in a whorl of 6 or 7 (?) with large globose stigmas, surrounding an inner whorl of minute imperfect (?) ones, with globose stigmas " and added the note, "if I am correct in describing the ovaries as in two whorls, the inner of imperfect carpels, the plant is intermediate between *Cryptocoryne* and *Lagenandra*."

Thus it would appear that these accessory bodies have been previously observed by several botanists. But while those who have examined dried specimens have considered them to be abortive carpels, that interpretation has not suggested itself to those who have examined living plants.

These accessory bodies are present in the Ceylon species, *Cryptocoryne Thwaitesii*, *C. Beckettii*, and *C. Nevillii*, as shown by the herbarium specimens, and in all the four species recently collected. They are stalked and somewhat pear-shaped in longitudinal section (Plate II, figure 1.) A vascular strand runs from the central column up the middle of the stalk and terminates about the centre of the head. The head is parenchymatous, and is covered with cylindrical processes, up to 30 μ high and 12 μ diameter, which are outgrowths from the cells of the outer layer. The processes of adjacent heads interlock, and so simulate a continuous tissue (Plate II, fig. 2). Near the periphery of the head occur large cells, up to 50 μ diameter, which contain bundles of crystals. These cells are not peculiar to the accessory bodies; they occur also in the carpels, immediately beneath the epidermis. The loose cells seen in the photographs of the sections are the tips of the processes of adjacent bodies. The processes are not septate, and they do not abstrict cells.

It is possible that the accessory bodies, either by their colour or by the emission of some odour, serve to attract insects to the base of the spathe and consequently to the stigmas.

The anthers are situated on the enlarged upper part of the column. As a rule, they are crowded, and arranged more or less in spirals (Text

figure 1). The condition figured by Engler (Icones ined.) for *Cryptocoryne Thwaitesii*, in which a few anthers (4-6) are scattered along a slender column, is not usual in that species and was evidently abnormal. The anthers are sessile, oblong-oval in plan, with a slight constriction in the middle which makes them somewhat eight-shaped, and their sides slope slightly inwards to the base. The upper surface is bordered by a narrow incurved margin. Before the anther has dehisced, each half bears a minute conical point.

In transverse section (Plate III, figs. 3, 4), it is found that a theca or pollen sac is situated beneath each conical projection, the theca being bilocular, with each loculus more or less circular in section. From the theca, elongated cells extend radially to the exterior on all sides except the upper; the walls of these cells are thickened in radial lines, and hence this tissue corresponds to the fibrous layer of a typical anther. From the upper edge of the anther, a flap of small-celled tissue extends inwards, and forms the incurved margin. Above the theca, a tissue of isodiametric cells extends upwards into the cone. The outer layer of the cone is continuous with the epidermal layer of the upper surface of the anther. Thus, although the appearance of the anther suggests that it consists of two flask-shaped thecae embedded up to the neck in a ground tissue, that is not actually the case. The outer layer of the conical projection is continuous with the epidermal layer of the anther, not with the wall of the theca.

When the anther is mature, the cells which overlie the theca and fill the conical projection break down and the cone becomes hollow. The apex of the conical projection then dehisces and the pollen is extruded, together with a relatively large quantity of a viscous fluid, in a minute globule. Subsequently, the projection collapses.

References to the extrusion of the pollen appear to have been based in all cases on Griffith's observations. His figure (Trans. Linn. Soc., X.X, tab. X, fig. 5) shows a very long tendril issuing from the apex of the conical projection, and in the description of that figure he stated "The opening in the apex of the projecting membrane is very distinct, and through it is seen passing a grumous boyau-looking body of great length." The tendril is about sixteen times the length of the conical projection, and no pollen grains are figured in it.

In the text of his paper, however, Griffith wrote, "At a later period, the apex of the cone is open, and through this opening the contents of the thecae *may be squeezed* (italics mine.- T. P.), assuming, from the comparatively small diameter of the apex of the cone, a more or less elongated form. In the instance figured, the length to which they attained was immense. The matter squeezed out resembles exactly

the process which originates from most globules of pollen, then acted on by water, and the very great length above noticed arose probably from the coalition of the processes of several granules occasioned by the pressure exerted. The opening in the cone appears to be of secondary importance; it is evident from the direction of the antlers, from the small size of the aperture, and from the relative diameters of the opening and globules of pollen (*i.e.* pollen grains - T. P.) that it is not sufficient to allow of a free exit of the latter. The necessary free exit of the pollen is secured by the separation of the membrane from the inner margins of the thecae, and at the time of fecundation the globules of pollen will be found uncovered."

Thus, Griffith's figure merely shows what happens when an anther is subjected to pressure on a microscope slide. It does not show what occurs naturally. If a spathe of which the anthers have not dehisced is gathered in the evening, and placed in a moist chamber, it will be found on the following morning, if the spathe has been in the right condition, that each conical projection bears a minute globule. By bringing the spadix in light contact with a glass slip, one or more of these globules may be removed without damaging the conical projections, and on staining them with iodine, it is found that they contain pollen. Before staining, one cannot be certain that pollen grains are present, only a faint outline of them being visible in the viscous matter; after staining, they show up quite clearly.

It is possible that the tendrils artificially produced by Griffith did not contain pollen grains, or more probable that he did not try any stain. The viscous matter is not the result of the bursting of the pollen grains, as he suggested. On the other hand, it is true that after the collapse of the conical projection, pollen is found in the cup formed by the base of the theca.

Griffith found the pollen of *Cryptocoryne alata* Griff. to be spherical. In all the available Ceylon specimens, both those recently collected and the herbarium examples of *C. Beckettii*, *C. Nevillii*, and *C. Thwaitesii*, the pollen grains are oval or bean-shaped, and thick-walled. Hooker's statement that the pollen of *Cryptocoryne* is vermiform (Flora British India) does not apply to the available Ceylon species.

CLASSIFICATION

As already stated, five species of *Cryptocoryne* have been recorded from Ceylon. One of these, *Cryptocoryne Thwaitesii*, is readily distinguished by its rough crenate leaves and long-tailed spathe, and another, *C. spiralis*, by its linear leaves and ridged limb. Recently, five, possibly six species have been collected. One of these is *Cryptocoryne Thwaitesii*,

but *C. spiralis* has not been found. It is, however, very difficult to decide from the descriptions and the herbarium specimens whether any of the other four are to be assigned to the species previously described from Ceylon.

Engler, in D.C., Mon. Phanerog., adopted, as the primary character or the separation of the species of *Cryptocoryne*, the relative lengths of the tube and the limb, dividing them into species which had a tube more than two or three times longer than the limb, and those which had a tube shorter than the limb ; and in this he was followed by Hooker in Flora British India and Flora Ceylon. But it will be evident from figs. 9-11, Plate V, that the relative lengths of the tube and the limb may vary considerably in the one species. Further, in *C. Beckettii*, in which spathes 14 cm. long have the limb shorter than the tube, the smaller spathes have the limb equal to the tube. It may perhaps be true that in species in which the limb is longer than the tube, that relation still holds good in the case of small spathes ; but evidence on this point is lacking, and the extent of the variation in other species makes it doubtful.

Further subdivision has been based on the shape of the limb, and whether it is twisted or not. As regards the latter point, it may be stated that the limb is always twisted in bud; and whether, in the case of those species which have the limb equal to or shorter than the tube, it is twisted after the spathe has opened, depends largely on its size. Further, although the limb is thick and fleshy when fresh, it very soon begins to shrivel when the plant is removed from its watery habitat, and it would not be safe to lay much stress on the shape of the limb, e.g., acute or acuminate, triangular or lanceolate, as observed on dried specimens.

In the case of the leaves, the variation is again extraordinary. It is natural that plants grown in shady situations should have larger leaves than those grown in the open, but the change, as in *C. Beckettii*, from leaves 23 cm. long to leaves 6 cms. or less, is greater than would be expected, in view of the fact that in both cases the plants are partly submerged. Moreover, in this species, the change in size is accompanied by a change in shape. The larger leaves have the base rounded or cuneate, but in the smaller it is distinctly cordate (Plate IV, figs. 2, 3).

Some species are described as having the spathe long-pedicelled, others the spathe sessile. But in the same species the pedicel may vary from 5 mm. to 4 cm. in length. It does not appear probable that sessile spathes can occur in *Cryptocoryne*.

From the descriptions, one would deduce that the presence or absence of the accessory bodies could be taken as the primary distinguishing character. The evidence of the Ceylon plants, however, suggests that

these are present in all species, but have been overlooked. There is very little difference between the spadices of the Ceylon species. The styles are slightly longer in some species than in others, and bend outwards at slightly different angles, but the differences are inappreciable. No available Ceylon species has globose stigmas.

In three of the recently collected Ceylon species, in which the spathes are similar in structure, the leaves vary to such an extent that practically the only tangible character by which they can be distinguished in all their forms is the colour of the limb and the collar.

The following descriptions have been drawn up from fresh specimens. The determinations, however, must be regarded as tentative, until more is known about the species of *Cryptocoryne* described from other countries.

Cryptocoryne Beckettii Thw. Rootstock stout. Leaves up to 23 cm. long, long-petioled, petiole up to 15 cm. long; lamina up to 8 cm. long, 3 cm. broad, oblong-oval or oblong-lanceolate, apex subacute or obtuse, margin crisped in the lower half, base slightly auriculate, not cordate, often oblique; lateral veins 5 or 6, the 2 or 3 lowest from the same point; upper surface dull pale green; cross veins not prominent. Spathe up to 14 cm. long, with a pedicel up to 4 cm. long, bulb 1.75 cm., tube 4.5 cm., limb 4 cm. Limb ovate-lanceolate, slightly twisted, one or both edges more or less denticulate, opening widely and funnel-shaped below with a recurved edge, margin recurved, surface even or faintly rugose. Limb olive-yellow; collar reddish purple or chocolate-brown; tube tinged reddish purple above. Carpels 5 or 6; styles short, bending outwards at an angle of about 60° from the vertical; stigmas capitate, oval, slightly convex; accessory bodies present.

Gangaruwa (van Buuren); Kadugannawa (van Buuren); Gangaruwa, January, 1925; Halloluwa, February 1925. Plate IV. figs. 1-4.

When cultivated in an open situation, the leaves become much smaller, though still long-petioled, and the shape is decidedly different. They are then more ovate, and cordate with a wide sinus at the base. The lamina is about 3 cm. long and 1.5 cm. broad, and the petiole about 4.5 cm. long. Leaves of the same shape occur on young rootstocks among the larger plants in nature. The spathe becomes much shorter, about 6 cm. high, with a pedicel, 6-8 mm. long, bulb 1-1.4 cm. long, tube 2.5-4.5 cm., limb 1.5-2.5 cm.

In all cases, the petiole is long in comparison with the lamina, and the limb is shorter than the tube and only slightly twisted.

The edge of the limb is denticulate, usually on one margin, sometimes on both margins, for varying distances. The limb is stout, and its margin more or less quadrangular in section, and the minute teeth are

situated on the inner edge of the margin. This is the case in all the present species in which the margin of the limb is denticulate, and apparently the same structure occurs in *Cryptocoryne spiralis*, as figured in Bot. Mag. No. 2220.

The leaves bear very minute, lanceolate, adpressed hairs, up to 0.4 mm. long and 50 μ diameter, scattered over both surfaces. These are scarcely visible on the fresh plant, but they show up strongly on leaves preserved in alcohol, owing to the fact that they contain bundles of crystals which appear white on the subtranslucent preserved material. Similar hairs occur on the other species described in this paper.

This species is probably identical with *Cryptocoryne Beckettii* Trimen. The type specimen of the latter, from Matale East, February, 1865, has leaves with an oval-lanceolate blade, up to 8.5 cm. long, 2.8 cm. broad, cordate at the base with a wide sinus, thin, margin crisped, lateral veins, 3-5, the two or three lowest from one point, and a petiole up to 9.5 cm. long. These leaves resemble the small leaves of the recent plant in shape, but are larger. Only a bud and the bases of one or two spathes are available, and there is no record of the colour. The broken spathes show a pedicel about 1 cm. long. The bud is about 2 cm. long, without any definite constriction between the bulb and the tube. Trimen stated that the limb was small and caudate, but it is not unfolded, and it is not possible to say what the shape would be when expanded. Accessory bodies are present. The column between the carpels and the anthers is short, but this is probably because the spathe is immature. The broken spathes indicate that when mature they are much larger. The pollen grains are small, 26-32 x 17-18 μ , like those of the recent specimens described above.

A second sheet in Herb. Peradeniya sub *C. Beckettii* is marked Kahata-ata-hela, in chinks of dry rocks, January, 1888. This was apparently collected without flowers, and was assigned to *C. Beckettii* with a query. The lamina is up to 5.5 cm. long, with a petiole 9 cm. long. The lamina is oblong-lanceolate, sometimes, but not invariably, more attenuated towards the apex than in the type, apex usually acute. base cordate with a wide sinus or oblique and not cordate, margin crisped, cross veins prominent. This resembles *C. Walkeri*, rather than *C. Beckettii*.

A third sheet in Herb. Peradeniya sub *C. Beckettii* is labelled Kailla, June 1st, 1886 (? Kella, Ratnapura district). The leaves of this have a lamina up to 10 cm. long and 2 cm. wide, with a petiole up to 20 cm. long. The lamina is narrow-lanceolate, margin not crisped, and the veins are less spreading than in the two previous specimens; in these respects the specimen resembles the Yatiellagala plant described

below. The spathe has a pedicel 5 cm. long, a bulb 1.2 cm. long, a tube 5 cm. long and a limb 2 cm. long. A purple colour persists on the collar, and on the upper part of the tube, but the limb is now pale. No tubercles are evident on the limb. The specimen is, however, nearer to the *Yatiellagala* plant than to the type of *C. Beckettii*.

It would appear probable that the second specimen is to be assigned to *C. Walkeri*, and the third to *C. Nevillii*. Trimen's description in *Journal of Botany*, XXIII (1885) p. 269, refers to the first specimen only; that in the *Flora of Ceylon* apparently covers all three.

Cryptocoryne Walkeri Schott. Rootstock stout. Leaves usually long-petioled, up to 21 cm. long; petiole up to 13 cm., lamina up to 8 cm. long, 2.5 cm. broad; varying to a length of 6 cm., petiole 2.5 cm., lamina 3.5 cm., ovate-lanceolate or oblong-lanceolate, often inequilateral, apex obtuse or subacute, margin crisped, base slightly cordate with a wide sinus, or attenuated abruptly into the stalk, equal or unequal, slightly auriculate, 5 veined, the three lowest from one point, the uppermost three veins and the cross veins prominent, green, purple beneath with purple red veins, and a purple red petiole; spathe up to 8.5 cm. long, pedicel 1.5 cm., bulb 1.2 cm., tube 3.5 cm., limb 3 cm., long; limb lanceolate, acute, up to 8 mm. broad, surface faintly rugose, slightly twisted, lower edge recurved, greenish yellow to bright green, fuscous on the outer surface; collar of the same colour as the limb; tube expanding slightly upwards, grooved down the front, white, strongly sprinkled purple red; carpels 5 to 7, styles short, stigmas subvertical, capitate, flat; accessory bodies present. Fruit globose, 9 mm. diameter, furrowed, crowned with the remains of the styles: ripe seeds not seen.

Gangaruwa (van Buuren); Halloluwa, February, 1925. Plate IV, figs. 5-8.

This species has leaves which resemble those of *C. Beckettii*, but they are more attenuated towards the apex, and are distinguished in the field by the strong *cross* veins. The larger leaves are long-petioled, but the smaller may have the petiole shorter than the lamina. The spathe differs in colour from that of *C. Beckettii*, but is similar to the latter in structure.

Cryptocoryne sp. indet. Rootstock stout; leaves up to 8 cm. long, petiole as long as the lamina; lamina up to 4 cm. long, 2 cm. broad, oblong-oval, apex obtuse or subacute, base cordate, auricled, the auricles close to the petiole, dark green, glossy, lateral veins 5 or 6, the three or four lowest from one point. Spathe up to 9 cm. long; pedicel 0.5 cm., bulb 1-3 cm., tube 2-3.5 cm., limb 2.5-3.5 cm.; limb long-triangular, apex acute, slightly twisted, appearing smooth but minutely rugose or lacunose, margin dentate, dark olive green or blackish green, sometimes

paler at the margin; collar dark purple; spathe sometimes opening widely with a recurved margin round the mouth, sometimes with a narrow vertical opening; tube with a well-marked groove down the front, white, mottled purple, expanding slightly above; carpels 5-7, styles curved outwards, short, stigmas capitate, oval; accessory bodies as numerous or twice as numerous as the carpels.

Ratnapura (van Buuren). Plate V, figs. 1-5.

This species differs from *C. Beckettii* and *C. Walkeri* in its comparatively short-petioled, dark green leaves, and especially in the base of the leaf. These characters appear to be constant under cultivation. The spathe is similar in structure to those of *C. Beckettii* and *C. Walkeri*, but differs in the colour of the limb.

It has not been found possible to match this with any specimen at Kew or the British Museum. *Cryptocoryne cordata* Griff. from the description and Engler's figure, has broader leaves, a very long tube, and a comparatively short limb. It differs also in colour, the limb being atropurpurascens and the collar lutescens. The stigmas figured by Engler are unlike anything observed in Ceylon specimens of *Cryptocoryne*. *Cryptocoryne auriculata* Engler, from his figure, has somewhat similar leaves, though not oblong, but the limb is more than twice the combined length of the tube and bulb.

Cryptocoryne Thwaitesii Schott. The limb of this species is lanceolate, with an elongated, linear tip, and about three times as long as the bulb and tube together. In recent examples the elongated tip is solid. The styles are directed upwards at an angle of about 45° and are about 0.5 mm. long, approximately about half the length shown in Engler's figure. The stigma is capitate, oval, flat, and broader vertically than the style, which expands at the apex to form a buttress. Accessory bodies are present. The anthers are crowded together in a cylindrical column as in text fig. 1; the condition figured by Engler, 4-6 anthers on a slender column, was probably abnormal.

Cryptocoryne Nevillii Trim. Rootstock slender, elongated, without stout white lateral stolons. Leaves long-petioled, petiole up to 14 cm. long, with a lamina 7 cm. long and 2 cm. broad, varying in exposed conditions to a total length of 4 cms., with a lamina 2 cm. long and 5 mm. broad; the larger leaves long-triangular, or narrow lanceolate, base cuneate, or almost deltoid, the smaller narrow lanceolate or lozenge-shaped, apex obtuse or subacute, base of the larger leaves slightly auriculate; lateral veins 3 or 4, the lowest 2 or 3 from the base, at a small angle with the midrib and sub-parallel; cross veins not prominent. Spathe up to 6 cm. high; pedicel up to 1 cm., bulb 1 cm., tube 2 cm., limb 2 cm.; limb lanceolate to triangular, acute, usually opening widely, face papillose with

scattered conical papillae when fresh, not evident on dried specimens. Limb and collar deep purple red, tube sprinkled with red purple, or deeply coloured red purple in the smaller examples. Tube with a well-marked groove extending from the lowest point of the mouth to just above the bulb, where it curves shortly to one side. Carpels 5 to 6, usually 6; styles short, almost horizontal; stigmas capitate, oval, slightly convex; accessory bodies present. Fruit urceolate, 7 mm. diameter, on pedicels up to 3 cm. long. Seeds wedge - shaped, five-angled, the upper surface oblique and convex, the two inner faces slightly concave, the lower end conical, angles not warted.

Yatiellagala (van Buuren); Halloluwa, Feb., 1925. Plate V, figs. 6-12.

The variation in the spathe of this species is illustrated in figs. 9-11, Plate V. These are all from plants with small or medium leaves, figs. 9 and 10 from plants grown in the Botanic Gardens, and the smallest from a plant growing wild in an open situation. In the latter instance some of the spathes did not exceed 2 cm. in height. It is probable that the actual range of variation will be greater than is shown by these figures: the long-leaved plants have not been collected in flower, and it is to be expected that they will have longer spathes.

It may be noted that in the same locality as the above plant, there occurs a form with similar long triangular leaves, but cordate at the base and with prominent cross veins. This is probably another species, but it has not yet been collected in flower.

It would appear possible that this is *Cryptocoryne Nevillii*. The type of the latter has similar stout stolons which were described in the Flora of Ceylon as fleshy root fibres. The leaves are up to 14 cm. long, with a lamina up to 6.5 cm. long and 1.5 cm. broad. The breadth of the lamina varies from 0.7 - 1.5 cm., and it is narrow oblong-oval or narrow lanceolate, cuneate at the base or attenuated into the petiole. One leaf is narrow obovate-oblong, rounded at the apex. The description of the leaves as, inter alia, linear appears to have been based on a spathe. The spathe is up to 15.5 cm. long, with a pedicel up to 2 cm., bulb 1 cm. (prox.), tube 11 cm., and limb 3 cm. The limb is narrow lanceolate, 3-4 mm. wide; in four flowers it may have been purple but the fifth is pale. The tube is marked with rather large purple spots at the mouth. The specimen examined had five carpels, with short styles, and capitate stigmas directed slightly obliquely downwards. The stigmas are not globose. Accessory bodies are present, as noted by Hooker. The pollen grains are large, 40-50 x 29-40 μ , as in the species from Yatiellagala. No papillae could be detected on the limb.

According to Nevill, who collected the type of *C. Nevillii*, the tube was spotted with dark purple, and the limb greenish purple. No mention

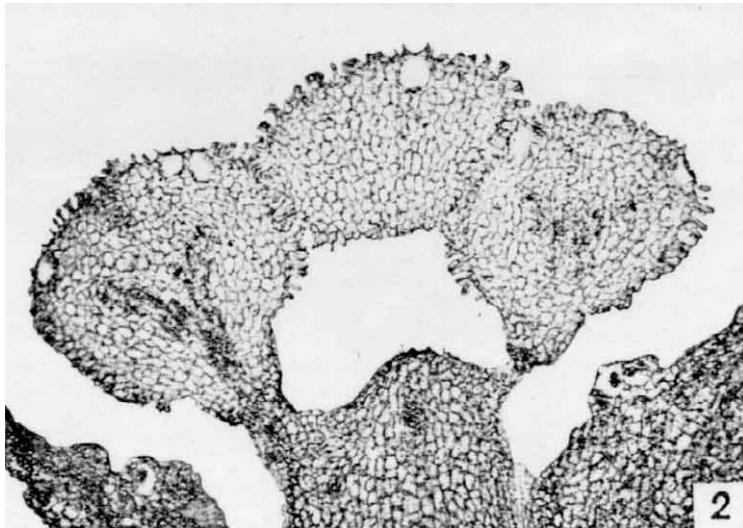
was made of a coloured collar, and this area in the type specimens is occupied by discrete spots. These may be variations in the larger examples, but until the type has been matched by fresh specimens it is not certain that the recent Yatiellagala plant is *C. Nevillii*. Attempts to obtain specimens of Atiudayan from the type locality of *C. Nevillii* has not been successful.

The statement in the Flora of Ceylon that in *C. Nevillii* the limb is longer than the tube is probably a slip of the pen. On the other hand, if the Yatiellagala specimens are the same, there is another possible explanation. As already stated, there is a well-marked groove down the front of the spathe in the Yatiellagala flowers, and in section the tube resembles a sheet curved round and united into a tube by its edges, the edges being rounded and the junction very narrow. Further, in some specimens the fusion is incomplete here and there along the groove. Consequently it is possible that, in the examination of herbarium specimens, the two sides might be separated and thus the limb would appear to be longer than it really is. In the measurements given in this paper, the length of the limb is measured from the tip down to the collar.

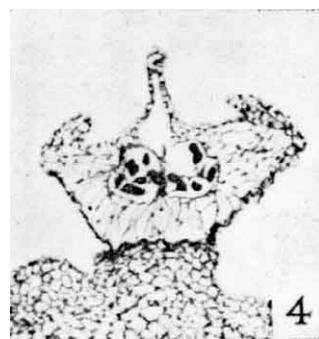
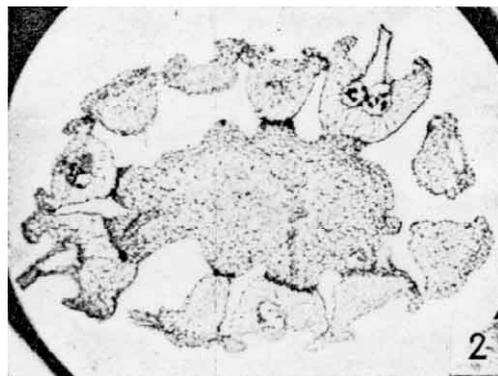
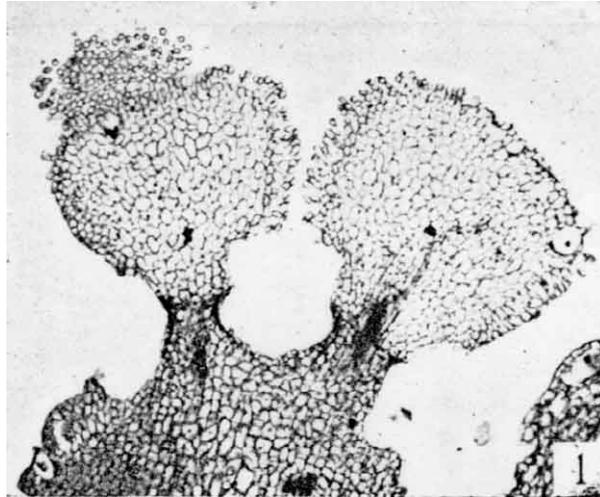
EXPLANATION OF PLATES

- Plate II, Fig. 1. Longitudinal section of the column and two accessory bodies, x 66. Parts of the styles are seen on either side at the base.
- Fig. 2. Longitudinal section of three contiguous accessory bodies, showing the interlocking of the peripheral processes, x 66.
- Plate III, Fig. 1. Longitudinal section of two accessory bodies, x 66.
- Fig. 2. Cross section of the anther column, x 40.
- Figs. 3, 4. Transverse section of an anther, passing through the conical process, x 66.
- Plate I V, Fig. 1. *Cryptocoryne Beckettii*, leaf viewed laterally, the greater part of the petiole omitted, natural size.
- Fig. 2. Ditto, leaf from upper side, natural size.
- Fig. 3. Ditto, an entire leaf from a cultivated plant, nat. size.
- Fig. 4. Ditto, a small spathe, natural size; the groove in the upper part of the limb is accidental.
- Fig. 5. *Cryptocoryne Walkeri*, leaf, natural size.
- Fig. 6. Ditto, venation of leaf, as seen from the back, natural size.
- Figs. 7, 8. Ditto, spathes, natural size.

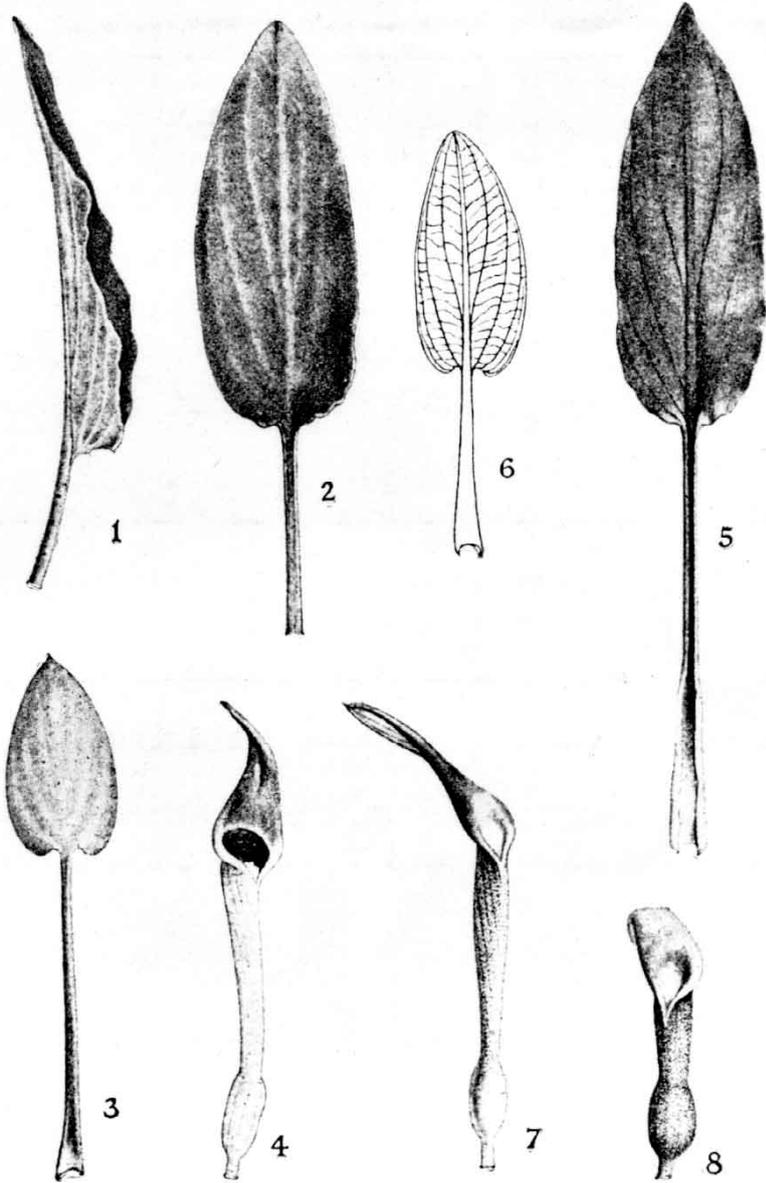
- Plate V, Fig. 1. *Cryptocoryne* sp. indet, leaf, natural size.
Fig. 2. Ditto, leaf viewed laterally, natural size.
Fig. 3. Ditto, venation, as seen from the back, natural size.
Fig. 4. Ditto, spathe, natural size.
Fig. 5. Ditto, upper part of spathe, natural size.
Fig. 6, 7. *Cryptocoryne Nevillii*, leaves from a cultivated plant, natural size
Fig. 8. Ditto, venation of leaf, as seen from the back of the leaf, natural size.
Fig. 9-11. Ditto, spathes, natural size.
Fig. 12. Leaf of probable wild form of the Yatiellagala plant, natural size.



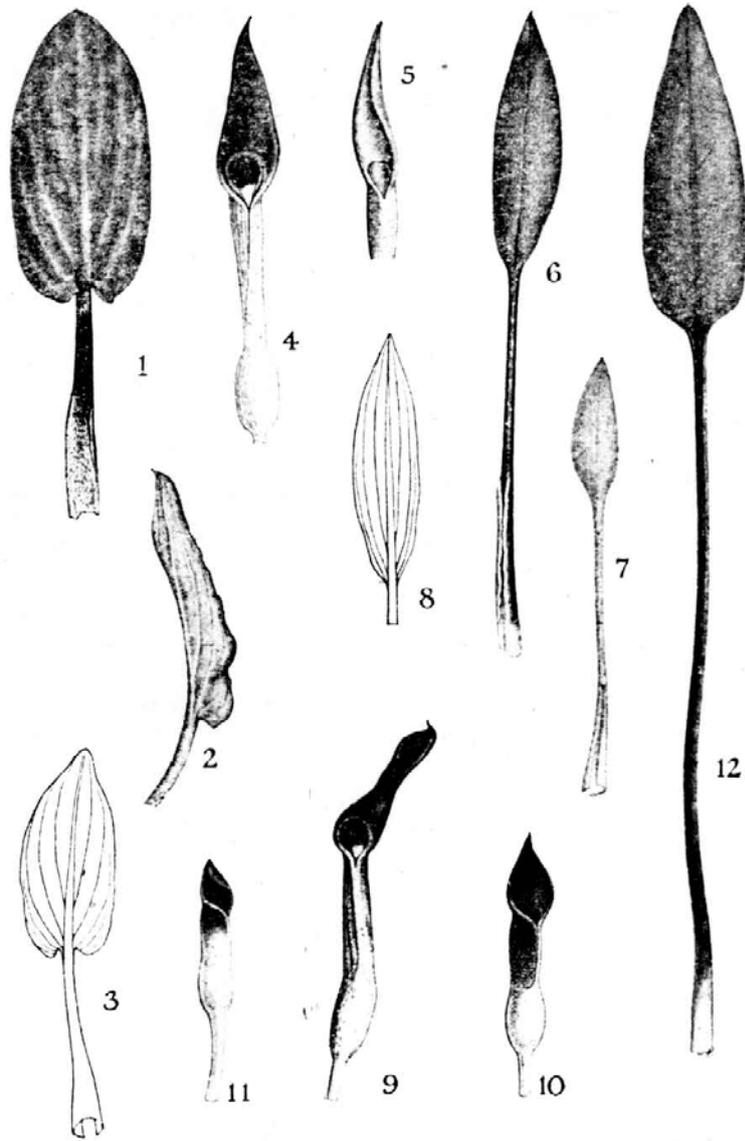
Cryptocoryne.



Cryptocoryne.



Cryptocoryne.



Cryptocoryne.