Some Selected Aquatic Ornamental Plants of Sri Lanka

A simplified guide to identification of

***Aponogeton* (Kekatiya)**
***Lagenandra* (Ketala) and**
***Cryptocoryne* (Atiudayan)**

D. S. A. Wijesundara and J. G. Shantha Siri

Technology Watch Centre (TWC)
National Science Foundation (NSF)

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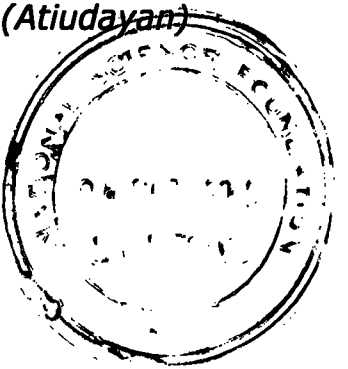

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Foreword

The aquatic ornamental plant industry in Sri Lanka has a vast potential in earning foreign exchange to the country. The industry has grown remarkably over the last couple of years. However, according to the stake holders, it has survived many hardships and still there are some problems which impede the growth of the industry. This industry could grow up to its full potential if the prevailing problems are sorted out. Aquatic plant industry requires an infusion of new technological methods such as artificial propagation through tissue culture which will remedy the prevailing problems while ensuring the sustainability of the industry. A workshop was conducted by the Technology Watch Centre (TWC) of the National Science Foundation (NSF) in February 2003 with the objectives of identifying technology related problems of the aquatic ornamental plant export industry in Sri Lanka in order to find practical and affordable solutions.

As identified at the workshop, publishing a book on identification of aquatic ornamental plants was one of the requirements of the industry. Therefore, the TWC has undertaken to publish this book with the help of the Science and Technology Personnel Development Project (STPDP) of the Ministry of Science and Technology. The TWC believes that the book will be a great help to the industry and other relevant authorities in minimizing problems associated with the identification of aquatic ornamental plants and thereby facilitate the growth of the industry.

We would like to express our grateful thanks to the STPDP project, especially Mr. D. B. Sumithraarachchi, Director, for his personal interest in preparing this book. Further, the effort made by Mr. R. M. W. Amaradasa/Director-Scientific Affairs and the TWC staff is highly appreciated. Our sincere gratitude is extended to Dr. D.S.A. Wijesundara/ Director, Royal Botanic Gardens, Peradeniya who gave assistance and guidance as the editor of this book and Dr. Y.M.H.B. Yapabandara/ Research Officer, Export Agriculture Department for providing information for the book. We acknowledge the permission granted by Mr. Jan D. Bastmeijer to reproduce some of the pictures of aquatic ornamental plants from his own URL.

We welcome the comments of our readers which will be taken into account when the book is revised in the future.

M. Watson
Director
Natioanal Science Foundation

Introduction

Floriculture as an export industry began in the early 1980s and has shown an impressive growth rate in foreign exchange earnings. The growth of this sector is mainly attributed to private sector nurseries while successive governments provided needed assistance although in a small way. At present, over 5,000 people in semi-urban and rural areas are involved in the floriculture industry.

The export of ornamental plants, cut flowers, and seeds from Sri Lanka accounted for one billion rupees in 2003. This income was mainly from the export of live plants which included a considerable amount of aquatic plants, branches, leaves etc. The export of aquatic plants from Sri Lanka also seems to be registering an upward trend. In 1997, nearly 4.2 million aquatic plants were exported from Sri Lanka, and this figure almost doubled in 1998 (about 8 million plants). However, more work needs to be done to ensure that this industry reaches its full potential and the present problems faced by the industry are ironed out so that it could become a key player in the Sri Lankan export market.

At a NSF-TWC workshop on Aquatic ornamental plants, the following needs were identified by the growers involved in exporting aquatic plants.

1. Need for adopting simple procedures for identification of aquatic ornamental plants (Need to publish a brochure on available methodologies of propagation and identification).

2. Awareness programmes/workshops to make the industry aware of trends in the areas such as market, technology, and competitors etc.

3. Application of computer packages such as DELTA for identification of aquatic ornamental plants.

Research and development of aquatic ornamental plant industry is another area which needs attention. Wild collection for export without artificial propagation would lead to an extinction of endemic aquatic plant species. It also affects the natural aquatic ecosystem. Therefore continuous research and development would be required not only for making the industry sustainable but also to achieve competitive edge in the global market. Some of the areas that need to be addressed by R & D are:

1. Identification of potential aquatic ornamental plant species

2. Preparation of simple propagation system for the potential species

3. Propagation of new exotic species

4. Natural population studies on native aquatic ornamental plants

5. Use of molecular markers for identification of these plant species.

Since the industry has a great potential, commitment from the policy making parties is crucial not only in making the industry sustainable but also facilitating its growth. Therefore, some of the areas to be paid more attention in this regard as identified by the industry are:

1. Involvement of stake holders when formulating and amending relevant regulations and ordinances

2. Unify certifying agencies (one stop shop) to make sure consignments leave the ports on time.

One of the major problems faced by the industry relates to the issue of identification of plants, as there are different species with similar morphological characters. In addition, there are a number of species bearing a same common name. The fact that export clearing agencies have no proper identification methods and capabilities also adds to the problems of the industry. These lead to frequent delays, hampering the industry's ability to meet customer deadlines. Another problem encountered by the industry is the absence of a central body from which the industry can obtain brood-stock to propagate the required number of plants.

Same species show different morphological features when grown under different environmental conditions. If there are proper identification techniques, at least for the potential species, it will facilitate the industry as well as relevant government authorities to minimize unnecessary delays due to the identification problems. If proper identification procedures are well documented, it will ensure consistency in activities related to identification of aquatic ornamental plant species thereby enhancing the efficiency.

The main purpose of artificial propagation is to make industry sustainable. The tissue culture technology for artificial propagation of some potential species already available at the Industrial Technology Institute (ITI). According to experts in the field, potential aquatic ornamental plant species could be propagated at a reasonable cost through the tissue culture technology.

The following are advantages in this method over wild collected plants.

- Help conserving the wild populations
- Possibility of large-scale propagation of plants
- Production of pathogen free planting materials
- Possibility of production of genetically identical plants in large-scale
- Climatic conditions and macro-environment do not affect the plant production
- Possibility of crop improvements via genetic modification
- Comply with policies/legal framework
- Ensure sustainability of the industry
- It requires a limited space

Identification of *Aponogeton species*

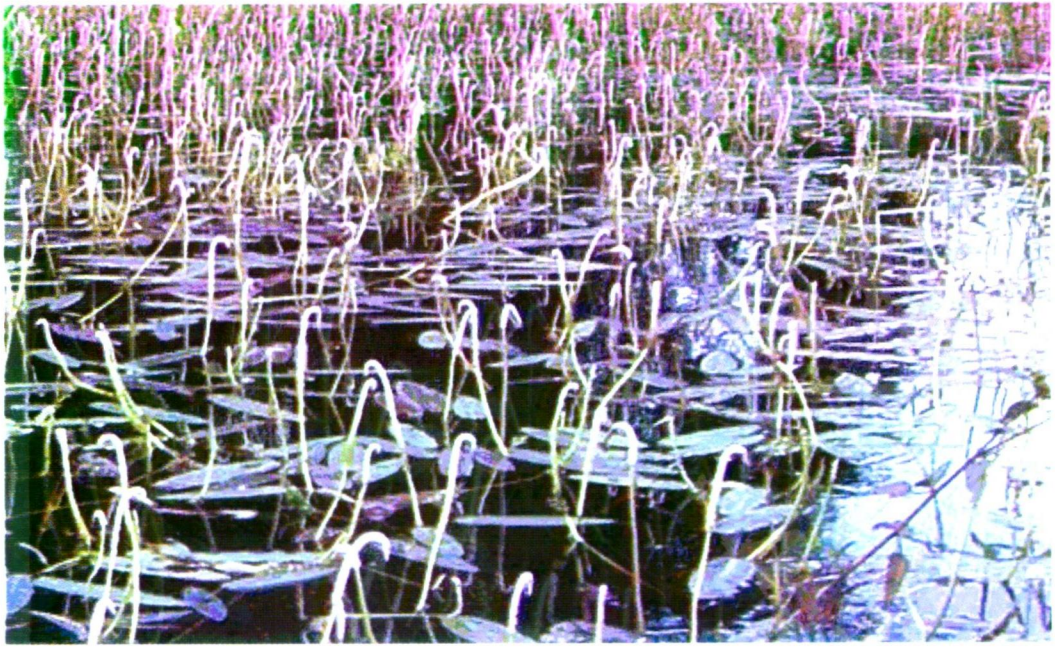


Figure 1. A natural population of *Aponogeton crispus* in Anuradhapura

Figure 2. A mature plant of *Aponogeton crispus* with rhizome, the part responsible for vegetative propagation of the plant

Aponogeton species are aquatic plants belonging to family Aponogetonaceae. There are about 43 species of Aponogeton distributed in Africa, Madagascar, India, Sri Lanka Malaysia and some parts of Australia. According to van Bruggen (1987) there are four *Aponogeton* species native to Sri Lanka namely *Aponogeton natans, A. crispus A. rigidifolius* and *A. jacobsonii.* Of these, *A.jacobsonii and A. rigidifolius are found only in Sri Lanka.*

A. jacobsoni is confined to the hill country (Nuwara Eliya, Badulla) of Sri Lanka. One of the well-known localities of that species is Horton Plains. *A. natans* is usually found in the dry and arid areas (Trincomalee, Mannar, Vavunia, Hambantota, Moneragala etc.). *A. crispus* is common in both dry and wet regions (Jaffna, Puttalam, Anuradhapura, Matale, Kurunegala, Kalutara, Kandy) while *A. rigidifolius* is found in the wet zone in the south west (Kalutara, Galle,Ratnapura) of Sri Lanka. All these species are known as kekatiya in Sinhala.

It must be emphasized that it is not easy to identify them by looking at the rhizome (underground stem) or a juvenile plant. One needs to examine both floral and vegetative characters for an accurate identification. Before going in to specific reproductive characters of each different species let's first look at the floral characters of a typical *Aponogeton* flower.

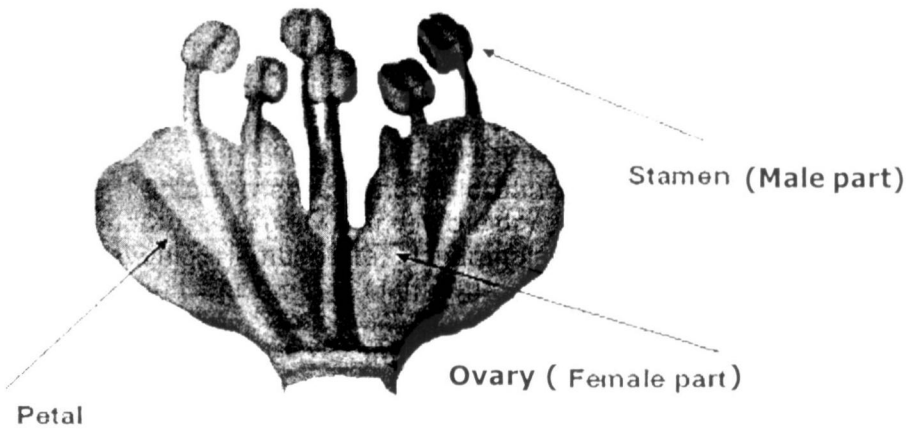


Figure 3. Parts of a typical *Aponogeton* flower

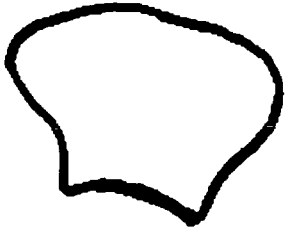
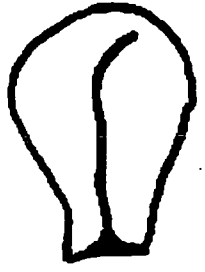
A. natans	*A. jacobsonii*	*A. rigidifolius*	*A. crispus*
Spoon-shaped 1.5-2 x 0.5-1 mm	Rounded-square, and sometimes wider than long 2x2 mm,	End is broader than the base 2-3.25 x 1.75-2 mm	End is broader than the base, 2.25x1.75 mm
			

Table 1. A comparision of petals of flowers of different species of *Aponogeton*

Aponogeton flowers are borne in long 'tail like' stalks that arise at the centre of the plant. They have only 2 (rarely 3) petals, 6 stamens and 3 female parts (ovaries). If examined using a hand lens, one can notice differences in the flower parts of the 4 different species.

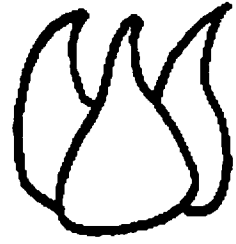
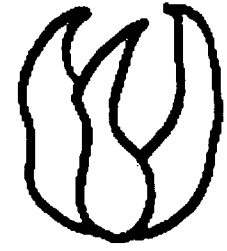
A. natans	*A. jacobsonii*	*A. rigidifolius*	*A. crispus*
Up to 2 x 0.75 mm	Up to 1.75 x 1 mm	2-2.5 x 0.75-1 mm	Up to 2 x 1 mm
			

Table 2. A comparision of shape of the ovaries of different species of *Aponogeton*

The female parts in each species consist of three parts (ovaries) at the centre of the flower. Each part (ovary) contains several small spherical masses (ovules) which will mature into seeds. *A. natans* has eight such ovules per ovary while all other species have only two ovules per ovary.

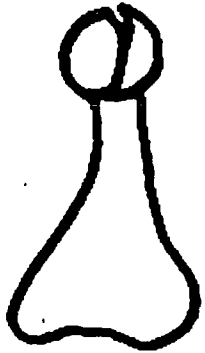
A. natans	*A. jacobsonii*	*A. rigidifolius*	*A. crispus*
2.5-3 mm, not widened towards base	1.5-2.5 mm, strongly widened towards base and swollen, anthers violet, pollen yellow	1.5-3 mm, widened towards base, anthers brownish grey, pollen yellow	Up to 2.5 mm, widened towards base, anthers violet, pollen yellow
			

Table 3. A comparision of shape of the stamens of different species of *Aponogeton*

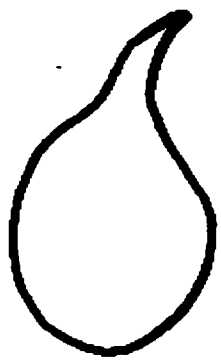
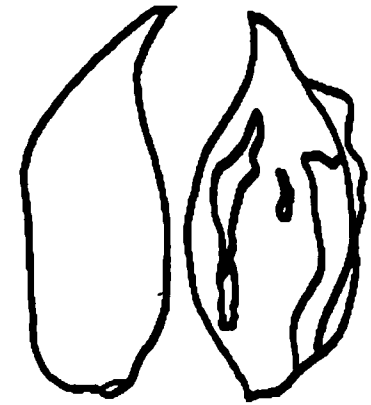
A. natans	*A. jacobsonii*	*A. rigidifolius*	*A. crispus*
Up to 4 x 2.25 mm, with a long (1 mm) beak	Up to 12 x 5 mm about 2.5 times as long as thick, smooth and often curved.	Up to 12 x 6 mm, terminally beaked	*Up to 12-18 x 5-7 mm, about twice as long as thick, terminally beaked, smooth or rough*
			

Table 4. A comparision of shape of the fruits of different species of *Aponogeton*

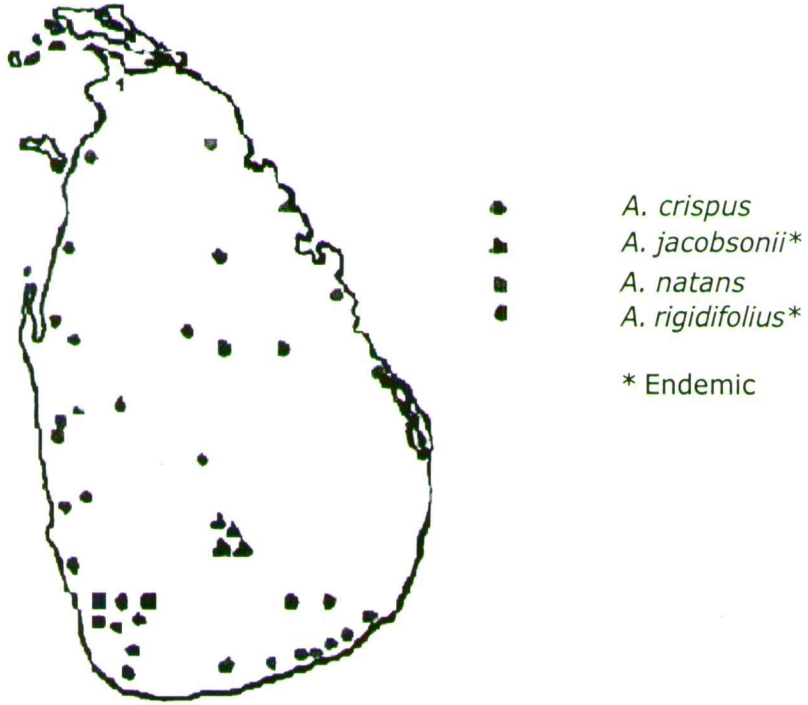


Figure 4. Distribution of Aponogetonaceae in Sri Lanka

Figure 5. A mature plant of *Aponogeton crispus*

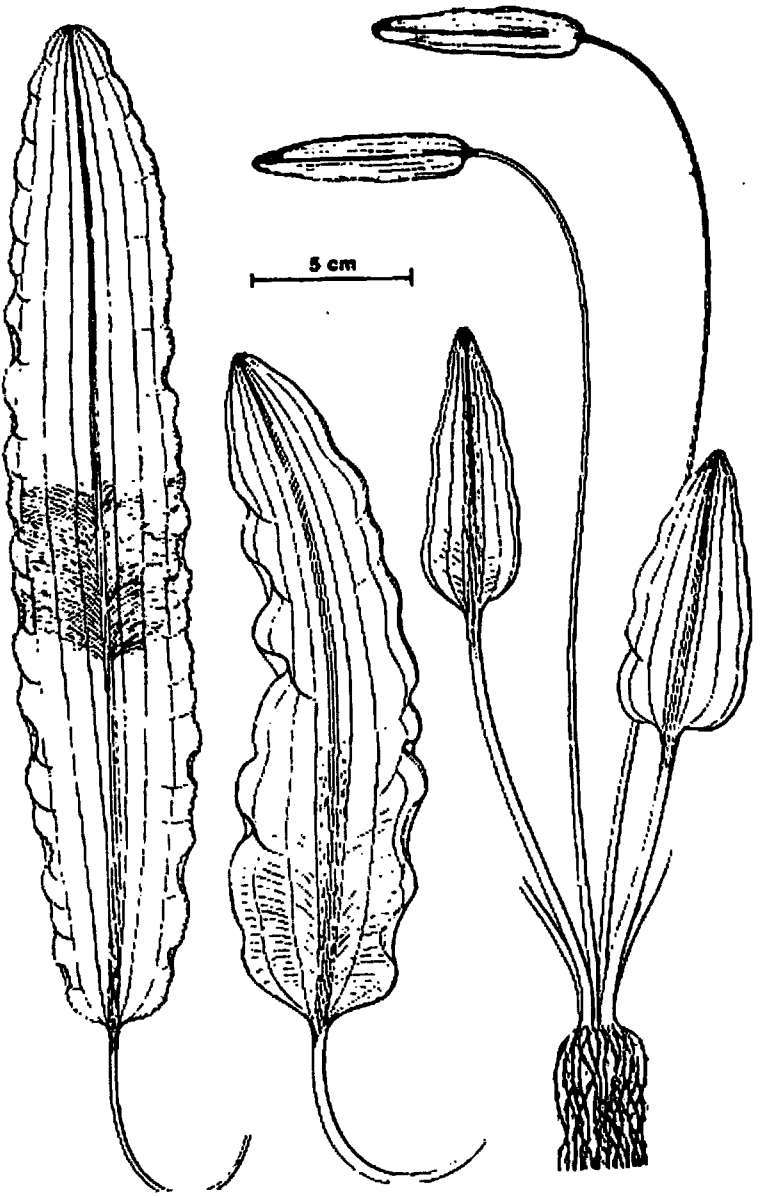


Figure 6. Shape of the leaves of *Aponogeton jacobsonii*

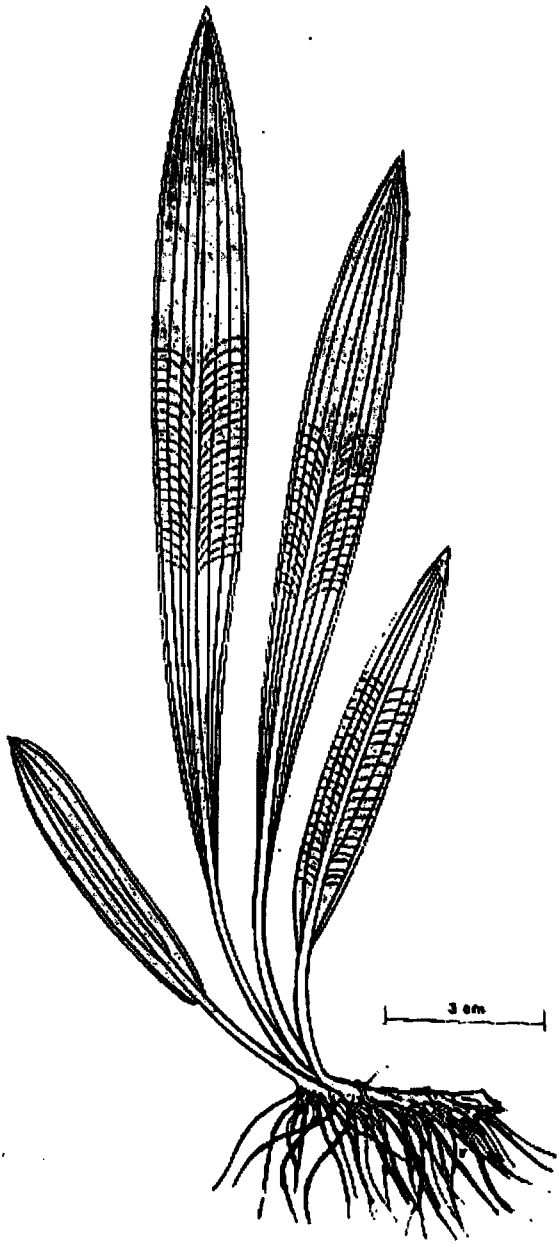


Figure 7. Shape of the leaves of *Aponogeton rigidifolius*

Identification of *Lagenandra* species

Identification of *Lagenandra* species

Lagenandra species are found only in India and Sri Lanka. These species, popularly known as ketala in Sinhala, belong to family Araceae.

Nicolson (1987) recorded the following eight *Lagenandra* species from Sri Lanka:

1. *Lagenandra ovata*
2. *L. praetermissa*
3. *L. lancifolia*
4. *L. koenigii*
5. *L. erosa*
6. *L. jacobsonii*
7. *L. thwaitesii*
8. *L. bogneri*

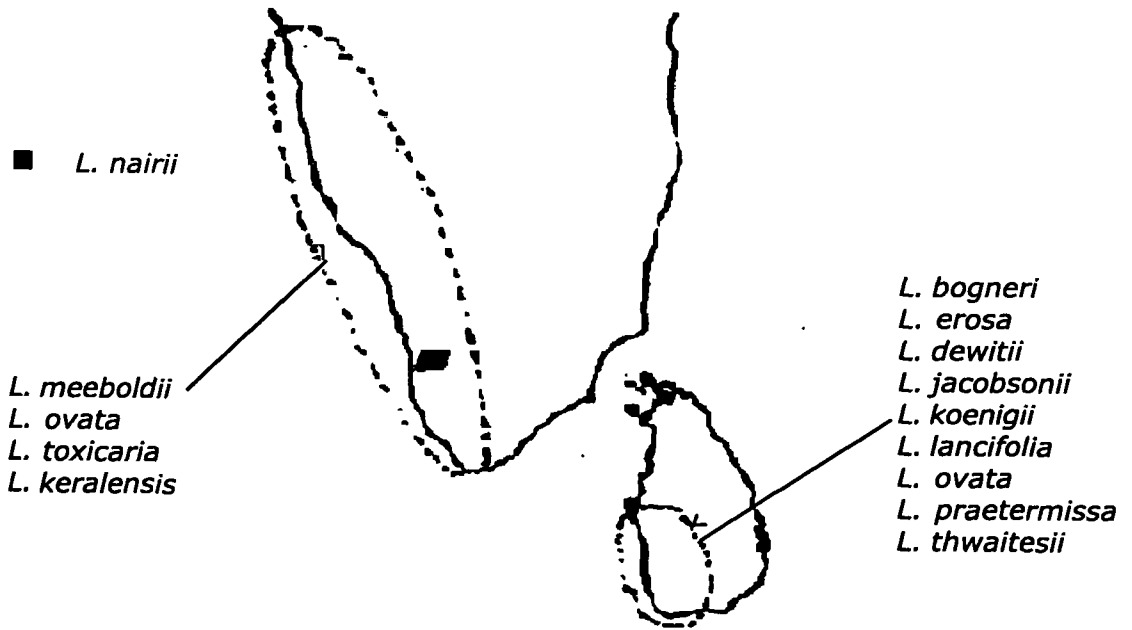
In addition to the above, *L. dewitii* was described by Crusio and Graff (1986). Except for *L. ovata* all *Lagenandra* species recorded from here are found only in Sri Lanka.

Flowers in the *Lagenandra* family (Araceae) are arranged in a spike (spadix) subtended by a leaf-like structure called spathe. In some species of Araceae, such as Anthurium, the spathe is variously colored and even the spadix is prominent. In *Lagenandra,* the spathe is in two parts. The margins in the basal part are united into a tube-like structure called kettle while the upper part is open and form a twisted blade tapering into a tail-like ending. The spike carrying the flowers is included in the kettle.

Of the 8 species of *Lagenandra* in Sri Lanka only three species have distinctly warty spathes. They are *L. ovata, L. praetermissa* and *L. lancifolia*. *L. ovata* and *L. praetermissa* are very large herbs.

Five species have spathes which are either smooth or non-warty. They are:

1. *L. koenigii*
2. *L.erosa*
3. *L.jacobsonii*
4. *L. thwaitesii and*
5. *L. bogneri*


L. nairii
L. meeboldii
L. ovata
L. toxicaria
L. keralensis
L. bogneri
L. erosa
L. dewitii
L. jacobsonii
L. koenigii
L. lancifolia
L. ovata
L. praetermissa
L. thwaitesii

Key for identification of *Lagenandra* species

Spathe warty outside

- *L. ovata*
- *L. praetermissa*
- *L. lancifolia*

Spathe not predominantly warty

- *L. koenigii*
- *L. erosa*
- *L. jacobsonii*
- *L. thwaitesii*
- *L. bogneri*

Warts large – up to 3 mm = *L. ovata*

Warts small – up to 1 mm

- Spathe more than 10 cm = *L. praetermissa*
- Spathe less than 10 cm = *L. lancifolia*

Figure 8. A mature plant of *Lagenandra koenigii*

Leaves are elongated (up to 50 cm), ribbon-like and narrow. Outside of the spathe is purple. Leaves are over 10 times longer than broad.

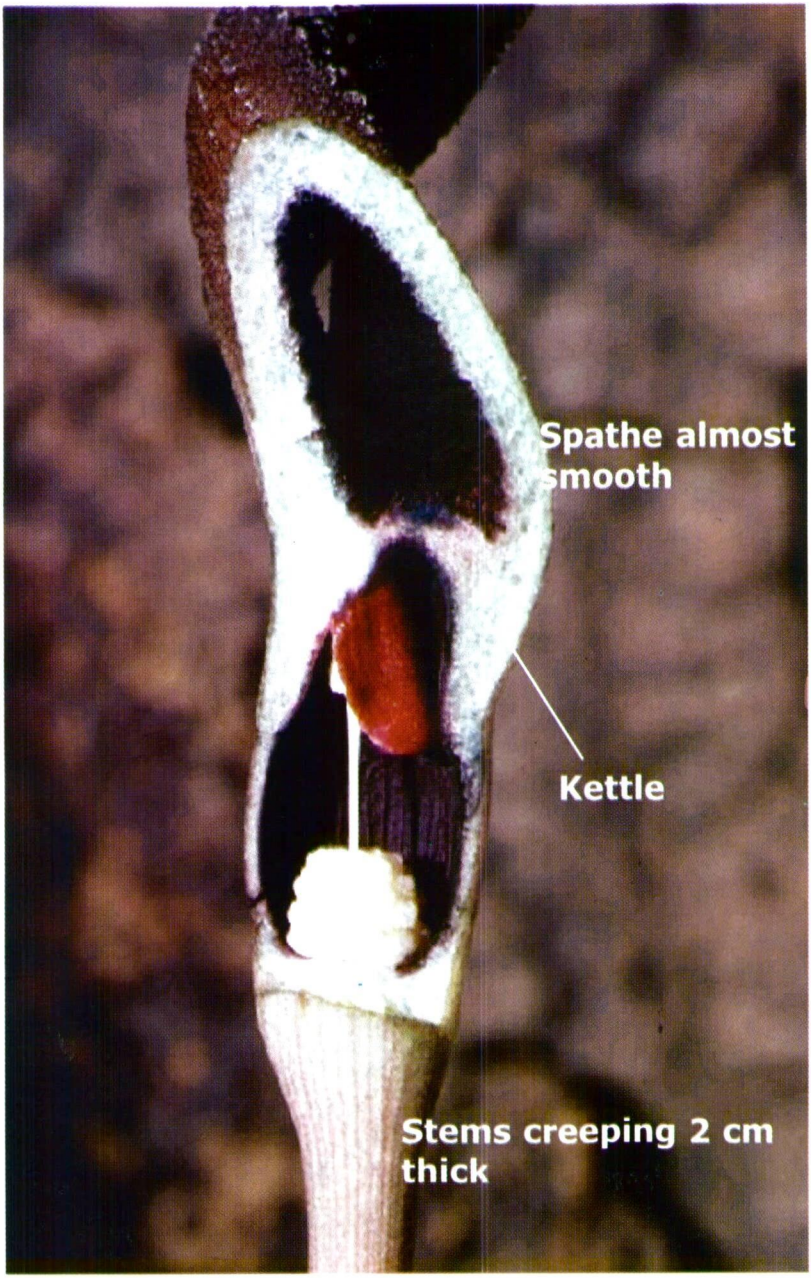


Figure 9. Reproductive structure of *Lagenandra koenigii* (A longitudinal section)

Figure 10. Shape of the leaves of *Lagenandra erosa*

Short (up to 20 cm long), ribbon-like, narrow leaves. Outside of the spathe is green. Leaves are over 10 times longer than the width of leaves.

Figure 11. Reproductive structure of *Lagenandra erosa* (A longitudinal section)

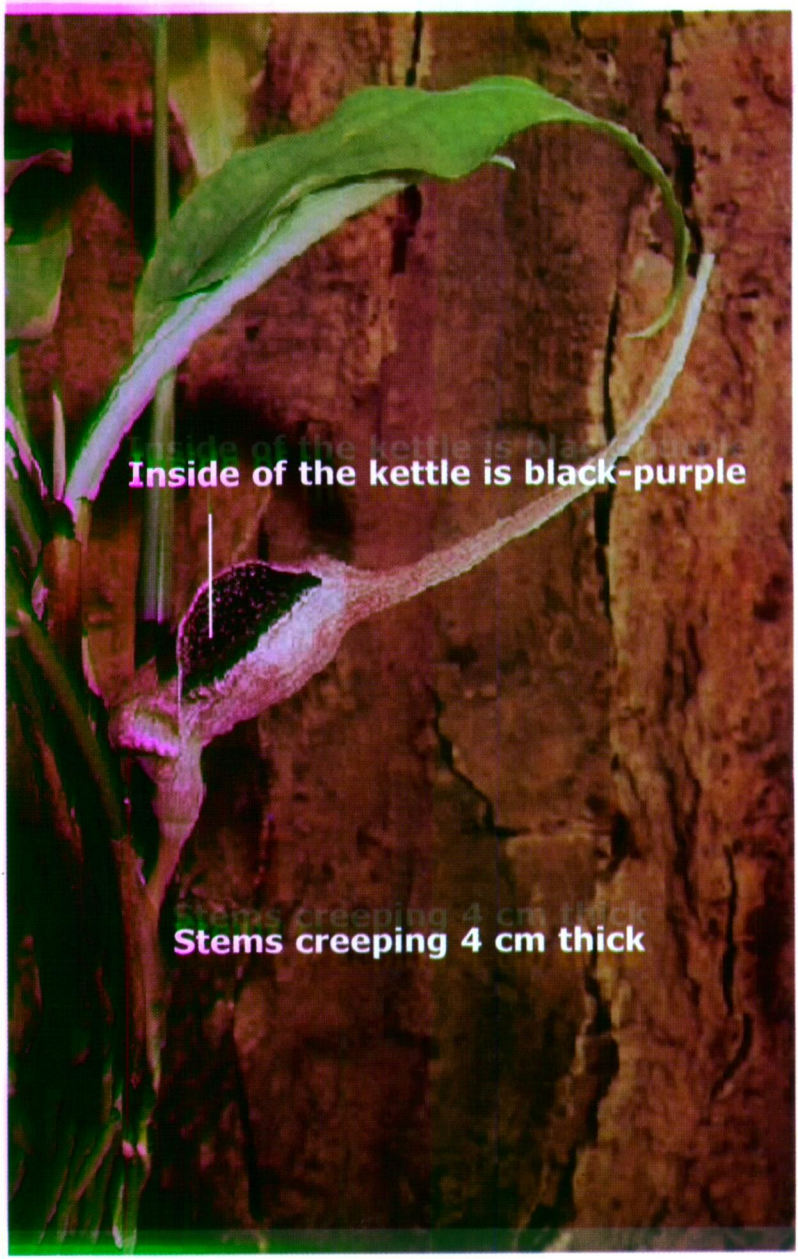


Figure 12. A plant of *Lagenandra jacobsonii*

The leaf blade is almost lance-shaped (about 5 times longer than broad). Spathe-limb is strongly twisted and inflated. Its stem is creeping 4cm thick. The inside of the kettle is black-purple.

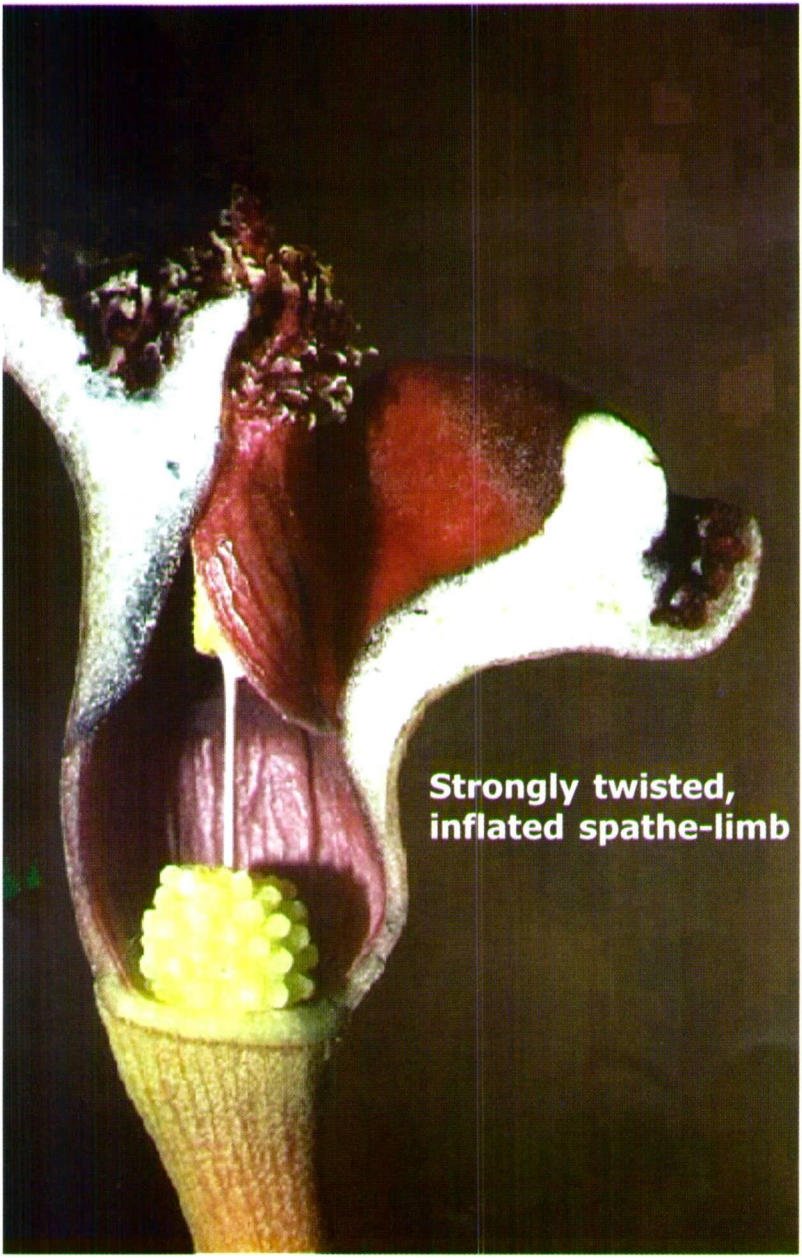


Figure 13. Reproductive structure of *L. jacobsonii* (A longitudinal section)

Figure 14. Length of the petiole of leaves of a mature plant of *Lagenandra thwaitesii*

The leaf blade is almost lance-shaped (about 5 times longer than broad) and the margins are silver-colored. The spathe-limb is cylindrical, stems creeping 1cm thick.

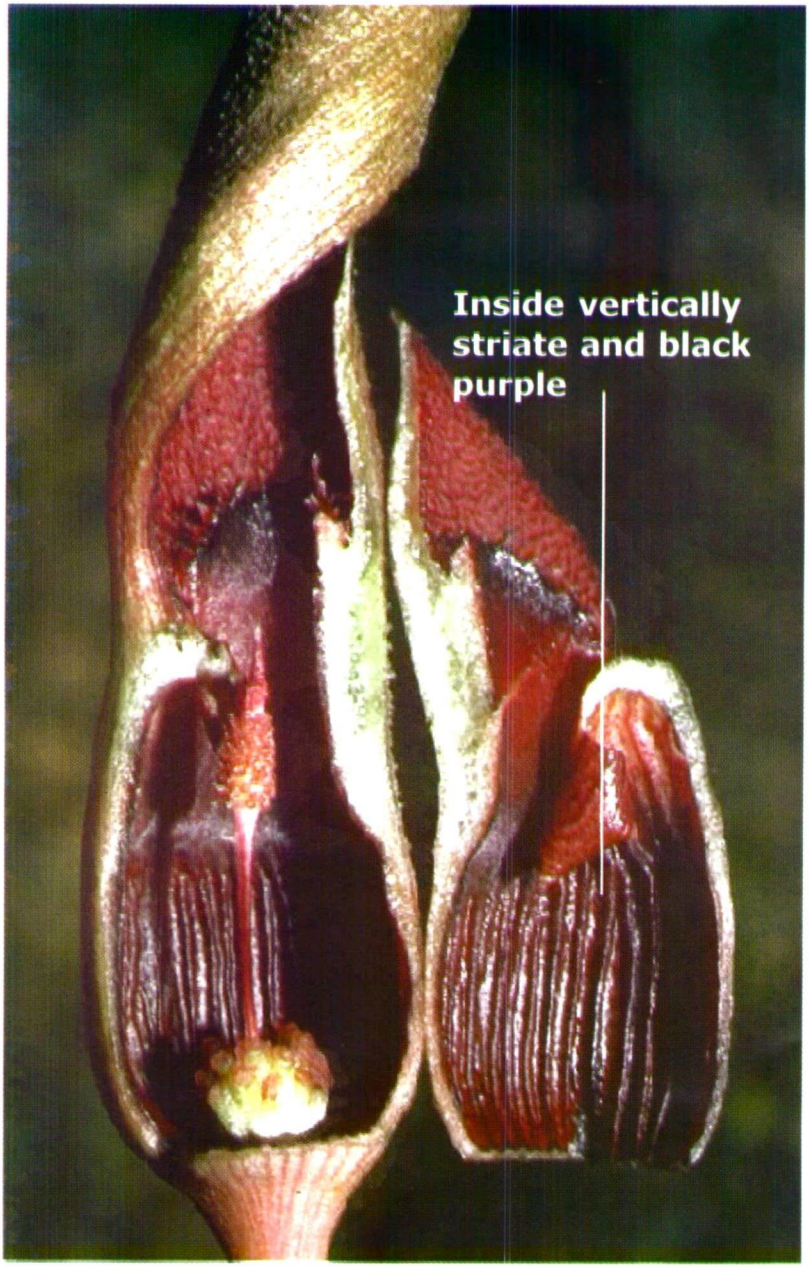


Figure 15. Reproductive structure of *Lagenandra thwaitesii* (A longitudinal section)

Inside color is black purple and the stalk of the inflorescence is about 2 cm long. There are prominant vertical grooves inside the kettle.

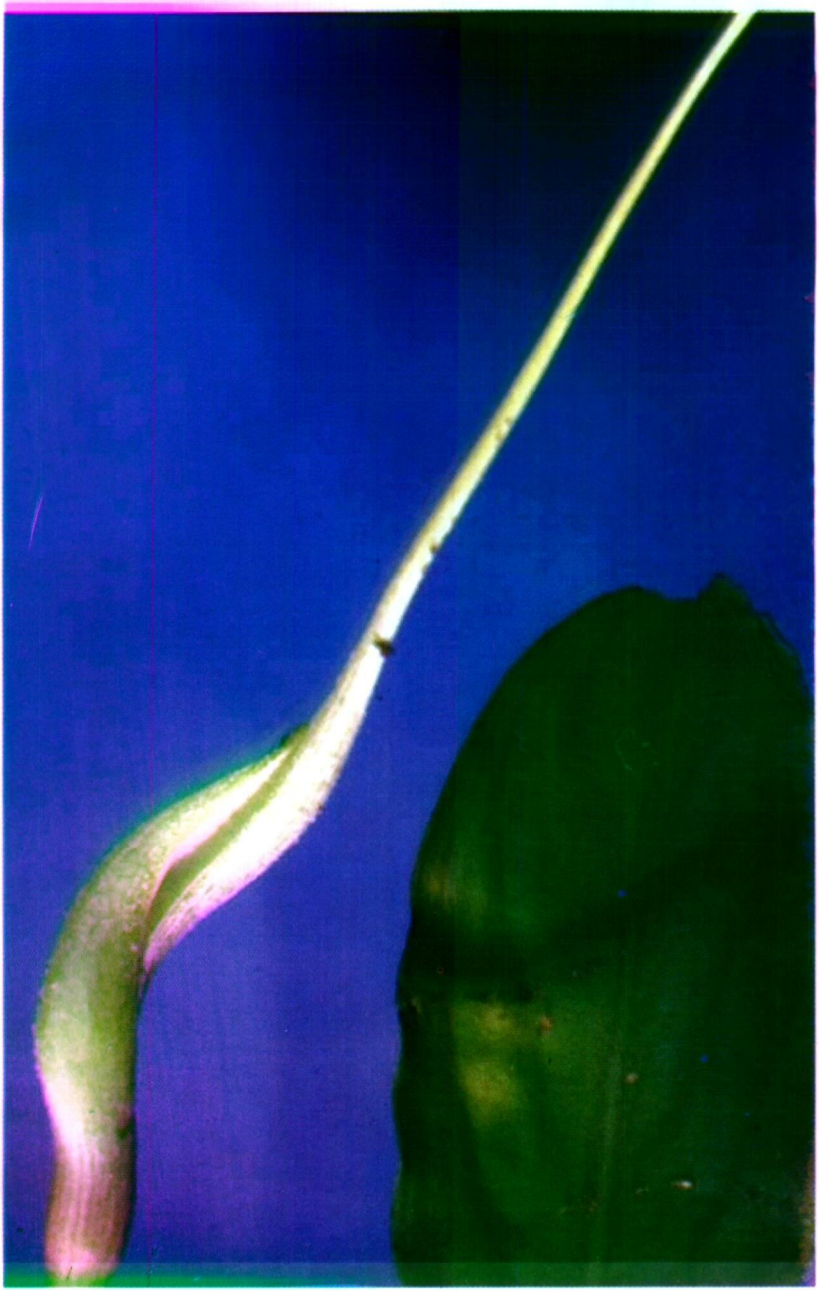


Figure 16. Shape of the leaf blade of *Lagenandra bogneri*

The leaf blade is almost lance-shaped (about 5 times longer than broad). *L. bogneri* can be distinguished from *L. thwaitesii* as the leaf margins are not silver colored (in *L. bogneri*). Also the inflorescence stalk in *L. bogneri* are longer (7-12 cm) than that of *L. thwaitesii*

Figure 17. Reproductive structure of *Lagenandra bogneri* (A longitudinal section)

Figure 18. *Lagenandra praetermissa* showing small warts on the spathe

Warts on the spathe are small (up to 1 mm). Open part of the spathe in *L. praetermissa* is almost cylindrical in shape. Spathe is over 15 cm long. It is a very large herb.

Figure 19. Reproductive structure of *Lagenandra ovata* showing large warts on the spathe.

In *L. ovata,* the warts are larger (about 1.5-3 mm) than those of the other two species. Spathe is about 20 cm long and the upper part has a hump-like inflation. *L. ovata* is also a very large herb.

Figure 20. A typical plant of *Lagenandra lancifolia*

Leaf shape is lanciolate.

Figure 21. Shape of the reproductive structure of *L. lancifolia*

Stems are creeping 1 cm thick. Small warts are found on the spathe . The Open part of the spathe is almost cylindrical and it is short (2-3 cm long) compared to the other *Lagenandra* species.

Identification of *Cryptocoryne* species

Identification of *Cryptocoryne species* of Sri Lanka

The genus *Cryptocoryne* is an amphibious member of Araceae with more than 50 different species distributed throughout Southeast Asia. *Cryptocoryne* species are found mostly in slow moving fresh water streams and shallow rivers, of width 1-20 meters, in tropical forests. *Cryptocoryne* species provide unique functions for aquatic ecosystems, such as cleaning of water by adhering suspended particles and prevention of soil erosion with their deeply growing rhizomes. Underground rhizomes can survive in severe drought conditions. These species are very popular as aquarium plants because they are quite easy to grow in aquaria and thrive well for a longer period. Moreover, they provide a wide range of colours (green to copper brown) and foliage patterns for a colourful and fascinating aquarium. No other aquarium plant can add reddish, reddish-brown or reddish-brown marble colours to an aquarium. Some of the stunted types of *Cryptocoryne*, such as C. parva, are used to create "lawns" in aquascaping. Thus *Cryptocoryne* is an intrinsic component of any colourful aquarium, and have an extended life span. This is the reason why more than 20 *Cryptocoryne* are being used for aquarium decorations in the world.

Cryptocoryne in Sri Lanka

The following *Cryptocoryne* species are found in and along springs, streams and rivers in the lowlands and midland rain forests of Sri Lanka.

1. *Cryptocoryne beckettii*
2. *Cryptocoryne wendtii*
3. *Cryptocoryne parva*
4. *Cryptocoryne willisii*
5. *Cryptocoryne thwaitesii.*
6. *Cryptocoryne alba*
7. *Cryptocoryne bogneri*
8. *Cryptocoryne walkeri*
9. *Cryptocoryne nevillii*
10. *Cryptocoryne undulata*

These species are not found anywhere else in the world (endemic) as naturally occurring water plants. These species are found either submerged or as emerged in water. They provide shade and shelter for fish and other aquatic fauna. Most of the endemic, threatened fish live associated with these endemic plants.

The natural habitats of these species are being reduced dramatically as a result of uncontrolled and forbidden exploitation and rapid depletion of forest covers. For example, the island's forest cover, which was as high as 80 per cent in 1920, reduced to 20 per cent by 1990, even this remaining natural forest source is deteriorating day by day. As a consequence, nine *Cryptocoryne* species are under threat of extinction.

Species	Locations
C. beckettii	Kandy, Kegalle, Ratnapura
	Galle, Hambantota, Matale
C. wendtii	Kandy, Matale, Kurunegala
C. nevillii	Batticaloa, Ampara
C. undulata	Kandy, Kegalle, Matale
C. parva	Kandy, Kegalle, Matale
C. walkeri	Kandy, Peradeniya
C. x willisii	Kandy, Matale, Ratnapura
C. thwaitesii	Galle, Kaluthara, Ratnapura
C. alba	Galle, Kaluthara, Ratnapura
C. bogneri	Ratnapura

Table 5. Distribution of *cryptocoryne* species in Sri Lanka
Source: Asia Pacific Tech Monitor- Nov-Dec 2000

Figure 22. Features of the inflorescence of *Cryptocoryne alba*

The limb is wide open. There is somewhat like a thickened collar zone. The limb has opened to nearly the end, one cannot distinguish a 'tail', as it is more usual in this species.

Figure 23. A *Cryptocoryne alba* plant with somewhat deviated leaf colour

Leaves are brown . The spathe is yellowish on the outside.

Figure 24. Leaf structure of *Cryptocoryne alba*

Green marmorated leaves and a distinct rose colored limb of the spathe.

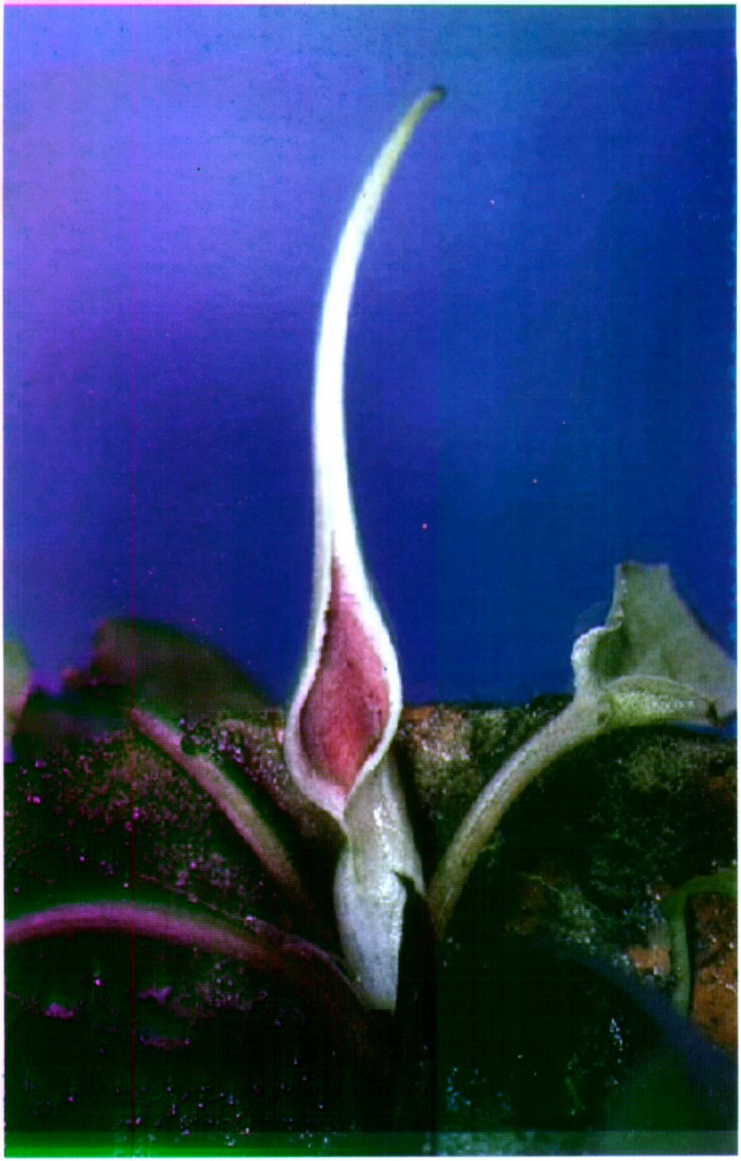


Figure 25. A plant of *Cryptocoryne alba* with red colored limb.

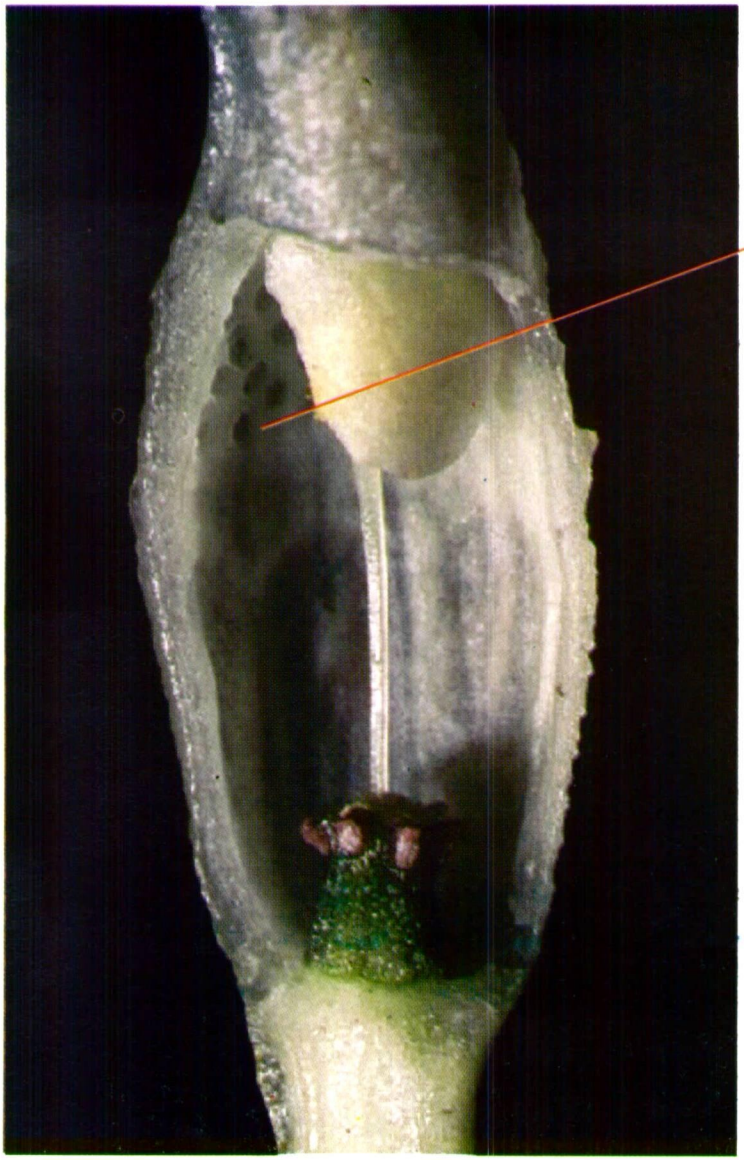


Figure 26. Structure of the inflorescence of *Cryptocoryne alba* (A longitudinal section)

There are alveoli (depressions in the wall) inside the limb opposite the male flowers.

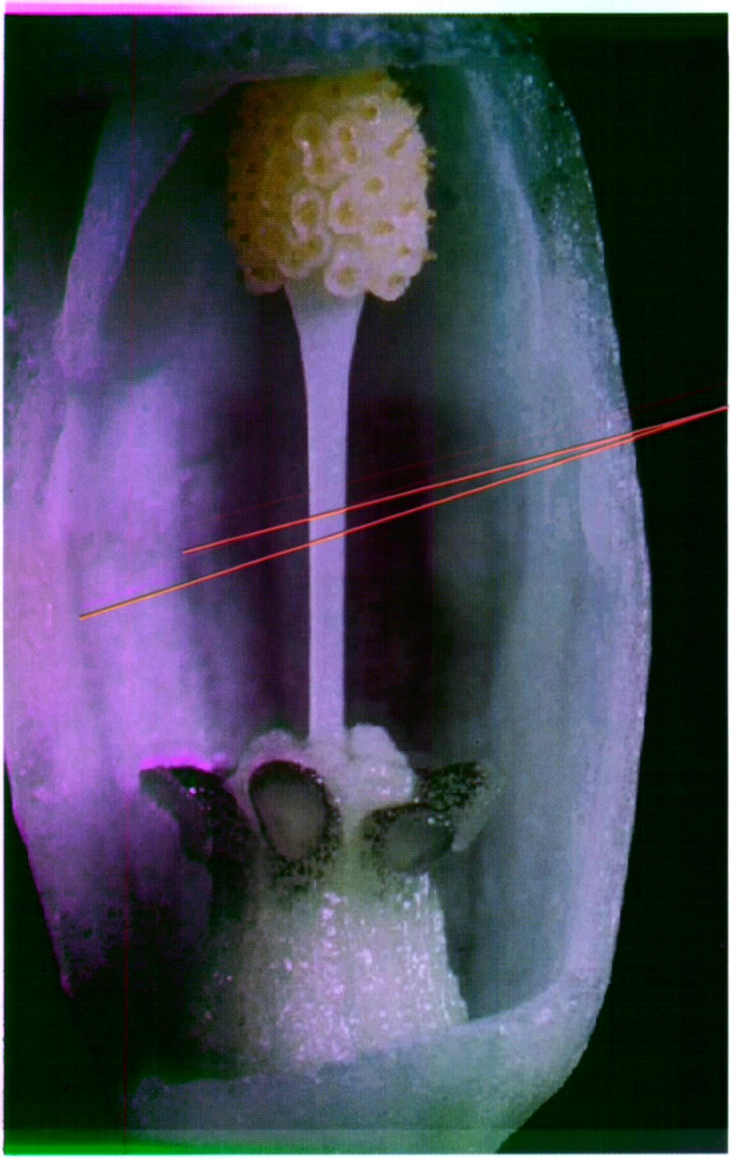


Figure 27. vertical grooves in the lower part of the kettle of *Cryptocoryne alba* (A longitudinal section)

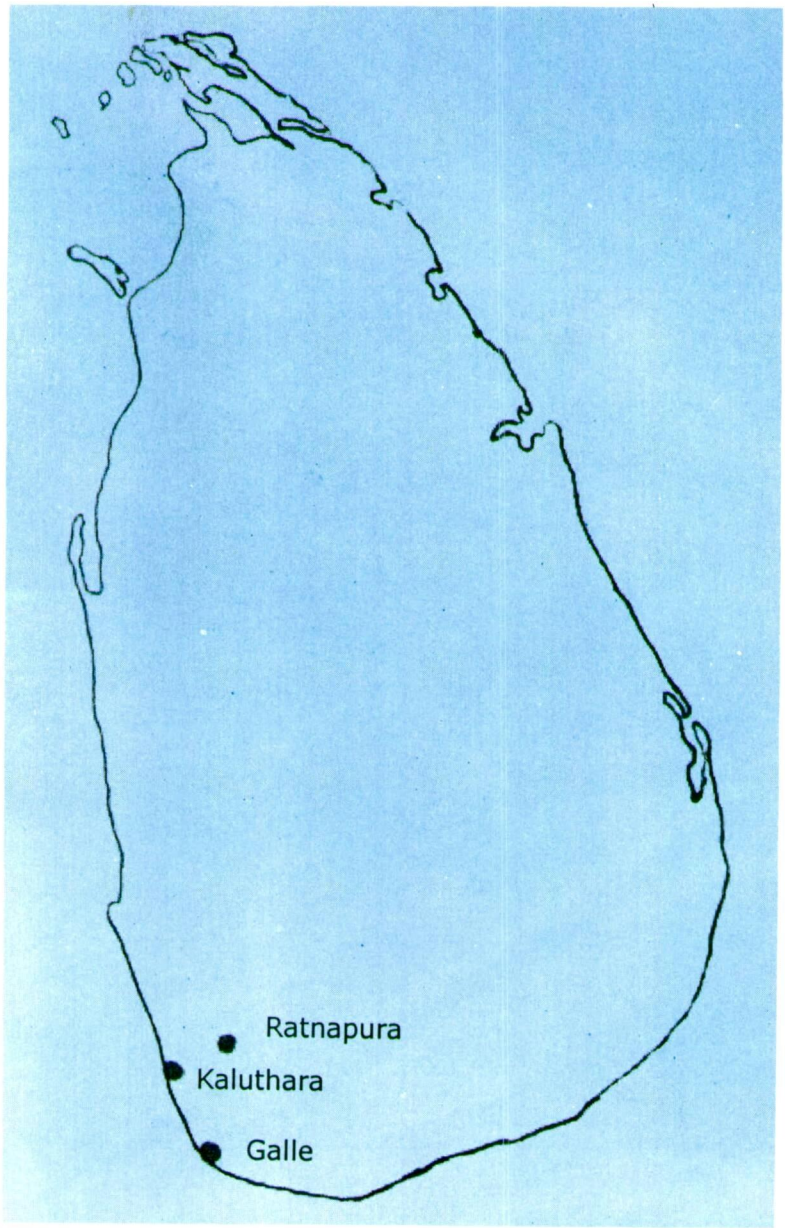


Figure 28. Disrtibution of *Cryptocoryne alba*

Figure 29. Typical limb of the spathe of *Cryptocoryne beckettii*

The asymmetrical limb is brownish yellow. The collar is broad and high. There is a groove in the top part of the limb.

Figure 30. Leaf structure of *Cryptocoryne beckettii*

The leaves have a fine undulated margin with dark transverse stripes.

Figure 31. Leaf structure of *Cryptocoryne beckettii*

Leaf has a wide undulated margin

Figure 32. Unique red-brownish limb collar of *Cryptocoryne beckettii*

The red-brownish yellow limb and the dark brown collar and throat, makes the best opinion that it is a *C. beckettii*.

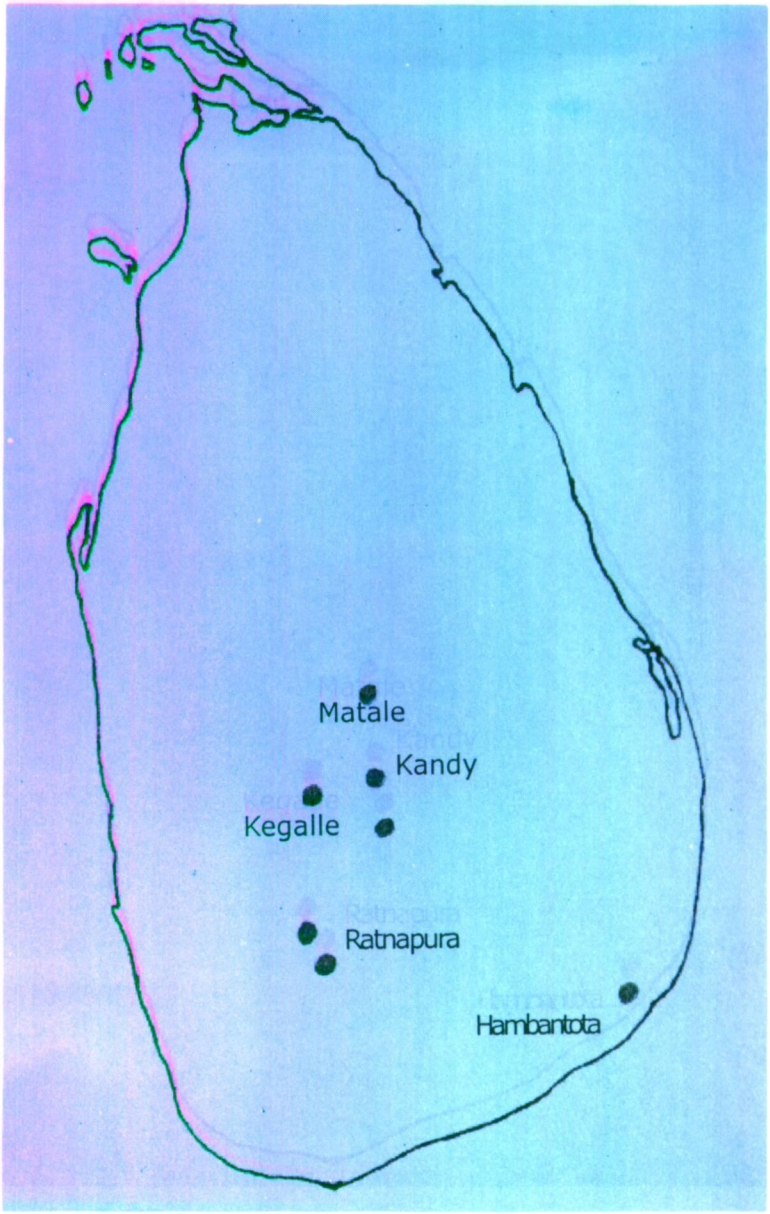


Figure 33. Distribution of *Cryptocoryne beckettii*

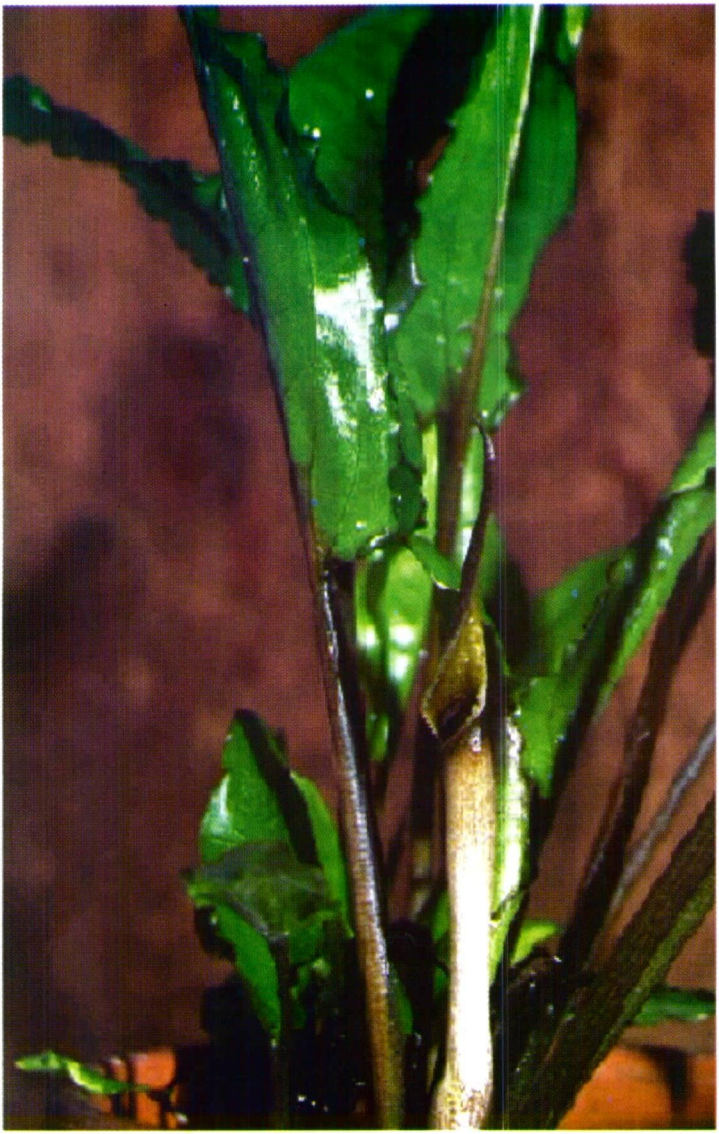


Figure 34. A quite normal specimen of *Cryptocoryne wendtii*

The leaves are grass-green, in submersed culture they may develop grayish spots. The limb of the spathe is yellow and is rather open.

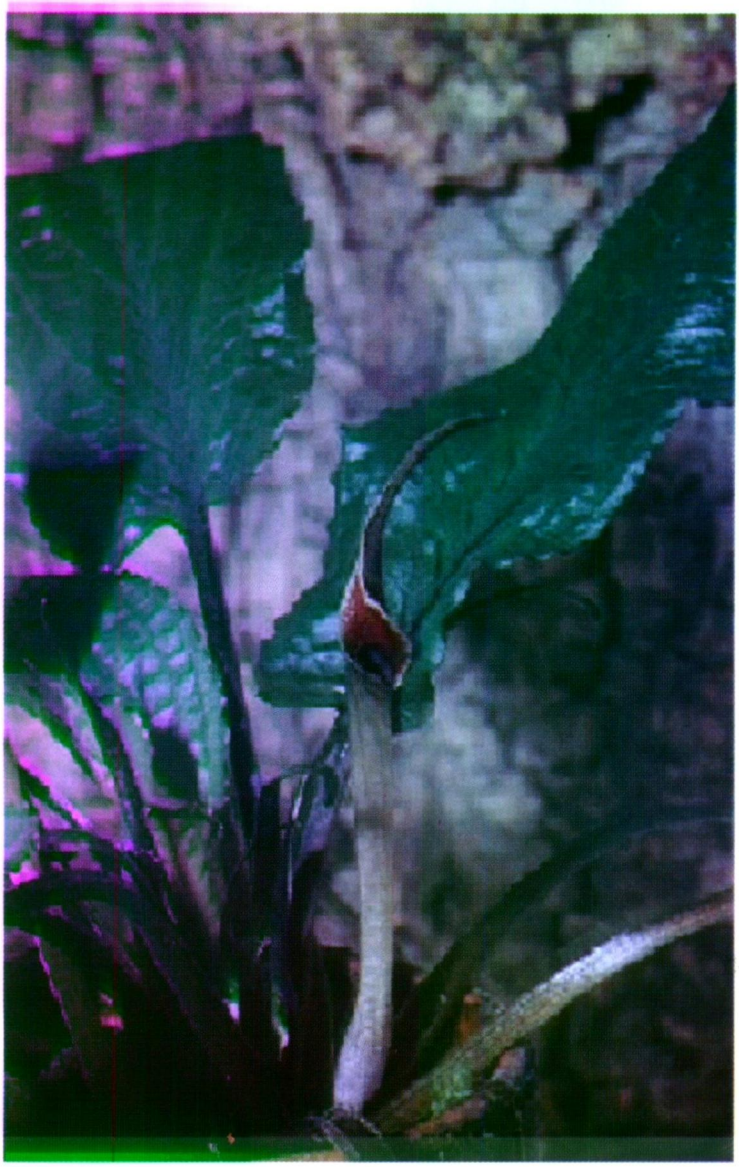


Figure 35. A giant form of *Cryptocoryne wendtii*

The leaves reach up to about 25 cm, with blades of 13 x 6 cm. Younger leaves are somewhat bullate.

Figure 36. *Cryptocoryne wendtii* plant with pronounced dark veins in leaves

This form has short cordate leaves. The same plant can develop elongated green leaves when grown submersed.

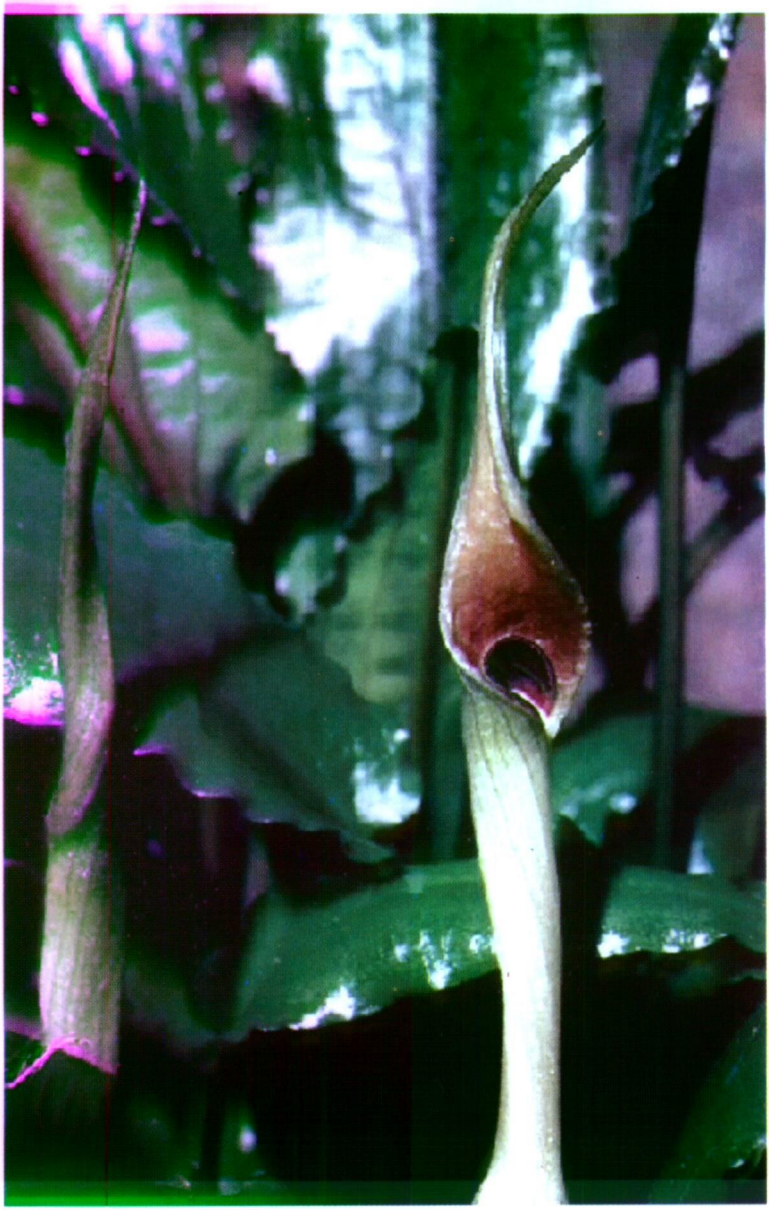


Figure 37. *Cryptocoryne wendtii* having a giant spathe

This spathe has a rather broad collar and is wide opened.

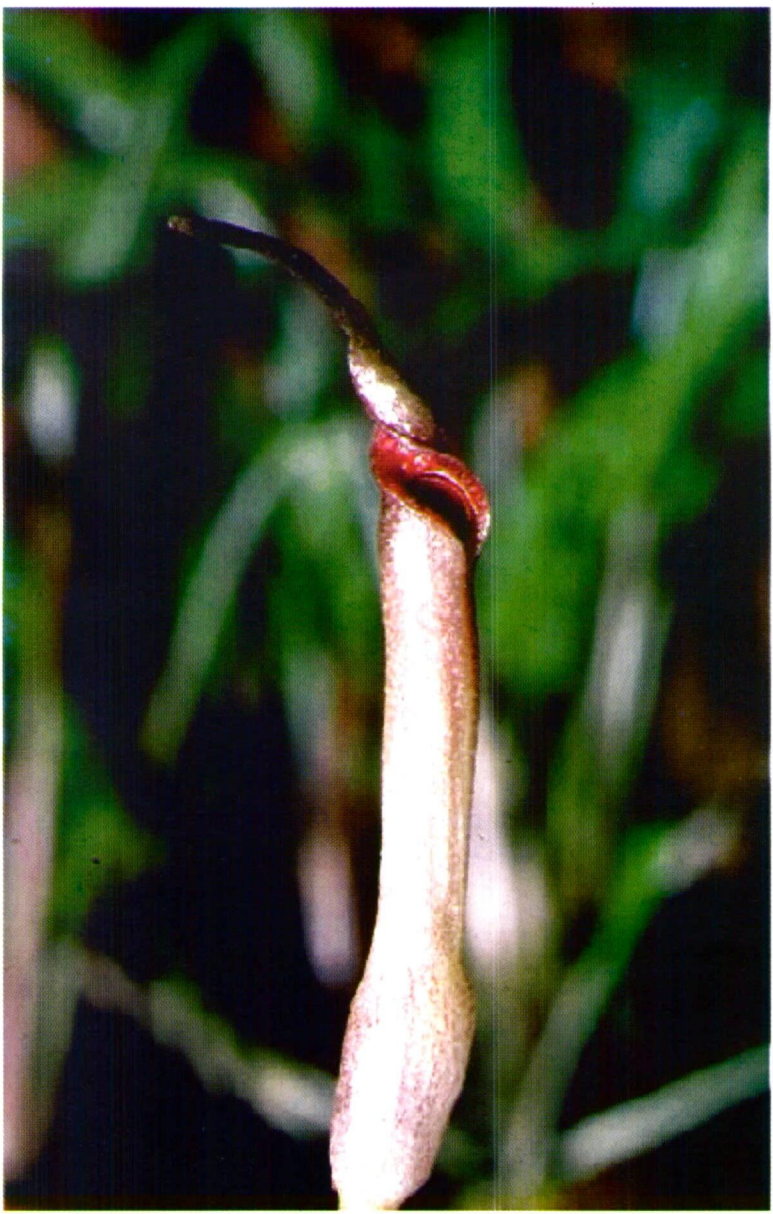


Figure 38. *Cryptocoryne wendtii* plant with a reddish spathe

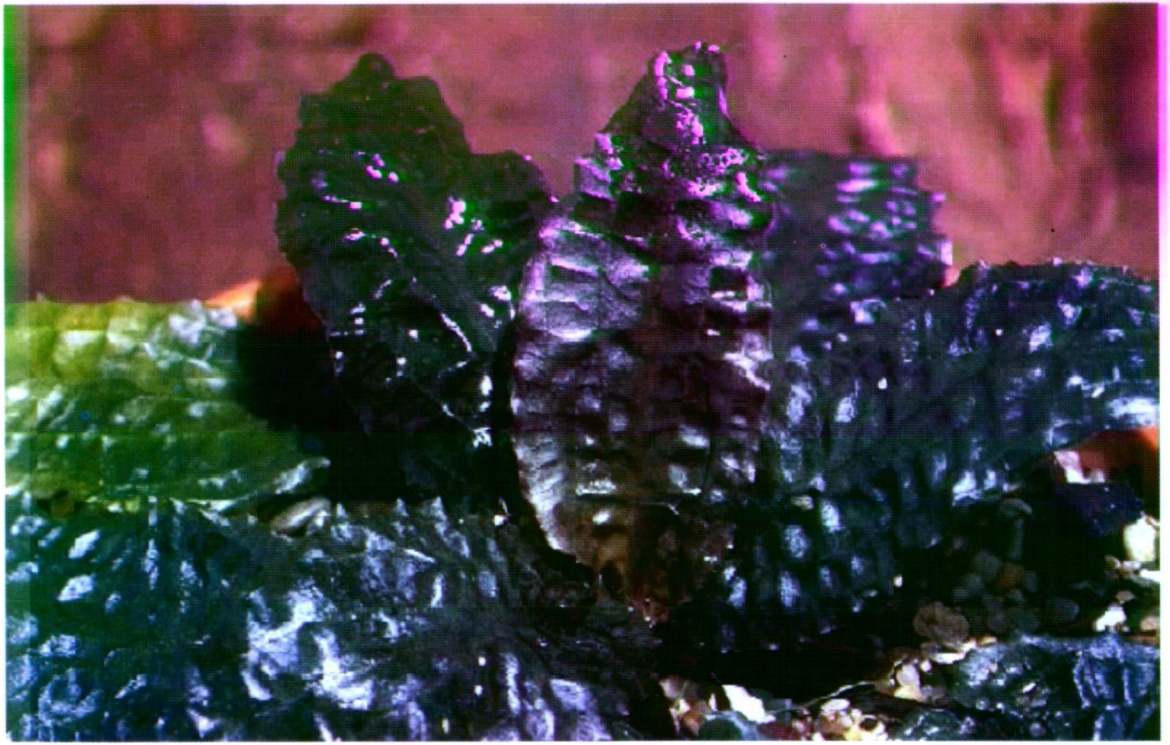


Figure 39. *Cryptocoryne wendtii* plant with bullated leaves.

This brown-leaved specimen may turn into a narrow-leaved, brown colored plant with dark stripes.

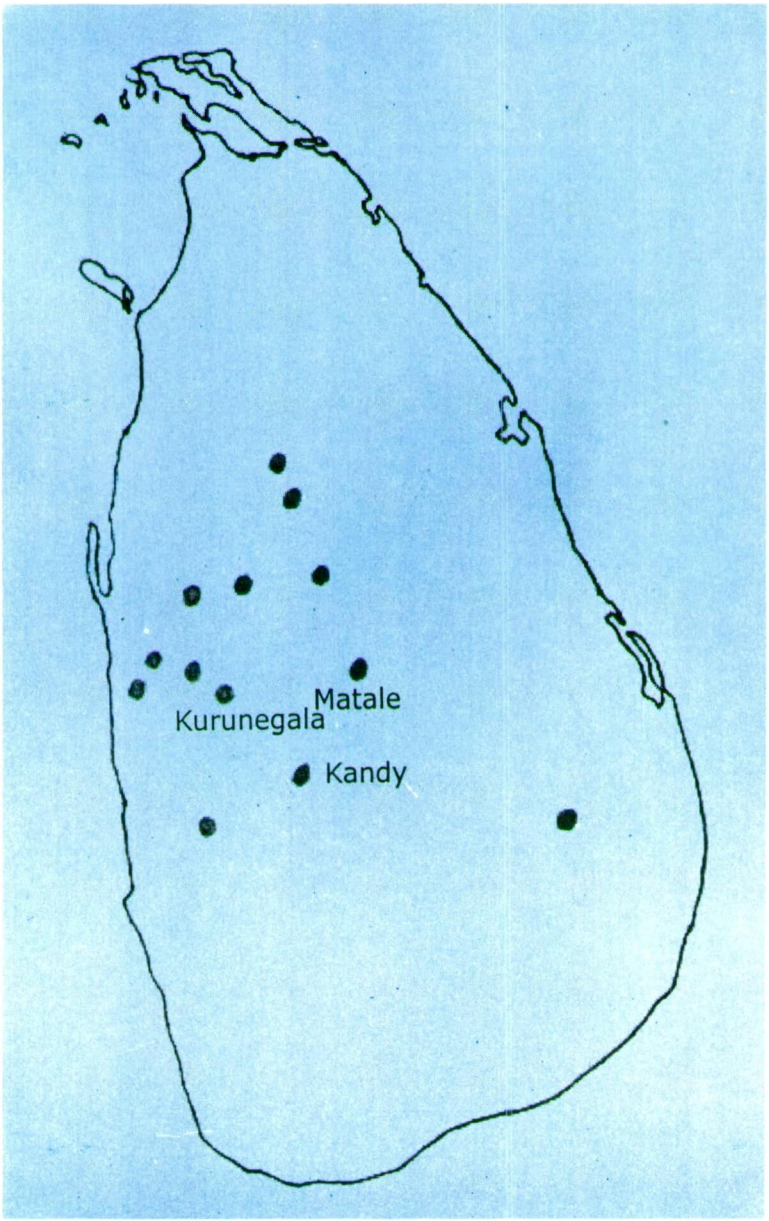


Figure 40. Distribution of *Cryptocoryne wendtii*

Figure 41. Common type of *Cryptocoryne willisii* kept in aquaria

Yellow throat is a typical feature of *C. willisii* which extends a bit on the limb, making the collar very pronounced.

Figure 42. A dark colored specimen of *Cryptocoryne willisii*

Leaves are dark with a right turn. Note the leaves can have some brownish along the veins.

Figure 43. *Cryptocoryne willisii* with several inflorescences

Though *C. willisii* is not always easy to flower, one can have several flowers at the same time.

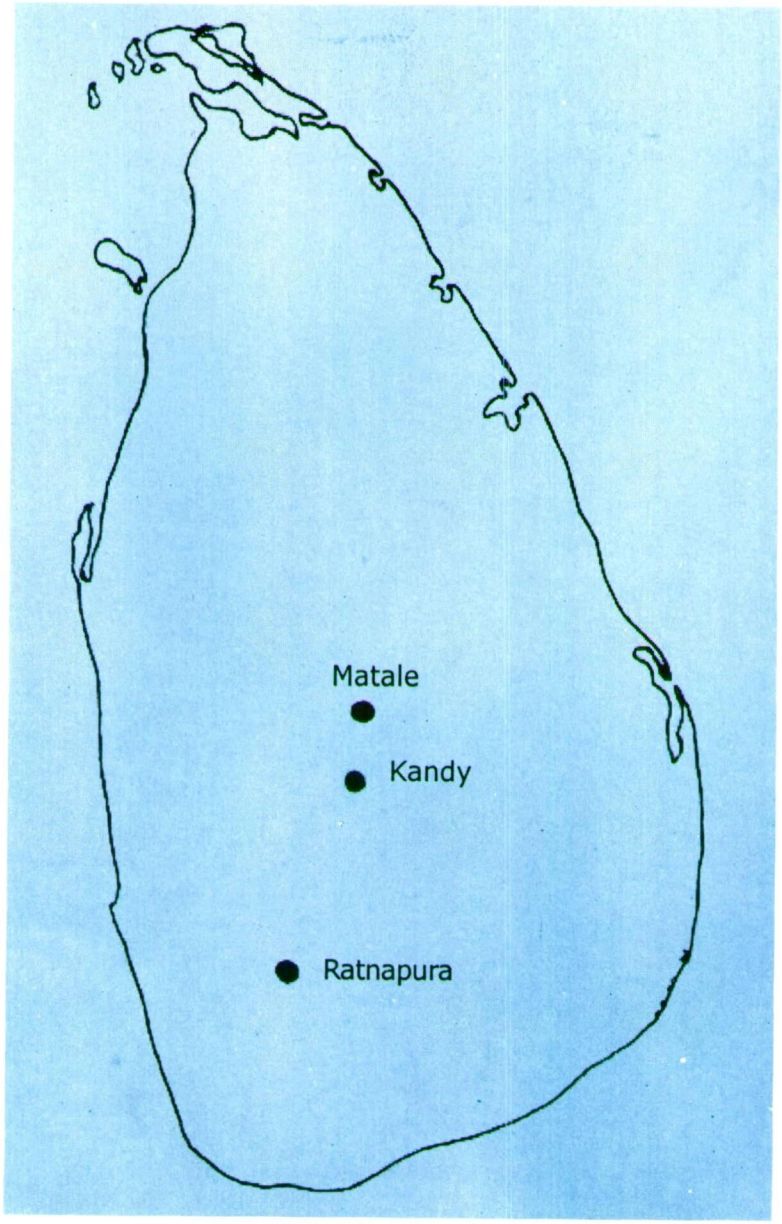


Figure 44. Distribution of *Cryptocoryne willisii*

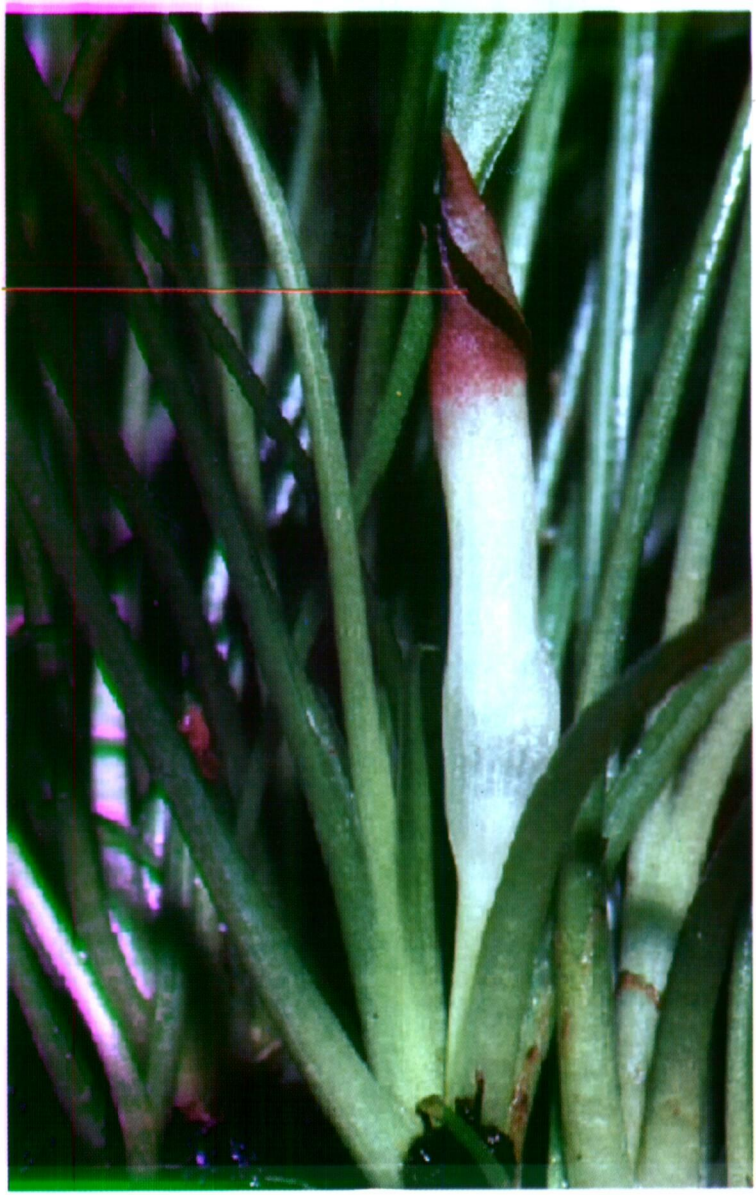


Figure 45. A mature plant of *Cryptocoryne parva*

Note the narrow opening of the limb which is a unique feature of this species.

Figure 46. A natural population of *Cryptocoryne parva* in Kegalle

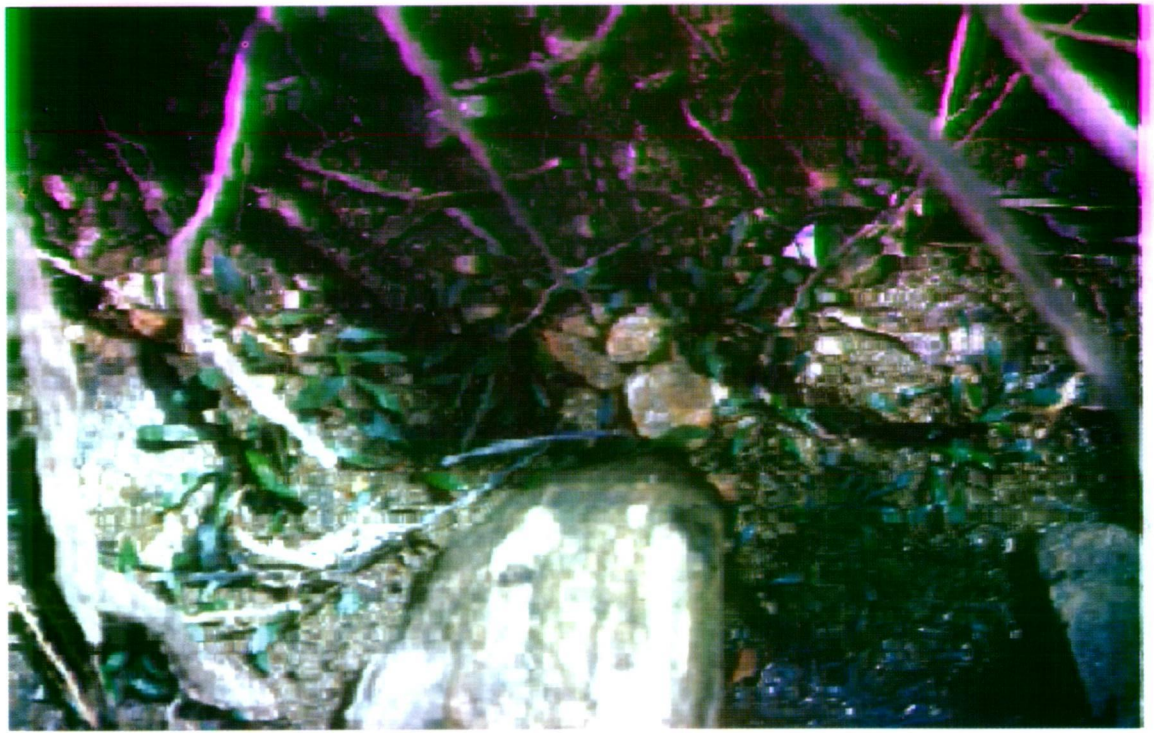


Figure 47. A natural population of *Cryptocoryne parva* in Kegalle

Figure 48. An inside view of the kettle of *Cryptocoryne parva* (A longitudinal section)

Figure 49. A mature plant of *Cryptocoryne parva*

The limb of the spathe never opens wide. There is a distinct collar.

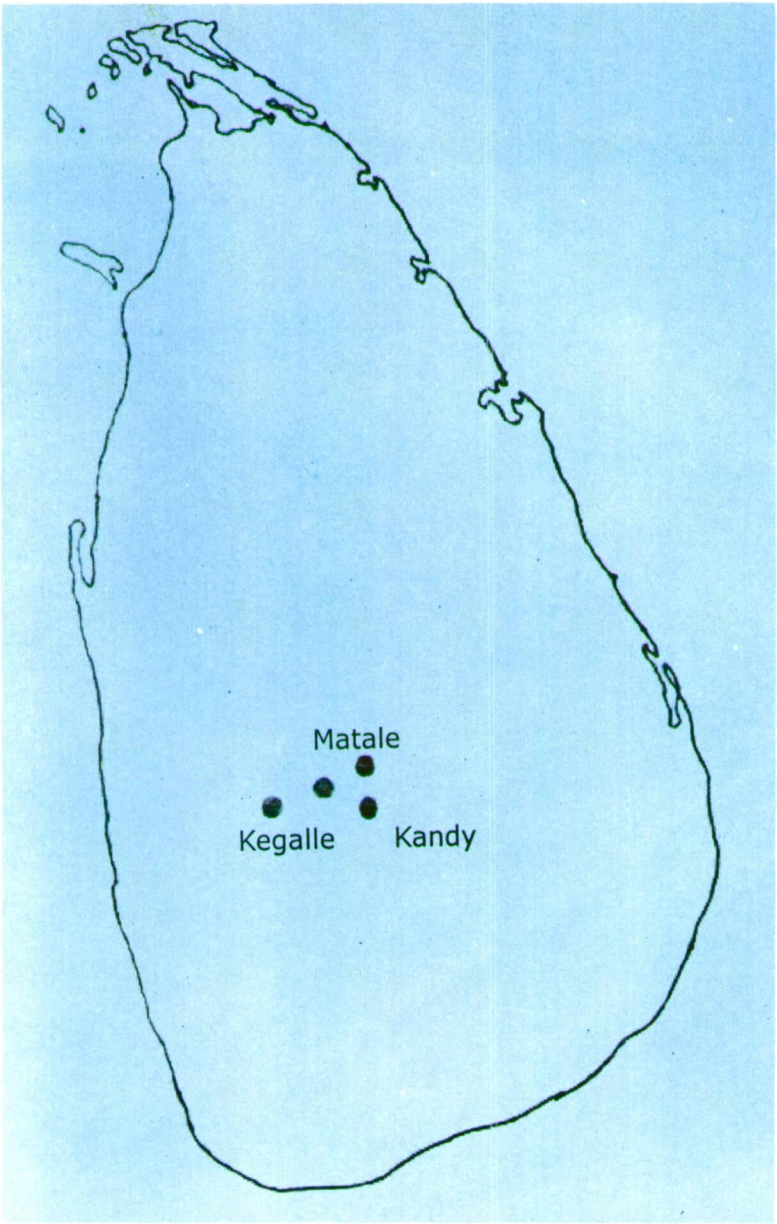


Figure 50. Distribution of *Cryptocoryne parva*

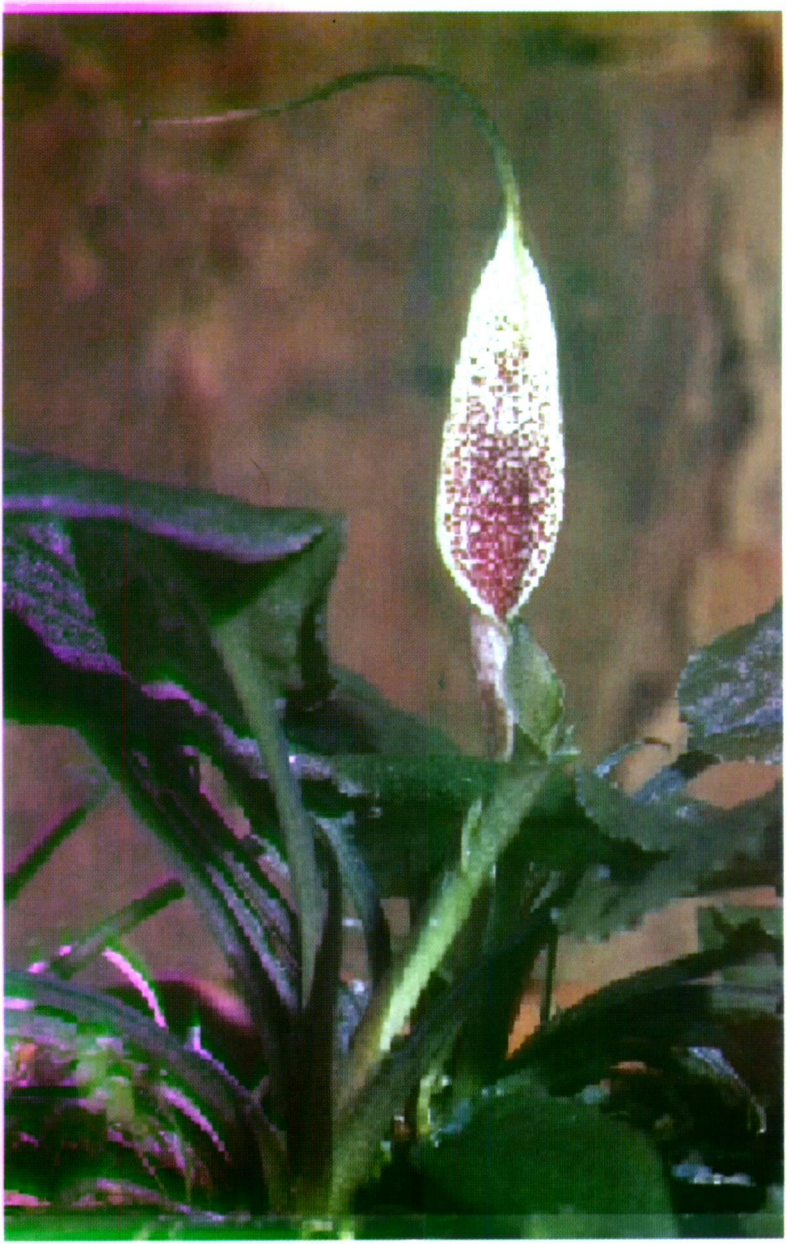


Figure 51. A typical plant of *Cryptocoryne thwaitesii*

The colour of the spathe limb is quite variable. The presence of the red dots varies from almost absent to densely covered.

Figure 52. Shape of inflorescence of *Cryptocoryne thwaitesii*

A yellowish limb of the spathe without any purple dots. The tail of the limb is upright, mostly it bent forward. The leaves have bullates.

Figure 53. Leaf shape of *Cryptocoryne thwaitesii*

Note the fine undulated margin of the leaves. The texture of the leaves is different from most of the other *Cryptocoryne* species. Like *C. bogneri*, it is covered with very small bulges.

Figure 54. A *Cryptocoryne thwaitesii* having black leaves reached up to 10 cm.

Figure 55. Inside view of kettle of *Cryptocoryne thwaitesii* (A longitudinal section)

The opened kettle. The presence of the red dots inside may vary. Note the very uncommon feature seen here. A root develops from the petiole of the spathe.

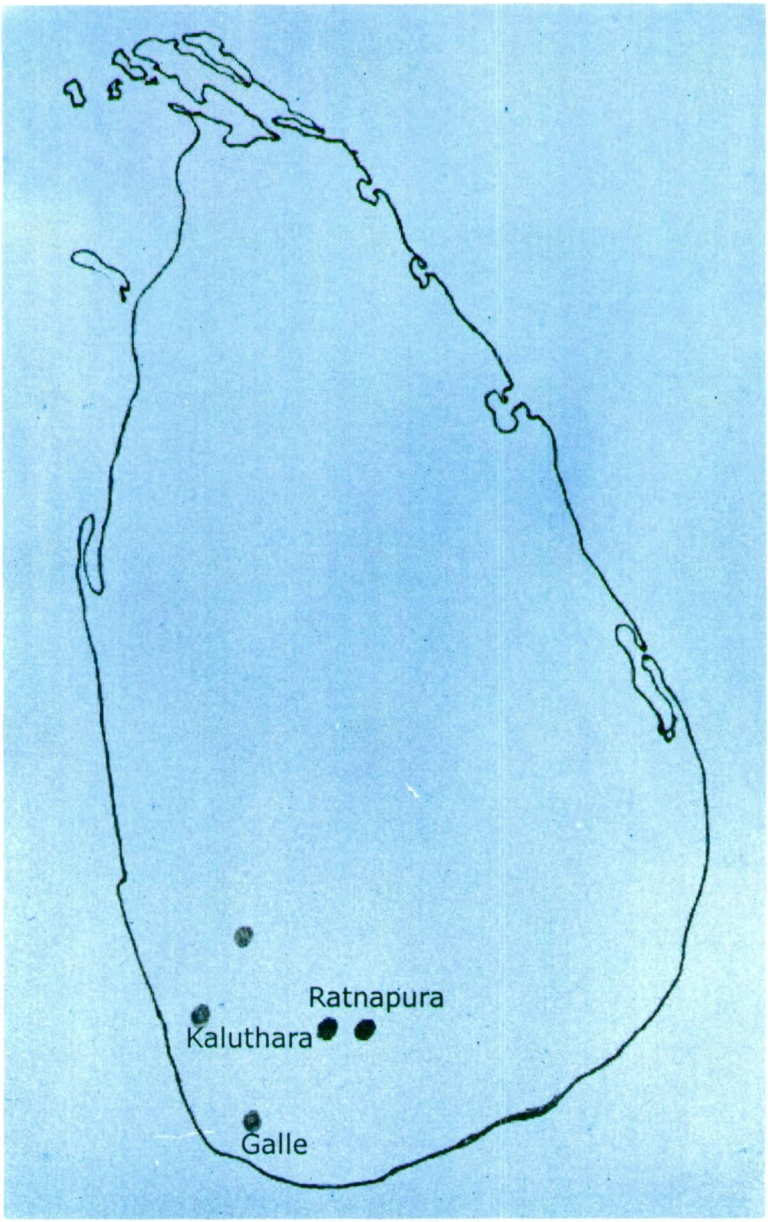


Figure 56. Distribution of *Cryptocoryne thwaitesii*

C thwaitesii grows, like *C. alba* and *C. bogneri* in the rainforest, South West of Sri Lanka

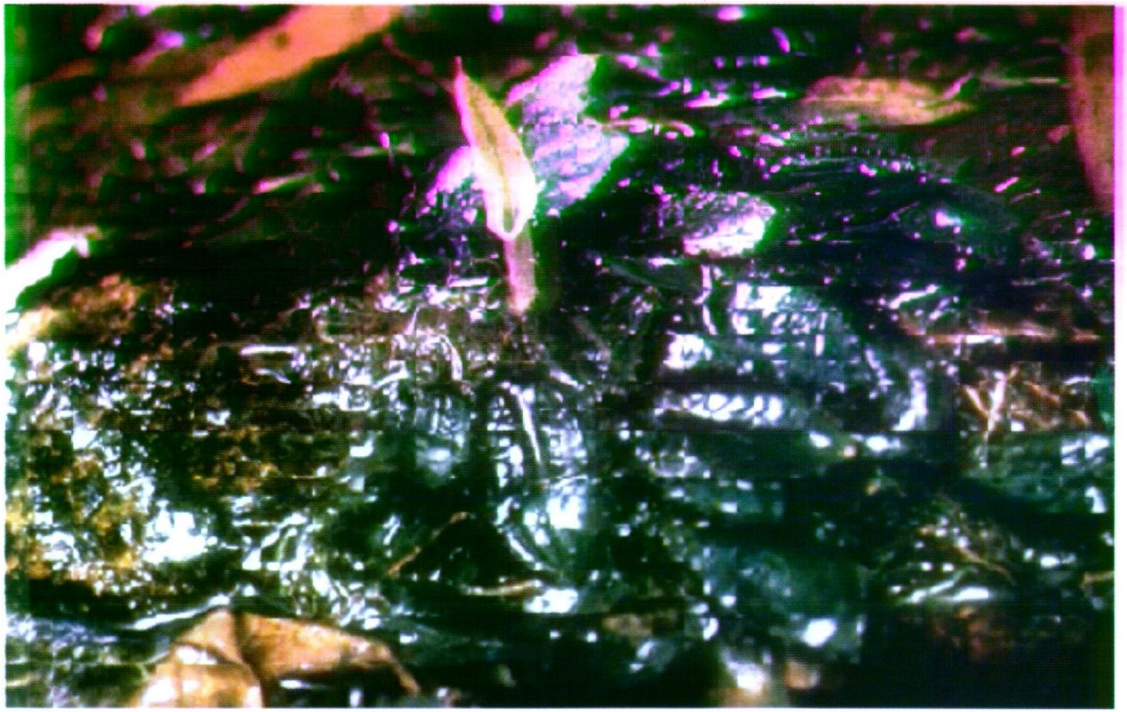


Figure 57. Shape of inflorescence of *Cryptocoryne bogneri*

A typical limb of *C. bogneri* which is slightly bent forwards.
The limb is smooth, towards the edges a bit warty.

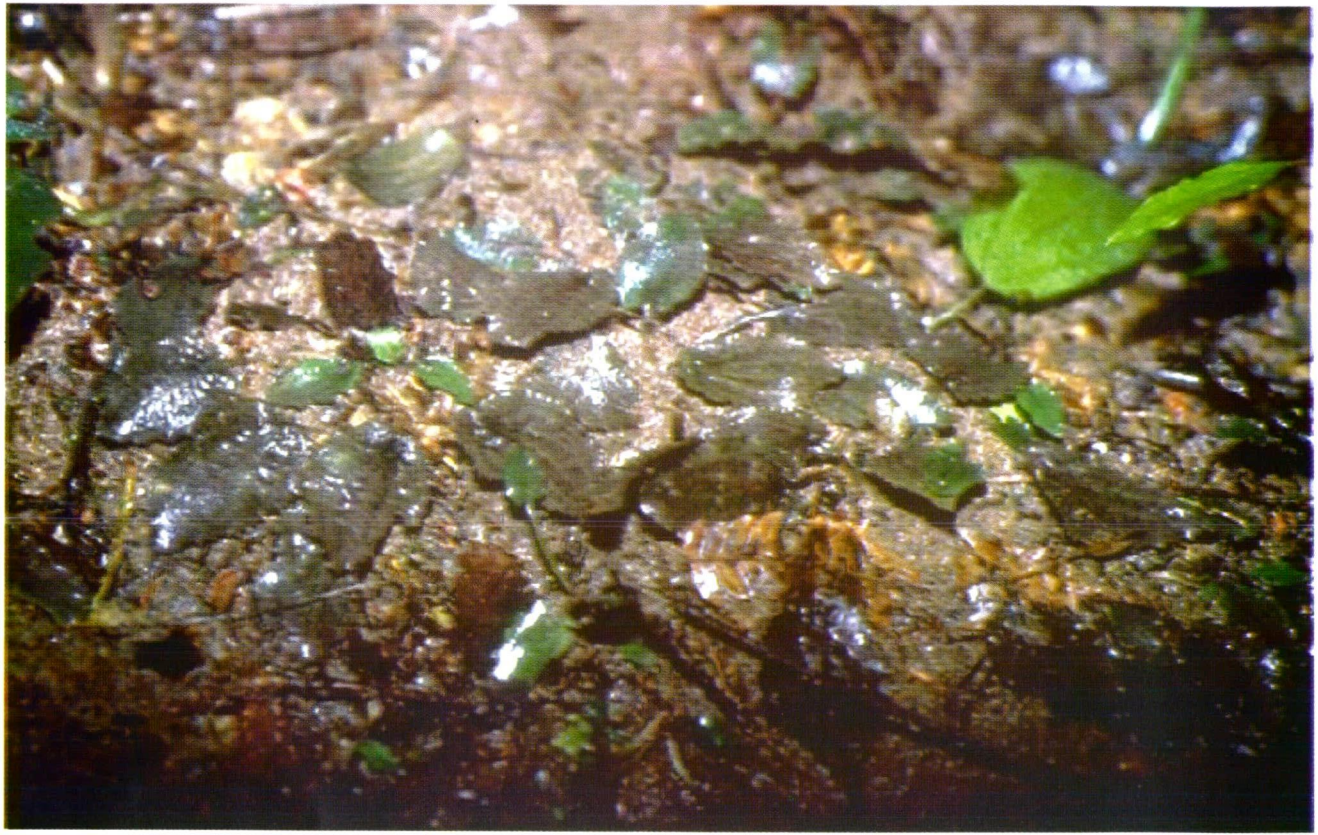


Figure 58. A natural population of *Cryptocoryne bogneri* in the South West of Sri Lanka.

Note the heart-shaped green to brown leaves.

Figure 59. A *Cryptocoryne bogneri* plant with short limb of the spathe.

Figure 60. Some of imported plants of *Cryptocoryne bogneri*

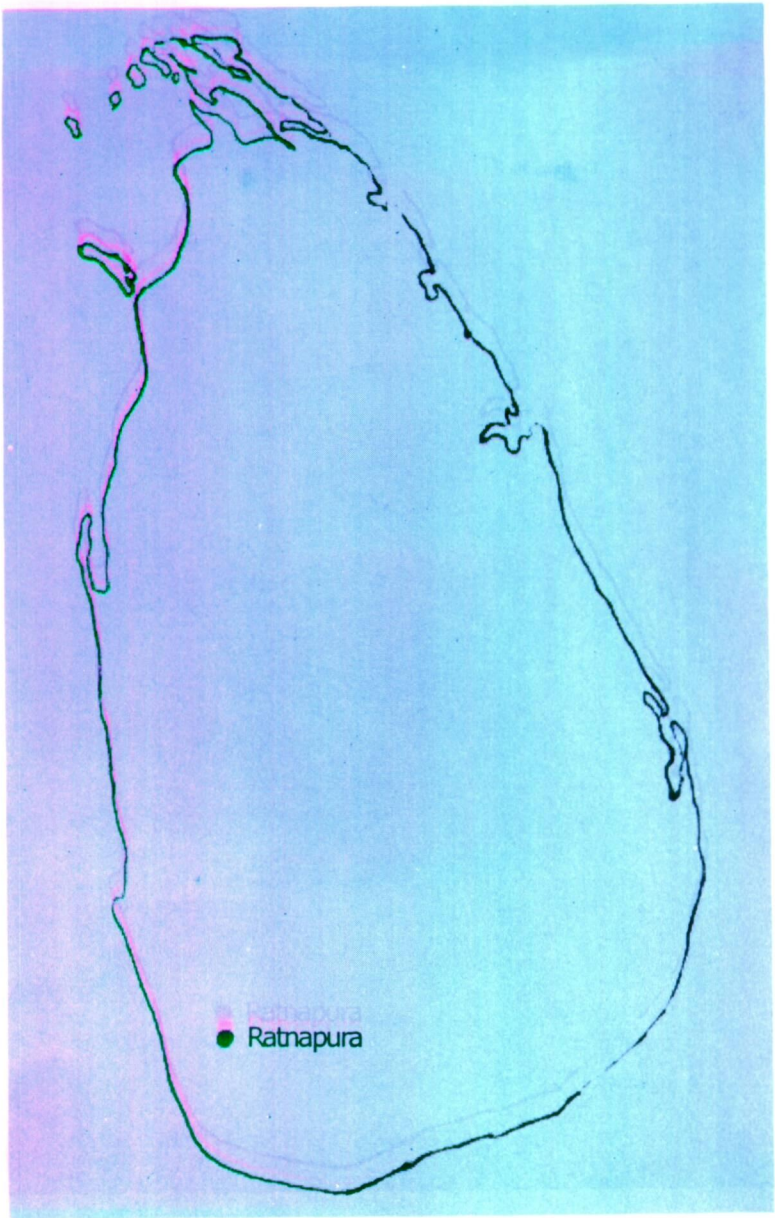


Figure 61. Distribution of *Cryptocoryne bogneri*

C. bogneri is found in the South West of Sri Lanka, together with *C. alba* and *C. thwaitesii*.

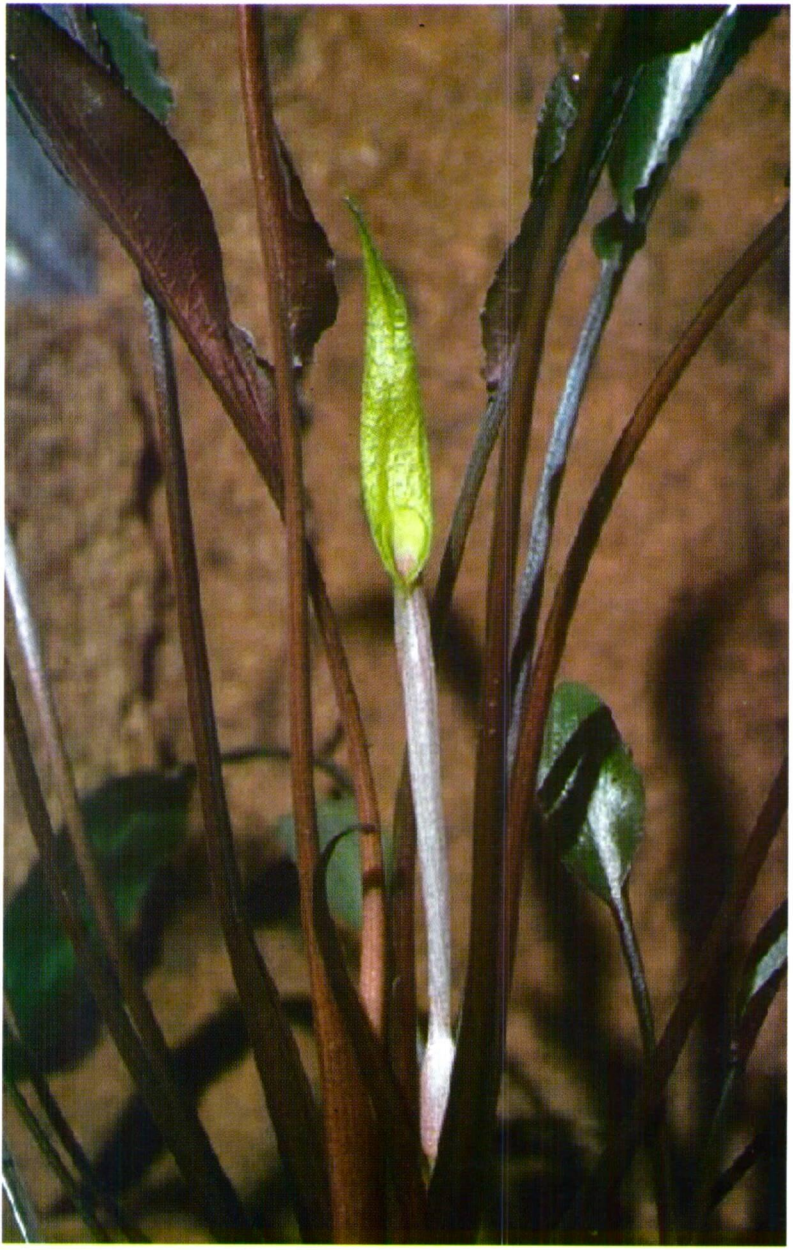


Figure 62. A typical mature plant of *Cryptocoryne walkeri*

Leaves are dark bronze-green with a purple lower side. As all common Sri Lanka species, they are easy to cultivate.

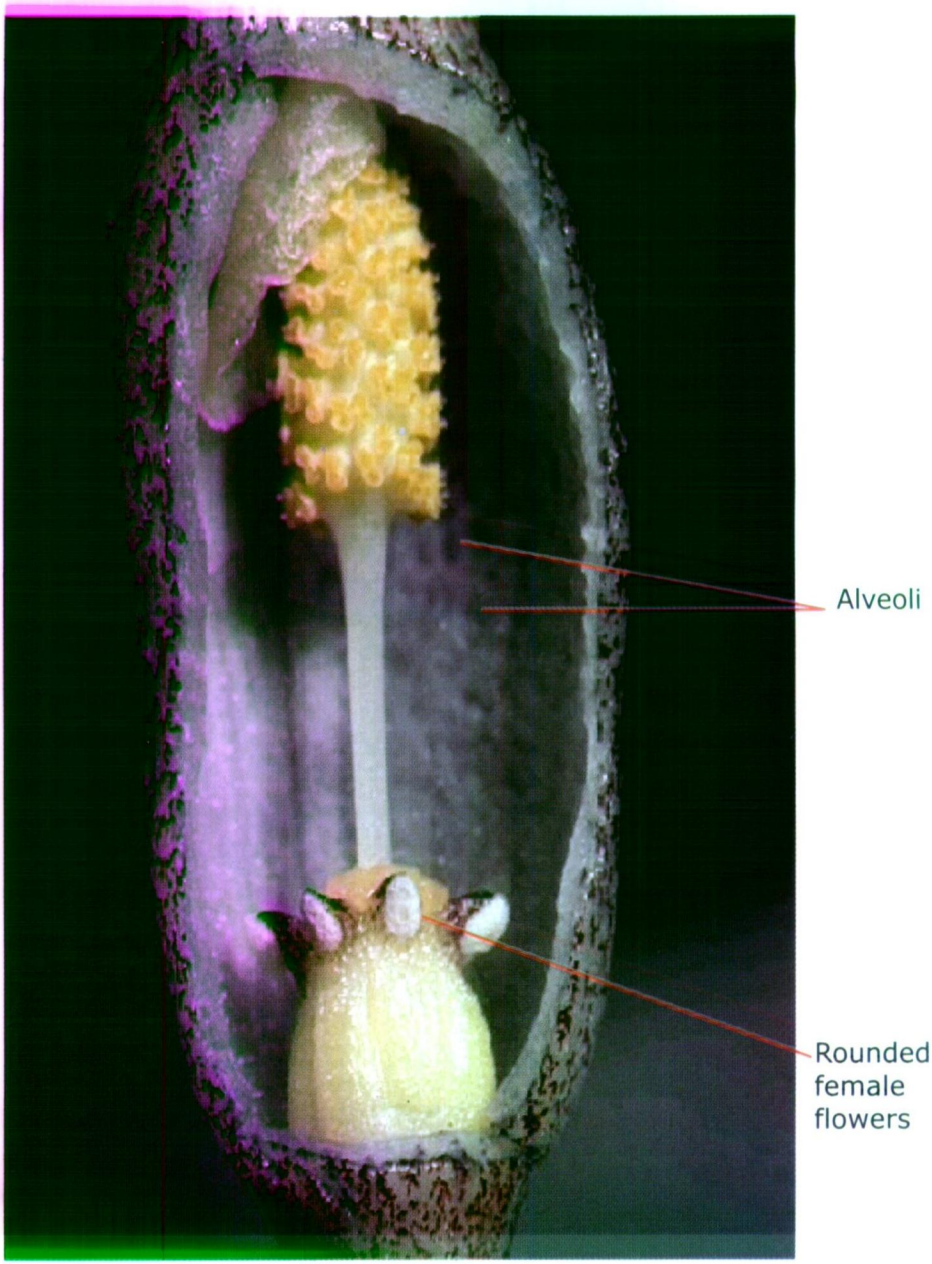


Figure 63. Inside view of the kettle of *Cryptocoryne walkeri*

The female flowers (lower part) are rounded, not seen in other species, but it is not present in all *C. walkeri* plants. Note the alveoli (windows) inside the kettle wall.

Figure 64. A *Cryptocoryne walkeri* plant with purple red leaves

This plant has leaves with purple red upperside making them attractive for aquarists. The limb is distinct yellow and lacks a pronounced collar.

Figure 65. Shape of the spathe limb of *Cryptocoryne walkeri*

The limb of this (older) spathe is somewhat folded back at the edges and has a distinct twist in the upper part of the limb. Note that this specimen has a wide collarzone.

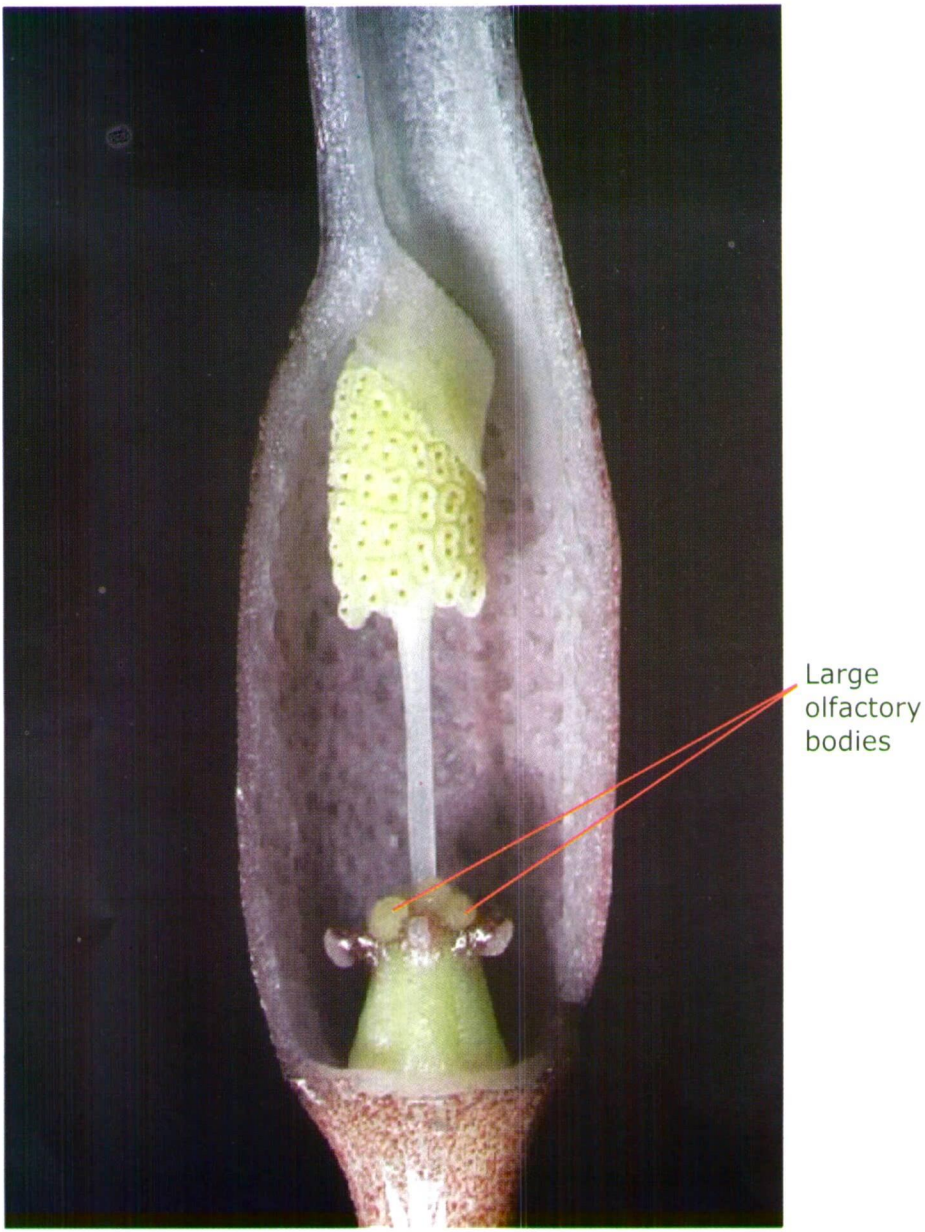


Figure 66. Inside view of the kettle of *Cryptocoryne walkeri*
(A longitudinal section)

The female flowers are not rounded, the styles are a bit longer. There are olfactory bodies above the female flowers.

Figure 67. Shape of the spathe limb of *Cryptocoryne walkeri*

A brownish limb of the spathe. Note the somewhat denticulated edges of the limb and the reddish inside color of the tube.

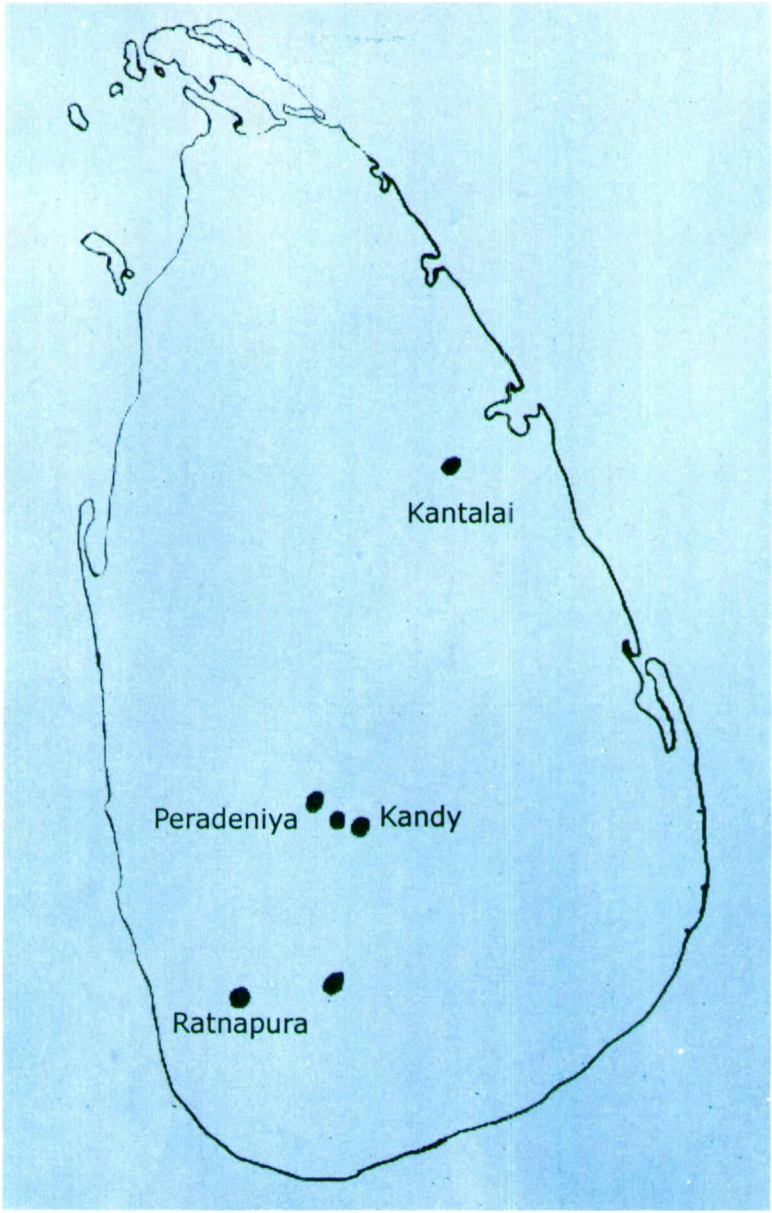


Figure 68. Distribution of *Cryptocoryne walkeri*

Figure 69. A mature plant of *Cryptocoryne nevillii*

The first year the plant is rather stout, but after a couple of years the plant grows smaller and smaller but still flowers easily after the dry period

Figure 70. Shape of the inflorescence of *C. nevillii*

The limb of the inflorescence is very distinct. A high collar and a throat with dark violet spots. The spathe is rather elongated, reaching up to 15 cm in well developed plants.

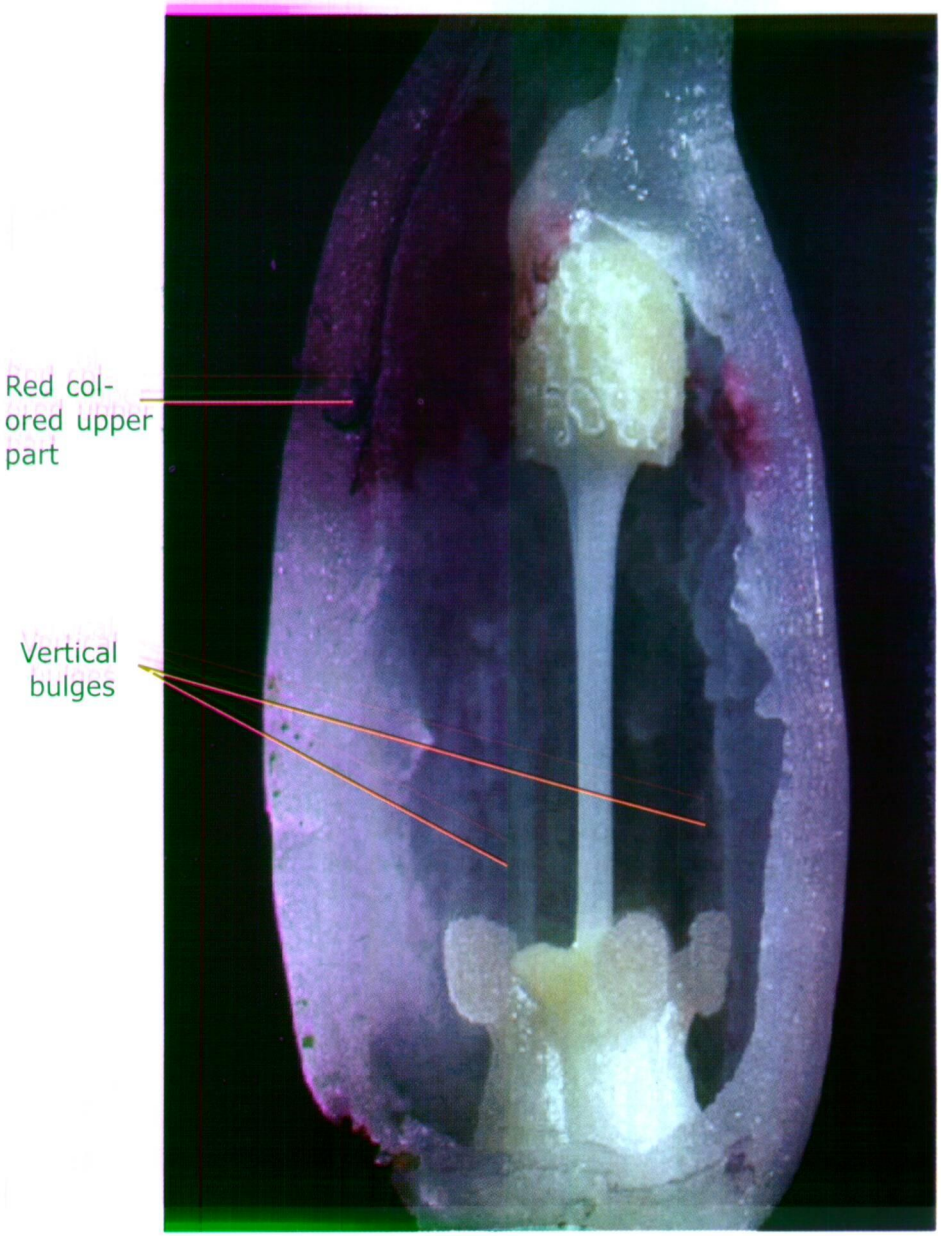


Figure 71. Inside view of the kettle of *Cryptocoryne nevillii* (A longitudinal section)

The upper part of the kettle wall can have a red color. Note the bulges inside the kettle wall.

Figure 72. A *Cryptocoryne nevillii* plant originated from an imported rhizome

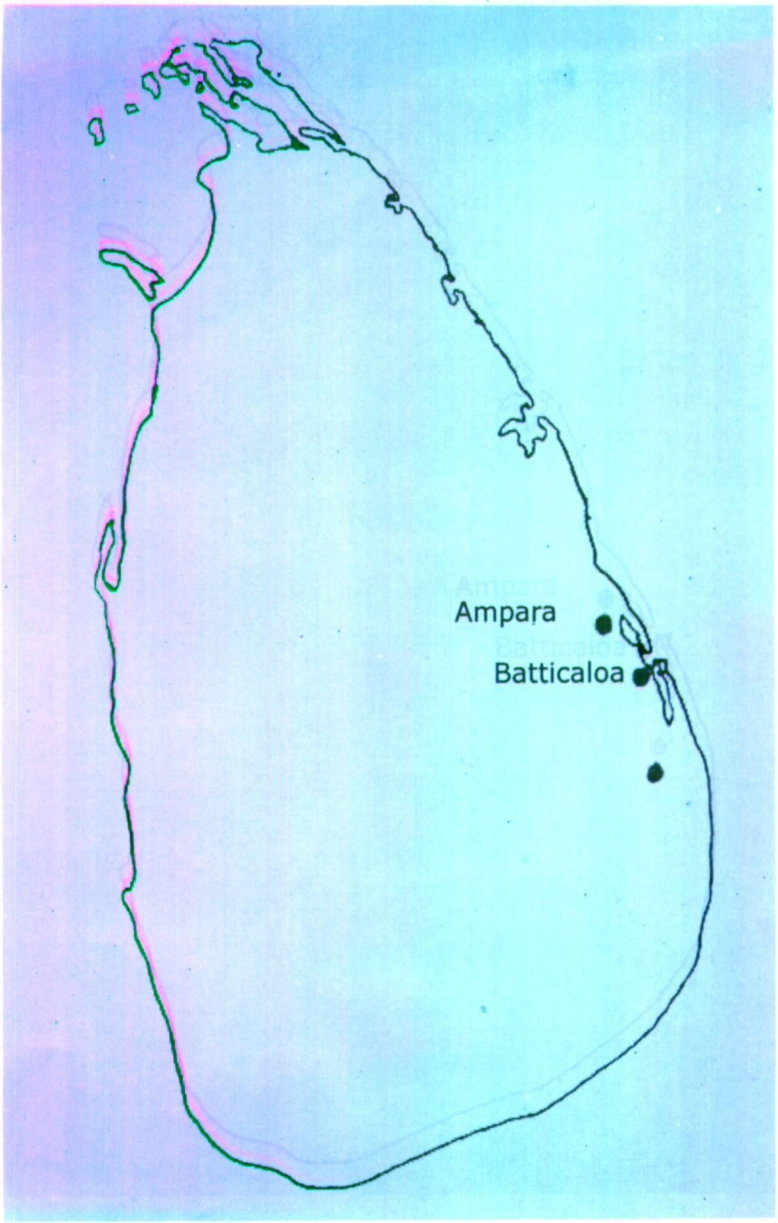


Figure 73. Distribution of *Cryptocoryne nevillii*

Figure 74. A mature plant of *Cryptocoryne undulata*

Generally, long petioled leave has striking red veins on the lower side. Both in emersed and submersed culture this character is quite stable.

Figure 75. A *Cryptocoryne undulata* plant without red veins in the leaves

As usual features are not always present, this specimen looks like a *C. wendtii* but has a 'normal' spathe of *C. undulata*.

Figure 76. Shape of the inflorescence of *Cryptocoryne unculata*

A broad twisted limb and a high collar is unique for this species. Note the dark rim at the edge of the collar.

Figure 77. Inflorescence of *Cryptocoryne undulata*

It has broad, nearly flat limbed spathe with a brownish color.

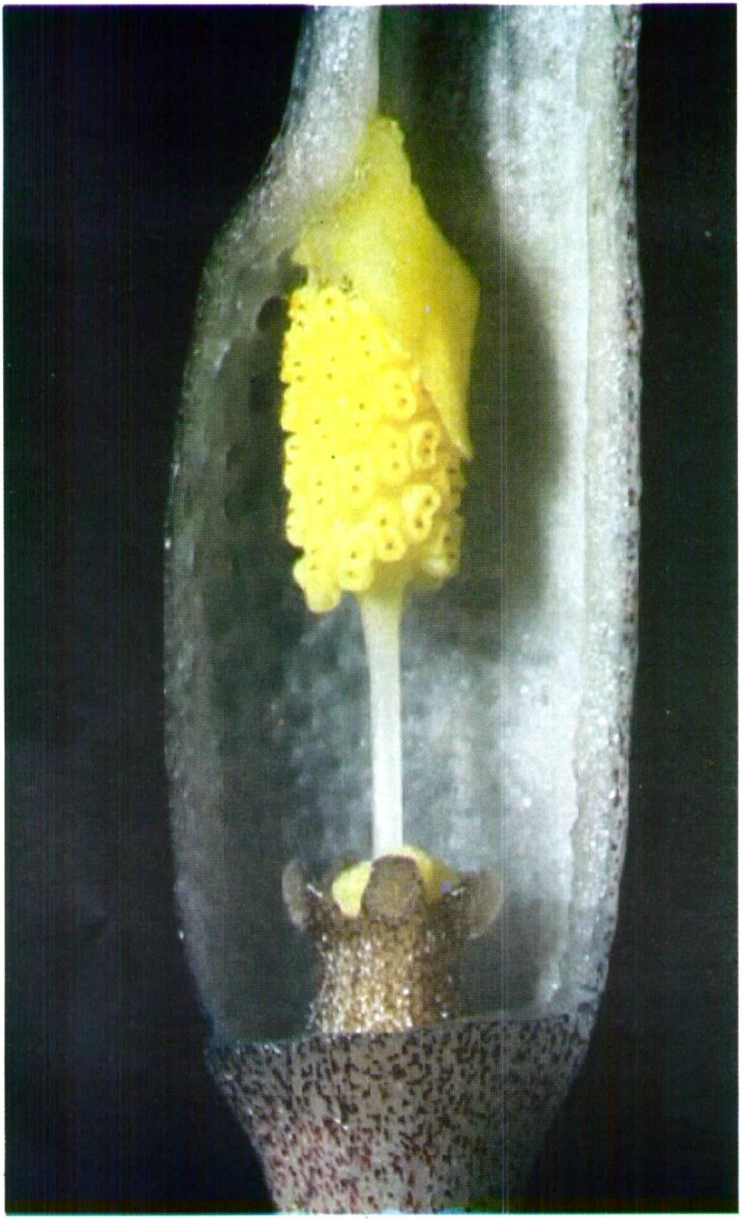


Figure 78. Inside view of the kettle of *Cryptocoryne undulata* (A longitudinal section)

Note the short spadix. The 'holes' in the kettle wall (alveoli) are normal for species from Sri Lanka.

Figure 79. *Cryptocoryne undulata* submersed culture.

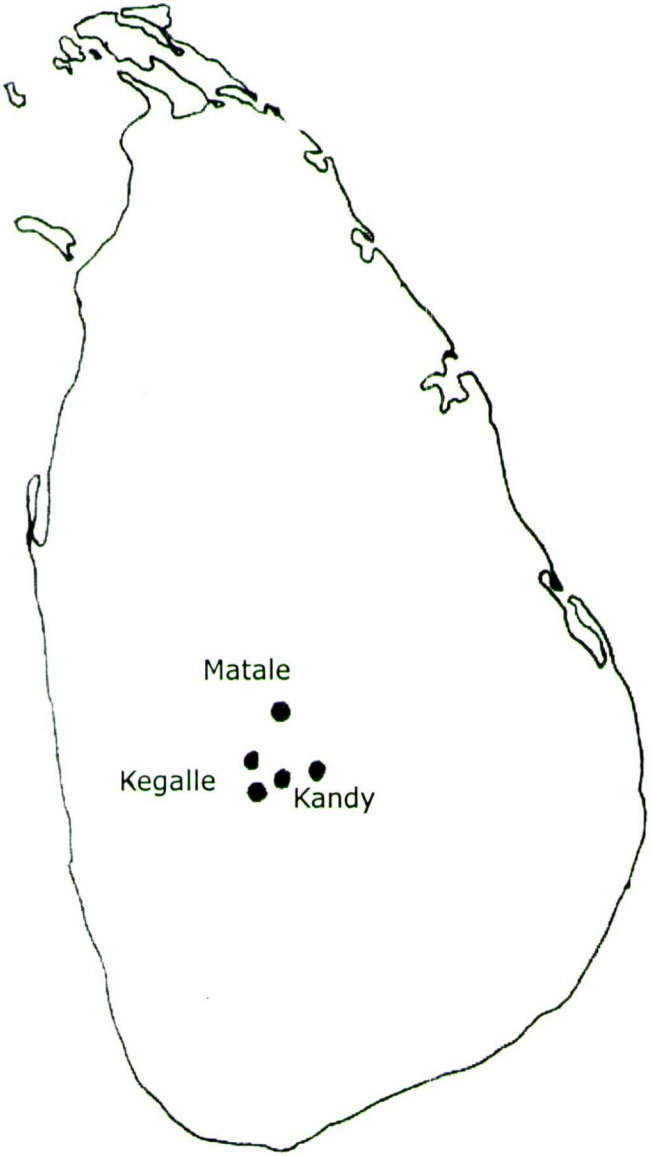


Figure 80. Distribution of *Cryptocoryne undulata*

References

Dassanayake, M. D. and F. R. Fosberg (1987). *A Revised Hand book to the Flora of Ceylon*, Volume VI, Amerind Publishing, New Delhi.

http://132.229.93.11/Cryptocoryne/index.html

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