

Kapisen

Plant Conservation Action group

Newsletter

March 2004 Volume 1 Issue1

Special focus on epiphytes and ferns

PCA plant red list project

Preview of pictures from the palms and pandans checklist

„Kapisen“

Kapisen, the emblem of the PCA newsletter, symbolizes a number of important topics for PCA members: the Unique Seychelles Flora, Beauty, Plants and People, Intact Ecosystems, and Conservation.

Unique Seychelles Flora

‘Kapisen’ is the Creole name for the endemic tree *Northea hornei*. *Northea* is one of the twelve endemic plant genera of the Seychelles.



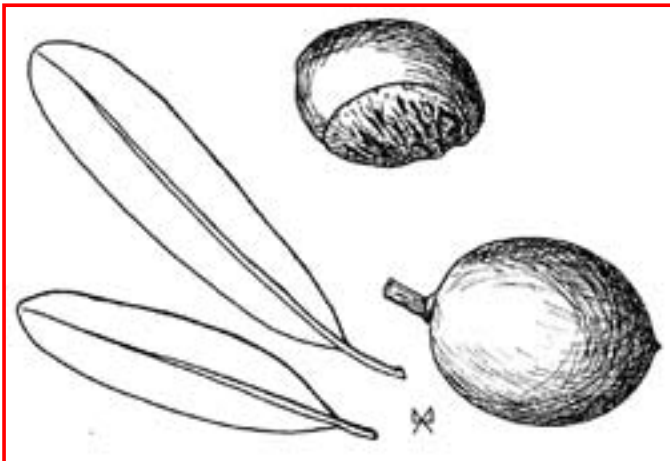
Kapisen leaves (front and back) and seed.

Beauty

‘Kapisen’ trees can reach the magnificent height of 20m. Their bark is a reddish brown and their large leathery leaves are often a rich brown on the underside. The oval fruits contain one large astonishing seed. The dark olive-green appearance of the ‘Kapisen’ trees stands out in the landscape, particularly on higher slopes and mountain tops.

Intact Ecosystems

‘Kapisen’ is an ecological keystone species. Fruit bats disperse the seeds, which is an important dispersal mode on oceanic islands. Old ‘Kapisen’ trees support a diverse epiphytic flora. They often die standing and decay slowly, providing saprophytes with an important habitat. Also, ‘Kapisen’ shows the typical ecological plasticity of many Seychelles endemics. It grows from almost sea level up to the highest mountain forests.



Kapisen leaves, fruit and seed by Katy Beaver (Courtesy of Seychelles Island Foundation).



Plants and People

The seeds of ‘Kapisen’ resemble the cowled head of a capuchin monk, hence the Creole name. The genus is named after the English painter Marianne North who visited Seychelles in 1883. She painted many endemic plants and also typical landscapes of the end of the 19th century, including completely deforested slopes almost to the top of Morne Seychellois. The species name *hornei* derives from John Horne who was the first trained botanist working in the Seychelles, contributing significantly to the first flora published in 1877 by Baker.

Conservation

‘Kapisen’ is an icon for plant conservation. The timber of ‘Kapisen’ was exploited until recently, so this species experienced the same major threat as many endemic timber trees. However, it is still regularly represented in the canopy layer of the intermediate and mountain forests along with the endemic palms and pandans, and inspires hope for plant conservation.

Welcome to the first *Kapisen*!

The Plant Conservation Action group (PCA) is a new NGO devoted to the conservation of the native flora of the Seychelles. *Kapisen* is the newsletter of the PCA that reports about on-going activities of the group, and intends to be an open forum for all people interested in the Seychelles' plants and their conservation. Just like the PCA itself.

PCA brings together people of all walks of life in the Seychelles and around the world that are concerned about the future of the unique flora of these remote oceanic islands. We share knowledge and ideas, discuss strategies and priorities, and take action. Time for the endangered species is short, and actions are needed immediately as is pointed out by the chairman of PCA in his opening article (p.4-5). PCA wants to open our eyes to overlooked aspects of the Seychelles' plant life. The special focus of this first issue of *Kapisen* is on epiphytes and ferns – 'the little known plant inhabitants of Seychelles forests' (p.6-7).

In one of the first PCA projects two students are developing a survey protocol and a database with the aim of monitoring the state of our endangered plant species and to review their IUCN red list status (p.9). Another on-going project is presented through the pictures of endemic palms and pandans that illustrate this newsletter. In 2004 PCA will produce a photographic checklist that covers all endemic palms and pandans, to help people to get to know more about Seychelles' botany. This booklet will be the start of a series that should completely cover all endemic flowering plants of the Seychelles. Another major PCA project in 2004 is the organization



Some PCA members on top of Morne Seychellois

of a workshop that will lead to a national plant conservation strategy (NPCS) within the framework of the Convention on Biological Diversity (CBD).

PCA intends to build a bridge between local plant enthusiasts and the world of botanical research and scientific literature. A comprehensive factsheet on the biology of the highly invasive shrub *Clidemia hirta*, and its distribution and management in the Seychelles compiles the current knowledge on a problematic plant intensively discussed in the Seychelles (p.11-13*). A list of new literature relevant to Seychelles' plant life completes the science section (p.14-15*).

However, PCA members are often to be found outdoors, either alone or during regular field excursions of the group, exploring the more inaccessible natural habitats of the Seychelles. You can get a glimpse of our experiences and observations in our 'notes from the field' (p.9).

We hope you will enjoy reading *Kapisen*!

Christoph Kueffer, Eva Schumacher & Katy Beaver
Editors

*This article is only available in the electronic pdf version of the newsletter that can be ordered from boga@seychelles.net or kueffer@env.ethz.ch.

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A crusade for plants

By Didier DOGLEY
Chairman, Plant Conservation Action group (PCA)

The majority of books, pamphlets, project proposals and papers highlight that the Seychelles flora is unique in the world. It arose from relicts of the flora of an ancient super-continent 'Gondwana', and then evolved in isolation during millions of years. The granitic islands of the Seychelles support c. 70 endemic, plus c. 130 further indigenous flowering plant species. There is one endemic family, the Medusagynaceae, and 12 endemic genera. There are c. 80 indigenous fern species, among them 12 endemic ones.

But Seychelles also supports an estimated number of at least 750 introduced exotic flowering plant species and this number is rapidly increasing. Most of these species have been introduced by man for the production of food, fodder, timber, spices, essential oils and other natural products, and for horticulture. Invasive exotic species are today the biggest threat to the biodiversity of the Seychelles.



Vakwa parasol (*Pandanus hornei*) at the Mare aux Cochons fresh water marsh on Mahé.



A Latannyen fey growing between granitic rocks.



Post-fire succession dominated by palms on Praslin.

In the past, habitat destruction was the number one threat. With the arrival of man vast areas were cleared for plantations and other forms of development. An estimated 90% of the primary vegetation was destroyed, with the remaining 10% surviving in small patches in inaccessible areas. Since the 1970s many of the plantations have been left abandoned and wild, thereby creating an excellent breeding stock for the further invasion of the few remaining fragments of natural habitats.

Today there is not a single habitat that has not been profoundly altered or invaded by exotic species. To make matters worse many of the endemic species were also collected and used for various purposes, e.g. as medicine and in the construction and craft industry. The unchecked exploitation of these resources has led to the extinction of some species, for example Bwa Marmay, and has driven many others to the very brink of it.

To date, 8 plant species have already been registered as extinct, 20 as critical endangered, 13 as endangered and 20 as vulnerable, and most of the others are rare. In fact, all the endemic flowering plants of Seychelles require some form of protection or conservation action to ensure their survival.

Chairman's Keynote

The challenges facing local plant conservationists are more serious than many may want to believe. The remaining small populations and fragmented habitats are constantly under threat from intensifying detrimental factors.

- For instance, it has been reported that diseases and pests that normally affect exotics are now visibly attacking the native flora. Recently there has been a surge in the number of epidemics killing trees such as Takamaka, Sandragon and Mourouk. Another problem is fruit flies, which pose a real threat to the endemic Kalbas Maron. At the Botanical Gardens scale insects, mealy bugs, aphids and leaf miners were observed on Wright's Gardenia (Bwa Sitron) and Bwa Dir Blan. The recently introduced spiral white fly was reported to live on Koko Maron. On Silhouette, although the mature Kapisen trees are producing viable seeds very few saplings can be found, indicating that something is killing the seedlings before they reach the sapling stage.
- Climate change in the form of repeated severe droughts may have a profound effect on the moist and mist forests of the granitic islands. However, these effects are still very much unknown because

no attempt has been made so far to study and evaluate the ecological changes that are taking place in these places.

- Unchecked collections and exploitation of target species such as Bwa Dou still remain a real challenge that needs to be tackled. The fewer, the smaller and the more restricted the populations get, the higher is the probability for extinction.

If one thinks of the fact that plants are the basis of all life, and that about 1000 endemic animal species in the Seychelles depend on them, then it becomes clear what a catastrophic effect the loss of our plant species would have on the whole biodiversity of the Seychelles.

As in the case of most conservation efforts the complexity of the problems calls for a holistic and concerted effort that requires the support of all parties and the public at large. Should we fail to take drastic and positive action within the next ten years to ensure the survival of the last remaining exemplars, it is most likely that between 35 and 50 percent of our endemic flora will become extinct within the next 25 years; that means within our own life time!



The La Réserve palm forest on Mahé.

Some little known plant inhabitants of Seychelles forests

By Katy BEAVER, Plant Conservation Action group
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How much do you know about mosses? or liverworts? (liver-what?!) Why are the tiny plants of the forest so unfamiliar? Perhaps because they do not have pretty flowers and are so small, and when you first look at them growing on rocks or tree trunks in the forest, they probably all look much the same - just nice green cushions. But they are actually a very important part of the forest, for they collect water - not in buckets or basins, but on their leaves, gathering it from the clouds and mist that drifts through the trees. The moisture keeps the humidity high in the forest, which in turn keeps the forest floor moist. They also form a micro-habitat in which many small insects, spiders, worms and other creatures live.

Mosses and liverworts grow abundantly in the higher forest of the Seychelles granitic islands. They are often called 'gomon' in Kreol (which is also the term given to seaweed). You need to look at these plants with a hand lens in order to see many of the differences between species! About 160 species have been listed for Seychelles and quite a number are endemic; almost all are native. They are mostly epiphytes (plants that grow on other plants) living on the trunks, branches, exposed roots and even leaves of trees and bushes, but they also cover rocks.



Epiphytes on a Sandragon tree at Morne Blanc.

Many epiphytes, such as the mosses and liverworts but also many ferns and orchids, have rather specific microhabitat requirements. For example they may need a certain type of bark structure or chemistry, and therefore tree species differ in the epiphyte flora they support. If you look at the trunks of Albizia or Chinese Guava (Gouyav-de-Sin) trees you do not see many mosses or liverworts, whereas Bwa Rouz, Kapisen, and even Cinnamon (Kannel) support much denser epiphyte populations. The growth of epiphytes often follows an ecological succession; therefore large old trees tend to have a much more diverse epiphyte flora than younger trees. However there is no published ecological information about these groups in Seychelles.



An epiphytes monitoring quadrat.

Large Sandragon trees often have many species of mosses and liverworts on them. So, when the Sandragon trees on Mahé began to suffer from two health problems at once (a fungus disease and the leaf-miner caterpillars of a tiny moth), it looked as if we might lose some very valuable habitat for epiphytes (including some rare orchids). A small research project was therefore set up to look at the epiphytes of a very large and imposing Sandragon tree near the top of Morne Blanc. We hope to learn more about the importance of old trees for the conservation of the native epiphyte flora, and about how the epiphyte populations change over time. We are also looking at the moss and liverwort species on other large trees in mist forest areas, and on large Sandragons in other areas of Mahé. For epiphytes, old trees are like islands in the forest. In the end, it is crucial to know how many suitable islands are needed so that these species survive in the long term. The relationship between the Sandragon diseases, the old Sandragon trees and the epiphytes shows how one disturbance can have a cascade of secondary effects. It also shows how an exotic species like the Sandragon can have a positive function in the forest.

Our project has been sponsored by the Environment Trust Fund.

Why are ferns interesting plants?

The example of the fern genus *Elaphoglossum*.

By Germinal ROUHAN
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I am a fern taxonomist, working as a PhD student on one tropical fern genus - *Elaphoglossum* (from greek elaphos=stag, and glossa=tongue). Taxonomy is the description of different species and their relatedness. I study the evolutionary relationships between the *Elaphoglossum* species from the Indian Ocean (i.e. Comoros, Madagascar, Mauritius, Réunion, Seychelles) and I will propose a revised description of the genus in the region.

The ferns are vascular plants like the flowering plants (= angiosperms), but without flowers. Nevertheless, the ferns are fascinating plants for many reasons:

- The earliest plants on earth: Ferns appeared on earth 400 million years ago, well before the first flowering plants, and were the main component of the oldest terrestrial vegetations.
- An important component of the tropical plant biodiversity: Currently, there are about 12,000 different species worldwide. Most of them occur only in the tropics.
- Ecological keystone species of humid forests: Ferns grow in special places. Some species grow on the trunk or the branches of a shrub or tree (=epiphytes), others grow on rocks (= epilithes), still others are terrestrials.
- Bioindicators for environmental change: Ferns are very sensitive to disturbances. While robust trees may survive for many years after a major disturbance of the environment, ferns disappear quickly. Therefore ferns can be used as an early warning system in forest conservation (so called bio-indicators). This technique was partly developed in Madagascar.

Whatever the interest is – evolution, biodiversity, ecology, or forest conservation – the necessary basis is a good understanding of the taxonomy of the species. To date, there are very few taxonomic treatments of the ferns in Seychelles. Three different studies were conducted, successively by Baker (1877), Christensen (1912), and Tardieu-Blot (1960). According to them, there are about 80 different

indigenous fern species in the Seychelles.

The taxonomy of the ferns of the Seychelles is preliminary, and a revision would be needed for all species. My study of the genus *Elaphoglossum* is a first modest step. We have confirmed the occurrence of four different species: *Elaphoglossum coriaceum*, *E. hornei*, *E. lancifolium* *E. lepervanchii*. All four species have been found only on Mahé and Silhouette. The genus *Elaphoglossum* grows preferentially in cloud forests that are restricted to these two islands. All species were relatively abundant, including the endemic *Elaphoglossum hornei*.



The endemic *Elaphoglossum hornei*.

References:

Baker, J. G. 1877. Flora of Mauritius and the Seychelles: a description of the flowering plants and ferns of those islands, C Reeve & Co, London.

Christensen, C. 1912. On the ferns of the Seychelles and the Aldabra Group. Transactions of the Linnean Society of London (Botany) 7:409--440.

Tardieu-Blot, M.-L. 1960. Les fougères des Mascareignes et des Seychelles. Notul. Syst. 16: 151-201.

Seychelles plant red list project

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In 1996 Dr. Annette Carlström published a first report, which evaluated the conservation status of the native flowering plants of the Seychelles. She compiled lists of the occurring species for all important natural and semi-natural areas on Mahé, Praslin and Silhouette. However, besides absence-presence data, no data on abundances is given in the report. Also the regeneration of the different species is not described.

Therefore the PCA decided to start a monitoring program of the flowering plant species of the Seychelles in accordance with the IUCN red list guidelines which allows to update the first assessment by Carlström and is precise enough to follow the population dynamics of rare species in time.



Stilt roots of Vakwa maron (*Pandanus sechellarum*).

The Seychelles plant red list project is undertaken with the scientific support of the Geobotanical Institute of the ETH in Zurich. We, Regula Bollier and Isabel Tanner, are the first two students from the ETH working in this project under the supervision of Dr. Karl Fleischmann. We are both studying environmental sciences at ETH, an interdisciplinary university course focused on sustainability and

environmental conservation. As an integral part of our studies we have to accomplish a practical traineeship in the 7th semester, which the two of us did with PCA working on the red data list project.

We worked mainly in the field to establish a survey protocol. By mapping the vegetation we quantitatively described the occurrence of rare native species. This information will also be used to set up a priority ranking to assess the value for conservation of the investigated areas. For 8 weeks of our 4 months practicum we were working in the areas of Fond Diable, Glacis Noir, Fond d'Albaretz, Fond Ferdinand and Salazie on Praslin. Another 8 weeks we spent on Mahé in the palm forest of La Réserve, on the inselbergs of Copolia, Mont Sébert, Montagne Palmiste and Glacis Deros and in the mountain forest of Congo Rouge.

We counted the juveniles and adults of rare plants along transects in 10 x 10 m and 30 x 30 m plots. Every plot was mapped on a 1: 10 000 map. Our data allows us to attribute to 900m² grid cells the density of each rare species found. The total extent of all grid cells where a specific species was found will give the extent of occurrence for this particular species. The abundance in each cell plus the extent (number of cells where the species was found) will be the basis for determining the red list status of a rare species, i.e. lower risk, vulnerable, endangered, or critically endangered.

Additionally, in Copolia, Fond Diable and Glacis Noir we applied the trail transect method developed by Karl Fleischmann to evaluate the importance for conservation of the investigated areas. This new set of data completes earlier work when the same method was used in other areas on Mahé, Silhouette and Praslin by Fleischmann and other scientists of the Geobotanical Institute. These data will help to define priority areas for protection and habitat restoration actions.

The collected data will be stored and processed in a red list plant species database. Is planned that in the near future the work started by us will be continued by other students of the Geobotanical Institute.

We would like to thank the PCA for giving us the opportunity to do our practical training in the beautiful nature of the Seychelles and for all their support during our stay.

Notes from the Field

In Seychelles, the remaining native woody plants are often small shrubs or trees. It is even difficult to find big individuals of common species such as Bwa kalou (*Memecylon eleagni*) or Bwa merl (*Aphloia theiformis*). So, observations of big specimen are a topic of conservation.

DIDIER DOGLEY discovered one of the biggest and best Bwa kalou in an unexpected place: in the garden of the hotel on Cerf Island.

In La Réunion, Bwa merl is called Change-écorce because it sheds its bark, like the exotic Guava trees. It was only after several months working in the forests of the Seychelles that CHRISTOPH KUEFFER found the first Bwa merl big enough to show the same phenomenon.

With trained eyes, you can make new discoveries in places often visited before. *Seychellaria thomasseti* is a tiny purple endemic saprophyte only a few centimeters high that occurs mainly in mountain mist forests.

EVA SCHUMACHER was surprised to find several of them in the intermediate altitude Mare aux Cochons forest when she was searching for fallen seeds on the forest floor.

Likewise JAMES MOUGAL discovered a rare endemic tree in a place where he must have passed by several times before. This is how he described the moment of his discovery: "The first time I saw a Bwa klate tree (*Rapanea seychellarum*) I couldn't believe it, because it looks almost like Kafe maron pti fey (*Erythroxylum sechellarum*) and also because I have been in Congo Rouge several time before during my five years working as a park ranger. That day, I had a long discussion with my working colleague and I was unable to convince him that it was a *Rapanea* tree because I wasn't sure myself. I could only confirm my suspicion when I was fortunate enough to spot a bunch of flowers. Since that day I have seen four *Rapanea* trees growing in that particular area".

With all the rain over the past few months, fungi have been popping up in some numbers on rotting trees, fallen branches, coconut husks and leaf litter. So KATY BEAVER has been keeping an eye out for new species that she hasn't come across before: "Some years ago I spent quite a bit of time looking at the Seychelles fungi, making drawings and notes and collecting specimens. Now that I am able to take digital photographs I am also building up a collection of photos of the many macro-fungi (toadstools, bracket fungi, etc.) we have here. Amongst leaf litter I found small white 'horns' sticking up. A set of pink-purple 'lumps' appeared on the trunk of a dead Bwa nwar tree – not a new fungal species for me but the first time I could photograph them. But my favourite is the lovely 'earth star' fungus I found one day while walking in the forest".



About PCA

Join PCA!

Any person interested in plant conservation in the Seychelles, either from the Seychelles or somewhere else in the world, is invited to join the Plant Conservation Action group (PCA). As a member you support plant conservation in the Seychelles, get *Kapisen* - the PCA newsletter - twice a year sent to you by e-Mail, and get regular invitations to events and field excursions. For joining PCA, contact Didier Dogley (Chairman) or Denis Matatiken (Secretary) at

E-Mail: boga@seychelles.net

Phone & Fax: (+248) 266 903

PCA Cards

A series of 4 art cards, designed by Eden Project in the UK, are available for SR 6 per single postcard or SR 20 (complete series) plus postage.

The cards show photographs of:

- A view from the top of Morne Seychellois over the Congo Rouge mist forest,
- The flower of Belzamin sovaz (*Impatiens gordonii*),
- An endemic snail on an endemic palm leaf,
- A Pitcher plant (*Nepenthes pervillei*).

Order from boga@seychelles.net or phone 266 903.



We thank our partners and sponsors

American Ambassador Fund, Cerf Island Marine Park Resort, Directorate Civil Aviation (DCA), Eden Project (UK), Environmental Trust Fund (ETF), Geobotanical Institute ETH Zurich (Switzerland), Ministry of Environment and Natural Resources, Ministry of Tourism, Pool&Patel, Seychelles Island Foundation (SIF), Sunrise Hotel

Forthcoming

The next issue of *Kapisen* will be published in October 2004, and will feature a report on the first Seychelles National Plant Conservation Strategy. Contributions are welcome until July 2004. Contact Christoph Kueffer or Eva Schumacher at kueffer@env.ethz.ch.

Clidemia hirta (Fo Watouk): A factsheet

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Global Distribution

Clidemia hirta (Faux Vatouk, Koster's Curse, Melastomataceae) is classified by IUCN as one of the 100 worst invasive species in the world (<http://www.issg.org/database>). It is native to the lowland of Central and South America and the Caribbean Islands (DeWalt 2003). *Clidemia* is invasive in Hawaii, American Samoa, Fiji, Southeast Asia, Sri Lanka and Tanzania (DeWalt 2003). In the Western Indian Ocean, it is one of the most problematic woody invasive species in small island states (Kueffer et al. 2003a) as well as Madagascar (DeWalt 2003). The introduction to the Western Indian Ocean region is probably very recent (1980s-90s) (Kueffer et al. 2003a).

Clidemia is a problematic agricultural weed, for instance in the Comoros, or in sugar cane fields in La Réunion (Kueffer et al. 2003a).

Distribution in the Seychelles

Clidemia was first reported from Silhouette in 1987 (Robertson 1989), where it is frequent in all forest habitats (Gerlach 1996), and where it may be a threat to the largest remaining wild population of *Impatiens gordonii* (A Griffiths, pers. comm.). On Mahé, the presence of a single plant was detected and eradicated in 1993 (Le Niol, Gerlach 1993),



Fo Watouk (*Clidemia hirta*)

and a first patch was then discovered in 1999 (Mt. Sébert, K Fleischmann, pers. comm.). Meanwhile, *Clidemia* has been reported from at least 15 different areas, mainly in and around the Morne Seychellois National Park. Single plants or patches were found in remote and rather undisturbed places such as Morne Seychellois, Congo Rouge, Glacis Deros and Trois Frères. Outside the National Park *Clidemia* has been reported from Mt. Sébert and Barbarons (Database Forestry Section, August 2003, Basil Esther & Stefan Zemp, compare Tab. 1). A single plant has been found on North Island (Hill 2002). To date, apart from Mahé, Silhouette and North, there are no reports of it growing on any other islands in the Seychelles.

Area	Extent	Habitat
Mt. Sébert	Large patch, mature individuals	Closed canopy, disturbed forest floor, path
Vingt Cinq Sous – Mare aux Cochons	Large patch, mature individuals	Mainly open canopy, dense grass vegetation, path
Sans Souci Road	Many patches, mature individuals	Closed canopy, road
Salazie	Large Patch, mature individuals	Mainly open canopy, disturbed forest floor, road
Dans Bernard	Large Patch, mature individuals	road

Table 1: Largest patches of *Clidemia hirta* found on Mahé (Database Forestry Section, Seychelles Ministry of Environment, August 2003).

Clidemia Factsheet

Biology

In its native range *Clidemia* is found in open areas (DeWalt 2003). However, in its introduced range it grows also in the understorey of undisturbed old-growth forest (Tunison 1991, Peters 2001, DeWalt 2003, Teo et al. 2003). In Singapore and Pasoh (Malaysia), *Clidemia* is so far the only exotic species able to invade old-growth primary and secondary forest (Peters 2001, Teo et al. 2003). Similarly, in the Seychelles *Clidemia* was found repeatedly under undisturbed canopy (Database Forestry Section, August 2003). It has been hypothesized that release from natural enemies, e.g. insect herbivores, allows it to grow in deeper shade where it is introduced (DeWalt 2003).

In the introduced range, *Clidemia* nevertheless grows mainly in open areas and along paths where relative growth rate and population density are markedly higher than in the understorey (Tunison 1991, Gerlach 1996, Peters 2001). It has a very high physiological ability to capture light but shows also good adaptation to shade (Baruch et al. 2000). In Pasoh (Malaysia), fruiting plants were found exclusively in gaps (Peters 2001). However, in the Seychelles fruiting individuals have already been reported from under closed canopy. It is probably not resistant to fire, but it rapidly colonizes burned areas (Weber 2003).

Flowering and fruiting probably occurs throughout the year (Gerlach 1996, Peters 2001, DeWalt 2003). Self-pollination is unlikely (DeWalt 2003). A *Clidemia* fruit contains between 300-500 seeds, each about 0.5 mm in diameter. A single adult may produce between 500-2000 fruits per year depending on plant biomass (i.e. mainly plant height) and site, as derived from data from several heavily invaded *Metrosideros polymorpha* forests in Hawaii (DeWalt



The fruits of *Clidemia hirta*.

2003). Peters (2001) reported 750 fruits per adult per year. A single fruiting large individual may thus produce up to 1 million seeds per year.

Fruit dispersal is mainly by frugivorous birds, but also humans, e.g. seeds attached to shoes (Tunison 1991). Gerlach (1996) suggested that rats are dispersing *Clidemia* seeds. Vegetative plant parts are probably also dispersed by water along streams. Re-sprouting ability of plant parts is great (Tunison 1991, DeWalt 2003).

The time for a seedling to reach maturity has been observed to be 6 months in Hawaii (Tunison 1991). Experimental data supports this short time span under high light availability (DeWalt 2003). Between 15-30% of seedlings (not reproductive, >4.5 cm) reached maturity within 1 year in several heavily invaded *Metrosideros polymorpha* forests in Hawaii (DeWalt 2003).

In a study in Sri Lanka, soil seed banks of *Clidemia* were an order of magnitude larger than the ones of any other species (Singhakumara et al. 2000). Similar patterns have been observed in the Seychelles (Gerlach 1996). Seeds may live in the soil for more than a year (DeWalt 2003); maybe even up to 4 years (Tunison 1991).

Mortality of seedlings (not reproductive, >4.5 cm) per year was between 5-25% in several heavily invaded *Metrosideros polymorpha* forests in Hawaii (DeWalt 2003). Similarly, first year mortality rates of freshly germinated seedlings of several species of the Melastomataceae family was between 0-20% under laboratory conditions (Ellison et al. 1993). No data is available on germination rates and initial seedling mortality (< 4.5 cm). Germination rates for three *Miconia* species of the Melastomataceae family sown out in different forest conditions in their native range were between c. 5% (understorey) and c. 25% (gap centres) (Ellison et al. 1993).



The native *Melastoma malabatricum* (Watouk).

Clidemia Factsheet

Management

Clidemia is of major concern for nature conservation in the Seychelles because it is apparently able to invade sensitive areas of high biodiversity that are so far invaded by only a few species, i.e. mountain mist forests and upland open canopy ridges and slopes.

The Forestry Section initiated in 2001 a programme to control Clidemia, that was widened to include also the participation of the public in early 2003 (Kueffer et al. 2003b). A database and early detection system were established. The aim is to contain the further spread of the species, especially to areas of high biodiversity and to new islands.

A leaflet, which can be obtained from the Forestry Section, has been produced to inform the public about the ecology and management of Clidemia. Agencies and people to be targeted by public awareness campaigns include the Ministry of Environment and Natural Resources, conservation NGOs, visiting and local biologists, hash runners, eco-tourism guides, tourists using eco-tourism trails, hiking clubs, wildlife club leaders, cinnamon croppers, workers of PUC and other agencies responsible for maintenance of roadsides, telephone and power cables, water reservoirs etc. It is hoped that these people will eradicate single individuals and small patches immediately after detection by completely uprooting the plant and hanging it over the branch of a shrub or tree so that the plant dries and dies. Large patches are supposed to be reported to the Forestry Section. Care should be taken that cut plant material of Clidemia is not further

distributed, e.g. when maintaining a roadside with a brush-cutter. During a public day in January 2003, covered by the media (Seychelles Nation, SBC), the largest patch of Clidemia (Mt. Sébert) was partly eradicated with the participation of school classes and local communities. As a follow-up, the site was replanted with endemic palms.

Mechanical control is difficult. Growth rates are very fast and time to reach maturity is very short. Infested areas have to be re-visited every 4-6 months to assure that no new fruits are produced. Small size and longevity of seeds increase the risk of accidental introductions to new areas (e.g. Praslin) by seeds attached to shoes and clothes. People eradicating Clidemia or passing through infested areas should carefully wash their clothes and shoes. Large seed banks and longevity of seeds in the soil require a long-term commitment and re-visitation of (formerly) infested sites for several years. Re-sprouting ability increases the risk of spread especially after eradication. If plant material is left on the ground, the plant may re-grow. Large amounts of plant material should be burned.

Glyphosate is an effective herbicide when used as a foliar spray (Weber 2003).

No biological control agent that is effective in the forest understorey has so far been identified for Clidemia, and the chances of finding an efficient agent are rather small because of the life-cycle properties of Clidemia (DeWalt 2003).

References

- Baruch, Z., R. R. Pattison, and G. Goldstein. 2000. Responses to light and water availability of four invasive Melastomataceae in the Hawaiian islands. *International Journal of Plant Sciences* **161**:107-118.
- DeWalt, S. J. 2003. The invasive tropical shrub *Clidemia hirta* (Melastomataceae) in its native and introduced ranges: tests of hypotheses of invasion. PhD Thesis. Louisiana State University.
- Ellison, A. M., J. S. Denslow, B. A. Loiselle, and D. Brenes. 1993. Seed and seedling ecology of neotropical Melastomataceae. *Ecology (Tempera)* **74**:1733-1749.
- Gerlach, J. 1993. Invasive Melastomataceae in Seychelles. *Oryx* **27**:22-26.
- Gerlach, J. 1996. The effects of habitat domination by invasive Melastomataceae. *Phelsuma* **4**:19-26.
- Hill, M. J. e. 2002. Biodiversity surveys and conservation potential of Inner Seychelles islands. *Atoll Research Bulletin*:495.
- Kueffer, C., P. Vos, C. Lavergne, and J. Mauremootoo. 2003a. A case study on the status of invasive woody plant species in the Western Indian Ocean. Forest Biosecurity and Protection Working Papers, FBS/4EF. Forestry Department, Food and Agriculture Organization of the United Nations, Rome, Italy.
- Kueffer, C., S. Zemp, and M. Vielle. 2003b. Community based control of *Clidemia hirta* in the Seychelles. *Aliens IUCN Newsletter* **16**:21.
- Peters, H. A. 2001. *Clidemia hirta* invasion at the Pasoh Forest Reserve: An unexpected plant invasion in an undisturbed tropical forest. *Biotropica* **33**:60-68.
- Robertson, S. A. 1989. Flowering plants of Seychelles. Royal Botanic Gardens, Kew.
- Singhakumara, B. M. P., R. S. J. P. Uduporuwa, and M. S. Ashton. 2000. Soil seed banks in relation to light and topographic position of a hill Dipterocarp forest in Sri Lanka. *Biotropica* **32**:190-196.
- Teo, D. H. L., H. T. W. Tan, R. T. Corlett, C. M. Wong, and S. K. Y. Lum. 2003. Continental rain forest fragments in Singapore resist invasion by exotic plants. *Journal of Biogeography* **30**:305-310.
- Tunison, T. 1991. *Clidemia hirta*. Element Stewardship Abstract The Nature Conservancy, Arlington, Virginia.
- Weber, E. 2003. Invasive plant species of the world. A reference guide to environmental weeds. CABI Publishing, Oxon, UK & Cambridge, USA.

Recent literature relevant to Seychelles' plant life (2002-2004)

- Burke, A.** 2003. Inselbergs in a changing world - global trends. *Diversity and Distributions* 9:375-383.
- Briggs, J. C.** 2003. The biogeographic and tectonic history of India. *Journal of Biogeography* 30: 381-388.
- Currie, D., R. Fanchette, J. Millett, C. Hoareau, and N. J. Shah.** 2004. The distribution and population of the Seychelles (bare-legged) Scops Owl *Otus insularis* on Mahé: consequences for conservation. *Ibis* 146:27 - 37.
- Currie, D., M. Hill, J. Millett, R. Bristol, J. Nevill, and N. J. Shah.** 2003. Conservation options for the critically endangered Seychelles Black Paradise Flycatcher *Terpsiphone corvina*. *Bird Conservation International* 13:97-114.
- Currie, D., R. Bristol, J. Millett, M. Hill, U. Bristol, S. J. Parr, and N. J. Shah.** 2003. Habitat requirements of the Seychelles Black Paradise Flycatcher *Terpsiphone corvina*: a re-evaluation of translocation priorities. *Ibis* 145:624-636.
- Denslow, J. S.** 2003. Weeds in paradise: Thoughts on the invasibility of tropical islands. *Annals of the Missouri Botanical Garden* 90:119-127.
- Ducouso, M., G. Béna, C. Bourgeois, B. Buyck, G. Eyssartier, M. Vincelette, R. Rabevohitra, L. Randrihasipara, B. Dreyfus, and Y. Prin.** 2004. The last common ancestor of Sarcolaenaceae and Asian dipterocarp trees was ectomycorrhizal before the Indian-Madagascar separation, about 88 million years ago. *Molecular Ecology* 13:231-236.
- Edwards, P. J., J. Kollmann, and K. Fleischmann.** 2003. Life history evolution in *Lodoicea maldivica* (Arecaceae). *Nordic Journal of Botany* 22:227-237.
- Fleischer-Dogley, F.** 2003. Plant conservation NGO for Seychelles. Page 5 *in* Plant Talk.
- Fleischer-Dogley, F., and T. Kendle.** 2002. The conservation status of the Coco de Mer *Lodoicea maldivica* (Gmelin Persoon): a flagship species. Pages 369 – 382 *in* M. Maunder, C. Clubbe, C. Hankamer, and M. Groves, editors. *Plant conservation in the tropics. Perspectives and practice.* Royal Botanical Gardens, Kew, UK.
- Fleischmann, K., P. J. Edwards, P. Héritier, C. Meuwly, and C. Kueffer.** 2003. Virtual gallery of the vegetation and flora of the Seychelles. *Bulletin of the Geobotanical Institute ETH* 69:57-64.
- Gmür, V.** 2003. Ecophysiological response to drought stress in seedlings of native and invasive trees on the Seychelles. Diploma thesis. Geobotanical Institute, ETH Zurich, Zurich.
- Gullstrom, M., M. de la Torre Castro, S. O. Bandeira, M. Bjork, M. Dahlberg, N. Kautsky, P. Ronnback, and M. C. Ohman.** 2002. Seagrass ecosystems in the Western Indian Ocean. *Ambio* 31:588-596.
- Haysom, K. A., and S. T. Murphy.** 2003. A global review of the status of invasiveness of forest tree species outside their natural habitat. *Forest Biosecurity and Protection Working Paper FBS/3E* Forestry Department, FAO, Rome.
- Héritier, P.** 2002. Ecological value of the Fond Ferdinand, Praslin, Seychelles and possible connection between Fond Ferdinand and Vallée de Mai. Diploma thesis. Geobotanical Institute, ETH Zurich, Zurich, Switzerland.
- Hill, M. J. ed.** 2002. Biodiversity surveys and conservation potential of Inner Seychelles islands. *Atoll Research Bulletin* 495.

- Kelly, J. A., and M. J. Samways.** 2003. Diversity and conservation of forest-floor arthropods on a small Seychelles island. *Biodiversity and Conservation* 12:1793-1813.
- Kueffer, C., S. Zemp, and M. Vielle.** 2003. Community based control of *Clidemia hirta* in the Seychelles. *Aliens IUCN Newsletter* 16:21.
- Kueffer, C., P. Vos, C. Lavergne, and J. Mauremootoo.** 2003. A case study on the status of invasive woody plant species in the Western Indian Ocean. *Forest Biosecurity and Protection Working Papers, FBS/4EF.* Forestry Department, Food and Agriculture Organization of the United Nations, Rome, Italy.
- Kueffer, C., P. J. Edwards, K. Fleischmann, E. Schumacher, and H. Dietz.** 2003. Invasion of woody plants into the Seychelles tropical forests: habitat invasibility and propagule pressure. *Bulletin of the Geobotanical Institute ETH* 69:65-75.
- Mauremootoo, J. R.,** ed. 2003. *Proceedings of the Regional Workshop on Invasive Alien Species and Terrestrial Ecosystem Rehabilitation in Western Indian Ocean Island States. Sharing Experience, Identifying Priorities and Defining Joint Action.* Indian Ocean Commission, Quatre Bornes, Mauritius.
- Meuwly, C.** 2002. Fire and vegetation on Praslin and in the Fond Ferdinand. Master thesis. ETH Zurich, Zurich.
- Richardson, D. M., P. Binggeli, and G. Schroth.** 2004. Plant invasions - problems and solutions in agroforestry. Pages 371-396 in G. F. Schroth G., C.A. Harvey, C. Gascon, H. Vasconcelos and A.M. Izac, editors. *Agroforestry and biodiversity conservation in tropical landscapes.* Island Press, Washington.
- Sawmy, M. V.** 2003. Saving the biological wealth of three little treasures in the Indian Ocean. Pages 29-33 in *Plant Talk.*
- Schumacher, E., H. Dietz, K. Fleischmann, C. Kueffer, and P. J. Edwards.** 2003. Invasion of woody plants into the Seychelles tropical forests: species traits in the establishment phase. *Bulletin of the Geobotanical Institute ETH* 69:77-86.
- Seaward, M. R. D., A. Aptroot, and F. A. Harrington.** 2002. The lichens of Aldabra, with comments on their distribution. *Bryologist* 105:473-477.
- Tobler, M.** 2003. Growth responses to drought stress under different light levels in native vs. invasive tree seedlings on the Seychelles. Diploma thesis. Geobotanical Institute, ETH Zurich, Zurich.
- Zemp, S.** 2003. *Cinnamomum verum* in the Seychelles. Management options for an economically interesting invasive plant. Geobotanical Institute, ETH Zurich, Zurich, Switzerland & Forestry Section, Seychelles Ministry of Environment, Victoria.