Exploring for rare plants (including insectivorous ones) in Indochina, and the challenge of the politics

Indochina

The geographical term Indochina is historically used to refer to south-East Asian countries located between India and China: Burma, Singapore, Thailand, Vietnam, Cambodia, Laos and Peninsular Malaysia.

The term is often confused with French Indochina, which was used, from 1887 onwards, to refer to Vietnam (formerly the states of Tonkin, Annam and Cochinchine), Cambodia and Laos.

The cultures of those countries are more or less influenced by China and India.
Cambodia, Laos, Myanmar and Thailand are particularly influenced by India whereas Vietnam is traditionally under the influence of the Chinese culture.

Today, most of these countries also show pronounced Western cultural influences like it is the case for almost all emerging countries.


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The climate

Indochinese countries are strongly subject to the influence of monsoon with seasonal rainfall patterns: a dry season which begins in November, or December and lasts until April or May where the rainy season begins.

Plants that occur in these strongly seasonal habitats generally exhibit adaptations to water stress and drought.

The different habitats of Indochina are affected in different ways by this seasonal climate:
Habitats like deciduous forests can get really dry while others like lower montane forests (« hill forests ») can hold a lot of humidity.

A low land in Cambodia, February.

Mount Bokor, Cambodia, July.

There are several distinctive types of habitats in Indochina including: Mangrove forest, flooded forest and grasslands, dry deciduous forest, lowland evergreen forest, hill evergreen forest, agricultural lands and wastelands.

In the Indochinese Peninsula, rare plants and especially carnivorous species can be observed in the following broad habitats types:

- **grasslands;**

- **agricultural lands and wastelands**

- **dry deciduous forest;**

- **pine forest;**

- **hill evergreen forest.**

Grasslands, agricultural lands and wastelands

By « grasslands », I will refer here to open habitats mainly composed of short vegetation: grasses, various ferns and short trees or shrubs like *Melaleuca*).

In Indochina, this type of habitat is very sandy.

Grasslands, in Indochina, are mainly found in the lowlands. During the rainy season, the areas surround the Tonle Sap Lake and the Mekong river are flooded, creating an immense wetland. Grassy clearings in the lowland and hill forests also get inundated.

In the dry season, these grasslands are very hot places (up to 100°F/ 40°C) and often get bone dry.

Grassland, Thailand

Grassland, Cambodia

Paddy field, Cambodia

Paddy field, Cambodia

Grassland, Cambodia

Swamp, Vietnam

Wasteland, Cambodia

Wasteland, Cambodia

Wasteland, Cambodia

Wasteland, Cambodia

Wasteland, Cambodia

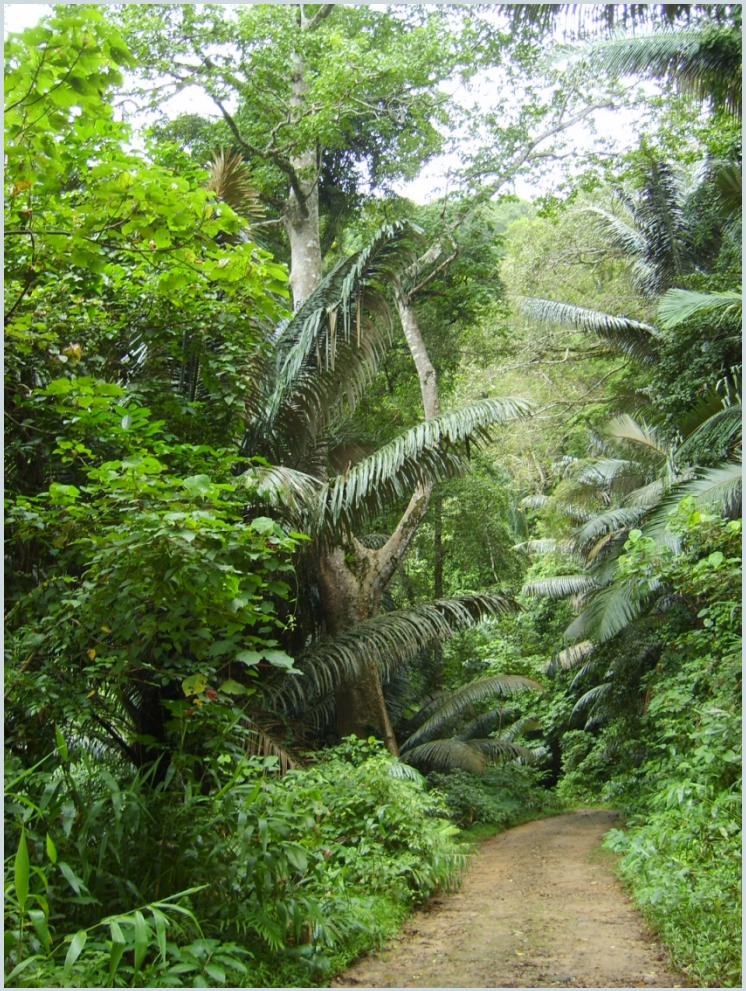
Dry deciduous forests and Pine forests

Cardamoms range, Cambodia

Kirirom plateau, Cambodia

Hill evergreen forests

Phnom Bokor, Cambodia



Phnom Bokor, Cambodia

Summit of Phnom Bokor, 1080 m.

Summit of Phnom Bokor, 1080 m.

Summit of Phnom Bokor, 1080 m.

Summit of Phnom Bokor, 1080 m.

Exploring for rare plants

INSECTIVOROUS PLANTS
MYRMECOPHYTES
PARASITIC PLANTS
ORCHIDS

INSECTIVOROUS / CARNIVOROUS PLANTS

What is a carnivorous plant?

A carnivorous plant attracts, captures, kills and digests preys using modified leaves that act as traps.

This group of plants, which is currently composed of approximately 720 known species divided among 11 families and 19 genera, is represented in Indochina by three genera in three different families: the sundews *Drosera* L. *(Droseraceae)*, the pitcher plants *Nepenthes* L. (Nepenthaceae) and the bladderworts *Utricularia* L. (Lentibulariaceae).

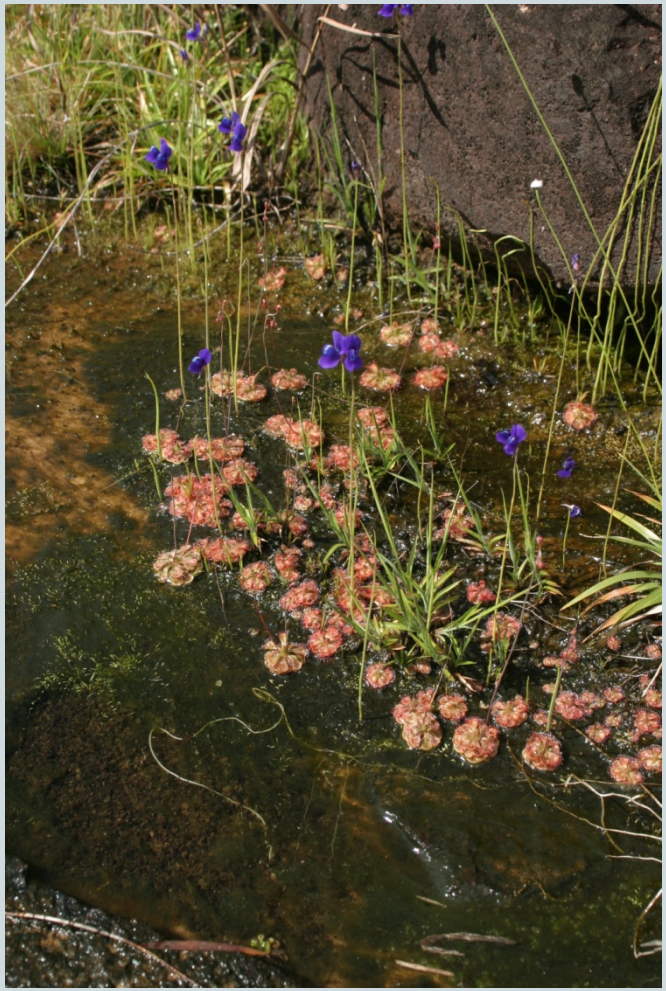
Carnivorous plants : the genus *Drosera*

Drosera ultramafica, Philippines

Drosera is a genus of sticky-leaved carnivorous plant that comprises about 190 species distributed on all continents (except Antarctica).

The greatest concentration is found in the southern hemisphere with Australia being the main biodiversity spot (almost 100 species).

Drosera burmanii



Drosera burmanii, Cambodia

Drosera burmanii, Vietnam

Drosera indica

Drosera indica, Vietnam

Red small form

Green giant form

Drosera indica, Cambodia

Two « forms » of *Drosera indica*, Cambodia

Two « forms » of *Drosera indica*, Cambodia

Drosera peltata

Drosera peltata, Cambodia


Drosera peltata, Cambodia

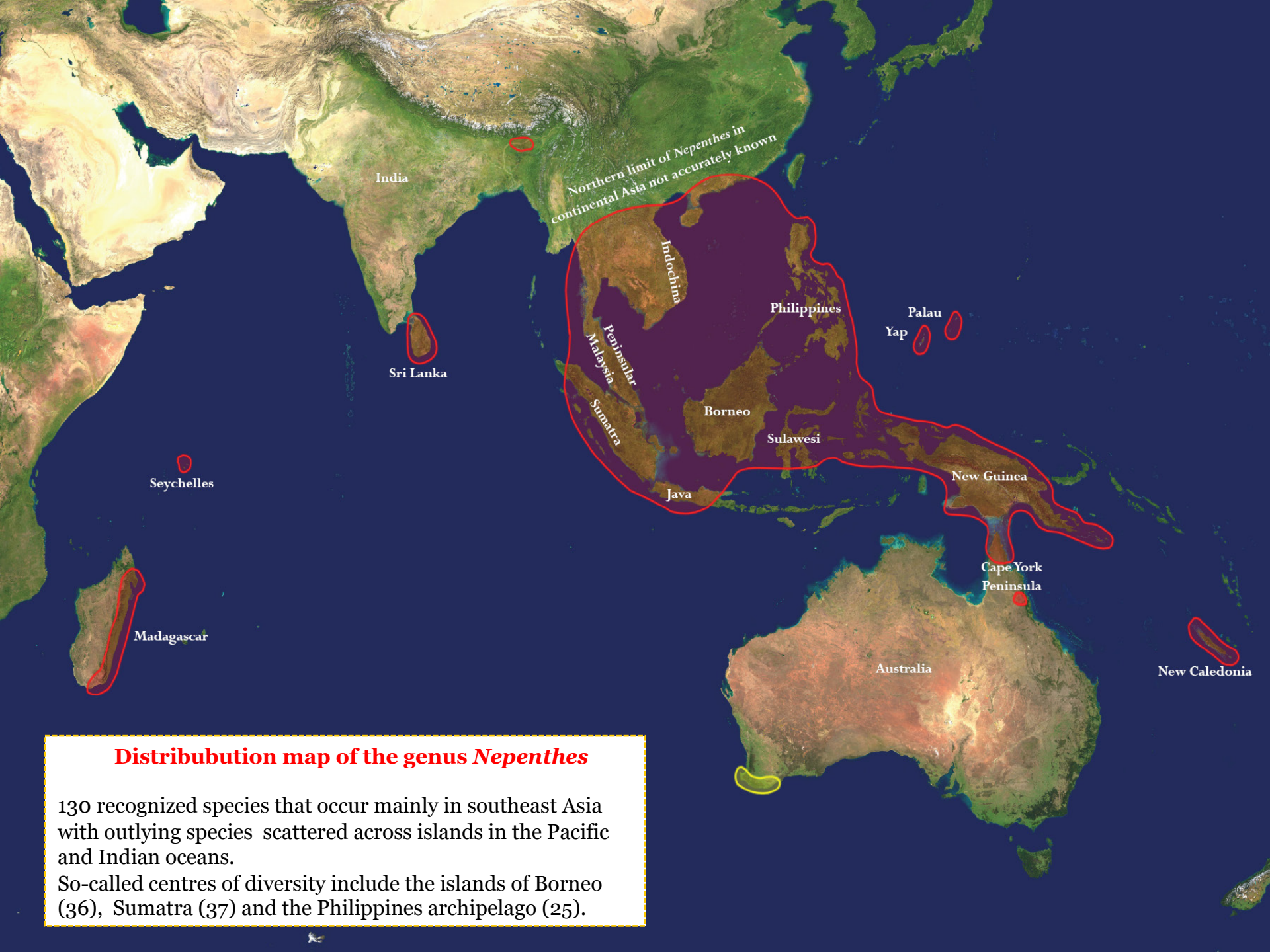

Drosera peltata, Cambodia

Drosera peltata with *Nepenthes bokorensis*, Cambodia

Carnivorous plants: the genus *Nepenthes*

Nepenthes are long lianas that usually climb among neighboring shrubs or threes, but can also scramble along the ground. They produce highly specialized leaves: at the end of the leaf blade (the normal looking leaf) arises the pitcher, which is connected to the leaf blade by a thin tendril.

The genus *Nepenthes* currently includes *130* known species worldwide, with the islands of Borneo, Sumatra and the Philippine archipelago considered to be the *Nepenthes* centres of diversity.



Distribubution map of the genus *Nepenthes*

130 recognized species that occur mainly in southeast Asia with outlying species scattered across islands in the Pacific and Indian oceans.
So-called centres of diversity include the islands of Borneo (36), Sumatra (37) and the Philippines archipelago (25).


Nepenthes mirabilis, Cambodia

Nepenthes mirabilis

Nepenthes smilesii

The content of a *Nepenthes mirabilis* pitcher

Nepenthes mirabilis var. *globosa*

previously known under the unofficial names of « N. viking » and « N. globosa ».
Plant from Trang has been sold as *N. mirabilis* « Trang bizarre »

Trang

Trang

Trang

Trang

Trang

Phang nga

Trang

Phang nga

N. Mirabilis var. *globosa*

N. Mirabilis var. *mirabilis*

Differences between both varieties dwell in the pitchers. Foliage and flowers are identical.

Pyrophytic *Nepenthes*

Nepenthes andamana, Thailand

Species of the *Nepenthes thorelii* aggregate

-***N. andamana*** (Thailand)
-***N. bokorensis*** (Cambodia)
-***N. chang*** (Thailand)
-***N. holdenii*** (Cambodia)
-***N. kampotiana*** (Cambodia, Vietnam, Thailand)
-***N. kerrii*** (Thailand)
-***N. smilesii*** **(formerly *N. anamensis*)** (Cambodia, Laos, Thailand, Vietnam)
-***N. suratensis*** (Thailand)
-***N. thorelii*** (Vietnam)

These Indochinese species form and aggregate of closely allied taxa with affinities to *Nepenthes thorelii*. They are similar in overall appearance and share many features:

- long racemose inflorescence,

- flowering at rosette stage,

- seed with reduced filiform appendages,

- coriaceous narrow leaves, decurrent leaf attachment,

- pyrophytic habit, with the production of a thickened rootstock,

- production of reddish lower pitchers.

Long racemose inflorescence

Nepenthes smilesii

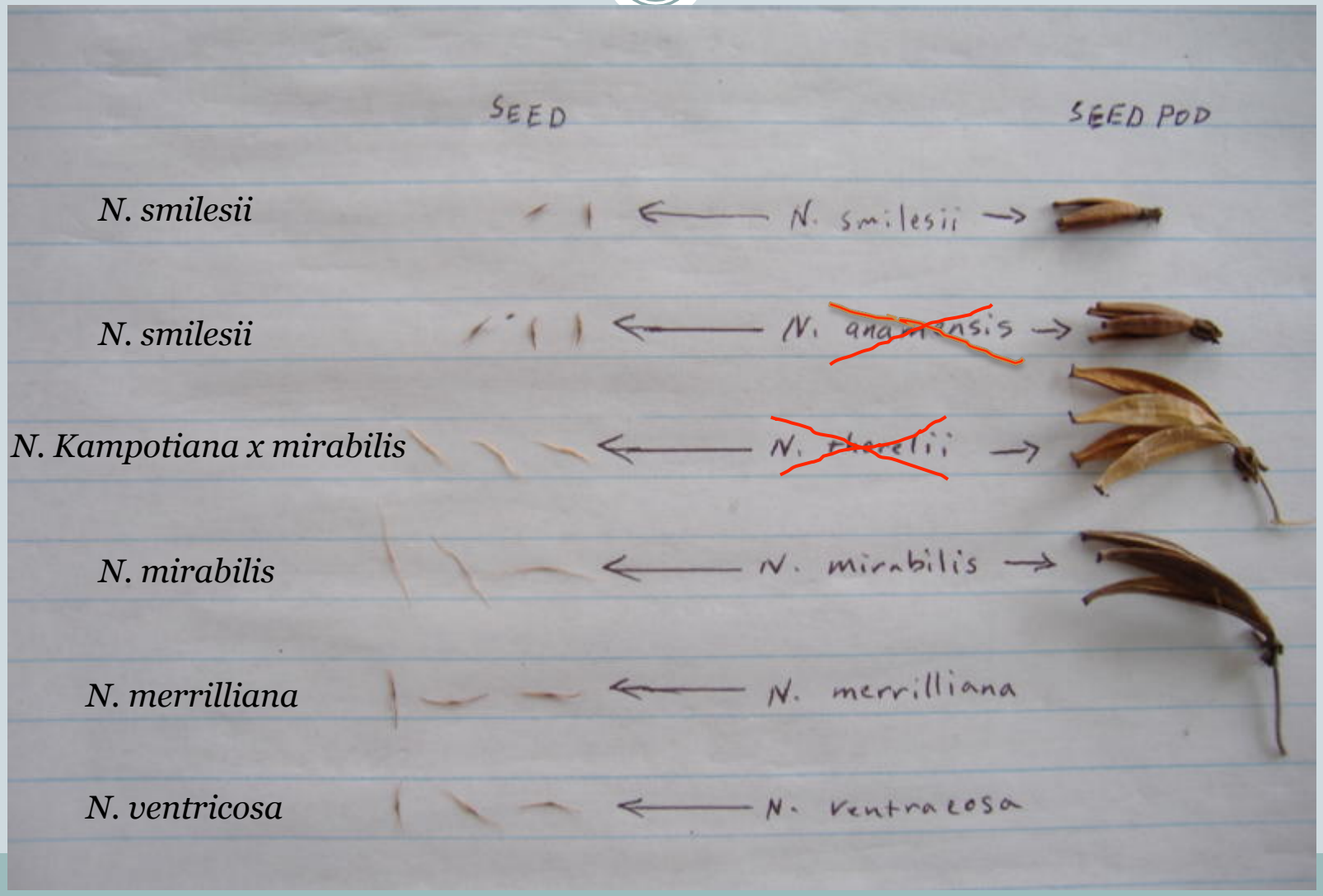
Nepenthes smilesii

Flowering at rosette stage

Nepenthes smilesii

Seeds with reduced filiform appendages

A comparison of seeds and seedpods between species from the *Nepenthes thorelii* aggregate and three other species.



Decurrent leaf attachment

Nepenthes bokorensis

Nepenthes holdenii

Do not confuse with *N. mirabilis*

N. mirabilis has clear petiolate leaves whereas species from the *N. thorelii* aggregate has sessile to subpetiolate leaves.

N. mirabilis

N. holdenii

Dry habitat

Nepenthes holdenii on dry steep slopes, Cambodia

Nepenthes smilesii, a few months after a fire.

Pyrophites *Nepenthes* are able to survive a long extended drought and low intensity fires.
After the first rains, they grow back from the roots.

Pyrophytic habit, with the production of a thickened rootstock

Rootstock or tubers

Propagating a pyrophytic *Nepenthes*

Propagating a pyrophytic *Nepenthes*

Propagating a pyrophytic *Nepenthes*

Propagating a pyrophytic *Nepenthes*

Nepenthes holdenii

Nepenthes holdenii, Cambodia

Lower and upper pitchers of *Nepenthes holdenii*

Variation of *Nepenthes holdenii* upper pitchers

Nepenthes bokorensis


Nepenthes andamana, Thailand

*Nepenthes sura*tensis, Thailand

Nepenthes aff. kampotiana, Cambodia

Comparison of dried upper pitchers

Carnivorous plants: the genus *Utricularia*

Utricularia (or bladderworts) is a genus of carnivorous plants comprising more than 220 species distributed all across The globe. They occur in fresh water and wet soils as terrestrials or aquatics. Some species are epiphytic.

Utricularia mostly capture minute organisms thanks to their sophisticated bladder-like traps.

Utricularia aurea, Cambodia

Utricularia aurea traps filled with preys, Vietnam


Utricularia subulata, Cambodia


Utricularia subulata, Cambodia

Utricularia aurea

Utricularia odorata

Utricularia odorata, Cambodia

Utricularia caerulea, Cambodia

Utricularia delphinioides

Cambodian population

Two variants of *Utricularia delphinioides*

Thai populations

MYRMECOPHYTES: THE GENUS *HYDNOPHYTUM*

What is a myrmecophyte?

A myrmecophyte ("ant-plant") is a plant that lives in a mutualistic association with ants. There are over 100 different genera of myrmecophytes. They all possess structural adaptations (called myrmecodomatia) such as galleries that provide ants with shelter or food, sometimes both.

In exchange, the ants colony helps the myrmecophyte in pollinatation and seeds dispersal. It can also gather some nutrients and in some case, defend the plant.

Myrmecodia species from Borneo

Diversity of myrmecophytes

Lecanopteris sinuosa

Nepenthes bicalcarata

Unidentified species of *Hydnophytum* from Cambodia

Unidentified species of *Hydnophytum* from Cambodia

Myrmecodomatia

MYRMECOPHYTES: THE GENUS *DISCHIDIA*

Dischidia is a genus of lianas in the family Asclepiadaceae. This genus is distributed in tropical areas of China, India and south-east Asia.

It includes about 80 known species which all grow as epiphytes.

Some *Dischidia* have developed a symbiotic relationship with insects and particularly ants. These plants have developed modified balloon-like leaves to either provide shelter or storage to the insects.

Dischidia aff. Rafflesiana from Cambodia

Dischidia aff. rafflesiana, Cambodia

PARASITIC PLANTS

What is a parasitic plant?

A parasitic plant is a plant that derives some or all of its sustenance from another plant. The well known mistletoe (*Viscum sp.*) is a parasitic plant that grows attached to a tree or a shrub.

More than 4000 species of flowering plants are considered to be parasitic. They use the hausterium, a modified root, to penetrate the host plant.

Parasitic plants exhibit a large variety of specializations in morphology, anatomy and reproductive biology. They range from chlorophyllous facultative hemiparasites to obligate parasites, to holoparasites. Many of them have a very narrow distributional range.

PARASITIC PLANTS: THE GENUS *SAPRIA*

Rafflesia arnoldii, Sumatra

Rafflesiaceae is a family of parasitic plants composed of 9 genera among which is found the genus *Rafflesia* (about 30 species) which includes *Rafflesia arnoldii* from Sumatra, the plant with the largest flower of all plants. It can reach 1 meter large (3 ft) and can weigh up to 11 kg (24 lb).

Rafflesiaceae occur in east and southeast Asia. They are holoparastites of vines in the genus *Tetrastigma*. which grow in primary undisturbed forests.

Rafflesiaceae do not have stems, leaves, roots, and no chlorophyll.
They are mainly composed of their flowers that emerge from the roots or lower stems of the host plants. They can therefore only be seen when they're ready to reproduce.

Sapria poilanei, Cambodia

Sapria is one of the genus included in the Rafflesiaceae family.

The flowers of *Sapria* are much smaller than those of *Rafflesia* species. They are about 20 cm in diameter and are usually bright red with sulphur-yellow or white spots. The genus *Rafflesia* have 5 petaled flowers whereas Sapria have flowers with 10 lobes.

Like *Rafflesia*, *Sapria* flowers appear above the ground and have a putrid odour.

Three species are described, *S. himalayana* is known from Cambodia and some parts of China, northeast India, Myanmar, Thailand and Vietnam. *S. poilanei* is found in Cambodia and Thailand. A recently described third species, *S. ram,* is found in Thailand.

Sapria poilanei, Cambodia

PARASITIC PLANTS: THE GENUS *BALANOPHORA*

Balanophoraceae (the name derives from the inflorescence which seems to be covered by barnacles) is a family of unusual holoparasitic flowering plants that occurs in subtropical and tropical parts of the world.
This family consist of 17-20 genera and approximately 50-100 species, depending on the source.

The plants usually grow in humid inland forests growing on tree roots and have an aboveground inflorescence, composed of numerous minute flowers, that has a fungus-like appearance.
The inflorescences develop inside the underground part of the plant, before it breaks through the surface of the soil. The underground portion, which is connected to the host plant looks more like a tuber and is not a real proper root system.

Like Rafflesiaceae, Balanophoraceae contain no chlorophyll.

Balanophora latisepala, Cambodia

Balanophora latisepala, Cambodia

Balanophora fungosa, Cambodia

Balanophora fungosa, Cambodia

ORCHIDS

What you may not know about orchids…

Orchids (or Orchidaceae) are the second largest family of flowering plants with more than 22 000 species distributed in almost 900 genera.

They are virtually found everywhere in the globe. The great majority indeed occurs in tropics and subtropics but they can also be found above the Arctic Circle or close to Antarctica.

Orchidaceae is an old family and recent studies suggest that the oldest Orchidaceae grew during the late Cretaceous.

In the tropics, orchids are mostly perennials epiphytes. Some are litophytes. Temperate species are almost all terrestrials.


Orchidaceae,
Phnom Bokor, Cambodia

Dendrobium formosum, Cambodia

Dendrobium sp., Laos

Unindentified Orchidaceae, Cambodia

Unindentified Orchidaceae, Cambodia

Paphiopedilum appletonianum, Laos

Paphiopedilum aff. callosum, Cambodia

The challenge of the politics


Tuol Sleng, Cambodia


Tuol Sleng, Cambodia


Kampong Trach, Cambodia

Kirirom plateau, Cambodia

Biologist Jeremy Holden with *Nepenthes smilesii*, Cambodia

Kampot province, Cambodia

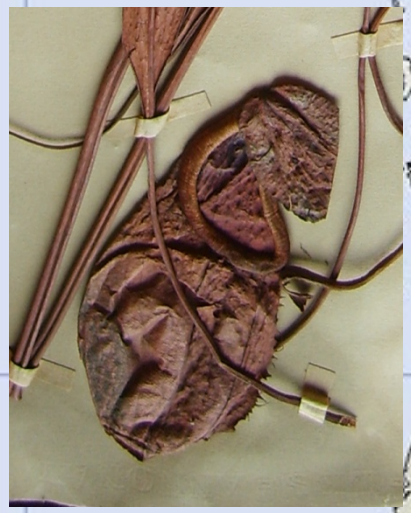
Dr. Clovis Thorel (1833-1911) was a French medic, botanist and explorer. He left France for Saigon, Cochinchina, in 1862. There, between 1862 and 1866, he extensively explored, collected and studied the local flora.

To this day, more than 15 species of plants have been named by him. Several others have been named after him (genus: *Neothorelia*, *Thoreldora*, *Thorelia*).

Le docteur Thorel découvrant des orchidées épiphytes.
Dessin de E. Tournois d'après une aquarelle de M. L. Delaporte.

A lost plant: *Nepenthes thorelii*.

This enigmatic species has been a source of confusion for taxonomists and horticulturists since its description.



CHINA
Vientiane
MYANMAR
Rangoon
LAOS
THAILAND
Andaman Sea
Bangkok
VIETNAM
CAMBODIA
Phnom Penh
Song Bé province
Ho Chi Minh City
?
Phan Tiet
Gulf of Thailand
South China Sea
0
500 Miles
0
500 KM
N. thorelii


Ti-Tinh, southern Vietnam,
type location of *Nepenthes thorelii*

Ti-Tinh, southern Vietnam, type location of *Nepenthes thorelii*

Ti-Tinh, southern Vietnam, type location of *Nepenthes thorelii*

Trang, southern Thailand, location of the mainland population of *Nepenthes mirabilis* var. *globosa*

Trang


Trang

Phnom Bokor national park , 2007


Phnom Bokor national park
2009


Phnom Bokor national park, 2009

« Temporary Master Plan of Bokor Mountain Project », 2009.


Muséum National d’Histoire Naturelle (MNHN), Paris

MNHN, Paris

MNHN's herbarium, Paris (P)


CINNAMOMUM
6193
N. gymnamphora
N. macrovulgaris
N. phyllamphora
N. rafflesiana
N. tentaculata


PHOEBE
6197
OCOTEA
6195
AUG. CHEVALIER PLANTES DE L'INDOCHINE
Coll. Aug. Chevalier

Nepenthes bokorensis and *Utricularia pierrei* holotypes

Sarracenia purpurea and *Darlingtonia californica* material

History of the Cambodian herbaria

1930-1950: two small herbaria have been made by French scientists. Those collection have been moved then neglected. A part of the material has been transfered to Paris. The rest has been destroyed during the Khmer Rouge period (1975-1979).

1994: Dr. Hul, redactor in chief of the Indochinese Flore started to put up a small local herbarium with some Cambodian botanists. This very small herbarium (2500 specimens) was set in a mere classroom for many years.

Herbarium temporary room, Phnom Penh, February 2010

Nepenthes holdenii (RUPP)

Nepenthes aff. Kampotiana (RUPP)

2011: Thanks to national and international help, the herbarium has now been granted with decent facilities.

The Cambodian herbarium has been officially unveiled and it is now known as RUPP (Royal University of Phnom Penh) among the world herbaria.

Opening of the National Herbarium of Cambodia (RUPP), March 2011

Dr. Sovanmomy Hul, curator or the Asian herbarium of Paris MNHN

Rare Indochinese plants and conservation issues

The vast majority of the species presented in this lecture are threatened in Indochina by rampant agriculture and urbanisation. During the course of this work, several populations of *Nepenthes* for instance have been eradicated.

The remaining plants are often collected for traditional medecine uses or poached to quench the thirst of some greedy collectors.

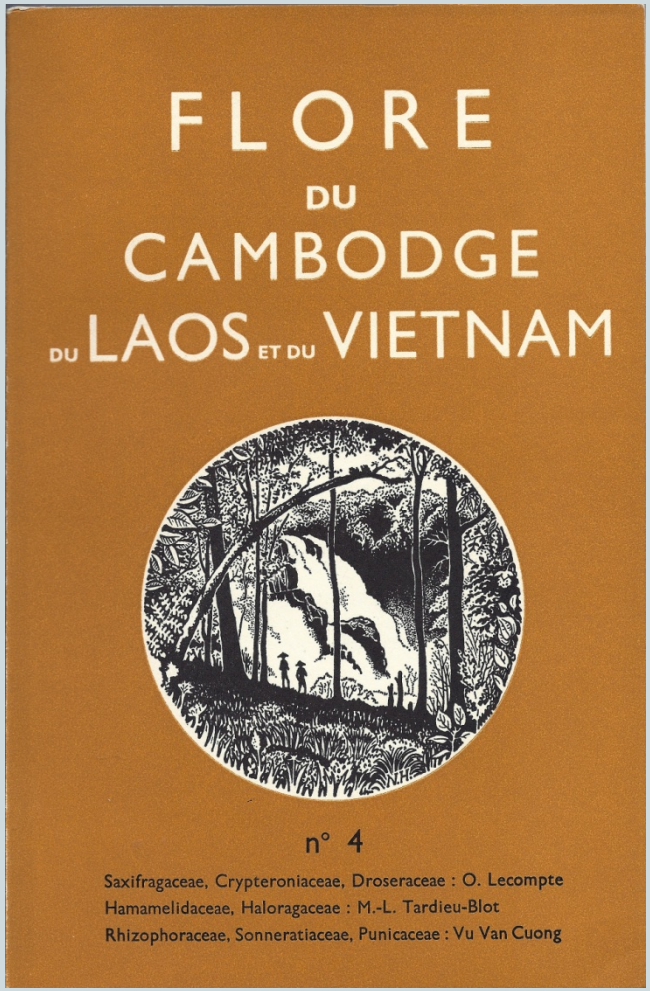
Before some **in-situ conservation** programmes (botanical gardens, preserves…) can be properly set (mandatory in the case of parasitic plants), it is important to keep the diversity of those threatened species with **ex-situ** programmes.

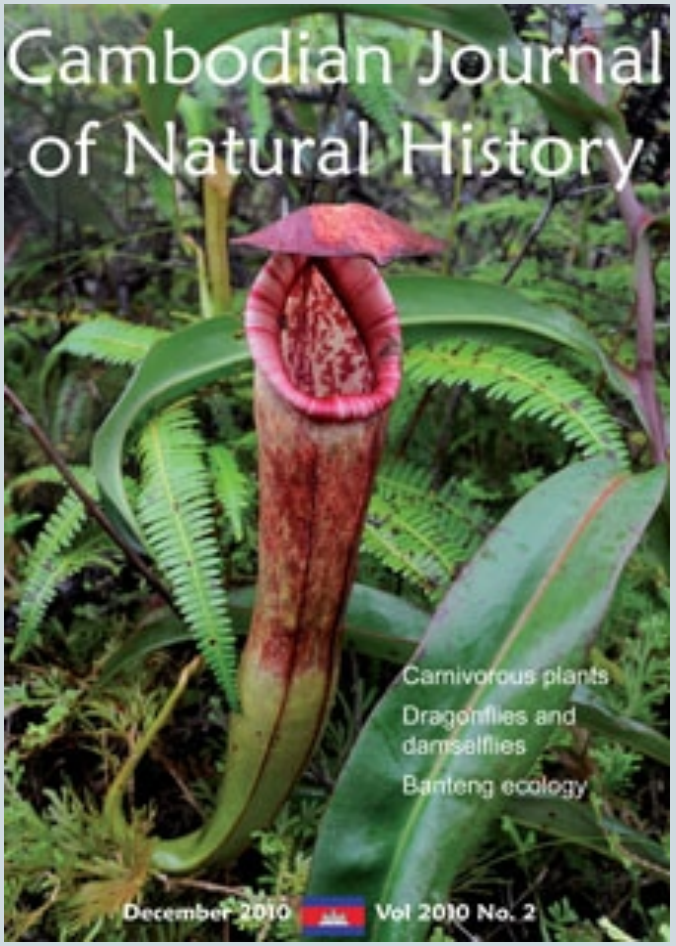
Careful and sustainable introduction of plants into cultivation is recommended. Cultivated Plants must be correctly labeled and clones must be numbered, and propagated.

A new fundation, called the *Ark of Life*, based in Leiden Botanical garden, The Netherlands, is gathering rare strains of highly threatened carnivorous plants species in order to ultimately introduce them back *in situ*. *Ark of Life* will ultimately extend its scope to other groups of plants as well.

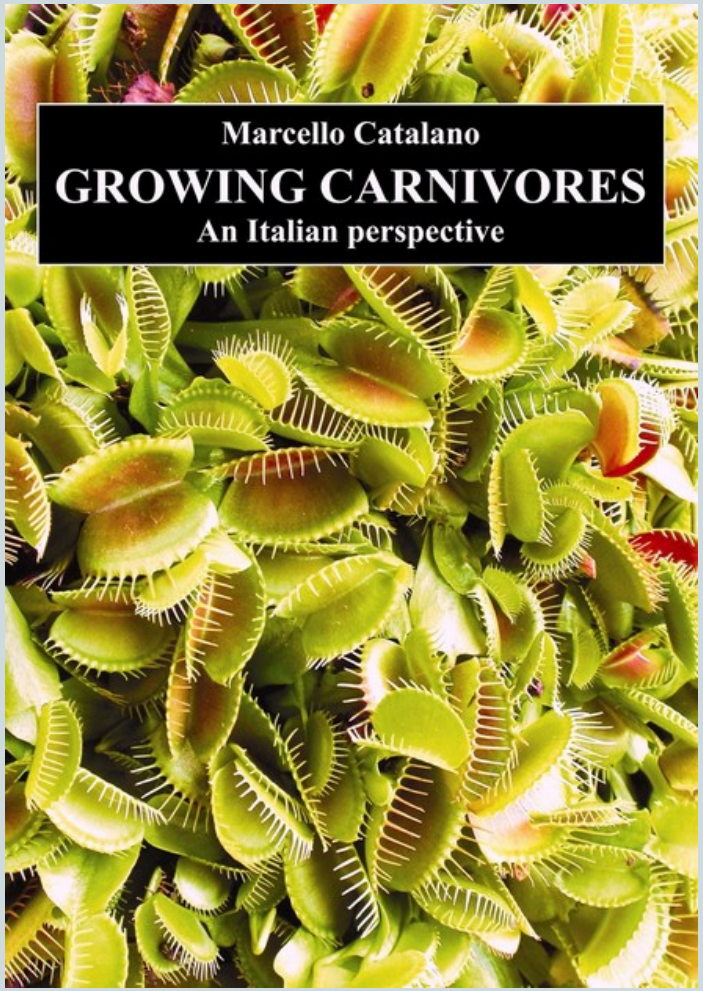
WORKS IN PROGRESS…

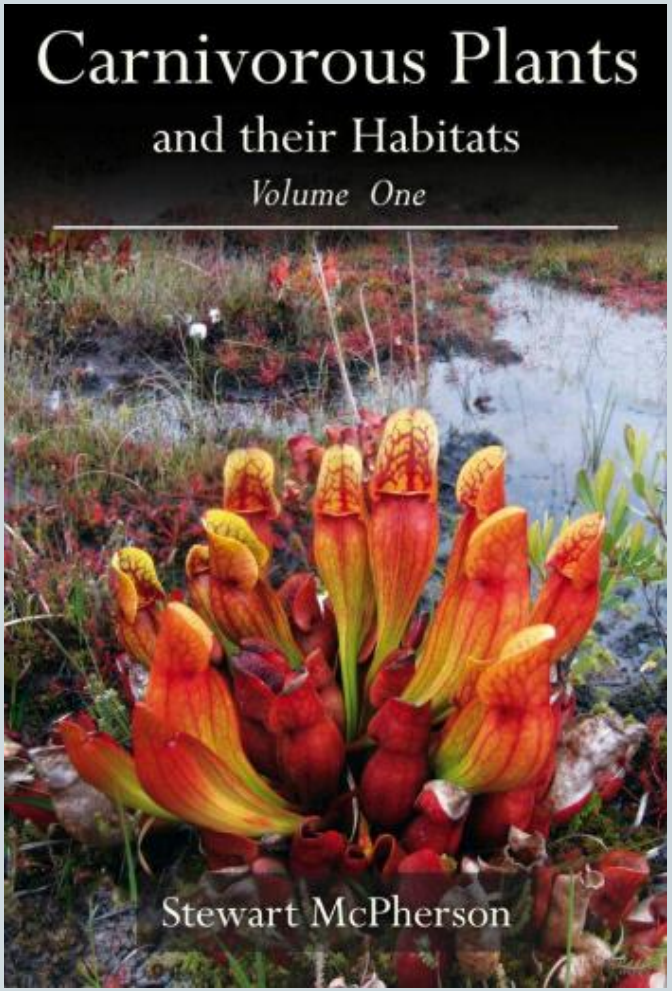
Flore and peer reviewed journals





Monographies





A *Nepenthes* field, Cambodia

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