

The Elusive *Nepenthes thorelii*

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ABSTRACT

Nepenthes thorelii Lecomte, originally described from Vietnam, has been a source of confusion for taxonomists and horticulturists since its description in 1909. The botanical and horticultural history of the species is retraced in this paper and recently uncovered additional material is presented. Diagnostic morphological characters are discussed leading to an amended description and a line drawing illustration. An IUCN conservation status is assessed based on field surveys undertaken in Vietnam by the author.

RESUME

Nepenthes thorelii Lecomte, dont la description a été réalisée à partir de spécimens collectés au Vietnam, a été une source de confusion pour les taxinomistes et les pépiniéristes depuis sa description en 1909. L'article retrace l'histoire botanique et l'histoire horticole de l'espèce et présente des spécimens d'herbier supplémentaires qui ont récemment été mis à jour. Les caractères morphologiques diagnostiques de l'espèce sont débattus et une description amendée ainsi qu'une illustration botanique sont proposées. Corollaire de recherches *in situ* effectuées par l'auteur, un statut de conservation basé sur les critères de l'IUCN est établi.

Key words: Conservation, Indochina, *Nepenthes*, taxonomy, *N. thorelii* aggregate, Vietnam.

INTRODUCTION

In comparison to some other families and genera of plants, the taxonomy of Nepenthaceae is far from being complete and the knowledge of many species is still very poor. Most of the herbarium specimens available were collected prior to Danser's treatment of the Malesian species (Danser, 1928) and relatively little collecting has occurred subsequent to this seminal revision. Although many species have been described between the 1970's and the present day (McPherson, 2009) - mostly due to an increasing horticultural interest- a lot of species are still barely known. The overall similarity of the members of some species aggregates, the morphological variability observed within some species, as well as the tendency to hybridise and form introgressive populations, makes species delimitation difficult in some groups of *Nepenthes* L. For this reason, the most recent revision of the genus remains a skeletal one (Jebb & Cheek, 1997). Some species like *Nepenthes deaniana* Macfarl. from the Philippines, *N. treubiana* Warb. and *N. klossii* Ridl. from New Guinea, or *N. pilosa* Danser from Borneo have just recently been relocated or documented for the first time since their first discovery and collection. Other species like *N. beccariana* Macfarl. , *N. mollis* Danser and *N. thorelii* Lecomte, the subject of the present paper, have not further been observed since the occasion of the type collection (McPherson, 2009).

Nepenthes thorelii has been a source of confusion for all the 20th century. The material of Nepenthaceae collected in Indochina on various botanical explorations is especially scarce and often fragmented (Mey, 2009), and the ancient type specimens hosted in European or Asian herbaria are often poorly conserved. Although Lecomte did provide a key to the Indochinese species (*Notulae Systematicae*, 1909: 60-61), his work did not prevent confusion among taxonomists and horticulturists about the identity of "true" *N. thorelii*: plants of Indochinese *Nepenthes* collected over the last century, either as herbarium material or living plants, were considerably variable and the characteristics between various taxa often unclear (Bednar, 1983).



Thailand

Laos

Vietnam

Cambodia

Mekong River

Phnom Penh

Ong-iem

Ti-Tinh

Cochinchina border

Sông Bé province

Phan Tiet

Ho-Chi-Minh

Mouths of the Mekong

South China Sea

200 km

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Figure 791 (facing page). Vietnam was once divided in three parts: Annam, Tonkin and Cochinchina. Cochinchina was the Southern part of Vietnam and included the Mekong delta. Sông Bé is an old province name. It corresponds now to the current provinces of Binh Duong and Binh Phuoc.

Danser's treatment of the genus (1928) focused on the Malasian species and, thus, did not include the *Nepenthes* species of the outlying areas and Indochina; he briefly mentioned the Indochinese species whilst proposing his infrageneric classification for the genus and *N. thorelii*, *N. anamensis*, *N. geoffrayi* and *N. kampotiana* were retained in subgenus *Vulgatae* sensu Danser (1928). He synonymised *N. smilesii* with *N. mirabilis* (*The Nepenthaceae of the Netherlands Indies*, 1928: 408-332). Apart from this change, Danser simply followed Lecomte's preceding work, as the Indochinese species were not part of the floral region of "the Netherland Indies" and because he only knew them from their descriptions.

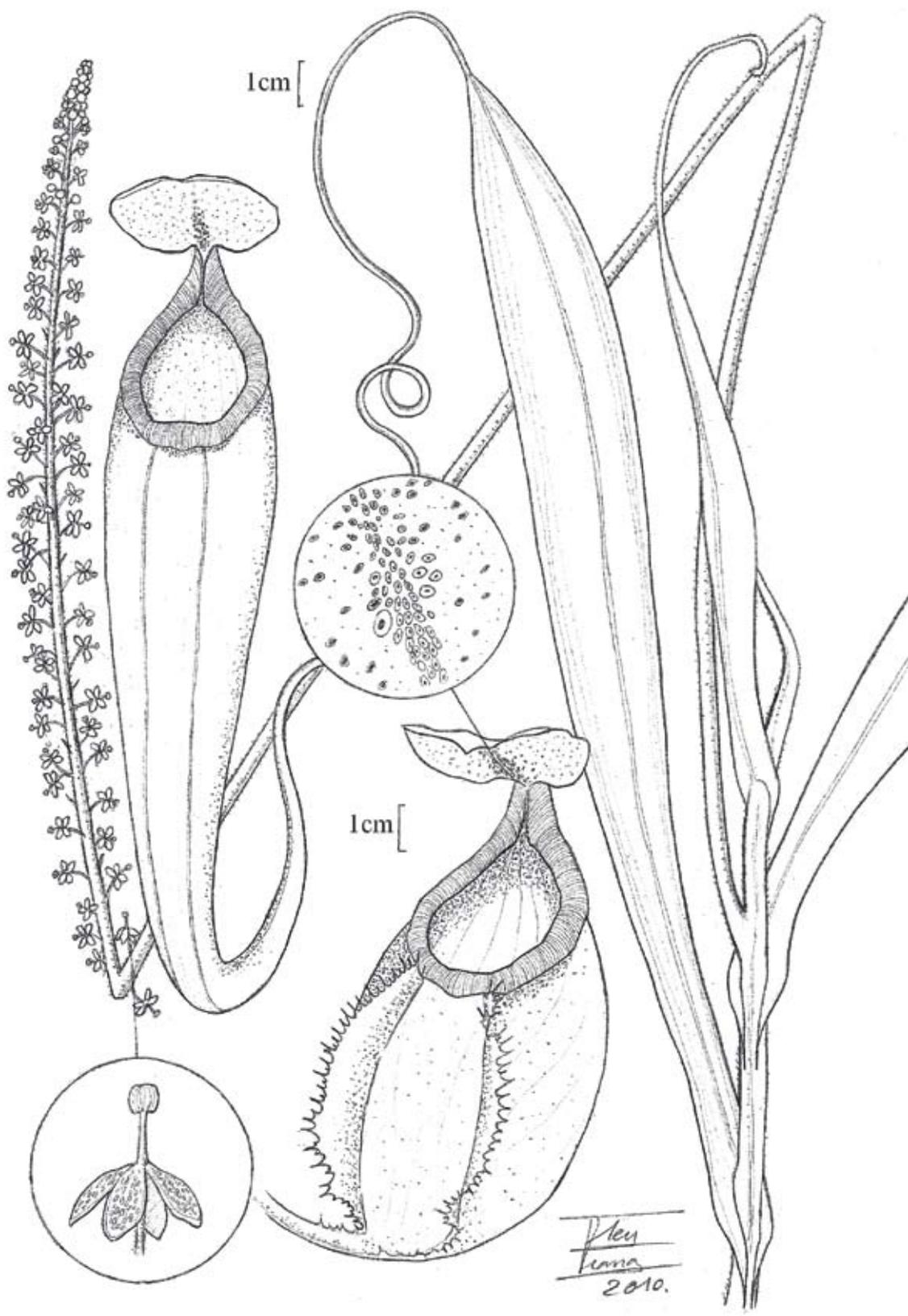
The last floral treatments of the genus *Nepenthes* were almost all regional ones (Kurata, 1976; Shivas, 1984; Tamin & Hotta, 1986; Jebb, 1991; Phillipps & Lamb, 1996; Clarke, 1997, 2001; Jebb & Cheek, 2001). The species from Indochina were only treated once after Danser's brief annotations: in 1997, Matthew Jebb and Martin Cheek published their "Skeletal revision of Nepenthaceae" and retained 3 Indochinese species: *N. anamensis*, *N. thorelii* and *N. smilesii*, describing the last as a "little known taxon". They did not handle this taxonomically difficult taxon in the same manner as Danser (1928), deeming that its inclusion within *N. mirabilis* as premature in the absence



Figure 792 (above). Paul Henri Lecomte (1856-1934) is a French botanist who traveled extensively in North Africa, Egypt, Antilles, Guyana and Indochina (Jaussau & Brygoo, 2004).

of further studies, and it was thus maintained as a separate species. Jebb & Cheek (1997) stated that the Indochinese species "remain poorly known and more studies are needed. In particular, the relationship between *N. anamensis* and the other endemic species, *N. thorelii*. There are problems with the delimita-

1cm [



1cm [

Plex
Luna
2010.

tion of [*N. thorelii*], *N. anamensis* and *N. smilesii* [...]. All three species share narrow linear leaves with clasping leaf bases. The limits of variation of these two species are not yet understood and *N. anamensis* may occupy similar habitats to *N. thorelii*.” (*A Skeletal Revision of Nepenthaceae*, 1997: 85-86). Since that work, *N. anamensis* has been synonymised with *N. smilesii*, and *N. kampo-tiana* has been reinstated as a distinct taxon at species rank (McPherson, 2009; Mey, 2009). Recent extended field and herbarium research has brought to light the fact that the Indochinese *Nepenthes* flora is more distinct and complex than previous works have indicated: it includes an aggregate of at least nine pyrophytic (fire-adapted) species, all closely related but also readily distinguishable through a set of key characters (Catalano, 2010; Cheek & Jebb, 2009; Mey, 2009; Mey *et al.*, 2010). A key to the species of this aggregate has been provided in a separate paper (Mey *et al.*, 2010).

Before the recent studies of the last five years, plants referred to as “*Nepenthes thorelii*” have entered horticulture and scientific research as samples for studies and as subjects for several papers (Heubl & Wistuba, 1997; Likhitwitayawuid *et al.*, 1998; Meimberg *et al.*, 2000, 2001, 2006; Takahashi *et al.*, 2007). Plants labeled as “*Nepenthes thorelii*” have also entered cultivation in horticultural collections of botanical gardens and carnivorous plant enthusiasts. It is now obvious that all of these so-called “*N. thorelii*” were actually other species from within this species aggregate, including *N. smilesii*, *N. kampo-tiana* or *N. bokorensis*, which used to be the species most accessible to poachers and explorers in the wild. It is also likely, given the similarity between species within the aggregate group, that some of those same introductions were in fact natural or man-made hybrids involving one or more of these pyrophytic taxa. The aim of this paper is to retrace the botanical and horticultural history of *Nepenthes thorelii*, to highlight the main sources of confusion, and provide a better understanding of the characteristics of all species within the aggregate group.

Figure 793 (facing page). A botanical drawing of *Nepenthes thorelii* Lecomte, showing (A) Climbing stem with upper pitcher, male inflorescence and flower detail, (B) Lower pitcher with detail of glands under the lid. Drawing based after Thorel 1032, Thorel 903, Bois 2228, 2229.

While studying Indochinese material for the description of *N. bokorensis*, voucher specimens were uncovered that clearly match the types of *Nepenthes thorelii*. Thanks to this additional material, it is possible to present herein an amended description and botanical illustration of *N. thorelii*. Photographs of the lectotype and one of the isolectotypes (both hosted in the Paris herbarium), as well as photographs of additional material uncovered are also provided.

In February 2010, a field trip was undertaken with renowned ecologist and *Nepenthes* expert, Dr. Charles Clarke (Selangor, Malaysia), in order to relocate putative remaining populations of *Nepenthes thorelii* in Southern Vietnam. On the occasion of this field work, two of the locations where *N. thorelii* was collected were inspected. Unfortunately, it was not possible to relocate the taxon. It cannot be said with any certainty that the species remains extant in Southern Vietnam. As a result of several factors that are discussed in the conservation section of this paper, *Nepenthes thorelii* is arguably close to a programmed extinction and, accordingly, an IUCN status of critically endangered (CR) is hereby assessed.

BOTANICAL HISTORY

Nepenthes thorelii is a rather enigmatic species that has only rarely been observed. It has received a lot of attention from researchers and horticulturists and it is, at the same time, one of the least understood of all Nepenthaceae. The herbarium specimens that formed the basis of the protologue by Lecomte were collected between 1862 and 1866 by the French medic, botanist and explorer, Dr. Clovis Thorel (1833-1911). According to the notes of the collector, the type collection was made between sea level and 200 m above sea level, in Cochinchina, which is an old colonial name for Southern Vietnam (Figure 791). Cochinchina included several Vietnamese provinces annexed by French colonialists in the 19th century (Tertrais, 2004). Thorel's collections include two series of herbarium specimens of *N. thorelii*, namely *Thorel 1032* and *Thorel 903*. These specimens are now hosted in Paris (P) (three mounted

Figure 794 (facing page). *Nepenthes thorelii* lectotype, male (Thorel 1032, P).



HERB. MUS. PARIS.

anthus
anthus *Chouli*
H. leaf
Lanthus



HERB. MUS. PARIS.

Herb. Mus. Paris



P00038406

COCHINELE

© P. TISSOT, 1862-1865

sheets of *Thorel 1032*, and the two sheets of *Thorel 903*, Bogor (BO) and New York (NY) (*Thorel 1032*). Almost 50 years later, in 1909, Paul Henri Lecomte (1856-1934) (Figure 792), French botanist and main redactor for the *Flore générale de l'Indochine* ("General flora of Indochina") described three species of *Nepenthes*: *N. geoffrayi* and *N. kampoiana*, based on material collected in Cambodia, and *N. thorelii*, based on Vietnamese material (*Notulae systematicae*, 1909: 62-64).

In a note following the Latin diagnosis of *N. thorelii*, Lecomte provided some ecological notes taken from Thorel's labels (*Thorel 1032*), and compared *N. thorelii* to *N. vieillardii* Hook., a species endemic to New Caledonia. At that time, only 40 *Nepenthes* species were known, and the Thorel material had previously been identified as *Nepenthes distillatoria* L. Lecomte (1909) proposed a key which included the six Indochinese species known at that time: *N. smilesii* Hemsl, *N. anamensis* Macfarl., *N. geoffrayi* Lecomte, *N. kampoiana* Lecomte, *N. thorelii* Lecomte and *N. phyllamphora* Willd. (the latter represents an illegitimate name of *N. mirabilis* (Lour.) Druce). According to Lecomte's key, *N. thorelii* can be distinguished from similar species by the three following characters: leaves with 3-4 longitudinal nerves on each side, a stem longer than a few centimeters, and strongly decurrent leaves (Lecomte, 1909).

Lecomte did not designate any types in his protologues for any of the three species. At that time, the description of a new plant species *sans* type was considered valid. Subsequently, the rules of modern botanical taxonomy required that a physically present herbarium specimen be selected as a reference (the so-called type specimen). Following the description of *N. thorelii*, Lecomte wrote of the collections he used to describe the Vietnamese taxon (the description can be accessed here: <http://www.carnivorousplants.it/desc.thorelii.pdf>): "*Cochinchine: (Germain) (Dr Harmand and Godefroy); Ha-tien (Pierre); Guia-Toan; Lo-thieu; marshes of the surroundings of Ti-Tinh, n° 1032 (Dr Thorel). Cambodia: ad montem Pursat, n° 344 (Godefroy).*" All of the materials mentioned in this list, with the exception of one of the isoelectotypes (*Thorel 1032*,

Figure 795 (facing page). *Nepenthes thorelii* isoelectotype, female (*Thorel 1032*, P).

Dryopteris thorelii LÉCONTE
Syntypus
Tübingen, 2. 11. 1892
Det. rev. Jan Schlauer

HERB. MUS. PARIS.
Dryopteris
Dryopteris distillataria
Guia-lava
COCHINCHINE
M. le D. THOREL, 1862-1866.



which was seen in a photo only), were examined. The conclusion is that, unfortunately, Lecomte used three different taxa to describe *Nepenthes thorelii*:

- Godefroy, on an expedition led by Dr. Harmand, collected *N. smilesii* from Bien Hoa, Cochinchina. Pierre also collected *N. smilesii*, from Ha-Tien, Cochinchina.
- Thorel collected *N. thorelii* from Lo-Thieu, Guia-Toan and Ti-Tinh.
- Godefroy collected the newly described *N. holdenii* Mey from Cambodia (Mey *et al.*, 2010).

This suggests that the original protologue of *N. thorelii* actually describes a chimera, and that the description and the key that Lecomte provided cannot reliably be used to identify *N. thorelii*. It should be noted that *N. kampfotiana*, which was described in the same paper, relied on material collected by the same person on the same day and at the same locality.

The situation improved when Jebb and Cheek lectotypified *N. thorelii* in 1997, designating one of the Paris herbarium collections of *Thorel 1032* as the lectotype for *N. thorelii* in their revision (Jebb & Cheek, 1997), automatically making the P, BO and NY doublets of this same collection isolectotypes. In doing so, they discarded much of the original material cited by Lecomte and only retained the specimens labelled as *Thorel 1032* which were all collected by Thorel in the same area and at the same time. Any true *N. thorelii* will exactly match the materials that constitute the lectotype (*Thorel 1032*).

As recent taxonomic treatments of *Nepenthes* have shown (Jebb & Cheek, 1997; Cheek & Jebb, 2009; Catalano, 2010; Mey, 2009, Mey *et al.*, 2010), several taxa of Indochinese *Nepenthes* share rather similar leaves with a base clasping the stem. The grade of decurrence of the leaf base can also be variable within the same species or even the same individual, depending on the age of the studied specimen. As Lecomte stated in the introductory chapter of the Nepenthaceae

section of *Notulae systematicae* (59-60), collections of Nepenthaceae in Indochina were scarce, and sometimes mounted specimens might consist of mixed collections or fragments, which made the study of the genus difficult. Little did he know that Indochina's flora comprised an aggregate of at least nine species (Mey *et al.*, 2010). Thus, until recently, the botanical history of *Nepenthes thorelii* has effectively been marked by just three dates: 1. the original scientific description in 1909 by Lecomte, 2. the inclusion in subgenus *Vulgatae* by Danser (1928), and 3. the lectotypification by Jebb & Cheek in 1997.

In 2007, while studying the Indochinese material for the description of *Nepenthes bokorensis*, the lectotype and one isolectotype of *Nepenthes thorelii* deposited in Paris herbarium were examined. The Paris material includes three mounted specimens of *Thorel 1032*: the lectotype is a male specimen with lower pitchers; it was collected in a place called "Lo-Thieu". One of the isolectotypes is a female plant with upper pitchers which was collected in "Guia-Toan". It was not possible to view the third specimen since it was on loan; this specimen was collected in Ti-Tinh marshes and comprises a climbing stem with leaves, fragmented pitchers, a damaged inflorescence and a detached infructescence. The two specimens of *Thorel 903* also collected in Ti-Tinh were examined: the first one is a male plant with two inflorescences and two very damaged pitchers; the second is a poorly preserved climbing stem with a broken inflorescence without its rachis.

During these herbarium studies, nine sheets of Vietnamese *Nepenthes* were uncovered by the author which belong to *N. thorelii*. These are specimens of the collections *Bois 2228* and *Bois 2229*, which form parts of the "*Herbier Bonaparte*". They were collected by D. Bois whilst on a mission in Indochina and Java between November 1902 and April 1903. The *Nepenthes* material in question was collected on the 26th of January 1903, in the Ong-iem marsh of Cochinchina. Ong-iem is a small village located approximately 70 km from Ti-Tinh village (Figure 791)

Figure 796 (page 1352). *Nepenthes thorelii*, (Bois 2228, P). Collection of MNHN-Paris.

Figure 797 (page 1353). *Nepenthes thorelii*, (Bois 2229, P). Collection of MNHN-Paris.

Nepenthes sanguinea
sur cresson d'Europe

HERBIER DU PRINCE NOLAND BONAPARTE

N° 2228

Nepenthes

Marsais de ong-ouï (Cochinchine)
26 janvier 1903.





Figure 798 (above). A swamp, near Phan Tiet, where *Nepenthes* which resemble *Nepenthes thorelii* have been photographed and poached. This location hosts populations of *N. mirabilis*, *D. indica* and various *Utricularia*.



Figure 799 (above). The village of Ti-Tinh has now been turned into rubber plantations (background).

The addition of this new and better preserved material, which includes a lot of aerial and lower pitchers with complete tendrils, leaves and stem, helps to provide a more comprehensive understanding of the overall morphology and variability of *N. thorelii*, enabling a significantly clearer circumscription of this enigmatic species. An amended description of the distinctive features of *N. thorelii* is presented here: ovoid to globose lower pitchers, obovate upper pitchers and an amplexicaul attachment of the leaf base that clasps the stem almost entirely and is strongly decurrent.

AMENDED DESCRIPTION

The description is based on Jebb and Cheek's study of the type specimens (Jebb & Cheek, 1997: 85-86) and on the recent material collected by D. Bois that the author uncovered in Paris herbarium (*Bois* 2228, 2229) (Figures 794-797).

Terrestrial vine with perennial rootstock producing basal rosettes then climbing shoots. Length of climbing shoots unknown. **Roots** mainly composed of irregularly branched swollen tubers up to 20 mm thick. **Stem** terete, ca. 6-8 mm diam. **Leaves** coriaceous, sub-petiolate, lamina linear-lanceolate to narrowly obovate ; 12-30 cm long, 1.8-3 cm wide; apex acute to acuminate; base amplexicaul inserted at an acute angle, and decurrent to stem for 1-2.5 cm, ultimately rounded, these basal wings almost meeting on opposite side of stem; longitudinal veins 2-4 on each side of midrib, arising from along the midrib ; pennate nerves, inconspicuous, numerous, curving towards the apex ; midrib 1-2 mm wide; tendrils straight, terete, 1-2 mm in diameter, coiling. **Rosette lower pitchers** 6-15 cm tall, 4-8 cm wide; ovoid to globose, not hipped ; wings broad, 5-8 mm, with fringe elements 2-5 mm, c. 2 mm apart ; mouth ovate-triangular, oblique, concave ; peristome striate, loosely cylindrical and bulbous, 2-5 mm across, towards lid to 7 mm across, ribs 0.25-0.4 mm apart, the inner margin with rounded teeth 0.2-0.5 mm long; spur 2-4 mm long, conical, simple, inserted at base of lid ; lid ovate to rounded with a slightly cordate base, 2-3.5 x 2-2.8 cm, not vaulted, lower surface without appendage ; glands prominently

lipped without striated sides, dense and numerous near base of midline, 0.3-0.7 mm across there, c. 0.15 mm across towards margin and not so dense. **Upper pitchers** borne on coiled tendrils, obovate, not hipped, narrowed towards mouth; to 20 cm tall, 5 cm wide; alae reduced to narrow ridges ; mouth oblique, concave; peristome rounded, not raised at front to form a triangular point, 3-5 mm across, outer margin regularly sinuate; lid as in lower pitcher. **Male inflorescence** a racemose panicle, to 90 cm long, peduncle 50-70 cm long, rachis 10-25 cm long ; 1-flowered pedicels 3-6 mm long, with or without a short bract. **Infructescence** tepals persistent, capsule fusiform, fruit valves 4. **Seeds** unknown. **Indumentum** of simple or branched hairs 0.3-0.4 mm long. **Colour of living specimens** unknown. Lower pitchers are likely reddish as for all species of the *Nepenthes thorelii* aggregate.

Additional material examined:

Nepenthes thorelii – Bois 2228, 2229 (P!), *Herbier Bonaparte*, Ong-iem swamp, Vietnam. *Thorel 903* (P!), Ti-Tinh, Vietnam. *Thorel 1032* (lecto P!), Lo-Thieu, Vietnam. *Thorel 1032* (isolecto P!), Guia-Toan, Vietnam. *Thorel 1032* (isolecto P photo!) Ti-Tinh swamp, Vietnam. *Thorel 1032* (isolecto NY photo!), forest swamp, Cochinchine.

Material of other Indochinese species examined:

Nepenthes andamana - *Catalano 013395* (holo BCU), Takuapa, sea level, province of Phang-nga, Thailand.

Nepenthes bokorensis - *M. Martin 1231 bis* (holo P!), Bokor Hill, 800 m, province of Kampot, Cambodia.

Nepenthes chang - *Catalano 013394* (holo BCU), Ko Chang, 300 m, province of Trat, Thailand.

Nepenthes geoffrayi - *Geoffray 84, 85, 87, 88, 91, 92, 93* (synt P!), Kampot, Cambodia.

Nepenthes holdenii - *Mey 1A* (holo, RUPP!), Cardamom Mountains, 650 m, province of Pursat, Cambodia, 1 VIII 2009. *Godefroy 344* (P!), “ad montem Pusath Cambodiae”, Cambodia, 1875.

Nepenthes kerrii - *Kerr 14127* (holo BK), Tarutao Marine Park, 500 m, province of Satun, Thailand.

Nepenthes kampotiana - *Geoffray 89, 90, 191, 362* (synt P!), Kam-pot, Cambodia.

Nepenthes smilesii - Charenphol, Larsen & Warncke 4623 (P!), Phu Kradung, Loei, Thailand. *Mey* 2 (RUPP!), Kirirom National Park, 712 m, province of Kampong Speu, Cambodia. *Godefroy* (Dr. Harmand expedition) (P!), inundated fields, Bien Hoa, Cochinchina, 1875. *Pierre* 26 (P!), Ha-tien, Cochinchina, 1874.

Nepenthes smilesii x *mirabilis* - *Mey* 6 (RUPP!), near town of Kampot, 14 m, province of Kampot, Cambodia.

Nepenthes suratensis - *Kerr* 13136 (holo BK), Kanchadanit, sea level, province of Suratthani, Thailand.

In November 2009, photographs surfaced on the internet showing wild plants from Southern Vietnam, growing at sea level, that appear to show *Nepenthes thorelii*. The sub-globose to globose lower pitchers, shape of the lid, peristome, leaf structure and the ecology (swamp habitat) seemed to fit with the materials and the descriptions. It was quickly decided to undertake a fieldtrip to compare those living plants with the dried material studied in Paris.

In February 2010, the locality, a swampy area (Figure 798) located near the coastal town of Phan Tiet, was visited by the author and Dr. Charles Clarke. The site is over 200 km from the type location of Ti-Tinh, but remains part of the Mekong Delta (Figure 791). Unfortunately, days of investigation revealed that all plants of the population seen online had been recently poached. Subsequent visits to the nearby National Park of Ta Ku Mountains revealed only populations of *N. mirabilis*. Interestingly, the Institute of Tropical Biology of Ho-Chi-Minh City mentioned a plant identified as *N. thorelii* in a short communication they published in the Vietnam Plant Data Center website under the title: "Medicinal plants used by the community at Takou Nature Reserve" (<http://tinyurl.com/39xp3us>).

Research was then carried out at Ong-iem (written "Ong-Yem or Hung-Yen" in modern maps), where Bois' collections were made. Once again, no evidence for *N. thorelii* or any other pyrophitic *Nepenthes* species was identified. Local people were only able to reveal small, isolated populations of *N. mirabilis*; most sites were found to have been turned into crop fields and rubber plantations. The locality of Ti-Tinh,

where one of the isolectotypes of *Thorel 1032* was collected by Thorel, was also visited. This is also the place where the material labeled as *Thorel 903* was collected. Again, this endeavour proved unsuccessful. Much of the town of Ti-Tinh has been turned into rubber plantations (Figure 799). The only carnivorous plants to be found were isolated *N. mirabilis* growing sympatrically with *Drosera burmannii* Vahl and *Utricularia aurea* Lour. in a small river, all three being carnivorous plant taxa well known from Vietnam (Tardieu-Blot *et al.*, 1965). It is worth noting that another species of carnivorous bladderwort, the enigmatic *Utricularia pierrei*, only known from the fragmented type collection, was collected from that very same locality (Taylor, 1989), though no evidence for the taxon could be found. According to some of the Ti-Tinh villagers, the pitcher plants were very abundant, 40 years ago, prior to the Vietnam war. The need to use the land and the collection of the pitcher plants for traditional medicine have since led locals to believe that the plants are gone. One villager, a kind, middle-aged lady, was genuinely surprised when we managed to discover together some isolated strains of *N. mirabilis*: the last time she saw some “nap am” (the Vietnamese word for pitcher plants) was when she was a child.

Unless some material lurks somewhere in the herbarium of the Institute of Tropical Biology of Ho-Chi-Minh City, it would seem that *Nepenthes thorelii* has never been officially collected by a botanist since Bois' collection in 1903. There are a variety of potential explanations for this; international conflicts, such as the well known Vietnam war, and fights with the Khmer Rouge of neighboring Cambodia (Brocheux & Emery, 2004; Tertrais, 2004); the rampant urbanisation and development of agriculture; and the lack of interest in this group of plants in both scientific and horticultural fields until very recently. Photos displayed on <http://tinyurl.com/34y8bgn> illustrate the *Nepenthes* from Phan Tiet that the author was unable to study personally, and which closely resembles *N. thorelii*. Unfortunately, no herbarium specimen is available for further examination. *Nepenthes thorelii* is thus, to this day, only known from herbarium material. The taxon has not been relocated in the wild.

Distribution: *Nepenthes thorelii* is known with certainty only from southern Vietnam. It has been collected at four localities which are all included in what was once Cochinchina, and is now more or less the area of the Mekong delta: Guia-Toan, Lo-Thieu, Ti-Tinh and Ong-iem. *Nepenthes thorelii* may grow elsewhere in the Mekong delta. It was not possible to relocate Guia-Toan and Lo-Thieu as the names are not used anymore, but these places must have lain within the borders of Cochinchina that Thorel extensively explored (Tardieu-Blot *et al.*, 1965). A staff member from Paris herbarium recently added (between my first visit at the herbarium in 2007 and my last in 2009) “Vietnam, Sông Bé, Lo-Thieu” and “Vietnam, Sông Bé, Guia-Toan” on the lectotype and on the available isolectotype labels. It was not possible for me to meet this person. However, “Sông Bé” is an old provincial name for an area which now includes the provinces of Binh Duong and Binh Phuoc, which host the villages of Ti-Tinh and Ong-iem respectively (Figure 791).

Ecology: Several labels (*Thorel 1032* (isolecto NY) (isolecto P); *Thorel 903*; *Bois 2228*, *2229*) indicate that *Nepenthes thorelii* is restricted to “forest swamps”. According to Dr. Thorel’s notes reported by Lecomte in his description of the species, *N. thorelii* is “found growing in swamps forests, on slopes or amidst grasses” (translated). Neither Thorel nor Lecomte makes mention of the pyrophytic habit of the species, but field studies of the other species of the *N. thorelii* aggregate show that the *N. thorelii* rootstock appears, like its close relatives, to be designed to endure drought and fires that follow the monsoon season. It is interesting to note that both Thorel and Bois mentioned that the species grew in swampy areas such as that visited near Phan Tiet (Figure 798). It is conceivable that *N. thorelii* may be restricted to the drier parts of swamps like the Australian endemic, *N. rowanae* (Clarke & Kruger, 2005).

Natural hybrids: A putative natural hybrid between *N. mirabilis* and the *Nepenthes* from Phan Tiet is visible on the pictures shown on <http://tinyurl.com/34y8bgn>. No herbarium specimens were collected of either plant.

CONSERVATION

Nepenthes thorelii has only been collected in Cochinchina. It is not known from any of the other neighboring Indochinese countries, and it is currently known from only four locations. Two of them, Guia-Toan and Lo-Thieu, have not been relocated since, although they seem to lie in the current Bing Duong and Binh Phuoc provinces. These are old Vietnamese names which are not used anymore, and the author of the present article was unable to relocate them. *Nepenthes thorelii* has also been collected in Ti-Tinh (Binh Duong province) and Ong-iem (Binh Phuoc province), two locations that are relatively close to each other (Figure 791). The author did not find any plants in those villages which are now filled with crops, paddy fields and rubber plantations. Several villagers referred to *Nepenthes* as plants that were once common. On top of this, Southern Vietnam has also been subject to war and the whole area - particularly the sites visited by the author (Ti-tinh and Ong-iem) - was heavily sprayed with both napalm and the defoliant “Agent Orange”, both of which caused the breakdown of original natural vegetation (Tertrais, 2004). Despite that, it is surprising that *N. thorelii* has not been collected again throughout the 20th century, even though the departments of botany are well developed in Vietnam and papers are published on a regular basis (Haager, 1993; Wen & Lowry, 2002; Averyanov *et al.*, 2003; Averyanov, 2009).

Nepenthes thorelii is listed as Data Deficient (DD) according to the IUCN because the available information was not sufficient for a proper conservation status to be made. However, *N. thorelii* has not been collected for more than 100 years in Vietnam, while other genera have been successfully relocated; the taxon was also recorded in habitats that were first damaged by war, and subsequently threatened by rampant agriculture and urbanisation (as with all lowland species of the *N. thorelii* aggregate). This strongly suggests that if *N. thorelii* still grows anywhere in Southern Vietnam, any remaining populations are likely to be very localised. As such, *N. thorelii* is here assessed as Critically Endangered (CR).

HORTICULTURAL HISTORY

In the 1970's, several researchers and carnivorous plant growers travelled in Cambodia and Thailand, introducing some *Nepenthes* into cultivation that they had brought from those countries. Although the delimitations between the Indochinese species were not clear to anyone, these plants were soon labeled as *N. thorelii*, *N. kampfotiana* and *N. smilesii*, and were used for hybrid breeding (Catalano, 2010). Simple and complex man-made crosses were made between these Indochinese plants, as well as with other *Nepenthes* species.

In 1979, the unofficial name "*Nepenthes thorelii-rubra*" was coined by Leo C. Song in an article published in the *Carnivorous Plant Newsletter* (Song, 1979). In the same publication, two other plants were referred to as "*N. thorelii* long-narrow" and "*N. thorelii* short-round" (Song, 1979).

In 1983, Bruce Lee Bednar grouped many Indochinese species (*N. mirabilis*, *N. kampfotiana*, *N. thorelii*, *N. anamensis*, *N. geoffrayi* and *N. smilesii*) under the informal name "*mirabilis* complex" (Bednar, 1983). In this article, the author casts doubt on the identity of several Indochinese species. According to him, cultivated plants labeled as *N. kampfotiana* didn't fit at all with the description of the plant named by Lecomte and were rather thought to represent a natural hybrid between *N. mirabilis* and *N. thorelii* (these plants were, from that time, referred to as *N. × lecoufleii*). Bednar also noted that plants known from cultivation as "*thorelii*-long green" and "*thorelii*-short round", as mentioned by Song (1979), are considered by many to be a Thailand form of *N. mirabilis* and true *N. thorelii*, respectively, because of the pubescent leaves and squat pitchers. Bednar implied that artificial crosses "like *N. 'Hachijo'* and *N. 'Effulgent Koto'* would be intergrades [of *N. mirabilis*]" and not hybrids. By demonstrating the variability of the horticultural material presented as *N. thorelii*, Bednar underlined the confusion, existing at the time, between all Indochinese species, showing that growers didn't have an idea of what *N. thorelii* really is. On top of that, according to Bednar, it seems that Lecomte's paper which includes the description of *N. thorelii*, *N. kampfotiana* and *N. geoffrayi* was not readily available (Bednar, 1983).

It now appears that those plants were actually various species of the *Nepenthes thorelii* aggregate, most likely *N. smilesii* (which turned out to be conspecific with *N. anamensis*), *N. kampoiana* and *N. bokorensis* - as other species of that aggregate are rare and especially localised.

In the mid 2000s, the horticultural interest for these plants rose in Thailand. Quickly, nurseries such as Neofarm grew and sold a lot of *Nepenthes* from the *N. thorelii* aggregate. Unfortunately, the exact origins of these plants, mostly wild collected from Thailand and neighboring Cambodia, Laos and perhaps Vietnam, were not revealed. Furthermore, they were and continue to be sold under fancy but ultimately meaningless names such as “*thorelii* giant”, “*thorelii* tiger” or “giant tiger”. Some of these plants turned out to represent known species, such as *N. smilesii* and *N. kampoiana*, while others proved to represent new species that were described a few years later (Catalano, 2010). Those Thailand plants have been used for intensive hybrid breeding, resulting in a lot of different hybrids of broadly similar appearance. It seems beyond the realm of reality to correctly identify these plants or their parentage, as species of the *N. thorelii* aggregate are overall similar in appearance.

In the same period, well known nurseries specialising in raising *in vitro* grown *Nepenthes*, such as “The *Nepenthes* Nursery”, “Borneo Exotics” or “Exotica Plants”, sold plants labelled as *N. thorelii*, or used various so-called “*N. thorelii*” as a parent for crosses. The plants that Borneo Exotics sold under that name turned out to be *N. smilesii*. Exotica Plants used at least four different plants under the name “*N. thorelii*” as parents for a lot of hybrids produced within their nursery. In the course of an informal discussion with the nursery owner, Geoff Mansell, he was able to present his four clones of “*N. thorelii*” in the following way:

- “*N. thorelii* (a)” is a plant that entered Mr. Mansell’s collection more than 20 years ago. It originated from a collector who lived here [Australia] and was Filipino, Peter Tsang. This man travelled abroad quite often and collected plants. The actual age of the plant could, thus, be between 30 and 40 years;

- “*N. thorelii* (b)”, also referred to as the “squat form”, originated from the same source. The original plant died, but Mansell noticed that its traits are

definitely displayed in its hybrids;

- "*N.thorelii* (c)" is the cross between the "*N.thorelii* (a)" and "*N.thorelii* (b)" and Mansell refers to that cross as "typical x squat".

- "*N.thorelii* (d)" is a plant of obscure origin: it comes from seeds that Exotica Plants bought as *N. gymnamphora*, but which proved otherwise.

Mansell made a lot of crosses using all of those "*N.thorelii*" plants, and he created widely acclaimed crosses such as *N.thorelii* x *trusmadiensis*.

A lot of hybrids bred elsewhere in the world actually include a parent labeled as "*Nepenthes thorelii*" such as *N. 'Dreamy Koto'* (*N.thorelii* x *Veitchii*), *N. 'Dwarf Peacock'*, (*N.thorelii* x (*N.khasiana* x *N.ventricosa*)), *N. 'Rokko'* (*N.thorelii* x *N.maxima*) or *N. 'Ile de France'* ((*N.mirabilis* x *N.thorelii*) x (*N.northiana* x *N.maxima*)).

From a horticultural point of view, the species of the *N.thorelii* aggregate are interesting parents, as they give to their progeny their resistance to low humidity and their robustness. However, these qualities have also worsened the general taxonomic confusion. It seems nearly impossible, because the species are quite similar, to retrace the parentage of their hybrids. *N. 'Dwarf Peacock'* could have *N.kamptiana* as a parent; Exotica Plants' "*N.thorelii* (b)" bears a lot of affinities with *N.bokorensis*. Unfortunately, this "*N.thorelii* (b)" died and we can't identify the plant as *N.bokorensis* in a reliable way, based on a handful of photographs alone. Unless the original "*N.thorelii*" used as a parent is clearly identified (when possible), it is a gamble to know which species of the *N.thorelii* aggregate was used to make the cross. It would be, in the same fashion, very complicated to identify a cross involving a species and another species belonging to closely related species such as *N.densiflora*, *N.diatas*, *N.singalana* and *N.bongso* or another cross including *N.boschiana*, *N.faizaliana* and *N.stenophylla*.

CONCLUSION

Taxonomy: After a long period of taxonomic confusion, recent herbarium and field studies have allowed a better understanding of the delimitations between all the pyrophytic species of Indochinese *Nepenthes*. The addition of the material collected by Bois in 1903 to the material collected by Thorel gives a good idea of the taxon that is *N.thorelii*. Further

studies of plants in their natural habitats are required to understand the true extent of its variation and ecology.

Horticulture: Many plants have been introduced under the name “*N. thorelii*” in the horticultural trade. It is obvious that not a single one of those plants fits with the material collected by botanists. As it is not generally possible to retrace the origins or parentage of these plants, the author of this paper strongly suggests that horticulturists and *Nepenthes* growers do not to change their labels, but to put the name *N. thorelii* in brackets. As a consequence, the hybrid cultivar *N. ‘Rokko’* should be “*N. thorelii*” x *maxima* and not *N. thorelii* x *N. maxima*. To avoid further confusion or misidentification, it is also essential that the current *Nepenthes* grower community carefully maintain records of recently described plants of the *N. thorelii* aggregate and tag the exact names in their collections and sales lists.

Conservation: It is not known whether populations of *N. thorelii* persist in Southern Vietnam. It is quite possible that plants may survive somewhere in small, isolated populations in the Mekong delta area, perhaps in one of the National Parks or Nature Reserves. It is important that the species is relocated so that wild populations can be studied by botanists. This will allow it to become the subject of *in situ* and *ex situ* survival projects, for which the careful and sustainable introduction of plants into cultivation (from controlled raising of wild-collected seed by authorised people) is recommended.

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REFERENCES

- Averyanov L. V. (2009).** “*Hayata glandulifera* (orchidaceae) new genus and Species from northern Vietnam”. *Taiwania* **54**(4):311-316
- Averyanov L. V., Cribb P., Phan Ke Loc & Nguyen Tien Hiep. (2003).** *Slipper orchids of Vietnam*. With introduction to the flora of Vietnam. 308 pp. Compass Press Limited Publishers, Royal Botanic Gardens, Kew.
- Bednar, B. (1983).** “*Nepenthes mirabilis* variation”. *Carnivorous Plant Newsletter* **12**(3): 64.
- Brocheux P. & Emery D. (2004).** *Indochine : La Colonisation ambiguë - 1858-1954*. La Découverte. Nouvelle édition.
- Catalano, M. (2010).** *Nepenthes della Thailandia*. Prague.
- Cheek, M. & M. H. P. Jebb. (2009).** “*Nepenthes* group Montanae (Nepenthaceae) in Indo-China, with *N. thai* and *N. bokor* described as new”. *Kew Bulletin* **64**(2): 319-325.
- Clarke C. M. (1997).** *Nepenthes of Borneo*. Natural History Publications (Borneo), Kota Kinabalu.
- Clarke C. M. (2001).** *Nepenthes of Sumatra and Peninsular Malaysia*. Natural History Publications (Borneo), Kota Kinabalu, Malaysia.
- Clarke, C.M. & R. Kruger (2005).** *Nepenthes rowanae* (Nepenthaceae), a remarkable species from Cape York, Australia. *Carnivorous Plant Newsletter* **34**(2): 36-41.
- Danser, B. H. (1928).** The Nepenthaceae of the Netherlands Indies, *Bull. Jard. Bot. Buitenz.* Ser. **3**, 9 (3-4): 249 -438. Reprinted 2006 with an Introduction by Dr Charles Clarke by Natural History Publications (Borneo), Kota kinabalu.

Haager, J.R. (1993). “Some new taxa of orchids from Southern Vietnam”. *Orchid Digest* 57(1):39–44.

Hemsley, W. B. (1895). “*Nepenthes smilesii* (Nepenthaceae)”. *Royal Botanic Garden, Kew; Bulletin of Miscellaneous Information*, 1895:116.

Heubl, G.R. & A. Wistuba. (1997). “A cytological study of the genus *Nepenthes* L. (Nepenthaceae)”. *Sendtnera* 4: 169–174.

IUCN. 2001. *IUCN Red List Categories and Criteria: Version 3.1 IUCN Species Survival Commission*. IUCN, Gland, Switzerland and Cambridge, UK.

Jaussaud P. & E. R. Brygoo. (2004). *Du Jardin au Muséum en 516 biographies*. Muséum national d’histoire naturelle de Paris.

Jebb M.H.P. (1991). “An account of *Nepenthes* in New Guinea”. *Science in New Guinea* 17(1):7-54.

Jebb, M.H.P. & M. Cheek. (1997). A skeletal revision of *Nepenthes* (Nepenthaceae). *Blumea* 42:1-106.

Jebb, M.H.P. & M. Cheek. (2001). “Nepenthaceae” *Flora Malesiana*, Series I, Volume 15: 1-157.

Lecomte, P. H. (1909). “Les *Nepenthes* d’Indo-Chine”. *Notulae Systematicae*: 46-65.

Lecomte, P. H. (1946). *Flore générale de l’Indo-Chine*, T.V: 46-52.

Likhitwitayawuid, K., R. Kaewamatawong, N. Ruangrungsi & J. Krungkrai. (1998). « Antimalarial naphthoquinones from *Nepenthes thorelii*”. *Planta Medica* 64(3): 237–241.

Kurata, S. (1976). *Nepenthes of Mount Kinabalu*. Sabah National Parks Publications No. 2, Sabah National Parks Trustees, Kota Kinabalu.

Macfarlane, J.M. (1908). “Nepenthaceae” In: A. Engler, *Das Pflanzenreich*: 39-40.

McPherson, S.R. (2009). *Pitcher Plants of the Old World*. Poole, England: Redfern Natural History Productions.

McPherson, S.R. (2009). “*Nepenthes* of Peninsular Malaysia and Indochina”. *Pitcher Plants of the Old World*. Poole, England: Redfern Natural History Productions: 549-631.

Meimberg H., P. Dittrich, G. Bringmann, J. Schlauer & G. Heubl. (2000). “Molecular Phylogeny of Caryophyllidae s.l. Based on MatK Sequences with Special Emphasis on Carnivorous taxa”. *Plant Biology* 2: 218-228.

Meimberg H., & G. Heubl. (2006). “Introduction of a Nuclear Marker for Phylogenetic Analysis of Nepenthaceae”. *Plant Biology* 8 (6): 831-840.

Meimberg H., S. Thalhammer, A. Brachmann & G. Heubl. (2006). “Comparative analysis of a translocated copy of the *trnK* intron in carnivorous family Nepenthaceae”. *Molecular Phylogenetics and Evolution* 39: 478-490.

Meimberg H., A. Wistuba, P. Dittrich & G. Heubl. (2001). “Molecular Phylogeny of Nepenthaceae Based on Cladistic Analysis of Plastid *trnK* intron Sequence Data”. *Plant Biology* (Stuttgart, Germany) 3: 164-175.

Mey, F.S. (2009). “*Nepenthes bokorensis*, a new species of Nepenthaceae from Cambodia”. *Carniflora Australis. Journal of the Australasian Carnivorous Plants society inc.* 7(1): 6–15.

Mey, F.S., M. Catalano, C. Clarke, A. Robinson, A. Fleischmann & S. McPherson (2010). “*Nepenthes holdenii* (Nepenthaceae), a new species of pyrophytic pitcher plant from the Cardamom Mountains of Cambodia”. In: S.R. McPherson. *Carnivorous Plants in their Habitats*. Redfern Natural History Productions Ltd., Poole (Appendix).

Philippis A., A. Lamb & C. C. Lee. (2008). *Pitcher Plants of Borneo*. Second Edition, Natural History Publications (Borneo) Sdn. : Kota Kinabalu, Sabah, Malaysia.

Shivas R. G. (1984). *Pitcher plants of Peninsular Malaysia and Singapore*. Singapore: Maruzan Asia Pte.

Tamin R. & M. Hotta. (1986). “*Nepenthes* di Sumatera: The genus *Nepenthes* of the Sumatra Island”. In: M. Hotta (ed.) *Diversity and dynamics of Plant Life in Sumatra 1*. Kyoto University, Japan: 75-109.

Song, L.C. (1979). “*Nepenthes* crosses made at California State University, Fullerton”. *Carnivorous Plant Newsletter* 8(1): 13.

Takahashi, K., M. Tanji & C. Shibata. (2007). “Variations in the content and isozymic composition of nepenthesin in the pitcher fluids among *Nepenthes* species”. *Carnivorous Plant Newsletter* 36(3): 73–76.

Taylor, P. (1989). *The genus Utricularia: A taxonomic monograph*. Kew Bulletin Additional Series XIV: London.

Tardieu-Blot M. – L., Lecompte O., Van Cuong V. (1965). *Flore du Cambodge, du Laos et du Vietnam 4*.

Tertrais H. (2004). *Atlas des guerres d’Indochine, 1940-1990. De l’Indochine à l’ouverture internationale*. Editions Autrement.

Wen J. & Lowry. (2002). “*Aralia hiepiana*, a new species of Araliaceae from Vietnam”. *Adansonia* 24 (2).