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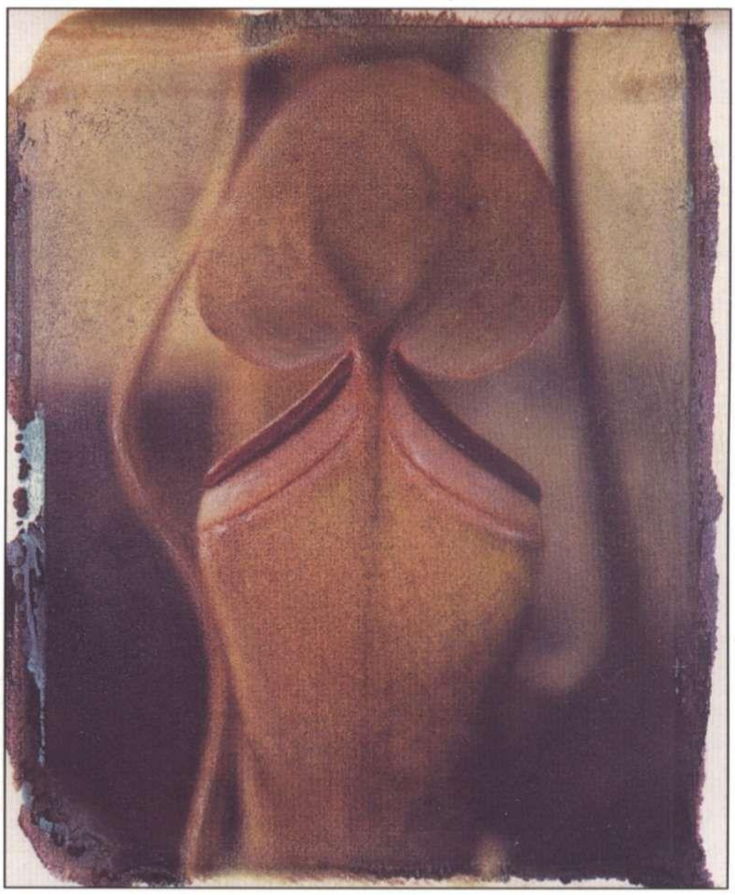
THE TROPICAL PITCHER PLANTS

(*NEPENTHES*)



Nepenthes albomarginata

"Can anyone see such marvelous things, knowing them to be only plants and feel no wonder?"

—*Gardeners' Chronicle,* 1849

IF THERE IS A ROYALTY among carnivorous plants, that distinction surely lies with the *Nepenthes.*

Ever since their discovery by Europeans in the middle of the seventeenth century, tropical pitcher plants have inspired awe and wonder in anyone who has laid eyes on them. *Nepenthes* have a rich botanical

and horticultural history, and the plants themselves are a virtual ecosystem of give and take with nature. The genus has the only species known to have devoured whole rats. And they are hauntingly beautiful, their pitcher traps often as elaborate and gaudy as artistic creations by humankind.

While primarily a plant of Southeast Asia, the first description of a species, *N. madagascariensis,* was given in 1658 by the then French governor of Madagascar, Etienne de Flacourt. He described in a book on the history of the island a strange plant with "a hollow flower or fruit resembling a small vase, with its own lid, a wonderful sight."

The second species described was *N. distillatoria* from Sri Lanka. When Carl Linnaeus first saw dried specimens of the plant, he was euphoric. He recalled Homer's *The Odyssey,* and the drug "Nepenthe" that Helen of Troy threw into flasks of wine to alleviate soldiers' sorrow and grief. Linnaeus wrote, "If this is not Helen's Nepenthes, it certainly will be for all botanists. What botanist would not be filled with admiration if, after a long journey, he should find this wonderful plant. In his astonishment past ills would be forgotten when beholding this admirable work of the creator!" Thus in 1737 the genus received its Latin name. It is ironic that *N. distillatoria* is one of the simpler species of *Nepenthes,* compared with the elaborate ones that had yet to be discovered, and that Linnaeus had no idea of the carnivorous nature of the plant, let alone any intoxicating influence the plant has on its prey. Like many others for years to come, he assumed the unusual pitcher leaves to be water-holding devices to help the plant survive drought.

Nepenthes khasiana

It wasn't until the following

century that *Nepenthes* had their heyday. Several things occurred to precipitate their rise in horticulture. One was imperialism, as Europeans began to explore and colonize Southeast Asia. In the 1700s orangeries were developed to grow the royal fruit Citrus for kings, and glass greenhouses were being built soon thereafter, enabling Europeans to grow exotic plants that were being discovered around the world. The Royal Botanic Gardens at Kew was started in England. In 1833 Nathaniel Ward invented the "wardian case," a sealed glass container that made it easy for exotic plants to survive long ocean voyages to England. In 1845 came the elimination of excise taxes on glass, resulting in cheaper and better greenhouses. Economies also boomed, so the middle and upper classes could afford such luxuries.

Nurseries also opened—for the first time plants were mass-produced for their ornamental value and sold to the public who could afford them. Among the first was the pioneering Loddiges Nursery in England, which introduced *N. khasiana* in 1825. James Vietch & Sons became the leader of such nurseries by the middle of the century. Hugh Low and Co. was another. These nurseries financed expeditions to faraway places such as Borneo, where exotic plants were collected and introduced into horticulture, *Nepenthes* being as sought after as palms, orchids, rhododendrons, and other ornamentals.

Also influential were the gardening magazines. Journals such as the *Gardener's Chronicle* and *Curtis's Botanical Magazine* featured articles on the cultivation of *Nepenthes,* with beautiful illustrations and advertisements from suppliers.

By the late 1800s, *Nepenthes* were much in vogue. Most conservatory greenhouses on the estates of the wealthy boasted *Nepenthes* hanging from the rafters, tended by a gardening staff only the rich could afford. Fancy hybrids were winning silver and gold medals at flower shows. New species were being discovered and introduced.

After the turn of the century, all of this came to an end. World wars, economic depression, fuel shortages—soon the dark, early years of the twentieth century led to dark and empty greenhouses everywhere.

NEPENTHIANA

***A study of tropical pitcher plants is virtually a who's who of early botany and horticulture. The following is a list of some of the personalities entwined among the vines of* Nepenthes:**

- Entienne de Flacourt: The French governor of Madagascar who first described seeing pitcher plants in 1658.
- George Everhard Rumph: The famous tropical botanist known as Rumphius described *N. mirabilis* as 'Cantherifera' in a book written in the late 1600s.
- Carl Linné or Carl Linnaeus: The father of scientific nomenclature gave the genus the name *Nepenthes* in 1737.
- William Curtis: Started *Curtis's Botanical Magazine* in 1787. It is still in publication.
- Sir Joseph Banks: Was involved with the early development of Kew Botanic Gardens and introduced *N. mirabilis* there in 1789. Banks also discovered *Cephalotus* while on Cook's tour of Australia.
- Father Joao Loureiro: A Portuguese priest in Vietnam, describes *N. mirabilis* as *Phyllamphora mirabilis* (Marvelous urn-shaped leaf) in 1790.
- Sir Stamford Raffles: Was founder of Singapore and started the Botanic Garden of Buitenzorg in Bogor, Indonesia. *N. rafflesiana* is named after him. Early 1800s.
- C. G. C. Reinwardt: Was the botanist of Raffles' garden. *N. reinwardtiana* commemorates him.
- Dr. William Jack: Discovered *N. rafflesiana* and *N. ampullaria* in Singapore around 1819. A surgeon for the East India Company, he befriended Sir Raffles when the latter was governor of Sumatra.
- Conrad Loddiges and his son, George: Were the first to introduce *N. khasiana* into cultivation (in 1825) through their Loddiges Nursery of Hackney, England. They were the first to make use of wardian cases to import *Nepenthes* and other exotics.

- P. W. Korthals: A Dutchman, publishes the first monograph on *Nepenthes* in 1839, describing nine species.

- Joseph Paxton: Began publishing the *Gardeners' Chronicle* in 1841, which helped popularize *Nepenthes* in cultivation.

- Hugh Low: Son of the owner of Hugh Low & Co. nurseries in England, Hugh Jr., in the mid-1800s, made three expeditions to Mt. Kinabalu in Borneo. He discovered four famous *Nepenthes: N. lowii, N. rajah, N. villosa,* and *N. edwardsiana.* He also introduced *N.* x *hookeriana* into cultivation.

- Sir Harry Veitch: Prominent member of the family that ran the Veitch Nurseries. *N. veitchii* is named after the dynasty, while Sir Harry is the namesake of *N.* x *harryana.* He introduced many species and hybrids of *Nepenthes* into cultivation. The Veitch Nurseries employed several of the most prolific *Nepenthes* hybridizers, among them Messrs. Dominy, Seden, Court, and Tivey. Many of their introductions survive today and some bear their names.

- Thomas Lobb: An employee of Veitch Nurseries, he collected many new species of *Nepenthes.*

- John Dominy: Also an employee of Veitch Nurseries, in 1862 he introduced the first commercial hybrid, *N.* x *dominii,* plus many others.

- Sir Joseph Hooker: Son of Sir William, he became director of Kew Botanic Gardens in 1865. A friend of Darwin, he proved the carnivorous nature of *Nepenthes* and wrote the second monograph listing thirty-three species in 1873. *N.* x *hookeriana* is named for his father.

- Charles Curtis: Another Veitch employee and collector, he discovered *N. curtisii (N. maxima),* which was named for him.

- Marianne North: Famous botanical artist, *N. northiana* bears her name because Harry Veitch saw her painting of it and realized it was a new species. Today, a gallery of her work remains on display at Kew Botanic Gardens.

- Frederick Burbidge: A collector for Veitch, he wrote the well-known *Gardens of the Sun* in 1880 (still in print). He discovered and named *N. burbidgeae* for his wife.

- Maxwell Masters: An editor of *Gardeners' Chronicle,* Veitch Nurseries named their beautiful hybrid *N.* x *mastersiana* for him and the work he did publicizing *Nepenthes.*
- James Taplin: An Englishman who moved to America, he produced many hybrid *Nepenthes* for George Such Nurseries in New Jersey in the late 1800s.
- J. M. Macfarlane: Wrote a revised monograph on *Nepenthes* in 1908, listing fifty-eight species.
- B. H. Danser: In 1928, wrote a monograph on *Nepenthes* reducing the species count to forty-eight.
- Matthew Jebb and Martin Cheek: In 1997, these two botanists at Kew Gardens revised the genus, listing eighty-two species.

Nepenthes are tropical pitcher plants that usually grow as climbing or scrambling vines. Most species are found in Southeast Asia, their center of distribution being the island of Borneo, but isolated populations are found as far off from this center as northeastern India, Madagascar, the Cape York Peninsula in northern Australia, and New Caledonia. There are currently estimated to be around eighty species.

Nepenthes are not typically jungle plants, but prefer more open and sunny ridges, slopes, meadows, fields, and stunted forests. Only 30 percent of the species are found in lowland areas where the days are hot and the nights warm. The majority of *Nepenthes* are highland or mountain plants, preferring warm days with cool nights. Humidity and rainfall are both high in the habitats supporting the plants.

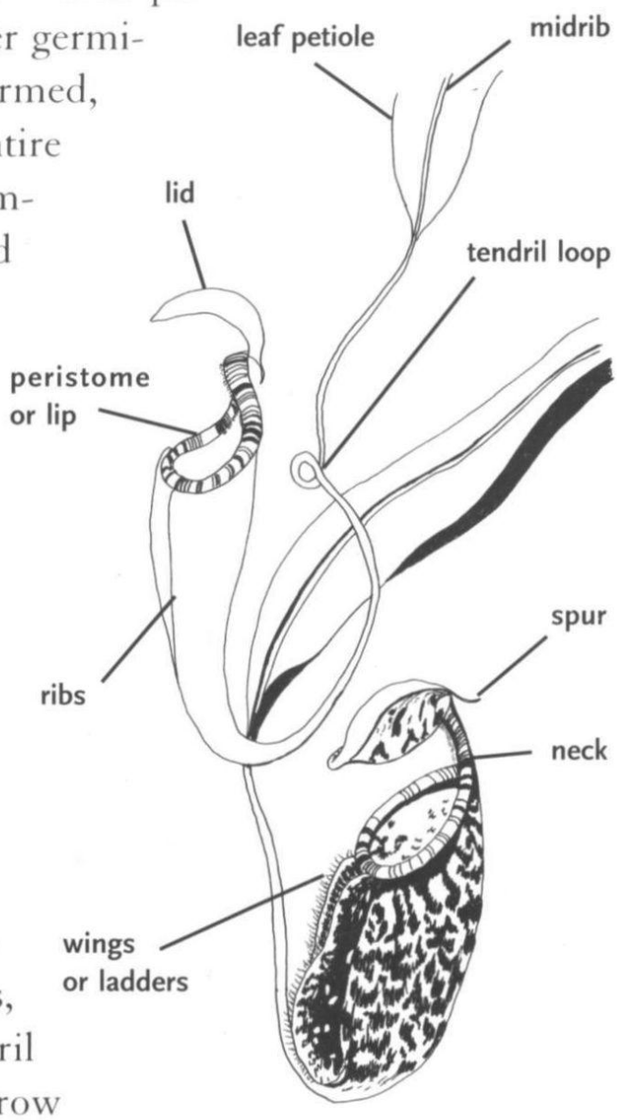
A giant form of *Nepenthes rafflesiana*

Nepenthes are found in a variety of

soils that are permanently wet throughout the year, although some survive droughts or brief drier seasons. The soils are kept moist by frequent rainfalls, foggy mists, or by seeps and springs. Some *Nepenthes* are native to marshes or swamplands. The soil itself is often a shallow layer of leaf litter, decomposing bark and twigs, and mosses, including sphagnum. Although this loose and airy soil is generally acidic, it may overlie a foundation of ultra basic rock like serpentine, or sandstone, or even alkaline limestone. Some *Nepenthes* grow epiphytically, their roots in mossy, leafy debris caught in the branches of trees. Sometimes the plants will grow in wet sand or gravelly seeps. Common companion plants are ferns, grasses, shrubs, and stunted trees. As with most carnivorous plants, these habitats are low in nutrients, and moving water carries away what little minerals are in the soils.

The seed of *Nepenthes* are very thin and filiform, and so lightweight they can be carried off by the wind—their primary method of dispersal. Soon after germination, tiny rosetted plants are formed, and after one year's growth the entire plant may be a mere one inch in diameter, the tiny pitchers erect at the end of broad, leaflike petioles. As the plant grows year after year, the rosette spreads to a diameter of a few inches in the smallest species to a few feet in the largest. The extensive root system is very brittle and hairlike.

The leaflike petioles are oval to lance-shaped, and have a prominent midrib vein down the center. At the end of the leaf this midrib extends into a tendril, the tip of which is the immature pitcher. Not all leaves form pitchers, but in those that do, the tendril lengthens and the tip begins to grow and swell, ballooning into a hollow, sealed pitcher. When mature, the lid pops open,



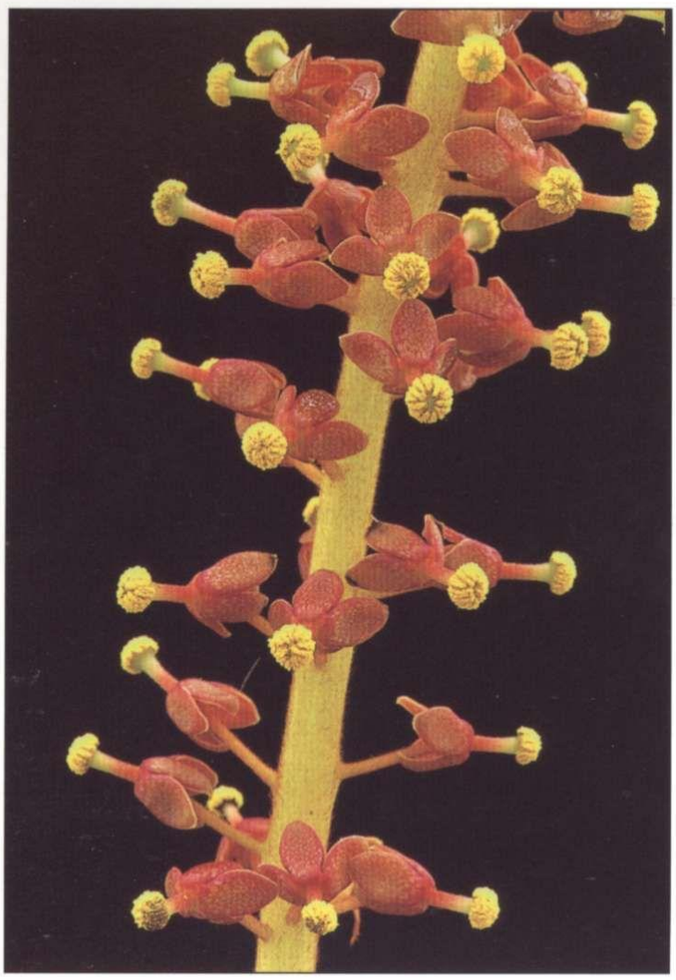
The upper and lower pitchers of *Nepenthes rafflesiana*

and the trap quickly reaches its full development. The lip or peristome unfolds, and the often bristly wings form "ladders" along the front. The pitcher quickly colors up in the sun, glistening with nectar droplets and often gaudy patterns to lure unsuspecting prey. These lower pitchers produced by the rosette sit on the ground facing outward. They are usually tubby and squat. When the pitchers open they already have digestion fluids in them, and will secrete more once the plant starts to catch prey. It can take weeks to months for a pitcher to develop, and its lifetime may be similar.

A rosette of ground pitchers may take five to ten years to mature. Then the climbing stem begins to grow. The leaves of the climbing stem look similar to those of the rosette, but the tendrils and pitchers can be dramatically different. As the tendril elongates, it slowly moves about, groping through the air for something, like a branch or twig, to grab hold of. (This movement is best seen in time-lapse photography.) The tendril then forms a single loop, whether or not it finds anchor. But, to form a hanging pitcher, support is usually needed. The tip of the tendril then swings upright like a hook, and it quickly swells into a pitcher. These upper or climbing pitchers can be so radically different in appearance from the lower ground pitchers they can seem to be of another species. They join the tendril from the rear rather than side of the trap. They are usually more graceful and funnel-shaped than the bulkier lowers, and they lack bristly wings along the front. In some species they are less colorful than the ground pitchers, while others are more so.

Nepenthes produce climbing stems for the purpose of having their flowers higher in the air and sunshine than the surrounding vegetation. The climbing stems may be fairly short in some lower-growing *Nepenthes,* such as *N. ventricosa.* In others they may grow several feet to several yards in length, scrambling over bushes or climbing into trees. After flowering, the stems usually continue to grow, and may flower repeatedly for several years. Meanwhile, down below, new shoots appear at the base of the stem. These rapidly develop into large rosettes of new ground pitchers. A wonderful thing about *Nepenthes* is that usually every year a new rosette is formed that eventually becomes a climbing stem. Thus most species are a continuously rejuvenating mass of ground rosettes and pitchers with many climbing stems and hanging pitchers of various ages.

Male and female flowers are found on different plants, but look



The flowers of a male *Nepenthes*

similar to each other. They are more odd than beautiful, but in some species can be colorful and attractive. The long flower stalks arise from the stem and are held upright. Each stalk has dozens to hundreds of small, densely packed blooms. Each bloom is a single flower, but occasionally they are joined in twos and threes. The individual flowers have short stalks and do not have true sepals or petals. Instead they have four short, teardrop-shaped tepals, and from this stands the small male anther or female stigma, depending on the sex of the plant. Stigmas are usually sticky and green, while the anthers are capped with a head of yellow pollen. Wind probably carries most pollen to female plants, but the tepals produce nectar to entice pollinators such as ants, beetles, and small flies. About 70 percent of plants in the wild are male, while 30 percent are female, thus males are also more common in cultivation. When pollinated, the female ovary swells, turns brown, and cracks open, releasing hundreds of fine, threadlike seed, the embryo a small bulb in the center. One flower spike can produce thousands of seed.

But it is the pitchers that make *Nepenthes* so famous. True leaves, the pitchers may be small and dainty to large and almost woody. They also have a fascinating life of their own, and apparently are more than just stomachs for the plant—they are a complete ecosystem of life and death.

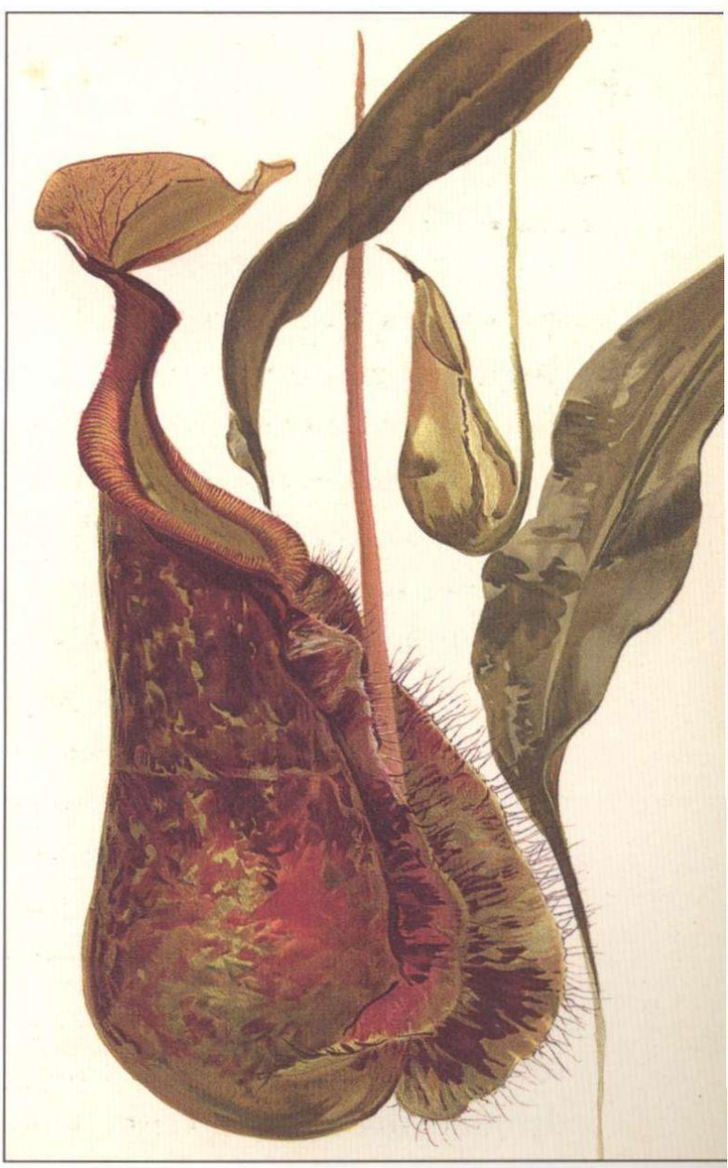
The whole plant is covered with nectar glands that supply food for insects such as ants. Nectar is heavier along the tendril, and rather copiously produced by the pitcher, particularly along the ladderlike wings, around the liplike peristome, and under the lid. The lid never moves once it has opened, as is commonly supposed, but instead prevents rain from entering and diluting the contents too quickly. Some species have

small or narrow lids that freely allow rainwater into the trap, and act primarily as a nectar-baited lure.

Insects, primarily ants, visit the pitchers in great numbers. They are led by nectar and color patterns to the underside of the lid and the slippery peristome. For many insects, the nectar has an intoxicating effect. After feeding for a while, some insects can appear to be in a drunken stupor, walking or spinning in circles. Many of these lose their foothold, falling from the lid or peristome into the depths of the trap.

When a pitcher first opens, the secreted solution inside is fairly neutral in pH. But as insects are caught, their struggles apparently signal the pitcher to secrete acids and enzymes in large quantity. This liquid is often thick and almost syrupy, so the prey sink quickly and drown.

The interior of the trap is divided into two zones. The upper is the waxy zone, where most insects find it impossible to climb, their feet becoming clogged with a slippery substance. The lower digestive zone is covered with hundreds to thousands of large glands clearly visible to the naked eye. These glands secret the juices that rapidly dissolve the soft parts of the prey. A fly can be digested in a couple of days. The glands then reabsorb nutrients from this soup. The carcass or exoskeleton sinks down to the growing graveyard of corpses at the bottom of the trap.



Nepenthes rafflesiana

Strangely enough, tropical pitcher plants don't eat all insects and animals that visit their fanciful and dangerous traps. In fact, over 150 creatures, during at least some part of their life, make the pitcher plants their home or otherwise have a mutually beneficial relationship with the plants.

The simplest of these "friendships" can be found with ant

colonies that make their nests near *Nepenthes.* While countless ants are caught and eaten by the plants, it has been found that at times of drought (when nectar is otherwise scarce), the pitcher plants sustain the ant colonies by offering sugary nectar for them to feed on. What effect the drugs in the nectar have on the ants is not yet known. It may be that only nectar of the pitcher causes intoxication, and not from other parts of the plants.

Numerous mites and microscopic organisms, plus mosquito and fly larva, live completely unharmed in the digestive juices of the plants, even when the acidity of the juice is as low as 3.0 on the pH scale. These creatures act as scavengers and may possibly help the pitchers with digestion.

A species of golden ant is known to drill holes into the thick, hollow tendrils of *N. bicalcurata,* where it raises its young. The adult ants feed on trapped prey. Drummer ants are well known on some species of *Nepenthes.* These solitary ants claim a plant as their own, and when threatened, beat their abdomens on the lids of the pitchers to scare off intruders. If Drummer ants fall into the trap, they can easily and mysteriously escape.

The red crab spider is a common resident of *Nepenthes,* sometimes living in up to 35 percent of their ground pitchers. It attaches itself to the interior of the trap by a small thread. It will swing on this and snatch flies that fall into the digestive juices, and has even been known to "fish" mosquito larvae out of the fluid. Amazingly, when threatened the red crab spider will plunge into the juices, only to haul itself out by its safety line when the threat has passed!

The pitchers of *Nepenthes* seem to go through stages of productivity as they age. Early in their life, they catch insects for the plant's benefit. But as they get older, their contents may become diluted with rain, or deteriorate and dry out. Many insects and other creatures then move in, feeding on the carcasses of the prey or making nests out of the once deadly traps. Recycling at Nature's best.

Humans, too, have utilized *Nepenthes* for more than their beauty.

Travelers have often used older pitchers filled with rainwater as a source of drinking water. As repulsive as it may sound, even insect-debris-laden water is refreshing to those suffering thirst in the tropics! The pitchers can also be cleaned out and used as water scoops.

Various medicinal uses have been beneficial to native inhabitants of

Southeast Asia. The sterile solution in unopened pitchers has been used as an eyewash, an asthma reliever, and a painkiller during childbirth. (I once applied the fluid to a mild skin burn, and was amazed at the immediate relief.) The roots of *Nepenthes* have also been used to regulate menstruation and to help reduce fevers. Various parts of the plants have also been used for indigestion, heartburn, stomach ailments, and dysentery.

The climbing stems of *N. ampullaria* were once commonly used like rope to bind fences and other construction. Today, larger pitchers are still used as cooking tools: rice is often cooked inside the pitchers, some believing the taste of the grain to be enhanced in this way.

WORLD DISTRIBUTION OF *NEPENTHES*

Region	*Total Number of Species*	*Endemic Species*
Borneo	32	24
Sumatra	21	11
Malay Peninsula	11	3
Philippines	10	7
New Guinea	10	5
Sulawesi	9	5
Indochina	5	4
Australia	1	0
New Caledonia	1	0
Sri Lanka	1	1
Assam, India	1	1
Seychelles	1	1
Madagascar	2	2

THE LOWLAND SPECIES

Species that grow below 3,000 feet are considered lowland. They experience hot days, warm nights, and continuous high humidity.

Nepenthes gracilis

This fine and graceful scrambler is native to Borneo, Sumatra, Malaysia, and Sulawesi, and in some of these areas is still a common roadside weed. The leaves are long and narrow, up to about eight inches. The small lower pitchers are two to three inches tall, cylindrical with a tubby base, with fine, eyelashlike wings and a thin, circular peristome and lid. The upper pitchers are similar but lack wings and can be twice as large. Several forms exist. The common is green with many red spots along the upper half of the pitcher. Another beautiful form has pitchers a full, deep red. Easy to grow and an excellent beginner's plant, it is perfect for the room-temperature terrarium, and can have its fast-growing narrow vines pruned back severely to encourage bushier growth. Easy to root in water.

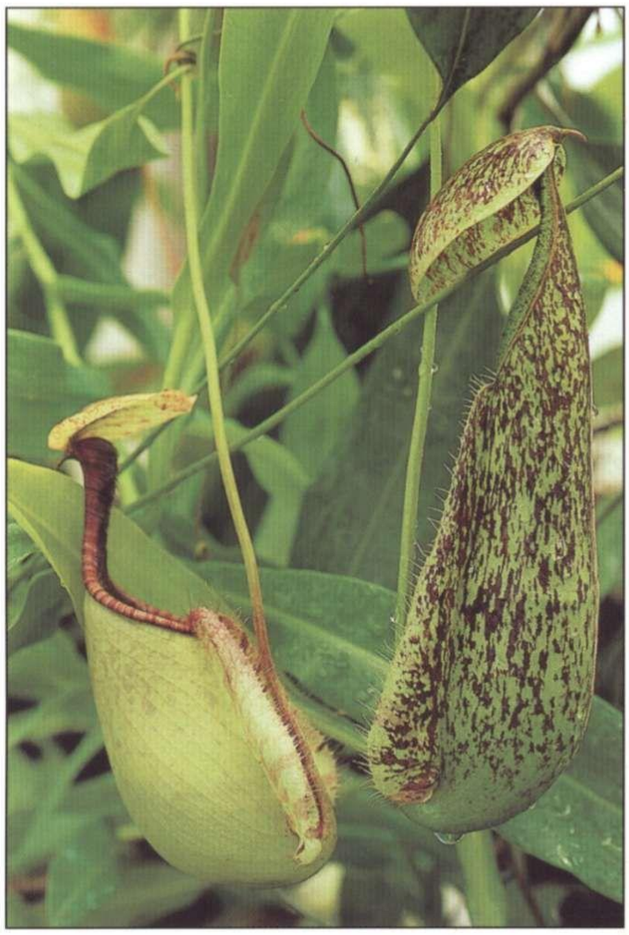
A red form of *Nepenthes gracilis* growing in Singapore

Nepenthes rafflesiana

This magnificent species is extremely variable, with many forms native to Borneo, Sumatra, and Malaysia. A large grower, it is a showpiece in the hothouse, or, when young, in larger, warm terrariums. The leaves can be fairly broad and one to two feet in length. Several forms have been named, but are confused in horticulture. Different forms have been hybridized, giving birth to a wide variety of handsome offspring.

This species characteristically has bulky lower pitchers with a thick, striped peristome; fine, sharp teeth; pronounced wings; and a tall, spiny neck where the peristome joins the lid. The lid is often large and vaulted, with two prominent keels running lengthwise. Upper pitchers are usually as ornamental as lowers, but can be very elongated and funnel-shaped.

The typical forms have pitchers four to five inches tall with pale green backgrounds that are very heavily splotched in reds or purples. Some that



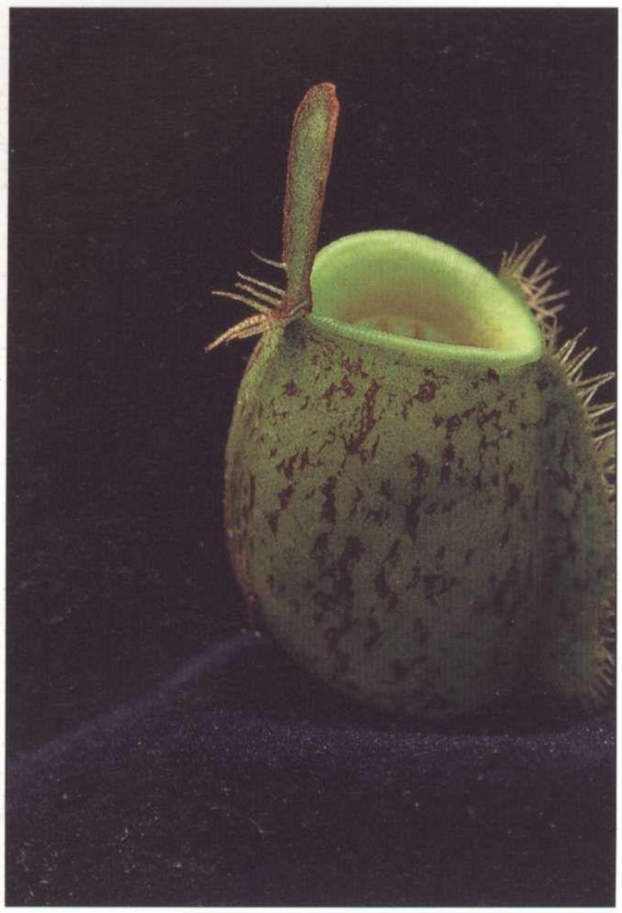
Two forms of *Nepenthes rafflesiana*. On the left is a green form. On the right is *N. rafflesiana* var. *nivea elongata* just opening.

are fully red with light green speckling and greenish wings were named *N. rafflesiana* var. *nigropurpurea* by Masters in 1882. *N. rafflesiana* var. *nivea,* collected by Burbidge, has creamy colored pitchers with red speckling and white hairs on the stem, while in *N. rafflesiana* var. *nivea elongata* the pitchers are longer and more narrow. Jumaat Adam, in 1990, described *N. rafflesiana* var. *alata,* which has ornamental, frilly wings on the lower portion of the tendrils. This variety itself can be variable, with red-blotched pitchers to pitchers predominantly green, outlined with purple in the peristome and wings. The most remarkable forms of *N. rafflesiana* have huge purplish pitchers over one foot in length, with tendrils that can be very long, dropping their heavy pitchers from above greenhouse benches all the way to the ground, a distance of nearly five feet. Giant plants are known from Sabah, Malaysia, and another from Malaysia is nicknamed "Singapore Giant". A dwarf form, called *N. rafflesiana* var. *minor* by Beccari, may be lost in cultivation.

Nepenthes ampullaria

This is another common, variable, and startling species from Borneo, Sumatra, the Malay Peninsula, and New Guinea. This species primarily produces numerous ground pitchers that are round and squat, resembling bird eggs. They are usually one to three inches high, but can be larger. The unique peristome sits at the top of the pitcher, circular and funnel-shaped. The lid is narrow and strapped, deflected from the opening and offering no protection from rain, which the pitchers readily collect. Two prominent wings sit at the front of the tubby pitcher. The leaves of the climbing stem rarely produce pitchers, but when the stem is very tall, clusters of pitchers can suddenly appear along its length.

Several varieties exist. In one, the pitchers are entirely green. The most common has green pitchers liberally spotted in red. There are several striking red forms, among them *N. ampullaria* 'Cantley's Red', which is scarlet with light green flecking.



Nepenthes ampullaria **is excellent for the terrarium.**

Nepenthes mirabilis **from Irian Jaya on New Guinea. This new variety has been nicknamed John Holmes.**

N. ampullaria is very popular for warm terrariums, as the climbing stems can be easily pruned back, resulting in clusters of ground pitchers. The plants also pitcher nicely in shadier conditions.

Nepenthes mirabilis

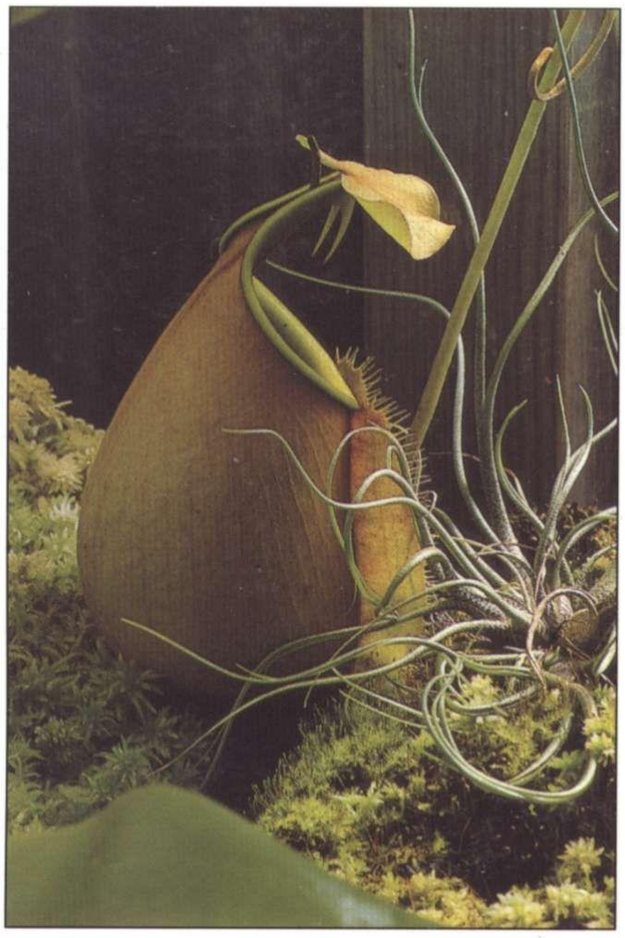
This is the most widespread species of the genus, its many forms found from southern China to northern Australia, including Malaysia and the Philippines. Its leaves typically are paper-thin with slightly fringed margins. A small grower, it makes a nice terrarium plant. The upper and lower pitchers are usually similar: cylindrical with a bulbous bottom, round mouth and lid, flattened peristome, and colored green to suffused with red. An interesting form called *N. mirabilis* var. *echinostoma* has a marvelously wide, oversized peristome that is flat and striped. A plant from Vietnam widely circulated as *N. anamensis* appears to be a form of *N. mirabilis,* and has been known to grow on windowsills.

N. mirabilis loves wet swampy conditions, but avoids acidic peaty soils, preferring more alkaline areas. It is often seasonally flooded in nature, and has even been known to colonize coastal, brackish swamps.

Nepenthes bicalcurata

This amazing plant is famous for its sharp, saber-toothed fangs that hang from the rear of its lid, making it appear rather dangerous. Native to Borneo, it prefers shaded peat swamps, and can grow to enormous dimensions. The stem is thick, with long, broad

leaves two feet in length. The lower pitchers average six inches tall, are round and squat, are almost woody in texture, and have prominent wings. They are green to coppery orange or reddish in color. The broad peristome joins to form a tall neck capped with a large lid. The two hard, sharp fangs are an outgrowth of the peristome and overhang the pitcher's mouth. Nectar sometimes drips from these, giving the appearance of oozing venom. Ants find the fangs difficult to negotiate, and often fall from them into the digestive pool below. It has also been suggested that the sharp fangs prevent small mammals from stealing prey from the trap. The upper pitchers are similar, but lack wings and are yellow green in color.



The lower pitcher of the viscious-looking *Nepenthes bicalcurata*, its sharp fangs overhanging its mouth. The frightened tillandisa is *T. butzii*.

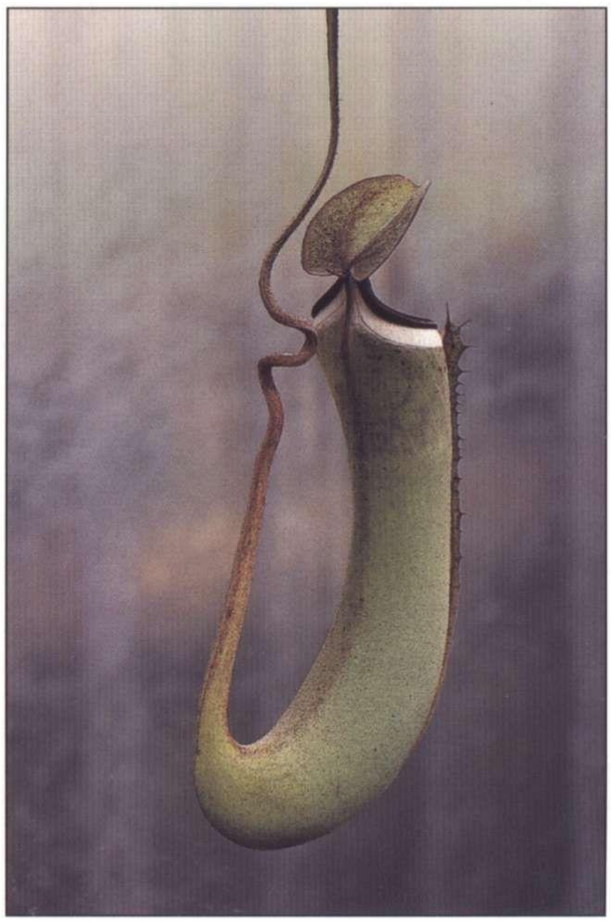
N. bicalcurata is easy to grow but needs hot, humid conditions. When young it succeeds well in terrariums, but does best in roomy hothouses and stove houses. Long a favorite with collectors, it is another showy, fantastic plant that never ceases to amaze people who see it.

Nepenthes albomarginata

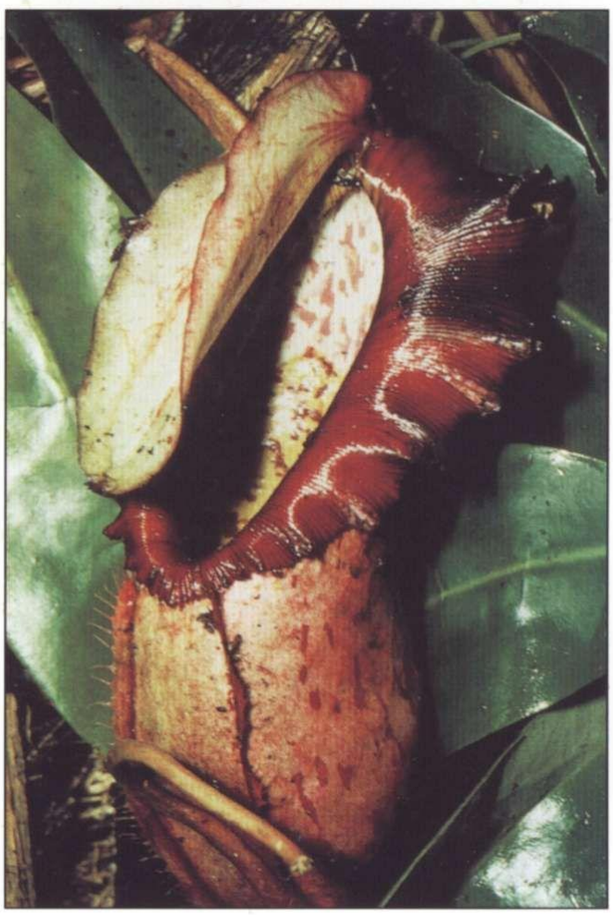
A small growing scrambler from Borneo, Sumatra, and the Malay Peninsula, the pitchers are cylindrical and around six inches long, with an oval mouth and lid, narrow peristome, and reduced wings. The beauty of this plant is the prominent white ring below the peristome, which almost appears hand painted. Most forms have grayish green pitchers, but a lovely Malaysian form has red lower pitchers.

Nepenthes reinwardtiana

This tall scrambler also comes from Borneo, Sumatra, and the Malay Peninsula, and sometimes grows epiphytically in trees. The smooth, curvaceous pitchers have negligible wings, and are long and thin, with a slight waist. The slanted mouth is oval with a thin peristome and oval lid. Its hallmark are two curious, waxy "eye spots" that usually appear on the upper interior back wall of the pitcher, which may be a lure for prey. There



The upper pitchers of *Nepenthes albomarginata*.



***Nepenthes northiana*, a striking lowland species with enormous and beautiful pitchers.**

is a common green form, and a more striking red form.

Nepenthes truncata

A spectacular plant from the Philippines, this large, coarse species has unusual leaves that are squared or truncated at their ends. The enormous pitchers have smooth green exteriors, with colorful interiors heavily mottled in reds, pinks, and purples. The lower pitchers are fat and cylindrical with prominent wings. The slanted mouth is large with a colorful and wide peristome that may be fluted along its edge and striped or golden orange. The lid is domed and held horizontally. The pitchers may reach fourteen inches in length.

Nepenthes northiana

This is the showy species made famous by Marianne North's colorful painting. It grows on limestone cliffs in Sarawak and is nearly extinct, but tissue-cultured plants have now reentered cultivation. The giant lower pitchers reach 14 inches in height, are bronzy green, heavily splotched with red. The slanted, large mouth has a huge fluted peristome pale red with purplish stripes. The lower pitchers are fat and squat, while the similar uppers are more cornucopia-shaped. I have found a good alkaline medium for it to be two parts coarse vermiculite, to one part each of perlite, pumice and sand. Avoid peat moss or sphagnum, which stunts its growth. A plant known as *N. decurrens* is believed to be synonymous.

Nepenthes merrilliana

From the Philippines and Sulawesi, this is another large species with heavy, squat, flat-bottomed lower pitchers. They are green, with prominent wings, and a wide, gaping mouth.

Nepenthes veitchii

This beautiful species from Borneo is found from sea level to about 4,000 feet, so some forms can be considered highland plants as well. The squat pitchers are green with strong wings. Its main attribute is its tremendously flared, nearly vertical peristome that is reminiscent of the gills of a fish. The peristome is the predominant feature of the plant. It can be green to golden brown, or, in some spectacular forms, beautifully striped in red. The oval lid seems to hang precariously at the top. This species often climbs up trees, its leaves hugging the trunks.

Nepenthes hirsuta

This small scrambler from Borneo is covered with dark, bristly hairs. The most popular form in cultivation has handsome, cylindrical pitchers heavily colored a dark brownish red, with a thin peristome and stems colored purplish black. A nice plant for the terrarium.

The upper pitchers of *Nepenthes veitchii.*

Nepenthes hirsuta **is a small growing specimen perfect for the warmer terrarium.**

Nepenthes thorelli

From Indochina, this species has been frequently used to produce popular hybrids, particularly in Japan. The lower pitchers are oval-shaped and tubby, and a lovely crimson color. The uppers are elongated, very slim, and a pale yellow green.

Lowland Hybrids

Nepenthes, like *Sarracenia,* hybridize in the wild, and some that were originally thought to be species are now known to be natural crosses. Hybrids have also been artificially produced for over 150 years, thus there are hundreds in circulation.

Unfortunately, CP lovers face problems with the nomenclature of *Nepenthes* hybrids similar to those of *Sarracenia.* Since no official registry was ever organized for *Nepenthes* (the International Carnivorous Plant Society has registered only cloned cultivars since 1978), the first time a particular hybrid was produced it may or may not have received a fancy "group" name. Sometimes single individuals were chosen and given varietal or cultivar status, thereafter reproduced vegetatively as clones.

Thus, as an example, the cross of *N. mirabilis* x (*rafflesiana* x *ampullaria*) was never given a fancy hybrid name by which all similar crosses thereafter would be called. However, many individual offspring of this cross have been named, making them cultivars. So we have *N.* x *wrigleyana, N.* x *coccinea, N.* x *compacta, N.* x *eyermanni, N.* x *lawrenciana, N.* x *morganiana, N.* x *paradisae, N.* x *patersonni, N.* x *ratcliffiana, N.* x *robusta, N.* x *splendida,* and *N.* x *stewartii,* all varieties chosen from offspring of the above mentioned hybrid produced by many people over many years—and most, incidentally, probably lost to cultivation.

Fortunately, some modern growers, such as Clyde Bramblett and Bruce Lee Bednar of southern Florida, have been following a more organized program of hybridization. New crosses that they develop receive a fancy group name, and outstanding individuals are then given a fancy varietal title.

Here I will review a few popular hybrids—some official cultivars, but most not.

Nepenthes x *trichocarpa*

This natural cross between *N. gracilis* and *N. ampullaria* was thought to be a species until recently. A pretty and delicate little plant, it is excellent in warmer terrariums. The small ground pitchers are tubby and spotted (resembling fat *N. gracilis* pitchers), while the uppers are more tubular and pale.

Nepenthes x *hookeriana*

This is the natural hybrid of *N. rafflesiana* x *ampullaria*. A large and vigorous plant, the lower pitchers are usually green with much red spotting, and have a heavy, squat, "boxy" look to them. This hybrid was very popular in the nineteenth century for use as a parent in other crosses. The many results have given us a wide range of plants that have somewhat similar compact and colorful pitchers that are still popular today. Some of these are:

Nepenthes x *wrigleyana*

This is *N. mirabilis* x (*rafflesiana* x *ampullaria*), and has thick, cylindrical pitchers, light green with much red spotting.

Nepenthes x *morganiana*

This is the reverse cross of the above, with fat, tubby pitchers and lighter red spotting.

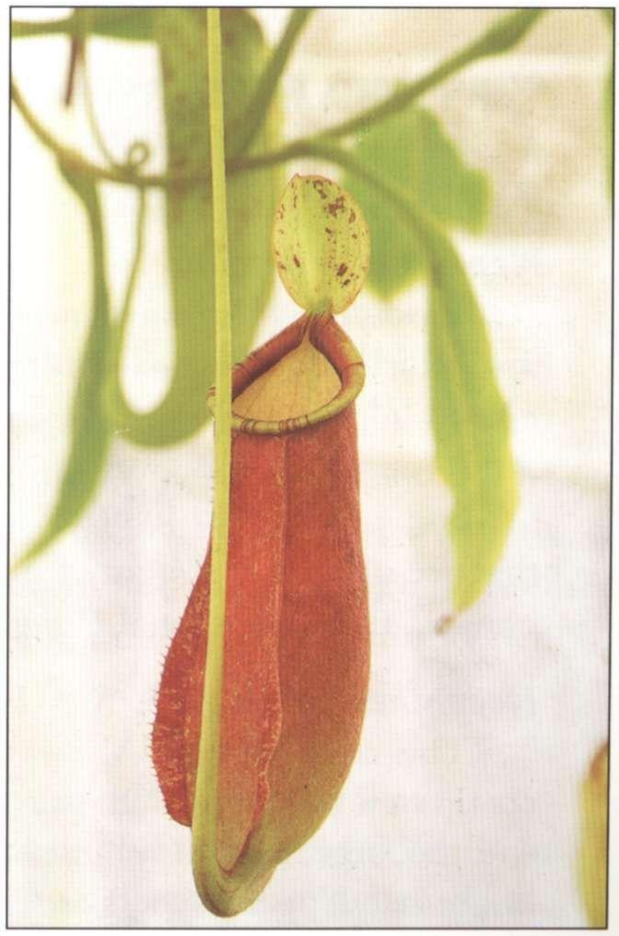
Nepenthes x *lawrenciana*

This is a rather similar cross.

Nepenthes x *coccinea*

Again, the same cross but with deep red pitchers lightly marked with green. Very handsome and popular.

A lower pitcher of *Nepenthes* x *morganiana*



N. x *coccinea*

Nepenthes x *boissiense*

This is (*gracilis* x *khasiana*) x (*rafflesiana* x *ampullaria*) and has rather bottom-heavy lower pitchers, very pale green with light red flecking.

Nepenthes x *superba*

This is a more richly colored sibling of the above.

Nepenthes x *henreyana*

This is the same but with pitchers predominantly red.

Nepenthes x *williamssii*

This is a sibling of *N.* x *henreyana* with similar dark red pitchers.

Nepenthes x *chelsonni*

This is (*rafflesiana* x *gracilis*) x (*rafflesiana* x *ampullaria*), resulting in red and green tubby pitchers with a wider mouth and larger floppy lid.

Some other popular Victorian hybrids still can be seen in collections and botanical gardens today, such as:

Nepenthes x *intermedia*

This cross of *N. gracilis* x *rafflesiana* is similar to *N. rafflesiana* in its neck and its red, blotchy, bulky pitchers.

Nepenthes x *dormanniana*

This is *N. mirabilis* crossed with (*gracilis* x *khasiana*), the lower pitchers well spotted but with a green peristome and wavy wings.

Nepenthes x *dominii*

This is *N. rafflesiana* x *gracilis*. The bulky lower pitchers are very crimson, which contrasts well with the green mouth and large, domed greenish red lid.

Some Victorian hybrids produce enormous, magnificent pitchers that are still the highlight of many botanical gardens and private greenhouses. Two exceptional clones are:

Nepenthes x *mixta*

This cross between *N. northiana* and *N. maxima* produces huge pitchers up to a foot long. The pale green traps are heavily streaked with red, and the large, slanted mouth has a wide, luscious peristome that glistens bright red. Upper pitchers are equally impressive but more funnel-shaped, like giant cornucopias. Produced by Tivey in 1893. A more richly colored form is called *N.* x *mixta* var. *sanguinea*. Another is *N. mixta* var. *superba*.

Nepenthes x *dyeriana*

This is another showstopper. A cross between *N.* (x *mixta*) and *N.* (*rafflesiana* x *veitchii*), the pitchers reach fourteen inches, and are green with many red/purple/brown streaks. The large peristome is candy cane–striped, turning bronze in good light. Amazingly, this clone has recently been found to do well on windowsills. Released by Tivey in 1903.

The magnificent lower pitcher of *Nepenthes* x *mixta*, a showy hybrid for the hothouse.

From 1918 to 1956, the Missouri Botanical Gardens housed one of the largest *Nepenthes* collections in the world, under the direction of George H. Pring. Three cultivars were named from a cross of *N.* [(*rafflesiana* x *hirsuta*) x (*rafflesiana* x *ampullaria*)] x (*rafflesiana* x *hirsuta*). All have tubby, squat pitchers of similar shape, but with coloration differences. They are *N.* x 'Lieutenant R. B. Pring', *N.* x 'St. Louis', and *N.* x 'Henry Shaw'. If anyone still grows these cultivars, both the author and Missouri Botanical Gardens would like to hear from you.

Three hybrids from France are noteworthy. A natural hybrid of *N. mirabilis* x *thorelli* was introduced from Cambodia by Mr. Marcel Lecoufle and named *N.* x *lecouflei*. He crossed this plant with *N.* x *mixta* var. *sanquinea* and introduced the beautiful *N.* x 'Ile de France'. The cylindrical lower pitchers are flushed pink in the upper part, with streaks of chocolate red, and the flat peristome is striped green and crimson. Upper pitchers are paler. Another, raised by Mr. Yvon Vezier, is *N.* x 'Ville de Rouen', a cross between *N.* x *superba* and *N.* x *mastersiana,* a highland hybrid.

In Japan in the twentieth century, more *Nepenthes* have been hybridized than ever before, far surpassing the numbers of Victorian hybrids. Of the many crosses produced from 1914 to 1939 by both individuals and commercial nurseries, almost none survived the hard winter of 1940, or the war and bombings that quickly followed.

Unfortunately, the Japanese follow their own rules of nomenclature—so duplicate crosses in the West have different names!

Since 1950, hybridization in Japan has resumed, with many beautiful results. Few of these are in circulation outside of that country, but trade is on the increase. One of the best crosses in worldwide circulation is *N.* x *rokko,* which I will discuss under highland plants, below. Of predominately lowland ancestry, a few are worth mentioning:

N. x *nagoya* = *N.* (x *mixta*) x *thorelli*

N. x *oisoensis* = *N.* (x *mixta*) x *maxima*

N. x *minamiensis* = *N.* (x *mixta*) x (x *wrigleyana*)

N. x *mizuho* = *N. rafflesiana* x (x *dyeriana*)

Probably the most prolific modern hybridizer in the world is Dr. K. Kawase of the Kosobe Botanical Garden at Kyoto University in Japan. He has produced many dozens of crosses (163 between 1973 and 1983) and has named them all alphabetically after Koto, which means "Old Capital" (Kyoto). Thus we have an amusing list that includes *N.* 'Aglow Koto', *N.* 'Balmy Koto', *N.* 'Delectable Koto', *N.* 'Dreamy Koto', *N.* 'Ecstatic Koto', *N.* 'Feverish Koto', *N.* 'Fruity Koto', and *N.* 'Giddy Koto', all the way to *N.* 'Zonal Koto'. Many of these plants are in wide circulation, but space does not allow me to review them here. Many of these hybrids have been bred from highland species, offering a wide variety suitable to cooler growing conditions. The Koto series are group names, not cultivars, so individual plants can be variable.

***Nepenthes* x 'Ile de France', upper pitcher**

For many years, two nurserymen in southern Florida, Bruce Lee Bednar and Clyde Bramblett, have hybridized many dozens of *Nepenthes,* producing some of the finest plants seen since the Victorian era. In August 1992, Hurricane Andrew had a devastating effect on some of their greenhouses, and many plants were blown into the Everglades, never to be seen again.

Their cooperative venture has since recuperated, and their hybridization program has resumed. They give their crosses group names, from which they occasionally choose varieties, listing the seed-bearing females first. Some of their more popular crosses are listed here.

Nepenthes x *excellens*

This cross between *N.* x *rokko* and *N.* x *mixta superba* is similar to the latter parent but with an even larger and flatter peristome of brilliant color. Two varieties are *N. excellens* var. 'Superba' and *N. excellens* var. 'Jessica Lauren'.

Nepenthes x *David Parkyn*

The striking pitchers are cylindrical with a slight waist, yellow with maroon stripes. The cross is *N.* (x *oisoensis*) x [*thorelli* x (x *wittei*)].

Nepenthes x *madisonii*

This is *N.* (x *oisoensis*) x *ventricosa.* The hourglass pitchers are tinted pink/orange/yellow with red speckling and a red, scalloped peristome.

Nepenthes x *dianiana* var. 'rex'

This is an offspring of *N.* (x *splendiana*) x (x *mixta*). The distinctive pitchers are speckled pink and have large wings and a tall, vaulted peristome.

Nepenthes x *dwarf peacock*

This is a miniature plant with teardrop-shaped pitchers, multicolored in reds, pinks, and purples. The parents are *N. thorelli* x (x *savannah rose*).

Nepenthes x *East Everglades*

This is the cross between *N.* (x *splendiana*) x (x *redlanderii*). The pitchers have a bright green background with dark red stripes and a round peristome.

Nepenthes x *hareliana* var. 'Red Skelton'

This bony-looking plant has long, thin leaves with skinny, skeletal pitchers dark maroon in color. The cross is *N.* (x *hachijo*) x [*thorelli* x (x *dyeriana*)].

Nepenthes x *sheridaniana*

This is *N.* x *splendiana* x *ventricosa.* The pitchers look like a plump, elongated hourglass, with heavy, blood-red spatters and a red, spiked peristome.

Another lowland hybrid worth mention was produced by Marie Baumgartl of Marie's Orchids, in California. She bred a vigorous plant

of *N. truncata* x *alata* with a plant called *N.* x "Sens", an unknown hybrid found growing in a botanical garden in Sens, France. The resulting offspring were named *N.* x *Frieda Crisp*. I was so impressed with these plants I chose three outstanding clones, which were named *N.* x 'Marie', *N.* x 'Frau Anna Babl', and *N.* x 'Nora'. All three of these clones are marked by bright red peristomes with white interior pitchers, the exteriors variably colored with pink blush to heavy streaks of purple.

THE HIGHLAND SPECIES

Seventy percent of *Nepenthes* are tropical highland or mountain plants, growing at elevations of 3,000 to 10,000 feet above sea level. Above the lowland heat of the rain forest, the mountain climate can be considerably cooler and wetter, especially at night. Day temperatures average in the seventies, and by early morning drop into the sixties and fifties or even cooler, but frost never occurs except at the highest of levels. The mountains are often shrouded in cloud cover, the nights frequently misty or rainy. As a result, the ground, rocks, and stunted trees are typically covered with thick growths of sphagnum and other mosses. These elevations are known as elfin or mossy forests, and when the sun breaks through the thick clouds, it is usually brief and in the breezy afternoons. This is the *Nepenthes* zone.

Nepenthes khasiana

The first species introduced into cultivation in 1825, N. khasiana is an endangered plant from the Khasi Highlands of Assam in northeastern India, the only Nepenthes native to that country. It is an extremely cool-tolerant plant, unaffected by brief lows in the thirties, and large plants in cultivation have been known to return from their stems after freezes down to twenty degrees—but they certainly prefer it warmer. The species is very adaptable to windowsills, and succeeds well as an outdoor plant in climates such as the immediate coast of California, where winters are frost free and summers cool and foggy. It also adapts to warmer, humid climates such as that found in Florida, but grows faster in winter when the nights are cool. A large plant, the stems can grow several feet long, with large leaves. The eight-inch pitchers are handsome, cylindrical and slim, with an oval mouth and lid. The upper pitchers can be heavily suffused with red coloration. There is a fairly prominent reddish band below the thin peristome. Males and females are common in cultivation, so seedlings are often produced,

but it is very difficult to strike from cuttings. Tissue-cultured plants are making this easy species more common.

Nepenthes ventricosa

From the Philippines, this wonderful species is as adaptable as *N. khasiana*. It is a low grower, with compact leaves growing along the gradually scrambling, branching stems. The lovely pitchers are tubby and rounded, with a constricted waist and no wings. The mouth is wide and oval, with a beautiful scalloped-pink peristome, thick, tightly ridged, and sharp-toothed. Variable, the best forms have lower pitchers up to five inches, suffused in carmine with crimson blotches. Upper pitchers are pale greenish yellow and smaller. The flowers can also be handsome and colorful. An excellent plant for the windowsill and terrarium, it is also tolerant of brief temperature drops near the frost level.

Nepenthes alata

A common and widespread species from the Philippines to Malaysia, this species is extremely variable, and also grows in the lowlands. Many forms exist in cultivation. The common one has slim pitchers with a slight waist and a bulbous bottom, the lower pitchers with fringed wings. The peristome is thin, with an oval mouth and lid, but overall the pitchers are bland, with only a slight flush of pink. In a plant I grow called 'Highland Form', the pitchers are rather similar but more flushed with red. Other varieties may have green pitchers with attractive red peristomes. Forms called "boschiana mimic" look nothing like the very rare *N. boschiana* from Borneo, and instead simply have a more bulbous bottom. (*N. boschiana* is a species similar to *N. maxima,* but has not been seen since the early twentieth century.) A "hairy" or "pubescent" form of *N. alata* has large lower pitchers that are fuzzy and streaked with red.

This form of *Nepenthes alata* is often called spotted or striped and is one of the easiest *Nepenthes* to grow, often succeeding on windowsills.

By far the best variety of *N. alata* is *N. alata* var. 'Spotted Form' from

Luzon in the Philippines. This is a beautiful plant and very adaptable to warmer or cooler conditions, often excelling on windowsills or outdoors in warm-temperate and subtropical climates. The lower pitchers are plumper than the typical, with strong wings, and are heavily streaked and splotched with red, sometimes entirely cherry red with darker spots. This contrasts well with the pale interior of the trap. Upper pitchers are more funnel-shaped but also nicely colored. The peristome is thin.

Nepenthes maxima

This rather gorgeous pitcher plant is widespread and variable, growing from Borneo through Sulawesi to New Guinea. Mostly from the highlands, where in New Guinea some forms can experience frost, it can also be found in lowland areas. Typically the lower pitchers are six to eight inches tall, but can be larger. They are heavily blotched and streaked in crimsons on a pale green to olive background. Wings on the lower pitchers are prominent. The mouth is oblique, with an enormous, fanciful peristome that can be widely flared and fluted, colored pink to wine red. The interior pitcher is pale with reddish spots. The lids are often held upright, are oval to triangular in shape, and colored green suffused with reddish streaks and spots. Most curious is the hooked boss at the underbase of the lid, and a thin, filamentous "tooth" hanging from the tip. Usually the upper pitchers are smaller, extremely funnel-shaped, and lacking much color. A fine plant for terrariums and windowsills, this is one of the most popular species and is very easy to grow. It is also tolerant of brief cold snaps near the frost level.

The magnificent lower pitchers of *Nepenthes maxima*

Nepenthes fusca

Another beautiful plant, this species from Borneo is closely related and similar to *N. maxima*. The pitchers, up to ten inches, are much narrower, the peristome slightly so. One form, which I call "Coppermouth," has a coppery orange peristome while the pitcher is blotched and spotted in brownish red. The more popular variety has long, cylindrical pitchers

heavily marked in purplish red, with a stunning peristome so purple maroon it looks almost black. The unusual lids are very narrow and triangular. Upper pitchers are short and very funnel-shaped, sometimes spotted, with unusually narrow and downward-curved lids.

Nepenthes stenophylla

Related to *N. maxima* and *N. fusca,* this attractive species has long, narrow pitchers of a pale yellow green color with sparser purple blotches. The mouth and lid are circular, the narrow peristome striped purple and green. The heavily marked lid has a boss similar to its relations. Upper pitchers can reach a foot long.

Nepenthes sanguinea

This vigorous, fast-growing Malaysian species has large, plump pitchers up to a foot tall, a big oval mouth with a large, upturned lid, medium peristome, and prominent wings. The magnificent 'Red Form' has lower pitchers fully scarlet on their exteriors, with pale to spotted interiors and a cherry-red peristome. The upper pitchers are funnel-shaped and plump, pale green, with red spots along the upper portion of the trap, and a striped peristome. Other forms of *N. sanguinea* have uniformly yellow green pitchers, sometimes with red stems. This species may be a good windowsill candidate.

Nepenthes macfarlanei

From the Malay Peninsula, this variable species has heavy, fat pitchers with large mouths that are oval to

***Nepenthes fusca*, lower pitchers. This form comes from Mt. Kinabalu.**

***Nepenthes sanguinea*, an easy and fast-growing highland species. This is a lower pitcher of the large red form.**

teardrop-shaped, thick peristomes red to purple in color, and medium wings. The lids are large and oval. The lower pitchers can be pale brown to reddish tan, with irregular reddish to purple spots. Upper pitchers can also be large, usually a beautiful creamy yellow with interior red spots, heavily striped peristome, and red-blotched, large oval lids. See terrarium photo page 42.

Nepenthes gracillima

Also from the Malay Peninsula, this slender species has long, tubular, six-inch pitchers. The wings are reduced to two long ribs, making the pitcher appear flat-fronted. The lower pitchers have sloping, teardrop-shaped mouths with a thin red lip, pale interior and oval, horizontally held lids, and are reddish brown to blackish in color. Uppers have a more circular mouth and are often olive gray. A very pretty plant for terrariums.

Nepenthes tentaculata

Another small grower excellent for terrariums, this variable species comes from Borneo and Sulawesi. The flat front of the pitchers have handsome, bristly wings; the slanted mouth is almost triangular with thin lips. Usually the lids have tentacle-like hairs on the top of the lid, but not always. The pitchers are usually four to six inches long, and may be green, spotted, or red. See terrarium photo page 42.

Nepenthes tobiaca

Some taxonomists consider this Sumatran species to be a form of *N. reinwardtiana,* but to the hobbyist they appear quite different. Their pitchers are small, and they can scramble considerably when given the room, like a highland counterpart to *N. gracilis.* One form has small, brownish red, tubby pitchers on the ground, with uppers green with some red spots. Another form is all green and rather boring. The peristomes are slim; mouths and lids circular. This plant is happy in the terrarium or on the windowsill, and on my porch survived to the freezing level but died when frosted.

Nepenthes carunculata

This very colorful plant is from Sumatra. The lower pitchers are mahogany red to almost chocolate, with beautiful, wine-colored, flared peristomes. Upper pitchers are boring and green. Nice in tanks, the pitchers are under six inches long. (See terrarium photo page 42.)

Nepenthes spectabilis

This species from Sumatra has beautiful pitchers that are plump and cylindrical, with a creamy yellow background, purplish blotches, and dark peristome. The striped mouth of the upper traps can be almost vertical.

Nepenthes spathulata

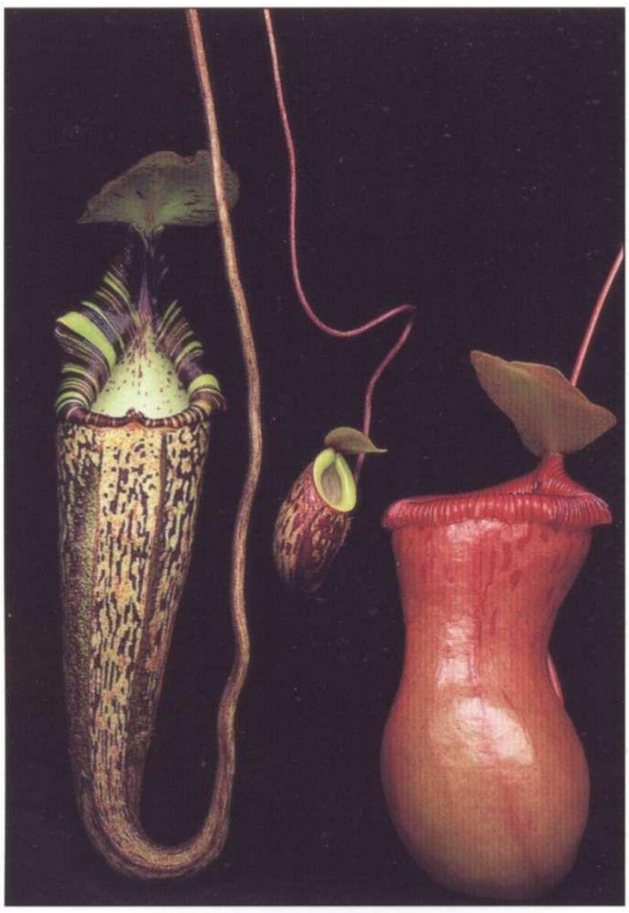
From Sumatra, this handsome plant has squat lower traps green in color with a wine-red peristome flared and wavy, almost rivaling that of *N. veitchii*. The upper pitchers are green and funnel-shaped and much less attractive. Easy to grow, it may get too large for a terrarium, but may succeed on windowsills. Cuttings easily root in water.

Nepenthes clipeata

On the verge of extinction, very few plants remain of this spectacular species due to overcollection and forest fires. It grows only on one cliff side on Mt. Kelam in Borneo, but has recently entered cultivation. The leaves are oval, and the tendrils bearing the pitchers come not from the leaf tip but its underside. The purplish pitchers are flask-shaped and can reach a foot in height. The peristome is striped and the unusual lid is a domed canopy over the oval mouth. The beauty of the plant is the way in which the pitchers seem to hover in air beside the leaves, their tendril attachments hidden from view.

Nepenthes madagascariensis

The first *Nepenthes* discovered was very rare in cultivation until recently, when it entered tissue culture. From Madagascar, its best feature is its upper pitchers, narrowly funnel-shaped, tinted claret, and with a yellow peristome and large oval lid. Lowers are often red and more typically tubby.



Left to right, the lower pitchers of *N. spectabilis*, *N. glabrata*, and *N. ventricosa*

The giant lower traps of *Nepenthes spathulata*

The dainty upper pitchers of *Nepenthes infundibuliformis* are shaped like miniature wine glasses.

Nepenthes infundibuliformis

Possibly a Sulawesi form of *N. maxima,* the lower pitchers are similar but squatter and orange brown in color. The tiny upper pitchers are startling—barely three inches tall, they are shaped like miniature wine glasses, with oval mouths and a very narrow lid. The pitcher rapidly constricts to the tendril, its interior sticky like flypaper, the digestive juices at the bottom viscid like syrup. This species has also been called *N. eymai.*

Nepenthes muluensis

From Mt. Mulu in Borneo, this charming small grower has five-inch cylindrical traps heavily blotched with purple on a creamy yellow background. In good contrast, the oval peristome and lid are almost pure white.

Nepenthes ephippiata

New to cultivation, this rare species from Borneo is most unusual, slightly resembling *N. lowii* and *N. rajah* (see below). The tubby pitchers are squat, slightly constricted at the waist, and about six inches tall. The large mouth has a narrow peristome. The main feature is the huge vaulted lid, the underside covered with peculiar, short tendrils. The coloration is fabulous: the outer pitcher is pale crimson while the interior is blood red. The lids are green with a red margin, turning fully red with age.

Nepenthes inermis

This is one of the strangest of pitcher plants. From Sumatra, the unusual upper traps are only one or two inches tall, papery thin, funnel-shaped with no peristome, and a thin, filamentous lid. They are pure green in color. It is believed that nectar on the tiny lid paralyzes small insects, which drop to the inner wall of the funnel trap and slowly slide into the digestive juices by means of a sticky, lubricating fluid.

Nepenthes glabrata

One of the daintiest and prettiest of the *Nepenthes,* this species comes from Sulawesi. The leaves are very narrow and lance-shaped. The small lower traps are smooth and tubby, barely one or two inches tall. The peristome is yellow, with a small oval mouth and lid. The pitcher background is lemon green, delicately marked with some red streaks as though hand painted. The upper pitchers are similar but larger and more cylindrical. Sometimes, tendrils and pitchers appear without leaves from the basal stems. In strong light some forms of the plant can turn purplish black. Certainly this species is a prize for any terrarium.

The upper pitchers of *Nepenthes glabrata* almost appear hand-painted.

Nepenthes hamata

When people ask me which is the scariest-looking and most dangerous *Nepenthes,* I usually point in the direction of this one, which sends shivers down most animal spines. A recent introduction from Sulawesi, it has also been called *N. dentata,* and was described in 1984. The lower pitchers are reminiscent of *N. maxima* and *N. fusca,* long and narrow, heavily blotched in purple, and with prominent wings. The upper lid is hairy. It is the highly evolved peristome that is so disturbing, for the lip has transformed into a row of long, curved hooks, sharp as knives, that overhang the pitcher's mouth. In the lower pitchers these teeth are purple black. The upper pitchers are pure green and the hooks particularly long—somewhat like a torture device from the Inquisition. One can only guess what

The upper pitchers of *Nepenthes hamata* can send chills down animal spines.

***Nepenthes villosa* on Mt. Kinabalua**

this plant may be evolving into. Pray that it doesn't start walking.

Mt. Kinabalu is Borneo's tallest and most famous mountain. Many of the species I have discussed grow there, but there are a few *Nepenthes* that grow nowhere else, or are found only on other nearby peaks. These include some of the most notorious and beautiful of the tropical pitcher plants.

Nepenthes burbidgea

A lovely species, it is native to Mt. Kinabalu and the adjoining Mt. Tamboyukon. The lower traps are up to a foot long, ovoid and stout, with moderate wings and a broad peristome, while the uppers are short, plump, and funnel-shaped. The coloration of the uppers is spectacular, the background a pale yellow white, marked with sparse, irregular rosy blotches. The peristome is striped with red and pale yellow. The large lids are heavily spotted in purple. Burbidge, its discoverer, described them as "pure white, semi-translucent like eggshell, porcelain-white with crimson or blood-tinted blotches." I have found this species easy to grow with nightly lows around sixty degrees. Cooler temperatures and the plant is reluctant to pitcher.

Nepenthes villosa

From the higher elevations of Mt. Kinabalu comes this popular, ground-scrambling species, where nighttime temperatures can drop to forty degrees. Upper and lower pitchers are similar. They are plump and roundish, up to eight inches tall, red orange in color, and covered with an animal-like pelt of fur. The lid is large and held horizontally. The spectacular peristome looks like a row of raised claws, sharp as razors and yellow in color. This is a slow-growing species that is easy to grow. Chilly nights in the fifties, with cool days, are required.

Nepenthes edwardsiana

From both Mt. Kinabalu and Mt. Tamboyukon, this species is very similar to *N. villosa,* but the pitchers lack the furry pelt and are long and

cylindrical. It is also a climber, up to forty feet, whereas *N. villosa* scrambles on the ground. The pitchers are golden to flushed red, the teeth of the peristome a similar series of raised hooks with downward-curved barbs. The long neck raises the lid far above the mouth.

Nepenthes macrophylla

Closely related to the above, this recently described species comes from Mt. Trus Madi, a neighbor of Mt. Kinabalu. The leaves are huge, up to two feet. The pitchers are more stout than those of *N. edwardsiana,* with a wide, gaping mouth. The teeth of the peristome are shorter and blood red.

Nepenthes lowii

Discovered by Hugh Low on Mt. Kinabalu, this famous plant also grows on several other tall peaks on Borneo. It may be the strangest of all *Nepenthes,* thanks to its bizarre upper pitchers. The lower traps are fairly normal and cylindrical, reddish brown, with a medium wide peristome. The oval lid is held horizontally and hints at peculiarities to come: under the lid hang many long, pointed appendages, like thin vegetable stalactites.

The stems grow tall, up to forty feet. The upper pitchers, up to several inches long, look like weird, constricted gourds. The peristome is entirely lacking, the mouth wide and gaping. The pitcher suddenly narrows to an extreme waist, then balloons to a bulbous bottom. The exterior of the trap is pure green, while the interior of the yawning mouth is shiny red to purple. The large

The mysterious eggs amid the bristles of the lid on *Nepenthes lowii*. Do they lure tree shrews for food?

The bizarre upper pitchers of *Nepenthes lowii*. Toilet bowls for birds?

lid of the upper pitcher is held vertically. It has the same strange, bristly projections as the lower trap lids. In cultivation, *N. lowii* is easy to grow.

A strange mystery surrounds this plant. Often, in the bristles of the lid, an oozy white substance is secreted, often taking the form of egglike beads. It does not attract insects. Professor J. Harrison, in the early 1960s, assumed they were snail eggs, and reportedly saw small tree shrews eating them. That *N. lowii* catches these small mammals has yet to be documented. It wasn't until plants entered cultivation that the "eggs" were discovered to be a product of the plant by grower Cliff Dodd and myself. Botanist Charles Clarke has observed birds and shrews feeding on the "eggs," while their excrement falls into the pitcher!

Nepenthes rajah

When Hooker described this species, also discovered by Hugh Low on Mt. Kinabalu, he wrote, "This wonderful plant is certainly one of the most striking vegetable productions hitherto discovered...", and it remains so to this day. Also found on Mt. Tamboyukan, *N. rajah* grows along the ground as a scrambler. The large leaves are blunt and truncated, and the tendril originates from the middle underside. The enormous pitchers are oval-shaped, almost woody in texture, red to purple in color, with a large, gaping, oblique mouth. The thick, fluted peristome is blood red. The interior of the tublike traps is pale green to pink and has no waxy zone, being entirely covered with large digestive glands. The giant lid is vaulted, red above and lime green below. The pitchers can be over a foot in length, and can hold over two quarts of digestive juices, but there have been specimens known to hold four quarts. The flower spikes can also be impressive, standing as tall as four feet. Climbing stems are rare.

Nepenthes rajah **at the Park Headquarters on Mt. Kinabalu**

N. rajah is the only pitcher plant truly documented as having caught rats. It is believed the mammals were in search of water when they fell in and drowned.

Highland Hybrids

Until recently, hybrids of highland *Nepenthes* have been rather rare in cultivation. Lowland plants have always been more popular to grow, because it's easier to heat greenhouses in winter than to cool them during warm summer nights. Also, areas where cool summer nights prevail (all of the lands west of the Rockies) were much less populated in the Victorian era when growing *Nepenthes* was so much in vogue. This has changed, of course, particularly with the invention of air-conditioning and evaporative coolers, which are helpful in reducing summer heat in greenhouses to temperatures more pleasing to mountain plants. Interior terrariums, especially in basements, have also added to the growing interest in breeding more vigorous and beautiful hybrids that are happy in cooler temperatures. Some of the following crosses have lowland ancestry, and thus can also do well in warmer conditions.

Nepenthes x *ventrata*

This hybrid, which is also tolerant of lowland conditions, is a vigorous plant with graceful, curvaceous pitchers intermediate between its parents *N. ventricosa* and *N. alata.* Variable parents give rise to variable offspring, so some are boring and green, while those from more colorful parents are bronzy and pleasing. A good terrarium and windowsill candidate.

Nepenthes x *emmarene*

This handsome cross between *N. khasiana* x *ventricosa* is happy in warm conditions yet is also tolerant to the frost level. The short pitchers are squat and cylindrical, tinted red with darker vertical streaks. Superb on windowsills or in humid, frost-free climates outdoors.

Nepenthes x *rokko*

A Japanese hybrid of *N. thorelli* x *maxima,* the clone I grow myself is one of my favorite *Nepenthes.* Lower pitchers reach eight inches, with a scalloped red peristome and many red streaks and spotting. Upper pitchers are funneled and green, with less color. A vigorous plant, its stems can climb seven feet in one year. It thrives in humid, frost-free climates and as a houseplant, but is too large for tanks. It also succeeds in lowland conditions.

Nepenthes thorelli x (x *wittei*)

My clone of this plant is a very vigorous and handsome hybrid similar to *N.* x *rokko* but darker in color.

Highland Hybrids

Related hybrids, left to right: *Nepenthes* x *rokko;* lower and upper pitchers of *N.* (x *rokko*) x *thorelli; N.* x Santa Mira var. 'Jack Finney;' and *N. thorelli* x (x *wittei*)

Nepenthes x *tiveyi*

Nepenthes x *mastersiana*

Nepenthes (x *rokko*) x *thorelli*

A variable plant, the clone I grow has beautiful lower pitchers that are squat and tubby, with a large, heart-shaped peristome ruby red in color. Much red markings cover the pitchers, the lid is oval and the wings strong. The upper pitchers are a buttery yellow with pale pink splotches. Superb on windowsills.

Nepenthes x *Santa Mira*

This was my own cross between *N.* [*thorelli* x (x *wittei*)] x (x *rokko*). All of the offspring were similar to their attractive parents, but even more richly colored. One clone, N. x 'Santa Mira' var. 'Jack Finney' produces numerous dark red pitchers with extra large floppy lids. Jack Finney is the author of *Invasion of the Body Snatchers* and Santa Mira was the location of that invasion in the 1956 film version of the novel.

Nepenthes x *mastersiana*

In 1883, Court produced this for Vietch Nurseries by crossing *N. sanquinea* and *N. khasiana,* and it was one of Sir Harry's favorite. It has large cylindrical pitchers with an oval mouth and lid, and the coloration is vibrant, especially in the cultivar *N.* x *mastersiana* 'Purpurea'. Try this one on a windowsill, or in cool greenhouses and terrariums.

Nepenthes x *tiveyi*

An utterly beautiful hybrid of *N. maxima* x *veitchii,* it has colorful pitchers and a rainbow peristome of large, flared proportions. Gorgeous, and suitable for warm or cool tanks.

Nepenthes sanquinea x *macfarlanei*

A beautiful plant with chocolate-red pitchers and red peristome—offset by a pale interior—it does best in cooler conditions.

Nepenthes x *harryana*

Named for Harry Vietch, this natural hybrid looks much like its similar, beautiful parents, *N. villosa* x *edwardsiana.*

Nepenthes x *kinabaluensis*

Discovered by Lilian Gibbs (the first woman to climb Mt. Kinabalu) in 1910 and named by Shigeo Kurata in 1976, this is a natural hybrid between *N. rajah* and *N. villosa.* Requiring cool conditions, the large pitchers measure one foot, are yellow with an orange blush, and have a gaping mouth with a scalloped, well-toothed, red peristome. The pitchers have a slight furry pelt and huge vertical lid.

***Nepenthes* x *kinabaluensis* on Mt. Kinabalu**

***Nepenthes* x 'briggsiana' var. 'Peter D'Amato'**

Nepenthes x *trusmadiensis*

A rare hybrid of *N. macrophylla* and *N. lowii,* it was discovered by Johannes Marabini and John Briggs in 1984 on Mt. Trus Madi. A fantastic plant, the huge pitchers are cylindrical to funnel-shaped, pure green, and with a spectacular green-and-red, sharp-toothed peristome. The yawning mouth reveals a beautifully red-blotched interior. The lid is large, dome-shaped, and held vertically.

Nepenthes rajah x *burbidgea*

One of the most breathtakingly beautiful of the natural hybrids, it comes from Mt. Kinabalu. The one-foot pitchers are tubby, with a pale, rose pink background heavily splashed with purplish marks. The large, undulating peristome is striped crimson and plum. The large lid is heavily streaked and smeared with dark red.

Nepenthes lowii x *stenophylla*

Discovered in 1985 by John Briggs on Mt. Mentapok in Borneo, this closely resembles *N. stenophylla* but has dusky, red-streaked pitchers with bristles under the lid.

Nepenthes stenophylla x *veitchii*

This hybrid has been recently found in a few locations in Borneo. It is a beauty, with wine-red pitchers marked in burgundy, and a gorgeous, large, fluted peristome, golden-yellow with a few burgundy stripes.

Nepenthes x *briggsiana*

This lovely and vigorous hybrid of *N. ventricosa* x *lowii* was created by

Johannes Marabini in Germany, and can be rather variable. The pitcher shape is wide-mouthed with a thin-toothed peristome, narrowing to a waist, with a bulbous bottom. The lid is large and held upright. One variety, named *N.* x 'Peter D'Amato' by Bill Baumgartl, has smaller pitchers solidly colored blood red. Other clones have rather sizable pitchers with paler coloration.

Nepenthes x *Judith Finn*

Produced by Marie's Orchids in California, this is a breathtaking hybrid of *N. spathulata* x *N. veitchii,* both famous for their wildly flared peristomes. The variable offspring were named for the popular assistant manager of Berkeley Botanical Gardens at the University of California, a longtime CP enthusiast. Several varieties of this cross may soon achieve clonal status.

CULTIVATION *(See Parts One and Two for further details)*

Soil recipes

Nepenthes enjoy loose, open soil that remain wet to moist but allows drainage of excess water. They are tolerant of a wide variety of soil mixes. The best include a portion of long-fibered sphagnum, the rest of the medium being a combination of coarse materials. My deluxe recipe is one part each of the following: long-fibered sphagnum, peat moss, perlite, pumice, lava rock, vermiculite, fine orchid bark, and charcoal. An easy and reliable alternative is: one part peat or long-fibered sphagnum, one part fine orchid bark, one part perlite, one part vermiculite. Another good mix is one part sphagnum to two parts osmunda fiber.

Containers

All containers must have drainage holes. Place a thin layer of sphagnum at the bottom of the pot to prevent the gradual loss of soil through the holes. This will also retain some moisture should the soil accidentally become too dry. Plastic pots work well, as do terra-cotta or glazed ceramics. Even better are wooden boxes or orchid baskets. Avoid metal zinc baskets, which poison *Nepenthes.* Four-inch pots suit young plants; six- to ten-inch pots (or larger) suit mature plants.

Light	Most *Nepenthes* enjoy very bright, diffused light or partly sunny conditions. Lowlanders often can take bright shade. Greenhouses generally require 50 percent shade cloth.
Climate	All *Nepenthes* are tropical plants, roughly divided into lowlanders and highlanders. Lowlanders require temperatures in the sixties and seventies at night, eighties and nineties during the day. Colder temperatures, even briefly, may stunt or kill them. Highland species require temperature drops at night. Highlanders do best in the fifties and low sixties at night, in the seventies and low eighties during the day. Many highlanders tolerate brief nighttime drops to the forties, if day temperatures rise. Exceptions are mentioned under the species listing. Humidity must be high all of the time, above 60 percent. Highland plants can experience more humidity fluctuations, with the highest humidity at nighttime.
Feeding	Any suitably sized insects can be fed to these pitcher plants, such as crickets, sow bugs, and mealworms. Dried insects are also excellent.
Fertilizers	Nepenthes appreciate fertilization. During the warmer months, apply twice monthly. In winter, once a month will suffice. Apply as a foliar feed, or also through the soil if plants are heavily watered at other times with pure water. Use a 50 percent solution of an orchid or epiphytic fertilizer. Avoid Miracid, which can stunt many Nepenthes.
Greenhouses	*Nepenthes* grow best in greenhouses. Lowlanders require stove houses or hot houses; highlanders do best in warm houses, but some tolerate cool houses. Many can be grown together at roughly sixty degrees minimum, eighty-five degrees maximum. While many highland varieties can tolerate hothouse conditions, lowlanders can be damaged at cooler temperatures. Hybrids are much more tolerant of temperature fluctuations, but are heavily influenced by their parentage.

Watering	In greenhouses, avoid the tray system entirely and place the containers on benches or hang them so that water can freely drain away. In terrariums and on windowsills, place the pot in a shallow saucer and water overhead as soon as the water in the saucer evaporates. Don't allow the pot to sit in deep water for extended periods. Greenhouse plants should be watered every day, or before the soil dries out. Always water overhead. If the medium dries out, the pitchers may shrivel and brown very quickly, even if the leaves and stems survive.
Windowsills	A surprising development in recent years has been experimental growing of *Nepenthes* on windowsills—with often wonderful results. Bright light to partly sunny conditions are necessary, and high humidity with frequent misting is helpful. Of the many plants found to thrive in good conditions, I can recommend *N. alata* "Spotted," *N. khasiana,* and *N. ventricosa* as the first to try. Some lowland hybrids with highland ancestry are also possible, such as *N.* x *dyeriana.* See the individual listings of species for further recommendations. If the plants don't pitcher, low humidity and light are usually why. The tendrils of upper pitchers will need something to grasp.
Terrariums / Grow-lights	Larger tanks are an excellent way to grow *Nepenthes.* Lowlanders may require heating pads to maintain a sixty to seventy degree minimum. Highlanders will thrive in homes that are chilly at night: fifty to sixty degrees. Choose smaller species, and prune back extensive climbing stems. The best species to try are *N. ampullaria, N.* x *trichocarpa, N. alata, N. mirabilis, N. gracilis, N. ventricosa, N. glabrata,* or young plants of larger species—but these will eventually outgrow the space. Lowlanders can take warm and steamy tanks; highlanders appreciate good air circulation and misting at nighttime.
Outdoors	If you live in a tropical climate similar to their native habitats, *Nepenthes* make wonderful potted outdoor plants, especially near latticework or trellises in partly

	sunny areas where they can climb. In humid subtropical or warm-temperate climates, outdoor growing can be tricky, due to seasonal fluctuations, so plants are best moved indoors or to greenhouses for winter. In places like southern Florida, many lowlanders and hybrids succeed year round outside, but you must protect them during rare winter chills. On the immediate coast of California, in the frost-free fog belt, many highland species can thrive. As a rule, they despise frosts and periods of hot temperatures with low humidity.
Bog gardens	*Nepenthes* are not suitable in bog gardens.
Pruning and transplanting	Mature *Nepenthes* can survive many years in large pots, but will require pruning of larger stems. This will also encourage new basal shoots to develop, and the cuttings can be used for propagation. Typically, mature plants develop one or more basal shoots annually. These form ground rosettes for one or two years before beginning to climb. It you prefer lower-growing plants with ground pitchers, pruning stems will not harm the plant. Never remove a climbing stem until a basal shoot has developed. Climbing stems require something to climb: other plants, hangers, pipes, lattice, and so on. Very old plants that need repotting should have all stems and most basal rosettes removed. Discard old soil and trim away excess roots, then soak in Superthrive and repot.
Pests and diseases	The primary pests of *Nepenthes* are thrips and scale, and rarely mealybug. Systemic insecticides work best. Flea collars help in terrariums. Sometimes the plants are bothered by a fungus that causes rusty spots on the leaves. Treat with a fungicide.

PROPAGATION

Nepenthes *are easy to propagate by seed and stem cuttings.*

Cuttings

Propagating Nepenthes from stem cuttings is the fastest way to obtain large plants, and the only way to multiply cultivars besides tissue culturing.

Along the climbing stem, and adjacent to each leaf base, are dormant nodules or shoots. Occasionally these grow on their own, producing branching stems. If the growing point of a stem is removed, nearby shoots start to grow, replacing the removed portion.

Some growers take cuttings a little at a time, removing the growing point for propagation and waiting until new shoots sprout before removing that next section. Alternatively, a whole climbing stem may be removed and divided into sections. Sections of the stem should have from one to three leaves attached. If multiple leaves are attached, remove the lowest. Remaining leaves should be cut in half. The lower portion of the cut stem is then treated with a fungicide/rooting hormone such as Rootone (a powder) or Dip and Grow (a liquid), following the manufacture's instructions. Insert the cuttings into pots of medium. A good medium to use is pure long-fibered sphagnum, or vermiculite, or a combination of the two. Rock wool is superb for rooting *Nepethes*. The entire block of rock wool can be planted in soil once the cutting has rooted. Keep the medium damp at all times and place the potted cuttings into a propagation case, terrarium, or similar enclosed tank to ensure very high humidity. Place in bright light, but out of direct sun, at a temperature range similar to that of the mother plant. Mist frequently, keeping the medium damp.

Cutting a *Nepenthes* vine for propagation.

Rooted cuttings with emerging shoots, ready to be potted

Within weeks to months the cutting should root, and the dormant bud sprout. It can then be transplanted and grown normally. Not all cuttings may survive. Remove dead ones from your propagating case. Superthrive and fertilizers can be used once the cutting has rooted.

There is a hormone available to promote growth of dormant shoots on plants, and these are often advertised in orchid magazines, such as *Orchid Digest*. These shoot promoters are usually pastes applied to the dormant bud. They are helpful to promote new shoots on a stem, which can later be removed as cuttings to be rooted. They can also be applied to cuttings with dormant buds, in addition to rooting hormones along the cut stem.

Some vigorous *Nepenthes* can be rooted in plain pure water, if all other conditions (such as high humidity) are right. Change the water frequently.

There are other ways to propagate stem-growing plants like *Nepenthes*, such as layering and air layering. Consult good books on gardening and houseplants for more techniques such as these. The above methods are still the most popular.

Pollination

To produce seed, male and female plants need to be in flower at the same time, or pollen can be stored in the freezer up to one year for future use. When they bloom, individual flowers open several at a time, working their way up the spike. To pollinate, pollen from a male flower needs to be transferred to the stigmas of females. One method is to remove a ripe

male flower by clipping it and, using forceps, dab the pollen onto the stigmas. Alternatively, one can shake the male spike over a sheet of plastic or aluminum foil. Ripe pollen will fall, and can be collected with a small paintbrush and transferred to the female. Flowers continue to open up the spike over a few weeks' duration. It is best to repeat pollination to assure good seed set. When you're successful, the female ovaries will swell over several weeks, turn brown, and crack open, revealing seed. Pollen can be stored in foil packets in the freezer. Be sure to label flower spikes that have been pollinated, as well as any stored pollen.

Seed

Nepenthes seed is short lived and should be sown as soon as possible. It can be stored several weeks in the refrigerator (do not freeze seed), but this can kill seed of lowland species. Good mediums to sow seed onto include milled sphagnum, a mix of peat and sand, or vermiculite. Keep the soil damp and sow sparsely. High humidity, as in a covered seed tray, is required. Keep the seed in an environment similar to that of the parents, but out of the direct sun. Grow-lights are useful—keep the seed within several inches of fluorescent tubes.

After the seed has germinated, remove the cover. Allow seedlings to grow until small rosettes are formed (six months to one year). Gently remove them and transfer to small individual pots of their preferred soil recipe. Watering seedlings with a weak solution of Superthrive will encourage good root growth. Fertilizing should be done with care, using a quarter strength solution the first year, once monthly.

Tissue culture

This works well using seed as the generating source, and has recently resulted in many once rare species becoming common and affordable. Vegetative tissue culture is still being perfected.