ON THE CULTIVATION OF
THE GIANT MALAYSIAN
PITCHERPLANT

(NEPENTHES RAJAH)

By Thomas C. Gibson
Department of Biology, University of Utah, Salt Lake City, Utah 84112

Nepenthes rajah ranks among the most
spectacular pitcherplants in the world:
large crimson traps with massive frilled
rims (see Plate 19 in Kurata 1976). It
also has a solid reputation for being dif-
cult to grow (e.g. Douglas 1884). Miller
(1906) states, “To grow the Rajah may
well be regarded as the summit of the
gardener’s skill.” Despite many intro-
ductions, the species remains extremely rare
in cultivation. Failure to grow this re-
markable carnivorous plant stems, in my
opinion, from a poor understanding of
its cloud forest environment on Mt. Kin-
abalu. In this article, I describe my lim-
ited success with N. rajah, particularly
how I have tried to simulate its natural
environment at the University of Utah.
Since this pitcherplant is considered en-
dangered, failure to cultivate it has im-
portant consequences for the conservation
of wild populations on Mt. Kinabalu (see
article by Dr. Faith T. Campbell in this
issue).

Many years ago the Director of Sabah
National Parks sent me a small packet
of N. rajah seed for my research. I now
have 12 robust plants, each over 9 inches
diameter. If they continue to grow
at present rates (1 new leaf/month and
1.75x size increments), they should be
mature within 1 year. I suspect this giant
pitcherplant can be raised from seed to
maturity in less than 4 years.

Natural Conditions on Mt. Kinabalu

N. rajah grows in cloud forest between
1650 and 2650 meters elevation on Mt.
Kinabalu. Kurata (1976, page 61) de-
scribes its habitat as “sunny and wet”
and “fond of wet places like swamps or
the surroundings of a water fall.” To
the best of my knowledge, this is the only
published description of N. rajah’s habi-
tat. For a general description of cloud
forest environments, see Grubb (1977),
Whitmore (1975), and Lawton (1988).

In 1972 I visited Mesilau Creek. Here
the pitcherplants grow among short gras-
ses on a steep slope under a stunted
forest (15 feet tall) over Oligocene ser-
pentine. Seedlings were common only on
a recent landslide. N. rajah, like most
carnivorous plants, colonizes semi-bare
ground created by disturbance.

Due to the open canopy of the stunted
forest, the pitcherplants are exposed to
the full sky. At these elevations, light
conditions are a bright haze with short
periods of full sun, usually in the cool
morning. The broad leaves of N. rajah,
therefore, are rarely exposed to long per-
iods of full hot sun. Throughout the day,
frequent mist and cool air temperatures
keep leaves from burning.

Rainfall at these elevations on Mt. Kin-
abalu may exceed 150 cm per year, dis-
tributed evenly throughout the year (data
for Kambanganoh, see Lowry et al. 1973).
During the day, humidity may fluctuate
at ground level, but at night, as tempera-
tures drop, local humidity may rise to
saturation.

Unfortunately, I have not found data
for day and night temperatures at any
N. rajah site. From my brief visit to Mes-
lau Creek, however, I would guess 65°-
70° (day) and 55°-60° (night).

In general, cloud forest soils are peaty,
here acidic, nutrient-poor, constantly
wet, and sterile (see Grubb 1977). Due
to serpentine, soils at N. rajah sites may
also be toxic. Extended periods of heavy
rainfall may oxygenate the peat layer and hence release nutrients stored in organic matter.

A pitcher of *N. rajah* captures substantial amounts of insect biomass during its lifetime, as much as several grams for the largest traps (personal observation). Pitcher contents can only be described as a “foul swill” of putrid insect victims, dead leaves, and twigs.

**Greenhouse Conditions at the University of Utah.**

During those rare moments when the sun shines, the cloud forest environment feels like perpetual spring. It is like standing in the brilliance of the driving cool mist from a waterfall. This contrasts markedly with the dark, oppressive, hot, stuffy artificial greenhouse environments created by growers for lowland *Nepenthes* species.

In general, I grow *N. rajah* “hard” (high light, cool temperatures, fluctuating humidity, low soil nutrients). In my opinion, it is a serious mistake to grow this species “soft” (dark, warm, constant high humidity, fertilizer in soil). Under such soft conditions, plants produce thin, over-sized leaves and no traps. In this weakened state, they become prone to stress and disease. From correspondence with my trading buddies, I know of several scores of *N. rajah* plants which have died under soft conditions.

In my opinion, the 3 most critical aspects of cultivating *N. rajah* are:

1) **Mist plants heavily, at least 5x per day.** This pitcherplant species will not produce traps unless heavily misted. In fact, its threshold for trap production occurs at much higher humidities than those of other *Nepenthes* species, probably because its open bowl pitcher form has high evaporation rates from it and will not function efficiently at lower humidities. Hence, there has been natural selection for plants which produce traps only at the highest humidities.

2) **Increase light levels, just short of burning.** I find that traps form only at high light levels. In fact, trap size increases with light intensity and appears due entirely to instantaneous photosynthetic input from its particular leaf. If leaves are misted regularly and air temperatures are lower, leaves will not burn as readily at higher light levels.

3) **Feed traps insects, not fertilizer.** Once traps have formed under high mist and high light conditions, the only direct way to put nutrients into a plant is to feed traps with insects. *N. rajah* has a poorly-developed root system and therefore fertilizer on the soil will not get into the plant readily. Instead, it will promote microbial activity, which can cause the plant to rot, especially if grown soft. Obviously, feeding insects through pitchers does not risk the possible loss of an entire plant. I also find that putting fertilizer into traps causes an internal imbalance in nutrients, which eventually stops whole plant growth. Furthermore, it is difficult to know how much fertilizer to put into a given trap, whereas insect biomass can easily be estimated from natural capture rates. Fertilizer in pitchers can also increase microbial action and therefore wipe out important enzyme systems for insect digestion.

I feed 1/2 of the pitcher volume with insects over 10 - 15 days, which grossly approximates natural capture rates. Small traps receive small ants and flies, whereas large traps get large insects, as many kinds as possible. I maintain fluid levels in traps with a pipette. If fed too much insect biomass, the top of a trap will die. Fed traps will turn from red to green. A UV light trap will catch pounds of insect biomass, which can then be frozen for future use.

Insect resources may be particularly important for *N. rajah*. This beast may be more-dependent on insect resources than other *Nepenthes* species. Undoubtedly, its large, long-lived, woody traps would have higher metabolic costs to produce than those of small, short-lived, flimsy traps, especially if they were less photosynthetic compared to green traps. By inference, the benefit derived from *N.
rajah's traps must also be greater. To ascertain the truth of this hypothesis, I have been constructing growth rate curves for various Nepenthes species as a function of the amount of insect biomass fed to plants. The slopes appear to be steeper for N. rajah.

I pot my plants in Canadian peat moss and white quartz sand (1:1). As the peat breaks down, it releases nutrients to the plant. This may be particularly important for establishing small seedlings or weak plants. Since the sand is coarse (#8 sand blasting silica grit), drainage is fast. I repot every 2 years or whenever the peat breaks down. There will be little disturbance to fragile root systems when repotting if you wash the soil mixture away from the plant. Moss stabilizes the soil surface.

I water plants heavily each morning with 99.95% pure water (reverse osmosis, then deionized; 18 meg-ohm). I use a fog nozzle so that the water will be heavily oxygenated.

Day temperatures are about 70°. I have found that newly-expanding leaves will develop black blotches of sun-burn if exposed to higher temperatures, especially during the summer, when light levels are naturally highest. Night temperatures are between 55° and 60°. During the summer, an evaporative cooler maintains night temperatures about 70°. Cool night temperatures during the summer may be crucial for success with this species.

One word of caution: a weak N. rajah plant must adapt gradually to the limits of this “hard” environment. If grown “soft”, it will be badly stressed under such harsh conditions. It will become yellow and re-veined, grow slowly, and probably back-slide in size. When first placed under my conditions, soft-grown Nepenthes typically shrink to ½ their size. I find that N. rajah adapts slowly. A plant will begin to change appearance only after 3 or 4 months of feeding traps with insects. It will produce larger, deeper green leaves and considerably larger traps. At this point, light levels can be increased again. Only a well-fed plant can tolerate higher light levels.

Readers who wish to obtain their own N. rajah plants should know that the Giant Malaysian Pitcherplant is considered an endangered species (only 2 small populations are known to exist within Kinabalu National Park). It is fully protected by Malaysian wildlife laws and by CITES. Do not buy illegal field-collected plants. Such plants invariably die within 3 months.

The author would like to correspond with other carnivorous plant enthusiasts who have attempted to grow N. rajah in order to learn better how to grow this remarkable beast. Since I plan to keep my 12 plants as stock to create hybrids with other Nepenthes species, I do not wish to trade or to sell any plants at this time.

Literature Cited.


(See front and back covers, this issue, for photos of N. rajah grown by Thomas Gibson.)
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CO-EDITORS:
D. E. Schnell, Rt. 1, Box 145C, Pulaski, VA 24301
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Seed Bank: Patrick Dwyer, St. Michael’s Episcopal Church, 49 Killean Park, Albany, NY 12205, USA.

BUSINESS MANAGER: Mrs. Pat Hansen, c/o The Fullerton Arboretum

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