The Genus Heliamphora

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Of all the insectivorous plants in cultivation, the genus *Heliamphora* is still, perhaps, the rarest and least understood. Differentiating species has been confusing in the past because of the wide variation in the appearance of the plants growing under different conditions. In this article, I will present a simplified key for species identification as well as some background and cultivation information.

Introduction

The first description of *Heliamphora* was given by the English botanist George Bentham, who described *Heliamphora nutans* in 1840.(1) The name *Heliamphora* was derived from Greek, meaning "marsh pitcher." (2) Since then, *H. macdonaldae*, *H. tatei*, and *H. tyleri* were described in 1931 (3), *H. minor* in 1939, *H. heterodoxa* in 1951, and finally *H. ionasii* and *H. neblinae* in 1978.(4) Subsequent reviews of the species by Maguire(5), Steyermark,(4), and most recently, Steyermark and Berry(6) have revised the genus into 5 distinct species with a number of subspecies. I had an opportunity to spend time at the Herbario Nacional of Venezuela (VEN) in Caracas studying their extensive herbarium collection of *Heliamphora* specimens, and the following is a condensation of my own observations, and the previously written treatises on the genus.

Species

• In studying field, home grown, and herbarium specimens, it quickly became clear that leaf shape and size is unreliable in species identification. *H. minor* has been reported to grow over 30 cm tall, whereas I have seen *H. heterodoxa* with nutans-shaped leaves and *H. ionasii* only 8 cm tall as a full-grown adult plant with narrow tubular leaves. Because of this, the most reliable method of differentiating species is probably based on the flower. Secondary leaf characteristics can then be used to confirm the identification.

The most recent review of Steyermark and Berry has classified *Heliamphora* into 5 species: *1) minor, 2) nutans, 3) heterodoxa, 4) tatei* complex, and *5) ionasii.* Table 1 summarizes my key to identification of these plants. Basically, the genera is divided into 2 groups based on the size of the flower anthers. Anthers larger than 4.5mm are considered large and comprise the species of *H. heterodoxa* and *H. tatei*. *H. nutans*, *H. minor*, and *H. ionasii* all have small anthers in the range of 2.5-4.0 mm. Next, the presence or absence of hair on the flower pedicel will help to further differentiate species. *H. nutans* and *H. heterodoxa* do not have hair present on the pedicel, even when the most distal part of the pedicel is examined under magnification. (20-30x magnification may be needed to see some of the fine hairs, which may only be present just at the junction of the flower with the stem). Finally, the number of anthers present and secondary characteristics mentioned in the key will help to confirm the plant's identification. Table 2 summarizes secondary characteristics which can be used to help confirm a determination, or when flowers are not available for examination. Note that the information in Tables 1 and 2 apply only to mature, adult plants. Juvenile plants cannot be identified with any certainty.

Using this key, all of the herbarium plants with flowers could be quickly and easily identified, with the exception of plants originating from the Chimanta Massif mountain range in southeastern Venezuela, where plants share traits of both *H. minor* and *H. heterodoxa*. *H. minor* from this area typically grow quite large (like *heterodoxa),*

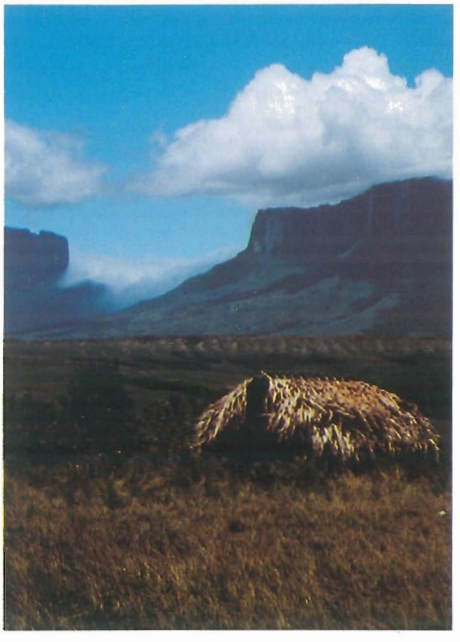

Figure 1. Typical Venezuelan Tepuis - Mt. Roraima on right, Mt. Kukenan on left. In the Gran Sabana, Bolivar State, Venezuela.

Figure 2. *H. nutans* in habitat, Mt. Roraima, southern ridge, 7000'.

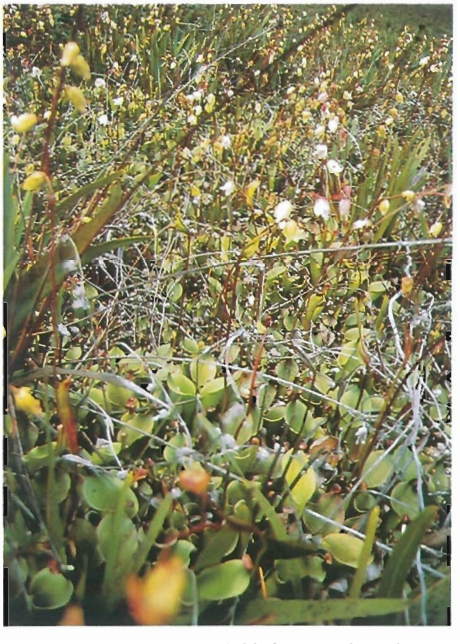

Figure 3. Lowland *H. heterodoxa* in habitat, Gran Sabana - 4000'.

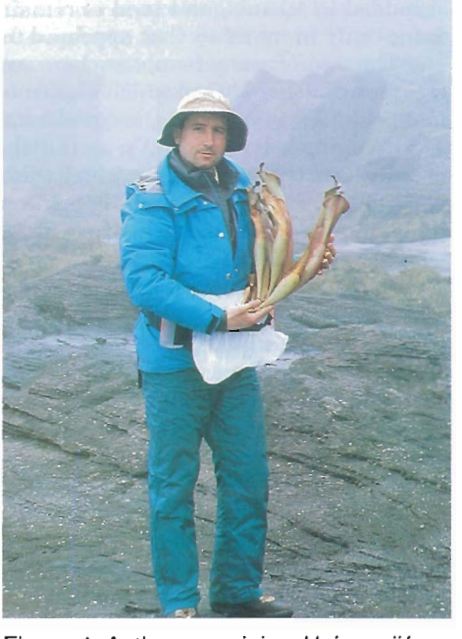

Figure 4. Author examining *H. ionasii* from 1st tier below the summit, Mt. Ilu. Fog in background is common.

while *heterodoxa* often show an uncharacteristic presence of pedicel hair. To investigate this further, I marked all the known locations of *Heliamphora* on a map. I found that only *H. minor* and *heterodoxa* have any ranges with significant overlap. The two species also share broad habitat tolerances, growing at both ground (4000') and mountain (7000 - 8000') elevations. I feel that this suggests that the mixed characteristics of plants from this area may be due to natural hybridization. A number of growers have now bred hybrids from these species, and it will be interesting to observe what traits are carried by the offspring to see if my hypothesis is supported.

Growing Conditions in Nature

I have seen all the species except for the tatei group in their natural habitat in Venezuela. Both *H. minor* and *H. heterodoxa* have been located in the Gran Sabana at elevations as low as 4000'. Temperatures at that level range from the 70-90 degrees during the day to about 50 - 70 degrees at night. These lowland *heliamphora,* however, always grew in areas of seeping ground water, and it is quite likely that the actual growing climate they experience is cooler because of the spring water. The majority of the plants grow at the higher altitudes and cooler conditions on top of the tepuis. A tepui (pronounced tey-PU-ee) is one of the flat, tabletop mountains formed by the unique sandstone geography of Venezuela. Most of the tepuis are at a height of 6000-8000', and probably average temperatures of 60-80 degrees Fahrenheit during the day, and 48-60 degrees at night. The plants are always found in areas of high rain and mist. On a typical day when I was present, it would not be uncommon for it to rain all night long and over half of the day on the tepui top, and I was there during dry season! There is little water reserve on the top of the mountain, and the soil tends to drain and dry quickly without the frequent rains. Although Dr. Paul Berry reported to me that he has observed the tepuis go dry for days, the tops of the mountains typically sit shrouded in clouds, and tend to remain wet year round. Ground-level plants were found only in marshes that appeared to remain wet throughout the year.

The tops of many tepuis are bare sandstone. The natural weathering of the rock creates a pink, sandy soil which would be quickly washed away if small, quick-growing plants like *Xyris decussata,* a grasslike plant, were not present to help retain the soil. The decaying leaves of the *Xyris,* and their fine roots retaining the soil underneath it usually form the substrate in which the heliamphora grow. The pitcher plants usually place only a small number of roots into the organic media to anchor themselves, and to help provide water during rare dry spells. Roots often extend several feet down when the organic layer is deep. A large rhizome is formed as the plant adds new pitchers over time. Many of the species send out runners similar to *Darlingtonia* and *Sarracenia* to the extent that a single large plant with its offshoots may occupy several square feet.

Dry season in southern Venezuela extends from October-November to March, with the months of January and February usually the driest. *Heliamphora* will usually start blooming near the end of dry season, usually in January and February. Plants set seed in approximately 1-2 months. It was interesting to observe that on any flower spike, the first flowers to open rarely developed seed, and the second or third flower always developed the largest seed pods. Plants appear to have their stigma mature before their pollen is released, so self-fertilization is unusual. This concurs with the observations made by Schnell in his homegrown plants(7). I did not observe the flowers being pollinated. Renner states that bumblebees and carpenter bees are the primary pollinators of *H. tatei var. neblinae* (8), although I did not observe them on my trips on the Roraima-chain plants. Maguire stated that "birds are the most commonly observed pollinators (on the tepuis) (9). I did observe one hummingbird

flying around a group of heliamphora on Mt. Ilu.

Examination of the contents of traps on the surface of the Roraimachain tepuis revealed a paucity of insects. Most were filled only with rain water. Indeed, in general, there were few insects seen on these tepuis. Plants found in the Gran Sabana had a much higher insect load, and mosquitoes were found breeding in some of the pitchers.

Examination of the Roraima chain plants show that they grow very slowly, adding only about 3-4 leaves per year on mature plants. This may be from a combination of low temperatures, the harshness of the growing conditions, and the relative lack of nutrients, even from insectivorous prey. This also points out the fragility of their environment. A few hikers passing through a heliamphora bog may cause damage requiring an entire year to recover!

Plants appeared to grow well in a wide range of conditions ranging from full sun exposure to heavily shaded rock crevices. As might be expected, plants that received a lot of sun exposure in general had more intense coloration and smaller size. The largest plants were always found in very damp areas with diminished sun light and protection from wind exposure. A fourfold difference in size for the same plants growing in different condition extremes was common.

Growing Heliamphoras at Home

Despite the rarity of the plants, *Heliamphora* are no more difficult to grow than *Cephalotus* and survive under similar conditions. The main error most people make is not providing a cool and humid enough climate. Maximum temperatures should be limited to 85 degrees Fahrenheit, with temperatures around 75 degrees much more desirable. Night time temperatures drops do not appear to be necessary (as it is with most highland *Nepenthes).* Although *H. heterodoxa* has been observed to survive 17 degrees Fahrenheit (10) (regrowing from the rhizome), it would probably be prudent to limit night cooling to 45-50 degrees. As with all carnivorous plants, I have always used only demineralized water to grow *Heliamphora, so* I don't know if they are tolerant to most tap waters. Until they become more readily available, I would recommend using only demineralized water to limit pH changes of the soil. Heliamphora should be kept under high-humidity, and greenhouse plants will benefit from frequent misting to simulate their natural environment. I use a cool-mist room humidifier which I purchased at a drug store to continually fog my plants.

The organic material in which I saw them growing in nature is probably best approximated by sphagnum moss, or a combination of leaf mold, chopped sphagnum and sand. I've always grown my plants in pure New Zealand-type sphagnum with good success, although I've seen several other combinations including the peat/perlite/ sand-type soils work successfully for other people.

Cliff Dodd's article in CPN (11) described a technique of growing *Heliamphora* indoors under fluorescent lights I know this method has worked well for a number of CP growers, and readers should study this as a practical guide for successful indoor cultivation.

Patience is important when starting to grow *heliamphora.* They are naturally slow growing, and larger plants will often take 6-12 months to recover after replanting if the rhizome or leaves are damaged. Small plants are much more tolerant of being transplanted.

Plants are easily replicated by rhizome divisions, and a few people have successfully produced seed, also. Several carnivorous plant breeders also have them in tissue culture which should allow the plants to become widely available in the future at reasonable prices. The effort is definitely worth it, as this is among the most beautiful of all carnivorous plants !

Figure 5 - *H.ionasii*, "deep red form", from first tier, Mt.Ilu. Note fine fuzz inside pitchers, quite marked on this form.

Figure 6 - *H.tatei* var. *neblinae* in habitat.

Acknowledgments

I am grateful to the Herbario Nacional of Venezuela for allowing me to have access to their herbarium collection, and for allowing me to photograph specimens for use in this article. Special thanks, also, to Dr. Paul Berry who furnished photographs of *H. tatei* from the wild, and to Mr. Tim Metcalf, Dr. Don Schnell, and Dr. Berry for their kind editorial assistance on this article.

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Table 1: Identification Key for Heliamphora

1 A) Anthers <4.5mm long.....2
B) Anthers >4.5mm long.....4

2 A) Flower pedicel pubescent.....3
B) Flower pedicel glabrous.....H. nutans*

3 A) Anthers number less than15. Plants usually dwarfed, typically 5-15 cm tall.
a) Pubescent zone present inside pitcher, typically 1/3 or less of pitcher height.....H. minor
i) Pubescent zone absent inside pitcher.....H. minor f. laevis.
B) Anthers number 15 or more.....H. ionasii*

4 A) Flower pedicel glabrous, anthers typically number less than 15 and never over 16, stems not branched.....H. heterodoxa
a) Pitcher appendage minimally developed.....H.heterodoxa var. exappendiculata
i) Upper inner surface of pitcher glabrous....H. heterodoxa var. exappendiculata f. glabella
b) Pitcher appendage well developed.....H. heterodoxa var. heterodoxa*
i) Upper inner surface of pitcher glabrous.....H. heterodoxa var. heterodoxa f. glabella
B) Flower pedicel pubescent, anthers number more than 15, with occasional stem branching.....H. tatei
a) Upper interior portion of pitcher glabrous above pubescent ring, or if hairs are present, are of uniform length.....H. tatei var. tatei
i) Inner pitcher glaborous.....H. tatei var. tatei f. macdonaldae
ii) Inner pitcher hairs uniform in length 0.8 - 2.0 mm long.....H. tatei var. tatei f. tyleri
b) Upper interior portion of pitcher hairs tapered in length from 0.2 - 1.0 mm long at top, to more elongated hairs 1-1.5 mm long at pubescent ring.....H. tatei var. neblinae*
i) Outside pitcher glabrous.....H. tatei var neblinae f. parva

* Anthocyanin-free forms of these plants have been identified in nature, as well as the typical red and green forms.

Table 2: Summary of Typical Characteristics for the genus Heliamphora

Characteristic	minor	nutans	heterodoxa	tatei group	ionasii
Pitcher length (cm)	5-31	5-29	12-42	12-50	12-50
Lower hairy zone length inside pitcher	2- 8	6-8.5	7-18	9-1 5	4.5-1 9
Ratio of hairy zone to total pitcher length	<3/8	1/3-3/8	3/8-1/2	3 /8- 1/2	>3/8
Pedicel pubescence	present	absent	absent	present	present
Anther length (mm)	3-4.5	3-4	4.5-8.5	5-8	3.5-4
Number of Anthers	10-14	10-14	7-16	15-20	15-20
Number flowers per scape	1-5	2-4	2-7	2-4	2-10

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2. *H. nutans* in habitat, Mt. Roraima, southern ridge, 7000'.

3. Lowland *H. heterodoxa* in habitat, Gran Sabana - 4000'.

4. Author examining *H. ionasii* from 1st tier below the summit, Mt. Ilu. Fog in background is common.

5. *H.ionasii*, "deep red form", from first tier, Mt.Ilu. Note fine fuzz inside pitchers, quite marked on this form.

6. *H.tatei* var. *neblinae* in habitat.

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