the tertiary uplift some 60 million years ago the present southeastern mountains and piedmont were a vast peneplain similar to the present coastal plain, dotted with bogs and laced with slowly moving waterways, then one might suggest that the plants "descended" from the now higher lands to the coastal plain after the uplift could be the ones following a more compatible environment while the mountain form was able to remain because of physiologic adaptations and selection to the now colder habitat; and likely through isolation over such a long period it underwent further evolution. Thus, in this early pre-uplift bog-plain, there may have been the condition of disruptive selection that we presently see with S. flava and that probably exists with other Sarracenias as well, the selection then becoming locally linear as habitat demanded. Of course, it was clearly serendipitous that a variant capable of survival was present when needed, and one wonders how many other early Sarracenias have come and gone during ancient environmental upheavals. There is some present biological indication of this hypothesis: Typical lowland S. rubras of the Carolina coastal plain will not grow or develop as well outdoors in mountain or piedmont bogs, the plants becoming stunted and juvenile. On the other hand, the mountain plants will not do as well in the warmer environments, although they will survive.

Therefore, in light of true morphologic differences (in fully developed plants in all cases), geographic isolation and important biologic variances, we certainly agree with Dr. Wherry's current suggestion of subspecies status for the mountain plants (jonesii). But, viewed in the overall perspective of the genus Sarracenia and S. rubra as an acceptable taxon, species designation would not be appropriate. The fact is the mountain plants are still more like S. rubra than unlike it. Contrary to previously published reports, there is a very strong violet-like scent to the flowers of jonesii, as in the Atlantic coastal plain plants of S. rubra. Also, we would disagree with previously published concepts of intermediate and lowlands pitcher forms occurring as taxa in the mountains. Observation of growing plants indicates that such pitchers are a natural occurrence in maturation of the jonesii plants, the pitchers being juvenile. The fact that juvenile pitchers of jonesii resemble so much the mature pitchers of lowlands S. rubra would further indicate that the mountain plants are more evolved.

There remain variations in the lowland plants. We are still studying the two color-vein variants in the Atlantic coastal plain and sand hills, the plants tending to occur in mixed colonies: One reticulately veined over a tan to green-tan background of lid and upper pitcher, the other with veins less prominent and with a rather diffuse red color of the outer lid and upper portions of the pitcher but with a lighter tan, still veined lid inner surface. These forms are clearly genetic as evidenced by their occurrence in mixed colonies and retention of characters in various transplants. We have found that relative scape length is extremely variable, certainly more so than pitcher characters, as any form, species and subspecies is moved about. Herbarium specimens, of course, could not indicate this but living with the plants certainly does.

Finally, there is the fascinating plant of the Gulf coast which reaches its zenith in western Alabama but can easily be found in western Florida and was once suggested to be a displaced portion of jonesii range. This it is not. The plant is moderately tall, the rubra odor of the flower is absent, the adaxial ala is not as strong as lowland rubras but still more prominent than a well-developed jonesii pitcher, the lid is more reflected away from the pitcher opening (which has a different shape) with the stalk of the larger lid somewhat reflexed, and there is not quite the bulge-like dilatation of the upper pitcher as in jonesii, the contours of the pitcher being smoother. There is more diffuse red pigmentation admixed with fine venation and the lid is frequently somewhat undulate on the margins. These characters follow in transplants. This variant is still under study and at present we have no conclusion regarding its taxonomic status which ultimately could fall anywhere from a rubra form (lack of flower odor and lid differences are disconcerting) to a separate species.

In the lowland plants of S. rubra one can see much ecophenic variation clearly related to water supply and planting medium. The drier sandy savannahs tend to produce small, almost juvenile pitchers even at flowering age, while the sphagnum filled roadside ditches and wetter bogs and bays produce larger, more robust plants. Reciprocal transplants confirm this impression. These variants obviously do not deserve taxonomic status.

HOW TO GROW ALDROVANDA VESICULOSA

by Mr. Ohtaki and Mr. Katagiri

Aldrovanda is a delicate aquatic plant which grows under very narrow environmental conditions. To be successful, certain conditions must be carried out in order that the plant continues its rapid rate of growth. Such conditions are:

1. Observation: You must observe your plants closely especially with respect to the shape of the growing point. If the growing point is rounded and onion-shaped, it is in quite good condition. If not, you should change the whole water soon, and trace the origin of the failure. The acidity of the water is very important and should be checked daily with either indicator dyes or pH paper which can be purchased in tropical fish stores. This species is much more sensitive to pH changes than the genus Utricularia. Under quite favorable conditions, Aldrovanda increases rapidly by branching, about eight times a month, and grows at the rate of seven to nine nodes per ten days. The optimum range

of pH or acidity level is 6.4 - 7.0.

2. Outdoor culture: Into a large water lily basin, made large as possible, place a layer of acid soil and plant various water plants such as Iris laevigata, Typha latifolia and Sagittaria. Fill the water to a depth of eight inches. Set up this basin in full sunshine and leave it alone for one to two months to observe if the above plants are growing well and the water becomes clear. It is then suitable for growing Aldrovanda. One may also use dead plant material of either rice stems or that of Phragmites or Typha when available. The stems are chopped into two-inch length, and one to two handfuls of dead material are added per gallon of water, and this is repeated three times a month. An excess of dead material is not damaging and if the water turns yellowish like beer, it indicates acidity and is good for the plants. If the water color turns blackish, it indicates the water is bad and needs changing soon.

3. Indoor culture: This method makes use of a tropical fish aquarium which should be large as possible into which one puts a layer of fine river sand that's acid in nature. Add rain water or distilled water for best results, but if you use hard city water, the pH must be corrected to about pH=6 by adding dilute sulfuric acid and leaving it alone for a few days. We have inexperience in the use of distilled water but it is possible that diluted Knop solution (1/10) produces good results. Aeration should be used using an aerator that produces fine bubbles to keep the water constantly refreshed. The temperature should be kept at 80° F. and not over 90° F. A plant-growth light like Gro-lux should be used for best results since insufficient light causes weak growth. If you wish, a small amount of Daphnia (living water flea) should be added as food for Aldrovanda. An excess amount will contaminate the water. Brine shrimp could be experimented with but the excess chloride ion is detrimental to the species. Chopped rice-straw should be added to the water as fertilizer. The aquarium glass can be cleaned naturally by adding pond snails or Red snail, paper shell as you do in an ordinary fish aquarium. If algae, as Spirogyra is present, it should be removed by tweezers as much as possible. It inhibits Aldrovanda's growth and means that the pH of the water is changing into the alkaline range. Although burnt Alum (Aluminum oxide) kills algae, it is not a desirable means of controlling it.

4. Supplementary information: In the outdoor culture, water levels decrease by evaporation and a fresh supply of water should be added from a watering can every evening. Consequently, the water is partially renewed with good results. When the plants fill the total surface of the water, they stop elongation by branching. At this time, the culture should be divided into two portions for use into another container. It is due to secretion of an organic acid by the plants which inhibits growth at this stage.

Typha latifolia = broadleaf cattail Sagittaria = arrowhead

GROWING DROSERA AURICULATA

by Leo Song

In the fall of 1972, I received several dormant tubers of Drosera auriculata. These were immediately planted in a mix consisting of 2:2:1 parts by volume of peatmoss, #20 quartz sand and decomposed granite gravel (1/8-1/4 ins.) respectively. Supplementary fertilizer in the form of bonemeal and dolomite powder was added at the rate of 1 level tsp/gal mix. The tubers were planted about 1/2 inch deep and watered thoroughly with distilled water. They were then placed in the lath house and no attempt was made to protect them from frosts or rains (California).

By about February of 1973, one of the tubers had sprouted and by mid-March, was in flower. By this time a second tuber had sprouted. The second one was in flower about May and was smaller - only one flower and seedpod being produced. Meanwhile, the first plant produced three flowers and three seedpods and they apparently were self-fertile. When the seedpods on the plants have ripened, I decided to check on the progress of tuber formation. (See CPN 1 (4): 59) By carefully digging down beside the stem, I encountered the old tuber and the stem of the "dropper" which led to the new tuber about 1/2 inch lower.

According to Vickery (1933), this is the method by which tubers work their way down into the ground. The tuber is actually formed at the apex of a generally downward growing stem (the "dropper"), which after growing downwards for a given distance, the growing tip then becomes inverted (facing upwards) and begins to swell. After reaching a certain depth, the tuber for the following year is produced beside the old tuber on a very short "dropper" stem. In most cases, then, the old tuber is exhausted and eventually dies, but the new tuber takes over next year. Formation of the new tuber depends on favorable conditions. The new tubers on my plants were slightly larger than the old ones, both being about 1/4 inch in diameter. The pot is now set aside and kept dry until fall rains. Several tubers didn't sprout last time but they are apparently alive with at least one producing a tuber on one side.

Literature reference: Vickery, Joyce. 1933 Vegetative reproduction in Drosera peltata and D. auriculata. Proc. Linn. Soc. N.S.W. (Australia) 58, 245-269.