ECOLOGICAL ADAPTIONS OF *SARRACENIA PURPUREA* IN COASTAL MAINE SPHAGNUM MOSS

(David E. Butler, 5114 Elm Street, Bethesda, MD 20814)

For a number of years, I have spent summer vacations in coastal Maine. The better-known attractions of "Vacationland" fill many books and are beyond the scope of this note. An added attraction for the CP enthusiast is the several species of sundews and the northern pitcher plant, *Sarracenia purpurea*, which inhabit local glacial bogs and heaths.

Many of these habitats contain extensive populations of *S. purpurea* and *Drosera rotundifolia*. *D. intermedia* may also be found in coastal Maine, but it is not common. The rarer sundews, such as *D. anglica* and *linearis*, have been reported in the northern part of the state (Schnell 1976; Newman 1980), but do not occur in the coastal region. However, temperature differences are unlikely to account for the absence of these species from the coastal area. For example, the average January temperature for Portland, Maine, in the coastal zone, is 31.2/11.7 degrees Fahrenheit. Marquette, Michigan, near known sites of *D. linearis*, averages 24.8/12.0 for the same month. On the other hand, Caribou, Maine, near the reported sites of *D. linearis* in Maine, is much colder. January temperatures average a mere 19.8/1.5 (Ruffner & Blair 1978). Thus, a diligent search may yield a range extension of these rarer sundews to the coastal area.

Although the coastal climate is relatively temperate, wind effects in unprotected areas can be quite severe. Indeed, some of the most interesting adaptions of the northern pitcher plant involve sites that are exposed to severe winds. My observations of *S. purpurea* in Maine include habitats on two coastal islands, Vinalhaven and Mount Desert. The climate of the two islands is identical: north temperate, characterized by mossy forest, bogs and open heath. Soil is gravelly and thin. In moist depressions, the soil is often pure peat, overlaid by sphagnum. Both islands are often shrouded in thick fog. On these islands, *S. purpurea* has adapted to a wide range of micro-habitats. Most remarkable is the range of adaptation in terms of pitcher size, coloration and form, even within the same bog area. Despite wide variations in growth habit, it is unlikely that these adaptations represent botanically distinguishable forms or subspecies.

Figure 1 illustrates a general habitat located within the boundaries of Acadia National Park on Mount Desert Island. The area, known only as "the Heath," supports a large colony of *S. purpurea*. The Heath lies in a remote area no more than several hundred yards from the ocean. Although seemingly solid ground, the area is in fact a eutrophicated glacial lake, covered by a continuous mat of sphagnum. The entire center of the area, several hundred yards in diameter, is quite exposed to the elements. Being an open field, the area receives full sun from sunrise to sunset.

Around the edges of the exposed area, low shrubs and pines are encroaching on the lake bed. The shrubs provide some shelter from the wind, and many typical forms of *S. purpurea* may be found in these areas. Plants in this slightly sheltered area flower freely. However, in the open areas, specimens of *S. purpurea* take on a depauperate, stunted form with pitchers rarely more than six inches in length. Based upon observation of new and aged pitchers, it appears that rarely are more than two or three pitchers produced in a

single season. However, these pitchers have unusually intense coloration. Many of these pitchers are entirely red and gold even in mid-summer (Cover).

Surprisingly, many of these pitchers take on the superficial form of the southern *S. purpurea*. Pitchers tend to be comparatively short and wide, and sometimes have scalloped edges. This is clearly not the southern form, however, as the outer surface of the pitcher is glabrous and the hood margins do not extend well beyond the pitcher lip. One hypothesis for development of these pitchers is a reaction to high winds that undoubtedly sweep through this habitat. Low, squat pitchers are resistant to tipping over in a heavy wind. Similarly, the scalloped hood margins may well be more resistant to tearing in high winds, much as corrugated cardboard is stronger than flat.

Although the depauperate adaption of *S. purpurea* is common in this bog, none of the plants observed had flowered. It appears that this is due to a combination of factors in the marginal habitat. The exposed position of the plants will result in wind damage to any flowering stalks before they reach any significant height. A second consequence of this habitat is a tendency to dessicate in the summer sun or in high wind conditions. Thus, conditions in the open heath are not conducive to flowering, even though plants in the same area with even a modicum of brush to shelter them from the wind will flower freely. It is logical to conclude that seeds of this form are simply dispersed from the 'average' plants growing nearby. This adaption may informally be viewed as a "tundra" ecophene.

Towards the edge of the heath, the terrain becomes heavily wooded. The soil remains deep sphagnum, however. Many *S. purpurea* may be found in this heavily shaded environment. In general, pitchers growing in these low light conditions take on the elongated form illustrated by Pietropalo (1976), and also discussed by Mandossian (1966). Mandossian found that, at an average reading of 755 foot-candles, *S. purpurea* will develop flat leaves with a very narrow pitcher, if any, and a wide wing. **(Continued on page 72)**

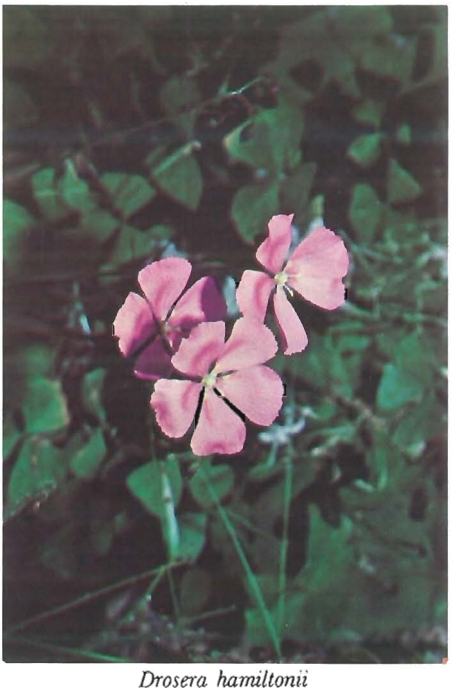
Fig. 1: The Heath, Mount Desert Island, Maine, looking toward the Western Mountains. Photo by David Butler.

Figure 3: *S. purpurea* in heavily shaded habitat, showing elongated pitcher development and maroon styles.

Photos by David Butler

Figure 5: Unusually large stoloniferous clone.

Fig. 4: *S. purpurea* in typical habitat, form with scalloped hood margins.
David Butler



Drosera hamiltonii
Photo by J. Mazrimas
See page 75.

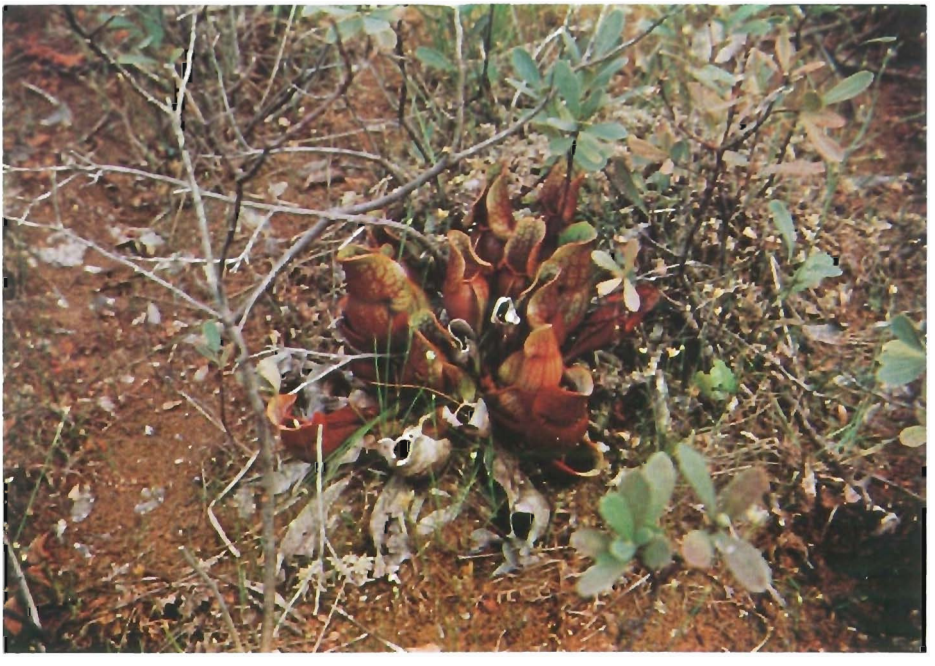


Fig. 6: Highly colored 'ripicola' emulation. Photo by David Butler.

A vigorous example of the shade growing form is illustrated in Figure 3. Although heavily shaded by its neighbor, the plant did receive some dappled sun in mid-afternoon. The leaves, while elongated, maintain an upright position due to the tall grass growing along with the pitchers. Many of these shade growers had flowered, resulting in expanded seed capsules.

Although the pitchers were almost entirely green as one would expect, the flower sepals were a surprisingly dark maroon color. I was not able to observe these plants in flower, but speculate that the petals may even be darker than the maroon petals of the typical ecophene.

Assuming that the two ecophenes discussed *supra* do not represent the "typical" habitat, other areas of the heath certainly do. The tree-lined perimeter of the eutrophicated lake is broken in several areas by open stream beds which have themselves become boggy with sphagnum growth. In these areas, *S. purpurea* is plentiful. Plants are of the typical northern form with varying amounts of red venation superimposed on mostly green pitchers. An interesting variation occurs when the pitcher hood develops scalloped edges, again reminiscent of the southern forms of *S. purpurea* (Figure 4). Plants in this area are not exposed to high winds. When occurring in a wind-sheltered habitat, this variation is likely due less to ecological adaptation, than an expression of the variability of the species.

Many plants in these optimum habitat areas are vigorous, multi-crowned specimens. An occasional plant will grow to an extremely large size. Figure 5 is an illustration of the largest plant noted in the heath area, which has spread over an area approximately .5 x 1.5 meters, and developed in the summer of 1984 eighteen flower stalks. The specimen is reminiscent of the 'stolonifera' variant described by Macfarland *et al.* (1933). Macfarlane reported clones ranging from three to twelve feet in width. I have not yet seen a specimen in the larger portion of this range. However, much of the heath remains to be explored.

Field observation suggests two arguments against varietal status for the stoloniferous plants. First, stoloniferous specimens are isolated among more normal-sized clones. Second, pitchers of stoloniferous specimens are often indistinguishable, in terms of form and coloration, from their neighbors.

Nomenclatural arguments aside, however, a large *S. purpurea* in the field is a magnificent sight to the CP enthusiast. I have also observed large clonal specimens of *S. purpurea* on Vinalhaven Island, about fifty miles as the puffin flies from the heath. None were as large as the illustration, and many appear to be in declining habitats—a pond, for example, that has eutrophicated to the point that the water table is not high enough to support the species.

Figure 6 is an example of a plant from such a habitat. Unlike the heath, this glacial pond has become an open peat bog. During dry spells the surface may dry to a hard crust. Indeed, many of the largest plants in this particular bog died during the dry summers of 1978 and 1979.

The illustrated survivor emulates the 'ripicola' variant described by Boivin (1951), but currently the subject of some dispute as a recognizable variant (e.g. Schnell 1979). The pitchers are shiny, brittle, numerous and highly colored, although perhaps not to the extreme extent of the classic 'ripicola' form. In contrast to the 'tundra' adaptation described earlier, the habitat of Figure 6 is protected from high winds by surrounding trees and rock bluffs. At least in the observed habitat, the subspecific designation would not appear to be appropriate, for plants growing in sphagnum towards the edge of the pond exhibited more "average" characteristics.

The foregoing discussion does not, of course, exhaust the possible habitats of this species in the coastal zone. One other noteworthy habitat was observed on Vinalhaven, where I located several colonies along the margin of a brackish pond formed by damming a salt water inlet.

The water remains sufficiently saline to support large colonies of jellyfish in the warm summer months. Yet pitcher plants flourish in sphagnum mats at lakeside. The roots invariably extend into the alkaline substrate. Unlike the typical fresh water pond, sphagnum cannot survive at or below the water level, additional evidence of the alkalinity of the habitat. Other than the apparent pH differential of the growing medium, however, plants exhibit no noteworthy features.

This completes the survey of ecological adaptions of *S. purpurea* in coastal Maine. I conclude that, in coastal Maine, *S. purpurea* exhibits extensive variation in pitcher size, form, and coloration. The number of pitchers and crowns per plant also varies considerably. In addition, some variation in flower color is suspected. Such variation raises the question of appropriate botanical classification.

Available evidence indicates that the observed differences are primarily habitat-based. However, one should not hastily rule out the possibility of formal or varietal distinction if appropriate empirical research is conducted. In particular, such research may resolve the question whether the scalloped vs. smooth hood margin is a genetic trait, and perhaps an indicator of other, less obvious distinctions within the northern subspecies. In addition, such variation well within the range of the northern subspecies casts some doubt on the validity of reports of intergrades or habitation by both the northern and southern subspecies in the same bog where ranges merge.

The prior work of Mandossian is worth noting when considering the question of ecological adaptation vs. formal status as an explanation for the variations noted above. Mandossian (1966) studied the impact of reciprocal transplants on *S. purpurea*. In that experiment, specimens were transplanted from acid-sphagnum bogs to alkaline-marl bogs and vice versa. Plants were assigned a leaf area index based upon the formula two-thirds length x width ("LW value"). In terms of both LW value and number of leaves per plant, reciprocal transplants approached their new neighbors after two growing seasons. Mandossian concluded that differences in pitcher size and number were primarily habitat-based. All but one of the habitats discussed in this note are likely to be acid, as they are peat or sphagnum based. Thus, although it is not practical to conduct reciprocal transplants in the areas I observed, Mandossian's conclusions are consistent with the conclusions of this note.

It is apparent that *S. purpurea* is well adapted to the harsh north temperate climate. While the species is not easy for the casual observer to locate, it is not rare if the appropriate habitat is available. CP enthusiasts should be grateful to the creators of Acadia National Park for permitting this species to flourish in its unique and scenic natural habitat.

AUTHORITIES CITED

Boivin, B. 1951. Centurie de Plantes Canadiennes-II. Canadian Field Naturalist 65: 21

Macfarlane, et al 1933. *Sarracenia purpurea* var. *stolonifera*, a Noteworthy Morphological and Ecological Type, Bull. Royal Botanic Gardens, Kew 4: 161.

Mandossian, A.J. 1966. Variations in the leaf of *Sarracenia purpurea*. Mich. Botanist 5: 26.

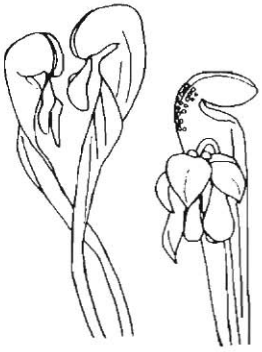
Newman, G. 1980. A New Drosera Record for New England, CPN 5: 19.

Pietropaolo, J. and P.A. 1974. The World of Carnivorous Plants 85.

Ruffner & Blair, ed. The Weather Almanac 1978.

Schnell, D. 1979. A Critical Review of Published Variants of *Sarracenia purpurea* L., Castanea 44: 47.

1976. Carnivorous Plants of the United States and Canada 59-62.



CARNIVOROUS PLANT NEWSLETTER

Official Journal of the International Carnivorous Plant Society

Volume 14, Number 3
September 1985

COVER: *S. purpurea* 'tundra' adaptation, growing in exposed area in center of Figure 1, page 69. Note that, in late July, only a single pitcher has been produced. Two pitchers from the prior season are also visible. Photo by David Butler.

The co-editors of CPN would like everyone to pay particular attention to the following policies regarding your dues to the ICPS.

All correspondence regarding dues, address changes and missing issues should be sent to Joanne Klingensmith, 437 Las Riendas, Fullerton, CA 92635. DO NOT SEND TO THE CO-EDITORS. Checks for subscriptions and reprints should be made payable to CSUF FOUNDATION-ICPS.

All material for publication, comments and general correspondence about your plants, field trips or special noteworthy events relating to CP should be directed to one of the co-editors. We are interested in all news related to carnivorous plants and rely on the membership to supply us with this information so that we can share it with others.

Views expressed in this publication are those of the authors, not necessarily the editorial staff.

Copy deadline for the March issue is January 1, 1986.

PUBLISHER: The International Carnivorous Plant Society by the Fullerton Arboretum, California State University, Fullerton, CA 92634. Published quarterly with one volume annually. Printer: Kandid Litho, 129 Agostino Rd., San Gabriel, CA 91776. Circulation: 659 (151 new, 508 renewal). Dues: $10.00 annually, $15.00 foreign. Reprints available by volume only.

CARNIVOROUS PLANT NEWSLETTER

VOLUME 14, Number 3 SEPTEMBER 1985