

Cage  
AS  
36  
.76  
P455  
1997  
no.5

**POPULATION SIZE AND ANALYSIS OF ARTHROPODS  
IN PITCHER PLANTS NATIVE TO  
ROBESON COUNTY, NORTH CAROLINA**

PRESENTED TO:

THE CHANCELLOR'S SCHOLARS COUNCIL OF  
THE UNIVERSITY OF NORTH CAROLINA AT PEMBROKE  
IN PARTIAL FULFILLMENT  
OF THE REQUIREMENTS FOR COMPLETION OF  
THE CHANCELLOR'S SCHOLARS PROGRAM

PRINCIPAL INVESTIGATOR: STEPHANIE A. SINGER  
DEPARTMENT OF BIOLOGY  
UNC PEMBROKE  
P.O. BOX 1510  
PEMBROKE, NC 28372-1510

MAY 5, 1997

FACULTY ADVISOR'S APPROVAL *Andrew N. Clark*  
FACULTY ADVISOR'S APPROVAL *Rainald D. Zeigler*  
DATE 5/5/98

A

00280986

## Abstract

The genus *Sarracenia*, pitcher plants, is composed entirely of carnivorous plants. Due to their microhabitat requirements, it is uncommon to find them locally. Also, their habitats are being altered and destroyed at an alarming rate (Rymal and Folkerts 1982). Pitcher plants, as well as other carnivorous plants, have adapted to mineral-deficient environments by trapping and digesting small animals to obtain certain of their required nutrients. This mechanism enables them to survive in habitats where few other plants can live or compete.

I studied the following aspects of the biology of both yellow (*Sarracenia flava*) and purple (*Sarracenia purpurea*) pitcher plants: 1. Number of leaves per plant, 2. Number of flowers per plant, 3. Arthropod presence in leaves of purple pitcher plants in relation to leaf position. Purple pitcher plants have significantly more leaves and flowers per plant than yellow pitcher plants. Arthropod presence in peripheral and interior leaves in purple pitcher plants was not significantly different, although non-significant trends were observed. Chironomids, mosquitoes, and "other" arthropods were more common in interior pitchers, while mites and springtails were more common in peripheral pitchers.

## **Introduction**

Although taxonomists' opinions vary, up to ten species of the genus *Sarracenia* have been recognized (Rymal and Folkerts 1982). Each species is located in different geographical areas, sometimes sharing geographical locations with other species.

*Sarracenia purpurea*, one of the species located along the Lumber River in Robeson County, North Carolina, covers such a wide range in the United States and Canada that high levels of population variation occur throughout this range. In the northern part of the range, the leaves of the plant are usually solid green and the plant has larger clumps. In the southeast, the leaves have some red and /or purple in them. In either case, the leaves grow near the surface of the earth (Schnell 1976).

*Sarracenia flava* is another species located along the Lumber River in Robeson County, North Carolina. Unlike *Sarracenia purpurea*, its leaves are elongated and stand erect. This species also shows variations, except that all variations can occur in the same population and are thus not geographical. Again, the variation in *Sarracenia flava* is in vein and color variation.

There are many different arthropods associated with pitcher plants. These arthropods can serve as prey for the plants, as pollinators, they can inhabit the plant, or feed on the tissues of the pitcher plants as a herbivore (Rymal and Folkerts 1982).

Some of the arthropods, which researchers have found in pitcher plants, are several species of *Diptera* including: midge larvae, mosquitoes, adult sarcophagids and their

species of *Diptera* including: midge larvae, mosquitoes, adult sarcophagids and their larvae, along with wasps and mites (Rymal and Folkerts 1982). Other insects and arthropods found in the fluid inside the leaves are ants, springtails, spiders, grasshoppers, small beetles, and occasionally butterflies (Jones 1908).

The general habitat for *Sarracenia purpurea* and *Sarracenia flava* is Pine Savanna. This is a wet, flat area, and occasionally low "islands" in peatlands or swamps. These areas have saturated soil part of the year, and are frequently burned. The Pine Savanna is distinguished from other habitats, such as the Pond Pine Woodlands and other pocosin communities, by its dominance of herb with little shrub component. The soil is composed of a variety of wet mineral soils (Schafale and Weakley 1990).

#### **Methods and Procedures**

The Mill Branch Orchid/Carnivorous Plant Savanna is the name of the 5.3 hectare site where the majority of research was done. This particular site is located down a dirt road running south from the junction of 1557 and County Road 1339 in Robeson County, Pembroke, North Carolina. The general landscape is stream terrace adjacent to the Lumber River characterized by moist, sandy soil which is rarely flooded. There is herbaceous vegetation, with few or no trees. The majority of trees are located along seepages and not in the middle of the area, which resembles a meadow. The elevation is 47-49 meters above sea level. This is slightly elevated in comparison to swamp forest and bottomland hardwoods, but slightly below the xeric sand ridge. There appear to be few dominant herb with a rather wide variety of species co-dominating.

The community resembles a Pine Savanna without the pine trees (Ash 1990). Data has already been collected from this area concerning the pitcher plant.

Census of pitcher plant populations was accomplished by a systematic search of a 2-hectare area surrounding the center of known populations. Searchers walked in concentric circles, examining all likely habitats. Red surveyor's flags were placed near each plant censused, so that no plant was counted twice. For each clump of pitcher plants found, the number of leaves and the number of flowers were counted.

The identification of arthropods inside *Sarracenia purpurea* was more difficult. Four leaves, two from the inner part of the plant and two from the outer edge, were taken from five plants of *Sarracenia purpurea*. Leaves were taken from widely separated plants in order to examine between-plant variation. Leaves were removed from each plant by cutting the petiole near the surface of the soil. Once removed from the plant, they were placed, with their contents, in zip-loc bags for transport back to the lab.

In the lab, the inside of each leaf was rinsed into a filter screen and the contents washed into a jar of ethanol with an identification tag. All of the samples were examined microscopically. The arthropods were separated into vials and later identified to the lowest possible taxonomic level.

Data was analyzed using Minitab statistical software for microcomputers. For the population study, distributions of numbers of leaves per plant and numbers of flowers per plant were compared between species. Histograms of leaf and flower number per plant were developed. Differences in the distribution of arthropod taxa in one species of pitcher plants were assessed.

## **Results**

### *Pitcher Plant Population Assessment*

A population of 235 pitcher plant plants were analyzed. There were 165 *Sarracenia purpurea* plants. The mean number of leaves per plant in this species was 26 with a range of 2.0 to 141.0 leaves per plant (Figure 1).

The mean number of flowers per plant for *Sarracenia purpurea* was 1.7 with a range of 0.0 to 14.4 (Figure 2).

The remaining 70 plants were *Sarracenia flava* individuals. The mean number of leaves per plant in this species was 15.0 with a range of 2.0 to 72.0 leaves (Figure 3).

The mean number of flowers per plant for *Sarracenia flava* was 0.5 with a range of 0.0 to 3.0 flowers per plant (Figure 4).

### *Arthropod Populations in Pitches of Sarracenia Purpurea*

The mean number of all arthropods found in the interior leaves was 132.0 versus a mean of 91.0 arthropods found in peripheral pitchers. This difference was not significant. Five major groups of arthropods identified were mosquito larvae, chironomids, springtails, mites, and all "other" arthropods.

The mean number of mosquito larvae of interior leaves was 108.0, and the mean number of larvae found in peripheral leaves was 70.0. This difference was not significant (Table 1).

The mean number of chironomids of interior leaves was 17.0, and the mean number of chironomids found in peripheral leaves was 11.0. This difference was not significant (Table 1).

The mean number of springtails of interior leaves was 0.6, and the mean number found in peripheral leaves was 0.7. This difference was not significant (Table 1).

The mean number of mites of interior leaves was 0.3, and the mean number of mites found in peripheral leaves was 4.5. This difference was not significant (Table 1).

The mean number of "other" arthropods of interior leaves was 7.0, and the mean number of "other" arthropods found in peripheral leaves was 4.6. This difference was not significant (Table 1).

## Discussion

### *Pitcher Plant Population*

There was a significant tendency for *Sarracenia purpurea* (purple pitcher plant) to have more leaves per plant than *Sarracenia flava* (yellow pitcher plant). This is possibly due to the fact that the yellow pitcher plant is less tolerant of environmental changes than the purple pitcher plant.

Both species of pitcher plants showed very low numbers of flowers per plant, which may suggest poor reproduction. In general, pitcher plants do not favor shaded areas created by shrubs and the succession of hardwoods. In optimal conditions, the pitcher plant's habitat is maintained by frequent fires. The particular area in which my research was done contained overgrowth of shrubs and some succession of hardwoods. A habitat not favored by pitcher plants.

As far as entire populations were concerned, there were a larger number of purple pitcher plants than the yellow pitcher plants. The yellow pitcher plant does not respond to environmental degradation with great fortitude; therefore, this species is being rapidly depleted in the Carolinas (Schnell 1976). However, the purple pitcher plant does not seem to have the same problem. At our site the yellow pitcher plants were dispersed over a larger area than the purple pitcher plants, perhaps due to difference in soil and water requirements.



The pitcher plants are located and restricted to this particular area in Robeson County, North Carolina, along the Lumber River, because they thrive in wet, usually flat areas, where the soil remains saturated part of the year (Schafale and Weakley 1990). The pitcher plant also has more success surviving if there is frequent fire to keep out competing plants and are able to do so because of their underground stems (Schnell 1976).

### *Arthropods*

There was no significant difference in the five major classes of arthropods with respect to their presence in peripheral or interior leaves. However, the mosquito larvae and chironomids were more often located in the interior leaves, while springtails and mites were located more often in the peripheral leaves. The interior leaves stand more erect, making it more accessible for airborne arthropods to make use of or get trapped in the leaves, while at the same time being less accessible to walking organisms. Also, it was observed that the interior leaves contained more water possibly making them more effective at trapping.

The springtails and mites were more often found in peripheral leaves. The peripheral leaves would be more accessible for arthropods that do not fly and are the first leaves in which ground traveling arthropods come into contact. Springtails are not usually found submerged in the liquid of pitcher plant leaves because they stand on water.

However, the method in which the leaves were collected could have caused them to be submerged in the liquid.

Some of the "other" arthropods found in the leaves of *Sarracenia purpurea* were the exoskeletons of beetles, wasps, crickets, ants, and spiders. Some of the abdomens of these arthropods were still intact or merely softened, but with time the plant's secreted digestive enzymes would have completely digested the abdomens of these arthropods.

Also a sarcophagid fly larva, a known inhabitant of pitcher plants that feeds on victims caught by the plant, a harvestman, and an earthworm were found. The presence of the earthworm found in a peripheral leaf is puzzling. However, it could have been that in removing the leaf from the plant, some soil near the base of the leaf was deposited into the zip-lock bag along with the worm.

## LITERATURE CITED

- Ash, A.N. 1990. Site Survey Report. UNC Pembroke. Pembroke, North Carolina.
- Jones, F.M. 1908. Entomological News. Pitcher-Plant Arthropods-III. Plates VII-IX  
Wilmington, Delaware.
- Rymal D.E. and G.W. Folkerts. 1982. Arthropods Associated with Pitcher Plants  
*Sarracenia*: Sarraceniaceae), and their Relationship to Pitcher Plant Conservation: A  
Review. Journal of the Alabama Academy of Science: 53(4) 131-137.
- Schafale M.P. and Weakley A.S. 1990. Classification of the Natural Communities of  
North Carolina. Third Approximation. North Carolina Natural Heritage Program  
Division of Parks and Recreation Department of Environment, Health, and Natural  
Resources. Raleigh, North Carolina.
- Schnell D. E. 1976. Carnivorous Plants of the United States and Canada.  
Lebanon Valley Offset Company Inc. Winston-Salem, North Carolina.

Table 1. The distribution of arthropods in peripheral and interior leaves of *Sarracenia purpurea*.

Pitcher position	Insect groups					Total Insects
	Mosquito larvae	Chironomids	Springtails	Mites	Other insects	
Peripheral	70±38 <sup>a</sup>	11±4	0.6±0.5	4.5±3.0	4.6±1.9	91±38
Interior	108±30	17±3	0.7±0.3	0.3±0.2	6.7±1.3	132±29

<sup>a</sup> Mean±standard error of the mean

## Figure Captions

Figure 1. The number of leaves per clump for *Sarracenia purpurea*.

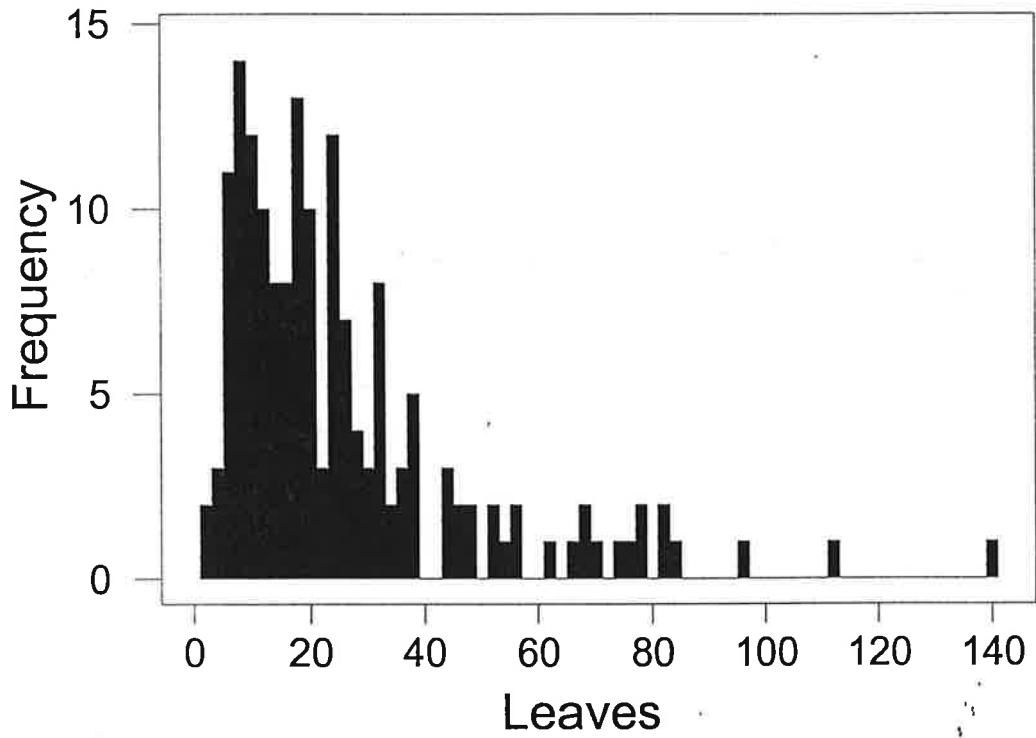
Figure 2. The number of flowers per clump for *Sarracenia purpurea*.

Figure 3. The number of leaves per clump for *Sarracenia flava*.

Figure 4. The number of flowers per clump for *Sarracenia flava*.

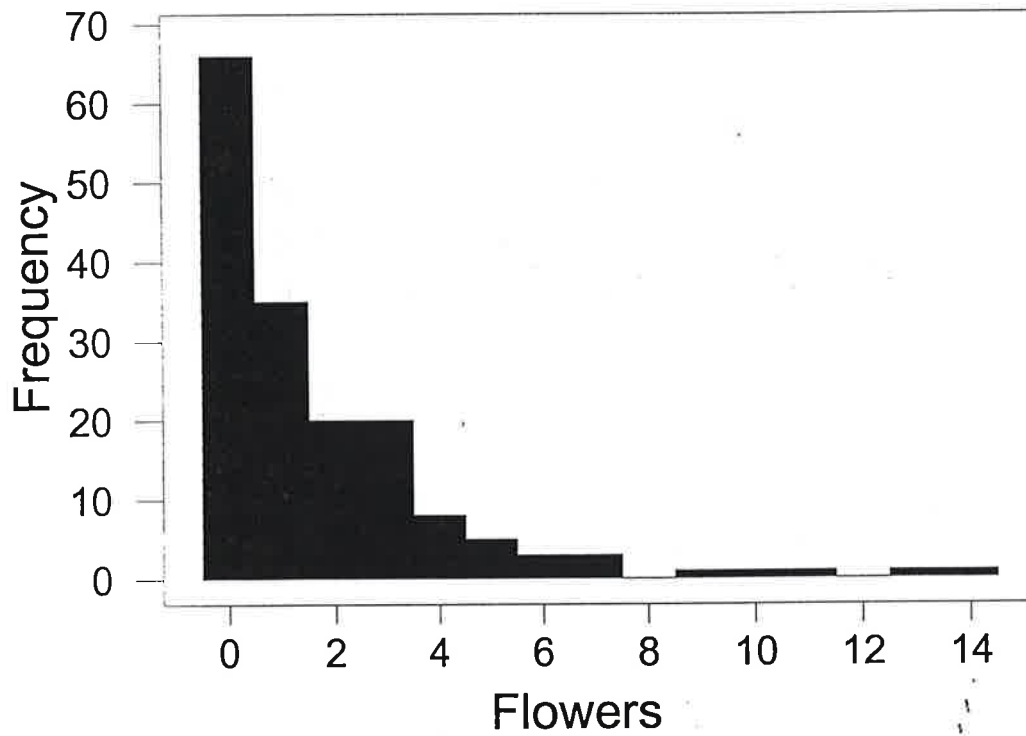
# FIGURE 1

*Sarracenia purpurea*



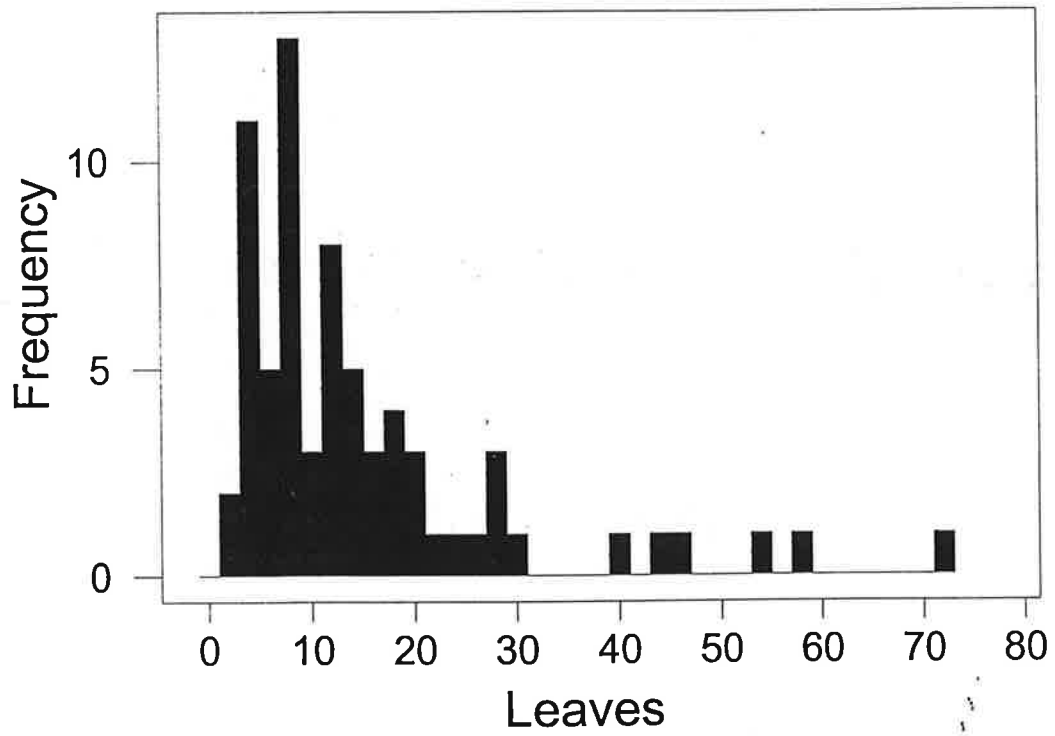
# FIGURE 2

*Sarracenia purpurea*



# FIGURE 3

## *Sarracenia flava*





# FIGURE 4

## *Sarracenia flava*

