# HOW VENUS' FLYTRAPS CATCH SPIDERS AND ANTS

By Stephen E. Williams

(Continued from September)

*How does a trap move?* Most authors, myself included, have preferred to think of this very rapid movement as being due to a rapid loss of water from various cells in the trap. Ashida proposed a model of trap movement based on this idea which is very attractive. He proposed that a loss of water from the cells on the inner surface of the leaf would allow cells on the outer surface of the leaf to expand and the lobes would then curve inward. Unfortunately there is no evidence that his ideas are correct and evidence from experiments by Brown [Table II] indicate that this is not likely to be the case. Although it is based on an inadequate number of samples and the methods are a bit crude, Brown's experiments indicate that closure results from a very rapid growth of the cells on the outer surface of the trap. A sudden release of a factor that causes the cell walls of this surface to loosen is not out of the question, while a reopening process due to growth is quite reasonable. Our laboratory is presently working on this problem—the answer to which may have importance to understanding the nature of plant growth in general. Presently, however, the best answer to the question of how a *Dionaea* trap moves is: "It is not known".

TABLE II. PERCENT INCREASE IN LENGTH OF ABAXIAL AND ADAXIAL SIDES OF *DIONAEA* TRAP LOBES DURING CLOSURE AND RECOVERY VERSUS THE INCREASE IN LENGTH OF UNSTIMULATED CONTROLS. [a]

| | *DIONAEA* | |
|---|---|---|
| | ABAXIAL | ADAXIAL |
| CLOSING | 8.4 (5)[b] | −1.0 (2) |
| RECOVERY | 0.8 (3) | 9.4 (2) |
| GROWTH OF CONTROL DURING ½ DAY | 0.5 (3) | |

[a] Data from W.H. Brown, Amer. J. Bot. 3,69-90 (1916).

[b] The number of replications is given in parenthesis.

We are left with a picture of an ant or spider walking inadvertently into a trap, tripping two hairs at an interval of a few seconds and finding itself trapped in a pocket with the triggerhairs. It stimulates these as it struggles and thereby tightens the trap around itself and initiates the secretion of digestive fluid which kills it. As the digestive fluids decompose the prey, salts and amino acids are released. These stimulate the trap to remain closed and perhaps also stimulate more secretion. When no more breakdown products exist to stimulate trap closure it reopens. When all of these actions are put together we see behavior which is as complex as that of some primitive animals. I cast my vote with Darwin, *Dionaea* is "the most wonderful plant in the world."

References: Except for the original data presented in Table I the author and others have reviewed these subjects in the following articles, each of which gives complete references.

Burdon-Sanderson, J.S. and Page, J.F.M., 1876. On the mechanical effects and on the electrical disturbance consequent on the excitation of the leaf of *Dionaea muscipula*. Proc. R. Soc. 25:411-434.

Lichtner, F.T. and Williams, S.E., 1977. Prey capture and factors controlling

(Please see **WILLIAMS** p. 100)

# Review of Recent Literature

De, D.N., S.N. Ghosh. Autoradiographic studies on the terminal heterochromatin of *Drosera burmanni*. Bull. Bot. Soc. Bengal 32 (½):41-47 1978.
The 20 minute chromosomes of this CP species have terminal segments of heterochromatin which the author shows replicate late in the cell cycle.

Dodge, Harold R. 1947. A new species of *Wyeomyia* from the pitcher plant. Proc. Ent. Soc. Wash. 49:117-122.
This paper contains Dodge's formal description of *W. haynei* which he feels best fits the southern populations inhabiting *Sarracenia purpurea* ssp. *venosa* pitchers, while the older *W. smithii* are found in populations of the northern ssp. *purpurea*. Previously, it was thought there was one species, *W. smithii,* involved. This older reference is of some interest because it eluded us so long even though we knew generally of the concept; now we have the exact reference. (See also Castanea 37:146-147, 1972; Castanea 44:47-59, 1979.)

Erber, D. An investigation of the biocenosis and the necrocenosis in pitcher plants of Sumatra. Arch. Hydrobiol. 87 (1): 37-48. 1979
*Nepenthes* pitcher content is influenced by the structure of the pitcher and life history of the insect species.

Heslop-Harrison, Y. and J. Heslop-Harrison, 1980. Chloride ion movement and enzyme secretion from the digestive glands of *Pinguicula*. Ann. Bot. 45:729-731.
Protein challenge studies of leaf segments of *P. ionantha* indicate that rapid movement of chloride ion from reservoir to endodermal to head cells in secretory glands causes a flush of water movement which washes stored enzymes out on to the leaf surface. (DES)

Mogi, M., J. Mokry. Distribution of *Wyeomyia smithii* eggs in pitcher plants in Newfoundland, Canada. Trop. Med. 22 (1): 1-12. 1980
Most eggs of this mosquito were laid in new pitchers of *Sarracenia purpurea* and chmical stimuli specific to new pitchers played a dominant role in selectivity. The distribution pattern of eggs suggested that a female lays eggs neither at random nor in a large batch but in small numbers. The ecology and evolution of mosquitoes breeding in small-container habitats was discussed.

---

**GULF COAST** - continued from p. 95

therefore the var. *'maxima'* label should also be discouraged.

Also in the Gulf area are found a variety of light to heavily veined specimens with a great degree of variability in coloration. The once thought to be nearly extinct form with red tube and green lid may be locally common in some locations in the Gulf. Finally, a copper-lid form with large wavy lid is found in only a few locations around and near Pensacola and appears to be the rarest of the *S. flava* forms in the Gulf area based on my explorations.

**WILLIAMS** - continued from p. 91

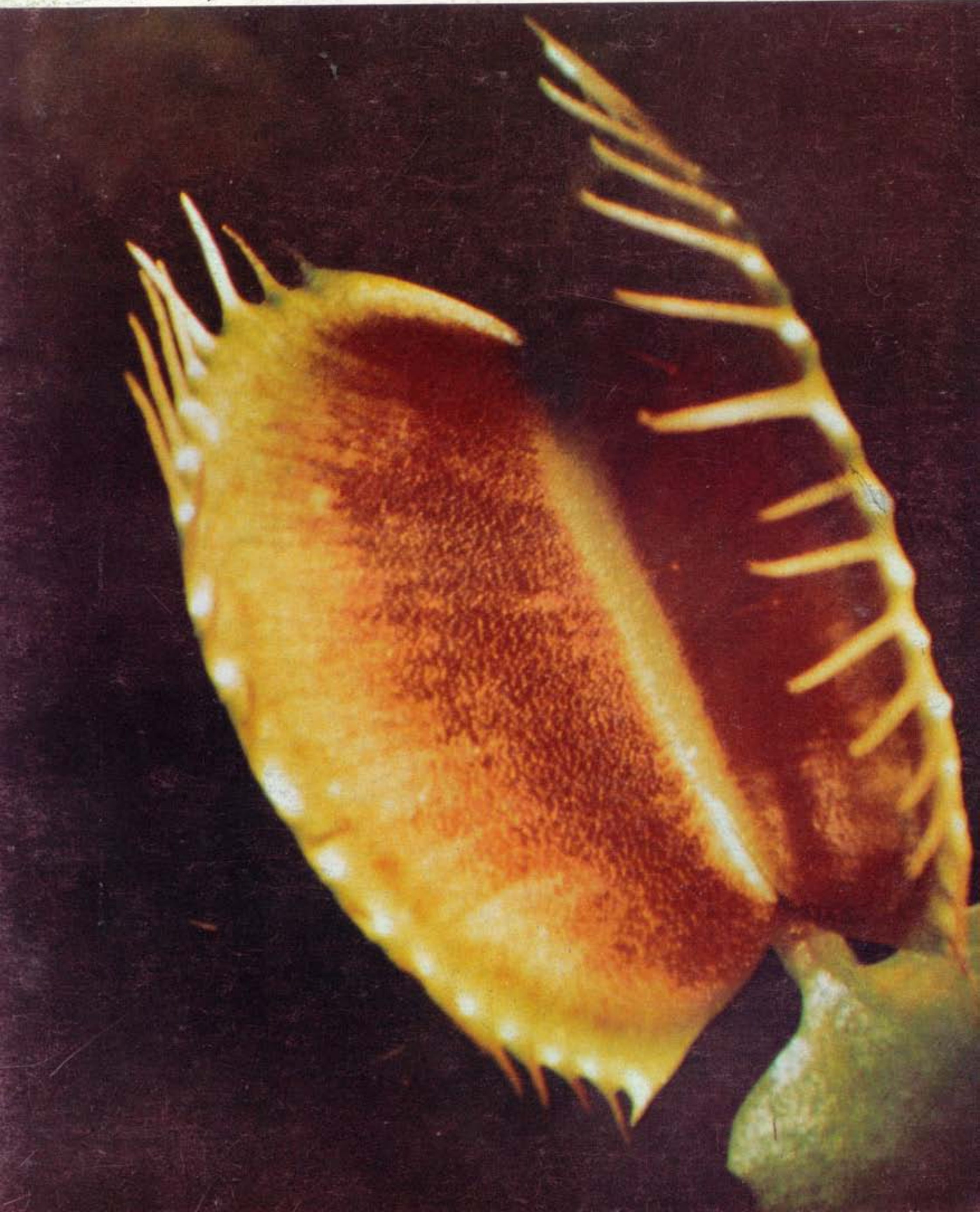
trap narrowing in *Dionaea* (Droseraceae). Amer. J. Bot. 64:881-886.

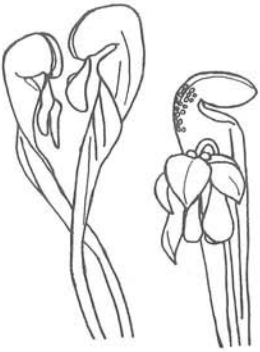
Williams, S.E., 1976. Comparative sensory physiology of the Droseraceae—the evolution of a plant sensory system. Proc. Amer. Philos. Soc. 120:187-204.

Williams, S.E. and Pickard, B.G. In press. The role of action potentials in the control of capture movements of *Drosera* and *Dionaea*. In: Galston, A.W. Plant Movements. Springer Verlag. Berlin, Heidelberg, NY.

# CARNIVOROUS PLANT NEWSLETTER

VOLUME 9, Number 4 DECEMBER 1980





# CARNIVOROUS PLANT NEWSLETTER

Volume 9, Number 4
December 1980

## COVER

We are continuing to feature *Dionaea.* The Venus' flytrap captures insects in its bear-trap-shaped leaves. Insects are reported to be attracted to glands in the region around the edge of the inner part of the leaf. If they chance to touch one of the three trigger hairs on either lobe of the trap only once during their movements, there is no response, but if the insect should be so unfortunate as to brush against the same hair or any of the other hairs a second time the trap snaps shut, incarcerating him. Note that the inner surface of the trap is convex and the outer surface is concave when the trap is open. Closure occurs when the lobes of the trap flip shut so that this situation is reversed. After closure the inner surface is concave and the outer surface is convex. Thus, the movement occurs in the lobes and not at a "hinge" between them as is sometimes erroneously stated. See continuation of Stephen Williams' article on page 91. Photo and caption by S. Williams.

The co-editors of CPN would like everyone to pay particular attention to the following policies regarding your subscription to CPN:

All correspondence regarding subscriptions, address changes and missing issues should be sent to Mrs. Kathy Fine, c/o The Fullerton Arboretum, California State University, Fullerton, CA 92634. DO NOT SEND TO THE CO-EDITORS. Checks for subscriptions and reprints should be made payable to CSUF FOUNDATION-ARBORETUM.

**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.**

Copy deadline for the March issue is February 1, 1981.

**CO-EDITORS:**
**D. E. Schnell, Rt. 4, Box 275B, Statesville, NC 28677**
**J. A. Mazrimas, 329 Helen Way, Livermore, CA 94550**
**T. L. Mellichamp, Dept. of Biology, UNCC, Charlotte, NC 28223**
**Leo Song, Dept. of Biology, California State University, Fullerton, CA 92634**

SECRETARY-TREASURER: Mrs. Kathy Fine, c/o The Fullerton Arboretum

**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: 910 (282 new, 628 renewal). Subscriptions: $10 annually, $15 foreign. Reprints available by volume only.**

Where the podium and the lever meet is a lighter colored flexible area where the hair can be bent. It is in this area that the sensory cells have recently been demonstrated to be located by R.M. Benolken and S.L.Jacobson. These initiate the electric current that triggers the impulses which sweep over the surface of the whole trap. The smaller red knobs are digestive glands which are thought to secrete the enzymes that digest the insect.
Photo by Stephen Williams