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### INSECTIVOROUS PLANTS IN CEDARBURG BOG

Bogs, with their poorly drained organic soils, high water tables, low mineral content and cool sluggish water, offer unique habitats for a variety of unusual plants of which the insectivorous ones are especially interesting. These plants have one feature that separates them from others—their leaves are capable of attracting, holding and partially digesting insects. Because bogs are difficult to traverse during the warmer months of the year, and the mosquitoes are numerous, many persons have never observed these plants in their native habitats and few professional botanists have studied the nature of their physiological adaptations to this environment. A series of articles about these "carnivorous plants" by Plummer (1966) and West (1965), which appeared in the publication *Carolina Tips*, prompted this writer to investigate the species which occur in Cedarburg Bog. This report is based on this survey, and most of the representatives cited here are filed as specimens in The University of Wisconsin—Milwaukee Herbarium.

The history of our knowledge about insectivorous or carnivorous plants dates back to the sixteenth century where reference to them appears in several herbals and in some of the journals of the early Spanish and French explorers who visited southeastern North America. An eighteenth century American botanist, William Bartram, also noted some of these plants in eastern United States, but he did not comment on the relationship of these plants to the insects found trapped on or within their leaves. Later workers, including Charles Darwin, observed that some of these plants with entrapped

insects produced more flowers and seeds than those without insects. Other investigators detected the odors of putrefaction about these plants and suspected their leaves were able to digest and absorb non-chitinous substances of the trapped insects. Some experiments in the 1920's suggested this to be correct as the presence of soluble nitrogenous compounds and some phosphates were detected in the water held within the leaves of some pitcher plants. However, some investigators believed that bacteria and yeasts brought in by the insects contributed the enzymes for this digestion process. Recent studies on a southeastern species of pitcher plant, *Sarracenia flava*, described by Plummer (1966), showed that the digestion-absorption processes for nitrogenous materials of insects is carried out by enzymes secreted by the leaves of these plants. Furthermore, these studies indicate that digested portions of insects also contribute phosphorus, potassium, calcium, iron and possibly other micro-nutrients to the metabolism of these plants.

Deevey (1958), Plummer (1966) and other workers have noted the interesting aquatic environment which is present in the tubular leaves of the pitcher plants. The non-absorbed water remaining in the leaves contains various nutrients which provide a suitable habitat for a number of insects which are unaffected by the digestive enzymes. In *Sarracenia flava* and probably other pitcher plants, the fly, *Sarcophaga sarraceniae*, lays its eggs and its larvae feed upon the undigested insect debris in these leaves. Other insects observed in these plants are midges, blowflies and mosquitoes, with the pitcher plant mosquito, *Wyeomyia smithii*, occurring throughout the ranges of its hosts.

Most of these insectivorous plants are widespread in tropical to warm temperate regions of the world. In these regions they probably evolved with adaptations to habitats with low levels of nitrogen, phosphorus and possibly potassium. Since most of these plants are capable of surviving without insectivory, their presence in mineral-deficient environments, such as bogs, may be due to the absence of competition from plants which are less well adapted to such conditions. Exactly when these plants became established in the bogs of temperate and boreal regions is an enigma to phytogeographers. Because most North American bogs are post-glacial in age, the migration of these plants into these habitats must have been from nearby areas with similar environmental characteristics. The Coastal Plain region of southeastern North America has poorly drained, nutrient-deficient habitats suitable for such plants, and it is likely that they migrated northward from here when the glaciated portions of the continent became available for plant colonization in early post-Pleistocene time. It is assumed that bog formation began in Wisconsin nearly 12,000 years ago; therefore, the appearance of insectivorous plants in Cedarburg Bog and other bogs was sometime later.

The representatives of these plants which have been observed in Cedarburg Bog belong to three families. The following brief descriptions of these families and some of their genera and species may be of interest to persons desiring to become acquainted with these plants.

## SARRACENIACEAE – Pitcher Plants

Only one representative, *Sarracenia purpurea*, is present in Wisconsin bogs. This is the largest of our insectivorous plants and is found on hummocks and at the bases of willows and bog birches. In Cedarburg Bog these plants are locally abundant at the east edge of Mud Lake, in the string-bog section and in the marshy area at the eastern edge of the bog basin. Each plant is readily distinguished by a rosette of tubular basal leaves, shaped like pitchers, with flaring tips and with wings along the inner sides. Each leaf is 3 to 10 inches long and up to 3 inches in diameter. The flowers appear from late May to August, on tall leafless stalks, and have greenish to purplish petals and conspicuous red, umbrella-shaped stigmas. A line drawing of this plant is shown in Figure 1. The mechanism of insectivory of this species is similar to that in *Sarracenia flava*. This family is represented by nine species in the genus *Sarracenia*, chiefly in eastern North America, and by a single species in the genus *Darlingtonia*, which ranges from northern California to Oregon.

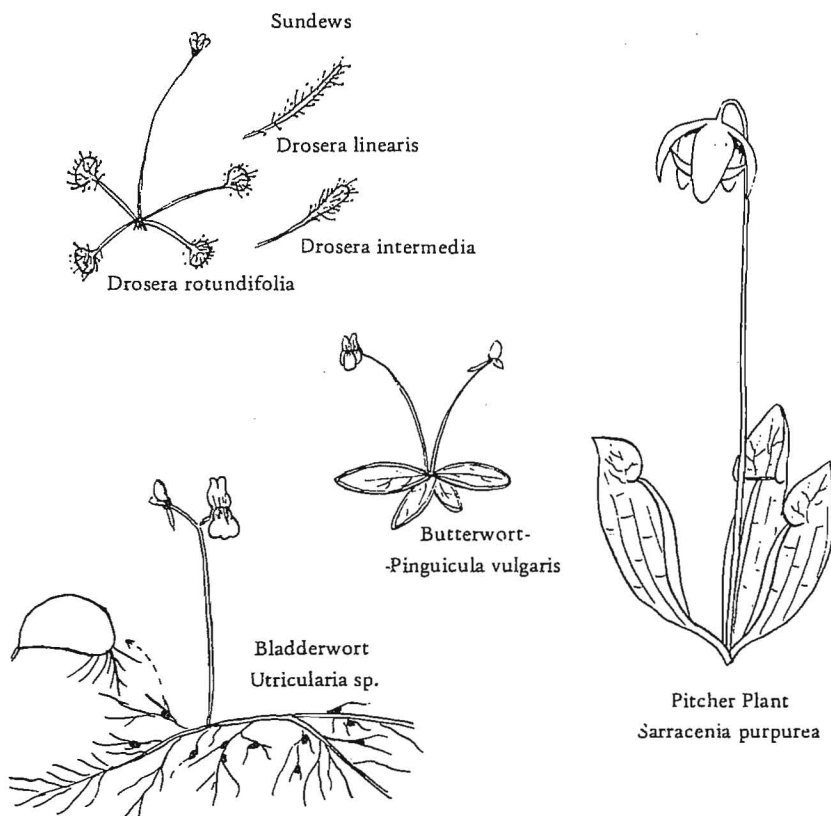


Figure 1. Some common insectivorous plants.

## DROSERACEAE – Sundews

The sundews are closely related to the pitcher plants and are often found intermingled with them in the same habitats. They are much smaller in size and, therefore, are frequently overlooked in the field. The individual plants consist of basal rosettes of flattened leaves with mucilage-tipped hairs on the blades. The flowers are small, with one or several borne on slender leafless stalks which arise from the short rootstock. The glandular hairs on the leaves not only trap insects but probably also serve as centers of reception and transmission of stimuli and some of them may also absorb some of the digested substances. West (1965) gives a very interesting description of the movement of these hairs and the curling action of the leaves during the process of trapping their prey. Because of their small size and the delicateness of the hairs, these plants are able to capture only small or very weak insects.

This family includes four genera and approximately 90 species. The largest genus is *Drosera*, with 85-88 species, most of them in Australia. About seven species of this genus occur in North America. The species collected in Cedarburg Bog may be recognized by the shapes of their leaf blades (Fig. 1), which vary in outline from linear to oval. Another interesting representative of this family is the Venus Flytrap, *Dionaea muscipula*, an endemic to a small area in North Carolina, which is often kept in terraria as a novelty.

## LENTIBULARIACEAE – Bladderworts and Butterworts

This family includes about 5 genera and 260 species which are world-wide in distribution. The largest genera are *Utricularia*, with about 100 species and *Pinguicula*, with 32 species.

The bladderworts, *Utricularia* sp., are found throughout Wisconsin in sluggish lakes and ponds. The leaves and stems, which are submerged, are not clearly distinguishable from each other but appear as a branching filamentous mass, sometimes two or more feet in length. From this mass, stalks arise which bear the yellow or purplish flowers above the surface of the water. Among the filaments are many small bladder-like structures which give the plants their name. A pictorial representation of one of these plants, together with an enlarged view of one of the bladders, is shown in Figure 1. Each bladder is attached by a short stalk and has a small opening at one end. The opening is fringed with hairs and is closed by means of two flaps. Minute swimming insects as well as such small animals as *Paramecium* and *Daphnia* may be trapped and digested within these structures. The exact nature of the digestive process and the enzymes involved are not known for these plants. In Cedarburg Bog, bladderworts may be observed in Mud Lake and in Long Lake. The specimens noted have been collected exclusively in Mud Lake (Modlin, 1970) and include *Utricularia vulgaris* and *U. geminiscapa*; however, other species which may occur here are *U. purpurea*, *U. gibba*, *U.*

*intermedia* and *U. cornuta*. The last species is usually found on moist peaty lake shores rather than in the lake proper.

Because these species are difficult to identify without complete plants, no detailed treatment is included in this report. Persons interested in identifying the individual species are referred to *Gray's Manual of Botany* or Fassett's *Manual of Aquatic Plants*.

The butterworts, *Pinguicula* sp., are plants with rosettes of yellow-green leaves, with curled margins, from which arise several scapes bearing one or more violet-like flowers. See Fig. 1. The upper leaf surfaces contain stalked and sessile glandular hairs which trap small and weak insects. The stalked hairs are mucilaginous and aid in trapping the insects, while the sessile ones contain enzymes for the digestion of the soft parts of the insects. These hairs are also capable of absorbing the digested material.

*Pinguicula vulgaris* is the only representative of the butterworts throughout boreal North America, but to date has not been collected in Wisconsin. Since it has been reported in northern Minnesota and northern Michigan, it should be looked for in northern Wisconsin. Because a number of other boreal species are present in Cedarburg Bog, it is a remote possibility that this plant may be found here.

Because insectivorous plants are restricted to specialized habitats, and are not abundant, they should never be picked. Finding them is in itself a rewarding experience, so they should be left untouched for others who have the fortitude to venture on a bog safari.

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