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The ecology of a moth associated with the northern pitcher plant (Sarracenia purpurea)

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THE ECOLOGY OF A MOTH ASSOCIATED WITH THE NORTHERN PITCHER PLANT, *SARRACENIA PURPUREA L.*

ABSTRACT

Endothenia daeckeana Krft. is an obligate associate of S. purpurea L. in Wisconsin. This paper presents a preliminary analysis of the ecological relationship between this moth and its host plant.

INTRODUCTION

The insectivorous habit has evolved in seven plant families world wide (Lloyd 1942, Schmucher and Linnemann 1959). Representatives of three families: the Droseracea, the Lentibulariaceae, and the Sarraceniaceae occur in North America. All but one of the eight species of the genus Sarracenia are confined to the southeastern United States. Sarracenia purpurea L., the northern pitcher plant, has the widest distribution reaching northward into the Canadian Provinces (McDaniel 1966). In Wisconsin, this species is confined to wet acidic or alkaline organic soils.

Much scientific and popular attention has focused on the insectivorous nature of this species (Lloyd 1942, Darwin 1900, Thompson 1981). S. purpurea has a cluster of specialized pitcher-shaped leaves that fill with liquid. Insects are attracted to these leaves, become trapped in the pitchers, die, and are digested by enzymes secreted by the plant (Lloyd 1942).

Much less is known about the insect associates which make use of the pitcher plants' other structures. A number of insect species use various parts of S. purpurea without being entrapped. Fish and Hall (1978) provide a detailed examination of the growth and development of the pitcher plant leaves and their insect fauna. They described a unique community of insect larvae and microbial decomposers that inhabit the modified leaves of the species. Jones (1907, 1908, 1921) described three groups of moths which also inhabit different portions of the plant: Papaipema appasionata Harvey (making use of the leaf), Exyra rolandiana Grt. (the rhizome), and Endothenia daeckeana Krft. (the reproductive structures).

Despite an early interest in the insect associates of S. purpurea, few detailed ecological studies exist. This preliminary study was designed to examine the ecology of one of these insect associates, the moth, Endothenia daeckeana. In the northern portion of its range, E. daeckeana is an obligate associate of S. purpurea and has been reported from plants in Maine and New Jersey (Heinrich 1926, Jones 1907, and Brower and Brower 1971). Previous work suggests that the larvae overwinter in the flowering stalks but little else is known about its distribution or ecology.

METHODS

Pitcher plant flowering stalks from the previous year were randomly collected from flarks within the Cedarburg Bog, Ozaukee Co., Wisconsin. A different flark

was used for each sampling period. Each old stalk was opened and any larvae or pupae found were collected and reared in closed culture dishes in the laboratory. Preliminary samples were collected in January and February 1981. Thereafter, sampling was at least monthly through July.

In early July, we placed 1m. tall wooden dowels covered with Tanglefoot among several patches of pitcher plants. These dowels were placed close to the plants so that any emerging insects might be sampled. Traps were checked several times during the remainder of the summer.

Flowering individuals were marked in late May and checked through the summer for evidence of insect predation.

RESULTS

Larvae were found in all collections of old flowering stalks. These moth larvae were reared in the laboratory and adults sent to the Smithsonian Institution for identification. All adults were identified as Olethreutes (=Endothenia) daeckeana Krft., Olethreutidae, Lepidoptera. About 20% of the flowering stalks examined had larvae, pupae, or visible signs of their presence (Table 1). Each infected flowering stalk had only one larva or rarely two. Most of the larvae were found in the hollow flowering stalk but a few were also found in the receptacle.

Table 1. The percentage of Sarracenia purpurea individuals inhabited by by larvae and pupae of Endothenia daeckeana during 1981 in the Cedarburg Bog, Wisconsin.

	March	April	May	early June	mid June	July
Larvae present	20	28	18	19	3	8
Pupae present	0	0	2	0	0	0
Evidence of pupae	0	0	0	11	17	16
N	82	83	132	59	99	63

Pupae first appeared in late May. However, evidence of pupae and larvae was found in old flowering stalks until the last collection date in early July. Most old flowering stalks had deteriorated after the July date and fallen to the peat surface. Sampling of old flowering stalks was discontinued after this date.

We collected no adult Endothenia moths on our tanglefoot traps. Adults had emerged from our laboratory reared larvae 10-21 days after they pupated, so we suspect that we had put out our traps too late.

In 1981, pitcher plants in the Cedarburg Bog flowered from the end of May to the middle of June. This overlapped the suggested period of adult moth emergence (which apparently continued until early July). By the July sampling date, the developing capsules showed evidence of larval damage. The larvae found were 1/2 the size of the overwintering ones and were consuming unripened seeds.

Most of the moth larvae that pupated in the laboratory did not develop into adults. An internal parasitoid developed in these individuals and emerged. These were collected and identified as an Ascogaster spp. All Ascogaster are egg-larval parasitoids of concealed feeding microlepidoptera (Shaw pers. comm.).

DISCUSSION

E. daeckeana adults emerge throughout the summer and lay their eggs on the developing flower bud or seed capsule of S. purpurea. It appears that only one egg is laid on each flowering stalk. Larvae feed on the seeds, then burrow into the receptacle and hollow out a chamber or continue through and develop a chamber in the hollow flowering stalk. The larvae overwinter in the stem or receptacle and begin to pupate shortly before the flowering period. Adults emerge soon after.

The larvae are vulnerable to attack by a parasitoid, Ascogaster spp. Ascogaster belongs to the Braconidae subfamily Cheloninae, a large economically beneficial group of parasitic Hymenoptera. In the Cheloninae, an egg is laid in the host and the parasitoid matures when the host reaches maturity (Borror et al. 1976). Ascogaster seems quite efficient at finding Endothenia larvae. Over 80% of the larvae reared in the laboratory had Ascogaster developing within them.

The ecology of E. daeckeana is the result of complex selective pressures exerted by the host plant and the parasitoid. In Wisconsin, E. daeckeana has an obligate relationship with the pitcher plant, S. purpurea. It utilizes safe portions of the plant and avoids contact with the pitchers. The flowering stalk and developing capsule provide a source of food and a relatively safe site for development. On the other hand, the braconid, Ascogaster spp., keeps the Endothenia population in check and probably exerts other selective pressures.

Endothenia adults may lay only one egg per capsule as a response to Ascogaster predation. Endothenia larvae may be particularly vulnerable to the Ascogaster spp. in the flowering stalk. Individuals in the receptacle may be more protected.

We have not been able to resolve whether Ascogaster spp. is an obligate parasitoid of E. daeckeana or has an alternate host. Having an alternate host may be important in years when pitcher plant flowering is low or when population levels of E. daeckeana are low.

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LITERATURE CITED

Borror, D. J., D. M. Delong, and C. A. Triplehorn. 1976. An introduction to the study of insects. 4th Edition. New York: Holt, Rinehart and Wilson. 852 pp.

Brower, J. H. and A. E. Brower. 1971. Notes on the biology and distribution of moths associated with the pitcher plant in Maine. Proc. Entomological Soc. of Ontario. 101: 79-83.

Darwin, C. 1900. Insectivorous Plants. 2nd Edition. New York: Appleton.

Fish, D. and D. W. Hall. 1978. Succession and stratification of aquatic insects inhabiting the leaves of the insectivorous plant, Sarracenia purpurea. Am. Midl. Natur. 99: 172-183.

Heinrich, C. 1926. Revision of the N. American moths of the subfamilies Laspeyresiinae and Olethreutinae. Bull. 132. U. S. National Museum (Smithsonian Institution).

Jones, F. M. 1907. Pitcher-plant insects. II. Entomol. News 18:413-420.

Jones, F. M. 1908. Pitcher-plant insects. III. Entomol. News 19:150-156.

Jones, F. M. 1921. Pitcher-plants and their moths. Nat. Hist. 21: 296-316.

Lloyd, L. E. 1942. Carnivorous plants. Chronica Botanica, Waltham, Mass. 352 pp.

McDaniel, S. 1966. A taxonomic revision of Sarracenia (Sarraceniaceae). Ph.D. thesis. Florida State University.

Schmucker, Th. and G. Linneman 1959. Carnivorie. In: W. Ruhland (Ed.), Handbuch der Planzenphysiologie. Band XI. Heterotrophie: 193-283. Berlin: Springer-Verlag.

Thompson, J. N. 1981. Reversed animal-plant interactions: the evolution of insectivorous and ant-fed plants. Biological Journal of the Linaean Society 16:147-155.

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