INSECT-PLANT RELATIONSHIPS OF THE INSECTIVOROUS PITCHER PLANT *SARRACENIA MINOR*[1]

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ABSTRACT

Eighty plants of *Sarracenia minor* Walt from Alachua County, Florida, were examined for insect prey and living insect associates. Leaf damage by the noctuid moth *Exyra semicrocea* (Guenée) had rendered two-thirds of the leaves non-functional and young larvae were present in 22.5% of the remaining functional leaves. Larvae of the sarcophagid *Blaesoxipha jonesi* (Aldrich) were present in 64% of the functional leaves and were estimated to consume as much as 50% of the insect prey captured by the leaves. Nests of the sphecid wasp *Isodontia mexicana* (Saussure) prevented insect capture in an additional 2.5% of the functional leaves. Over 90% of the insects captured by the leaves were ants, indicating that *S. minor* may be specialized in securing its insect prey.

Pitcher plants seem to illustrate every imaginable relationship between plants and insects. They capture insects in leaves modified as pitfall traps and can absorb amino acids, peptides, and other nutrients from insect prey (Plummer and Kethley 1964). Several species of aquatic Diptera have adapted to survive in the digestive fluid of pitcher plant leaves consuming the remains of captured insects and intercepting much of the nutrients earned by the plant (Jones 1935). Larvae of noctuid moths known only from pitcher plants feed directly upon the leaf tissues often inflicting considerable damage to local plant populations (Jones, 1920). Also, empty leaves occasionally provide a convenient nesting site for certain ants (Kannowski 1967) and wasps (Jones 1904).

This report concerns the insect relationships of the Hooded Pitcher Plant, *Sarracenia minor* Walt. This species is locally abundant in poorly drained pinewoods along the Atlantic Coastal Plain from central Florida to the southern portion of North Carolina (McDaniel 1971). Tall pitchers with translucent spots on a strongly recurved hood distinguish this pitcher plant from all other species of *Sarracenia* (Fig. 1).

MATERIALS AND METHODS

On 18 August 1974, I collected one leaf from 80 plants in a moderately dense stand of *S. minor* on the periphery of a small pinewoods pond near Orange Heights, Alachua County, Florida. The noctuid moth *Exyra semicrocea* (Guenée) had extensively damaged the plants leaving only one leaf per plant, on the average, in a functional state. Each leaf was severed at the base of the petiole, placed upright in a plastic bag, and stored in an insulated box for transportation to the laboratory. Within 24 hours each leaf

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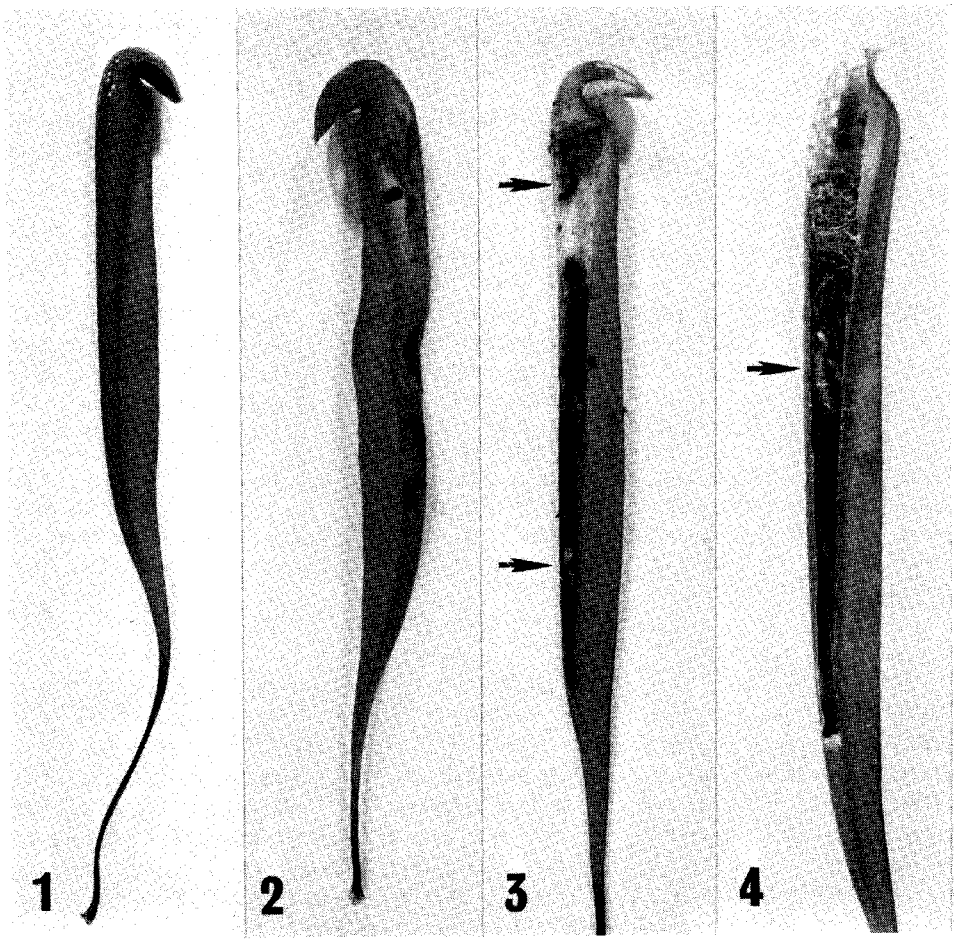

Fig. 1. A functional leaf of the Hooded Pitcher Plant, *S. minor*. (Approx. 1/3 actual size.) Fig. 2. Damage to *S. minor* leaf by the noctuid moth *E. semicrocea*. Fig. 3. Co-occupation of a leaf chamber of *S. minor* by *E. semicrocea* (above) and *B. jonesi* (below). Fig. 4. Occupation of a *S. minor* leaf chamber by a larva of the sphecid wasp *I. mexicana* (arrow).

was slit lengthwise with a surgical scalpel and inspected for insect prey and living insect larvae. Samples of living larvae were reared to maturity for positive identification.

Results and Discussion

Insect Associates—The most obvious insect associate of *S. minor* was the moth *E. semicrocea*. Plants were estimated to possess on the average, three leaves, two of which had been at least partially consumed by *E. semicrocea* (Fig. 2). Leaves damaged by this moth were riddled with holes and most had toppled over. Leaves in such condition are obviously not functional as insect traps and usually contain no other insect associates. Of the 80 functional leaves 18 (22.5%) also contained moth larvae but did not

show signs of damage. In most of these the larvae had just hatched from small white eggs secured to the upper inside portion of the leaves.

Such extensive damage by *E. semicrocea* is surprising since *S. minor* populations tend to be quite isolated and no other host species are known to occur in Alachua County. Factors which prevent this pest species from totally destroying its only host plant deserve more careful study.

The sarcophagid *Blaesoxipha (Fletcherimyia) jonesi* (Aldrich), which inhabits the leaf's digestive fluid, was rather abundant. Single larvae were in 51 (64%) of the leaves, and all 3 larval stages were represented among the samples. *B. jonesi* is an obligate pitcher plant inhabitant as are all species in the subgenus *Fletcherimyia* (Stone *et al.* 1965).

The young are deposited as first instar larvae into newly opened leaves where they complete their larval development consuming freshly captured insects (Forsyth and Robertson 1975) (Fig. 3). Pupation occurs outside the leaf. These fleshy maggots were reported by Hepburn and Jones (1919) to possess anti-enzymes which protect them from the digestive fluid.

Larvae of a third insect associate, the sphecid wasp *Isodontia mexicana* (Saussure), were found in 2 of the samples (2.5%). The bottom and top extremes of an inhabited leaf were filled with dead plant material forming a closed chamber. Inside the chamber was a single wasp larva with numerous tree crickets and caterpillars obviously provided by the adult (Fig. 4). This insect cannot be an obligate pitcher plant inhabitant since its range exceeds that of the plants (Jones 1935; Bohart and Menke 1963).

All three of the insects inhabiting *S. minor* are of some disadvantage to the plant. *E. semicrocea* obviously renders many of the leaves functionless as insect traps, although the remaining leaf tissue stays green for some time and may contribute to the plant by photosynthesis. *B. jonesi* does not damage the leaves in any way but it does consume substantial amounts of insect material captured by the plant. The largest maggots occupy nearly as much space as the captured insects, which indicates that they may be intercepting as much as 50% of the insect material from the plant.

Occupation of leaves by the wasp larvae also renders the leaves functionless as insect traps since the tops of the pitchers are plugged with dead plant material. The development time for this species is not known, but if it is brief the leaves may become functional at a later time.

Considerable interaction occurs among the three insect associates of *S. minor*. Leaves attached by *E. semicrocea* are not suitable as nesting sites for *I. mexicana*. However, a leaf once occupied by the wasp may be safe from moth damage since it seems to attack from the inside of the leaf.

The time of invasion by *E. semicrocea* is of importance to the survival of the sarcophagid. *B. jonesi* can survive only if leaf damage is delayed until enough insects are captured to support its larval development. Otherwise, it will surely starve. Occupation of a leaf by *B. jonesi* does not prevent the moth from attacking and their coexistence was noted in several of the samples (Fig. 3).

The population of *E. semicrocea* may have a suppressive effect upon *B. jonesi* but its effects on *I. mexicana* would probably be minimal since the wasp presumably also nests elsewhere.

INSECT VICTIMS—The insects captured by the pit-fall-trap leaves of *S. minor* were mainly ants, with lesser numbers of small Diptera, winged Hymenoptera, and a few Blattidae. Over 90% of the leaves from which in-

sect remains were recognizable contained ants, sometimes 100 or more, in various stages of decomposition. Several leaves contained many newly captured live ants which boiled out when slit for inspection. The small Diptera seemed to be associated with the few newly opened leaves as they had not yet been decomposed and no other insect remains were present.

These observations indicate that *S. minor* may be more selective in capturing insects than other pitcher plant species, and concur with similar observations made by Jones (1935). Judd (1959) and Swales (1969, 1972) report 11 orders of insects recovered from the leaf fluid of *S. purpurea* and Wray and Brimley (1943) report 12 orders from *S. flava*.

This apparent prey selectivity may be due to the physical nature of the leaves as *S. minor* leaves are much narrower than those of *S. purpurea* and *S. flava*. However, the possibility of a more order-specific chemical attractant should not be overlooked.

Conclusions

Leaf samples from a north Florida collection site indicate that a population of *S. minor* can be profoundly affected by its insect associates. *E. semicrocea* causes extensive damage to the leaf tissues, decreasing photosynthesis and disabling the insect traps. *B. jonesi* parasitizes the digestive fluid consuming significant amounts of captured insects. *I. mexicana* plugs the openings of leaves preventing the entrance of prospective insect prey. All of these insect associates of *S. minor* are detrimental to the host plant.

Insects beneficial to the plant in the form of prey are much less diverse than those of other pitcher plant species indicating that *S. minor* may specialize in capturing ants.

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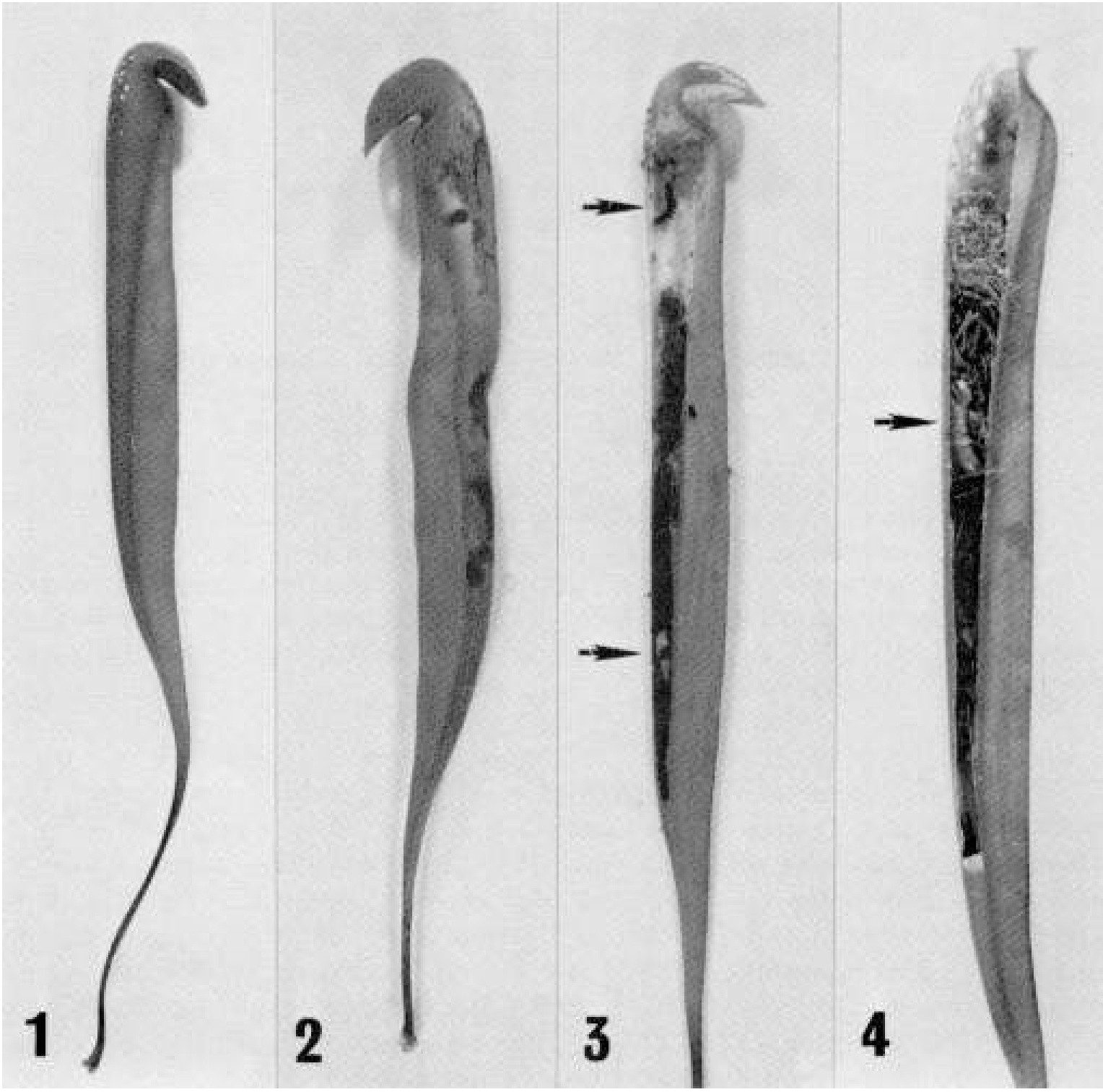
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