PROCEEDINGS
OF THE SECOND SYMPOSIUM
ON THE BOTANY OF THE BAHAMAS

Editor

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CCFL Bahamian Field Station

San Salvador, Bahamas

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Printed by Don Heuer in the USA

ISBN 0-935909-

HEMIPTERA ASSOCIATED WITH SEVERAL BAHAMIAN SHRUBS

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ABSTRACT

I surveyed the Hemiptera on five species of shrubs to determine specific relationships between these insects and the reproductive state of their host plants. In daily surveys of each species, I noted reproductive state of the plant, insects present, and their position on the plant. Several species preferred hosts bearing fruit. The shield bug, *Diolcus irroratus*, preferred female plants of *Croton linearis* with mature fruits. The seed bug, *Craspeduchus bilimeki* preferred fruits of its host plant, *Corchorus hirsutus*. Another seed bug, *Oncopeltus aulicus*, preferred fruiting *Urechites lutea*. The same species also inhabits *Asclepias curassavica*. Both its host plants produce cardenolides. The stink bug, *Loxa viridis*, preferred fruits of *Leucaena leucocephala*. Two predator species occurred on the plants. The ambush bug, a *Phymata* species, preferred staminate flower stalks of *C. linearis*. The assassin bug, *Zelus longipes*, occurred on *L. leucocephala* and *U. lutea*.

INTRODUCTION

Specific plant-insect interactions have evolved over a long period of coevolution during which the plant's chemical defenses were countered by detoxifying mechanisms of the insects (Ehrlich & Raven, 1965). It has been suggested that in the tropics where the shortage of soil nutrients combines with strong selective pressures by herbivores (Janzen, 1970), there may be more instances of chemical defense and herbivore specialization.

The purpose of this study was to determine whether specific relationships exist between some of the common shrub species on San Salvador Island and the insects found on them. I hypothesized some herbivores would be specific to the plants known to produce secondary chemicals. I also hypothesized that some insects would prefer specific reproductive stages of their host plants. The plants studied were *Croton linearis* Jacq., (Family: Euphorbiaceae), *Lantana involucrata* L. (Family: Verbenaceae), *Corchorus hirsutus* L. (Family: Tiliaceae), *Leucaena leucocephala* (Lam.) de Wit (Family: Legmunosae), and *Urechites lutea* (L.) Britt (Family: Apocynaceae). All are species associated with the coastal coppice plant community found near the northern end of San Salvador (Smith, 1982).

This study concentrated on members of the insect order Hemiptera. Since these insects are rather poor fliers, they remain relatively inactive on their host plants for long periods of time. Their forewings, called hemelytra, are half leathery and half membranous, and are not as well adapted to lift the heavy bodied forms in flight. When feeding, they insert the modified piercing-sucking mouthparts into the food and begin digestion prior to ingestion. This also produces long periods of relative inactivity. While many species of Hemiptera are phytophagous, others are insectivorous. At least 29 species in this order have been reported on San Salvador Island, Bahamas (Elliott, 1984a).

METHODS

I conducted these observations between May 16 and June 6, 1986 at two sites near the northern end of San Salvador. I studied *C. linearis*, *C. hirsutus* and *L. involucrata* on the dump road, about 1/4 mi. south of the C.C.F.L. Bahamian Field Station. I studied *L. leucocephala* and *U. lutea* on the grounds of the field station.

On 16 May, between the hours of 1300 and 1600, I surveyed the 119 *C. linearis* along the dump road between the intersection with the Queen's Highway and the path to the beach. I recorded the size and reproductive condition of each plant, counted the Hemiptera present, noted the sites they occupied on the plants, and recorded other

TABLE 1

Hemiptera Associated with Each Shrub Species

Croton linearis Jacq.

Diolcus irroratus (Fabr.) (40)
Phymata sp. (13)
Hyalymenus longispinus Stal (5)
Craspeduchus bilimeki (Distant) (3)
Banasa herbacea (Stal) (1)
Chondrocera laticornis Laporte (1)
Oncopeltus aulicus (Fabr.) (2)

Lantana involucrata L.

Oncopeltus aulicus (Fabr.) (1)

Corchorus hirsutus L.

Craspeduchus bilimeki (Distant) (770)
Banasa herbacea (Stal) (3)
Hyalymenus longispinus Stal (1)
Diolcus irroratus (Fabr.) (2)
Jadera antica (Walker) (1)
Oncopeltus aulicus (Fabr.) (3)

Urechites lutea (L.) Britt.

Oncopeltus aulicus (Fabr.) (90)
Zelus longipes (L.) (5)

Leucaena leucocephala (Lam.) de Wit

Zelus longipes (L.) (21)
Loxa viridis (Palisot de Beauvois) (6)
Thyanta perditor (Fabr.) (1)
Oncopeltus aulicus (Fabr.) (1)

insect visitors as well. On May 17, I marked 25 individuals each of *C. linearis*, *L. involucrata*, and *C. hirsutus*. I surveyed them daily until June 5, recording reproductive condition and number and position of the Hemiptera present.

Twenty-five plants of *L. leucocephala* and *U. lutea* were surveyed daily from May 20-30, and the same data collected.

RESULTS AND DISCUSSION

The Hemiptera visiting each species are listed in Table 1. The fauna of each plant species will be discussed separately.

Croton linearis

This plant is dioecious (Correll and Correll, 1982). Staminate flowers open periodically following rains (Elliott, 1984b). The pistillate flowers have virtually no petals (Spahn, 1982). The mature fruit is a brown mottled capsule. The plant must contain some secondary chemicals since it is used medicinally throughout the Bahamas (Smith, 1982; Higgs, 1969). Its medicinal properties have been discussed at this symposium (White, 1987).

The phytophagous shield bug, *Diolcus irroratus* (Fabr.) was the most commonly

encountered hemipteran on this species. This insect is globose, yellow-brown and mottled and looks superficially like one of the fruits of the plant. Because of this resemblance, one might expect the insect to show a preference for plants in fruit, or about to fruit.

Of the 119 plants surveyed on May 16, 53% were male, and most bore only floral buds that day. 47% of the plants were female, many with developing fruits. A total of 32 plants bore insects that day; 13 were male plants and 19 female. There was no difference between the pattern of insect visits to plants of each sex and that expected due to chance (chi square = 2.01). However, of the 16 plants bearing *D. irroratus*; 15 were female plants, and one a male. These results show a significant preference for female plants (chi square = 14.1). Furthermore, while only 23% of the female plants bore mature fruits, 53% of the *D. irroratus* were on those plants; thus they showed a significant preference for fruiting plants (chi square = 7.5). I also observed a significant preference for female plants during the long term studies (chi square = 6.86).

A species of ambush bug, *Phymata* sp., also occurred on granny bush. These insects feed on insects they capture while lying in wait on vegetation. Thirteen individuals of this species were seen on the 25 marked plants during the study. Two nymphs occurred on male buds where the pale yellow-green, slightly globose immatures were well-camouflaged. The others were adults and occurred on staminate flowering stalks. The pale color and irregular outline of these adults contributed to their camouflage among the flowers of *C. linearis*. Furthermore, the male flowers of *C. linearis* attract a number of pollen and nectar-feeding insects such as bees, wasps, flies, and small butterflies, all potential prey for the adults.

The phytophagous broad-headed bug, *Hyalymenus longispinus* Stal was occasionally encountered on *C. linearis*.

Lantana involucrata L.

The only insects commonly seen on marked plants were scale insects, and the coccinellid beetles which preyed upon them. A single individual of the seed bug *Oncopeltus aulicus* (Fabr.) was seen briefly on a plant during the survey.

Corchorus hirsutus L.

The most common hemipteran visitor was *Craspeduchus bilimeki* (Distant), a seed bug. Twenty-two of the twenty-five marked plants were occupied at least one day during the study. The three unoccupied plants bore few reproductive structures or none. Typically adults and nymphs occurred on the same plants; mating pairs also occurred frequently. The population on marked plants appeared to decline during the study. There were a mean of 70.42 $\pm$ 9.43 individuals observed daily during the first week of observations, and only 28.71 $\pm$ 8.04 seen per day during the last week. The decrease occurred in all age classes. Perhaps this was in part due to my disturbance of the plants each day as I counted bugs. The disturbed plants appeared to dry as the survey continued.

Most of the plants bore both floral buds and fruits throughout the study. I recorded the numbers of individuals on buds, fruits, and vegetative parts of the plants, and found a significant preference for fruits (chi square = 599.5). This preference is consistent with the fact that these insects are seed eaters at all stages of the life cycle.

Urechites lutea (L.) Britt.

The plants I surveyed were not marked, and different individuals may have been observed. The plants varied in reproductive condition; 8.% were in flower; 31.5% had both flowers and floral buds; 17.5% bore old pods, that had opened and released seed; 13% bore mature pods with seeds, and 30% had no reproductive structures. The most common hemipteran on these plants was *O. aulicus*. The number occurring on plants with mature pods was significantly greater than expected if plants were selected randomly without regard to reproductive condition (chi square = 183.25). These insects, too, belong to the seed-eating insect family, Lygaeidae, and their preference for pods bearing seeds is understandable.

O. aulicus also frequents plants of the milkweed, *Asclepias curassavica* L., in the grazed areas at the end of Jake Jones' Road (Elliott, 1984a). *A. curassavica* contains toxic cardenolides fed upon and utilized by the

monarch butterfly as a defensive chemical (Brower, 1969). The fact that danaine butterflies visit plants in both the Asclepiadaceae and Apocynaceae has been considered evidence that they formed feeding relationships with the Apocynaceae prior to the divergence of the Asclepiadaceae (Edgar, 1975; 1982). However, *Urechites* is one of the few apocynaceous genera which still contain cardenolides. These chemicals may act as attractants for oviposition and feeding by insects able to withstand their toxicity (Edgar, 1975). Thus it is possible that attraction to the cardenolides is the basis for use of both *A. curassavica* and *U. lutea* by *O. aulicus*. Berenbaum and Miliczky (1984) have recently shown that other species of *Oncopeltus* store cardenolides, which protect them from invertebrate predators such as mantids, and that their black and red coloration is also aposematic.

Probably the presence of toxins in *Urechites* explains the absence of other phytophagous Hemiptera. The only other hemipteran observed on *Urechites* was *Zelus longipes* (L.), another sit-and-wait predator, similar in its behavior to *Phymata*. A variety of color patterns have been reported in the West Indian populations of this widely distributed species (Hart, 1986). Those on San Salvador have a black and orange-red pattern. Perhaps their occurrence on plants frequented by *O. aulicus* is an example of Batesian mimicry; however, this remains to be tested.

Leucaena leucocephala (Lam.) de Wit

Z. longipes also occurred on this species; there was no preference for plants in various stages of reproduction. In fact a significantly larger number of individuals occurred on plants without reproductive structures (chi square = 12.08). The reason for this is unexplained.

Six individuals of the large stinkbug, *Loxa viridis* were seen on this species, and five occurred on plants bearing brown pods. *L. viridis* occurs in two color morphs, one bright green, the color of green jumbay pods, and the other brown, the color of older pods. Although stinkbugs produce noxious secretions, birds do have techniques for eating them (e.g. Schlee, 1986); thus there may be selection for protective coloration. The presence of both green and brown pods in the field at the same time might select for the polymorphism observed in this bug.

CONCLUSIONS

Except for *L. involucrata*, each plant species had a distinct assemblage of associated Hemiptera. There were often correlations between the occurrence of a species and the reproductive condition of its host plant. The seed-eating species preferred the mature fruits of their host plants. The seed bug *C. bilimeki* preferred fruits on its host plant, *Corchorus hirsutus*. *O. aulicus* preferred fruiting plants of *U. lutea*. *D. irroratus*, which resembles the fruits of *C. linearis*, preferred female plants, particularly those in fruit. In this case, the association may have been selective as a means of camouflage. The stink bug, *Loxa viridis*, was found almost exclusively on pods of *L. leucocephala*.

Secondary plant chemicals clearly play a role in host plant selection by *O. aulicus*. On San Salvador, it prefers two species which contain cardenolids, *A. curassavica* and *U. lutea*.

The predatory species show preferences for sites where they are likely to encounter prey. This was best illustrated in the case of *Phymata* sp. which occurred most commonly on male flowers of *C. linearis*. These flowers attract a variety of pollinators which are suitable prey. This sit-and-wait predator may also obtain some advantage through camouflage. The adults are camouflaged among the flowers of *C. linearis*, and the predatory nymphs resemble the male buds on which they occur.

ACKNOWLEDGMENT

I thank Dr. and Mrs. Gerace for all their assistance during my visits to San Salvador. The field station provided room and board during this study. Additional travel support came from a Siena College Faculty Research Grant. Dr. Robert Smith of Hartwick College first helped me identify the plants I surveyed in this study. Dr. Randall Schuh of the American Museum of Natural History determined the Hemiptera. Sheryl Spurrier typed the manuscript.

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