EFFECT OF GROSS CARDIAC GLYCOSIDE CONTENT OF SEEDS OF COMMON MILKWEED, 
Asclepias syriaca, ON CARDIAC GLYCOSIDE UPTAKE BY THE MILKWEED BUG Oncopeltus fasciatus

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Abstract—Milkweed bugs, Oncopeltus fasciatus, were fed seeds of common milkweed, Asclepias syriaca, that contained differing concentrations of cardiac glycoside. Whole seeds had a mean cardiac glycoside concentration of 4.01 mg equivalents to digitoxin per g dry weight, and seed embryos had a mean concentration of 5.56 mg/g dry weight. Bugs fed these seeds concentrated cardiac glycoside: their mean concentration was 6.85 mg/g dry weight. Milkweed bugs fed seeds of lower cardiac glycoside content sequestered a greater percent of the available glycoside than bugs fed seeds of high glycoside content. The quantitative variation of cardiac glycoside content of the seeds of this single species did not significantly affect the growth of bugs. In a separate feeding preference experiment, bugs were offered seeds of both high (5.18 mg/g dry weight) and low (2.30 mg/g dry weight) cardiac glycoside content. The bugs showed no indication of selecting seeds of either high or low glycoside content.

Key Words—Warning coloration, cardiac glycosides, phytotoxin, milkweed bugs. Oncopeltus fasciatus, Hemiptera, Lygaeidae, Asclepias syriaca.

INTRODUCTION

The milkweed bug, Oncopeltus fasciatus (Dallas) (Hemiptera, Lygaeidae) usually feeds on milkweed plants, Asclepiadaceae (Feir, 1974). This plant family is characterized by a large number of species which contain cardiac glycosides, a group of secondary plant substances that affects heart function

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in warm-blooded vertebrates (Robinson, 1967). Milkweed plants are often toxic to mammal livestock feeding on them, resulting in considerable livestock mortality (Kingsbury, 1964). It is known that some insects, however, are relatively insensitive to large concentrations of cardenolides (Rothschild and Kellett, 1972). Furthermore, certain groups of insects utilize as their primary food source families or species of plants possessing the same secondary substance. Various species of lygaeid bugs (e.g., *Caenocoris nerii*) and danaine butterflies (including the monarch) feed mainly on plants of the family Asclepiadaceae (Feir, 1974; von Euw et al., 1971; Brower, 1969).

The cardenolides ingested by these insects appear to protect them from vertebrate predators. Many lines of evidence converge on this conclusion: (1) both groups of insects ingest and sequester the cardiac glycoside from the plants they eat, and both do not possess these substances if they feed on a plant lacking them (Brower et al., 1967; Scudder and Duffey, 1972); (2) bluejays fed monarch butterflies reared on toxic plants display an emetic response and will then refuse monarchs as food on sight alone (Brower, 1969); (3) both monarch butterflies and milkweed bugs are brightly colored. Speculation centers on the possible evolutionary advantage of warning coloration (Rothschild, 1972); (4) high concentrations of cardenolides occur in the ventral metathoracic scent glands and dorsolateral thoracic and abdominal spaces of the milkweed bug (Duffey and Scudder, 1974). The secretions from *O. fasciatus* and the scent glands of other hemipterans have pungent-smelling unsaturated aliphatic aldehydes (Games and Staddon, 1973). These chemicals may help a predator to identify a milkweed bug as unpalatable by providing a distinctive olfactory or gustatory cue.

The experiments presented in this paper exploited natural variation in the cardenolide content of wild collected milkweed, *Asclepias syriaca* L., seeds to investigate three questions: (1) Do milkweed bugs sequester in their bodies amounts of cardiac glycoside that are directly proportional to that of their food, or do they sequester varying proportions of cardiac glycoside from seeds having a high or low concentration of cardiac glycoside? In the latter case, milkweed bugs might have a higher minimum concentration of glycoside per bug, making an emetic response from a vertebrate predator more likely. (2) Does the concentration of cardiac glycoside in *A. syriaca* seeds affect the growth of the milkweed bug? (3) Do milkweed bugs selectively feed on seeds of either high or low glycoside content? This might result in a change in the amount of cardiac glycoside in their bodies.

**METHODS AND MATERIALS**

*Preparation of Seeds and Bugs.* Seed pods were collected from 70 *Asclepias syriaca* plants in October 1972, on Ellwell Island in the Connecticut