HEMOLYMPH TOXICITY AND FOREGUT BLOATING IN *PERIPLANETA AMERICANA* (L.) CAUSED BY COLD INJURY AND DDT INTOXICATION

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B.S., Stephen F. Austin State College, 1965

A MASTER'S THESIS

submitted in partial fulfillment of the

requirements for the degree

MASTER OF SCIENCE

Department of Entomology

KANSAS STATE UNIVERSITY
Manhattan, Kansas

1970

Approved by:

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INTRODUCTION

Toxins may be liberated into insect hemolymph by several different types of stressors such as intoxication by chlorinated hydrocarbon and organophosphorus insecticides, electrical stimulation, immobilization and induced physical activity (Roan and Hopkins, 1961; Sternburg, 1963). Sternburg and Kearns (1957) first reported a toxic hemolymph factor which was not DDT in DDT-poisoned American cockroaches. Beament (1958) reported that immobilization or constant motion in a revolving powder mill caused paralysis in Periplaneta americana (L.), and that the paralyzing factor was a blood toxin possibly from neural origin. Heslop and Ray (1959) suggest that there is a common reaction of P. americana to insecticidal intoxication that may obscure the specific symptoms of the insecticide and that any type of stressor may cause common symptoms once a certain mechanism is triggered. Patel and Cutkomp (1967) found some similarities and some significant differences in oxygen consumption, heartbeat frequency, and loss of weight between immobilized cockroaches and DDT-treated cockroaches depending on the conditions to which they were subjected. They postulated that secondary effects of DDT were essentially those of stress, but the primary effects were distinctive. Ameel (1965) observed the collection of gas in the foregut of Leucophaea maderae (Fabr.) and P. americana when they were subjected to organophosphorus and chlorinated hydrocarbon insecticides, induced physical exercise and electrical shock. The effects of the various types of stress on the nervous system are not known, but it is possible that the damage results in ion leakage thus producing hyperactivity and nervous tremors. Bloating of the foregut appears to be a secondary symptom after prolonged stress and nervous system break down.

This study was concerned with the effects of cold injury and immobilization on the production of hemolymph toxins, foregut bloating, and comparison of these symptoms to those produced by DDT intoxication in P. americana. The first phase was designed to investigate the syndrome of stress symptoms related to cold injury and how cold injury affects foregut bloating. The second phase investigated the toxicity of the hemolymph at various times after cold injury and the effects of different dosages of toxic hemolymph on normal cockroaches. The third phase was the relationship between induced prostration of cockroaches by topical DDT treatment and hemolymph toxicity. The effects of topical application of DDT to the cerci of dissected nerve cords bathed in saline and production of toxins was also investigated. Insects in each experiment were observed carefully for intoxication symptoms, foregut bloat and whether the method of stress caused toxin to be produced in the hemolymph. In the fourth phase experiments of ligating the esophagus and severing the abdominal tracheal trunks supplying the foregut were to elucidate the origin of the gas causing foregut bloat.

MATERIALS AND METHODS

Experimental Insects

Nymph and adult American cockroaches, Periplaneta americana (L.), were used, and the sex is stated when pertinent to the results of the experiment. Experimental colonies were started from "stock" colonies by transferring approximately 100 cockroaches of various instars into a #2 square galvanized tub. Each tub was equipped with a wooden frame screen top and filled with three to four inches of wood shavings on the bottom. Cockroaches were regularly fed and watered using Purina Laboratory Chow^{R} and a poultry