

**INSECTS OF ALFALFA IN MANITOBA WITH PARTICULAR REFERENCE
TO *Lygus* spp., *Adelphocoris lineolatus* (Hemiptera: Miridae) AND *Acyrtosiphon
pisum* (Homoptera: Aphididae) AND THEIR NATURAL ENEMIES**

A thesis

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of

The University of Manitoba

by

Md. Jashim Uddin

In Partial Fulfillment of the Requirements

for the Degree of

DOCTOR OF PHILOSOPHY

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Insects of Alfalfa in Manitoba with Particular Reference to *Lygus* spp., *Adelphocoris lineolatus* (Hemiptera: Miridae) and *Acyrtosiphon pisum* (Homoptera: Aphididae) and their Natural Enemies

BY

Md. Jashim Uddin

A Thesis/Practicum submitted to the Faculty of Graduate Studies of The University of
Manitoba in partial fulfillment of the requirement of the degree
Of
Doctor of Philosophy

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Abstract

Md. Jashim Uddin. University of Manitoba, 2005. **Insects of alfalfa in Manitoba with particular reference to *Lygus* spp., *Adelphocoris lineolatus* (Hemiptera: Miridae) and *Acyrtosiphon pisum* (Homoptera: Aphididae) and their natural enemies.**

Supervisor: Dr. N.J. Holliday

The study was conducted from 1999 to 2001 to determine the most suitable method to be used for sampling insect pests on alfalfa, to determine the seasonal occurrence of common insect pests and natural enemies, to assess the roles of common natural enemies on insect pests, and to find out ways to increase the benefits from insect natural enemies in relation to the production practices of alfalfa in Manitoba. Among different sampling methods, sweep-net sampling was found to be the most consistent and reliable method of sampling most insect taxa, although beat tray sampling provided better estimates for *Lygus* spp. nymphs. It was found in the present study that *Lygus* spp. Hahn, *Adelphocoris lineolatus* (Goeze) and *Acyrtosiphon pisum* (Harris) were the most prevalent insect pests. Carabids, chrysopids, coccinellids, *Nabis* spp., *Orius* spp., spiders and opilionids were the most commonly occurring predaceous taxa. Circumstantial evidence from the field study and evidence from the laboratory study indicate that coccinellids play important roles in population growth of the above pests on alfalfa. Field and laboratory studies also provided evidence that carabids, coccinellids, chrysopids and nabids alone or together as a guild can suppress these pest populations on alfalfa. Parasitoids appeared to be important, as they killed a considerable percentage of *Lygus* spp. and *A. pisum*, but not of *A. lineolatus*. *Aphidius ervi* Haliday was the most prevalent aphid parasitoid.

No control measures were required in hay fields, as swathing hay suppressed pest populations below damaging levels, partly through causing *Lygus* spp., and sometimes *A. lineolatus*, to move into adjacent seed fields. Conversely, insect pests were more numerous in seed fields, although these fields usually received chemical insecticides as pest control measures. Whether populations of natural enemies can be enhanced in seed alfalfa fields was examined, and it was found that nepetalactone, which is an aphid sex pheromone component, can be used to enhance natural enemy populations, and the benefits thereof, in seed fields.

Successful rearing of *Chrysoperla carnea* (Stephens) and *Chrysopa oculata* Say larvae by using *Megachile rotundata* (Fabricius) (leafcutting bee) prepupae as the chrysopid larval diet expanded the use of leafcutting bees and provided a basis for inexpensive culture of chrysopids. The potential of insect pests and their natural enemies for management in connection with the current alfalfa production practices are discussed.

Dedication

To the ever deprived, yet greatest pastors: the farmers of Bangladesh;
to the eternal prophesy of a great philosopher: my mother, Mahmuda Begum;

and

to the great sacrifices of my beloved father, Late Abdul Jalil Hawlader, who was eager to
see the completion of this thesis.

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CHAPTER 1

Introduction

Alfalfa, *Medicago sativa* (L.), is a perennial legume and is one of the most important forage crops grown in Canada (Harper *et al.* 1990). Alfalfa is widely grown in the Prairie Provinces (Goplen *et al.* 1987; Harper *et al.* 1990; Schaber *et al.* 1990b; Schaber and Entz 1991). Because alfalfa is a perennial plant with a dense canopy and complex crown structure, it offers relatively persistent and varied niches for insects in fields (Brown and Fick 1986; Summers 1998). As a result, diverse assemblages of insect pests and their natural enemies develop and establish in alfalfa fields (Pimentel and Wheeler 1973b; Harper 1988; Schaber and Entz 1991). A number of these insect pest species cause economic damage to alfalfa crops, particularly in the case of alfalfa grown for seed, which is a much more valuable crop than hay.

Insect pests, which damage Canadian alfalfa, include mainly the lygus bug, *Lygus* spp., the alfalfa plant bug, *Adelphocoris lineolatus* (Goeze) (Hemiptera: Miridae) and the pea aphid, *Acyrtosiphon pisum* (Harris) (Homoptera: Aphididae) (Lilly and Hobbs 1962; Harper 1978; Goplen *et al.* 1987; Murrell 1987; Schaber and Entz 1988; Soroka 1991; Soroka and Murrell 1993). In addition, damage caused by the alfalfa weevil, *Hypera postica* (Gyllenhal) (Schaber and Entz 1988; Schaber *et al.* 1990b) and the superb plant bug, *Adelphocoris superbis* (Uhl.) (Lilly and Hobbs 1962), has been reported from Alberta. Murrell (1987), however, did not often find these latter insects in alfalfa fields in Saskatchewan. In Manitoba, although prior to the study reported here no thorough studies have been done, *Lygus* spp., *A. lineolatus*, and *A. pisum* have been reported to infest alfalfa crops (Timlick *et al.* 1993; Gerber and Wise 1995).

Pest control by cultural, biological or chemical methods is available for alfalfa (Bolton and Peck 1946; Lilly and Hobbs 1962; Craig 1973; Harper 1978, 1988; Harper *et al.* 1990; Schaber 1992), though farmers rely heavily on pesticides. Debach and Rosen (1991) reviewed the effects of chemical insecticides and concluded that dependence upon chemical insecticide application is not a sustainable strategy, as chemical insecticides disrupt the natural ecological balance and escalate the resurgence of pest problems. In addition, indiscriminate use of insecticides results in development of pesticide resistant pest genotypes (Debach and Rosen 1991; Snodgrass and Elzen 1995; Snodgrass 1996). Hence, there is interest in holistic schemes to reduce the reliance on chemical insecticides and increase the use of insect natural enemies (Schaber and Richards 1979; Davis 1985) as a part of a sustainable crop production system. In Manitoba, such a scheme is lacking. To develop a holistic pest management scheme, knowledge of the important insect pests and their natural enemies, and their interactions in relation to production practices is required. The present study is designed to gather the required information and the general objectives of this thesis are

- to assemble information on what insects are frequently present in alfalfa fields,
- to examine the seasonal occurrence of more common insect pests and their natural enemies in relation to production practices in alfalfa fields,
- to investigate the roles of natural enemies on important insect pests in alfalfa fields,
- to find ways to increase the benefits from insect natural enemies.

Thesis Organization

The thesis is divided into four main sections: Introduction, Literature Review, Research, and General Discussion. The research section presents results of the thesis research in six different sub-sections (parts), each in the style of a scientific paper. The general discussion relates the important findings from the six research papers, and provides direction for future research and conclusions with respect to insect pests in alfalfa fields of Manitoba.