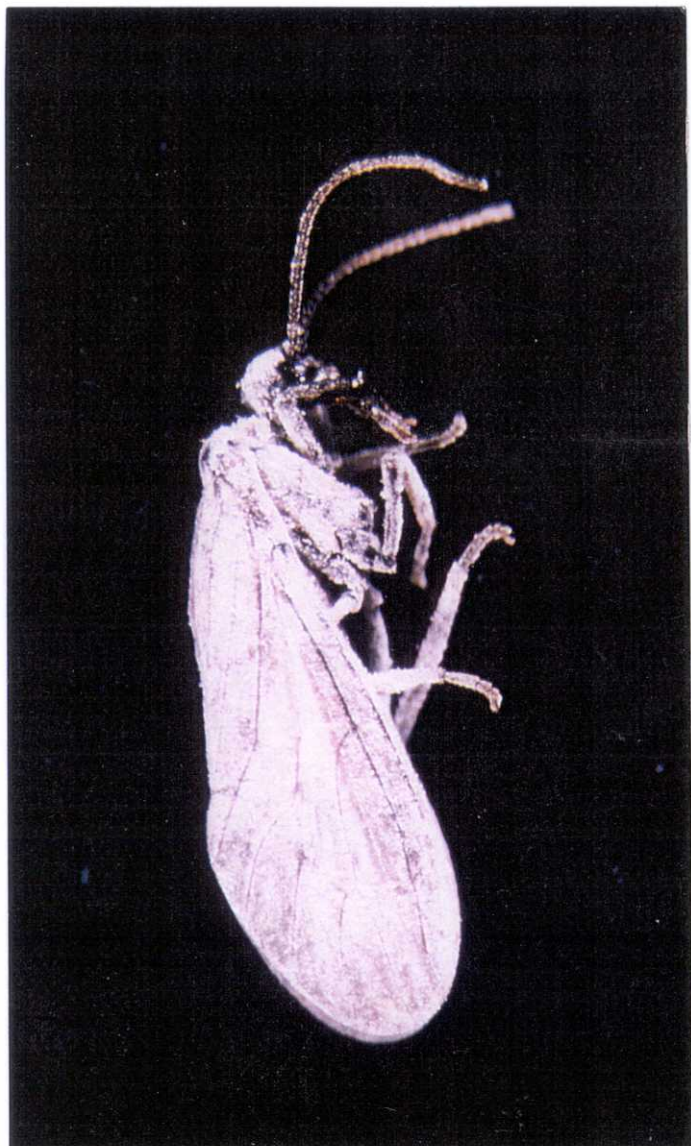


A FIELD GUIDE TO  
**BENEFICIAL INSECTS AND ARACHNIDS**  
IN BRITISH COLUMBIA SEED ORCHARDS



Michelle J.A. Hall, M.P.M.  
British Columbia Ministry of Forests

Cover photos: dusty-wing (Coniopterygidae) on left, *Harmonia* sp. ladybird beetle (Coccinellidae) on right.

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by

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Province of British Columbia

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## PREFACE

This field guide is intended for use by all persons who work in conifer seed orchards in British Columbia. It features beneficial arthropods which are common and/or important in seed orchards, with emphasis on biology and conservation. The term beneficial is used to include not only predators and parasites, but also pollinators and nutrient recyclers. Information in the guide is based on several years of monitoring and personal observations in seed orchards, and on reference to the literature. Each of 49 profiles is organized into 9 subjects: importance, distribution, biology, food source, seasonal occurrence, monitoring, conservation, recommended readings, and descriptions of life stages (with illustrations). Habitat manipulation techniques are provided to assist seed orchard managers in attracting and retaining beneficial arthropods. Pesticide toxicities specific to each beneficial are listed when available.

## INTRODUCTION

This field guide is specific to beneficial insects and arachnids in seed orchards. Some are common (e.g. ladybird beetles), and others are less commonly seen but have important beneficial effects (e.g. springtails). The guide also provides suggestions for seed orchard managers to enhance the environment to encourage beneficial arthropods to visit and/or remain in an orchard. Not covered in this guide are several other kinds of beneficial organisms including vertebrates, nematodes, bacteria, fungi and viruses.

Beneficial organisms are naturally present, helping to reduce pest insect and mite populations. Unfortunately, orchard practices sometimes interfere with their efforts. Slight changes (e.g. leaving some flowering weeds between tree rows when mowing) may allow the beneficials to exert a greater effect in suppressing pest populations. This can reduce the money, time and effort that seed orchard managers dedicate toward managing pests.

### Seed Orchards

Seed orchards are a vital component of reforestation and the basis of tree improvement in British Columbia. A seed orchard is defined as "a plantation of genetically superior trees, intensively managed to produce frequent, abundant, and easily harvested high-quality seed crops which are adapted to specific seed planning zones"(6). Each year over 200 million trees are planted in British Columbia (6). The goal of the provincial government is to supply 50% of this seed from seed orchards by the year 2000. Close to 6000 kg of seed orchard seed have been produced in the last 30 years, enough seed to produce 647 million seedlings (98). The total orchard area is increasing by an average of 12.5% per year (29).

Orchards currently (1995) produce seed for 13 species including Douglas-fir, western hemlock, western redcedar, yellow cedar, spruce (engelmann, interior, sitka and white), pine (lodgepole and white), true fir (amabilis and grand), and western larch (2), and have reached various stages of development. Seed orchards are concentrated on the Saanich Peninsula of Vancouver Island and in the Okanagan Valley due to favourable, Mediterranean climatic conditions (6).

### Profile Topics

Information in this guide is based on several years of monitoring and personal observations in seed orchards, and on reference to the literature. Description of content in each of seven descriptive categories is as follows:

**Importance.** This category may include feeding nature of different lifestages of the insect, spider or mite, beneficial value, pest potential, origin, biological control history, commercial availability, how and where released, and status in other industries.

**Distribution.** Worldwide, North American and Canadian occurrence of taxon is given.

**Biology.** Biological subjects may include whether the organisms are active during the day or night, fecundity, oviposition habits, social organization, nesting habits, development times, life expectancy, courtship and mating behavior, reproduction, overwintering habits,

generation time, type of development, territorial behavior, defence mechanisms and pheromone use.

**Food Source.** Preferred prey is given for each lifestage when possible, as well as alternate food sources, volume of prey consumed, preferred lifestage of prey, prey locating methods, and non-lethal effects on prey.

**Seasonal Occurrence.** The months when beneficial organisms are active (not necessarily feeding) are presented graphically. Data were obtained from trapping studies, B.C. Forest Service Seed Pest Management insect collection, pest survey report comments, and FIDS (Forest Insect and Disease Survey, Canadian Forest Service) insect collection. No distinction is made between different lifestages unless indicated.

**Monitoring.** Habitats where different lifestages of beneficials are likely to be collected are listed in order of most to least common occurrence. Other information may include preferred weather conditions, type of activity, host plant or tree species, and preferred time of day. Commonly used techniques (5,13,82,117) are suggested for detecting beneficials, with information on difficulty, degree of effectiveness or sensitivity, and handling procedures.

**Conservation.** This section provides suggestions for seed orchard managers who wish to attract and/or retain beneficials in the orchard. It may include attractants, alternative orchard practices, mowing techniques and pesticide toxicities (information obtained from the literature). Applying pesticides should be considered to be a last resort. When they are necessary, the Pesticide Toxicities List should be consulted to choose the least toxic alternative. Pesticides are listed by active ingredient, according to their degree of toxicity to the beneficials, in order of highest to least toxic, and may include trade names, application rates, application techniques and particularly susceptible lifestages. Pesticides registered in the United States were also included for the benefit of seed orchard managers in the Pacific Northwest states. The toxicity level assigned to a pesticide often differed between researchers. I chose the highest toxicity rating reported to represent the worst case scenario for the beneficials. These studies also reported their data in different ways. I followed the most common protocol and assigned toxicity levels as either high (>80% mortality), moderate (40-80%), low (10-40%), slight (<10%), or safe (0%). Information was obtained from the literature.

## **SEED ORCHARD RECOMMENDATIONS**

The following recommendations are examples of habitat manipulation techniques which can be used to enhance and promote natural biological pest control by attracting natural enemies and maintaining an environment that is favourable to their survival. They are inexpensive and easily integrated with other orchard practices.

### **1. USE PESTICIDES ONLY AS A LAST RESORT**

..... and consider beneficials when selecting and applying them.

### **2. ENCOURAGE PLANT DIVERSITY**

..... by allowing strips of flowering weeds to grow between rows, and maintaining hedges that naturally exist on orchard borders. This will increase the availability of resources such as alternate prey, adult food sources, and shelter areas, required to support natural enemies.

### **3. MAINTAIN PERMANENT GROUND COVER**

..... to provide beneficials with moisture, overwintering sites, and protection against predators and climate extremes.