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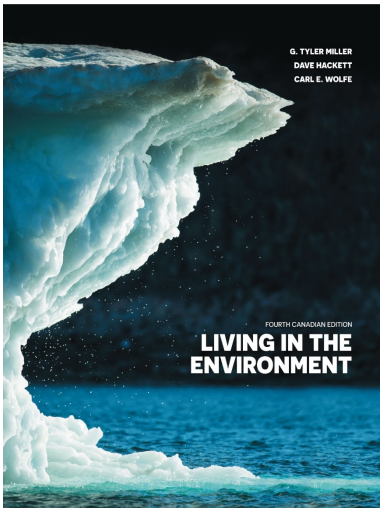

prepared by

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Chapter 23

Pest Management

Key Concepts

Types and uses of pesticides

Advantages and disadvantages of modern pesticides

Regulation of pesticides

Alternatives to conventional pesticides

How Does Nature Keep Pest Populations Under Control?

Pest

– An organism that interferes with human activity
– Situation- and opinion-dependent definition

Natural Controls

– Predators, parasites, disease

What Are Pesticides?

Chemicals designed to kill pest organisms
- Insecticides
- Herbicides
- Fungicides
- Rodenticide

Biocide: Kills species other than target

Plants have been making their own pesticides for millennia.

First-Generation Pesticides

Sulphur, lead, arsenic, mercury
- Nondegradable inorganic toxins

Plant extracts
- *For example,* pyrethrum, rotenone

Second-Generation Pesticides

Primarily synthetic organic compounds

Persistence varies from days to years

Some common types

- Chlorinated hydrocarbons
- Organophosphates
- Carbamates
- Botanicals
- Microbotanicals

DDT: The First Second-Generation Pesticide

Broad spectrum pesticide

Persistent: Not readily degraded

Water-insoluble, so retained on crops

Fat-soluble, causing **bioaccumulation**

Genetic resistance in insects

DDT: The First Second-Generation Pesticide

Thinned eggs in peregrine falcons

Killed beneficial insects

Banned in North America in 1972

Still used in countries to combat malaria

The Case For Pesticides

Save human lives from pest-transmitted disease

Increase food supplies

Increase profits for farmers

Work faster and better than alternatives

Health risks low *vs.* benefits with proper use

Newer pesticides becoming safer, more effective

What Is the Ideal Pesticide?

Affects only target pests

Does not allow pests to evolve immunity

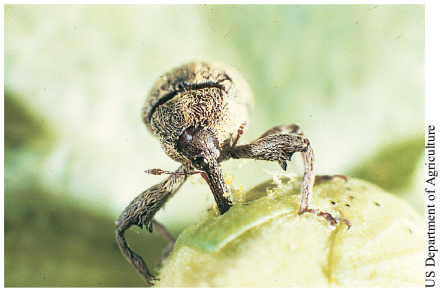
Rapid breakdown to harmless byproducts after use

Affordable and cost-effective

The Case Against Pesticides: What Is the Major Problem With Using Pesticides?

Promotes evolution of genetic resistance by selecting members of population with genetic immunity

Especially a concern for species that reproduce quickly



US Department of Agriculture

The Case Against Pesticides: What Are Other Problems With Using Pesticides?

Wipe out natural predators

– Create new pest species

– Increase populations of existing pests

Migrate into the natural environment

Harm to other wildlife or human health

How Successful Have Pesticides Been in Reducing Crop Loss?

Six percent more of the U.S. food supply is lost to pests today than in the 1940s.

Losses due to insects have doubled since 1942 despite 10x more insecticides.

For every $1 spent on pesticides, there is $5–$10 in environmental damages.

Pesticide use can be reduced without affecting yield.

How Are Pesticides Regulated in Canada?

Federal

– 2006 Pest Control Products Act (PCPA)

– Regulates manufacture, import, sale, or use

Provincial

– Use, storage, and disposal regulations

Municipal

– Residential- and cosmetic-use restrictions in 75 municipalities (2006)

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What Should Be the Primary Goal of Pest Control?

Reduction not eradication

Economic Threshold

– Point when losses due to pests outweigh cost of pesticide use

– Preferred over insurance threshold or cosmetic spraying

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Alternatives to Conventional Chemical Pesticides

Adjusting cultivation practices
- Crop rotation
- Companion planting

Genetic engineering for pest resistance

Biological pest control

Insect birth control, pheromones, hormones

Hot water or insecticidal soaps

Biological Pest Control

• Import natural predators, parasites, diseases specific to the pest

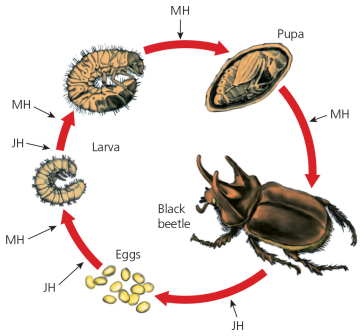
Spider populations
- Kill more insects worldwide than combined insecticides
- Can be encouraged when farmers build hibernation huts

***Bacillus thuringiensis* (Bt)**
- Occurs naturally in soil, plants, caterpillars
- Concentrates the toxins from Bt into a spray

Hormones and the Insect Life Cycle

Normal growth and development requires **juvenile** hormones (**JH**) and **moulting** hormones (**MH**).

Synthetic hormones disrupt this cycle when applied at the correct time.



Hormones and the Insect Life Cycle

Agricultural Research Services/USDA

Normal hornworm

Hornworm treated to prevent production of MH

Integrated Pest Management (IPM)

- Ecological system approach
- Reduce pest populations to economic threshold
- Field monitoring of pest populations
- Preferential use of biological agents before synthetic

IPM Examples

Dion Manastyrski © BC Ministry of Forests

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Spruce budworm control

- Natural predators
- Biological agents (e.g., Bt)
- Selective harvesting

Gypsy moth control

- Natural predators
- Pheromones
- Biological agents
- Synthetic insecticides

Spotlight: Mountain Pine Beetles

Removal of infested trees

Trapping using pheromone mimics

Signalling trees as *not-worth-invading* using beetle pheromone mimics

Controlled burn of badly infested patches

Treat trees with chitosan, an ecofriendly biopesticide

Limited spraying with insecticides.

Why Is IPM Not More Widely uUsed?

Requires expert knowledge

Slower than conventional pesticides

Method development is site-specific

Initial costs may be high.

Government subsidies favour conventional pesticides.

Strategies for IPM Promotion

Tax pesticides to fund IPM research

Government-funded demonstration projects

Send experts onto farms for dialogue

Special crop insurance for IPM

Ecologo labelling

Remove subsidies that favour conventional pesticides

Conclusion

Pests are part of an ecosystem.

Controlling them means manipulating ecosystems, with unintended consequences.

Insecticides offer a limited solution.

IPM strategies may yield better results.