



JUNIOR PEST INVESTIGATORS™

DISCOVERING GREENER PEST CONTROL AT SCHOOL AND AT HOME

TEACHER'S GUIDE

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Welcome Teachers!

The general public, governmental agencies at all levels and environmental groups have expressed a growing interest in the pest management practices used in K-12 schools. Integrated Pest Management (IPM) is a multiple-strategy solution to pest prevention and control through practical strategies that minimize risks to human health and the environment. Whether IPM is mandatory or voluntary in your school, Junior Pest Investigators helps guide efforts toward positive change.

Unit Goal: Turn Knowledge into Action

Junior Pest Investigators is a call to action! The goal of this unit is to have students track down scientific facts about organisms that can become pests and use the facts to prevent and solve pest problems with low-risk Integrated Pest Management (IPM) actions. Armed with this know-how, they put IPM into action in school and at home.

How the Lessons Work

This Know-How chart illustrates the framework of the lessons; kids collect the facts (KNOW) that provide clues that lead to informed, safe, and effective actions (HOW). See at a glance how each lesson builds understanding (KNOW) that leads to action (HOW). Turn your students into contributing members of a successful IPM team!

| IN-THE-KNOW WITH IPM Gain KNOW-HOW! Put science into action to outwit pests. | | |
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| | KNOW . . . | HOW . . . |
| Lesson 1 Eek-ology: Introduction to Pests | When you know all living organisms play vital roles in a balanced ecosystem . . . Example: Insects are pollinators of many plants; food for birds, frogs and other beneficial animals; predators of certain organisms; decomposers of organic matter; and producers of useful products such as silk and honey. | You can choose methods that do not disrupt nature's work. Example: Instead of using insecticides that kill non-target organisms as well as pests, plant marigolds in the garden. Their smell repels many insects. |
| Lesson 2 Habitat Hot Spots | When you know all organisms need food, water and shelter to survive . . . Example: Fruit flies eat overripe fruits and vegetables. | You can make your spaces uninviting to pests by eliminating access to food, water and shelter. Example: Store fruits and vegetables in pest-proof places (the refrigerator). |
| Lesson 3 Be In Step With IPM | When you know the decision-making steps of IPM . . . Example: The ABCs of IPM: Anticipate to prevent, Be on the lookout, Choose green strategies. | You can implement an IPM plan that uses responsible, effective strategies for solving pest problems. Example: Be on the lookout for conditions that may invite pests. Clean to prevent pest invasions. |
| Lesson 4 It's In Your Hands | When you know that IPM is a low-risk, effective way for people to prevent and solve pest problems . . . | You can spread the word! Educate kids and grown-ups about simple ways they can put IPM into action. |

TOOLS BEYOND THE LESSONS PLANS



TIP Use the blank **KNOW-HOW** chart included in this guide throughout the unit as you and your **Junior Pest Investigators** collect facts and connect them to solution strategies.



INQUIRY LESSONS: From “Eek-ology” to “It’s in Your Hands,” go beyond the facts to engage students in rigorous and relevant investigations rooted in National Science Standards and Best Practice Instructional Strategies.

CURRICULUM CONNECTIONS: From “Pest Puzzlers” to “Can-Do Cans,” inspire students to extend learning with these creative, multidisciplinary activities.

EXTENSIONS: From “Feeling Buggy” to “A Day in the Life of...,” challenge students to develop research and technology skills as they explore the biology of bugs just a click away at the Web-based Orkin Learning Center.

HOME IN-PEST-IGATIONS: Connect with families through invitational activities that encourage students to “Go Green with IPM” at home as well as in school.

READY-TO-USE RESOURCES: Motivate and guide students’ learning with copy-ready handouts, useful graphic organizers, original poems and engaging nonfiction reading selections. Sample parent letters and assessment tools are also provided to give you everything you need to teach and enjoy these valuable lessons.

CLASS PROJECT STARTERS: Junior Pest Investigators is a call to action! After learning about pests and the safest ways to prevent and manage them, you and your students can show what you know by following the project suggestions in Lesson 4. Make today’s students and tomorrow’s leaders better prepared for responsible decision-making. Being Junior Pest Investigators makes everyone winners!

YOUR ROLE: CO-INVESTIGATOR

The inquiry-based approach of Junior Pest Investigators puts students in the driver’s seat. Your role is to facilitate their investigation by introducing them to the learning activities in each lesson and sharing the resources provided. The lessons give you everything you need to engage your students and build understanding: hands-on activities, reproducible materials, guiding questions and nonfiction reading selections just right for kids. Support your students on their quest to find facts and put knowledge into action to make their living and learning places healthier and safer!

THINGS TO KNOW BEFORE YOU BEGIN



What IPM Is and Is Not:

Integrated Pest Management, or IPM, is an environmentally responsible approach to pest management that relies on preventing pest problems by correcting conditions that can provide pests with food, water or shelter. IPM programs proactively manage pests and help minimize any hazard to people, property or the environment. Least-toxic pesticides are used as a last resort, only when non-chemical approaches are not adequate, and used in a way that reduces potential exposure to people, pets and other non-target organisms.

IPM differs from “traditional” pest management techniques in several ways:

IPM addresses the causes of pest problems rather than the symptoms

Non-integrated methods often rely solely on the application of chemicals designed to kill pests. Unlike IPM, these programs address only the symptoms of pest problems rather than the causes.

IPM does not favor scheduled chemical treatments

Non-integrated methods rely on routine pesticide applications whether pests are present or not. IPM only uses chemical treatments as the last option – addressing the root cause of a pest problem first and implementing solutions to help prevent a reoccurrence.

IPM treatments are less toxic and more targeted

Non-integrated methods tend to apply pesticides in broad areas and use more than necessary. IPM programs only apply pesticides after addressing the causes of a pest infestation. When pesticides are used they are used only in targeted areas and in the least amount and toxicity possible.

IPM is a partnership

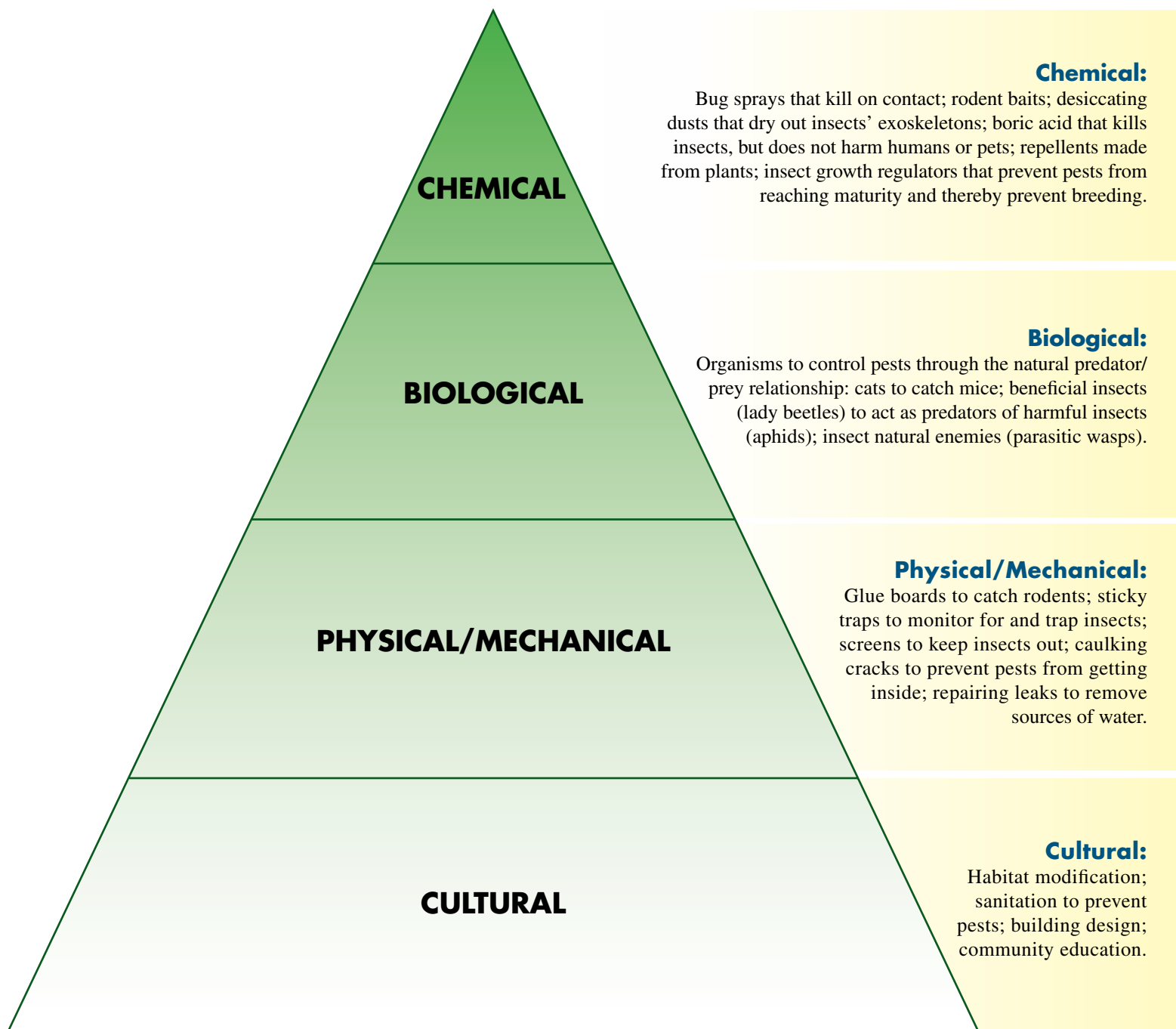
A successful school IPM program is a partnership between pest management professionals, school administrators, custodial staff, teachers and students. Lasting solutions depend on everyone’s commitment and participation in preventing pest problems from occurring.

A guiding principle of IPM is collecting scientific knowledge about pest biology and behavior, and using this knowledge for better decision-making as a range of actions are considered. IPM involves a process of steps in decision making, in these lessons called the ABCs of IPM (see Lesson 3).

FOUR CATEGORIES OF IPM ACTIONS



As you guide your students to connect facts with actions in IPM, it's helpful to think about four categories of IPM actions:



Watch Out For “Loose Use” Of Terms

Are all insects bugs? Is a pest always a pest? The answer is no, and that’s why choosing and using correct terminology from the glossary when teaching the lessons is important. Help your students use the terms correctly and consistently. The language of science is precise, and the lessons guide you in the use of accurate terms and definitions so students avoid stereotyping, misunderstanding, or making broad or inaccurate generalizations. Upon hearing the word pest, for example, many people think of insects, mice or spiders. But pests can include many types of rodents, arachnids and insects, as well as plants, bacteria and fungi, including mildew and mold. You and your students will discover many examples of times and places when a “pest” is not a pest! Using the preferred word “organism” reinforces the concept that the situation determines whether or not an organism is a pest or not a pest. Also, the word “bug” is often used incorrectly by the public and the media in place of the word “insect.” Not all insects are bugs so be sure to use the word “insect” or “organism.”

Monitoring is a key component of IPM, and this curriculum recognizes that monitoring actions will be different for children than for adults. Be sure that you understand that for adults, monitoring means regularly inspecting spaces and keeping records and counts of organisms seen or captured in a certain amount of time, indicating if an organism is becoming a problem so you can take action early. But for children, monitoring means checking their spaces for ways pests might get in and places where pests might find the food, water and shelter they’re seeking for survival. The focus is on childrens’ role in eliminating sources of food, water and shelter for pests – simple solutions like wiping up spills, removing clutter and cleaning up crumbs.

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| <p>WHAT IS A PESTICIDE?</p> | <p>A PESTICIDE is anything that makes a claim on its label that it kills, repels or mitigates any living organism. Because there are many types of pests, the word pesticide has many meanings: germicide (kills germs), disinfectant (kills microorganisms), fungicide (kills fungi), herbicide (kills weeds), insecticide (kills insects), rodenticide (kills rats and mice).</p> <p><i>The U.S. Environmental Protection Agency (EPA) is responsible for registration of pesticides in the U.S. The EPA’s definition of a pesticide is: “any substance or mixture of substances intended for preventing, destroying, repelling or mitigating any pest.”</i></p> |
| <p>WHICH ARE PESTICIDES?</p> | <p>Mosquito repellent; cockroach baits and sprays; rat and mice poisons; ant baits; products to kill mold and mildew; lawn and garden weed killers; swimming pool chemicals, including those that kill algae; flea and tick sprays, powders and pet collars; insect sprays and wasp repellents for indoor use; termite control products.</p> <p>ALL OF THESE ARE PESTICIDES ACCORDING TO THE EPA</p> |

MAKING THE CONNECTION



Once students have collected facts about organisms, what clues do the facts reveal for effective strategies for dealing with a particular pest? Guide them to figure out which facts provide the clues for choosing a method to solve the problem.

In IPM, the pest species is correctly identified before actions are taken. (When in doubt, adults can enlist help for identifying specimens from pest professionals or your local Cooperative Extension Service.) How does proper identification aid IPM? Examples:

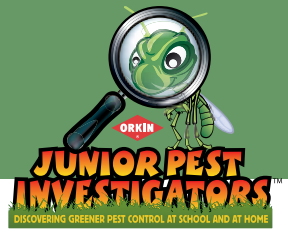
- Ants include many species, mostly beneficial. Most pest species, like the small odorous house ant are just nuisances, often requiring simple preventive actions. Others, like larger carpenter ants can threaten the structural integrity of your home! It is important to know the difference so you can take appropriate action.
- Some organisms may look alike but can have very different roles or effects. For example, some lady beetles with yellow and black stripes are beneficial because they eat harmful garden pests. But, they can be confused with their “look-alike,” the striped cucumber beetle, which chews on the flowers of squash plants and damages the young fruits.

Again, you should understand that precise identification and collection of pest specimens is an IPM role for the **adults** or even pest management professionals, but not for children. As Junior Pest Investigators, students are safely limited to discovering identifying characteristics of pests as a part of their research.

Other examples of connecting the facts to appropriate actions:

- The lifecycle stages of a mosquito provide clues to prevention. When students learn about the lifecycle of a mosquito, they will be able to identify low-risk solutions from the categories of action chart. A low-risk cultural action to minimize the mosquito population is to dump out sources of standing water where mosquitoes lay their eggs. Students will realize by dumping sources of standing water in their yard, they can help reduce the number of mosquitoes that hatch. Targeting a potential mosquito breeding site prior to hatching of the mosquitoes is a proactive measure versus a reactive spraying of adult mosquitoes after they’ve become a problem.
- Hand-pulling individual dandelions in the early stages and before they flower and spread seeds is a mechanical action that takes the place of spraying chemicals (chemical action) to treat an entire lawn when dandelions appear.
- Securing lids on trash containers is a cultural action children can take to keep flies out of the garbage where they lay eggs that hatch into maggots.

ADDITIONAL RESOURCES TO AID YOUR INVESTIGATIONS



WEBSITES

The IPM Institute of North America

<http://www.ipminstitute.org/>

Offers background and resource links on school IPM and “IPM Super Sleuth,” an interactive Web site for kids.

Penn State Entomology Science Education

<http://www.ento.psu.edu/Scied/Default.html>

Offers entomology-related resources for educators.

Orkin Connections: “The Learning Center”

www.orkin.com/learningcenter

Extend learning with interdisciplinary activities on the Web at the Orkin Learning Center. Examples of what you’ll find:

“Name That Bug” An interactive game that teaches facts about different insects.

http://www.orkin.com/learningcenter/kids_and_teachers_games.aspx

“Are You One of Us?” A classification activity that helps students learn about identifying characteristics of insects.

They sort insects from non-insects.

www.orkin.com/media/downloads/smithlevel1.pdf

“Seeing is Believing” A compare/contrast activity that challenges students to sort a variety of pests and then create their own.

http://www.orkin.com/media/downloads/seeing_is_believing.pdf

“Hidden Home Threats” A home diagram highlighting places with risks in our homes and steps to keep ourselves safe.

Developed in collaboration with the Centers for Disease Control and Prevention (CDC) and the National Center for Healthy Housing (NCHH).

<http://www.orkin.com/media/downloads/HiddenHomeThreats.pdf>

“Camouflage: A Study of Stealth and Survival” A design-and-create art activity that teaches about insect camouflage.

<http://www.orkin.com/media/downloads/camouflage.pdf>

“Feelin’ Buggy” A creative writing activity in which students compare and contrast human and insect senses.

http://www.orkin.com/media/downloads/feeling_buggy.pdf

“Range Maps” A collection of range maps for habitats of dangerous pest species helps students see the climate/geography/habitat connection.

http://www.orkin.com/media/downloads/DangerousPests_Web.pdf

“Create an Insect” An art activity in which students design unique bugs with the characteristics common to all insects.

<http://www.orkin.com/media/downloads/createaninsect.pdf>

LITERATURE CONNECTIONS: FICTION AND NONFICTION



“A Day in the Life of...” A research/art/writing activity that focuses on the distinguishing characteristics of different insects.
<http://www.orkin.com/media/downloads/adayinthelifeof.pdf>

PRIMARY (K-3)

Berger, Melvin. *Spinning Spiders*. HarperCollins, 2003. 32 pages (978-0060286970) (Outstanding Science Trade Book)
Characteristics of spiders and the methods they use to trap their prey in webs.

Bernard, Robin. *Insects*. National Geographic Society, 2001. 16 pages (978-0792266709) (Outstanding Science Trade Book)
Describes the body parts and identifying characteristics common to many kinds of insects.

Cronin, Doreen. *Diary of a Fly*. Joanna Cotler, 2007. 40 pages (978-0060001575)
Facts about a fly’s life revealed in diary-format picture book.

Cronin, Doreen. *Diary of a Spider*. HarperCollins, 2005. 40 pages (978-0060001537)
Facts about a spider’s life revealed in diary-format picture book.

Cronin, Doreen. *Diary of a Worm*. HarperCollins, 2003. 40 pages (978-0060001506)
Facts about a worm’s life revealed in diary-format picture book.

Ehlert, Lois. *Waiting for Wings*. Harcourt, 2001. 40 pages (978-0152026080)
Features the life cycle of four common butterflies.

Holland, Gay W. *Look Closer: An Introduction to Bug-Watching*. Millbrook Press, 2003. 32 pages (978-0761326649)
Readers are invited to head out to the yard, garden and pond with a magnifying glass to look closely at insect life.

Murawski, Darlyne. *Bug Faces*. National Geographic Society, 2000. 32 pages (978-0792275572)
Close-up photos of insect faces with descriptions of their unique features, including compound eyes and pincher jaws.

Merrick, Patrick. *Cockroaches*. (Naturebooks). Child’s World, 2003. 32 pages (978-1567662061)
Facts about physical characteristics, behavior, habitat and life cycle of cockroaches.

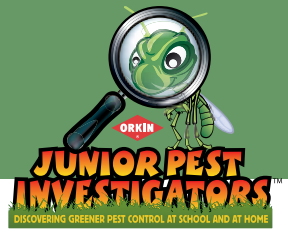
Reinhart, Matthew. *Young Naturalist’s Handbook: Insectlopedia*. Hyperion, 2003. 48 pages (978-0786805594)
Provides facts about the lives, bodies, habitats, and survival skills of various insects.

Sill, Cathryn. *About Arachnids: A Guide for Children*. Peachtree Publishers, 2003. 32 pages (978-1561450381)
(Outstanding Science Trade Book)
Introduces children to the physical characteristics, behavior and life cycle of arachnids.

Siy, Alexandra. *Mosquito Bite*. Charlesbridge, 2005. 32 pages (978-1570915918) (Outstanding Science Trade Book)
Provides information about a mosquito’s life cycle.

Sturges, Philemon. *I Love Bugs!* HarperCollins, 2005. 24 pages (978-0060561680)
A boy shares his love of insects by describing their characteristics in this rhyming story.

LITERATURE CONNECTIONS: FICTION AND NONFICTION



INTERMEDIATE (4-6)

Jackson, Donna M. *The Bug Scientists*. Houghton Mifflin, 2002. 48 pages (978-0618108688)

Provides information and photos that teach about entomology and entomologists.

Wechsler, Doug. *Bizarre Bugs*. Boyds Mills Press, 2003. 35 pages (978-1590780954)

Facts about unusual insects featuring their physical characteristics, adaptations/survival skills and life cycles.

Yount, Lisa. *Pesticides*. Lucent Books, 1995. 128 pages (978-1560061564)

The need for pesticides, their history, benefits and negative aspects are all given equal coverage. Also discussed is the birth of the environmental movement after the publication of Rachel Carson's *Silent Spring*, biological alternatives to chemical pesticides and the genetic engineering of pest-resistant plants.

Zabludoff, Marc. *The Insect Class*. Marshall Cavendish, 2006. 96 pages (978-0761418191)

Provides information about physical characteristics, life cycle, behavior and survival skills of various insects, including fleas, earwigs and lady beetles.

PRIMARY AND INTERMEDIATE

Johnson, Jinny. *Simon & Schuster's A Children's Guide to Insects and Spiders*. Simon & Schuster, 1996. 80 pages (978-0689811630)

An introduction to more than 100 insects and arachnids with information about identifying characteristics and habits.

Levi, Herbert, and Lorna Levi. *Spiders and Their Kin*. St. Martin's Press, 2001. 160 pages (978-1582381565)

Excellent, user-friendly, concise overview of commonly encountered arachnids and their life cycles.

Llewellyn, Claire. *The Best Book of Bugs*. Kingfisher, 1998. 32 pages (978-0753451182)

Describes habits and life cycles of insects. Provides clues for identifying various insects in their natural habitats.

Murawski, Darlyne. *Spiders and Their Webs*. National Geographic Society, 2004. 32 pages (978-0792269799)
(Outstanding Science Trade Book)

Facts and photographs about the physical characteristics, habits and behavior of spiders.

Winner, Cherie. *Everything Bug: What Kids Really Want to Know about Insects and Spiders*. NorthWord Press, 2004. 63 pages (978-1559718912)

Questions and answers about spiders and insects.

Zim, Herbert, Clarence Cottam, David Wagner, and Jonathan Latimer. *Insects: Revised and Updated*. St. Martin's Press, 2001. 160 pages (978-1582381299)

Excellent, user-friendly, concise overview of commonly encountered insects and their life cycles.

IN-THE-KNOW WITH IPM

Gain KNOW-HOW! Put science into action to outwit pests.

| KNOW. . . <i>(Collect the facts.)</i> | HOW . . . <i>(Connect the facts to the solutions.)</i> |
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