

Friend or Foe?

Curriculum Links

Science: Understanding

- Living things have life cycles (ACSSU072).
- Living things, including plants and animals, depend on each other and the environment to survive (ACSSU073).

Science: Inquiry Skills

- Use a range of methods including tables and simple column graphs to represent data and to identify patterns and trends (ACIS068).
- Represent and communicate ideas and findings in a variety of ways such as diagrams, physical representations and simple reports (ACIS071).

About this unit

These activities are designed to awaken students' curiosity about the insects in their garden and importantly to realise that not all insects are pests!

These short and long activities loosely follow an inquiry learning framework. This means that the first activities elicit and explore students' prior knowledge of insects. Then there are thinking activities to define a question for personal study (tuning in), to be followed by research and investigation (finding out). To help with this investigation, we've included the instructions for making your own simple bug catchers, which safely catch bugs for students to examine up close.

At the end of the unit you will probably direct the class to take action through making recommendations, writing up their findings, and/or presenting their new-found knowledge to an audience of peers and parents.

If there is going to be an open day in the garden, time the unit so that these projects are available for display and perhaps give students a chance to run 'Wildlife safaris', showing visitors what insects they can find and what they know about them.

Curriculum links in garden classes

All sorts of extensions into science and literacy (oral and written communication, in particular) can be made throughout these activities.

There are many resources out there about insects, some better than others. At the end of the unit, we've included a list of useful resources that you might interweave with these activities, but of course you may have others that work for your students. If you have previously used a resource that you like, these activities might supplement or extend what you are already using.

There are other materials from the Kitchen Garden Foundation about insects. Additional materials can be accessed on our website at kitchengardenfoundation.org.au/resources





1: Tuning in Friend or Foe?

Year level 4

Curriculum Links

Science

- Living things have life cycles (ACSSU072).
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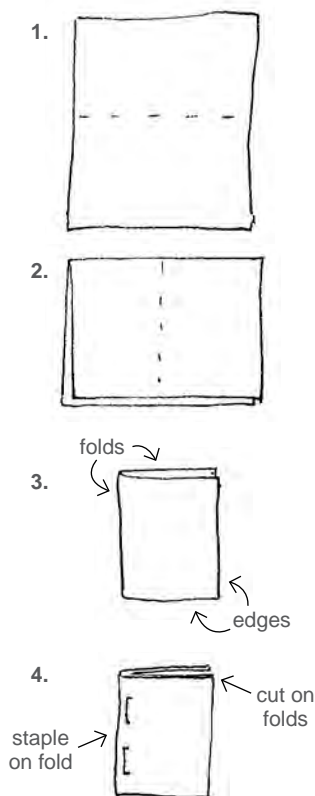
Resources

- a picture or story book that relates to insects
- paper, pens and pencils for drawing
- large sheets of paper if the class is to work together

Location

The classroom

Duration:
45 minutes



Getting started

- To introduce the theme of insects, share a story or song with the class, such as the classics *There was an Old Lady who Swallowed a Fly*, or *The Very Hungry Caterpillar*, by Eric Carle, or one of your own favourites. (A resource list at the end of this unit includes online book lists on the insect theme.)

During the lesson

- Ask the class to tell you about a time when they observed insects in the garden.
- If you have time, take students out into the garden for five minutes of quiet listening and observing time.
- Discuss their experiences of insects in the garden. Probe for context:
 - What was happening?
 - Which plant was the insect on?
 - How would you describe the insect? (Wings, legs, other characteristics?)
 - What was it doing? (Crawling, digging, wriggling, flying?)
 - Is there anything else we can see or hear that tells us there are insects in the garden?
- Either as a whole class or working individually in their own mini-book, students record what they know about insects. (To make a simple mini-book, fold a piece of paper into quarters, staple down one folded side, then cut through the folds on the other folded side, to make a four-page book.)
- On the first page of their mini-books or in their workbooks, students draw pictures of insects. Encourage them to add labels and include what they know or imagine about insects.
- Then, across the top of three columns on large paper (as a whole class) **or** on the remaining three pages (working alone), students write these headings:
 - What I know**
 - What I want to know**
 - How I am going to find out**
- Give the class plenty of time to fill in these sections and prompt for thoughts about all sorts of insects, from beetles to centipedes, spiders, moths and butterflies. If students suggest animals or birds that are not insects, you can start talking about how we define an insect (covered in the next lesson).

Extensions / Variations

- Make bug catchers in a garden class, for students to collect their own specimens for investigation later in the unit. Instructions are on the next page.
- Discuss ethical treatment of the specimens they catch – i.e. no sucking up spiders in the bug catchers, as the tubing will break their legs.

Assessment



- The initial diagrams and writing about insects can be compared with work completed at the end of the unit as a part of students' final presentation, poster or project – providing evidence of learning.

How to make a bug catcher

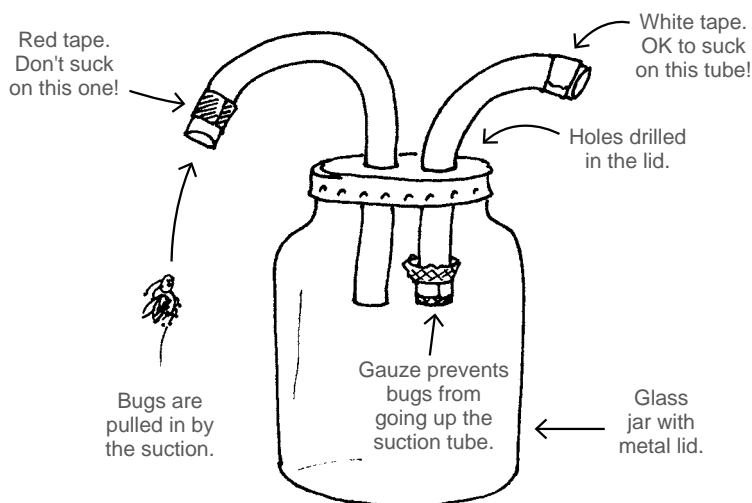
This activity requires an adult to operate the drill and cut the pieces. Students can help with the assembly, but be careful of sharp edges around the holes in the jar lids.

Objective

To make a bug catcher that will get the children excited about catching insects!

You will need:

- glass jars with lids
- 10 mm drill bit and drill
- Stanley knife or paring knife
- 10 mm diameter clear flexible tubing – allow 45 cm for each jar
- white electrical tape
- red electrical tape
- gauze or wipes
- sticky tape
- scissors



What to do:

- Remove the lids from the jars and drill two holes 3 cm apart in the lid. Adults do this. (Tip: if you drill from the top side of the lid, any sharp edges will be on the inside and out of the way.)
- Cut two lengths of tubing: one 15 cm and the other 30 cm long.
- Take the 15 cm length of tubing and cover one end with gauze, wrapping sticky tape around it to hold it on.
- Insert the tubing into the pre-drilled holes in the lid, with the gauze end on the underside of the lid.
- Wrap a piece of the WHITE electrical tape about 2 cm from the top end of the 15 cm tubing (i.e. opposite end to the gauze).
- Now insert the longer piece of tubing through the other hole and wrap the RED electrical tape 2 cm from the top end.
- Screw the lid back onto the jar and there you have it – A Bug Catcher!

How to use:

Walk around the garden, armed with bug catcher in hand. When you see a bug, take the piece of tubing with the red tape and place very close to the bug. Now take the tubing (with the white tape) and suck. Hopefully the little bug has travelled up the tubing and into the jar; there will be no chance of sucking the bug into your mouth as the gauze will stop this.

Tip

Discuss with students that it would be cruel to suck up spiders or other insects whose long legs would get damaged in the tubing. (You may be able to get spider viewers, which are a Perspex box with a magnifying glass lid.)

Also, slugs get stuck in the tubing, which can be a nuisance to remove.



2: Finding Out Insect Investigations

Year level 4

Curriculum Links

Science

- Living things have life cycles (ACSSU072).

Resources

- good images of several different kinds of insects
- a diagram showing the structure of the classification *Arthropoda*
- lists and galleries are available online at state natural history museums. There are excellent galleries on the Australian Museum website and CSIRO. We have provided links for you on the last page of this unit
- make sure you show Australian insects. If you show insects from your climate zone, students have a better chance of seeing them when you are in the garden

Location

The classroom

Duration:
45 minutes

Vocabulary

abdomen
arthropod
characteristic
classification
entomology
exoskeleton
head (of an insect)
invertebrate
metamorphosis
phyla/phylum
thorax
vertebrate

Preparing for the class

- Collect a variety of images and a diagram of an arthropod to show the class.

Getting started

- Ask the class: How do we know an insect is an insect?
- Excellent answers might include: it's got lots of legs, it has a shell, or it crawls and flies. All of these are part of the answer.
- Explain that the whole world of animals has been divided into groups based on their *characteristics*. (Discuss what characteristics might be – i.e. the physical attributes of these types of animals that make them different from other animals.)
- These groups, or *classifications*, of animals are called *phyla*. One *phylum* includes all the animals with backbones. These animals are called *vertebrates*. Another *phylum* includes all the animals that don't have backbones. These animals are called *invertebrates*.
- Insects are part of the phylum Arthropoda, so we call them *arthropods*.
- All arthropods have three characteristics in common, which set them apart from other groups of animals:
 - Their skeleton is on the outside of their bodies, as a hard shell. A skeleton on the outside of the body is called an *exoskeleton* (outer skeleton).
 - Their bodies are segmented.
 - They have at least three pairs of legs, six in total, each of which is jointed. Sometimes a set of these joints develop into wings.

During activity

- On an interactive whiteboard or projector, show students pictures of several different kinds of insects – these could be your own photos of the insects caught in the bug catchers, or images from online resources such as CSIRO (see end of unit for suggestions).
- For variety, you might choose an image of a spider, an ant, a moth, a butterfly, millipede, beetle – and others.
- Explain that insects have a segmented body, the head, the *thorax* and the *abdomen*.
- Point out the shell, or the exoskeleton.
- Discuss that the three pairs of jointed legs could also, in some adult insects, change to become wings. You might introduce the term *metamorphosis* (which we look at in more detail in part 5).
- Hand around, or display, a diagram of the segmentation of insect bodies, showing the three identifying characteristics of the phylum Arthropoda: exoskeleton, segmented body and at least three pairs of legs (some of which might be wings).
- Students draw their own images of insects, or draw the insects they have caught, using their new knowledge of the physical structures of insects.

Insect Investigations

- At the end of the lesson, students choose one variety of insect to study (ants, spiders, centipedes etc). Their study might span several sessions – you decide how long and in-depth it will be.
- Each student's investigation question is: **Is it a friend or a foe in our garden?**
- Tell students that at the end of their insect investigation, they will present their argument. They need to gather evidence and explain why they believe the insect is a friend or a foe.
- They can present their argument with diagrams, a presentation, a scientific report, a tour of the garden with explanations and 'stops' to view evidence or any other suitable format that they agree with you.
- Remind students that there may be other invertebrates (animals without a backbone) in the garden, such as slugs or snails, but to reinforce the learning about classifications students should choose an arthropod to study. If in doubt, refer to the three characteristics of arthropods, above. There are also sub-divisions of the phylum Arthropoda.

Following up

- Arrange for students to hunt for their chosen insect in the next garden class and to take observer's notes. (See the proforma plus the activity cards on the following pages for activities in the garden that can inform the students' insect investigations.)
- Ensure that students define their investigation, negotiate and confirm the details with you: which insect are they studying and what will they produce at the end?



Insect Investigators!

My name is: _____ Class: _____

I am investigating: _____

Is it a friend or a foe in our garden? _____



My Insect Observations

Insect observed: _____

Location: (Include the plant name if you can. Was it on the soil, the stem, the leaf, the flower
– or somewhere else?) _____

Date: _____ Time of day: _____

Weather: (circle all that apply)

hot cold cloudy sunny mixed cloud/sun rainy dry

Other words I would use to describe the weather: _____

Any other evidence of insect activity? (Such as bite marks, eggs, trails.)

Picture of my insect (drawing or photograph):





3: Finding Out In the Garden

Small bites

Once students are engaged in their own self-directed inquiry learning about a type of insect, these cards might come in handy. They can be given to groups in a garden class, or you can take any of these ideas and work them into your own classroom explorations of science, insect life and indigenous flora or fauna.

These cards would be best in combination with a backyard insect chart or a field guide to identifying insects. There are links to several online printable guides at the end of the unit – don't forget to use an Australian guide that's relevant to your climate zone.

STOP the stomp

When you see a fearsome creature in the garden, such as a beetle or a bug with lots of legs, don't step on it! It might be helping you. Looks aren't everything.

How would you know if an insect is a friend or a foe?



- *Where did you find it? Was it on a plant, under a plant, under something else? Be very specific as you make a note in your garden journal.*
- *Can you see any damage on the plant where you found it?*
- *Look closely at the insect (if you have a bug catcher, it will help to catch it).*
- *What clues can you guess from its body about what it eats? (For example, does it have big jaws for eating plant matter?)*

Can you add anything to your insect investigation as a result of what you have observed? Make careful notes of your observation, as this is excellent evidence!

Discuss with your class what you found: if the insect is a foe, will you need to take action?

Check out the neighbours

Many different insects live in our garden. Some of them are good for our plants, some of them aren't.

Your teacher might assign you a particular part of the garden to explore.

Hunt for evidence, plant detectives! Get your magnifying glasses and ...



- Look on plant leaves. Are there bite marks, slashes or holes?
- Look for eggs under leaves, around stems and in fresh new shoots. Are there clusters or single eggs? What colour are they?
- Check for little bodies: aphids, red spiders and mites.
- What other evidence can you see?

- Write down what you see in your garden journal. Where is it? What part of the plants is it on? How big is it and what colour?
- You could draw a diagram or take a photo of what you found. Can you see the insect itself?
- Do you need to do anything? (Can you confirm that it is harming your plants?) Discuss how you would develop and assess a suitable plan of action with your teacher. (This doesn't just mean spraying: it could include providing habitat to encourage a beneficial insect to take up residence in your garden.)

Chomp the chomp!

Some of the bugs you will find in the garden are definitely harming our plants.



- When you are absolutely sure you've got a 'baddie', pick it off the plants or collect it in your catcher.
- Can you feed them to the chooks? Check with an adult first!
- Some insects are chook delicacies ... by helping our plants, we're also making the chickens happy and varying their diet.

- Investigate which insects chooks love to eat.
- What would be a recipe for a chook delicacy of insects? (yum-yum) Write it up. If it includes the insect you are studying, you might add your recipe to your insect investigation.



4: Going Further Writing Wonder Questions

Year level 4

Curriculum Links

Science

- Living things have life cycles (ACSSU072).
- Represent and communicate ideas and findings in a variety of ways such as diagrams, physical representations and simple reports (ACSI071).

Resources

- books, magazines and other printed matter about insects. These should include gardening books with suggested identification and pest control strategies, information about pollination of plants, animals that eat insects and other related topics
- images of insects
- a variety of websites with information about insects (a few are provided at the end of this unit to get you started)
- CDs, videos and other materials related to insects
- students' mini-books or the class chart showing what they know, want to know and how they plan to find out
- paper and craft materials, digital cameras, notebooks, bug catchers and a 'secure area' if you decide to let students examine some of their insects in the classroom

Location

The classroom

Duration:

1.5–2 hours, over more than one session

Preparing for the lesson

- Set up computer, book and insect examination areas in the classroom, depending on your resources. If you are comfortable that they can be contained, and if students can collect insects in the garden sometime just before class, one table can be an insect examination area.

During the lesson

- Once the students have chosen the insect they are planning to investigate, you will need to give them time to explore the resources available to them.
- Remind students to consider the outcome of their project: will it be a report, a presentation, a model of a particular insect, a garden tour, a video or photostory? It might be something creative, like a 'Day in the Life of ...' diary of their insect, a map of insect habitats or something else.
- If the students will have time in their investigations, ask them to think of one more question about the insect they have chosen to study – something they are wondering about.
- These 'Wonder Questions' might be, for example, 'I wonder ... Why do ants live in hives? Why are some spiders poisonous? How do insects pollinate our garden plants? Can you eat insects? How do bees make honey?'
- Some students will find their 'Wonder Question' after they start reading about their insect.
- Provide time to explore the materials available to the students.
- Set a time, after some initial exploration, when each student needs to agree with you what they are going to produce and when you will discuss and record what their wonder question might be.
- Students work on their insect investigations over one or more sessions.

Taking action

- Together, you might compile a class book with all of the students' expert knowledge. This could include regular observations, such as monthly counts of specific insects, monthly survey of holes in cabbage leaves, number of slugs in slug traps etc. Collecting regular data enables you to work with representing and analysing data for an understanding of how the insect life in the garden changes across the seasons.



5: Going Further Hop, Hop, Whirl and Fly

Year level 4

Curriculum Links

Science

- Living things have life cycles (ACSSU072).
- Living things, including plants and animals, depend on each other and the environment to survive (ACSSU073).
- Represent and communicate ideas and findings in a variety of ways such as diagrams, physical representations and simple reports (ACSIS071).

Resources

- a map of Australia

Location

The classroom

Duration:
45 minutes

Vocabulary

larva/larvae
locomotion
metamorphosis
pupa/pupae

Getting started

- To add depth to students' investigations, one way to start could be with a general discussion about *locomotion*, or in other words, how insects move.
- Some insects fly, others burrow through the ground. Some scurry on their legs, climb or hop. Many insects have different ways of moving at different points in their development.
- Introduce the concept of *metamorphosis*. Many insects change their form completely as they progress in stages from egg to *larva* to adulthood. Most insects go through these three stages, but some also go through a stage called the *pupa*, where their body parts grow into different positions to allow for complete metamorphosis or drastic change, such as the emergence of wings.

Movement and metamorphosis

- Explore a couple of examples from the students' investigations and, if you can, display diagrams of the life cycle of one or two insects, such as a butterfly or a grasshopper.
- (If your area is likely to be threatened by locusts, you could use this local concern as a topic to introduce the cycle from egg, to hopper, fledgling and fully adult locust, laying eggs for the next generation – and the question of pest control as we look after the plants we have nurtured, on a large or a small scale. Information about locusts can be found on the Department of Agriculture, Fisheries and Forestry website: www.daff.gov.au/animal-plant-health/locusts
- You might ask your students to demonstrate their own impression of their insect's movement, at the different stages of its life.
- Allow students time to incorporate this learning into their insect investigations.



6: Going Further Natural Barriers

Year level 4

Curriculum Links

Science

- Living things, including plants and animals, depend on each other and the environment to survive (ACSSU073).

Resources

- a map of Australia
- maps of the local area, showing main landscape features such as oceans, deserts and other features

Location

The classroom

Duration:
45 minutes

Getting started

- Tell the students that now that you have discussed movement or locomotion, you can introduce the idea of barriers that stop movement of insects.
- Revisit all the ways the students said that insects move: hopping, flying etc.
- Barriers can be small barriers, such as sticky traps and pots of soapy water around the legs of the worm farm to stop ants from getting in.
- Discuss barriers that we set in our garden and how we use our knowledge of how an insect moves in order to stop it from getting to plants we want to protect. Examples include crushed eggshells to prevent slippery snails from reaching plants, collars to prevent caterpillars crawling up trees and sticky traps to catch flying insects.

During the lesson

- Barriers can also be large – very large parts of our environment.
- Ask students to think of a landscape feature that might be so large and extreme – hot or dry or cold and wet – so that there is nothing to eat and the insect cannot survive long enough to get across it. Examples might be oceans or the deserts of Australia, which are large and dry and will not sustain insect life long enough for the insects to cross them (therefore an insect cannot survive the long journey from one side to another). Mountains, high plateaus or huge rivers might also be barriers.
- Explain that this is just one of the reasons we find different types of insects in different parts of Australia. (Other reasons include the availability of the insect's main food source, and that relies in turn on climate.)
- Discuss: We know that some insects are beneficial to plants. Plants rely on them to do certain things – prompt for a response that some flowering plants require bees, moths and other pollinators in order to set seed.
- What about the plants that rely on insects? Can they get up and move?
- If some plants rely on specific kinds of insects to carry their pollen, do students think that these plants will be found in large numbers on both sides of a major land barrier such as a desert?
- Show students a map of Australia as you discuss this. Introduce the concept of indigenous plants being native to a specific area and populations of those plants evolving alongside the insects they rely on to pollinate and help them create seeds.

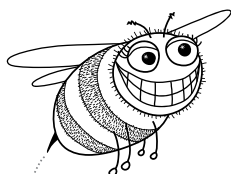
Pollen transporters

- Discuss other things that can carry pollen or plant life, such as wind, birds and even people, cars, mud on vehicles or animals.
- Introduce the concept of quarantine and other restrictions that prevent people from moving fruit, plant material, soil and other natural materials that might carry insects, insect eggs or larvae.

- If a student is exploring bees, you could introduce the question of the bee mite that threatens bee populations world-wide, but is not yet found in Australia. There are different restrictions for each area of the country; this will make better sense to your students if you use a local example, such as border controls between NSW and Victoria, WA and SA, or between Tasmania and the mainland.
- Because bees are a popular topic for Kitchen Garden Schools, we have written a short list of activity ideas about bees. See pages 17-18.

Extension / Variation

- Depending on how much complexity you want to include, this discussion can lead nicely into the topic of biodiversity. Materials about biodiversity are widely available and your students may already be familiar with the concept from other studies.
- You might introduce or extend this lesson by reading *The Story of Rosie Dock*, by Jeannie Baker (1995, Random House).





7: Taking Action Insect Investigations on Display!

Year level 4

Curriculum Links

Science

- Living things have life cycles (ACSSU072).
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- Use a range of methods including tables and simple column graphs to represent data and to identify patterns and trends (ACSI068).
- Represent and communicate ideas and findings in a variety of ways such as diagrams, physical representations and simple reports (ACSI071).

Resources

- students' work, models, diagrams, presentations and other elements of their Insect Investigation that they have agreed with you

Location

The classroom or the garden

Duration:

Depends on the format,
probably 1–1.5 hours

Before the lesson

- Check with each student that they have a clear, realistic plan for their presentation in advance of this session.
- Remind students that they need to answer the inquiry question: Is this insect a friend or a foe in our garden?
- Review their Wonder Question and what they are going to do to answer it.
- Check that props or other arrangements, such as a visit to the garden for a 'Bug Safari', are organised well in advance.
- Of course, this lesson might take place on a display day, parent and community visit to the garden or other open day.

During the lesson

- Students' work, pictures, diagrams and presentations are on display.
- Celebrate the variety of investigations the class has prepared!
- Take a class tally: do we have more friends than foes in the garden?
- Is there anything the class would like to change about the garden to encourage the beneficial insects they have investigated?

Assessment



Students' achievement of the objectives will be evident through:

- the depth and breadth of the information they present about their insect
- the clarity of their argument and evidence about the insect as a friend or a foe in the garden
- observing their use of references and sources, written and otherwise
- comparing their initial diagrams and writing about insects with their final presentation, report or product.

Friend or Foe? Resources for teachers

Activities, galleries and identification charts

State galleries and museums usually have collections of local insect species, available for visitors to view. Speak to them about educational resources or check their websites for local reference material.

Australian Museum 'Bugwise' – this resource is written specifically for schools and includes lessons, activities, field guides and insect identification charts.

<http://australianmuseum.net.au/Bugwise/>

Australian Museum: What are insects?

<http://australianmuseum.net.au/What-are-insects>

Australian Museum Insects homepage – here you can access excellent image galleries; also, try clicking on 'More about insects' on the left-hand side of the main page to see information on topics from predation to pollination, seed dispersal and metamorphosis.

<http://australianmuseum.net.au/Insects/>

Diagram of an Arthropod (simplified – no legs or antennae) – from **BugGuide**. **Note:** this is an American site, so some of the species information may not be locally relevant. This diagram is generic enough to be of use, however.

<http://bugguide.net/node/view/37485/bgimage>

CSIRO Backyard Biodiversity – this page links to a printable PDF field guide and activities assisting students to identify insects in their garden and learn how they contribute to biodiversity.

www.csiro.au/resources/pfbc.html

CSIRO About Insects page – this page provides links to lots of information, mainly designed for teachers and advanced readers.

www.ento.csiro.au/education/about.html

If you have the curled black Portuguese Millipedes in your area, you could look at the **Millipede Mayhem** activity, **Collecting Millipedes**, which was a nation-wide collection project in 2007.

Compare your school's collection data with other schools and maps of this invasive species across Australia:

www.csiro.au/csiro/channel/pchgb.html

CSIRO Australian Ants Online

<http://anic.ento.csiro.au/ants/>

CSIRO Australian Moths Online – with a huge gallery of moths linked from 'Find a moth'.

www.ento.csiro.au/anic/moths.html

There is also an index of **Insect Common Names** on the CSIRO website, which might be of some use. www.ento.csiro.au/aicn/name_c/a_1.htm

Museum Victoria's Biodiversity Snapshots – a field guide with species information and identification details and photos of 280 species, covering insects as well as birds, mammals, lizards and other creatures commonly found in the garden.

www.biodiversitysnapshots.net.au

Life cycle of the locust – from the Department of Agriculture, Fisheries and Forestry. This diagram clearly shows the lifecycle, including the development of wings where, in some arthropods, an extra set of segmented legs grows.

www.daff.gov.au/animal-plant-health/locusts/about/about_locusts/lifecycle

Green Harvest – Garden organic pest control articles (and shop). Lots of information about simple, organic ways to discourage pests in the garden.

http://greenharvest.com.au/pestcontrol/organic_pest_control_index.html

Lists of books about insects

These resources include picture books as well as non-fiction for all primary school levels.

- The Children's Hour literacy list on the theme of insects – includes some very recently published picture books.

www.tchliteracy.com/k-thms20.htm

- World of Wonders bugs book list – mainly non-fiction.

<http://wow.osu.edu/experiments/insects/childrenslit.html>

- Logan Library – picture books about bugs.

<http://library.loganutah.org/books/children/BugsPB.cfm>