



Pathfinder Honour:

Trainer's Notes

Insects 1



Instructions to Trainers / Instructors of this Honour

Thankyou for being involved with this Honour. These notes have been developed to assist in teaching / instructing this honour. We recognise that there is much more information available and we are grateful that you should share your expertise.

Please remember that Honours are designed to develop our Pathfinders in many ways; their interests, their knowledge and their relationship with their Saviour and Creator. Your enthusiasm and creativity will have a huge impact on those doing the honour.

To complete an Honour, the following (where applicable) must be completed satisfactorily:

- Physical and Practical Requirements.
- Honour Workbook.
- Honour Assessment Sheet. (*On SPD Honour Website but Leader's level access is required*)

Additional Reference Material

Please see ADDITIONAL REFERENCES on the final page of these notes

Acknowledgements

These notes were based on the following excellent site:

http://en.wikibooks.org/wiki/Adventist_Youth_Honors_Answer_Book/Nature/Insects

Please refer to the text for additional citations. Be aware that any material on the above site and other references is beyond the control of the SPD.

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REQUIREMENT 1: What are the distinguishing characteristics of an insect?

- a. All insects have three pairs of jointed legs. These are attached to the thorax.
- b. They are encased in an external skeleton, called an exoskeleton. This contains chitin, one of the hardest wearing substances known. As the insect grows, it sheds its skeleton and forms a new one. The skeleton has muscles attached and the muscles then support the internal organs.
- c. They have a body made up of three parts, a head, a thorax and an abdomen.
- d. They do not have lungs but breathe through spiracles, which are holes along the side of the body.

REQUIREMENT 2: How are insects classified? List five orders of insects, giving a brief description of a species in each order. This may be done in conjunction with Requirement 6

Modern insect classification divides the Insecta (ie insects) into 29 orders, many of which have common names. Some of the more common orders are:

- a. Hymenoptera - wasps, bees, ants, sawflies.
- b. Odonata - dragonflies and damselflies
- c. Hemiptera - cicadas, aphids, plant hoppers, leaf hoppers, shield bugs
- d. Phasmatodea – stick insects
- e. Blattodea - cockroaches
- f. Isoptera - termites
- g. Mantodea - mantises
- h. Phthiraptera – lice
- i. Coleoptera - beetles
- j. Siphonaptera - fleas
- k. Diptera - flies; ie sand flies, fruit flies, house flies, tsetse flies; mosquitoes, midges
- l. Lepidoptera - butterflies and moths

We present a few of the orders here to help you out, but if you want to identify the insects you find, you will very likely need a good field guide. You can try various on-line identification aids as well. Please see ADDITIONAL REFERENCES on the final page of these notes.

a. Hymenoptera (wasps, bees, ants, sawflies).

Apis (Honey Bee)

Where found: Worldwide

Description: There are about 20 000 bees but only a few bees that are used for producing honey for people.

They live in colonies called hives with only one egg laying female called a queen. The rest of the bees are sterile females with a few males called drones. Bees are related to the wasps

Pictured: A black bee (*Apis mellifera mellifera*)

<http://en.wikibooks.org/w/index.php?title=File:Abeille-bee-profil.JPG&filetimestamp=20061117214442>



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b. Odonata (dragonflies and damselflies)

Amax junius (Green Darner)

Where found: North America

Description: It is one of the biggest and fastest-flying dragonflies, able to reach speeds of 85 km/h (55 mph).

It is also Washington State's state insect.

Pictured: Green Darner (*Amax junius*)

http://upload.wikimedia.org/wikipedia/commons/d/d5/Green_Darner.jpg



c. Hemiptera (cicadas, aphids, plant hoppers, leaf hoppers, shield bugs)

Cicada (part of super family Cicadoidea)

Where found: World wide

Description: The Australian bush is never silent in summer because of the constant singing of cicadas. They have a drum like structure in their body with a large cavity in the abdomen, which amplifies the sound to an astonishing level.

Picture: Cicada in Australia, emerging from its nymph case



d. Phasmatodea (Stick Insects)

Description: The Phasmatodea are an order of insects, whose members are variously known as stick insects (in Europe and Australasia), walking sticks (in the United States of America), ghost insects and leaf insects.

Some species are capable of secreting a substance from glands on the thorax that can cause an intense burning irritation of the eyes (and in some cases temporary blindness) and mouth of potential predators on contact.

Have a look at a giant stick insect in [Insects_Fascinating Facts](#).

e. Blattodea (Cockroach)

Description: Cockroaches (or simply 'roaches') are insects of the order Blattodea. This name derives from the Latin word for cockroach, 'blatta'. Among the most well-known species are the American cockroach, the German cockroach, the Asian cockroach and the Oriental cockroach.

Have a look at the giant cockroach in [Insects_Fascinating Facts](#).

Picture: <http://en.wikibooks.org/w/index.php?title=File:Cockroachcloseup.jpg&filetimestamp=20070715100941>



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f. Isoptera (Termite)

Description: Termites mostly feed on dead plant material, generally in the form of wood, leaf litter, soil, or animal dung. About 10% of the estimated 4,000 species (about 2,600 taxonomically known) are economically significant as pests that can cause serious structural damage to buildings, crops or plantation forests.

Termites are major detritivores, particularly in the subtropical and tropical regions, and their recycling of wood and other plant matter is of considerable ecological importance.

As social insects, termites live in colonies that, at maturity, number from several hundred to several million individuals.

Have a look at the giant termite nest in Insects_Fascinating Facts.

Picture: Formosan subterranean termite soldiers (red heads) and workers (pale heads).

http://en.wikibooks.org/w/index.php?title=File:Coptotermes_formosanus_shiraki_USGov_k8204-7.jpg&filetimestamp=20051103010020



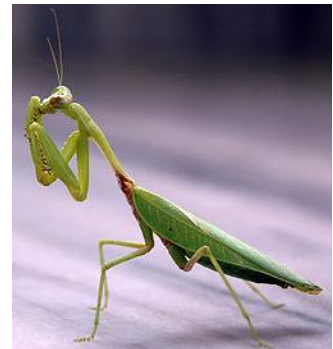
g. Mantodea (Mantis)

Description: Mantises are notable for their hunting abilities. They are exclusively predatory and their diet usually consists of living insects, including flies and aphids; larger species have been known to prey on small lizards, frogs, birds, snakes, and even rodents.

Most mantises are ambush predators, waiting for prey to stray too near. The mantis then lashes out at remarkable speed.

Picture:

http://en.wikibooks.org/w/index.php?title=File:Praying_mantis_india.jpg&filetimestamp=20050728230827



h. Phthiraptera (Lice)

Description: As lice spend their whole life on the host, they have developed adaptations which enable them to maintain close contact with the host. These adaptations are reflected in their size; (0.5–8 mm), stout legs and claws which are adapted to cling tightly to hair, fur and feathers. Also, they are wingless and flattened.

Lice feed on skin (epidermal) debris, feather parts, sebaceous secretions and blood. A louse's colour varies from pale beige to dark grey; however, if feeding on blood, it may become considerably darker.

Picture

http://en.wikibooks.org/w/index.php?title=File:Lice_image01.jpg&filetimestamp=20060618154647



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i. Coleoptera (Beetles)

Description: Beetles are a group of insects, which have the largest number of species.

They are placed in the order Coleoptera, which means 'sheathed wing' and contains more described species than in any other order in the animal kingdom, constituting about twenty-five percent of all known life-forms.



Picture: Bombardier Beetle, *Brachinus sp.*, Orange County, North Carolina, United States, length 13mm

http://en.wikibooks.org/w/index.php?title=File:Brachinus_spPCCA20060328-2821B.jpg&filetimestamp=20060329224314

j. Siphonaptera (Flea)

Description: Fleas are external parasites, living off the blood of mammals and birds.

Fleas are small (1.5 to 3.3 mm ie 1/16 to 1/8-inch), long, agile, wingless insects with tube-like mouthparts adapted to feeding on the blood of their hosts. Their bodies are flattened side to side, permitting easy movement through the hairs or feathers on the host's body. The flea body is hard, polished, and covered with many hairs and short spines directed backward, allowing the flea a smooth passage through the hairs of its host.



Their legs are long, the hind pair well adapted for jumping (vertically up to 180 mm (7 inches); horizontally 330 mm (13 inches) - around 200 times their own body length, making the flea the best jumper out of all animals in comparison to body size.

Picture:

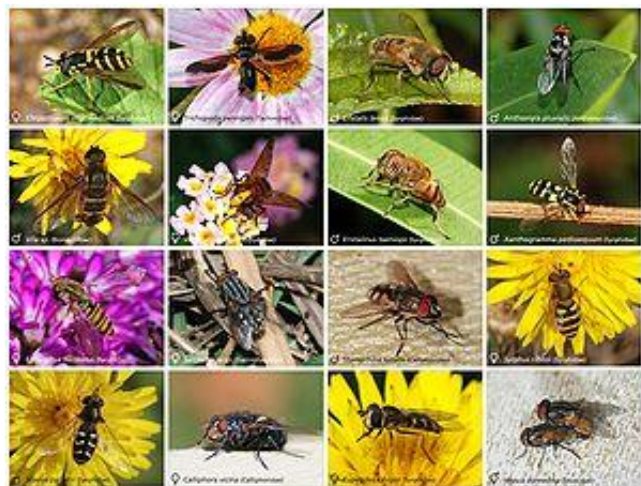
http://en.wikibooks.org/w/index.php?title=File:Scanning_Electron_Micrograph_of_a_Flea.jpg&filetimestamp=20050828121912

k. Diptera (Flies; ie sand flies, fruit flies, house flies, tse-tse flies; mosquitoes, midges)

Description: The presence of a single pair of wings distinguishes true flies from other insects with "fly" in their name; such as mayflies, dragonflies, damselflies, butterflies, etc. It is a large order, containing an estimated 240,000 species of mosquitoes, gnats, midges and others, although under half of these (about 120,000 species) have been described.

It is one of the major insect orders both in terms of ecological and human (medical and economic) importance.

The Diptera, in particular the mosquitoes (*Culicidae*), are of great importance as disease transmitters, acting as vectors for malaria, dengue, West Nile virus, yellow fever and other infectious diseases.



Picture: <http://en.wikibooks.org/w/index.php?title=File:Diptera1.jpg&filetimestamp=20080119171046>

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1. Lepidoptera (Butterflies, Moths and Skippers)

Description: Lepidopterans undergo complete metamorphosis, going through a four-stage life cycle:

1. egg
2. larva/caterpillar
3. pupa/chrysalis
4. imago/adult.

For more information check out the Moths & Butterflies Honour on this Website

Picture

http://en.wikibooks.org/w/index.php?title=File:Parthenos_sylvia_philippensis.jpg&filetimestamp=20060728180637



REQUIREMENT 3: Name five species of useful insects.

- a. Bees, wasps, ants, butterflies and even beetles pollinate our fruit, vegetables and crops. Without pollination we would starve.
- b. Silkworms spin silk to make thread for cloth. This has greatly affected human history.
- c. Fly larvae (maggots) were once used to treat wounds to eat away dead flesh and so stop gangrene. While this practice stopped for many years, once again maggots are being bred to do this.
- d. Maggots are also used to tell how long a body has been dead. In case of a murder, the maggots are used to date the death by their development.
- e. But there is still more for maggots. They are bred to be used as bait by fishermen as are crickets and grasshoppers.
- f. Honey-bees are used to produce honey.
- g. If that isn't enough, in some Asian countries, you can enjoy? eating fried or roasted insects.

REQUIREMENT 4: Name five species of injurious insects. Tell how they might be controlled or their damage minimised. What is the world's most deadly creature and why is it so dangerous?

- a. Grasshoppers and locusts can form huge plagues and eat every bit of vegetation as they travel. This means that, not only are crops destroyed, but stock and other animals may die from starvation.
- b. Weevils are also destroyers of crops and food.
- c. Parasitic insects bite and often inject saliva which carries diseases. These include mosquitoes, mites, bed bugs, lice and certain flies. Some of the diseases carried by insects are malaria, sleeping sickness and dengue fever.
- d. Termites can destroy buildings by eating away the timber.
- e. Cockroaches contaminate food and our houses.

Controlling insects and minimising their damage

Until recently we did not understand that insects carried disease. For the last two hundred years people, have been using chemicals and draining wetlands to combat insects. Loss of wetlands is serious for the environment and chemicals are dangerous to humans and other creatures.

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Scientists have recently been using bio-control. This means using fungi to attack insect larva, using ladybirds to eat larvae and even creating crops, which insects won't eat. This is a very interesting field of study.

Fruit fly traps are used to tell when fruit flies are about and then the farmer sprays and so uses less insecticide.

For people in malaria prone areas, one of the most important things is to avoid being out during the late afternoon early evening when malaria mosquitoes are flying.

The world's most deadly creature

The world's most deadly creature is the female mosquito. Because she needs blood to produce eggs, she injects saliva into a living animal to thin the blood before sucking it up. If the animal or person has a disease, she will transmit it to all the other 'victims' she bites.

Over two million people (2 000 000) die from malaria each year and she carries many other diseases as well. She is the WORLD'S SCARIEST CREATURE

REQUIREMENT 5: Tell two Bible stories in which insects played an important role.

- ✿ Exodus 8:21-31: God sent a plague of flies on Egypt.
- ✿ Exodus 10:1-18: God sent a plague of locusts on Egypt.
- ✿ Judges 14: The bees in the lion which Samson killed
- ✿ Proverbs 6:6-8: The lesson of the ant
- ✿ Jonah 4:5-11: God used a worm to teach Jonah about His concern for people.
- ✿ Acts 12:20-23: King Herod was eaten by worms and died.

REQUIREMENT 6: Do one of the following.

- a. **Mount a collection of 20 species of insects representing at least six different orders. (No moths or butterflies and no carelessly mounted or broken specimens will be acceptable.) Note: This is the least preferred option by the SPD**
 - i. Place under each specimen a label showing the locality where caught, the date caught, and the collector's name. Labels should not be larger than 6 mm x 20 mm (1/4 x 3/4 inches).
 - ii. Identify insects with common names and scientific order on second labels to be mounted below the first.
 - iii. Arrange all specimens neatly in an insect box according to orders and families. Orders should be pinned to the box rather than attached to the individual insect pins.

In the South Pacific Division, this option is the least preferred option. In many places there are concerns relating to toxicity of the euthanizing products. As such, no instructions have been provided in relation to preserving insects. If choosing to do this option, please check and comply with local regulations. Following are some resources which may be useful:

- ✿ Insects on Display: A Guide to Mounting and Displaying Insects - by Connie Zakowski, Rainbow Books, Florida, 2000
- ✿ The Handbook of Insect Collecting by Courtenay Smithers, Angus & Robertson, Australia, 1988
- ✿ Collecting and Preserving Insects – Beginner's Guide
<http://xeranthemum.vicissitudo.net/insects.html>

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- b. Make coloured drawings or paintings of 20 species of insects, representing at least six different orders. Drawings or paintings need to be life size or larger, to show the details of small insects, and in natural colouring. Label the drawings with common names and genus or species level names.**
- c. Take colour photographs of 20 species of insects, representing at least six different orders. All pictures should be in focus, close-ups and properly labelled, showing where photographed, the date photographed, common names and genus or species level names.**

This requirement can really be divided into two phases: field work, and lab work. The field work comes first, and it consists of going out into the wild and finding as many insects as you can. Do not worry about identifying them. Photograph as many as you can. If they are too difficult to photograph, capture them and bring them back to the lab where you can refrigerate them as described later. The lab work is when you sit down and attempt to identify the insects you have captured, either photographically, or physically.

Photographing insects can be challenging, but with a few tips, success is within reach. Perhaps the most important feature of your camera for insect photography is the 'macro mode.' This feature allows the camera to focus on subjects less than 50 cm away. It is often marked on the camera body with a small flower icon (since flower photography is also mostly close-up). If you cannot find how to enable this feature on your camera, consult the user's manual. If you cannot find that, search for one on the Internet.

Once you find an insect, you may discover that it moves far too quickly for you to be able to take a decent picture. One trick you can use in this case is to capture the insect and pop it in a refrigerator for about an hour. This will not harm the insect, but it will certainly slow it down. After taking a few pictures, release the insect into the wild again.

You can also try placing the insect in a drinking glass, and covering the top with the camera lens and body. Use a transparent glass for this so that light can illuminate the insect. Once it settles down, take the picture. Have fun!

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ADDITIONAL REFERENCES

Australia

- What Bug is That – A guide to Australian Insect Families by the CSIRO.
<http://anic.ento.csiro.au/insectfamilies/>
- Australian Insect Resources: <http://australian-insects.com/australian-resources.php>

New Zealand

- What is this bug? <http://www.landcareresearch.co.nz/research/biosystematics/invertebrates/invertid/>
- Insects in New Zealand: <http://www.teara.govt.nz/en/insects-overview/1>
- Native Insects of New Zealand by David Miller, Reed 1970
- Common Insects in New Zealand by David Miller, Reed, 1971

New Guinea

- Insects of Papua Indonesia: <http://www.papua-insects.nl/>

General

- Wikibooks: <http://en.wikipedia.org/wiki/Insects>
- Bug Guide: <http://bugguide.net/node/view/15740>
 - Identification, Images, & Information for Insects, Spiders & Their Kin for the United States & Canada