Collecting Insects

Overview of major techniques

There are two major collecting approaches to sampling insects: **active collecting,** such as sweep netting, foliage beating, searching the ground, under rocks, sifting leaf litter, peeling tree bark; and **passive collecting,** where traps are set to either attract or intercept insects including pitfall traps or baited pitfall traps, malaise and flight intercept traps, light traps and collecting at a light sheet, sticky traps, pheromone traps and yellow pans.

Different collection methods are used to target **different types of insects,** such as crawling insects, flying insects, plant inhabiting insects, ground dwelling insects, and cryptic insects. The most suitable method used in any particular situation will always be dependent on the aims of the collecting and the types of insects that are being targeted.

For example, a biodiversity assessment of an area would more likely use a range of broad scale passive trapping methods targeting a range of insect groups. Whereas, agricultural pest monitoring for one particular insect species or targeted collecting of one particular group may involve more active collecting and less of a range of methods, for example sampling a crop with a beating sheet and active searching of foliage, or for butterfly collecting, simply a sweep net and a great deal of patience!

And it should be noted that in many situations more than one method of collection may be required or may result in more success in targeting a particular species or group of species, especially as different life stages of the same insect often inhabit different habitat niches and have different modes of life (e.g. flying butterflies and moths with (usually) plant eating crawling caterpillar larvae).

There are **advantages** and **disadvantages** to all of the methods, and unless one is undertaking a broad insect biodiversity assessment of an area it's generally a good idea to design sampling / collecting (and also specimen processing) so as to **minimise "by catch" of non-target species** as much as possible, for a more efficient working practice.

Whilst there are many excellent references that cover all collecting methods in detail (some given at the end of this section), below we focus on collection methods that will be used in the workshop and that target the collection of flying insects and insects associated with plants.

Collection techniques for plant associated and flying insects

Active plant sampling:

Foliage Beating or Beat Sampling: A beating sheet or beating net is held under vegetation and the foliage firmly tapped with a beating stick to dislodge insects from the branches falling into the net. Insects are collected off the sheet or net using an aspirator or by hand into a container if they are too large to fit through the aspirator tube. Samples from each plant species should be kept separate, as discussed in the following section. This is an effective method for many plant inhabiting insects including beetles, bugs, psyllids, caterpillars, and bug and beetle larvae.

Sweep Netting: Generally a net with a long pole and deep mesh bag is used, either to collect large flying insects individually (butterflies wasps, flies, dragonflies) or by sweeping over foliage in a back and forth / figure of 8 pattern many small insects hidden in the foliage will be collected.

Hand Collecting or Visual Checking: A useful method in support of beating and sweeping and plays an important support role in agricultural sampling, being useful for detecting pests such as aphids and silverleaf whitefly, *Bemisia tabaci* (Hemiptera: Sternorrhyncha). While checking leaves for adult or

larval leaf feeding insects, buds and flowers should be separated to search for eggs or small larvae too. This may also incorporate looking around on the ground for insects and digging around the base of the plant and checking roots of crops. Collect specimen samples into either ethanol or dry vials.

Passive sampling of flying insects:

Yellow pans: Small yellow plastic dishes are placed on the ground (see photo right). Dishes are half filled with water and a drop or two of detergent (to break the surface tension). Collect the yellow pans at the end of the day. Transfer specimens to an alcohol vial. Salt may be added to the water as a preservative if yellow pans are left out for longer. Note that many insects are attracted to yellow and pan traps are very efficient collecting devices for flies, small wasps and certain groups of beetles.

Setting a line of yellow pan traps for the day

Light trapping:

(i) Light sheet: Use of a light next to a white sheet. This involves setting up a white sheet, usually using tent poles and ropes, beside which a mercury vapour (MV) or fluorescent light is fixed. Insects attracted can be collected into specimen vials. Note: safety glasses should be worn when working at a MV light to protect eyes because of the UV emitted. Light traps attract a myriad of insects, primarily moths, but also terrestrial and aquatic bugs and beetles, wasps and mantids, while different species may arrive at different times throughout the night. To some extent this is not passive sampling, as the insects have to be found and collected by the collector at the sheet.

A mercury vapour light trap setup at sunset

(ii) Black light (UV) bucket traps: This is a passive collecting method using light, which can be left unattended. A UV-strip light is held vertically between 3 vanes which balance the light over a large funnel placed over a bucket shaped container. Many insects attracted to the light will fall downwards into the bucket through the funnel. Inside the bucket crunched up newspaper or cardboard (broken egg cartons are good) are placed to increase surface area for the insects to shelter, lessening the amount of damage they may cause each other. This is important, because bucket traps tend to collect beetles which can damage moths simply by running around. The insects are killed as they accumulate. A slow

Collecting at a light sheet after dark

release method of killing the insects over a long period of time is ideal, for example, using a wick in a bottle of ethyl acetate. Some of the vaporising chemical should be put on the paper or egg-cartons to stun or kill the first arrivals.

Bucket light trap powered with 12V battery

Malaise Trapping: A malaise trap is a tentlike trap, which captures aerial insects. This is a mass trapping exercise where all specimens are captured in a large jar, which is usually filled with ethanol. These can be set up for a varying amount of time, for example a week. These traps work by intercepting insects in flight and so work best when positioned in natural flight paths of flying insects, such as forest edges or clearings, on forest tracks or riverbanks. They are particularly good for collecting wasps, flies, beetles, and bugs.

Malaise trap

Sticky Traps: Adhesive (paint on or as pre-prepared strips) surface designed to collect insects that may wander or alight onto the surface and are often attached to tree trunks or attached to poles amongst crops (see phot below right). Although not widely used for general insect collecting (hard to handle and easy to damage insects in the process of removing them), they can be good for capturing flies, wasps and beetles, as well as other flying insects ants and other flightless inhabitants of tree trunks. A yellow substrate (card or plastic) is often used to attract insects.

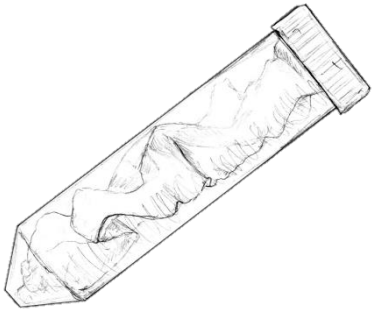
Pheromone Traps: Used for pest monitoring, these traps attract insects with a specific chemical lure based on the sex pheromone of a particular species. They therefore generally only trap one sex of one species, usually males. They are usually designed with a sticky surface around the chemical lure so that numbers of individuals can be estimated. Trap designs include pots and shelters, so that trapped insects are not destroyed by rain. Pheromone traps can quickly attract large numbers of species that are not evident from general collecting, such as the sweet potato weevil, *Cylas formicarius* (Coleoptera: Brentidae).

Setting yellow sticky traps in an agricultural field

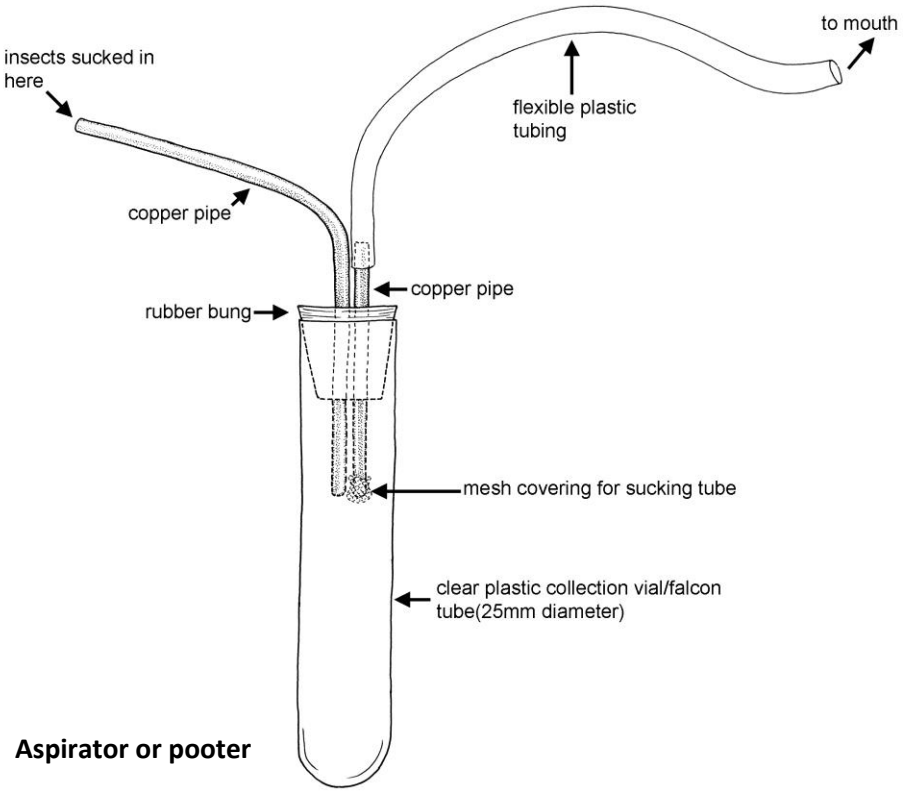
Method for collecting insects from host plants

Packing list for field sampling

- Beating net and stick – a shallow calico or nylon bag on a metal hoop with a short wooden handle.
- Aspirator.
- Prefilled ethanol vials – to collect some specimens straight to ethanol in field.
- Collecting transfer tubes with strips of tissue or toilet paper inside – for dry collecting.
- Notebook.
- Pen/Pencil.
- Label card – small squares pre-cut is a good idea.
- GPS (if you have access to one, not essential).



Collection transfer tube with tissue inside – empty and ready for collecting



Aspirator or pooter

Beat sampling method and handling of samples

When targeting host specific insects, keep beat samples from different plant species separated. At a site sample multiple individuals of a particular plant species using the foliage beating or beat sampling technique. Once sampling has been completed from a particular plant species, transfer the specimens from the aspirator tube to a collection transfer tube, before commencing from another plant species.

When using an aspirator it's a good idea to have the flexible tube in the mouth ready and then place the copper tube end behind an insect, before sucking air through the plastic tube into the mouth which then sucks the specimen through the pipe and into the aspirator vial.

To transfer specimens easily, it helps to tap on the aspirator before opening and have the lid off the collection tube already and then once the aspirator tube is over the collection tube then tap on the aspirator tube again to dislodge specimens into the collection tube, before quickly closing.

The tissue in the transfer tube, provides protection for the specimens from being damaged in transit and also provides an absorbent substrate if using ethyl acetate to kill specimens.

Avoiding sucking up spiders into the aspirator as they may attack insects and make a mess in the tube with their webs! Ants also may attack other insects in your tube so it's best to collect these separately and / or treat the sample tube with ethyl acetate promptly to prevent damage to other specimens from predation in the tube.

Note taking in the field

Always carry a dedicated field notebook with you when out collecting and write up notes and label specimens once finished collecting, recording all field data at a site before moving on.

The **baseline information** that is required when collecting insects in the field is the **location, date and collector.**

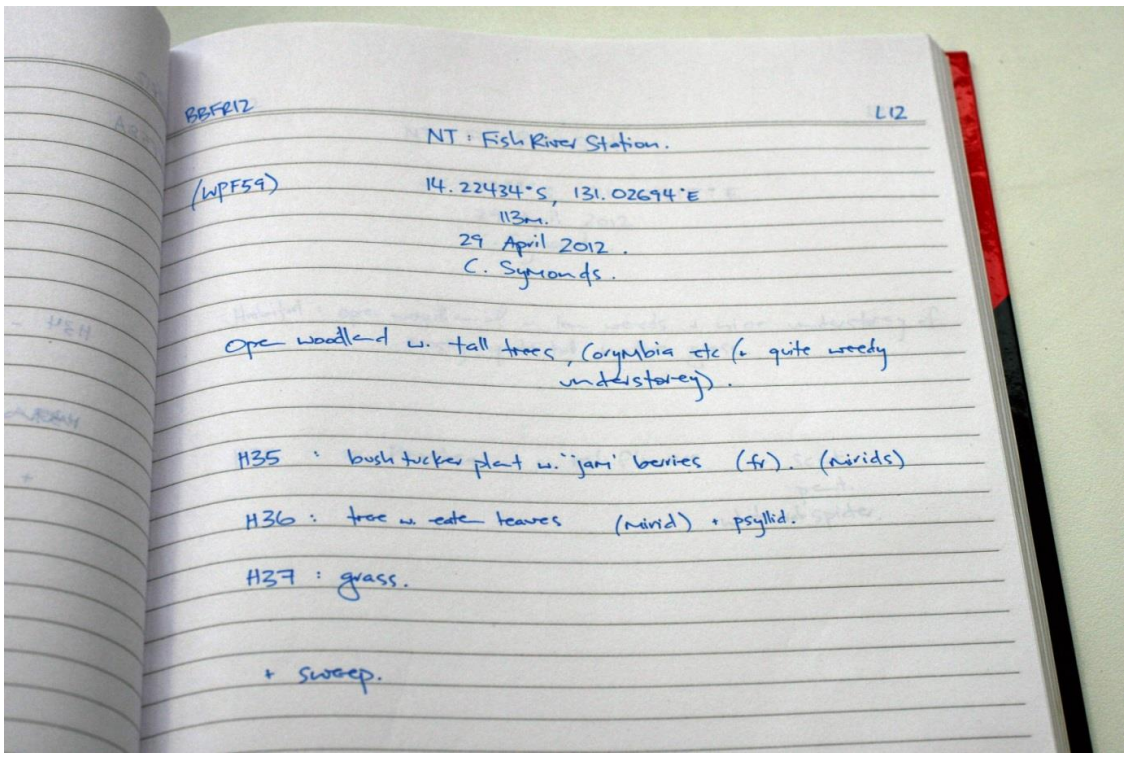
This **combination of information** for collected specimens may be referred to as a **"collection event".**

Collecting further **supplementary information**, is also important, such as **habitat, collection method, and host plant** adds more value to the specimen data and may also assist in identifying that insect.

For broad scale surveys it may serve to develop coding systems by which you can temporarily label and then refer back to the notebook later when preparing permanent labels for the specimens.

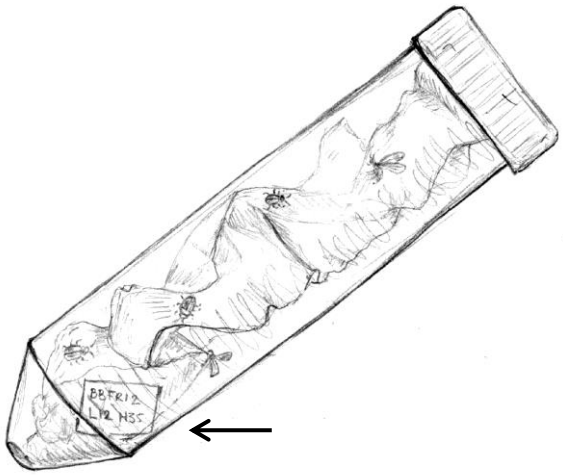
For **host plant specific insect sampling**, for example, we have created a system of codes that comprise of 3 components which make up a unique collection event: a **trip code, locality number** and **host number**. Note that on any one trip the localities and hosts are labelled individually and successively from 1 onwards.

Example of a **field notebook**, recording insects collected from different host plants at a site using this coded system (with a trip code, locality numbers and host numbers):



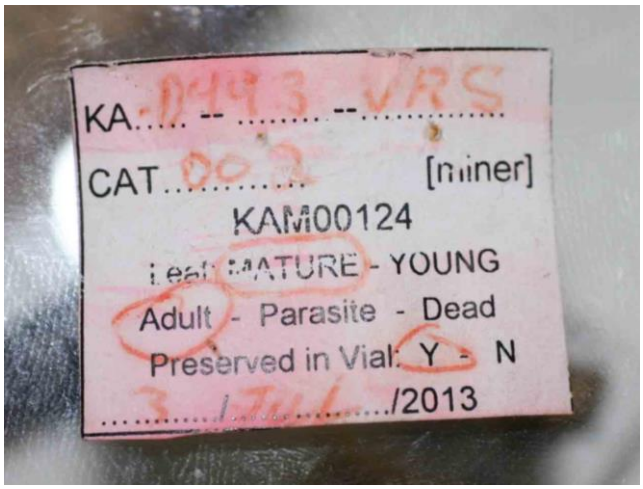
Labelling specimens in the field

Always label specimens at the time of collection before departure from a site, using **temporary field labels**. Temporary field labels can be created using your collection codes from your field notes, written onto small pieces of cardboard or paper, which includes the locality and host information. Always place labels inside tubes:



Collection transfer tube with insect specimens sampled from a plant species and a temporary field label added with collection information, e.g. code from field notebook entry as above: BBFR12 L12H35

Temporary field labels can be created using collection codes from field notes (as above), or using basic collection information (i.e. collector, locality, date and relevant host/habitat information). Temporary field labels can also be created and printed prior to going into the field, which can be useful, for example, in ecological survey work where detailed information is required for a number of variables, or where localities have been predetermined.



Example of a temporary field label used in insect collecting, investigating host specific of Lepidoptera in New Guinea rainforests, by the New Guinea Binatang Research Centre (NGBRC), Madang. The pre-printed labels incorporate collection codes and ecological information.

Note: use pencil or a permanent pen.

Preservation methods of different insect orders

For immature stages, mostly being soft bodied, wet preservation is required for the most part. However some nymphs of hemimetabolous groups such as Hemiptera and Orthoptera have a hard exoskeleton and may be dry preserved and pinned or point mounted.

For adults the following killing/preservation techniques are used:

Archaeognatha [bristletails]	Ethanol
Blattodea [roaches, termites]	Dry or Ethanol
Coleoptera [beetles]	Dry or Ethanol
Dermaptera [earwigs]	Ethanol
Diptera [flies]	Dry or Ethanol
Embioptera [footspinners]	Ethanol
Ephemeroptera [mayflies]	Ethanol
Hemiptera [aphids, psyllids, scales, cicadas, true bugs]	Dry or Ethanol
Hymenoptera [bees, sawflies, wasps and ants]	Dry or Ethanol
Lepidoptera [butterflies and moths]	Dry
Mantodea [mantids]	Dry or Ethanol
Neuroptera [lacewings]	Ethanol
Odonata [dragonflies and damselflies]	Dry
Orthoptera [crickets, grasshoppers]	Dry
Phasmatodea [walking sticks]	Dry
Plecoptera [stoneflies]	Ethanol
Psocodea [book lice, lice]	Ethanol
Siphonaptera [fleas]	Ethanol
Strepsiptera	Ethanol
Thysanoptera [thrips]	Ethanol
Trichoptera [caddisflies]	Ethanol
Zoraptera [zorapterans]	Ethanol
Zygentoma (= Thysanura) [silverfish]	Ethanol

Further references and resources for insect collecting

Internet resources:

Collecting Ants – Ants (Formicidae) of the southeastern United States
http://mississippientomologicalmuseum.org.msstate.edu/Researchtaxapages/Formicidaepages/Collecting.tips.htm#.VGTAG8nRbRl

Insect Collecting – Queensland Museum
http://www.qm.qld.gov.au/Find+out+about/Animals+of+Queensland/Insects/Collecting+insects

Insect monitoring techniques for field crops - DAFF QLD
http://www.daff.qld.gov.au/plants/field-crops-and-pastures/broadacre-field-crops/integrated-pest-management/help-pages/insect-monitoring

Books:

Dahms, E. C., Monteith, G. & Monteith S. 1983. *Collecting Preserving and Classifying Insects*. Queensland Museum.

Upton, M. S. & Mantle, E. L. 2010. *Methods for Collecting, Preserving and Studying Insects and Other Terrestrial Arthropods.* Australian Entomological Society. 83pp