



Observer's Manual

Observing and Recording Insect Pollinators as they Forage

By Jim Dyer

Ecological Monitoring and Assessment
Network Coordinating Office (EMANCO)
of Environment Canada

Seeds of Diversity Canada

April 2007

introduction



Quite simply, without pollinators, our world would look entirely different and would not be able to support the number of people that it currently does. Alarming, there is a wide-spread lack of appreciation and knowledge about native bee species and other pollinators. Pollinators need your help!



Discover a whole new ecosystem in your backyard!

By observing pollinators in your gardens, local parks, along country roads, basically anywhere flowers are growing, and then sending in your observations, you can help scientists to better understand the importance of pollinating insects so that steps can be taken to preserve them.

In order for you to contribute useful observations, it is essential to follow the instructions described in this Manual. Pollinators can only be monitored successfully if all participants record their observations systematically and consistently. To be useful to ecologists, the information must contain the following:

- ✿ environmental setting description
- ✿ date
- ✿ location coordinates
- ✿ site and habitat descriptions
- ✿ flowers visited
- ✿ weather conditions.

We've provided you with standardized field sheets to ensure that all of these supporting records are collected and are consistent with other observers.

The basic premise in designing this monitoring program is *non-destructive sampling*. You are asked to record the diversity of the insect types you see without taking samples (killing pollinators) and without necessarily achieving precise identification of any one species.

The recording procedure should not, however, detract from the satisfaction and enjoyment of observing pollinators as they function in their natural setting. So get out there, and help ensure the future of pollinating insects!

Note: This guidebook provides both direct field guidance and a basis for training future observers. Its focus is on the monitoring process, not pollinator ecology. To understand the environmental issues and ecological background more thoroughly, go to the source document for this Manual, "Raising awareness among Canadians about plant pollinators and the importance of monitoring and conserving them" on the Pollination Canada Website (www.pollinationcanada.ca).

getting started



Becoming an insect observer is probably one of the least expensive hobbies you will ever have, but there are a few materials you will need. Since you will be taking notes and filling out field sheets as you observe, the first tools you will need are:

- ☐ a clipboard
- ☐ a couple of sharp pencils
- ☐ several copies of the Pollinator Site Form
- ☐ the Pollinator Follow-up Form (if you've visited and recorded observations at the site before)
- ☐ the Pollinator Description Form.

You should also bring:

- ☐ a good magnifying glass (which you will often hold within inches of the flower)
- ☐ a ruler, preferably transparent, about 10cm or 15cm long, with metric units (you will be asked for measurements)
- ☐ a map (you will need to give the location of the site)
- ☐ a watch (you will need to give the time of observing)
- ☐ a pair of gloves.

Useful Tips

Searching around in a dense ground cover if you drop your pencil or magnifying glass will cost valuable time and detract from the enjoyment. So you will also need:

- ☐ strings or lanyards (to attach your magnifying glass, ruler and pencils to your clipboard or wrist).

Keeping your completed forms in order will help you recall and reference previous sightings.

So use a:

- ☐ three-ring binder.

On Field Guide Books

Field guide books can help you identify insects and flowers. While quite a few good field guides on wildflowers and weeds are available in book stores, and some on insects as well, there is not much



information available (at least in field guide form) specifically about pollinating insects. Any field guide books you choose to use do not necessarily need to be with you while observing. As you are flipping pages, your insect will usually fly away. Instead, spend your observing time taking notes and filling in the form, and you can make a systematic guess when you finish observing or get home, based on your descriptive data, guide books and possibly help from an expert.



On Nets

A net is an optional piece of equipment, but it is not recommended. Although there is no need to collect samples in this monitoring program, it may occasionally be useful to capture an insect temporarily in a net so that it can be examined more closely or slowly. Such cases include insects that fly too fast or are foraging on flowers too far away to be seen clearly, such as in the tops of flowering fruit trees, or at the centre of an impenetrable patch of vegetation. Insects netted in this way are seldom injured too badly to survive when released. However, each scoop with the net usually does significant damage to the flowers. As well, by retrieving one insect, you may have scared away most of the others and have thus biased the results of your observing session. So if you must use a net, do so very sparingly and after your recorded observing session.



be careful, be courteous



To observe pollinators at work, you must find a good patch of flowers. Wherever you observe, the first concern is to observe safely and responsibly. You might wonder what ill could befall you just by standing in your garden watching a bee working its flowers. But step outside your own backyard to visit other hangouts for pollinating insects and safety starts to be a little more of an issue. With some forethought and common sense, however, these risks can be easily handled.

Public Areas

To observe in public parks or other public lands, you will probably get there by car. Park in designated areas, even though that may mean a longer trek to the corner with the best flower patch. If there are no designated parking spots, choose one that will not block traffic or destroy foliage. Some of the best stretches of wild flowers are on road embankments. If you park on the shoulder of a road, make sure that your car is well clear of traffic.

Private Areas

If the site you want to observe is on private property, or you have to cross private land to reach it, you must get permission from the owner, otherwise you are trespassing. Whether the site is private or public, take any garbage or litter home with you, or deposit it in an appropriate trash can or recycle bin.

Personal Safety

If you are compelled to go alone to remote, deserted corners of public properties, take the same precautions you would in any other isolated situation. Don't get so absorbed in watching insects that you don't notice people moving around or toward you. If you have young children with you (which is generally not a good idea because the noise and movements they make can be distracting to you and scare pollinators away), you are responsible for both their safety and behaviour.



It's Wild Out There!

Unless you are in wilderness, you are not likely to encounter any large wild animals. Social wasps, however, do call for some caution. Yellow jackets, paper wasps, and bald faced hornets have evolved their defences specifically for mammals. A sting from one such wasp can be very painful, but an attack from a swarm can be life-threatening. If you know you are allergic to stings (and still want to observe), remember your allergy kit. Being social, if there is one hornet, there are likely many. When browsing through thick flower patches, it is possible to bump, step on or disturb a nest, unknowingly. Move about slowly and carefully and know your escape route, and don't try to kill a wasp that won't leave you alone. Stand perfectly still since insects see motion much better than images.

Spending any time in the sun calls for drinking fluids. Water is your best option but if your choice is a soft drink, bear in mind that the sugar will attract yellow jackets. They frequently crawl inside pop cans and a sting on the lips or tongue is not unheard of. The same caution applies to fruit juices.

Garden gloves are a good idea when wasps are around, whereas sandals are a bad idea if you intend to enter a flower patch. Gloves will also protect you from thorns. Avoid wearing the same colours as the flowers, such as yellow when goldenrod is in bloom.

Bumblebees and honeybees are not nearly as aggressive as wasps, but if accidentally trapped, they can sting. Bumblebee stings are very painful. If stung by a honeybee, remove the stinger right away, since it continues to pump its venom after tearing away from the bee. Although much less painful, even the little sweat bees can sting if trapped.

Many of the best wild flower patches are also favourite mosquito hangouts. With the new concern about the West Nile and the Avian Flu viruses, use insect repellent and expose a minimum of skin. Other nuisance insects include black flies, deer flies and horse flies. None are life-threatening but they can spoil your fun. Poison Ivy is another good reason for covering as much skin as is comfortable. As soon as you realize such contact was made, wash the area with hot soapy water. Since you will usually be observing on sunny days, often in peak sun hours, wear a hat, shirt and sun screen, as sunburn is another serious health concern.



using the field sheets



With a little practice, the field sheets can usually be completed in only a minute or two.

Although they may look long and tedious, these forms are intended to prompt you to observe the minimum amount of detail needed for this monitoring program. Not all entries will be needed on every trip. Most entries only require a multiple-choice selection, but these choices should all be read carefully.

There are three field sheets:

1. Pollinator Site Form
2. Pollinator Follow-up Form
3. and Pollinator Description Form (generally supplemental).

Note: Only one copy of each is provided in the Manual, so photo-copy or print the pages as you need them.

Fill in a new **Pollinator Site Form** for every new site that you visit. This form asks you to describe the site, and allows you to record your first insect observations at that site.

Use the **Pollinator Follow-up Form** to record further insect observations on subsequent visits to each site. You can also use it if you need more room than a Site Form allows. Be sure to indicate which visit (by number) the Follow-up Form is for.

Use the **Pollinator Description Form** only if you find a flower-visiting insect that you don't recognize. This form helps you to systematically describe the insect for later identification. You don't have to use this form for pollinators that you know by name.



pollinator site form



Getting started. Every time you observe pollinators at a new site, fill in a Site Form. Each site must be identified by a unique number, so enter a number at Site # that you have not used before. Record the date and time when you start your observation session. Remember to record the “Time spent observing” when you finish. Enter your name and address. Please use the same name on each Site Form, so that your observations can be connected in the Pollination Canada database.

Location. Give your location a name that is meaningful to you, e.g. “John’s back garden”, “Pepper Park rose bed”, “Meadow north of cottage”. Since the program will be most successful when people observe the same spot repeatedly, be sure to describe the location so that you can find it again. Enter an address for the site if one is available. If the site has an official name such as a park, school or industrial lot, give that name.

Pollination Canada Pollinator Site Form

Site # Visit #

Date Start time am pm Time spent observing minutes

Name Email

Street Address City/Town Province Postal Code

Location (give location a name and coordinates; if address is same as above, leave address section here blank)

Location Name Street Address City/Town Province

Latitude (decimal degrees) Longitude (decimal degrees)

Landscape (check any features that apply to your site)

☐ urban ☐ suburban ☐ rural ☐ park ☐ wilderness
☐ embankment ☐ vacant ☐ cropland ☐ meadow ☐ orchard
☐ hedgerow ☐ garden ☐ forest ☐ riverbank ☐ public

Weather (check one from each section)

Sky ☐ sunny ☐ cloudy ☐ overcast ☐ Shade (i.e. trees, building) ☐ not shaded ☐ shaded
Wind ☐ windy, steady ☐ windy in gusts ☐ light breeze, steady ☐ light breeze in gusts ☐ calm
Temperature ☐ cold ☐ cool ☐ seasonal ☐ warm

Flowers visited by insects (list each kind of flower where insects were visiting and refer to these numbers in the table below)

1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.
----	----	----	----	----	----	----	----	----	-----	-----	-----	-----	-----	-----

Flowers Visited Form # Column #

Understanding latitude and longitude

Latitude and longitude are the basis of a global grid system that has been used for intercontinental navigation for hundreds of years. For those who never learned, or have forgotten their high school geography, here is a quick review of this system.

Lines of **latitude** run east-west around the world parallel to the equator, and each other (think of “ladder”). Lines of **longitude** cut the equator at right angles and pass through both poles (think of “long”).

There are 90 degrees of latitude from the equator to either pole and there are 180 degrees of longitude from a point in England to the mid-Pacific, going in either direction. Each degree is divided into 60 minutes. A minute of latitude is roughly equal to 1.2 statute miles, or about 2 km. Since all longitudes converge at the poles, no such handy generalization works for minutes of longitude.

Although city and regional road maps usually use their own grid system, many maps identify latitude increments on the east and west map borders and the longitude increments along the north and south borders. If you own or can borrow a hand-held GPS, one trip to your site with that unit will also give you this information. As well, there are many web sites that can convert an address to decimal degrees.

- Landscape.** This information is important because it links each floral-insect interaction to the surrounding environment. Describe your site by checking the boxes that best describe it. For this purpose, large areas of rural, open or abandoned land can be considered as wilderness. An embankment can apply to either a road or a railroad. An industrial site (not always the safest place to observe) or a parking lot would be urban and public, and should be apparent from its Location name.

- Weather.** Describe the weather at the time of observing. This is important information because insects are sensitive to weather, and they may appear only in certain conditions. As well, many insects need direct sunlight to navigate. The easiest source for weather information is your local public weather forecast. But all that is really needed is your general impression of the day relative to what you might expect in that locale during that season.

Flowers visited by insects. In addition to recording the insects that you see, it is important to record the flowers that they visit. This information, plus the time of day, is often a clue to an insect's identity.

Write the names of the flowers that have insect visitors, whether the insects are feeding, landing briefly, or just idle on the flowers. You do not have to name any flowers that have no insect visitors.

Although there are hundreds of wild flowers that could be encountered anywhere in Canada, they are more easily identified than insects. Flowers don't fly away and they are well described in field guide books. As well, common knowledge about flowers is generally much higher than it is for pollinating insects.

You can enter the names of up to fifteen flowers on the Site and Follow-up Forms. The numbering is very important since you will use the numbers to indicate the flowers that each pollinator visited. In rare cases where there are more than fifteen kinds of flowers, simply write the new flower names in the margin, with increasing numbers. If you use a Follow-up Form as a "second page" in your observation session, you can write more flower names on that form, but strike out and replace the numbers so they do not duplicate the numbers on the first page.

- Floral-visiting insects.** If the flowers are in full bloom and weather conditions are good (generally bright sunshine, warm and not too windy, and not in a drought period), you can expect to see plenty of insects. Only those insects that are seen visiting flowers need to be recorded. This program does not expect you to learn to identify every insect. Instead, the goal is to survey the diversity of pollinators at various sites. Recording how many different kinds of bees, or non-bees, that are observed at your sites will document the relative pollinator diversity, even without more precise identification.

The form is titled 'Pollinator Counter Form' and includes the following sections:

- Location:** Fields for Name, Latitude (decimal degrees), and Longitude (decimal degrees).
- Landscape:** Checkboxes for urban, embankment, hedgerow, suburban, vacant, garden, rural, cropland, forest, park, meadow, riverbank, orchard, and public.
- Weather:** Checkboxes for sunny, windy, steady, cold, cloudy, windy in gusts, cool, overcast, light breeze, steady, seasonal, shade (i.e. trees, building), light breeze in gusts, warm, not shaded, calm, and hot.
- Flowers visited by Insects:** A table with 15 numbered rows for recording flower names and insect observations.
- Floral-visiting Insects:** A table with columns for Insect Name and Size, Type (Bee, Fly, Butterfly, Moth, Wasp, Beetle, Other, Don't know), Number Observed, Last Seen (Never, Not this summer, This summer, Past month), and Flowers Visited (Form #, Column #).

Size (mm):	☐ Moth ☐ Bee ☐ Fly ☐ Butterfly ☐ Wasp ☐ Beetle ☐ Other ☐ Don't know	☐ This summer ☐ Past month		
Size (mm):	☐ Bee ☐ Fly ☐ Butterfly ☐ Moth ☐ Wasp ☐ Beetle ☐ Other ☐ Don't know	☐ Never ☐ Not this summer ☐ This summer ☐ Past month		
Size (mm):	☐ Bee ☐ Fly ☐ Butterfly ☐ Moth ☐ Wasp ☐ Beetle ☐ Other ☐ Don't know	☐ Never ☐ Not this summer ☐ This summer ☐ Past month		
Size (mm):	☐ Bee ☐ Fly ☐ Butterfly ☐ Moth ☐ Wasp ☐ Beetle ☐ Other ☐ Don't know	☐ Never ☐ Not this summer ☐ This summer ☐ Past month		

Name — You will encounter many kinds of insects during your observations. Most people do not know the names of all the insects that they see, and even experts cannot identify them all by sight alone. This program has been designed to allow people to name the insects that they recognize, and describe the rest. An accurate description of an insect's features, the date and time, and the flowers that it prefers can often lead

to a good identification later. If you can name an insect with certainty, write its name in the left-most column. Otherwise, make up a descriptive name (e.g. small black bee) and proceed to describe its features using the Pollinator Description Form. If you have already described an insect using this form, write the same name that you gave it earlier, and note the Description Form/Column numbers in the right-most column.

Plain-language descriptive names are most useful for bees and hover (Syrphid) flies, since there are so many species, with several kinds often observable in the same flower patch. Other types of pollinators may be more recognizable from guide books.

Descriptive names made up by observers should infer relative sizes, major colours and hairiness, particularly for bees. Often, two insects are so much alike that you would give them the same descriptive name, although you somehow know they are different. In these cases, differentiate them with numbers. E.g. small black bee 1, small black bee 2.

Type — Check off the insect type from the eight options provided.

Bee: The familiar honeybees, furry bumblebees and leaf-cutter bees are recognizable by their abdominal pollen baskets. Distinguishing other bee families is almost beyond the ability of most non-professional observers. However, you may be able to see the difference between bees by comparison even if you cannot identify them by name. With a little practice, you can learn to tell the difference between bees and wasps.

Wasp: This category includes all social flower-feeding wasps, including hornets and yellow-jackets. If you can recognize the very long-waisted, hunting wasps, put them under "Other".

Fly: The two major fly families are easy to recognize with a little practice.

Beetle: Although there is an incredible number of different beetles, you do not have to identify them by name (unless you know them with reasonable confidence). It is important to distinguish beetles from other kinds of pollinators, but descriptive names (e.g. shiny, long, green beetle) are adequate for this program.

Butterfly / Moth: These are often fairly easy to learn by name, but it is more important to first learn the difference between the two categories.

Other: Use this category for floral-visiting insects that you recognize, but that are not members of the other categories (e.g. sucking bugs found in flowers). Name the insect as accurately as you can.

Unknown: Use this when you are not sure which category an insect belongs in (e.g. small, white butterfly-or-moth). Be as descriptive as possible.

Size: Size is a simple feature to measure, and a crucial way to distinguish insects that have similar colours and appearances. Occasionally an insect will be so engrossed in foraging that it can be measured directly. Give the length from head to tip of abdomen (not including the antenna) in millimeters (mm). It can be hard, however, to directly measure the size of insects that are constantly on the move. Some insects (bees and flies) are often impossible to measure directly.

TIP – Instead of measuring the insect itself, visualize in your mind the length of the portion of leaf or flower that the insect covers while sitting still. Then, hold your ruler against that space immediately after the insect has moved.

With practice, you will often succeed in gauging the length without a ruler. This is achieved by familiarity with a set of benchmark pollinators: insects that are seen frequently, usually well-known and easily recognized. However, many of these can vary in length, such as bumblebees. This approach is often as simple as “smaller than a honeybee, bigger than a house fly” — so while it is quicker than the clear ruler, it is also much less precise and requires considerable practice.

Number Observed: When you notice an insect foraging at a flower, look for others of the same kind. Estimate the number of those insects in the flower patch. Count quickly several times if there are a lot. Most flying insects will come and go, so if you try to count for too long you will get duplicate counts. Counts are approximate, so we only expect your best estimate when the number is high.

For example – There will frequently be more social insects, such as honeybees or yellow jackets, than you can count, whereas half a dozen syrphid flies is more typical and you may only see one of a particular solitary bee.

Flowers Visited: Enter the numbers corresponding to the flowers where each insect is observed. Insects might visit more than one type of flower, and each type of flower might be visited by more than one kind of insect.

Description Form/Column: If you have filled in a Pollinator Description Form for an insect, refer to the corresponding Form and Column numbers here. This helps reviewers to connect your observations with a possible identification of the insect.

Need more room? If you need more room for plant names or insects, use a Pollinator Follow-up Form as a “second page”. Use the same Site number and Visit number (i.e. Visit #1). If you use this second page to list more plants, strike out and replace the numbers so that they do not duplicate the numbers on the first page.

Return visits. When you return to the same site for a repeat observation, use the Pollinator Follow-up Form. It allows you to record insect observations without describing the site again.

pollinator follow-up form

The Pollinator Follow-up Form is similar to the Site form, but it only asks you to describe the weather conditions and to list plants and insects. It is used for two purposes:

- ❁ Repeat observations at a site where you have already filled in a Site Form.
- ❁ Extra pages, if you need more room for plant names or insects.

Repeat Observations. When you return to a site for your second observation session, use a Follow-up Form with the same Site number that you used earlier, and Visit number 2. Enter your Name and the Location Name the same as you did on the Site Form.

Fill in the Flowers section again. Do not re-use the numbers from the previous observation session. There may be new seasonal flowers in the area, and others may have faded and disappeared.

Extra Pages. If you need more space for plant names or insects during an observation session, use a Follow-up Form as a “second page”. Enter the

same Site number and Visit number as the first page. If you enter more flower names on this page, strike out and replace the numbers so that they do not duplicate the numbers on the first page.

You do not have to fill in the Weather section, since it has already been recorded on the first page.

pollinator description form



The Description Form is optional and is only recommended when you are not confident in your insect identification. It is meant to help you, not force you to fill out extra forms. It is essentially a checklist which prompts you to observe and record all the features by which you can distinguish, if not identify, the insect later on. The descriptions on this form will also allow comparison with other observers' records and help an expert to identify your insect. While it can be used simply as an observing guide, filling one out occasionally is great practice.

Describing an insect. Complete one column of this form for each insect that you think needs description. Usually this will be a pollinating insect seen for the first time, but it may also be one that you have seen before.

Note as many details as you can see. Some questions apply only to certain insects, as this sheet is aimed at all four pollinating insect orders. If the answer doesn't come immediately, move on

to other features. Don't guess if you can't see the feature. An insect will often leave temporarily, before coming back to resume feeding, allowing more details to be noted. For each feature, select a number from the "Choose from" line.

Cross-referencing to the Site and Follow-up Forms. Enter your name as it appears on the Site or Follow-up Form. Also, at the top of each column enter the Site and Visit numbers of the session in which the insect was described.

Return to the Site or Follow-up Form where you record the insect, and enter the Description Form and Column number in the Insect section.

Descriptive features. Three groups of features are used to describe an insect.

Flight pattern and wing configuration are key features separating the insect orders.

- ✿ Between flies and bees, it is usually hard to tell if one or two pairs of wings are present, even when the insect is at rest. So in spite of being a major anatomical difference, it is not a useful feature out in the field.
- ✿ Butterfly and moth wings are easily differentiated.
- ✿ Beetle wings easily separate them from the other three pollinator orders, but they can be confused with sucking bugs if their wing covers (elytra) are not examined carefully. The forewings of the latter generally appear to cross, whereas beetle wing covers always meet in a straight margin down the centre.

Colour patterns are easy to see and remember, but it often takes discipline to recall what body part accounted for each flash of colour that your eyes registered. The eight lines of body parts and twelve colour codes prompt you to objectively observe different colours as the best means of differentiating insects within the six pollinator types.

Often body parts are two-coloured, such as bands of yellow or white on a dark abdomen for bees or black patches on orange or red elytra of beetles. To record this, write the two colours in that space with the dominant colour first. Do not record more than three.

Morphological features reflect very basic insect anatomy. Relative sizes (one body part to another) are both easy to assess and valuable.

On the head, the eyes and antennae provide key clues to distinguish among insect orders and also often indicate the gender (larger for males). The thickness of the neck and waist that separate the three body segments are also important clues. The relative antennae length, tip of the abdomen and hairiness are effective in differentiating insects within the pollinator types.

the observing experience

You are likely to see many kinds of insects around flower patches. While some are not interested in flowers, do not be surprised at any insect you find foraging for pollen or nectar. Flowers host many part-time or secondary floral feeders, plus the occasional predator, such as ambush bugs or crab spiders.

Unless the insect is either on a flower, or you have seen it on this or another flower previously, do not bother to record it (unless you are sure it is a bee).

Is there any pollen sticking to the insect? You will get a good indication of whether it is pollinating effectively, or just foraging, if you can see pollen on its body (particularly when not in the pollen basket).

Don't forget to consult the Description sheet as a guide, even when not filling one out.

How long to observe. There is no strict time limit on how long you observe, but time spent observing is asked for on the Site and Follow-up Forms. Even doing insect counts does not justify setting a fixed time period. You should know after about ten minutes if it is worthwhile waiting for any new foragers to show up and will develop a sense of the density of pollinators, since new ones arrive as others leave.

Filling in the Pollinator Description Form will lengthen the session because of the time needed to go through the checklist of body features, and it may take more than one try or insect to observe all of these features. Your chances of seeing pollinators are better the longer you spend watching. You will likely want to spend more time if your site has a large area of flowers.

Pollinator identification. For those who need to be able to put names to everything they see, and are frustrated with the dilemma described above for bees, the situation is not hopeless. A digital photo album has been assembled for representative members of the principal bee genera from southern Ontario and can be found at www.pollinationcanada.ca. It also illustrates the major families in the other orders. Any participating observer could scan through this album as they are reviewing a Pollinator Description Form to confirm an assigned name. A descriptive set of text accompanies each insect shown in the digital photo album.

Recording by camera. The final advice in this Manual is devoted to the role of the digital camera in monitoring pollinators. So far this new technology has not raised the ability to observe the pollinator community as much as one might expect. The camera is not a substitute for careful, systematic observing and recording for several reasons. First is that a steady inflow of images from a large network of observers could not be dealt with logistically or objectively, or summarized into meaningful results. The second problem is that actually taking quality images is very difficult. Only a high resolution camera with a close focusing lens is suitable. The challenge is to get very close to a very small target that spooks easily and typically alights for very short time intervals. It also moves much faster relative to the short focal length required than any other form of wildlife. The human eye, on the other hand, is much faster than the finger camera shutter sequence. There is also a bias because many of the most important pollinators are the most difficult to photograph. As well, time spent getting one perfect shot of one insect is taken away from the real task of observing, counting and recording the other members of the pollinating community.

What the digital camera offers is the ability to take a lot of images that don't need development. Because they can be seen right away, these images can enhance the observing process by allowing some observed features to be checked right after an observing session. So if you are thinking of a camera, treat it as a tool that will occasionally enhance your own observing skills, not as an end product. If you are genuinely interested in insect photography, and have invested in a high quality camera, then make your camera sessions separate from your observing and recording sessions.

conclusions



Over \$1.2 billion of Canadian horticultural produce depends upon insects for pollination. Without insect helpers, we would have no apples, pears, cucumbers or melons. Sunflower and safflower would be impossible to grow, and strawberries would be extremely expensive.

There are over a thousand species of pollinating insects in Canada, but of these only five are used domestically (honeybees, mason bees, certain bumblebees and two kinds of flies for greenhouse pollination). The others are essential to gardeners and farmers too, but little is known about their populations and their habits.

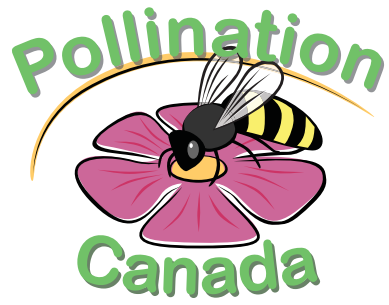
Sadly, domesticated honeybees are suffering severely from an epidemic of parasitic mites that threaten not only the honey industry, but also the fruit and vegetable produce that depends on this very important pollinator. Pollination has always been taken for granted, but it is a resource that may need to be managed in the future. We need to understand these important insects better!

Wild pollinators are “keystone species”, meaning that most other species in their ecosystems depend on them, either directly or indirectly. Plants depend on pollinators to help them make seeds for their reproduction, and birds and other animals depend on those seeds for food too. Without wild insects pollinating flowers, the whole food chain suffers.

By taking on the pollinator protection challenge, you have chosen to be part of a proactive network of people conserving pollinating insects. We hope you find this experience rewarding.

Thank you for helping to ensure the future of our planet.





Observation Forms

Photo-copy or print
the following pages
as you need them



Pollinator Site Form

Site #		Visit #	1			
Date		Start time	☐ am ☐ pm	Time spent observing		minutes

Name				Email			
Street Address							
City/Town			Province			Postal Code	

Location (give location a name and coordinates; if address is same as above, leave address section here blank)

Location Name			Distance from road (approx.)		
Latitude (decimal degrees)			Street Address		
Longitude (decimal degrees)			City/Town		Province

Landscape (check any features that apply to your site)

☐ urban	☐ suburban	☐ rural	☐ park	☐ wilderness
☐ embankment	☐ vacant	☐ cropland	☐ meadow	☐ orchard
☐ hedgerow	☐ garden	☐ forest	☐ riverbank	☐ public

Weather (check one from each section)

Sky	☐ sunny	☐ cloudy	☐ overcast	Shade (i.e. trees, building)	☐ not shaded	☐ shaded
Wind	☐ windy, steady	☐ windy in gusts	☐ light breeze, steady	☐ light breeze in gusts	☐ calm	
Temperature	☐ cold	☐ cool	☐ seasonal	☐ warm	☐ hot	

Flowers visited by Insects (list each kind of flower where insects were visiting and refer to these numbers in the table below)

1.	4.	7.	10.	13.
2.	5.	8.	11.	14.
3.	6.	9.	12.	15.

Floral-visiting Insects (name each kind of insect that you see and the flowers they visit; if you can't specifically identify an insect, fill out the Pollinator Description Form and identify here which Form and Column # you used)

Insect Name and Size	Type	Number Observed	Last Seen	Flowers Visited	Form #	Column #
Size (mm):	☐ Bee		☐ Never ☐ Not this summer ☐ This summer ☐ Past month			
	☐ Fly					
	☐ Butterfly					
	☐ Moth					
Size (mm):	☐ Wasp		☐ Never ☐ Not this summer ☐ This summer ☐ Past month			
	☐ Beetle					
	☐ Other					
	☐ Don't know					
Size (mm):	☐ Bee		☐ Never ☐ Not this summer ☐ This summer ☐ Past month			
	☐ Fly					
	☐ Butterfly					
	☐ Moth					
Size (mm):	☐ Wasp		☐ Never ☐ Not this summer ☐ This summer ☐ Past month			
	☐ Beetle					
	☐ Other					
	☐ Don't know					
Size (mm):	☐ Bee		☐ Never ☐ Not this summer ☐ This summer ☐ Past month			
	☐ Fly					
	☐ Butterfly					
	☐ Moth					



Pollinator Follow-up Form

Site #

Visit #

Use this form: (a) if you don't have enough room on the Pollinator Site Form for your plants or insects; or (b) for a follow-up visit to the site.

Date				Start time		☐ am ☐ pm	Time spent observing		minutes
	d d	m m	y y y y						

Name		Location Name	
------	--	---------------	--

Weather (check one from each section)

Sky	☐ sunny	☐ cloudy	☐ overcast	Shade (i.e. trees, building)	☐ not shaded	☐ shaded
Wind	☐ windy, steady	☐ windy in gusts	☐ light breeze, steady	☐ light breeze in gusts	☐ calm	
Temperature	☐ cold	☐ cool	☐ seasonal	☐ warm	☐ hot	

Flowers visited by Insects (list each kind of flower where insects were visiting and refer to these numbers in the table below)

1.	4.	7.	10.	13.
2.	5.	8.	11.	14.
3.	6.	9.	12.	15.

Floral-visiting Insects (name each kind of insect that you see and the flowers they visit; if you can't specifically identify an insect, fill out the Pollinator Description Form and identify here which Form and Column # you used)

Insect Name and Size	Type	Number Observed	Last Seen	Flowers Visited	Form #	Column #
Size (mm):	☐ Bee		☐ Never			
	☐ Fly		☐ Not this summer			
	☐ Butterfly		☐ This summer			
	☐ Moth		☐ Past month			
	☐ Wasp					
Size (mm):	☐ Bee		☐ Never			
	☐ Fly		☐ Not this summer			
	☐ Butterfly		☐ This summer			
	☐ Moth		☐ Past month			
	☐ Wasp					
Size (mm):	☐ Bee		☐ Never			
	☐ Fly		☐ Not this summer			
	☐ Butterfly		☐ This summer			
	☐ Moth		☐ Past month			
	☐ Wasp					
Size (mm):	☐ Bee		☐ Never			
	☐ Fly		☐ Not this summer			
	☐ Butterfly		☐ This summer			
	☐ Moth		☐ Past month			
	☐ Wasp					
Size (mm):	☐ Bee		☐ Never			
	☐ Fly		☐ Not this summer			
	☐ Butterfly		☐ This summer			
	☐ Moth		☐ Past month			
	☐ Wasp					
Size (mm):	☐ Bee		☐ Never			
	☐ Fly		☐ Not this summer			
	☐ Butterfly		☐ This summer			
	☐ Moth		☐ Past month			
	☐ Wasp					
Size (mm):	☐ Bee		☐ Never			
	☐ Fly		☐ Not this summer			
	☐ Butterfly		☐ This summer			
	☐ Moth		☐ Past month			
	☐ Wasp					



Pollinator Description Form

Fill out one insect per column.

d d	m m	y y y

Form #	
--------	--

Column #	1	2	3	4	5	6	7	8
Site #								
Visit #								

Flying Characteristics

Flight Pattern								
Choose from: 1 <i>hovering and darting</i> 2 <i>side motion never still</i> 3 <i>clumsy</i> 4 <i>fluttery</i> 5 <i>too fast to see</i>								
Wing Beats								
Choose from: 1 <i>too fast to see</i> 2 <i>just slow enough to see</i> 3 <i>easily observed</i> 4 <i>forewings not operating</i>								
Wing Texture at Rest								
Choose from: 1 <i>large scaly</i> 2 <i>hard or leathery</i> 3 <i>membranous</i>								
Wing Shape at Rest								
Choose from: 1 <i>close to body</i> 2 <i>V-shaped</i> 3 <i>roof-like</i> 4 <i>curled</i> 5 <i>folded flat over back</i> 6 <i>vertical</i>								

Colours of Body Parts

Head								
Thorax								
Abdomen								
Eyes								
Antennae								
Legs								
Wings								
Wing Covers								
Choose one or two of: 1 <i>black</i> 2 <i>brown</i> 3 <i>orange</i> 4 <i>gold</i> 5 <i>red</i> 6 <i>yellow</i> 7 <i>green</i> 8 <i>white</i> 9 <i>blue or violet</i> 10 <i>gray</i> 11 <i>metallic</i> 12 <i>membranous (clear)</i>								

Morphology

Size of eyes								
Choose from: 1 <i>almost meet at centre</i> 2 <i>well separated but large</i> 3 <i>small</i> 4 <i>can't tell</i>								
Abdomen								
Choose from: 1 <i>flat and straight</i> 2 <i>flat and tapered</i> 3 <i>round and tapered</i> 4 <i>cylindrical</i> 5 <i>thin</i>								
Tip of Abdomen								
Choose from: 1 <i>rounded</i> 2 <i>flattened</i> 3 <i>pointed</i> 4 <i>long needle-like point</i> 5 <i>can't tell</i>								
Antennae Type								
Choose from: 1 <i>single strand</i> 2 <i>branched or feathered</i> 3 <i>can't tell</i>								
Antennae Length								
Choose from: 1 <i>very short</i> 2 <i>can reach thorax</i> 3 <i>can reach abdomen</i> 4 <i>as long as body</i> 5 <i>can't see</i>								
Head-Thorax (neck)								
Choose from: 1 <i>not visible</i> 2 <i>very thin, head can turn</i> 3 <i>long but thick</i>								
Thorax-Abdomen (waist)								
Choose from: 1 <i>long and thin</i> 2 <i>thin but short</i> 3 <i>constricted but not thin</i> 4 <i>no waist apparent</i>								
Mouth Parts								
Choose from: 1 <i>sucking</i> 2 <i>biting</i> 3 <i>distinct snout</i> 4 <i>can't tell</i>								
Legs								
Choose from: 1 <i>short thin</i> 2 <i>short thick</i> 3 <i>long thin</i> 4 <i>long thick</i>								
Body Shape								
Choose from: 1 <i>slender</i> 2 <i>thick</i> 3 <i>flat wide</i>								
Hairiness								
Choose from: 1 <i>none</i> 2 <i>moderate on part of body or legs</i> 3 <i>all over body</i> 4 <i>thick, conceals body shape</i>								
Pollen								
Visible on: 1 <i>head</i> 2 <i>thorax</i> 3 <i>abdomen</i> 4 <i>legs</i> 5 <i>body</i> 6 <i>body and legs</i> 7 <i>none</i> 8 <i>can't tell</i>								
Body Length (mm)								

resources



Many of you will wish to explore in more detail and depth the amazing world of pollinators. We've come up with a list of resources you might want to check out. Of course, there's lots more out there, so we encourage you to go to your local library for more information.

If there are "essentials" that you know about and are not found on this list, please contact us. Our coordinates may be found on our website at www.pollinationcanada.ca.

Books

Field Guides and Keys

Note: Regional field guides for insects and plants are a must. Unfortunately, we can't list all publications for all of North America. For field guides region-specific information, contact your local library, bookstore, garden store, natural history museum, or wildflower or native plant society.

- ❁ Peterson, R.T., White, R.E., Leahy, C.W., and Borror, D.J. 1987. ***Peterson First Guides. Insects.*** Houghton Mifflin, Boston, MA

Description: Peterson First Guides are the first books the beginning naturalist needs. Condensed versions of the famous Peterson Field Guides, the First Guides focus on the animals, plants, and other natural things you are most likely to see. They make it fun to get into the field and easy to progress to the full-fledged Peterson Guides.

- ❁ Borror, D.J., and R.E. White. 1998. ***A Field Guide to Insects.*** America North of Mexico. Houghton Mifflin, Boston, MA.

Description: Detailed descriptions of insect orders, families, and many individual species are illustrated with 1,200 drawings and 142 superb color paintings. Illustrations, which use the unique Peterson Identification System to distinguish one insect from another, include size lines to show the actual length of each insect. A helpful glossary explains the technical terms of insect anatomy.

Other Interesting Field Guides and Keys:

- ❁ ***National Audubon Society Field Guide to North American Insects and Spiders*** by National Audubon Society
- ❁ ***National Audubon Society Field Guide to North American Butterflies*** by National Audubon Society



- ❁ *Peterson First Guide to Butterflies and Moths* by Paul A. Opler
- ❁ *The Audubon Society Handbook for Butterfly Watchers* by Robert Pyle
- ❁ *The Butterflies of Canada* by R. A. Layberry, P.W. Hall and J. D. Lafontaine
- ❁ *A Field Guide to the Beetles of North America* by Richard E. White
- ❁ *The Bees of the World* by C. D. Michener
- ❁ *National Audubon Society Field Guide to North American Wildflowers: Eastern Region (Revised Edition)* by National Audubon Society
- ❁ *Wildflowers (Peterson Field Guides Color-In Books)* by Frances Tenenbaum (Author), Virginia Savage (Illustrator), Roger Tory Peterson (Series Editor)
- ❁ *A Field Guide to Wildflowers: Northeastern and North-Central North America (Peterson Field Guides)* (Paperback) by Margaret McKenny (Author), Roger Tory Peterson (Series Editor)

Literature on Pollinators, Pollination, and Conservation

For a more detailed list, go to www.xerces.org

- ❁ Buchmann, S. L., and G. P. Nabhan. 1997. *The Forgotten Pollinators*. Island Press, Washington, D.C. (An excellent introduction to all aspects of pollinators and pollination. A most highly recommended book and a call-to-arms for pollinator conservation and habitat restoration.)
- ❁ Ellis, B. W., F. M. Bradley, H. Atthowe, and R. Yepsen. 1996. *The Organic Gardeners Handbook of Natural Insect and Disease Control*. Rodale Press, Inc., Emmaus, PA. (Provides basic information, with entries on more than two hundred plants and their cultivation, soil preparation methods, pests, garden plans, etc.)
- ❁ Emmel, T. C. 1997. *Butterfly Gardening: Creating a Butterfly Haven in Your Garden*. Friedman/Fairfax Publishers, New York, NY. (A great introduction to butterfly gardening; full of practical advice.)
- ❁ O'Toole, C., and A. Raw. 1999. *Bees of the World*. Blandford, London, U.K. (A comprehensive introduction to bee biology, behaviors, and lifecycles. If you are going to buy one book on bees, this is the one.)
- ❁ Procter, M., P. Yeo, and A. Lack. 1996. *The Natural History of Pollination*. Timber Press, Portland, OR. (Probably the best single volume on pollination and plant/pollinator relationships.)
- ❁ Shepherd, M., S. L. Buchmann, M. Vaughan, and S. H. Black. 2003. *Pollinator Conservation Handbook. A Guide to Understanding, Protecting, and Providing Habitat for Native Pollinator Insects*. Xerces Society, Portland, OR. (A comprehensive guide to pollinator insects, their natural history, and what can be done to conserve them. The most complete single volume on pollinator conservation.)



Websites

On Pollination:

- ✿ <http://en.wikipedia.org/wiki/Pollination>

On Insects:

- ✿ <http://www.insectclopedia.com/>
- ✿ www.cbif.gc.ca/spp_pages/butterflies/index_e.php
- ✿ Identification: www.einsteins-emporium.com/life/animal-info/insects/insect_identification.htm
- ✿ Threats to insects: http://www.ec.gc.ca/EnviroZine/english/issues/33/feature3_e.cfm and <http://www.fao.org/AG/magazine/0512sp1.htm>
- ✿ Threats to honeybees: http://www.cbc.ca/news/story/2003/05/02/bees_mites030502.html

On the status of pollinators in North America:

- ✿ <http://www.nap.edu/catalog/11761.html>

Conservation Initiatives for Pollinators:

- ✿ Pollination Canada: www.pollinationcanada.ca
- ✿ North American Pollinator Protection Campaign: www.nappc.org
- ✿ Join the North American Pollinator Protection Campaign ListServ: <http://lists.sonic.net/mailman/listinfo/pollinator>
- ✿ The Pollination Partnership: www.pollinator.org
- ✿ The Xerces Society (check out their Red List of Pollinators at Risk): www.xerces.org
- ✿ International Initiative for the Conservation and Sustainable Use of Pollinators (CBD): <http://www.biodiv.org/programmes/areas/agro/pollinators.asp>
- ✿ International Network of Expertise for Sustainable Pollination: <http://www.uoguelph.ca/~inesp/>

On Creating Habitat to Attract Pollinators

- ✿ Evergreen: <http://www.evergreen.ca/en/hg/hg-started2.pdf>
- ✿ Kidsgardening.com: <http://www.kidsgardening.com/growingideas/projects/jan03/pg1.html>
- ✿ The Xerces Society: http://www.xerces.org/Pollinator_Insect_Conservation/butterflygarden.pdf
- ✿ Canadian Wildlife Federation's Backyard Habitat Program: http://www.cwf-fcf.org/pages/wildprograms/wildprogramsbackyard_e.asp?section=6&page=122&language=e
- ✿ Canadian Wildlife Federation's Wild About Gardening Program: <http://www.wildaboutgardening.org/>





Published by:
Seeds of Diversity Canada
P.O. Box 36, Stn Q, Toronto ON M4T 2L7
1-866-509-SEED
www.seeds.ca

Photos © Jim Dyer, 2006

Pollination Canada logo design:
Catherine Welsh

Publication design:
Stephanie Pelot (www.pentafolio.com)