Integrated Pest Management is an environmentally friendly and less expensive way of managing the pests in the urban yard. It is made up of four key strategies:

**Cultural Control**
This is all about prevention, and is a key feature of IPM. It includes:
- Cleaning up debris where pests can hide
- Cleaning up dead plants in the garden so pests cannot survive the winter there
- Using plants that are resistant to pest damage or plants that can tolerate damage
- Rotating the plants in the garden from year to year so that disease doesn’t build up in that spot
- Putting plants where they will be healthier or are less attractive to pests

**Physical Control**
- Removing insects by hand, such as plucking bagworms off the shrubs
- Cutting off infected portions of the plant, such as pruning tree branches that covered with Fall Webworm caterpillars
- Crushing insects, such as insect eggs
- Trapping to remove insects

**Chemical Control**
This should be the last thing you think of, not the first, when you want to control pests in the yard.
- Use chemicals sparingly
- Use chemicals only when needed
- Use chemicals only where needed
- Use chemicals that are easier on the environment such as:
  - Bt (Bacillus thuringiensis)
  - Horticultural oils
  - Horticultural soaps
  - Insect growth regulators (IGR)

**Biological Control**
In undisturbed land, such as native prairie and forests, insects and plants live in harmony, with the numbers of insects that feed on plants kept in check by a variety of predators, diseases, and parasites. To some extent, this natural cycle can occur in homeowners’ yards.
Biological Control
Use of natural enemies to help manage pests below economic levels

**The 3 P’s—Predators, Parasites, Pathogens**

**Predators**

The helpers you will see most often in the yard are the predators. They are usually larger than the insects they eat. They eat a lot of insects and they are usually fast moving. They are generalists as a rule, so they will eat pests, non-pest insects, and even each other at times.

Lady Beetles—the adult beetles are usually orange or pink with or without black spots, though they can also be solid black. Lady beetles are voracious eaters, and eat lots of aphids. They will also eat insect eggs and young caterpillars.
Lady beetles hibernate (diapause) as adult beetles over the winter in sheltered places. Lady beetles, like all insects, are cold blooded. The female lady beetle lays her eggs near aphids. A lady beetle will let out a foul-smelling yellowish liquid when it is frightened. This will repel any would-be predators. Lady beetles can fly about 15 miles per hour.

**This is called the mealybug destroyer, but it is just another kind of lady beetle.**

Unfortunately, not every member of the Family Coccinellidae is beneficial. There are two species in the Ladybeetle family that are pests.

**Mexican Bean Beetle**

**Squash Beetle**

Leaf damage on beans caused by the Mexican Bean Beetle

**Lacewings**—Lacewings are in the order Neuroptera, meaning “nerved wings”. Their larvae are so predaceous, they are called aphidlions.
- The lacewings larva’s jaws are hollow. It pierces the aphid, holds it up, and drains out the juices, leaving behind the empty skin.
- Lacewing larvae do not poop! Their diet is aphid juice, so there’s little solid material. Instead, when they molt for the final time into a pupa, the larval skin contains all the frass.
- Most lacewings are predators.
- The most common lacewing is green but there is also another family that is brown.

**Praying Mantis**
- Praying mantids are generalists predators.
- There is no pupal stage.
- Mantids can look over their shoulder.

**Egg Case**
**Nymph**
**Adult**

**Syrphid Fly**—also called hover fly or flower fly.

The syrphid larva (the proper term for a fly larva is maggot) feeds on aphids and other small, soft-bodied insects.

**Spiders**
- Spins a web
- Actively hunts
- Lies in wait

**Black widow**
**Brown Recluse (Fiddle-back)**
Ground Beetles - Ground beetles are fast-moving generalist predators. They will eat anything they find on the ground, such as caterpillars or leaf-feeding beetles that get knocked off the plant.

Even the larvae are predaceous

Wasps - Wasps are efficient generalist predators. Paper wasps, mud daubers, hornets, yellowjackets, cicada killers all prey on insects.

Other Predators

Spiny soldier bug

Minute pirate bug

Daddy longlegs

Predaceous mite
Parasite vs. Parasitoid

Both parasite and parasitoid are smaller than their host. Both have a part of their life stage that feeds an organism of a different species. A successful parasite does not kill its host. It needs its host to help it move around to infect others. A parasitoid is a parasite of a host, but when the parasitoid emerges, it kills its host.

Parasitoids—There are more helpers that you are less likely to see because they are so tiny. These creatures include some flies and tiny wasps.
- They are much smaller than the insects they eat
- They usually only consume one host
- They are often very picky about what insects they eat, and usually are species specific
- These tiny wasps do not sting people
- The female wasp or fly will lay her eggs inside or on top a host insect, usually in the egg, larva, or pupa
- The young wasp or fly will burrow inside the “host” and eat it from the inside out. When the wasp/fly is ready to pupate, the host will be killed.
- There are many successful parasitic wasps. This wasp lays its eggs in aphids. The parasitized aphid becomes swollen, brown and dry and is referred to as a mummy.

Not all parasitoids are wasps. Tachinid flies are also excellent biological control agents for a number of pest insects.
Pathogens—Finally there are diseases that insects can get, referred to a pathogens. Here a few examples:

These Caterpillars were killed by a virus

Nematodes

- Nematodes are tiny worms (roundworms)
- Nematodes can be free-living, but many are parasitic
- Some species of nematodes are important plant pests (e.g., pine wilt nematode, soybean cyst nematode)
- Entomopathogenic nematodes are used as biological control agents of insect pests

- Two key biocontrol nematodes are:
  - Steinernema—The Ambusher
  - Heterorhabditis—The Hunter

- Nematodes are most effective against soil-dwelling insects
- Nematodes must be applied in large numbers and kept moist
- Nematodes are fairly species-specific

Nematodes spilling out of a beet armyworm pupa

Nematodes in a maggot

What you can do to help

- Remember that the insect predators and parasites are just as susceptible to insecticides as are the insect pests. So only use chemical insecticide when absolutely necessary, and apply it only where it is needed. Also, try to apply the chemical in the early morning or at dusk, when predators and parasites are not as active.
- Rely on IPM techniques; most of these do not harm the natural enemies of the insect pests.
- Encourage parasites by providing flowers that produce nectar; while the larvae feed inside other insects, the adults drink nectar from flowers.
- Predators and parasites can be purchased from biological control companies and released in your yard.

This aphid was killed by a fungus. In fact, when it’s warm and humid in the spring, many aphids (and other insects) are killed by fungi