

## Some Beneficial Insect Release Instructions

### **Ladybugs**

Keep the ladybugs refrigerated or store in a cool place until you are ready to release. This will calm them down from being shipped or they make fly to a neighbors garden. The best time to release them is in the early evening. They will most likely stay in the general area of where you placed them and find food and water. They will be thirsty from their package and shipment journey so sprinkle or mist the area before you release them. Beyond their release, they will get all their moisture needs from the harmful pests they eat like aphids.

### **Praying Mantis**

AKA – Praying Mantis. Average release rate of 3 cases per 5,000 square feet or 10-100 cases per acre. Attach the cases on twigs, leaves, fences, or the crotch of a bush or tree. Do not place on the ground because ants can get to them. Begin outdoor releases after last chance of frost and they should be hatched before August for best results. Praying mantis eat garden pests as well as beneficial insects but do not eat ladybugs because they are bitter. (Either somebody snacked on one or they asked the praying mantis ??? ☺)

### **Application for the 10 Mil. garden size Nematodes**

The 10 Mil. nematodes are placed in a sponge. Place the entire sponge in a gallon of water, squeeze for a few minutes to get the nematodes out of the sponge and into the water. Discard the sponge and pour the gallon of water into the sprayer or water can and apply to the soil.

### **Beneficial Nematodes**

#### **Quick Facts...**

- Insect parasitic beneficial nematodes are small round worms that kill insects but are harmless to other organisms.
- Several species of these nematodes are developed as biological insect controls.
- Among the pests effectively controlled are most turf insects and several other insects that live in soil.

The beneficial nematodes are small, round worms that complete part of their life cycle in insects. Several species can kill insects in this process, and some are marketed as a biological control agent.

The use of insect parasitic nematodes to control soil insects, including many turf grass and Garden pests, has received increased attention in recent years. Insect parasitic nematodes are also known as predator nematodes, beneficial nematodes or entomogenous nematodes. Insect parasitic nematodes have been studied for potential biological control of turf pests for more than 50 years. However, their increasing availability and rising public demand for alternatives to insecticides has heightened interest in beneficial nematodes. Two types of beneficial nematodes have been most actively considered for control of insect pests. Steinernema has been thoroughly researched, including control studies for Japanese beetle conducted in the 1930s. Recent attention has shifted to include the genus Heterorhabditis. Both groups are in the order Rhabdita, the bacteria-feeding nematodes. It includes a large number of common but frequently overlooked soil-infesting nematodes that assist in organic matter breakdown.

### **Life Cycle of Beneficial Nematodes**

Beneficial nematodes are mobile and move short distances in search of host insects. Heterorhabditis is more mobile than Steinernema. Nematodes use carbon dioxide and perhaps other chemicals produced in waste products of insects as cues to find their hosts. Upon entering the insect the nematodes kill their host by releasing bacteria into it, strains of Xenorhabdus species that are associated with the nematode. The bacteria develop within the body cavity of the susceptible host. The host dies from blood poisoning within a few days.

The dead insect generally maintains its original shape and does not decay in a normal manner because its body is filled with these specialized bacteria. Associated color changes may occur. For example caterpillars and grubs parasitized by Heterorhabditis may have a reddish-brown color. The nematodes develop by feeding upon the bacteria and degraded host tissues.

The active stage of the nematode that invades an insect is the juvenile (dauerlarva) stage. These infective juveniles are applied for insect control. Steinernema nematodes enter the insect through natural openings, such as the mouth, spiracles and , then penetrate into the body cavity. Heterorhabditis nematodes use natural openings but also can enter by piercing the body wall.

Once inside the infected insect, nematodes develop rapidly, in five or more days, depending on host quality and temperature. Normally, one to two generations occur in a host insect. Thousands of nematodes can be produced following a single infection. Ultimately, the body wall of the dead host insect ruptures and releases the nematodes. The beneficial nematodes typically kill their host insect within two to three days after invading the body cavity.

## Red Wiggler Worms

The most common type of composting worm is the Red Wiggler Worm. As they feed, they digest great quantities of organic matter and release a residue called a worm casting that is very rich in nitrogen, phosphorous, potassium, and micronutrients. They can be stored in the refrigerator in a cloth bag (not in a plastic bag or container.) Do not freeze the little guys. Lightly water the area before you release them and scatter them around the area. Release them early in the morning or after sunset. Do not release in direct sunlight.

**Spider mite larvae**, nymphs and adults feed on the underside of the leaves and cause yellow spots, later even yellow leaves. Plant cells turn yellow, which can be seen on the upper surface of the leaf as small yellow spots. This reduces the photosynthetic area of the leaf and the plant gets out of the physiological balance. This results in decreased plant growth and production. Finally the crop may die from the infestation. Nymphs and adults produce webbing that can cause cosmetic damage to the crop. If large numbers of spider mites are present, plants may be completely covered with webs.

### Release rates:

- For tomatoes and cucumbers, 1 predator per plant plus 1-2 per infested leaf.
- For other greenhouse crops, tropical plants, and outdoor gardens, 2,000 per 3,000 sq. ft.
- For bedding plants, 1,000 per 10,000 sq. ft.
- For large agri-business, 5,000 - 20,000 per acre depending on infestation.

**Predatory mite, Galendromus occidentalis**, is a very versatile mite predator and tolerates high temperatures low and high humidity (40-85%) well, both indoors and out. Does best in warm weather (80° to 110° F). Tolerates low humidity of inland valleys. Does not do well in cool coastal areas. Goes into diapause (hibernation) in colder temperatures.

Recommended for greenhouses only if plants are maintained as low as 40% relative humidity. It is native to California and has been researched for spider mite control in almonds, grapes, and many other ornamentals and plants. This predator is well adapted for outdoor use and can perform in hot situations where humidity remains above 40%. Use *G. occidentalis* to control spider mites, two spotted mites, Russet mites, and others on gardens, greenhouses, and orchards of all types. Adults eat 1-3 pest adults or up to 6 pest eggs/day. Release rates indoors, 2-3/sq. ft. bi-weekly, 1-2 applications; outdoors, 5,000-20,000/acre, bi-weekly, 1-2 applications.

**Spider mite larvae**, nymphs and adults feed on the underside of the leaves and cause yellow spots, later even yellow leaves. Plant cells turn yellow, which can be seen on the upper surface of the leaf as small yellow spots. This reduces the photosynthetic area of the leaf and the plant gets out of the physiological balance. This results in decreased plant growth and production. Finally the crop may die from the infestation. Nymphs and adults produce webbing that can cause cosmetic damage to the crop. If large numbers of spider mites are present, plants may be completely covered with webs.

### Release rates:

- For tomatoes and cucumbers, 1 predator per plant plus 1-2 per infested leaf.
- For other greenhouse crops, tropical plants, and outdoor gardens, 2,000 per 3,000 sq. ft.
- For bedding plants, 1,000 per 10,000 sq. ft.
- For large agri-business, 5,000 - 20,000 per acre depending on infestation.

**Predatory mite, Neoseiulus californicus** predatory mites consume their prey at a more leisurely pace than do their friends *Mesoseiulus longipes* and *Phytoseiulus persimilis*, one adult or a few eggs per day, they can survive longer under starvation conditions and can also live on a diet of pollen. In plants where it is very hard to detect the first spider mites, *Californicus* may be introduced preventatively. Completes a generation in one to two weeks depending on temperature (12 days at 64° F, 4 days at 90° F). The female lays about 3 eggs per day for two weeks and lives about 20 days. At 77° F the female can consume 5.3 spidermite eggs per day. Does best in warm humid conditions, but will also tolerate low humidity (40% - 80% RH at 50° - 105°F). Occurs along coast and inland valleys of California. PESTICIDES: Susceptible to pesticides. Avoid using any pesticide one week prior or one week after releasing predators. STORAGE: Highly perishable, should be used immediately upon delivery. If storage is absolutely necessary, refrigerate at 40°-50° F. (6°-10° C). Not to exceed 3 days, to minimize mortality. They are not cannibalistic and survive shipping very well. Release 1 - 4 per plant or 1 - 2 per square foot in greenhouses at the first sign of spidermites. Use 10,000 per acre in field. Later releases will require much higher numbers to be effective. Releases of *californicus* can be made when Spider mites are present and laying eggs. even if no spider mites have been found yet. *N. californicus* need a minimum of 40% humidity and ideal temperatures 60-90 degrees F. Can tolerate temperatures up to 105 degrees F. Works great in gardens and greenhouses.