GROWERTALKS

Pest Management

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Azadirachtin & Neem Oil

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The term “neem” is sometimes used to refer to azadirachtin and neem oil. However, this isn’t the correct use of the term. Neem is derived from the neem tree, *Azadirachta indica*, but it isn’t a single substance. The seed kernels contain the highest concentrations of active compounds.

Seeds are soaked in water and alcohol to extract any pesticidal constituents. After removal of the natural neem oil from the seeds, the subsequent neem oil is treated with alcohol, causing the azadirachtin and related substances to separate from the neem oil. The remaining oil, without the azadiracthin, is called clarified hydrophobic extract of neem oil. Therefore, the two main active ingredients derived from the neem tree seeds are: azadirachtin and clarified hydrophobic extract of neem oil (also referred to as “neem oil”).

Azadirachtin and clarified hydrophobic extract of neem oil have short residual activity, due to their susceptibility to ultra-violet light (sunlight) degradation. Therefore, repeat applications are usually required. Both compounds have low toxicity to humans and mammals with an LD50 >5,000 mg/kg. Below are descriptions of azadirachtin and clarified hydrophobic extract of neem oil.

Azadirachtin

Azadirachtin isn’t a single substance, but has a very complex structure being a mixture of related substances extracted from the neem seed kernels. The seeds are the only source of azadirachtin.

Azadirachtin affects insects in many different ways, including acting as an insect growth regulator, repellent, anti-feedent, sterilant and/or oviposition inhibitor. Azadirachtin, as an insect growth regulator, is an antagonist (a substance that acts against and blocks a physiological action) that inhibits the synthesis or metabolism of the insect molting hormone, ecdysone. Consequently, inhibition of the molting process, and thus metamorphosis, causes insects to die when transitioning into the next life stage or instar (insect stage between molts). Disruption of the insect life cycle prevents the production of future generations.

Azadirachtin is only effective on the immature/young life stages of insects. Moreover, azadirachtin is slower-acting than conventional insecticides, which is primarily due to azadirachtin altering or modifying the behavior of insects. The material works as a stomach poison in which insects must ingest the active ingredient during feeding in order to be negatively affected. Activity is better on chewing than sucking insects, which is why azadirachtin is effective against caterpillars.

Azadirachtin has minimal contact activity and is most effective at warmer temperatures (>70F/21C) with reduced efficacy at lower temperatures. Azadirachtin may have systemic properties with activity against certain insect pests, although this depends on plant type and pH of the growing medium, with less systemic activity at pHs >7.0

(alkaline).

Although azadirachtin may have systemic properties, water solubility is very low (0.05 ppm), which means azadirachtin takes time to be distributed/translocated throughout the plant vascular tissues (e.g., xylem and phloem). Some studies have reported that foliar applications of azadirachtin are effective in suppressing populations of the twospotted spider mite (*Tetranychus urticae*). Most commercially available products are labeled for use against many different insect pests, including aphids, caterpillars, leafminers, mealybugs, scales, thrips and whiteflies. Commercially available products for use in greenhouses include Azatin, Ornazin, AzaGuard, Molt-X, Azatrol and AzaSol.

Clarified hydrophobic extract of neem oil

Clarified hydrophobic extract of neem oil works by suffocating (blocking breathing pores) insect and mite pests. Neem oil is active on a wide-range of soft-bodied insect and mite pests, such as aphids, leafhoppers, whiteflies, spider mites, mealybugs and scales.

Neem oil may kill eggs, immatures (larvae or nymphs) and adults; however, neem oil only has contact activity, so it's important to obtain thorough coverage of all plant parts and make repeat applications based on label recommendations. The commercially available product for use in greenhouses is Triact.

Effects on natural enemies

Azadirachtin and clarified hydrophobic extract of neem oil, in general, are less directly (associated with acute mortality or survival over a specified time period) and indirectly (affiliated with influencing physiology or behavior) harmful to most natural enemies (parasitoids and predators) compared to conventional pesticides. For instance, studies have demonstrated that exposure to azadirachtin didn't affect reproduction of the aphid predator, Aphidoletes aphidimyza; aphid parasitoid, Aphidius colemani; and the predatory mite, Neoseiulus californicus.

In addition, exposure to azadirachtin didn't inhibit prey consumption (fungus gnat larvae) of the rove beetle, Dalotia coriaria. Neem oil has been shown to not be directly harmful to green lacewing, Chrysoperla carnea eggs, larvae and adults. However, studies have reported that azadirachtin may be directly harmful to certain natural enemies. For example, exposure to azadiracthin inhibited egg-laying of green lacewing (C. carnea) females.

Any direct effects of azadirachtin and clarified hydrophobic extract of neem oil on natural enemies will vary depending on life stage (egg, larva, nymph, pupa or adult) exposed, type of natural enemy (parasitoid or predator), application rate used and product formulation. **GT**

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