

What Rose Grower's Should Know About Colony Collapse Disorder

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Editor's Note: In the November issue Kathy Brennan discussed how to "Bring The Buzz Back to Your Garden". This month Dr. Cloyd continues the discussion on the honeybees with his article regarding the colony collapse disorder.

Within the last few years honey bees have been literally "under assault," resulting in a significant decline in hives and/or colonies across the USA. What is going on? Well, honey bees pollinate over 130 crops within the USA and add approximately 15 billion dollars in crop value annually. The decline in honey bee hives and/or colonies is due to a "disease" that is currently referred to as colony collapse disorder or CCD. At this point, it may be premature to acknowledge that an actual disease is involved. However, this "disease," which primarily occurred in 2006-2007, has been responsible for up to 90% losses in honey bee hives. Colony collapse disorder is currently present in over 20 states within the USA.

The "disease" interferes with the ability of honey bees to process sensory input resulting in disorientation. When honey bees leave the hive to scout and forage they are unable to find their way back to the colony or hive. Adult honey bees simply disappear leaving behind honey, pollen, queens, capped brood, and few worker bees; however, immatures may still be present. Moreover, adjacent honey bees ignore empty hives, and there are no dead honey bees in existing hives. So, what is causing CCD? A number of factors were initially proposed to be responsible for or associated with CCD including 1) traditional bee pests and diseases (American foulbrood, Nosema, and varroa and trachea mites). However, these have no history of promoting CCD-like symptoms; 2) type of bee food since high fructose corn syrup by-products may be harmful to honey bees; 3) bee management; 4) lack of genetic diversity (genetic bottleneck) associated with the queen source may increase susceptibility to pests and diseases; 5) sub-lethal effects of pesticides used in bee colonies; 6) non-target effects of pesticides on honey bees; and 7) genetically modified crops.

There are a number of potential causes of CCD although it is apparent that more than one causal agent is involved. In fact, in all likelihood, a combination of factors

is responsible for the decline in honey bee hives and/or colonies. As such, below are factors that researchers have hypothesized to be associated with CCD:

* Mites (old and new). The varroa mite (*Varroa destructor*) may transmit viruses to honey bees or increase stress thus weakening honey bees. Furthermore, honey bees may have depressed immune systems, which increase their susceptibility to diseases. This is similar to the acquired immune deficiency syndrome (AIDS). It should also be noted that varroa mite is difficult to control due to populations having developed resistance to the commonly used miticide, fluvalinate.

* Nutritional and/or environmental stress. Malnutrition decreases the nutritional fitness of honey bees. In fact, nurse bees fail to produce brood food.

* Pathogens (new and re-emerging) such as the microsporidia, *Nosema apis* and *N. ceranae*. Microsporidia reside in the digestive tract of honey bees, which causes honey bees to leave colonies (or hives) and they fail to return.

* Pesticides. Pesticides including insecticides in the organophosphate, carbamate, and pyrethroid chemical classes are generally directly toxic to honeybees. In fact, carbaryl (Sevin), which is used by rose growers, is extremely harmful to not only honey bees but foraging bumble bees. Furthermore, sprays of any product in these chemical classes may contaminate nectar and pollen. However, it should be noted that the inherent toxicity, formulation, and application method will influence how deleterious insecticides are to honeybees. For example, wettable powder and microencapsulated formulations have a high affinity to bind to pollen more so than other formulations. In addition, the inert ingredients may be more harmful to honeybees than the active ingredient.

* Combination of all the above factors. Additional potential causes of CCD include the Israeli acute paralysis virus (IAPV) and habitat destruction. There is no doubt that suburbanization or urban sprawl has significantly impacted habitats frequented by honey bees via habitat loss or fragmenta-

tion of existing habitats. A decline in the "health" of the environment may indicate that honey bees are serving as biological indicators. There is also information suggesting that systemic insecticides, primarily the neonicotinoid-based insecticides, which are widely used in agriculture and home landscapes, may negatively affect honey bee learning and disrupt their homing abilities. Studies have demonstrated that the active ingredient of these systemic insecticides, when applied as a drench to the soil, is present in flowers, which may either directly or indirectly affect honeybees. Additionally, systemic insecticides coating the surface of seeds may eventually appear in the nectar or pollen of certain plants. Laboratory studies have demonstrated that imidacloprid (sold as Merit®) impairs the "mushroom body" in the brain, which is responsible for olfactory memory. As a result, honey bees when exposed to imidacloprid are not able to find their way back to the colony or hive. However, it is unlikely that systemic insecticides are solely responsible for CCD since plants may not take-up sufficient concentrations of the active ingredient that are lethal to honey bees. Flower morphology may also influence the ability of systemic insecticides to reach floral parts (petals and sepals). Furthermore, weeds that are flowering or other flowering plants that are visited by honey bees such as goldenrod (*Solidago* spp.) are typically not treated with a systemic insecticide.

At this point, there is no "smoking gun" that is responsible for CCD or the collapse of honey bees across the USA although current research is indicating that multiple viruses may be involved. However, the impact of CCD or the consequences of continued honey bee decline is a concern because if the current trend continues it could potentially lead to an increase in food prices and/or a decrease in food availability. Those who are interested in more information should purchase and view the PBS special, "Silence of the Bees," which premiered on October 28, 2007.

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