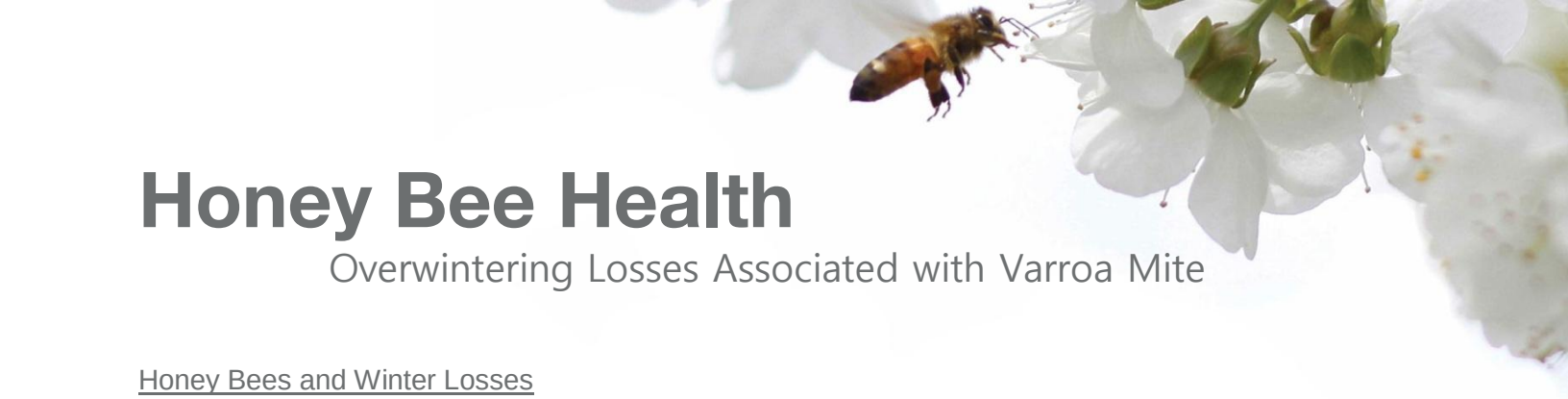

Honey Bee Health

Overwintering Losses Associated with Varroa Mite

Honey Bees and Winter Losses

Pollinators are critically important to both agricultural and non-agricultural landscapes. Many crops, including fruits, nuts, and vegetables, rely on insect pollinators, none of which is more important than the honey bee, *Apis mellifera*. The value of honey bees to agriculture is not only because they are such efficient pollinators, but also because of the utility of their colonies, which can be managed to increase the numbers of bees and moved to fields or ranches when needed, sometimes over great distances. Colony losses are typically expected following the winter season, but experts are concerned of significantly greater losses this spring, continuing a trend that has seen losses of 30% or more since the 1990s.

According to the USDA annual survey, colony losses coming out of winter in 2012 were nearly 22%, lower than what was observed in recent years. Some bee experts believe this was due to the abnormally warm winter – the fourth warmest winter in U.S. history. "A warm winter means less stress on bee colonies and may help them be more resistant to pathogens, parasites and other problems," said Jeff Pettis, co-leader of the survey and research leader of the Agricultural Research Service (ARS) Bee Research Laboratory in Beltsville, Md., and the USDA's chief intramural scientific research agency[1]. But the encouraging results from early 2012 have given way to deep concerns about this spring's forecast for colony health and survival.

Winter Colony Dynamics

A honey bee colony is a dynamic social structure containing up to 60,000 or more individual bees. These numbers vary greatly depending on colony maturity, the time of year and the health of the hive. Even a healthy colony can lose up to a thousand bees per day during the summer[2]. Wintering bees are physiologically different than their summer siblings, and can live for several months. If the health of winter bees is compromised, they may not survive the winter period and the full extent of the losses may not be noticed until the spring. Colony health can be negatively impacted by many factors, including pathogens, parasites, predators, severe weather events, habitat loss, nutritional deficiencies, and hive management practices.

Honey bee colonies are highly adaptable and will thrive if all of their basic needs – food, shelter and safety – are met. They can survive long, cold winters and extended periods when there is no natural forage. Unlike most insects, honey bee colonies are able to withstand cold winter conditions by producing individuals in the late summer that are more suited to surviving long periods confined in the hive by cold weather, as well as by harnessing the collective warmth generated by individual bees, who cluster tightly together around the queen to maintain a constant core temperature. Although the bees are generally not active outside the hive in winter, the colony is actually very busy inside the hive as it continues to access stored food in the form of honey and pollen, generate heat within the cluster and care for the queen, all of which are necessary for the colony's survival. If adequate provisions have not been made during the summer and fall, then a colony is likely to collapse by the following spring because of starvation – a common cause of colony loss over winter in North America.

The Varroa Mite

Even well-provisioned hives are not immune from other stressors that can negatively impact colony health. One of the most important threats to bee health is the Varroa mite (*Varroa destructor*), an exotic parasite introduced to North America in the mid-1980s. This mite feeds by sucking the blood of honey bees and it reproduces on the developing bee brood. Serious bee diseases are also vectored by the mite, which makes Varroa and its associated pathogens a lethal mix. Across the northern hemisphere, poor bee health correlates extremely well with the presence of the Varroa mite.

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Some bee experts throughout North America have predicted severe winter colony losses this year because of increased Varroa mite populations[3], which have flourished with the rapid honey bee population growth seen in the first half of 2012. Unfortunately, strong colonies and a long brood-rearing season are excellent for Varroa population increases as well, and reports of higher mite loads started to appear in the late summer.

Recent scientific research has shown that the winter survival of individual honey bees and honey bee colonies is dependent on the level of Varroa infestation. In temperate regions, the number of honey bees in a colony rapidly increases in the spring and summer and starts to decrease in early fall[4]. The number of mites on adult bees peaks rapidly in late summer to early fall as the amount of brood within a colony decreases[5]. The bees emerging from infested brood cells late summer become winter bees. Adult winter bees that were infested with Varroa as immature bees within the brood cells do not fully develop the physiological characteristics typical of a long-lived winter bee. This makes them less likely to withstand the grueling environmental stressors associated with winter conditions and survive until the spring[5].

Pollination Concerns for 2013

The rise of Varroa populations seen in the fall and the lingering impact of drought conditions throughout much of the United States has generated concern among beekeepers and farmers that sufficient numbers of healthy colonies will not be available to meet the pollination needs of this year's agronomic crops[3]. In previous years beekeepers have been especially adept at building up their colonies during the spring, allowing more than a million colonies to be transported across the U.S. each year for pollination purposes. However, high colony losses over the winter of 2012-13 are making this a difficult year for colony replacement and business recovery. Also, because commercial honey bee populations are managed, the number of colonies is artificially high and often exceeds seasonably available forage that provides the necessary nectar and pollen to satisfy their nutritional needs. This is especially acute in the spring, when the nutritional requirements of bees coming out of winter must be met to support this critical period of rapid colony growth. It is clear that high infestations of Varroa do not simply add to the nutritional challenges facing honey bee colonies, they exacerbate them and in doing so directly threaten our agricultural sustainability.

Managing Varroa

The bottom line is when honey bees do well, so will Varroa and each year of low colony mortality typically will be followed by several years of high colony mortality, as the Varroa effects are fully realized in the host-parasite relationship. What can change this pattern is improved monitoring for disorders and more sophisticated integrated management of the bees and pests, including Varroa.

Research by scientists at Plant Research International show that timely treatment of Varroa mites can significantly reduce the buildup of infestations during the development of winter bees and increase the colony's survival rate in the spring[5]. Hive best management practices should include a routine examination of bee health indicators. Unfortunately, the available supply of highly effective miticides to control Varroa mites is shrinking due to the onset of mite resistance to currently available products and a lack of suitable alternative methods of control.

Finding solutions to address these issues is critical to food production and agricultural sustainability, and is why Bayer established its Bee Care Program. This program brings Bayer's extensive experience and knowledge in bee health under one coordinated platform. A key element in this program includes the establishment of two dedicated Bee Care Centers.

Honey Bee Health

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The Bayer Bee Care Centers – one located in our global headquarters in Germany and the other in our North American headquarters in Research Triangle Park, North Carolina – are fully dedicated to honey bee research, education and training. The North American Center will include a full laboratory and research apiary, as well as honey extraction and workshop space needed to conduct bee health research. The research will focus on integrated management of the multiple causes affecting bee health, including parasites, such as the Varroa mite, predators, diseases, seasonal management, and environmental stressors. The Center will also provide state-of-the-art meeting, training and presentation facilities for beekeepers, farmers, researchers and educators, including an interactive learning center.

For more than 25 years, Bayer has been firmly committed to environmental stewardship and the protection of beneficial insects and bees. We fully support further research into the role of various potential pressures on bee health.

References

1) Survey by USDA and Collaborators Reports Fewer Winter Honey Bee Losses, Kim Kaplan (May 31, 2012) – USDA-ARS http://www.ars.usda.gov/is/pr/2012/120531.htm

2) Bees of the World (2004) by Christopher O'Toole and Anthony Raw

3) Project Apis m. post by founding member and chairman (Jan 16, 2013) http://projectapism.org/content/view/93/49/

4) Martin (1998), A Population Model for the ectoparasitic mite, Varroa jacobsoni in honey bee (Apis mellifera colonies (Ecol Model 109: 267-281)

5) van Dooremalen et al. (2012), Winter Survival of Individual Honey Bees and Honey Bee Colonies Depends on Level of *Varroa destructor* Infestation (PLoS ONE, Vol 7, Issue 4, April 2012)

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For more information on Bayer's commitment to bee health, please contact the Customer Interaction Center at 1-866-99-BAYER or visit www.bayercropscience.us/our-commitment/bee-health.