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It is the mites because

> *"But even if the varroa mite problem were solved today, this would not by itself solve all of the problems facing honey bees and beekeepers,"* Dr. Jeff Pettis, Research Leader USDA -Agricultural Research Service [1]

The latest research on mites, and another avenue[2] to control them is welcomed. However, the recent research [3] and surveys[4,5] and the current "Mite-A-thon" obfuscates the real cause of the bee health crisis: their toxic environment.

The focus on varroa mites, as the sole pest to honey bees, detracts from a primary factor affecting the health of honey bees: pesticides. The varroa mite has been in the USA since the mid-1980's. Beginning in 2005 bees started dying in unprecedented numbers. As the cause had not yet been identified, it was called "colony collapse disorder (CCD)." While many researchers have correlated the ecosystem accumulation of systemic and conventional pesticides with abnormal bee mortality, too many continue to discount bee toxic pesticides, including those pesticides clearly defined as "bee toxic." But in this bee health crisis "*There is relatively little incentive for university entomologists to consider complex real-world issues such as the cumulative effects of toxic synergies that involve low doses of neonicotinoids, the way beekeepers might*."[6]

Research across a number of years shows the residues of crop protection pesticides in bee hives creating sub-lethal and behavioral altering environmental levels of toxins within the "house, nursery, and food pantry" of the bee hive. When honey bees eat sub-lethal levels of toxins, when they feed it to their young, when it contaminates the pollen and nectar they bring into the hive, or the pesticides leach across frames contaminating pesticide-free pollen or nectar, of course the bees are susceptible to the effects of the varroa mite. A weakened immune system is typically attacked on many fronts. With honey bees the varroa mite is just the final straw in the colonies' health. "It is the mites because" of the accumulation of pesticide residues on the bee forage, as well as pesticide residues in and on water.

Pesticide exposure alters the varroa- to-bee-relationship allowing varroa to overrun the hive. Using Bee Informed Partnerships' treatment threshold of no more than three varroa mites per hundred bees the composite sample of a bee yard is just under or at the threshold. When the bees are subjected to an insecticide spray, if it is in the city, maybe mosquito abatement, or in agriculture, aphid spraying on a blooming crop; a relatively "light hit" of pesticides may only kill half of the bees. What happens to the varroa to bee ratio then? Every varroa mite in a brood cell raising its next generation are happily feeding on healthy bee larva. In a matter of hours, the mite to bee ratio may double. Research is showing however, that varroa mites exposed to sub-lethal levels of these same pesticides go into hyper breeding mode. Several weeks out the hive is in trouble with a varroa mite overload; *but it is mites because, not because of mites.*

It is simply mis-information to continue to promote a single cause, varroa mites, and therefore imply a single solution. It is mis-information to the food consumer, agricultural stakeholders, and policy makers to ignore other factors simply because it makes for convenient data collection. Dr. Pettis provided additional insights in his 2014 testimony stating, "The loss of honey bees may also reflect a much larger issue of general pollinator declines, with honey bees acting as an indicator species." An insightful examination of the honey bee health crisis is presented in *Vanishing Bees* by S. Suryanarayanan and D.L. Kleinman, who suggest "that forms of knowledge and ignorance about honey bee toxicology are a result of methodological choices that

do not necessarily reflect the ground realities of commercial pollination or the social lives of honey bees."[7]

Research has shown toxicities of individual pesticides increase when they are mixed together.[9,10,11] Research shows there are high residue levels of pesticides in the hive that kill queen bees, and larvae.[9,12,13, 21, 23, 24] Pesticide labels clearly state which products are toxic to bees, and other non-target organisms.[11] Systemic neonicotinoid pesticides are labeled as bee toxic, and the research shows the toxicity of these pesticides from direct, residue, and cumulative impacts upon bees.[21, 22, 24] Research shows bees exposed to low levels of pesticides have higher varroa mite loads.[25] These higher mite loads compromise the honey bees immune system resulting in higher virus and Nosema loads.[10] Some pesticides turn off the honey bees ability to detoxify pesticides.[26] Research is showing fungicides are problematic for honey bee health.[9,14,15] Research shows that pesticides applied to a crop, or yard, or public lands, drift.[16,17,18,19,20] If the pesticides drift onto pollinator habitat then that forage is now a contaminated food source for honey bees and other pollinators. But it makes for difficult research when examining the impact of all of these factors on bee health. And yet, we must. Bee health is not failing just because of the varroa mites; varroa mites are taking advantage of a hive already suffering a weakened immune system as they interact in their ecosystem. *"It is the mites, because. . . "*

Recent national honey bee loss numbers paint an incomplete picture of bee health, and discount the efforts that beekeepers are engaged in to keep their bees alive. The constant requeening of hives, splitting hives in the fall, keeping bees out of their spring buildup areas until the risk of planting pesticide coated corn seed is done, and the continual feeding of bees as if they were feedlot livestock.

We must ensure research is complete, encompasses the bees' real-world, and involves /acknowledges beekeepers in the research design, development, and implementation.
Honey bee health will only improve when we acknowledge the complete experience of the honey bee and the beekeeper.

The factors impacting honey bee health are pesticides, pests, pathogens, and poor forage. To continue the fallacy of a single pest is misleading. When examining bee health one cannot simply assess one pest, but every single factor, and the cumulative effects of all of the factors. Bee health is not a singular assessment—as samplers of the environment, honey bees are telling us the accumulation of pesticides make the immune system weaker, reduce the reproductive ability of the queen and drone bees, make bees forgetful, accelerate the hive tasks of worker bees, and affect the next generation of bees. It is irresponsible to ignore the impact of pesticides upon honey bees, when so many of the chemicals are registered, and sold with federal pesticide labels clearly stating "this product is toxic to honey bees." (For example see this pesticide label http://www.syngenta-us.com/currentlabel.aspx?productid=721) Assessing the health of bees from the four factors impacting their health: pesticide exposure, bee pests and diseases, and loss of forage may difficult for scientists, we cannot continue to do research simply on one pest of the bee thinking that is the only problem. We cannot continue to ignore the other factors affecting bee health that allow the varroa mite to have such an impact. The intense use of pesticides contributes significantly to the weakened health of honey bees exacerbating the impact of the varroa mite. If it is just varroa mites impacting the health of honey bees, what has caused the decline in Monarch butterflies?

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