Pollinator Peril - Research Highlights

Gary Rondeau - Oregon Sustainable Beekeepers

Pollinator declines continue

•In 2013 > 40% of honeybee colonies were lost entering the California almond pollination event. (8)

•Other invertebrates lack a constituency to speak for their health so declines go largely unnoticed. Naturalists and scientists worldwide continue to sound the alarm of general ecosystem collapse.

•Wide-spread herbicide use significantly reduces quantity and diversity of invertebrate habitat. Monarch butterflies have declined by 97% since 1996. (9)

•Farmland birds have seen drastic declines as well, especially insectivores – likely be cause insect populations are gone. (13)

Europe Acts

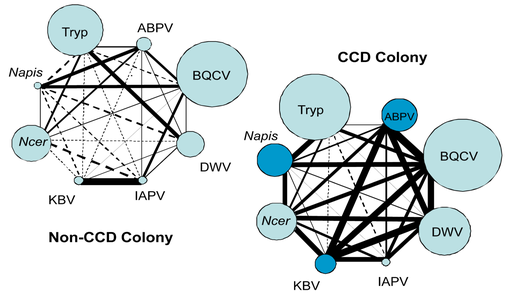
European Food Safety Authority (EFSA) scientists recommend a ban on neonicotinoid insecticides. (4)
The European Union votes to impose two-year moratorium on use of the neonicotinoids.

Pathogens, Parasites and Pesticides

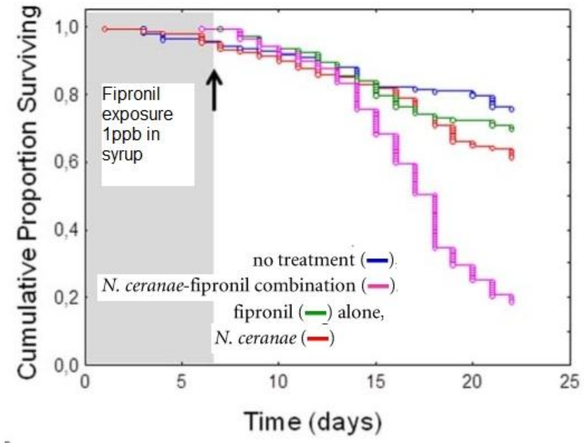
Pathogens and parasites are usually responsible for the ultimate demise of honeybee colonies. Research shows that residual pesticide exposure can make matters much worse.

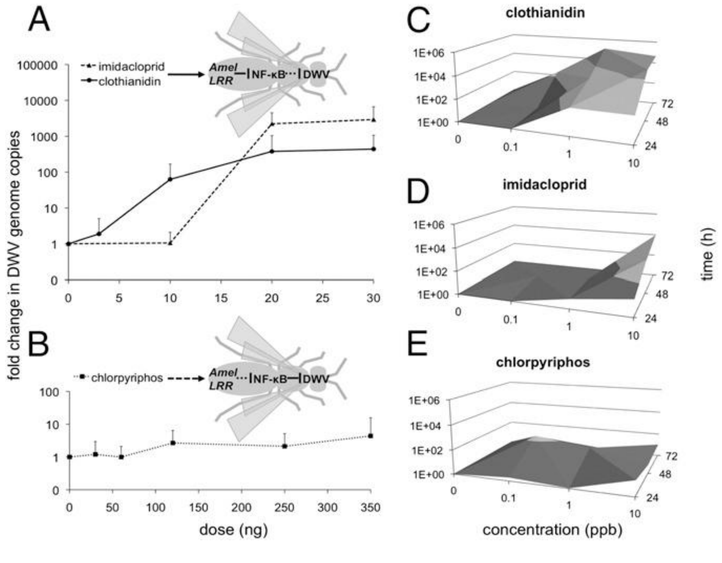
Nosema infection is more virulent in bees exposed to fipronil (1) and to other pesticides and fungicides (10). The study with fipronil shows that it takes a couple of weeks for effects to show up.

When honeybee colonies eventually go down in colony collapse, another study shows that the virus and pathogen load in the bees changes character compared to non-collapsing colonies. (2) Certain viruses are more prevalent and also seen in conjunction with others. This suggests immune system compromise in CCD colonies.



The first study looking at the interaction of pesticides and honeybee viruses (3) showed that exposure to neonicotinoids clothianidin and imidacloprid at field-realistic levels allowed the deformed wing virus (DWV) to replicate in adult honeybees, whereas exposure to the organophosphate chlorpyriphos did not significantly increase replication of the virus.





How much is too much insecticide?

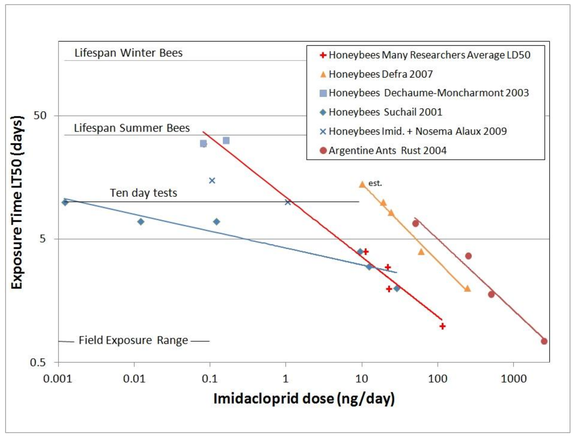
•Bumblebees fed 6ppb imidacloprid in pollen and 0.7ppb in syrup for 14 days subsequently produced fewer reproductive queens and collected less pollen that bees not exposed to the levels mimicking treated oil-seed rape fields. (5,6).

•Bees exposed to planting dust from treated seed are often killed immediately, and residual concentrations on nearby floral sources can be contaminated >5ppb (7).

•Bumblebee kills in Oregon demonstrated that imidacloprid concentration of 60ppb in flowers killed the bees before they could complete foraging on linden blossoms. Most of the treated trees had residual concentrations of neonicotinoid insecticides in flowers > 20ppb.

•Time-dependent toxicity data for imidacloprid on bees and ants shows that the longer the exposure, the less total amount of insecticide required to kill. (11) Extrapolation of these results to the lifespan for winter bees suggests that exposure levels of 0.25ppb will eventually be lethal to aged bees.

•Synergy with pathogens observed at 1ppb levels for fipronil, imidacloprid and clothianidin(1, 3)



Conclusions

Neonicotinoid insecticides act synergistically with pathogens to harm insects. Despite being a neurotoxin, they also seem to suppress immune function at low residual doses. The neonicotinoids exhibit delayed toxicity that makes residual contamination particularly a problem for this class of pesticide.

How to Help

Beekeepers

• Learn about the problems with the neonicotinoids and work with our neighbors and farmers to limit their use.

• Move bees to locations where residual contamination with these chemicals is less likely.

Homeowners and Gardeners

• Provide a diverse selection of floral sources for honeybees and native pollinators.

• Eschew neonicotinoid insecticides. Grow organic!

• Become informed about neonicotinoid insecticides and help convince our government agencies to do their job.

• Consider your transition out of the corporate food system.

Literature cited

1. Aufauvre J, Biron DG, Vidau C, Fontbonne R, Roudel M, et al. (2012) Parasite-insecticide interactions: a case study of Nosema ceranae and fipronil synergy on honeybee. Sci. Rep. 2: 326.
2. Cornman RS, Tarpy DR, Chen Y, Jeffreys L, Lopez D, et al. (2012) Pathogen Webs in Collapsing Honey Bee Colonies. PLoS ONE 7(8): e43562. doi:10.1371/journal.pone.0043562
3. Di Prisco G, Cavaliere V, Annoscia D, Varricchio P, Caprio E, et al. (2013) Neonicotinoid clothianidin adversely affects insect immunity and promotes replication of a viral pathogen in honeybees PNAS2013, doi:10.1073/pnas.1314923110
4. EFSA. 2013. Conclusion on the peer review of the pesticide risk assessment for bees for the active substance imidacloprid. EFSA J 11:3068.
5. Feltham H, Park K, and Goulson, D. (2014) Field realistic doses of pesticide imidacloprid reduce bumblebee pollen foraging efficiency. Ecotoxicology doi: 10.1007/s10646-014-1189-7
6. Gill RJ, Ramos-Rodriguez O, Raine NE (2012) Combined pesticide exposure severely affects individual- and colony-level traits in bees. Nature 491: 105-108.
7. Krupke CH, Hunt GJ, Eitzer BD, Andino G, Given K (2012) Multiple Routes of Pesticide Exposure for Honey Bees Living Near Agricultural Fields. PLoS ONE 7(1): e29268. doi:10.1371/journal.pone.0029268
8. New York Times, March 29, 2013. Mystery Malady Kills More Bees, Heightening Worry on Farms.
9. New York Times, January 29, 2014. Migration of Monarch Butterflies Shrinks Again Under Inhospitable Conditions.
10. Pettis JS, Lichtenberg EM, Andree M, Stitzinger J, Rose R, et al. (2013) Crop Pollination Exposes Honey Bees to Pesticides Which Alters Their Susceptibility to the Gut Pathogen Nosema ceranae. PLoS ONE 8(7): e70182. doi:10.1371/journal.pone.0070182
11. Rondeau G. (2013) Time-dependent toxicity of imidacloprid on bees and ants.
12. Tennekes HA, Sánchez-Bayo F. (2013) The molecular basis of simple relationships between exposure concentration and toxic effects with time. Toxicology 309:39-51.
13. White, G. The problem with pesticides: it's the birds and the bees. The Beekeepers Quarterly 111 March 2013