The Bee's Knees: The Effect of Secondary Metabolites in Place of Neonicotinoid Pesticides on Apis mellifera and Drosophila melanogaster

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Our world is undergoing a silent agricultural crisis, and it is all due to the fact that bees (the most crucial pollinator of crops) are slowly dying, along with their entire colonies. This is due to the use of toxic neonicotinoid pesticides that affect bees immune and nervous systems, deteriorating their acetylcholine receptors thus disorienting them in their return to the hive. The project's intentions were to test the use of secondary metabolites in place of neonicotinoids as pesticides that do not affect bees, while still repel detrimental pests such as fruit flies. The project consisted of five tests: testing zone of inhibition of bees to secondary metabolites, zone of inhibition of fruit flies, flight times of bees returning to their hive (to test for disorientation), initial disposition when bees are exposed to secondary metabolites, and disposition over time. The data showed that bees are attracted to some metabolites (lemongrass, sage, menthol), and repelled by others (cedar wood, patchouli). Flies are repelled by sage and cedar wood, and are attracted to peppermint. Flight times proved that secondary metabolites do not affect orientation, and that initially bees are inclined to go to Sage, and over time, they do not show a disposition (they will go to any as long as there is food). In conclusion, it was found that Sage oil would be the best secondary metabolite tested to replace neonicotinoid pesticides, and upon further research it was discovered to be due to its high concentration of α-Pinene. α-Pinene acts as a natural acetylcholinesterase inhibitor allowing bees to restore memory. Much can be done with the findings, and with these new pesticides, food production can continue to increase, eliminating a threat to population.