Pesticide Poisoning is Killing Honey Bees: Warning for Ecosystem

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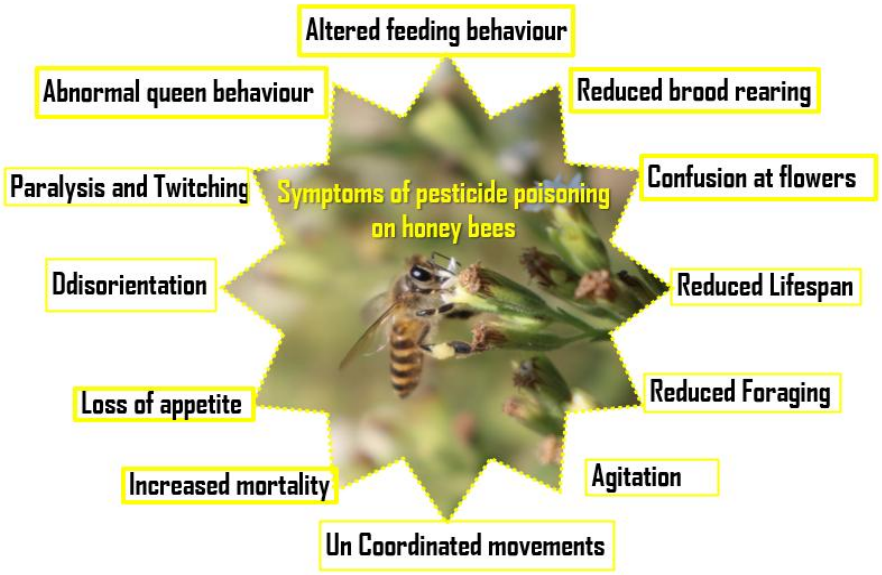
In our fragile ecosystems which support our food production, a disturbing phenomenon has emerged, casting a shadow over the foundation of our agricultural system. The intricate partnership between honey bees and crop pollination, which underpins the growth of countless fruits, vegetables, and nuts, is facing an unprecedented threat: pesticide poisoning. As the delicate balance of nature is disrupted by the unintended consequences of chemical warfare against pests, the silent toll of pesticide poisoning is ringing alarm bells for both environmentalists and farmers alike. This article sheds light on the grim reality of pesticide poisoning and its catastrophic impact on honey bees, highlighting the urgent need for sustainable agricultural practices that safeguard the invaluable contributions of these pollinators. From exploring the mechanisms behind pesticide toxicity to outlining the far-reaching consequences for crop production and ecosystem health, navigate the intricate web of this crisis, seeking solutions that can restore harmony to the vital interplay between agriculture and the environment. As we delve deeper into this serious issue, it becomes evident that change is necessary and that we must take steps to control pests in a way that respects the fragile balance of our interconnected planet.



Honey Bees as an Input in Crop Production

Pollinators and pollination play a crucial role in the functioning of almost all terrestrial ecosystems including those dominated by agriculture because they are in the front line of sustainable productivity through plant reproduction and serve as basic pillars for crop production. Pollination is simply the transfer of pollen from the anther of one flower to the stigma of another or the same flower. It is achieved by biotic and abiotic means. Among, biotic agents, bees are the most valuable pollinators in agriculture, especially honey bees, bumble bees, stingless bees, mason bees, solitary bees, etc. The biology of honey bees is well known and they can be managed in easily transportable boxes for pollination of many crops. On 03/08/2021, the Ministry of Agriculture and Farmers Welfare, considering the importance of honeybees in enhancing crop productivity, beekeeping/honeybees decided to be included in the package of practices for a particular crop and region as **Input in Agriculture,** which will boost agricultural production through enhancement in crops in a sustainable manner in our country.

Pesticide Poisoning in Honey Bees

Modern insecticides have an awful lot decrease toxicity to people, wild mammals and birds and are carried out in decrease amounts, however they're even greater poisonous to invertebrates. Several studies show the higher toxicity outweighs the lower volumes, leading to extra lethal standard effect on pollinators and waterborne bugs inclusive of dragonflies and mayflies. The use of several crop protection chemicals, such pesticides, fungicides etc. makes bees vulnerable to poisoning and death.

Pesticide poisoning has been recognized as a significant threat to bee populations worldwide, particularly to honeybees and other pollinators. Bees play a crucial role in pollinating many of the crops that make up a large portion of our global food supply, so their decline can have serious implications for agriculture and ecosystem health. Pesticides, including neonicotinoids and other chemical classes, have been associated with various negative effects on bees:

1. Lethal and Sublethal Effects: Pesticides can cause direct mortality among bees. High doses of certain pesticides can quickly kill bees by targeting their nervous systems or other physiological processes. Even when bees are not killed outright, exposure to sublethal doses of pesticides can have significant impacts on their behavior, physiology, and overall health.

2. Impaired Foraging Behavior: Pesticides can disrupt the ability of bees to navigate, forage for food, and return to their hives. This can result in reduced food collection and compromised hive health.

3. Disruption of Reproduction: Pesticides can interfere with the reproduction of bees. For example, they can affect queen bee development, egg-laying behavior, and the overall reproductive success of the colony

4. Reduced Immune Response: Pesticide exposure can weaken the immune systems of bees, making them more susceptible to diseases and pathogens. This can lead to increased mortality and decreased overall colony health.

5. Colony Collapse Disorder (CCD): Although the exact cause of CCD is complex and multifactorial, pesticide exposure has been identified as one of the contributing factors. CCD refers to the sudden and unexplained disappearance of worker bees from a colony, leading to the collapse of the entire colony.

To address these concerns, there has been growing interest in adopting more sustainable agricultural practices and developing alternative pest management strategies that minimize the impact on pollinators. This might involve reducing or eliminating the use of certain classes of pesticides, implementing integrated pest management techniques, creating pollinator-friendly habitats, and improving pesticide regulations and labeling to safeguard pollinators.

Sources of Bee Poisoning

Bees can be exposed to pesticides through various sources, both in agricultural and non-agricultural settings (Fig 1(a); 1(b). In agricultural areas, there is a negative relationship that was found between pesticide use on agriculture sites and pollinator abundance, group richness, and diversity. Pollinators in agriculture areas can be exposed to plant protection products in two ways:

i) By direct exposure to either drift droplets, which are scattered during the foliar spraying of crops, dust from seed drilling at planting, or inhalation of volatile pesticides during or after application to the crops

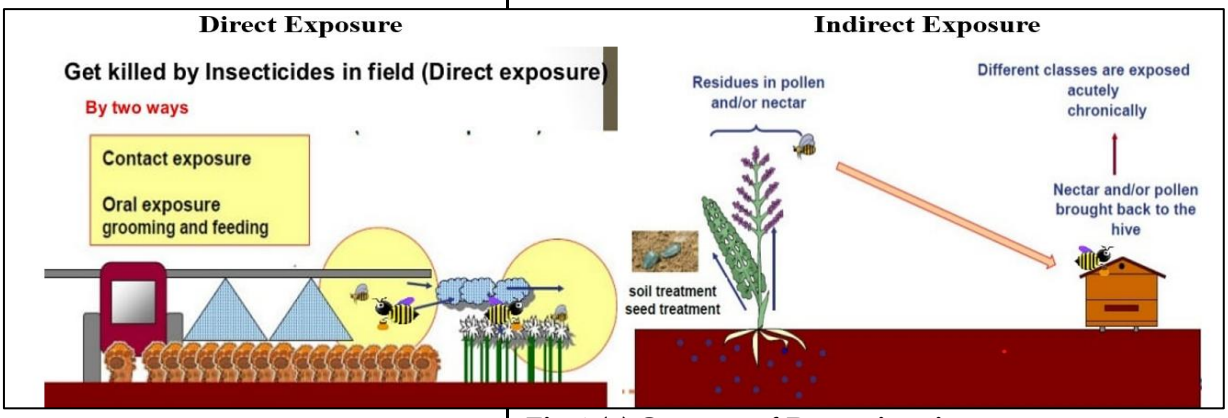


Fig 1 (a) Sources of Bee poisoning

(Source: Thompson, 2009; Christian et al, 2012)

ii) By exposure to residues present in pollen, wax, nectar, honey, and guttation drops, which may result either from direct spray contamination of flowers, or direct contamination during treatment of the combs (for honey bees only)

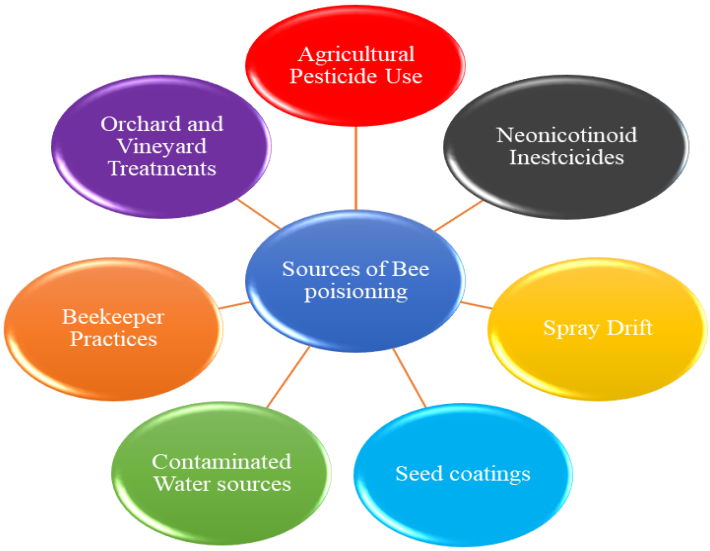


Fig 1 (b) Sources of Bee poisoning

To mitigate bee poisoning, it's important to use pesticides responsibly, following recommended application guidelines and considering their potential impact on pollinators. Integrated pest management practices, which prioritize minimizing pesticide use through targeted and sustainable strategies, can help reduce the risk to bees and other beneficial insects. Additionally, promoting pollinator-friendly habitats, reducing the use of systemic pesticides like neonicotinoids, and advocating for stronger pesticide regulations can contribute to protecting bee populations.

Management Practices against Pesticidal Hazards

Effective management practices to mitigate the hazards of pesticides on bees and other pollinators involve a combination of strategies aimed at reducing exposure, promoting pollinator health, and using pesticides responsibly. Here are some key practices:

1. Integrated Pest Management (IPM): Implement IPM strategies that focus on preventing pest problems through a combination of cultural, biological, and chemical control methods. This approach helps reduce the reliance on pesticides and minimizes their impact on non-target organisms like bees.

2. Selective Use of Pesticide: Choose pesticides that are less harmful to bees and other pollinators. Opt. for products with lower toxicity and shorter residual effects. Use narrow-spectrum pesticides that target specific pests rather than broad-spectrum ones that affect a wide range of insects.

3. Time Pesticide Applications Carefully: Apply pesticides when pollinators are less active, such as early morning or late evening, when bees are less likely to be foraging. Avoid applying pesticides during peak flower blooming periods.

4. Communication: If you are an agricultural producer or land manager, communicate with local beekeepers and other stakeholders about your pesticide application plans. This can help beekeepers take measures to protect their colonies during pesticide treatments.

5. Habitat Enhancement: Create pollinator-friendly habitats around agricultural fields and in non-agricultural areas. Plant native flowering plants that provide food and shelter for bees. This can help support healthy pollinator populations and reduce their reliance on treated crops.

6. Buffer Zones: Establish buffer zones between treated areas and areas with high bee activity. These zones can serve as a physical barrier that reduces the risk of pesticide exposure to pollinators.

7. Cover Crops and Trap Crops: Use cover crops or trap crops to deter pests away from main crops, reducing the need for pesticide use. These strategies can help manage pests while preserving pollinator health.

8. Pesticide-Free Zones: Designate specific areas or refuges on your property where no pesticides are used. This provides safe havens for pollinators to forage and reproduce.

9. Monitoring and Thresholds: Regularly monitor pest populations to determine if and when pesticide treatments are necessary. Establish economic or pest

population thresholds to guide the timing and necessity of pesticide applications.

10. Education and Training: Educate farmers, land managers, and the public about the importance of pollinators and the potential risks of pesticides. Provide training on proper pesticide application techniques and how to minimize harm to non-target insects.

11. Regulations and Labeling: Support and advocate for stronger pesticide regulations that take into account pollinator health. Ensure that pesticide labels provide clear information on potential risks to bees and other non-target organisms.

12. Research and Innovation: Invest in research to develop safer pest management alternatives and new technologies that reduce the need for pesticides while maintaining crop productivity.

Conclusion

By combining these practices, it's possible to reduce the negative impacts of pesticides on pollinators while still effectively managing pests and protecting agricultural yields. Both beekeepers and growers can take steps to help encourage safe pollination and manage the risk of bee poisoning. Most bee poisoning events occur because of a lack of communication and coordination between the chemical user and beekeepers. Collaboration among farmers, beekeepers, researchers, policymakers, and the public is essential to implement these practices and promote sustainable coexistence between agriculture and pollinators.

References

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