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Gut-Microbiota in Honey Bee and the Food Security

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Introduction:

Honey bees are the natural honey manufacturing factories belong to the order Hymenoptera and family Apidae. It is aeusocial flying insect which is of native to Africa, Asia and Europe continents. Different kinds of honey bees play a major role in pollination and thereby, enhance food security. Nowadays, apiculture is used as a part of integrated farming system to increase the crop yield. Apiculture is the commercial cultivation of honey bees for the production of honey with added advantage of increasing pollination in the crop plants which indirectly influence the yield.

Microbiota refers to microorganisms in particular environment. In such honey bees, microbiota is of diverse distinct communities of microorganisms and they play an important role in nutrient composition of honey and disease resistance in honey bees (Alberoni *et al.*, 2016). At present honey bees are stressed up with a number of biotic and abiotic factors, which affect honey bees health and productivity. In addition to pathogens, pesticides and lack of flowers lead to complications in insect health, which have been deeply studied.Inspite of various conventions on mitigation of climate change, it is mourning to mention that climate change, habitat loss and invasive

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species have become equally challenging for survival of honey bees, beehive integrity and in balancing the agricultural ecosystem.

Diversity of gut microbiome in honey bee

Gut microbiota of honey bees is traced with the help of next generation sequencing

(NGS), which shows that microbiome consists of eight dominant groups comprising over 95% of the whole community (Kwong and Moran, 2016). The Gram-negative *Gilliamella apicola* and *Frischella perrara* belong to the Gammaproteobacteria class, and the Betaproteobacterium *Snodgrassella alvi* are predominant in the midgut. The rectum is preferentially colonized by different *Lactobacillus* species (viz., *Lactobacillus mellis*, *Lactobacillus mellifer*, *Lactobacillus helsingborgensis*, *Lactobacillus kullabergensis*, *Lactobacillus melliventris* and*Lactobacillus kimbladii*) and two species belonging to the genus Bifidobacterium (*Bifidobacterium asteroides* and *Bifidobacterium coryneforme*). And less abundant microbes such as Alphaproteobacteria (related to the genera Bartonella/Brucella and the Acetobacteraceae family) (Alberoni *et al.*, 2016) are found that play a vital role in the maintanence of honey bee health and quality of honey produced through various mechanisms via their metabolites.

Role of gut microbiota in honey bees

Nutritional support

Microbes present in the gut of honey bees provide nutritional support through their enzymes (cellulases, hemicellulases and lignase) and metabolites (Vitamins, Fattyacids, Aminoacids) where they aid in breakdown of complex carbohydrates and for their healthy lifestyle. Fructobacillus species isolated from bee bread, brood cells and larval gutwere found to utilize the plant complex molecule lignin, which is a component of pollen and thus beginning the breakdown of this important high-protein plant-derived food (Rokop *et al*., 2015). Gammaproteobacteria, Firmicutes, Bifidobacteriaceae are involved in sugar uptake systems and breakdown of plant-derived macromolecules. *Bifidobacterium asteroides*was found to beinvolved in a complete biosynthetic pathway for folate synthesis(Vit-B_9).

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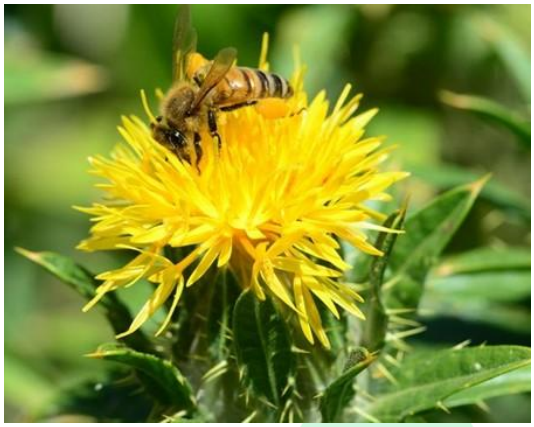
Enhance immune responses



Honey bees have a simpler immune system compared with other insects, while the presence of different gut microbes boost its host immunity and act as antagonistic organisms against pests and pathogens. One main effector of the innate immunity in honey bee is represented by antimicrobial peptides (AMPs) which is a major cell wall component of Gram-positive bacteria. *Lactobacilli* and *Bifidobacteria* inhibit honey bee pathogens like*Paenibacillus larvae*, *Melissococcus plutonius* and *Ascosphaera apis*. Some of the Lactobacillus species areknown to produce antimicrobial compounds (Alberoni *et al.*, 2016) that aid in self defence against honey bee pathogens.

Influence pollination

Pollination is most frequently viewed as a bipartite interaction between plants and pollinators. Minor taxa from the intestinal tract of honey bees impact on the efficacy of honeybees as pollinators, mostly when they exist in the gut and also have the capacity to grow in floral nectar and capable of modifying the chemical properties of nectar. Honey bee gut microbiota influence the efficiency of *Apis mellifera* as pollinators by changing nectar chemistry and affecting the foraging behavior in addition to impact on bees' health as symbionts (Khan *et al*., 2020).

Conclusion

Change in climate is of major influencing factor on microbial community in the environment and it is indirectly affecting the composition of honey bee gut microbiota. Inapiculture and under integrated agricultural productionhoney bee gut microbiota play a vital role. Population of honey bees as a pollinator have played a major role in the evolutionary process and are currently playing the same role which is of prime aspect in agriculture to achieve increased productivity, thereby food security. Hence, there is a need to

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preserve the honeybee microbiota, which is of great influential factor in honey bees as theyprovide support in nutrition and immunity, and this could be possible through mitigation of climate change and that will ultimately balance the ecosystem.

References

Alberoni, D., Gaggia, F., Baffoni, L., & Gioia, D. 2016. Beneficial microorganisms for honey bees: problems and progresses.*Applied Microbiology and Biotechnology, 100,* 9469-9482.

Kwong, W. K., & Moran, N. A. 2016. Gut microbial communities of social bees. *Nature Reviews. Microbiology, 14,* 374-384.

Rokop, Z. P., Horton, M. A., & Newton, I. L. G. 2015. Interactions between co-occurring lactic acid bacteria in honey bee hives. *Applied and Environmental Microbiology, 81,* 7261-7270.

Khan, K. A., Al-Ghamdi, A. A., Ghramh, H. A., Ansari, M. J., Ali, H., Alamri, S. A., AI Kahtani, S. N., Adgaba, N., Qasim, M., & Hafeez, M. 2020. Structural diversity and functional variability of gut microbial communities associated with honey bees. *Microbial pathogenesis, 138,* 1-13.

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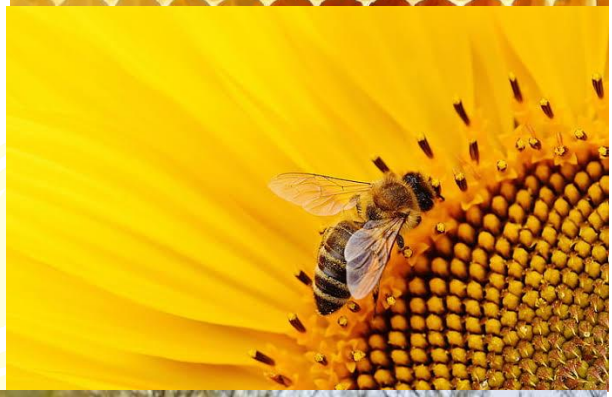

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