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Nutritional landscape as a driver for honey bee immunity

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Honey bee immunity is a complex system that is shaped by a wide range of responses to both biotic and abiotic environmental stressor factors. The immune mechanisms operate across several levels of organization, from the colony, where social immunity plays a critical role in protecting against external threats, to the individual bee. At the individual level, immunity is further refined through cellular, humoral, and molecular responses, all of which are integral to the innate immune system's ability to defend against pathogens and environmental stressors. A known relationship exists between immune function and the colony's nutritional state, where the presence of parasitic Varroa mites and associated viruses disrupt this balance by suppressing individual immune responses and facilitating pathogen transmission. These interactions can be further exacerbated by climate change and the presence of xenobiotics, particularly pesticides and chemicals used in beekeeping management. This study, as work package of the project BeeGuards, aims to investigate honey bee immune functions, focusing on how differential nutritional value of the landscape affects both individual and colony-level immune responses, pathogens resilience and holobiont impact. A vegetation analysis will be performed to characterize the environment within the foraging range of honeybees, providing further insights into the surrounding landscape and its potential influence on colony health. Additionally, we plan to incorporate artificial intelligence approaches to better understand these complex dynamics