



Toward a microbiome-aware environmental risk assessment: how to mobilize microbiome studies as an indicator.

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INTRODUCTION

The rise of high-throughput ‘-omics’ techniques has highlighted the role of the microbiome for the functioning of ecosystem and host health with a great impact on medical and animal sciences. It becomes more and more evident that microbiome-aware environmental risk assessment has to be explored for addressing future challenges. Recently, a joint project between the Walloon Agricultural Research Center (CRA-W), the UCLouvain and the European Food Safety Authority (GP/EFSA/ENCO/2020/02) has started to inform the possible way forward.

The main goal of the Microbiome project is to assess if and how microbiome can be considered in environmental risk assessment. The work package covered here focuses on insect’s microbiome as an indicator of detrimental environmental health effects by using the honeybee model. Thanks to a quite simple and very consistent core microbiome worldwide, this model allows scientists to clearly identify healthy microbiome and adverse situations removing the major limitations for the use of microbiome as indicator. We highlight pros and cons of the model, knowledge gaps and possible ways to use it, e.g. for microbiome-aware risk assessment in the food and feed chain.

METHODOLOGY

The global strategy is to evaluate the state of art in key areas such as the composition of the core microbiome of honeybees, identification of sources of natural variations, dysbiosis of the gut microbiome of honeybees and adverse health effects of insect-associated microbiome (entomobiome). The main purpose is to highlight indicators of dysbiosis in honeybee gut microbiome. Identification of major difficulties and analysis protocols needed will be described.

RESULTS

A literature review on honeybee microbiome began in 2021 and will continue in 2022 as studies are delivered monthly on the link between microbiome and bees health. Literature allowed us to identify honeybee core microbiome and its main variations in composition of relative and absolute abundance according to change in their environment. This baseline situation and its variations allow us to hypothesise that the honeybee microbiome could be used as a valuable indicator for risk assessment. The literature on dysbiosis permits to identify trends of variations in the composition of gut microbiota that could potentially be used as indicators for risk assessors. Identification of gaps in knowledge is also a key issue for progressing with the possible integration of microbiome of honeybees in the risk assessment process.

DISCUSSION

Honeybees are often seen by scientists as an optimal model to study the link between health and microbiome. A literature review confirmed that its relative simplicity allows for using variations of abundance of taxa in microbiome as a potential useful indicator of health status of individual honeybees. However, work still needs to be done to link microbiome to protection goals identified by EFSA. Indeed, microbiome fluctuations are not always linked to an adverse health situation or an increase of mortality, but they act more as part of a multi-stressors system. We propose using the fluctuations of microbiome in honeybees as a signal for risk assessors to identify situations where risk assessment might need to go further by considering factors such as an increased susceptibility to pathogens, for example. The methodology will be discussed and challenged via a network of researchers and risk assessment experts. Taking into account the entomobiome could be a part of the willingness of the EU to develop a holistic risk assessment including multiple stressors.