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Selected chemical properties of cereal grains affecting the microbiome structure and metabolic activity of the lesser grain borer and rice weevil

SUMMARY

The damage caused by feeding storage pests, although often underestimated, is considerable, ranging from 10 to as much as 30 per cent. Insects are responsible for a large proportion of this. Some of the most dangerous insect pests currently stored are the rice weevil and the lesser grain borer. With the warming of the climate, they are better able to thrive in temperate zones, thus causing more damage. There are several methods for controlling these pests, but we mainly use chemical methods for their control. However, chemical control has several side effects, including food safety problems. In addition, long-term use of the same active substances entails the risk that pests will develop resistance to them and that the effectiveness of the preparations will be reduced. In line with current EU legislation and the general trend to reduce the amount of chemicals used, new, more natural methods of controlling storage insect pests should be sought. A significant opportunity for change in this area is to learn more about the insect's relationship with its internal microbiome. The microbiome very often helps with digestion, detoxification or the acquisition of chemical resistance. Therefore, a new and promising way to combat storage pests may be to learn about their microbiome and biochemical activity in food chains. It is necessary to know the behaviour and food preferences of storage pest species and to determine which chemical characteristics of the grain affect the weaker development of the microbiome and thus limit or prevent the proper functioning of the insect. The present study aimed to understand the mechanisms of resistance in cereals by investigating the effects of the chemical composition ot the grain of different cultivars of common wheat and barley on the feeding disorders of the lesser grain borer (*Rhyzopertha dominica* F.) and the rice weevil (*Sitophilus oryzae* L.) and on changes in the structure of their microbiome. A series of comprehensive studies from insect population ecology to biochemical and molecular analyses were carried out and concluded that the gut microbiome of *S. oryzae* and *R. dominica* influences the development and function of these pests. In the case of *S. oryzae*, its elimination resulted in the insect's death. It was also confirmed that the different chemical compositions of the grain affected the development of the pests studied and the rearrangement of their microbiomes. These studies have provided valuable insights that can help in the development of new storage practices and pest management strategies through the use of cultivars with greater natural resistance or the use of non-toxic symbiont-destroying substances to prevent insect development.

Keywords: *Sitophilus oryzae*, *Rhyzopertha dominica*, bacteriobiome, barley, wheat