PLANT IMMUNITY

Enemy's enemy is a friend

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Many insect herbivores are pests that cause damage to agriculture or natural ecosystems. Plants have developed various strategies to defend against their insect herbivores, such as producing volatiles to attract predators or parasitoids of the insect — in other words, making friends with the enemy's enemy for their own good. Recently, Charles Mason et al., at Pennsylvania State University, USA, demonstrated new examples revealing how maize plants interplay with the gut microbiome of fall armyworm to restrict insect invasion.

The fall armyworm (*Spodoptera frugiperda*) is a generalist insect pest that feeds on more than 80 plant species, including several major crops like maize, rice, sorghum and sugarcane. In this study, the researchers inoculated larvae of fall armyworm with three different types of gut bacteria (*Enterococcus* species, *Klebsiella* species and *Enterobacter* species). The bacteria exerted negative effects on larval growth when they were feeding on maize leaves. Interestingly, all three groups, especially the *Enterobacter* species, caused more adverse effects on larval growth and survival rate when the worms were fed with leaves from a resistant (Mp708) maize line

over a susceptible (Tx601) line. This suggests that the insect gut bacteria may interact with plant defence mechanisms to suppress larval growth. Following this, Mason et al. measured an index of insect antibacterial activity, haemolymph phenoloxidase (PO) activity, and confirmed that feeding on Mp708 maize leaves promotes the induction of PO activity in *Enterobacter*-treated larvae. As one of the mechanistic scenarios, they hypothesized that maize defensive responses may dampen the protective gut barrier, thus accelerating the invasion of gut bacteria into the larval body cavity. In support, they found that large trichome or chitinase treatment of maize leaves in combination with *Enterobacter* inoculation resulted in significant inhibition of larval growth.

Alternative mechanisms may exist to further explain the interaction between plant defence systems and larval gut microbiota. This study opens up new research opportunities for exploring the relationship of plants, herbivores and their microbiomes.

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