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Keeping your food fresh: active manipulation of cytokinin-metabolism by a cell content feeder

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Cytokinins play a central role in plant physiology, including regulation of senescence and nutrient translocation. Recent studies have revived interest in their role in plant-insect interactions. At the end of the sixties, some scientists suggested for the first time that phytophagous insects might manipulate cytokinin levels in the tissues where they feed to increase their sink strength (Engelbrecht et al., Nature, 1969). Here, we present our results on the interactions between the cell-content feeding mirid *Tupiocoris notatus* and the wild tobacco *Nicotiana attenuata*. Using highly sensitive LC-MS techniques, we detected two types of active cytokinins present in mirid bodies: isopentenyl-adenine (IP), and isopentenyl-adenosine (IPR). Surprisingly, the free base IP was ten to fifty times as concentrated in mirid bodies as in the leaf tissues where *T. notatus* normally feeds. By using N^{15}-labeled plants, we showed that *T. notatus* specifically transfers these two types of cytokinins into the leaves on which it feeds. The effects of *T. notatus* damage on the physiology of tobacco leaves was assessed by determining the concentration of soluble sugars, soluble proteins, free amino acids, and photosynthetic parameters over a time course during mirid attack. Responses were compared in wild-type plants and in transgenic plants with manipulated levels of cytokinins or impaired cytokinin perception. Even when insects had damaged the majority of the leaf-surface, levels of nutrients remained close to levels in undamaged controls. In contrast, plants with altered cytokinin metabolism and signalling showed larger changes in nutrient levels during *T. notatus* feeding. Our results suggest that *T. notatus* compensates for the damage it causes by manipulating cytokinin signalling in damaged leaves.

Engelbrecht, L., Orban, U., Heese, W. 1969. Leaf-miner caterpillars and cytokinins in the "green islands" of autumn leaves . Nature 223: 319-321