Flies avoid a plant's poison using a newly identified taste mechanism

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Many plants protect themselves from hungry animals by producing toxic chemicals. In turn, animals rely on detecting the presence of these harmful chemicals to avoid consuming dangerous plant material. A paper, published in this week's issue of *PLoS Biology*, investigates the response of an insect to a common plant weapon - the toxin L-canavanine.

The work, from authors at the Institute of Functional Genomic of Montpellier, finds that the fruit fly *Drosophila melanogaster* can recognize L-canavanine and identifies the cellular receptor that facilitates this recognition. Surprisingly, the receptor that identifies L-canavanine is not from the gustatory receptor family responsible for all known taste sensation in insects - instead it is a modified glutamate receptor, called DmXR.

When fruit flies were forced to consume L-canavanine they subsequently failed to reproduce - all of the offspring died as larvae - thus showing an evolutionary advantage to evolving a mechanism to sense and avoid consuming the toxin. The work - lead by Yves Grau - demonstrated that the mechanism is based on DmXR. First the authors showed that human cells modified to express DmXR would respond to L-canavanine, whereas unmodified cells did not respond.

Next, they demonstrated that fruit flies have the ability to modify their behavior when exposed to L-canavanine: when offered two sugar solutions the flies avoided the one spiked with L-canavanine. Genetically

modified Drosophila which had the DmXR receptor disabled showed no such preference, again indicating the key role of the receptor in the tasting of this toxin. By observing Drosophila behaviour, the authors found that the application of L-canavanine to the flies legs (where the taste receptors are) caused them to retract their mouthparts - thereby avoiding consuming the poison.

Understanding sensations in insects is not just of scientific interest - given that many insects are pests and vectors for disease, identifying chemicals that are insect-specific and the pathways that are involved may provide alternatives to insecticide use in the future.

More information: Mitri C, Soustelle L, Framery B, Bockaert J, Parmentier M-L, et al. (2009) Plant Insecticide L-Canavanine Repels Drosophila via the Insect Orphan GPCR DmX. *PLoS Biol* 7(6): e1000147. doi:10.1371/journal.pbio.1000147, biology.plosjournals.org/perls … journal.pbio.1000147

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