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Diet Acts on Detection of Female Sex Pheromones in a Male Moth

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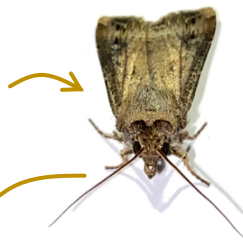
1. Introduction

In most insects, sex-partner meeting relies on males' attraction by a mixture of species-specific odorants emitted by females: **sex pheromones** [1]. The pheromonal compounds are recognized by specific **olfactory receptors** (ORs) located in the membrane of dedicated **olfactory receptor neurons** (Phe-ORNs) inside **antennal sensilla** [2]. The pheromonal signal is then integrated into **olfactory centers**, ultimately leading to **sexual behavior**. In the **male moth *Agrotis ipsilon***, **sex pheromones detection** elicits to **oriented flight** towards the female [3]. As **diet impacts the male's sexual behavior** in this species, we suggested that diet might also affect sex pheromones detection. To test this hypothesis, we examined the effect of different diets on both antennal response by electroantennography (EAG) and Phe-ORN activity by single sensillum recordings (SSR).

2. Materials & Methods

Different *ad libitum* diets from the first day after emergence (D1):

- water;
- sucrose (suc.);
- sucrose with glucose and fructose (suc. + fru. + glu.);
- NaCl (Na);
- sucrose with glucose, fructose, and NaCl (suc. + fru. + glu. + Na).



Sex pheromone detection's studies in 5-day-old (D5) male moth with:

- isolated antenna in electroantennography
- pheromonal neuron in single sensillum recording

4. Conclusion & Perspectives

Diet rich in **various sugars (sucrose + fructose + glucose)** with **sodium** has a **positive impact** on sex pheromones detection in D5 male *A. ipsilon*.

In *Drosophila melanogaster*, juvenile hormone (JH) is involved in the development of male sexual behavior by **upregulating** the antennal expression of a **pheromonal receptor** [4].

In several insects, **diet modulates** both **biosynthesis** and **action** of JH (Fig. 4).

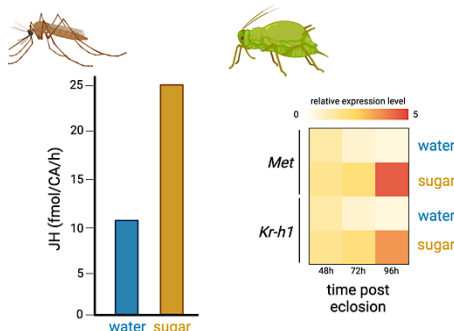


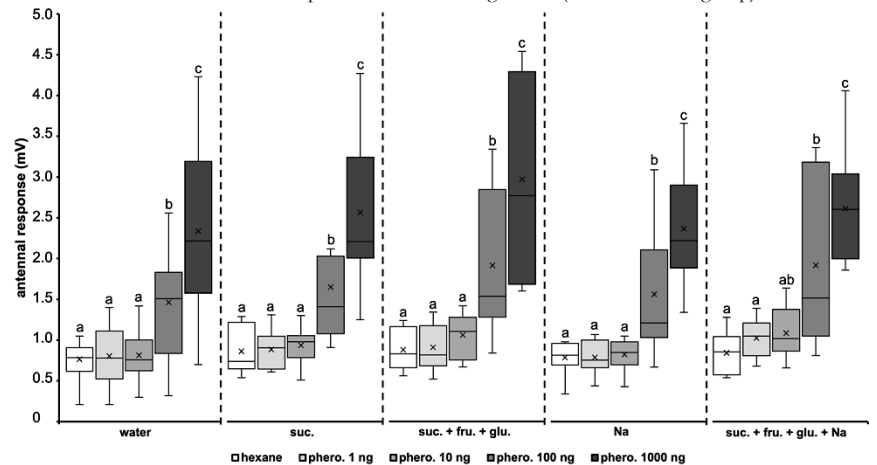
Figure 4. Diet effects on JH biosynthesis and JH signaling pathway (Met is JH receptor, Kr-h1 is a transcriptional factor).

In male *A. ipsilon*, **AipsOR3** is specific for **Z7:12Ac** pheromonal molecule [5].

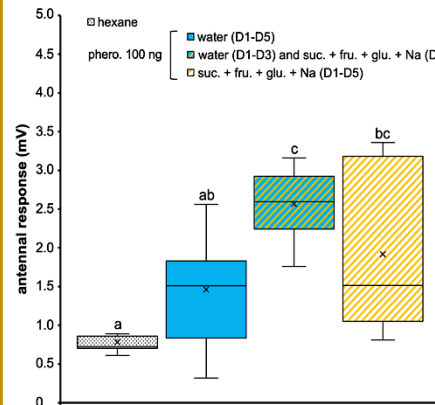
→ Would diet impact **AipsOR3** expression in Phe-ORNs through JH and/or actors of JH signaling pathway?

3. Results

↓ **Figure 1.** Antennal response after stimulation with different doses of sex pheromones according to diet (n = 10 for each group).



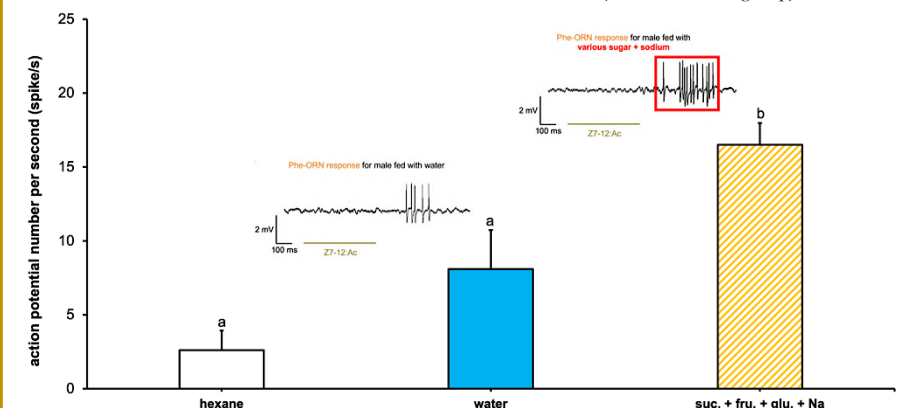
Various sugars and Na diet **decreases** the sex pheromone sensitivity threshold (Fig. 1).



← **Figure 2.** Antennal response after stimulation with 100 ng of sex pheromones for fasted males from D1 to D3 which we then fed with various sugar and sodium until D5 (n = 10 for each group).

Various sugars combined with Na **raise** the antennal response to female sex pheromones **immediately after consumption** (Fig. 2).

↓ **Figure 3.** Electrical activity of Phe-ORN after stimulation with 10 ng Z7:12:Ac (a pheromonal compound) for D5 males fed water or fed with various sugars plus sodium. Values correspond to mean ± SEM (n = 10 for each group).



A diet composed of **various sugars with Na increases** the response of Phe-ORNs to Z7:12:Ac pheromonal compound emitted by female (Fig. 3).

References

- Cardé, R.T., Baker, T.C. 1984. *Sexual Communication with Pheromones*. Springer, Boston, MA.
- Fleischer, J., Krieger, J., 2018. *Front Cell Neurosci.* 12, 425.
- Deisig, N., Dupuy, F., Anton, S., Renou, M., 2014. *Insects* 5, 399
- Lin, H.-H., Cao, D.-S., Sethi, S., Zeng, Z., Chin, J.S.R., Chakraborty, T.S., Shepherd, A.K., Nguyen, C.A., et al., 2016. *Neuron* 90, 1272–1285.
- Vandroux, P., Li, Z., Capoduro, R., François, M.-C., Renou, M., Montagné, N., Jacquin-Joly, E., 2022. *Front. Ecol. Evol.* 10.

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