Hyssopus pallidus, a candidate biocontrol agent of the codling moth

Silvia Dorn, Johanna Häckermann, Silke Hein, Claudia Notter

ETH Zurich, Switzerland

Parasitoid research at ETH: *Examples*

- **Flight distance of a released native parasitoid: *stable isotope marking***
- **Nutrition and flight: *computer-linked flight mill***
- **Olfactory orientation and parasitism: *selection for high-olfactory resp. strain***

Fruit - vegetables - stored products

www.em.ipw.agrl.ethz.ch

Hyssopus pallidus parasitizes the concealed caterpillar

- **Larval parasitoid *Hyssopus pallidus* *(*Hym. Eulophidae), native to Europe, with *Cydia pomonella* and *C. molesta* as only known hosts there**

  Wasp enters the fruit, paralyzes the host, oviposits

- **Ectoparasitoid**

  Most ancestral parasitoids: ectoparasitoids of concealed hosts

- **Strongly female-biased sex ratio. Contributes to favorable rapid scale-up of mass-rearing procedure**

Mattiacci, Hütter, Dorn, 1999. Biol. Control 15: 241-251

Hausmann, Mattiacci, Dorn, 2005. Bull. Entomol. Res. 95: 429-436

Factors influencing adult behavior (I): Rearing environment

- **Biotic rearing environment:**

  High-quality parasitoids are obtained by exposing developing parasitoids to fresh apple odor

  Gandolfi, Mattiacci, Dorn, 2003.
  Proc. R. Soc. London B, 270: 263-2629

Research question:

- **Abiotic rearing environment?**
  Influence of cold temperature ?

  in biological control: short-term cold storage desirable but difficult to implement

Temperature experiment

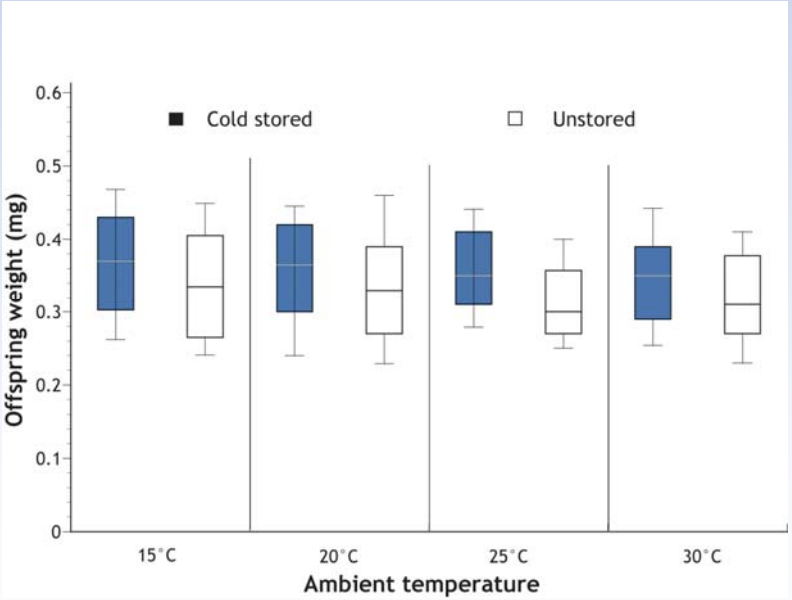
- **Objective:** To increase logistic flexibility

- **Approach:** Treatment 14 d at 4°C during pupal stage

  After adult emergence: performance assessed under different ambient temperatures

Effect of cold storage during rearing

- **No effect on parasitism capacity of the parental generation**
- **No effect on sex ratio of progeny**
- **Offspring number not reduced after release at 25° and 30°C**



N = 100
$p < 0.01$

Häckermann, Rott, Tschudi-Rein, Dorn 2008. BioControl

- **Significant and consistant effect on offspring weight:**
  Increased offspring weight of cold stored parasitoids

Factors influencing adult behavior (II): Adult environment

- **Adult abiotic environment:**

  Highest parasitism rate (irrespective of rearing temperature) when ambient temperature (at oviposition) reaches 20°C and more

  Häckermann, Rott, Tschudi-Rein, Dorn, 2008. BioControl

Research question:

- **Adult biotic environment?**
  Influence of nutrient source for adult females ?

  in biological control: efficiency after release outdoors

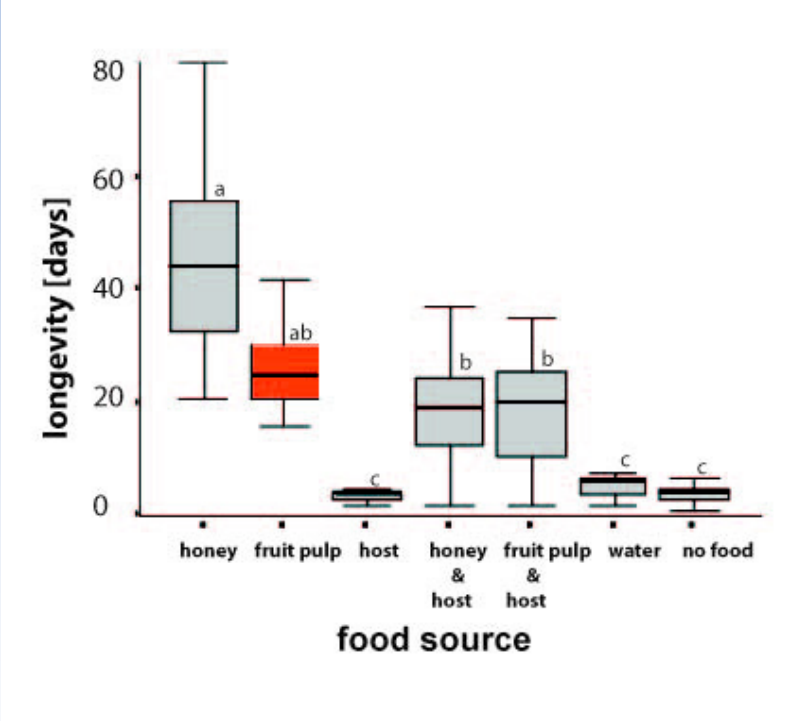
Nutrient source experiment

- **Objective:** To find accessible and suitable nutrient sources to enhance parasitoid survival and reproduction

- **Approach:** Testing easily accessible food sources: including
fruit pulp that becomes available after
fruit moth caterpillars bored into the apple

  Controls: water or no food
  Standard: honey

Effect of nutrient sources on adult females



Kruskal-Wallis *H* test
with Nemenyi post hoc test,
$p < 0.05$

Hein, Dorn, 2008.
Biological Control 44: 341-348

- **No effect of host feeding on lifespan**
- **Significant increase of lifespan (as well as on lifetime reproduction) by using fruit components**

Summary and conclusions: Ectoparasitoid *Hyssopus pallidus*

- Short-term cold storage
  at the pupal stage of this ectoparasitoid
  can be made without quality loss,
  thus allowing flexibility in production logistics.
  Adults even benefit from a short-term
  cold storage at their pupal phase

- Apparently, this parasitoid uses fruit components as a nutrient source to increase longevity and fertility.
  Female parasitoids in the field
  may thrive solely on the plant tissue
  damaged by their host caterpillars

For literature:
www.em.ipw.agrl.ethz.ch