

## **43-2 - Effect of fungal colonization of wheat grains with *Fusarium* spp. on food choice, weight gain and mortality of meal beetle larvae (*Tenebrio molitor*)**

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Species of *Fusarium* have significant agro-economical and human health-related impact by infecting diverse crop plants and synthesizing diverse mycotoxins. Here, we investigated interactions of grain-feeding *Tenebrio molitor* larvae with four grain-colonizing *Fusarium* species on wheat kernels. Since numerous metabolites produced by *Fusarium* spp. are toxic to insects, we tested the hypothesis that the insect senses and avoids *Fusarium*-colonized grains. We found that only kernels colonized with *F. avenaceum* or *Beauveria bassiana* (an insect-pathogenic fungal control) were avoided by the larvae as expected. Kernels colonized with *F. proliferatum*, *F. poae* or *F. culmorum* attracted *T. molitor* larvae significantly more than control kernels. The avoidance/preference correlated with larval feeding behaviors and weight gain. Interestingly, larvae that had consumed *F. proliferatum*- or *F. poae*-colonized kernels had similar survival rates as control. Larvae fed on *F. culmorum*-, *F. avenaceum*- or *B. bassiana*-colonized kernels had elevated mortality rates. HPLC analyses confirmed the following mycotoxins produced by the fungal strains on the kernels: fumonisins, enniatins and beauvericin by *F. proliferatum*, enniatins and beauvericin by *F. poae*, enniatins by *F. avenaceum*, and deoxynivalenol and zearalenone by *F. culmorum*. Our results indicate that *T. molitor* larvae have the ability to sense potential survival threats of kernels colonized with *F. avenaceum* or *B. bassiana*, but not with *F. culmorum*. Volatiles potentially along with gustatory cues produced by these fungi may represent survival threat signals for the larvae resulting in their avoidance. Although *F. proliferatum* or *F. poae* produced fumonisins, enniatins and beauvericin during kernel colonization, the larvae were able to use those kernels as diet without exhibiting increased mortality. Consumption of *F. avenaceum*-colonized kernels, however, increased larval mortality; these kernels had higher enniatin levels than *F. proliferatum* or *F. poae*-colonized ones suggesting that *T. molitor* can tolerate or metabolize those toxins.

## **43-3 - Chemical ecology in stored product protection: The impact of host odor cues on host location by *Holepyris sylvanidis*, a natural enemy of *Tribolium confusum***

*Chemische Ökologie im Vorratsschutz: Der Einfluss von Wirtsgeruch bei der Wirtssuche von Holepyris sylvanidis, einem natürlichen Antagonisten von Tribolium confusum*

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Most stored food products are highly endangered by insect infestation which often is followed by fungal or bacterial infection provoking global losses of food every year (Adler, 2010). Instead of using harmful pesticides which can cause tremendous costs, food contamination and pest resistance, novel and environmentally-friendly control methods for management of stored product pests are required. Parasitoids are able to control and regulate the population density of many host species (Jervis et al., 2008), and their application as biological control agent against pest insects has been shown to be a promising approach (i.a. Flinn and Schöller, 2012). In order to

improve such biological control methods for protection of stored food products it is essential to deepen and broaden our knowledge of the factors that drive the parasitoid's host location.

In the present study we investigated how naturally occurring chemicals mediate interactions between the larval parasitoid *Holepyris sylvanidis* (Hymenoptera: Bethylidae) and the confused-flour beetle *Tribolium confusum* (Coleoptera: Tenebrionidae). *T. confusum* is one of the most important stored product pests in the food processing industry, and its larvae are the preferred host of *H. sylvanidis*. Preliminary studies indicated that *H. sylvanidis* females are attracted to volatiles from *T. confusum* larval feces and infested wheat grist. We aimed to identify the chemicals which mediate the host location behavior of *H. sylvanidis* and which could be useful for biological control of *T. confusum*.

Host odors (larval feces, infested wheat grist) and habitat odors (non-infested wheat grist) were collected and analyzed by coupled gas chromatography–mass spectrometry (GC-MS). The parasitoid's physiological response to host and habitat odors was tested by coupled gas chromatography-electroantennographic detection (GC-EAD). Active compounds were additionally analyzed by electroantennography (EAG). Behavioral responses of naïve *H. sylvanidis* females to host and habitat odor samples and authentic compounds were monitored in a static 4-field olfactometer according to Steidle and Schöller (1997).

### Conclusion

We identified several volatiles common in host and habitat odor, and some compounds that were detected exclusively in host odor. One electrophysiologically active host odor compound also attracted *H. sylvanidis* in olfactometer bioassays and therefore, is considered as key component to guide the parasitoid to its host.

### Literatur

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## 43-4 - Chemotaktische Orientierung der Eilarve der Dörrobstmotte *Plodia interpunctella* hin zu Pflanzenerzeugnissen und Lebensmitteln

*Chemotactic orientation of neonate larvae of the Indianmeal moth Plodia interpunctella towards stored products and food items*

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Vorratsschädliche Insekten finden gelagerte Pflanzenerzeugnisse, Lebens- oder Futtermittel nach den von diesen abgegebenen typischen Duftstoffprofilen. Die chemotaktische Orientierung adulter Dörrobstmotten wurde nachgewiesen und gasförmige Reinsubstanzen identifiziert, die durch Sensillen auf den Antennen der Motten wahrgenommen werden können (Olson et al. 2005, Uechi et al. 2008, Ndomo et al. 2012). Mit Eilarven wurde in der Vergangenheit wiederholt versucht, eine Orientierung nachzuweisen. Dies ist nun in Versuchen erstmals gelungen. Dazu wurde eine Petrischale mit 184 mm Innendurchmesser in vier gleich große Sektoren eingeteilt. Am Rand eines Sektors wurden in einer Breite von 10 mm potenziell attraktive Pflanzenerzeugnisse (z.B. Weizenkleie, Hibiskustee, Mandelbruch) oder Lebensmittel (Bruch von Nussschokolade) ausgebracht. Eilarven im Alter von ca. 12-48 Stunden wurden einzeln im Zentrum der Petrischale ausgesetzt