

observation. Mortalities and F1 adults of *T. confusum*, *R. dominica*, and *S. granarius* was significantly changed by the rates of diatomaceous earth. In untreated wheat mortality was less than 10% for three species. Mortalities at 2000 mg/kg wheat applications at the end of 4-week of exposure against *S. granaries* were found to be 95.6% and 98% for SilocoSec and local DE, respectively. For *R. dominica* adults, mortalities were recorded as 90% and 92.4% for SilocoSec and local DE, respectively. Additionally, mortality of *T. confusum* at 2000 mg/kg wheat was 100% for both DE samples. Results showed that local DE and SilocoSec are equally effective against three major stored grain pests.

## **The Effectiveness of Silicosec, Diatomaceous Earth Against the Lesser Grain Borer, *Rhyzopertha dominica* (L) (Coleoptera: Bostrichidae)**

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### **Abstract**

In this research, the efficacy of SilicoSec was assessed in two sets of experiments. In the first set of experiment, the efficacy of SilicoSec at the rates of 0, 250, 500, 1000, 1500, 2000, 2500 and 3000 mg/kg wheat were evaluated against *Rhyzopertha dominica* adults at 55% r.h and 25°C. Insect counts were performed at the end of 3 week of exposure for the mortality. F1 progeny assessment were made after 8 weeks.

In the second set of experiment, the efficacy of SilicoSec against the same insect pest was evaluated at dose rates of 0, 250, 500, and 1000 mg/kg wheat for three months of exposure. In each experimental vial there were 10 adults per 250 g wheat with 10 replicates. Insect counts as dead and alive were made at the end of three months of exposure. For each vial, progeny production was determined as total insects excluding 10 adults introduced at the beginning of the experiment.

According to results, increase in dose rates increased the adult mortality, while it decreased the progeny production. As the exposure time increased, mortality rates were also increased. At the dose of 2000 mg/kg, 98.5% adult mortality and 10.55 adult progeny per vial were obtained.

For three months exposure, population development was inversely proportional to dose rates. According to results, increase in dose rates increased the adult mortality, while it decreased the progeny production. Population confinement was achieved at 1000 mg/kg dose rate of SilicoSec for three months of exposure.

**Key words:** Diatomaceous earth; *Rhyzopertha dominica*; exposure interval; progeny production; mortality

## **Host-preference and parasitic capacity of five *Trichogramma* species (Hym.: Trichogrammatidae) against some stored product moth pests**

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### **Abstract**

Most stored product insects are either beetles or moths. Moth pests are important hazards to the storage of a wide variety of products. Natural enemies are applied commercially against stored-product moths in Central Europe. So, the host-preference and parasitic capacity of four local *Trichogramma* spp. (*T. bourarachae*, *T. cordubensis*, *T. euproctidis* and *T. cacoeciae*), towards four species of stored product moth eggs were investigated in laboratory experiments in order to select new candidate species for use in mass rearing and biological control against moths in storages. The results were compared with *T. evanescens*, the common wasp used commercially for biological control. The naturally occurring *Trichogramma* species were collected for the first time in Egypt from two representative olive growing areas in arid area (170 km south of Alexandria) and semi-arid area (60 km west Alexandria, near the coast). All these wasps were also bred from naturally parasitized host eggs during

favorable and even at unfavorable temperature conditions of June-August. The presence of warm weather wasp-strains may suggest the existence of well-adapted wasp species or strains which may be appropriate candidates for the control of stored product pests. The strains had also been collected in late winter and summer, thus demonstrating activity also during less favorable weather conditions, raising again the possibility of using these egg parasitoids as an inundative biological control agent in stored products.

Experiments were carried out by offering eggs of the Indianmeal moth *Plodia interpunctella* (Hübner), the Mediterranean flour moth *Ephesia kuehniella* Zeller, the warehouse moth *E. elutella* (Hübner), and the almond moth *Cadra cautella* (Walker) in choice and no-choice assays to a single female parasitoid. Two different choice experiments were used to certify the same conclusion in both methods. The bioassay for host-preference of *Trichogramma* spp. was carried out by offering a single female wasp the choice between equal numbers of host eggs on square cards "Petri dish tests" and /or strip cards "strip card tests". In both methods, counting the number of *Trichogramma* developing in the host eggs (parasitism) show the preference of the wasp for ovipositing and indicated the ability of the parasitoid to develop in these eggs (i.e., host suitability).

In Petri dish tests, *E. kuehniella* was a highly accepted host species for *T. bourarachae*, *T. euproctidis*, and *T. cacociae* wasps while *E. elutella* and *C. cautella* eggs were more accepted by *T. evanescens* and *T. cordubensis*, respectively. In the strip card tests, *E. kuehniella* eggs were highly accepted by *T. bourarachae*, *T. cacociae* and *T. evanescens*. Eggs of *E. elutella* and *C. cautella* were more acceptable for *T. euproctidis* and *T. cordubensis*, respectively. Furthermore, a comparative study of the parasitic capacity of the *Trichogramma* spp. was carried out under 'no choice conditions' by exposing a freshly emerged single wasp to an unlimited number of host eggs. Significant differences were found among the parasitic capacity of the tested *Trichogramma* spp.: *T. bourarachae* showed a good parasitic potential against *S. cerealella* and *E. kuehniella*; *T. evanescens* and *T. cacociae* against *S. cerealella*; *T. cordubensis* against *S. cerealella* and *P. interpunctella* and *T. euproctidis* against *P. interpunctella*. However, dissection of host eggs with wasp-emergence holes showed that all tested wasps had a propensity to superparasitize the host eggs. Results of the present work suggest that the test wasps failed to discriminate parasitized hosts eggs among a large number of non-parasitized eggs, thus superparasitism occurred. Also, both of Petri dish and strip cards methods may underestimate the actual parasitization capacity due to self-superparasitism and mortality in black eggs that suffered desiccation during the early stages.

*T. cordubensis*, *T. euproctidis* and *T. bourarachae* showed promise for further investigation into selecting new biological control agents against some stored product lepidopterous pests.

**Keywords:** Stored product moths; *Trichogramma* spp.; host preference; parasitization capacity; superparasitism.

## Monitoring of the Indian meal moth and its parasitoids in long-term grain storage

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### Abstract

The Indian meal moth *Plodia interpunctella* became a major pest in bulk grain storage in Germany in recent years. Monitoring with adhesive pheromone-baited traps revealed a dependence of the number of generations of the moth from the temperature conditions in store, which themselves depend on insulation of the storage structure. The larval parasitoid *Habrobracon hebetor* was monitored with the help of cone traps placed in the grain. Baiting these traps with moth webbings significantly increased the number of female wasps trapped in 5 cm depth in wheat. Field trials showed both the pest and the beneficial can be monitored in stores, but more research is needed to develop a biological control strategy for *P. interpunctella*.

**Keywords:** stored products, bulk grain, Pyralidae, Trichogrammatidae, Braconidae

### Introduction

Monitoring of pest populations is a basic prerequisite for biological control of stored-product pests (Zimmermann 2004), but difficult in large quantities of bulk grain. Within the frame of a project on the application of beneficials in long-term grain storage of grain, the phenology of the Indian meal moth *Plodia interpunctella* (Hübner, 1813) (Lepidoptera, Pyralidae) was studied in different grain flat