

# Effects of shelf architecture and parasitoid release height on biological control of *Plodia interpunctella* (Lepidoptera: Pyralidae) eggs by *Trichogramma deion* (Hymenoptera: Trichogrammatidae)

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## Introduction

**Experimental Objective:** To explore the impact of shelving type, the presence of packaging, and release point on the foraging success of *Trichogramma deion* on eggs of the Indianmeal moth (*Plodia interpunctella* IMM) in the presence and absence of packaging.

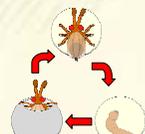
- IMM is a serious pest of finished stored products of worldwide distribution.
- Moths can be especially problematic in warehouses and retail stores, where they attack finished commodities and result in consumer complaints.
- Traditional management of IMM has centered on chemical treatments, however close proximity to consumers limits the use of many insecticides.
- Biological control using egg parasitoids in the genus *Trichogramma* is one potential alternative pest management strategy.
- The variety of shelving types in a typical warehouse or retail store environment may challenge the success of *T. deion* as a biological control agent for the Indianmeal moth.



Male *T. deion*



Male (left) and Female (right) *T. deion*



Life cycle of *T. deion*

*T. deion* is an endoparasite of Lepidopteran eggs and is generally applied as an inundative biological control tactic. 10 naïve females, aged between 12-16 hrs and allowed access to males and honey for at least 4 hours were released in appropriate arenas on day 1.



Typical Open Shelves

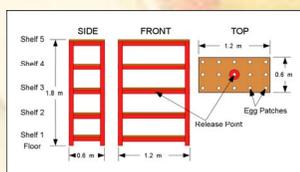


Typical Gondola Shelves

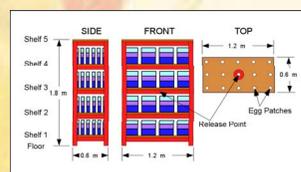
Products in finished stored product environments can be found in many storage types. Two of the most popular shelving types are: open (or warehouse) shelves and gondola shelves. Gondola shelves have a central divider, resulting in a more complex architecture and nearly twice as much surface area compared to open shelves.

## Materials and Methods

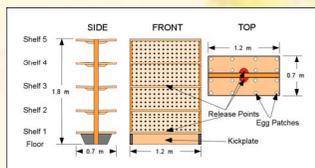
**Experimental Design:** 2 x 2 factorial design consisting of four treatments replicated 5 times. Factor one consisted of either open or gondola shelves while factor two consisted of either bare shelves or shelves with 24 empty cereal boxes. An additional empty gondola shelf treatment was added with *T. deion* released on the 1<sup>st</sup> shelf.



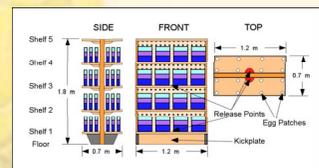
Open shelves w/out packages



Open shelves with packages



Gondola shelves w/out packages



Gondola shelves with packages

### Experimental Setup:

- Individual trials were run in walk-in growth chambers set at 24°C, 60%RH, with a 16:8 photo phase
- Sentinel egg patches consisting of 4 fresh IMM eggs were used to monitor *T. deion* host-foraging success
- Open shelves had 15 sentinel egg patches on each shelf and on the floor beneath the shelving unit while gondola shelves had 16 egg patches (8 on either side of divider)
- Approximately 500 female *T. deion* pupae were placed at the center of each shelf (250 per side for Gondola shelves) and allowed 48 hours to forage
- Sentinel egg cards were collected and graded after 7 days with black host eggs or eggs with eyespots graded as parasitized



Open shelf



Gondola shelf

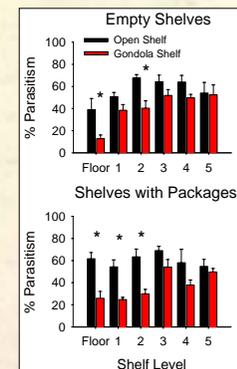


Sentinel egg patches unparasitized (Left) and parasitized (Right)

## Results

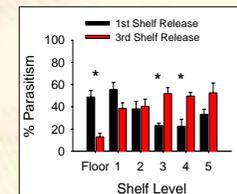
### Shelving Type Comparison:

- Percentage parasitism was significantly higher on open shelves versus gondola shelves below the release point.
- The overall vertical pattern of parasitism was less uniform on gondola shelves
- Packaging may have had a significant effect on percent parasitism on gondola shelves below the release point



### Release point Comparison:

- Trichogramma deion* parasitized more eggs on the top three shelves when released at shelf three
- Trichogramma deion* parasitized more eggs on the bottom two shelves and the floor when released at shelf one



## Conclusions

- Gondola shelving interfered with parasitism by *T. deion* this may have been due to increased surface area or more complex architecture compared with open shelves.
- Packaging may also have interfered with parasitism on gondola shelving but did not have an affect on open shelving.
- Release point location greatly influenced the vertical distribution of parasitism on gondola shelves, however much of the parasitism observed in first shelf releases was on the floor
- Therefore, a central release point on gondola shelves provides better overall coverage of product bearing surfaces
- Stored product managers need to take shelving type into consideration if *T. deion* is to be used as an inundative biological control for IMM.

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