

# Screening of North American species of *Trichogramma* Westwood (Hymenoptera: Trichogrammatidae) for control of the Indian mealmoth, *Plodia interpunctella* (Hübner) (Lepidoptera: Pyralidae)

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There are North American *Trichogramma* spp. that will accept *P. interpunctella* as a host.

## INTRODUCTION

Stored-product moths are among the major stored-product pests, infesting a wide variety of cereals and cereal based products. An alternative control method to synthetic chemical insecticide is to release parasitoid wasps of the genus *Trichogramma* Westwood into the stored-product environment. These chalcid wasps lay their eggs into the moth eggs, thus killing the eggs and preventing the development of the pest.

In Germany, the control of the Indian mealmoth *Plodia interpunctella* and the Mediterranean flour moth *Ephesia kuehniella* in food processing facilities is achieved by releasing large quantities of *Trichogramma evanescens* Westwood using the inundative release strategy. In Canada, *Trichogramma* species are commercially reared, and used to control field and glass house insect pests but it has not been used commercially in North America to control warehouse and food processing insect pests.

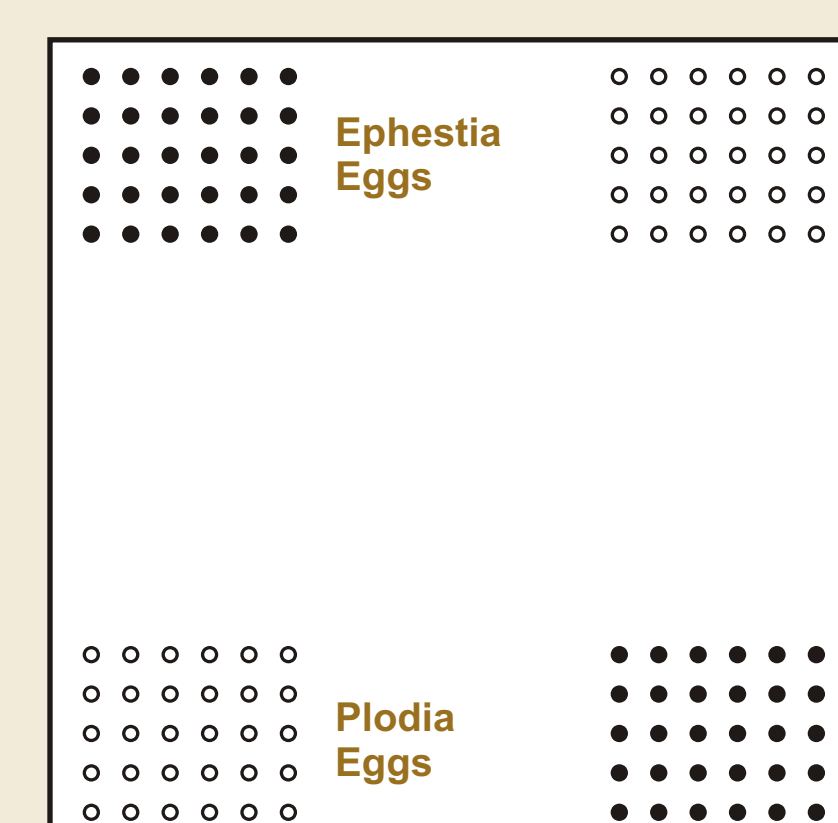


## OBJECTIVE

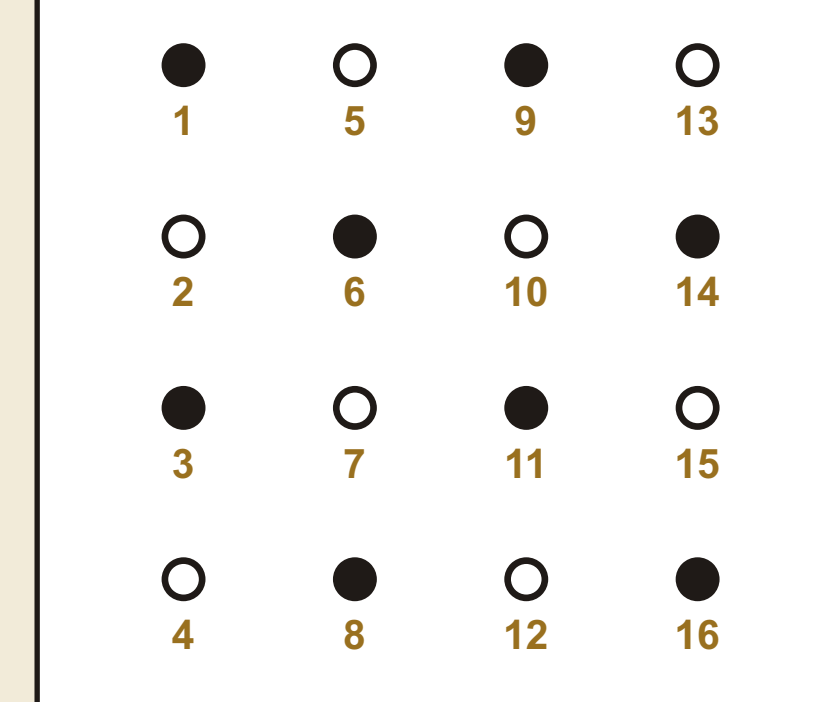
Given that it is impossible to assess a large number of strains under commercial conditions, the goal of this study was to assess in the laboratory the capacity of the many strains and species of *Trichogramma* available in North America to control *P. interpunctella*.

## MATERIALS AND METHODS

### Host-preference tests:

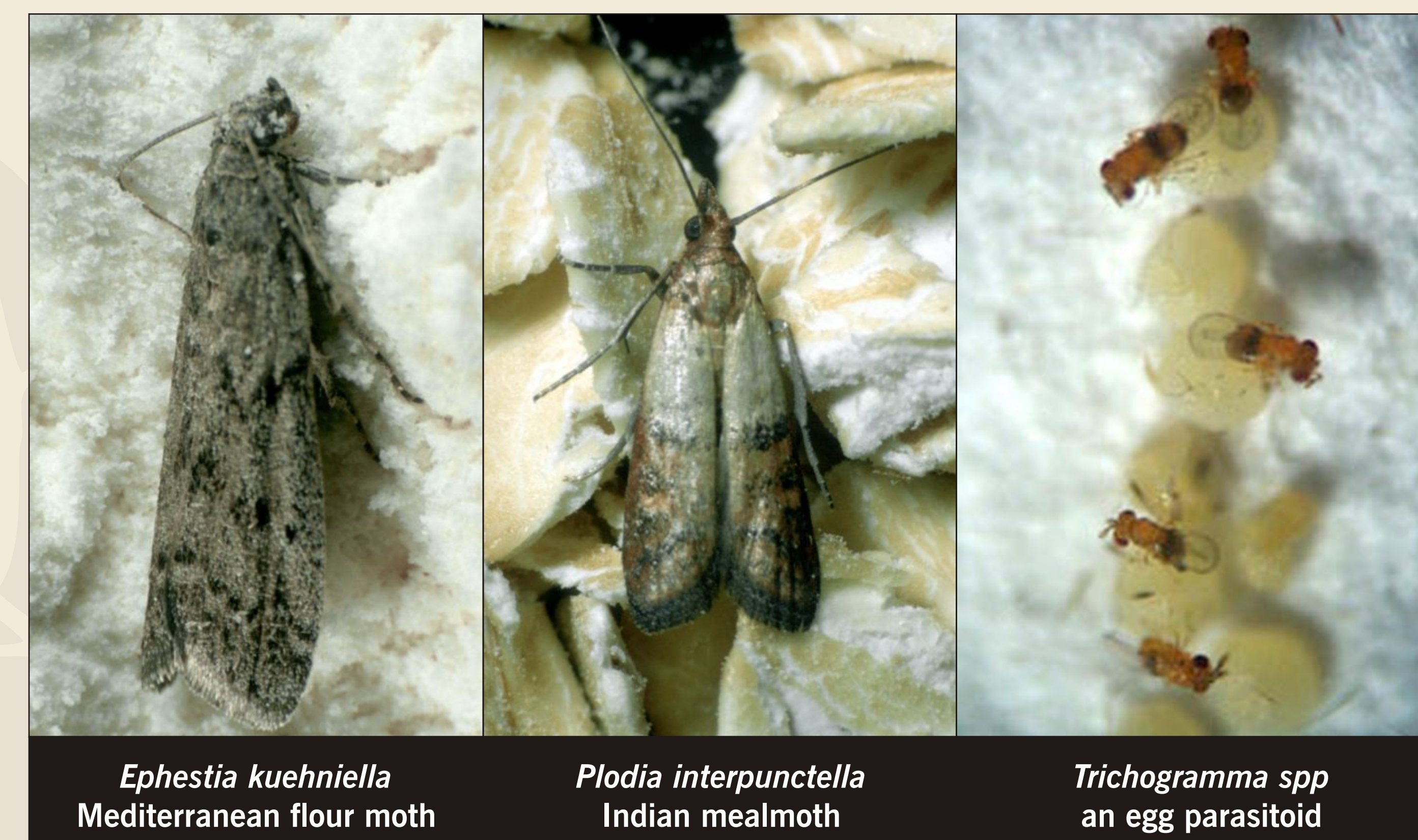


**Figure 1. The Hassan preference test:** The 60 eggs of *P. interpunctella* and 60 eggs of *E. kuehniella* are glued to a card and presented to one female *Trichogramma*. The percent emergence was recorded for each moth.



**Figure 2. The Dijken preference test:** The eggs of *P. interpunctella* or *E. kuehniella* were glued on a card, a *Trichogramma* female released onto the card and the card was video taped for 1 hour. The oviposition attempts and *Trichogramma* emergence were recorded.

### Insects:



### Fecundity Test:

One-day old *Trichogramma* females were given approximately 40 *P. interpunctella* eggs each day of their entire life. The longevity of the female, the number of moth eggs parasitized and the sex of the emerged *Trichogramma* were noted.

Table 1. Origin of the species and strains of *Trichogramma* studied

| Information   | <i>Trichogramma</i> species and strains    |                           |                           |                                  |                         |                              |                              |                                 |
|---------------|--|---------------------------|---------------------------|----------------------------------|-------------------------|------------------------------|------------------------------|---------------------------------|
|               | <i>T. evanescens</i> Westwood <sup>1</sup> | <i>T. pretiosum</i> Riley | <i>T. pretiosum</i> Riley | <i>T. deion</i> Pinto and Oatman | <i>T. minutum</i> Riley | <i>T. brassicae</i> Bezdenko | <i>T. sibericum</i> Sorokina | <i>T. minutum</i> Riley         |
| Strain        | Lager                                      | 5                         | USA                       |                                  | 12                      |                              |                              |                                 |
| Original host | <i>Heliothis armigera</i>                  | unknown                   | unknown                   | unknown                          | unknown                 | unknown                      | <i>Rhopobota naevana</i>     | <i>Choristoneura fumiferana</i> |
| Plant         | unknown                                    | sweat corn                | unknown                   | cranberry                        | blueberry               | unknown                      | cranberry                    | spruce                          |
| Country       | Egypt                                      | Canada                    | USA                       | Canada                           | Canada                  | Moldavia                     | Canada                       | Canada                          |
| Location      |  | QC                        | CA                        | QC                               | QC                      |                              | BC                           | ON                              |
| Collector     |  | F. Fournier               |                           | F. Fournier                      | F. Fournier             | F. Bigler                    | D. Henderson                 | S. Smith                        |

<sup>1</sup> *T. evanescens* is used in Germany for biological control of stored-product moths

## RESULTS

Table 2. The comparison of several *Trichogramma* species in various laboratory tests to evaluate their capacity to control *P. interpunctella*

| Test                          |   | <i>Trichogramma</i> species and strains |                       |                         |                 |                      |                     |                     |                   |
|-------------------------------|---|---|-----------------------|-------------------------|-----------------|----------------------|---------------------|---------------------|-------------------|
|                               |   | <i>T. evanescens</i> <sup>1</sup>       | <i>T. pretiosum</i> 5 | <i>T. pretiosum</i> USA | <i>T. deion</i> | <i>T. minutum</i> 12 | <i>T. brassicae</i> | <i>T. sibericum</i> | <i>T. minutum</i> |
| Time to emerge at 15°C (days) |   | 10                                      | 12                    | 14                      | 11              | 12                   | 11                  | 27                  | 21                |
| Hassan Test                   | <i>P. interpunctella</i> parasitized (%)          | 20                                      | 8                     | 17                      | 8               | 15                   | 8                   | 3                   | 3                 |
|                               | <i>E. kuehniella</i> parasitized (%)              | 53                                      | 42                    | 45                      | 40              | 35                   | 37                  | 27                  | 28                |
|                               | Ratio <i>Plodia</i> / <i>Ephesia</i>              | 0.38                                    | 0.20                  | 0.37                    | 0.21            | 0.42                 | 0.22                | 0.15                | 0.11              |
| Dijken Test                   | <i>P. interpunctella</i> parasitized (%)          |   | 39                    | 19                      | 49              | 50                   |                     | 13                  |                   |
|                               | <i>E. kuehniella</i> parasitized (%)              |   | 55                    | 49                      | 69              | 100                  |                     | 75                  |                   |
|                               | <i>P. interpunctella</i> Ratio Contact/Parasitism | 0.77                                    | 1                     | 0.78                    | 0.92            | 0.55                 |                     | 0.13                |                   |
|                               | <i>E. kuehniella</i> Ratio Contact/Parasitism     | 0.86                                    | 0.96                  | 0.61                    | 1               | 1                    |                     | 0.75                |                   |
| Fecundity on <i>Plodia</i>    | Longevity (days)                                  |   | 1.7                   | 2.6                     | 3.1             |                      |                     |                     |                   |
|                               | Females produced                                  |   | 8                     | 19                      | 13              |                      |                     |                     |                   |
|                               | Males produced                                    |   | 7                     | 0.3                     | 12              |                      |                     |                     |                   |
| Ranking                       |   | 1                                       | 2                     | 2                       | 2               | 3                    | 3                   | 4                   | 5                 |

<sup>1</sup> *T. evanescens* is used in Germany for biological control of stored-product moths

## CONCLUSIONS

- The Hassan preference test was not sufficient to select the best strain.
- The best strains available in North America are: *T. pretiosum* 5, *T. pretiosum* USA, and *T. deion*.
- We are currently testing *T. pretiosum* USA in warehouse trials to control *P. interpunctella* and *E. kuehniella* infestations.

## ACKNOWLEDGMENTS

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