The Influence of Colour Oil-Soluble Dyes on the Performance of Marked, *Mythimnia unipuncta* Moths

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Introduction

• Armyworms and cutworms (Lepidoptera: Noctuidae) are a group of at least seven moth pest species that affect canola and cereal crops in the Canadian Prairies. The larvae feeds on foliage and ultimately consume entire leaves[1] (Fig. 1)

Figure 1: Armyworm larvae

• Monitoring these economic pest moths has been achieved through the use of sex pheromones (Fig.2). However, pheromones are species-specific and attract only male moths. Feeding attractants, based on fermented sugars (acetic acid and 3-methyl-1-butanol) and floral compounds (phenyl acetaldehyde), is an alternative tool for attracting both sexes of multiple pests.

• In order to evaluate the efficiency of pheromone and feeding attractants, it is important to measure the attraction radius of these lures through mark-release-recapture (MRR) studies.[2]

• The use of oil-soluble dyes added in larval diets is an affordable, easily-incorporated method to internally mark moths.[3] However, it is crucial to determine if the dyes cause unfavourable side effects in the behaviour of marked moths to ensure an accurate study.

Figure 2: Feeding attractant trapcatch

Objective

- Determine the effect of colour oil-soluble dyes incorporated in larval diet on the performance of true armyworm moths (*Mythimnia unipuncta*)

Methods

- True armyworm larvae were reared on an artificial diet based on pinto beans. Colour dyes were diluted in cottonseed oil (CSO) and incorporated in the diet mix (500 ppm of colour dye in diet).
- Five treatments were evaluated (Fig. 3):
  - Black dye (Sudan Black B) + CSO.
  - Blue dye (Sudan Blue II) + CSO.
  - Red dye (Sudan Red 7B) + CSO.
  - CSO alone.
  - Control diet, neither dye nor CSO.

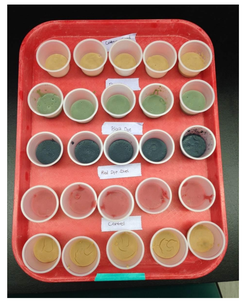

Figure 3: Diet Treatments

Methods

- Larvae were reared individually in 1 oz. cups in growth chambers under controlled conditions (23 ºC, 16:8 photoperiod, 70% RH).
- Larvae were monitored from egg until pupation, recorded as developmental time (Fig. 4). Following pupation, the pupal weight of 30 pupae per each treatment were recorded and analyzed as a proxy for adult fitness.
- Data was evaluated using a 1-way ANOVA. Means comparison was performed using Tukey's studentized range test. All analysis were performed in R 3.1.1.

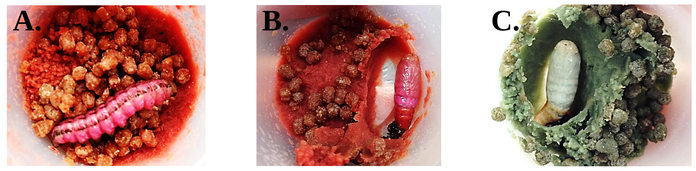

Figure 4: *M. unipuncta* A) Red dye + CSO larva. B) Red dye + CSO pupa. C) Blue dye + CSO pupa.

Results: Developmental Time

- Female individuals had a longer developmental time than male individuals (F1,127=8.66, p=0.003).
- Colour dyes treatment had a significant effect on developmental time (F4,127=56.95, p<0.001)

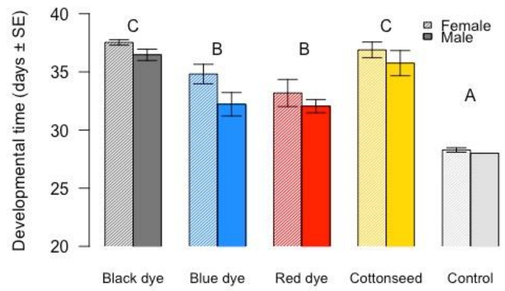

Figure 5: *M. unipuncta* Developmental Time From Neonate to Pupa for Five Treatments

- Control larvae took the lowest time to develop, followed by red and blue dye. Black dye and cottonseed oil treatments had the longest time.

Results: Pupal Weight

- There was no significant difference between female and male pupae (F1,127=0.93, p=0.334).
- Colour dyes treatment had a significant effect on pupal weight (F4,127=4.95, p<0.001)

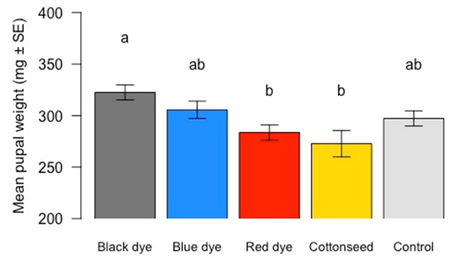

Figure 6: *M. unipuncta* Mean Pupal Weight for Five Treatments

- Cottonseed oil pupae had the lowest pupal weight amongst treatments, closely followed by red dye pupae. Blue dye and control were intermediates, and pupal weight was greatest in black dye.

Conclusions

- The dye solvent, cottonseed oil, increased the developmental time of the true armyworm larvae and influenced pupal weight. However, the pupal weight of the larvae reared on control diet was similar to the larvae reared on the other four treatments, implying no significant variation in adult fitness.
- Thus, the use of colour oil-soluble dyes show little to no effect on the fitness of the true armyworm, proving to be a useful technique in MRR studies.

Acknowledgements

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Literature Cited

1) Capinera, J. L. (2006). Armyworm, Pseudaletia unipuncta (Haworth) (Lepidoptera: Noctuidae).
2) Hagler, J. R., & Jackson, C. G. (2001). Methods for marking insects: current techniques and future prospects. Annual review of entomology, 46(1), 511-543. **3)** Zhao**, X. C., Wu, K. M., & Guo, Y. Y. (2008).** Oil-soluble dyes in larval diet used for marking Helicoverpa armigera. Entomologia experimentalis et applicata, 126(3), 256-260.