Investigating the role of abiotic factors, and dispersal on dynamics of striped and crucifer flea beetles (Coleoptera: Chrysomelidae) in canola

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Introduction

Stripped flea beetles, (*Phyllotreta striolata* (Fab.)) and crucifer flea beetles (*Phyllotreta cruciferae* (Goeze)) are major pests of canola and cause significant yield losses as high as $300 million (Dosdall and Mason 2010).

Fig.1 a) Striped flea beetle b) Crucifer flea beetle feeding on canola

(a) (b)

None of the available monitoring methods provide accurate forecasting for flea beetles (Soroka and Elliott 2011), and weather-based phenology models can help producers make informed decisions on timing and thresholds for flea beetle management.

Objectives

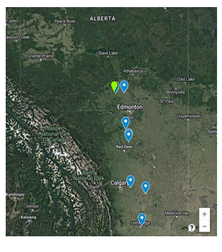
- Development of weather-based, stage structured deterministic predictive models for *P. striolata* and *P. cruciferae*
  - *Field monitoring*
  - *Lab studies*
  - *Overwintering studies*
- Study of dispersal of *P. striolata* and *P. cruciferae*

Material and Methods

Development of weather-based predictive models for *P. striolata* and *P. cruciferae*

Field populations of *P. striolata* and *P. cruciferae* were monitored weekly across central and southern Alberta using yellow sticky traps in 2021 (N= 10 sites) and 2022 (N=7 sites). Monitoring was timed to record overwintered adults (May- mid-June) and teneral adults (mid-July to August). At each site, portable hobos were installed to record air and soil temperatures at daily and hourly time steps.

Fig. 1 a and b. Flea beetle sampling sites for year (a) 2021 and (b) 2022



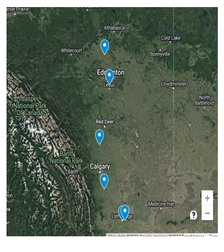
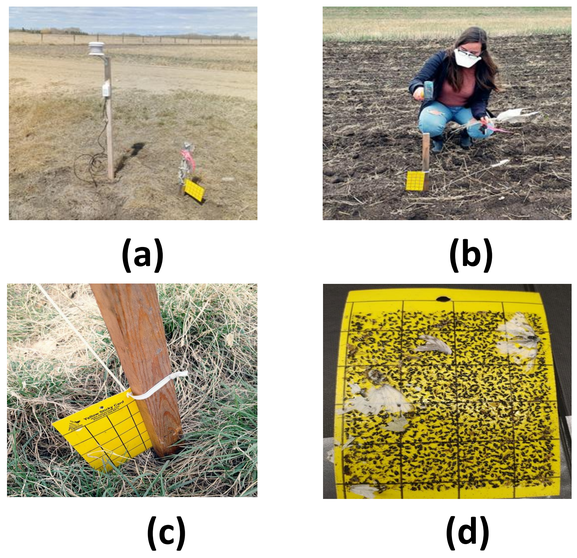


Fig. 1 a Fig. 1 b

Material and Methods

Fig.2. Field sampling methods



(a) (b)

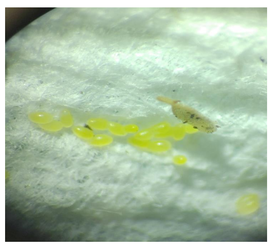
(c) (d)

Fig. 2 (a-c) Yellow sticky card set up paired with temperature hobo in commercial canola fields. d) A field collected yellow sticky card

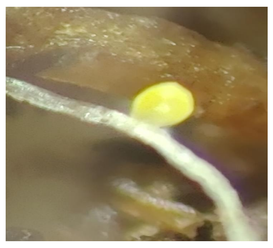
Temperature effects on flea beetle development

Development of all life stages of flea beetles was studied at the following temperatures: 10°, 15°, 20°, 25°, 30° C using controlled growth chambers. Studies will continue in 2023.

Fig. 3. a and b. (a) Eggs of striped flea beetles (b) Egg released on canola root to study development at different temperatures



(a)



(b)

Effect of overwintering conditions on the biology of flea beetles

Adult crucifer flea beetles were set up in mesh bags and buried in the soil in the fall of 2022 to understand effects of overwintering conditions on flea beetle survival. The survival analysis will be conducted in spring 2023.

Fig. 4. Overwintering study in the field

Study of flea beetle dispersal

We will measure the effect of biotic (physiological state) and abiotic conditions (light and temperature) on beetle flight capacity and dispersal ability using a computer-linked flight mill system under controlled conditions in 2023.

Results

Fig.5. Seasonal phenology of striped and crucifer flea beetles across survey sites

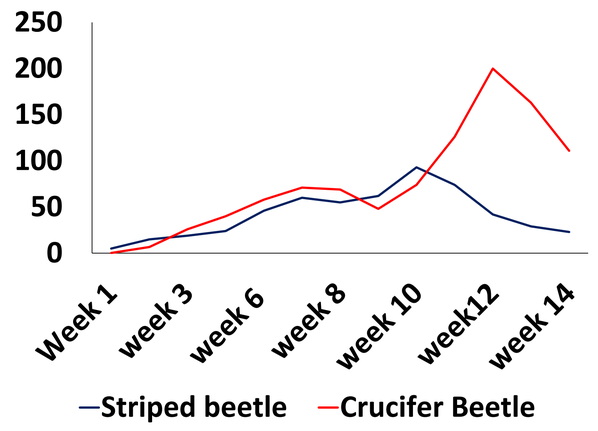
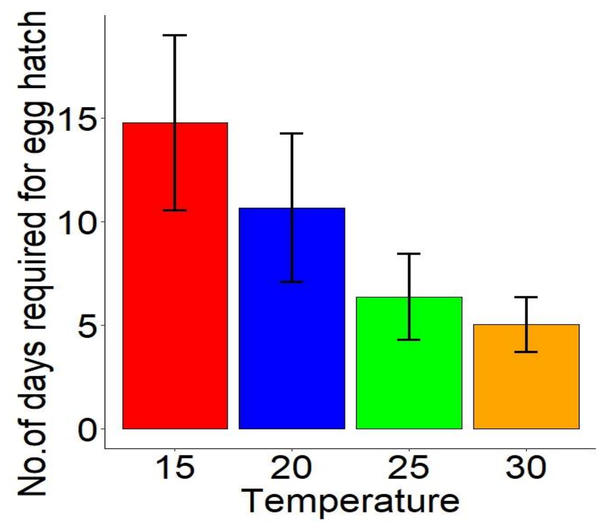


Fig.6. Mean number of days required for egg hatch for *P. striolata* at different temperatures



Temperature affected incubation time for eggs of *P. striolata*. Eggs hatched faster at higher temperatures compared to lower and mean duration was lowest at 30°C.

Benefit to industry

Weather-based predictive models can provide canola producers with firsthand forecasts on emergence and peak activity times of both species of flea beetles in canola helping them make informed decisions on timing the flea beetle management interventions. Precise forecasting will save unintended insecticidal spraying and costs also helping achieve sustainability goals

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References

Dosdall, L. M., and Mason, P. G. 2010. Key pests and parasitoids of oilseed rape or canola in North America and the importance of parasitoids in integrated management. In Biocontrol-based integrated management of oilseed rape pests. Edited by Williams, I. H. Springer Netherlands. Pp. 167-213

Soroka, JJ., and Elliott, B. (2011). Innovative methods for managing flea beetles in Canola. Prairie Soils and Crops, 4, https://prairiesoilsandcrops.ca/articles/volume-4-1-screen.pdf

Flea beetle images: https://www.google.ca/search?q=flea+beetle+images+canola+council&source=lnms&tbm=isch&sa=X&ved=2ahUKEwi25Navk_r7AhUOFTQIHa05DdgQ_AUoAXoECAIQAw&biw=1242&bih=538&dpr=1.1#imgrc=UaBnrxky7E3CcM