Flea beetle species

Two principal species on prairies:
- striped flea beetle - primarily in northern areas
- crucifer flea beetle – southern areas,
  traditionally the most damaging
- hop flea beetle – everywhere in low numbers

Flea beetle biology

adults emerge with warm weather in spring
move to crucifer fields as these germinate
feed, mate, lay eggs May – July, then die
larvae exit eggs in June - July
root feeders, do little damage
next generation adults emerge from pupation
July – Sept, feed until cold temperatures
Flea beetle damage

- adults are leaf feeders
- ‘shot-hole’ feeding
- cause seedling mortality
- reduced seedling growth
- delayed maturity
- pod shattering
- lower seed yield and grade
- annual losses $130-300M
Management

Primarily chemical control

– insecticide seed treatment –
  > 90% of canola seed is treated in Canada – up to 6 million ha
– foliar sprays at >25% damage – economic threshold
Flea Beetle Management Research

- planting date
- seed size
- seedling vigour
- zero tillage
- pheromones
- population monitoring
- host plant resistance
- species shift
Planting Date

- early planting and establishment of canola can prevent significant injury to young plants by migrating flea beetles

Dosdall, North Dakota Field Crop Insect Management Guide

BUT

- central and northern Alberta – more damage to canola planted in April than May

Cárcamo et al., 2008

SEED at temps warm enough for canola but cool for flea beetles
Seed size and seedling vigour

• Planting large seed from superior quality seed lots allows uniform and rapid crop establishment under variable growing conditions
  – maximizes seedling emergence, growth
  – plants are vulnerable to fb feeding injury for the least amount of time

Elliott et al. 2007, 2008
Seed and seedling vigour

- Seed lots with high germination in the standard germination test (>97%) and pre-chill test (>90%) provided the best establishment in warm and cool soils; seed lots with low electrical conductivity (<75 uScm⁻¹g⁻¹) provided the best establishment in minimum and zero tillage.

- Seed lots with a high vigour index (v.i.=1000 seed weight x %germination/100) (open pollinated cvs > 3.0, hybrids >4.5) provided the best plant growth and highest seed yield under differing growing conditions and tillage practices.

Fall seeding of canola

- if successful, fall seeding of canola can result in seedlings that are large enough to tolerate flea beetle feeding in the spring BUT
- need to decrease risk in fall seeding

Dosdall and Stevenson 2005

Tillage – Conventional vs Zero

- zero till seeding decreases damage from flea beetles compared to conventional tillage
  - zero till results in decreased temperatures and increased moisture at the soil surface
  - flea beetles prefer warm, sunny conditions

Dosdall et al. 1999
Flea Beetle Pheromone

- male *P. cruciferae* emit an aggregation pheromone that attracts both sexes (Peng et al. 1999)
- pheromone purified by Bartelt et al. (2001)
- field tests showed pheromone attracted flea beetles (Soroka et al. 2005)
  - positive dose response
  - response additive and synergistic with plant volatile allyl isothiocyanate
Unexpected Results

- pheromone attracted a flea beetle parasitoid

Implications

Possibility of using pheromone

- in early warning monitoring systems
- in direct mass trapping situations
- as a parasitoid attractant
Flea Beetle Population Monitoring

- overwintering mortality of flea beetles is generally low
- therefore, numbers seen in the fall might predict populations in the next spring

Monitoring by

- fall surveys
- various types of traps

Knodel, Soroka, Elliott
N. Dakota Flea Beetle Population Monitoring

Flea Beetles in Canola (late summer)

Season Final, 2010

No. beetles / 4 sweeps
- 0
- 1-10
- 11-25
- 25-50
- 51-100
- 100 +

Average number of Flea Beetles per 4 sweeps

www.ag.ndsu.nodak.edu/aginfo/ndipm/index.htm
2003 – Flea Beetle Year from Hell

Flea beetles near Saskatoon 2003

Prediction – 2004 – severe flea beetle damage
Saskatchewan Spring 2004

Colder, wetter than seen in several years

Flea beetle numbers very low
FB Host Plant Resistance

• different crucifers have varying attractiveness to flea beetles

Lamb, Palaniswamy, Dosdall, Gavloski, Elliott
FB Host Plant Resistance

- intergeneric host plant resistance – crossing *B. napus* (susceptible) with *Sinapis alba* (generally resistant) created plants with increased resistance to flea beetles

Gavloski et al. 2000
Hairy leaves impart resistance to flea beetles

• transgenic resistance - genes inserted from *Arabidopsis* to *B. napus*  
  Gruber et al. 2006

• lab and field trials – less feeding on hairy canola  
  Soroka et al. 2011
Flea beetle species shift

• in lab, striped flea beetles less susceptible to seed treatments than crucifer flea beetle (Tansey et al. 2008)
• use of seed treatments may be selecting for striped flea beetles
• survey undertaken to map dominant flea beetle species (Soroka 2009-11)
2010 Survey - Flea Beetle Species

Flea beetle species
- striped
- crucifer
- other

Canola production area
2010 Survey - Flea Beetle Numbers

Beetles/trap/day
- < 5
- 5-10
- > 10

Canola production area
Current work

Canola Cluster Funding

- determine biological differences between crucifer and striped fb
- determine causes of seed treatment failures

Elliott, Dosdall, Olfert, Olivier, Otani, Soroka
Future work

• should address the question –
“Why do we treat 6 million hectares of canola seed every year to combat an insect that is a pest only in some locations in some years?”