Varroa mite migration into colonies: how it increases mite populations and presents new problems for Varroa control

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Why are Varroa such a problem?

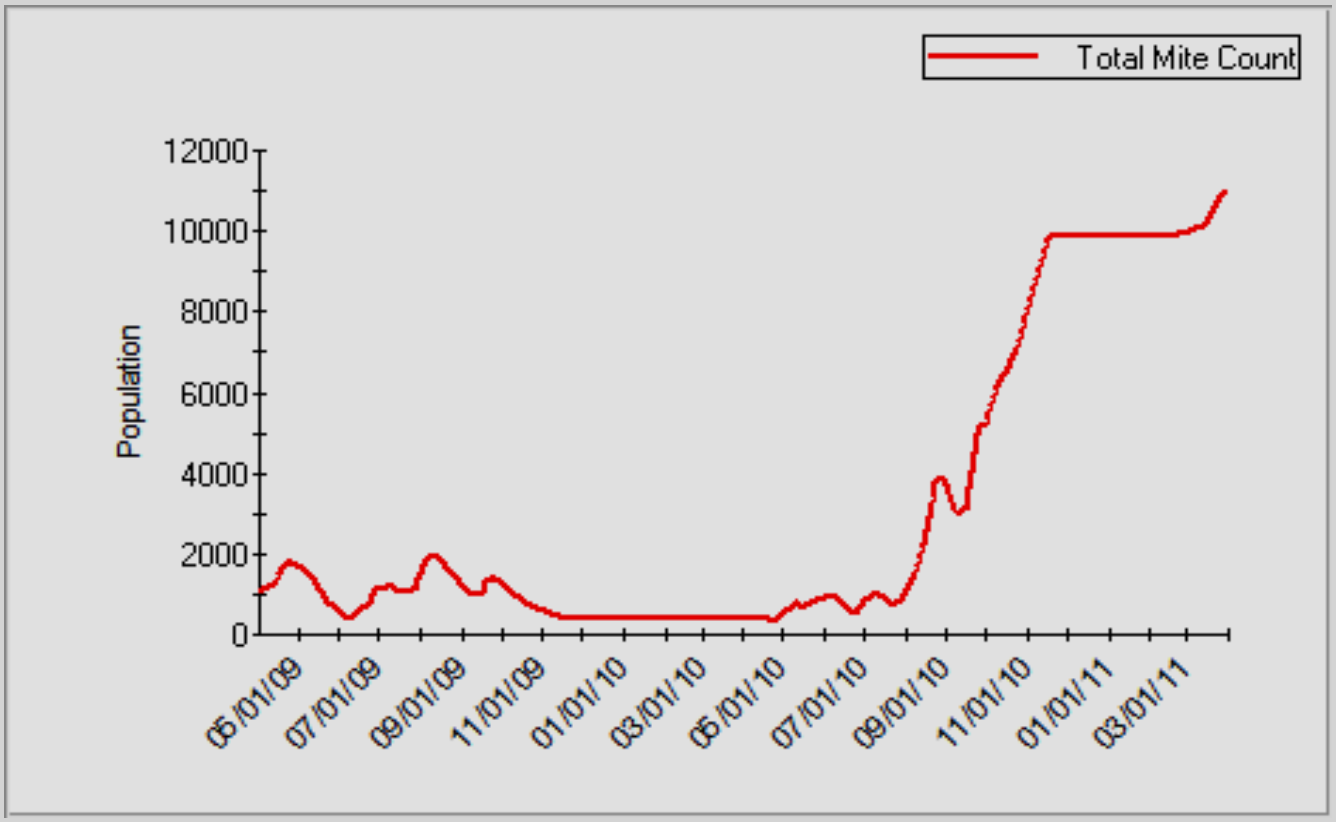
- Reproductive rates are not very high
  - Each invading ‘mother mite’ can produce about 1.5 mated female offspring in worker cells and 2.7 in drones (Fries et al. 1994; Martin 1998).
- Takes 2-3 years before populations impact colonies (Boecking and Genersch 2008; Genersch 2010; Rosenkranz et al. 2010).

VARROAPOP Program

Honey bee and Varroa mite population dynamics model

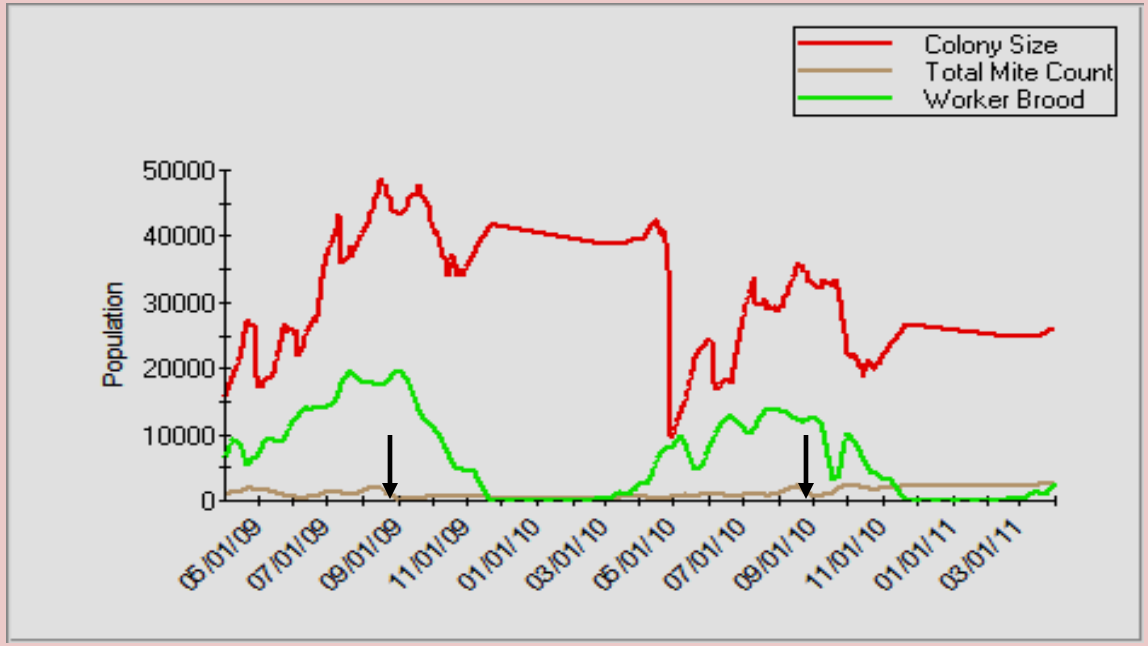
DeGrandi-Hoffman G, and Curry R (2004) Int J Acarol 30:259–274

Mite population growth

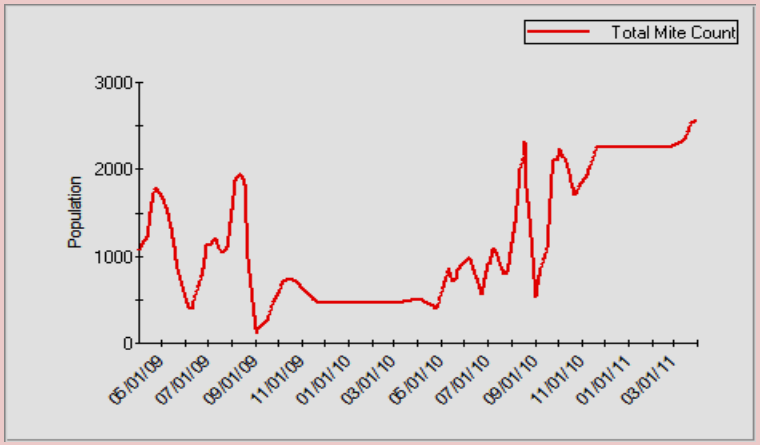


DeGrandi-Hoffman G, and Curry R (2004) Int J Acarol 30:259–274

Mite and colony population growth
Miticide applications in August each year



Mite population

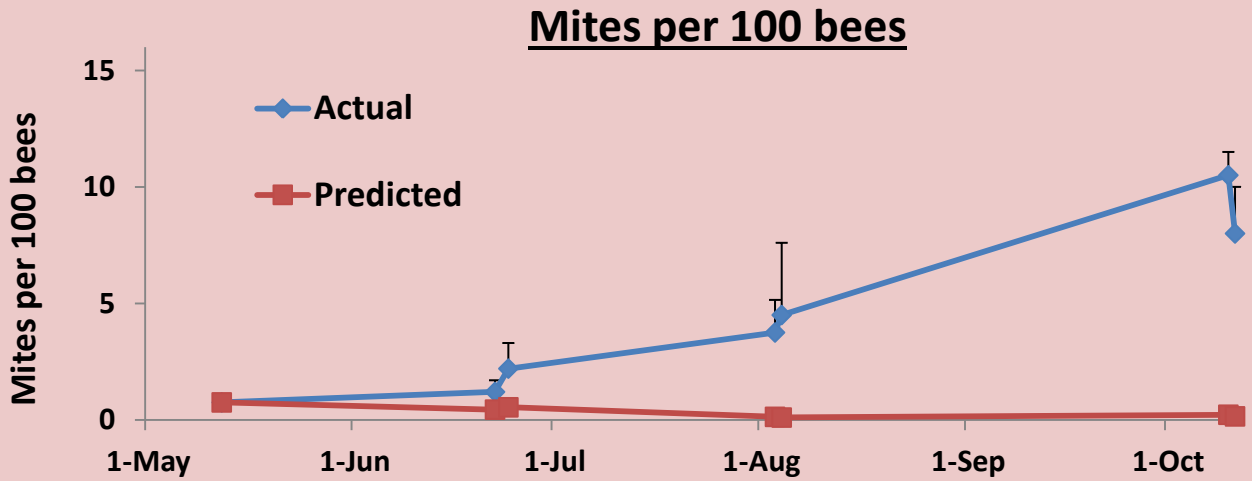


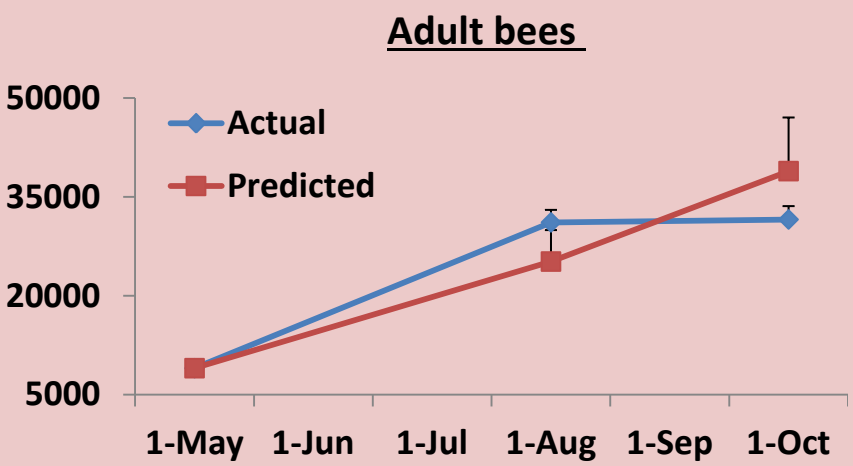
DeGrandi-Hoffman G, and Curry R (2004) Int J Acarol 30:259–274

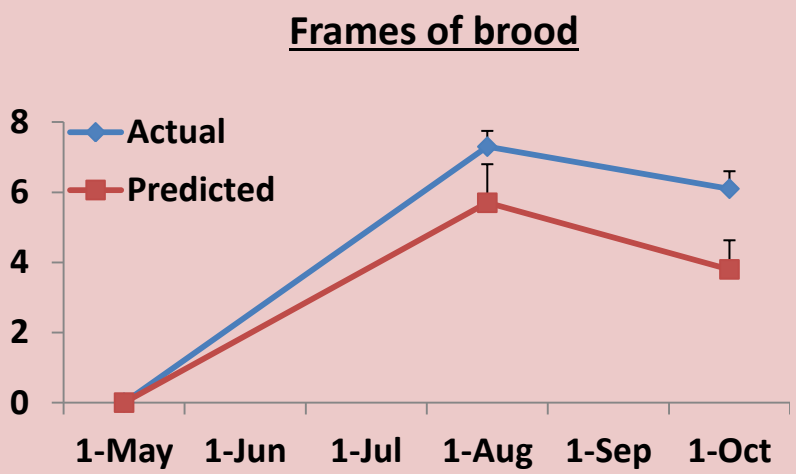
What’s happening now

(treat in April and then September)

Varroa Population Growth







DeGrandi-Hoffman et al. 2014 J. Appl. Exp. Acar. 64: 171-186

Mite migration

- Reports in the literature:
  - Sakofski F, Koeniger N, Fuchs S (1990) Seasonality of honey bee colony invasion by *Varroa jacobsoni* Oud. Apidologie 21:547–550
  - Kraus B, Page RE Jr (1995) Population growth of Varroa jacobsoni Oud. in Mediterranean climates of California. Apidologie 26:149–157
  - Delaplane KS, Hood WM (1999) Economic threshold for Varroa jacobsoni Oud. in the southeastern USA. Apidologie 30:383–395
  - Kralj J, Fuchs S (2006) Parasitic *Varroa destructor* mites influence flight duration and homing ability of infested *Apis mellifera* foragers. Apidologie 37:577–587
  - Frey E, Schell H, Rosenkranz P (2011) Invasion of *Varroa destructor* mites into mite-free honey bee colonies under controlled conditions of a military training area. J Apic Res 50:138–144
  - Frey, E. Rosenkrantz. 2014. Autumn invasion rates of *Varroa destructor* (Mesostigmata: Varroidae) into honey bee (Hymenoptera: Apidae) colonies and the resulting increase in mite populations. J. Econ. Entomol. 107(2): 508-515

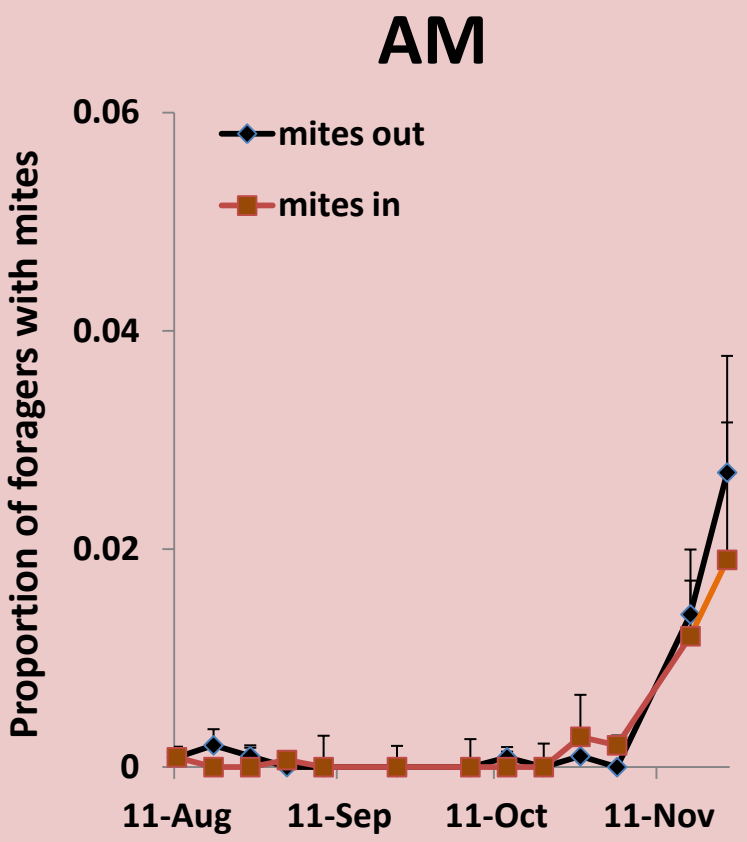
Examining the role of migration on mite population growth

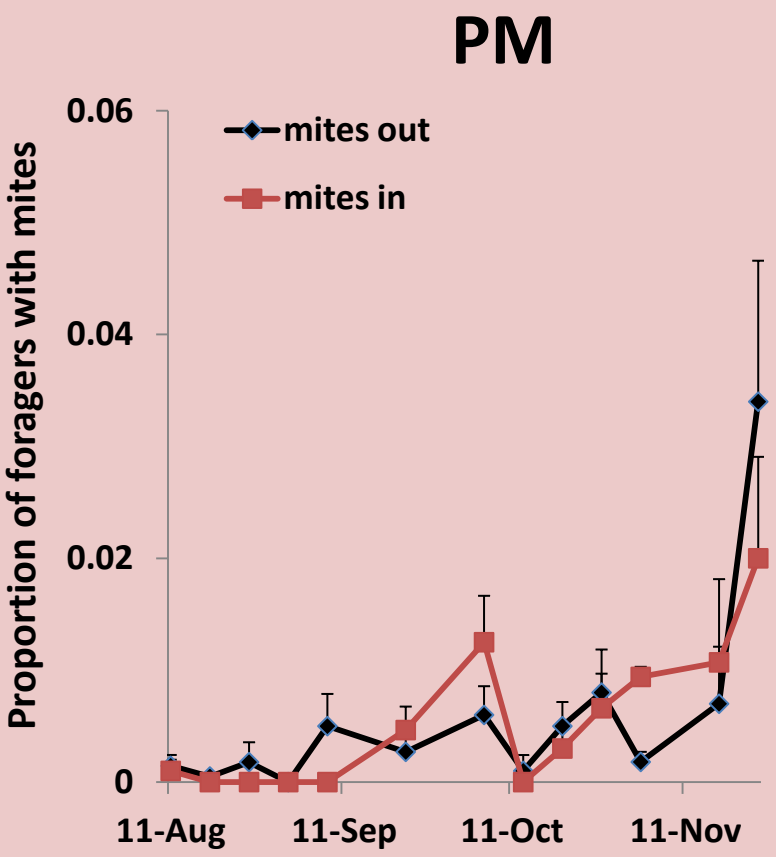
- Started with package bees – 2 sites, 20 colonies per site
- Monitored mite populations starting before first sealed brood
- Monitored colony population growth
- Measured the proportion of foragers with mites
  - incoming and outgoing

Colony set up for mite migration measurements

Measuring migration

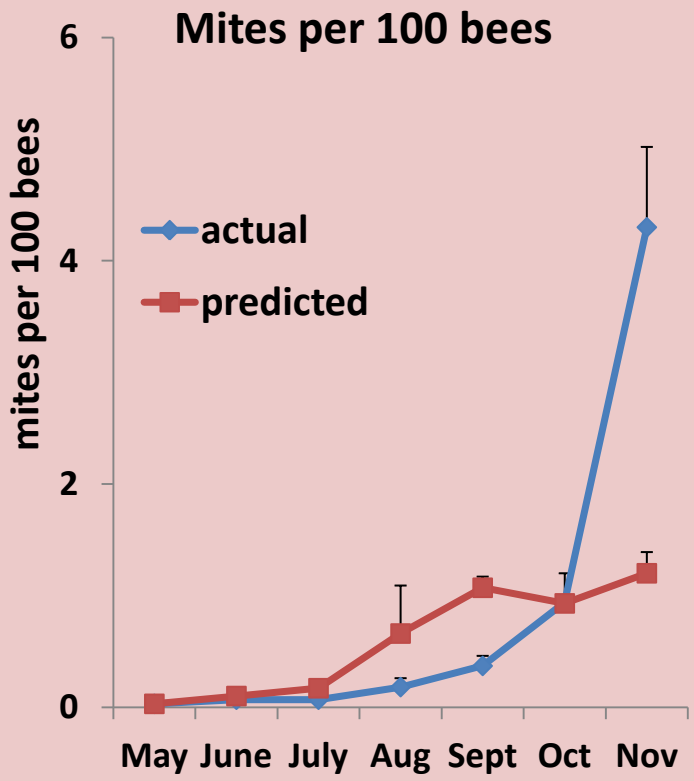
Mites on foragers site-1

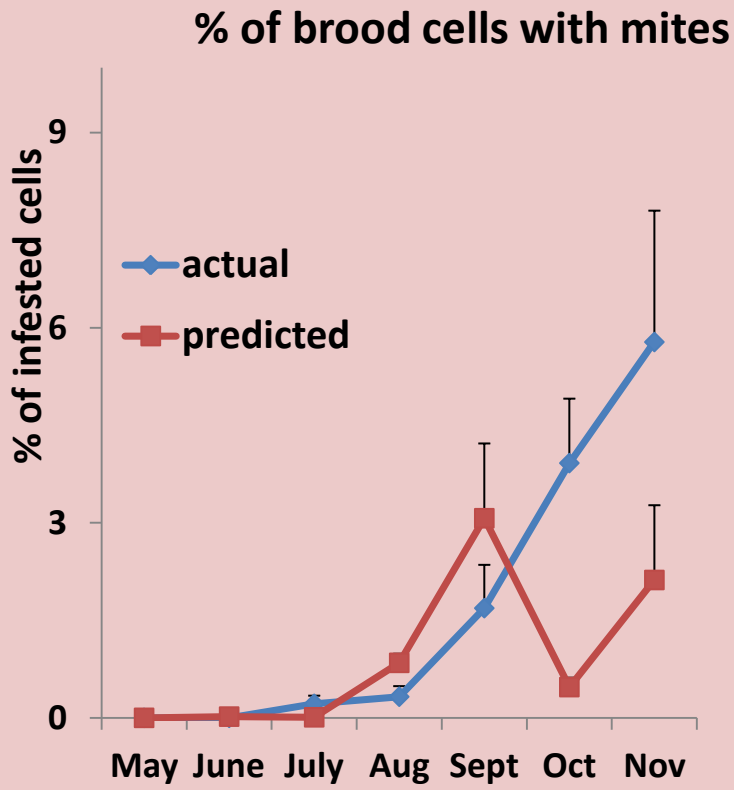




Mite population growth

site-1

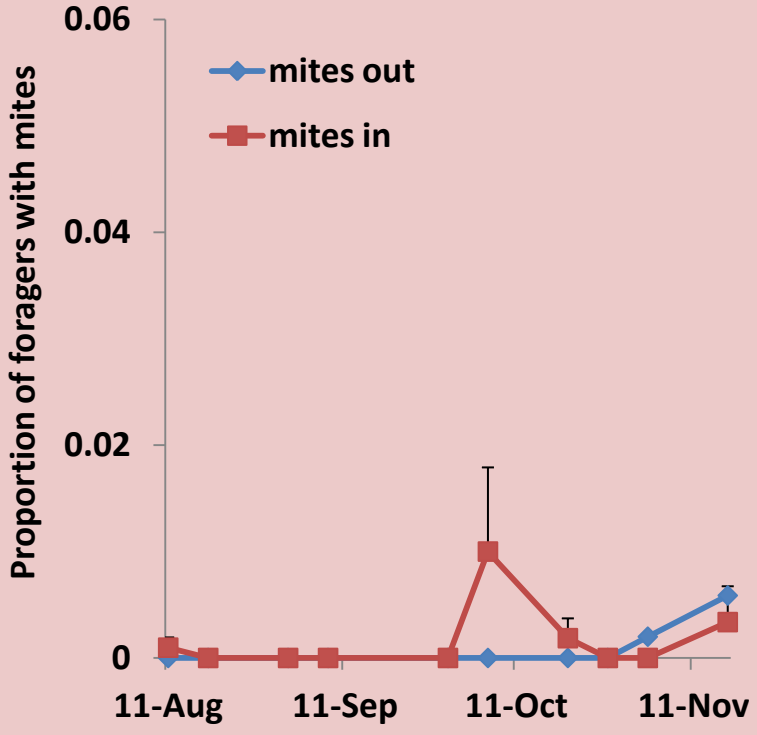




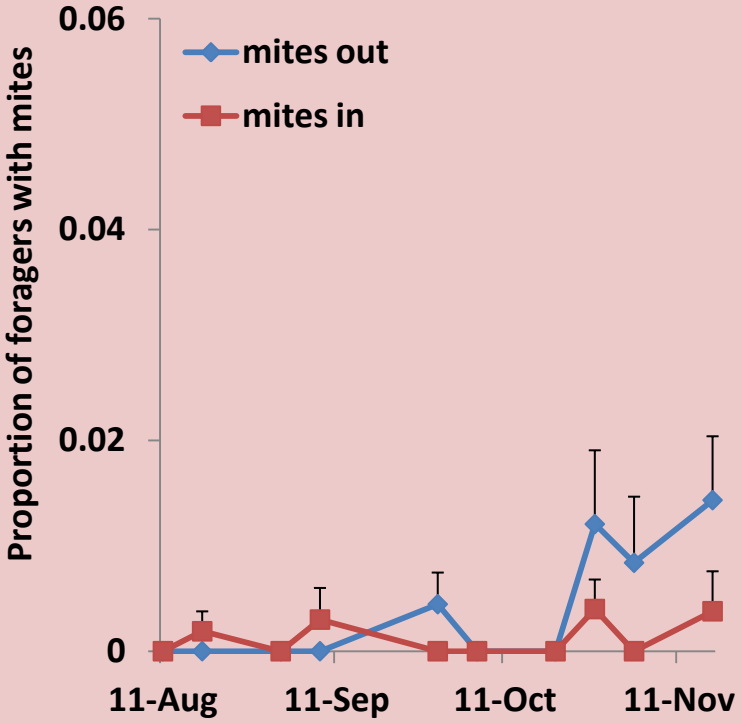
Mites on foragers

Site-2

AM

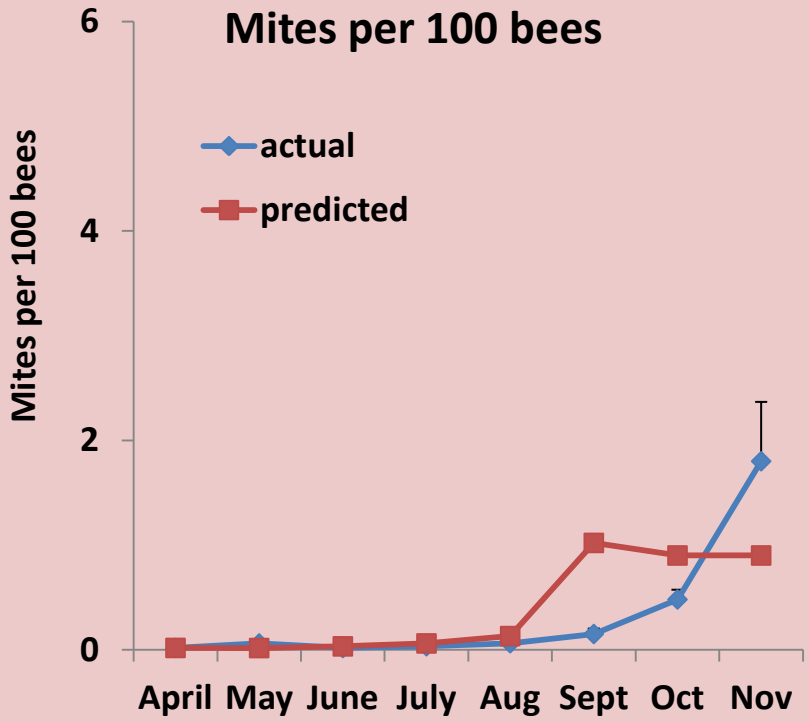


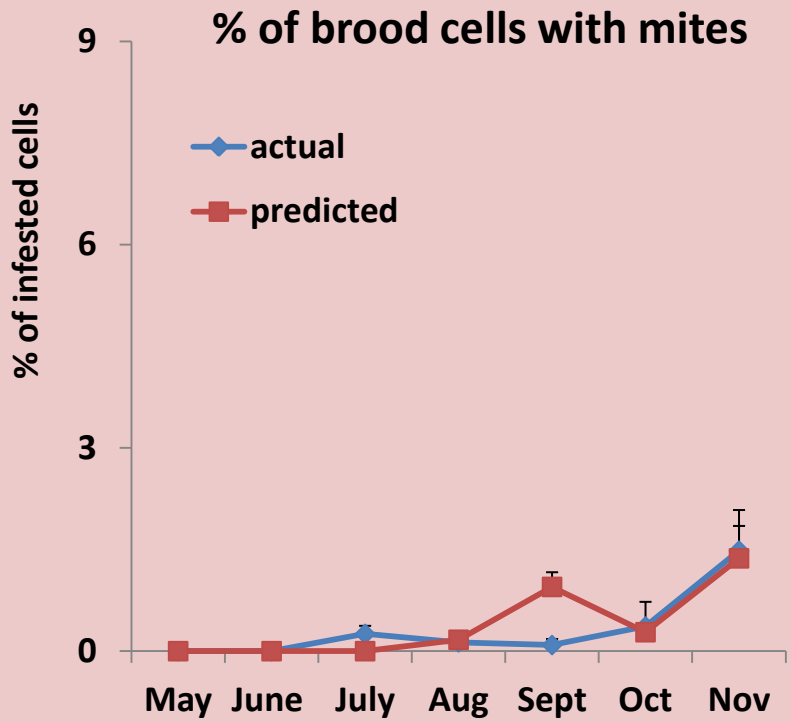
PM



Mite population growth

Site-2





Factors affecting Varroa population growth

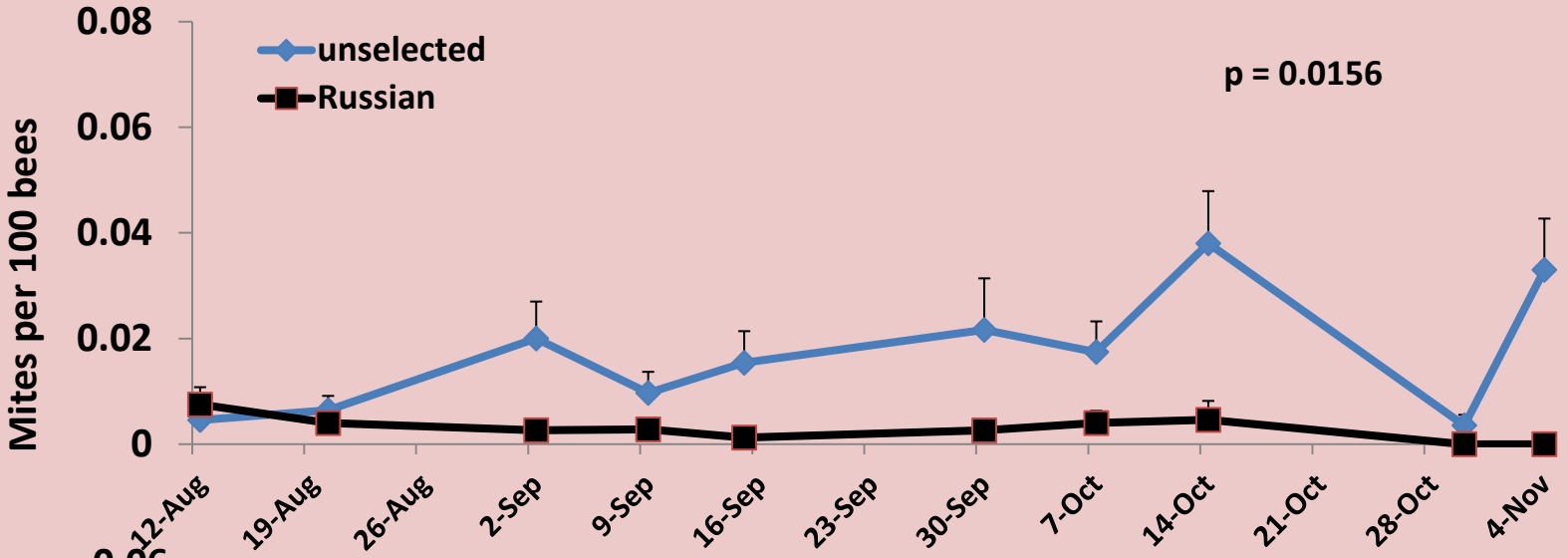
Site-1	frames of adult bees	0.036
	frames of brood	<0.0001
	infested cells (mites / 100 cells)	0.811
	foragers with mites	<0.0001
Site-2	frames of adult bees	0.507
	frames of brood	0.162
	infested cells (mites / 100 cells)	0.839
	foragers with mites	0.012

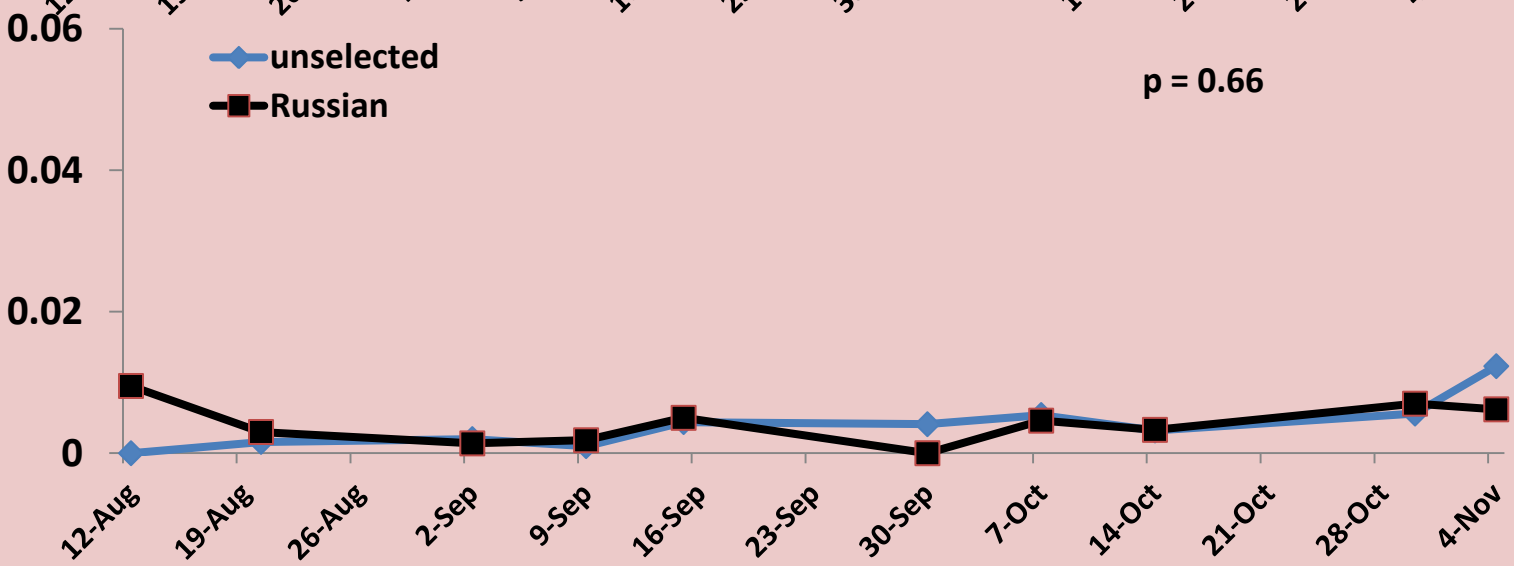
If foragers with mites affects Varroa population growth, what does this mean for mite resistant lines?

Collaboration with Drs. Tom Rinderer and Bob Danka
USDA-ARS Baton Rouge, LA

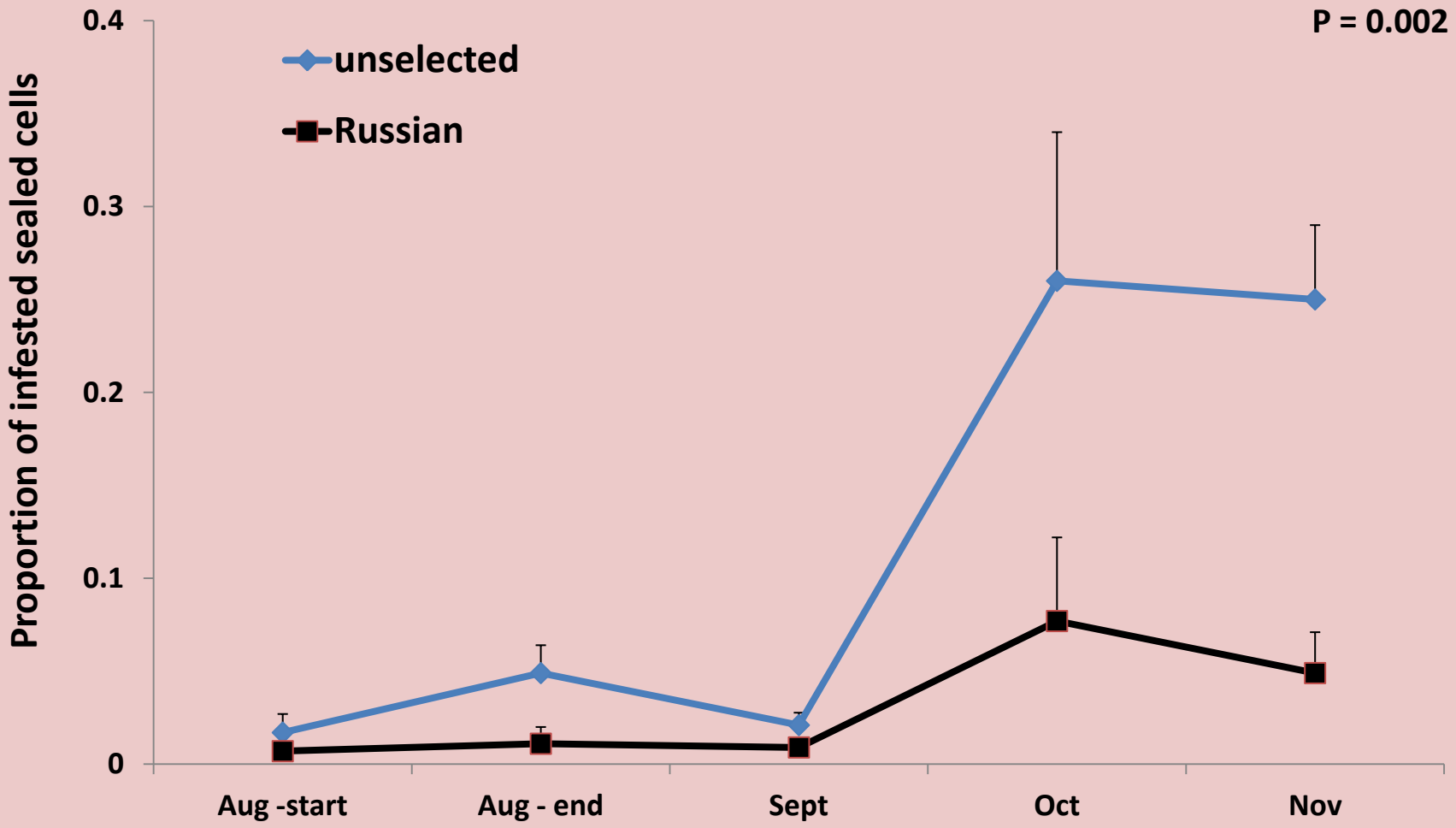
Experimental Design

Mites on Foragers

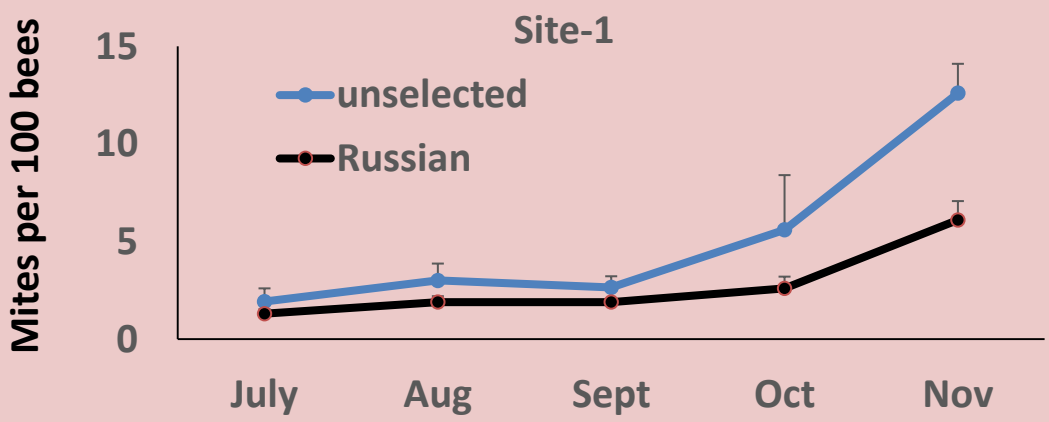


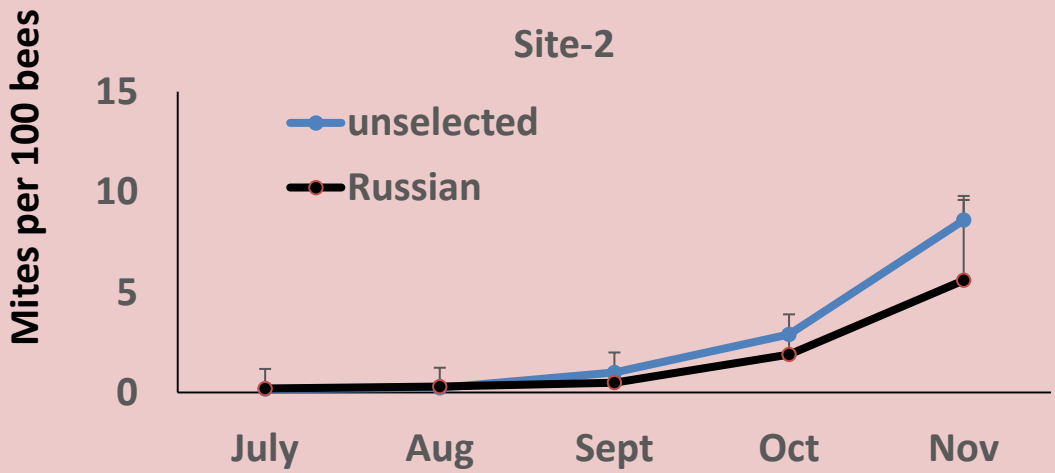


Infested Cells



Mites per 100 bees





Conclusions

-The growth of mite populations is positively correlated with proportion of foragers with mites.

- The mite population might not be the product of mite reproduction alone.

- Mite resistant lines may not have lower mite populations

How could this happen?

- **Parasites and pathogens need dispersal strategies**

Photo from the Peace Bee Farmer

Future Directions

Nurse bee

Forager

Acknowledgements

- Funded by USDA-Areawide Grant

- Thank you to commercial beekeepers especially Frank Pendell and Randy Verhoek.