Essential Partners: The Pollinators Ensuring their efforts

Alfalfa Leafcutting Bee

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Alkali Bee

Alfalfa Leafcutting Bee, Megachile rotundata (Fabricius)



- in U.S. by 1940s; from Eurasia
- 1960's commercially exploited for alfalfa seed production
- overwinter as "prepupae"
- adults emerge in summer; hot weather (>70°F)
- nest in cavities; leaf pieces line cells
- 45,000-60,000 bees/ac in U.S.

Alkali Bee, Nomia melaneri Cockerell

- Native to Great Basin of American West
- Gregarious, solitary, ground-nesting bee; only managed ground-nester
- Known alfalfa pollinator since 1940s
- Oldest nesting aggregations (34 yrs wild, 50+ yrs managed)
- Emerges and nests in summer
- ≥ 50 nesting sites remain in WA, OR, ID, UT, CO, & NV
- Use diminished after 1960s:
 > change in farming
 - lack of nest sites
 - poor weather
 - pesticides
 - disease

















Life in a Nest









Pollination = "Tripping" an alfalfa flower



Pressure on keel releases staminal column and exposes pollen; pollen groomed from face and neck of bee plus nectar gathered

Declining Health of Pollinators - Threatening the Partnership???



Four P's – Which one to blame (or should we blame all four?)

- Pathogens
- Pesticides
- Parasites (mites, parasitoids, protozoa, etc)
- Poor Nutrition

Bee Returns Usually Poor in U.S.

Post Winter
 & Incubation
 Mortality



Pollen Balls



 Summeremerging Generation



Chalkbrood



• Parasitoids & Predators





Nest Establishment



Virus prevalence in alfalfa pollinators 2011



Bee species	Virus Prevalence (%)						
	DWV	IAPV	BQCV	SBV	KBV	ABPV	CBPV
Alkali bees (Nomia melanderi)*	34.3	17.1	2.9	2.9	0	0	0
Alfalfa leafcutting bees (Megachile rotundata)**	17.5 ± 13.2	12.5 ± 15.5	5.0 ± 7.1	0	0	0	0
Honey bees (Apis mellifera)***	87.1 ± 17.0	62.9 ± 33.8	89.9 ± 10.9	20.0 ± 40.1	0	0	0

Rajwinder Singh, Rosalind James, Ed Rajotte, and Diana Cox-Foster * Combined sample of adults & larvae (N=35). ** Mean ± SD; adults only; 20 ALCB adults per field, 4 fields. *** 20 honey bee workers per hive, 3 hives per apiary, and 4 apiaries.



IAPV decreases ALCB adult survivorship, when acquired as a newlyemerged adult



Parametric Surival Fit, Frechet Dristribution

Treatment	p < 0.0001 *
Sex	p = 0.0002 *

Rajwinder Singh, R. James, E. Rajotte, D. Cox-Foster, in revision

IAPV results in greater disruption of larval diapause, when feed to ALCB larvae





A= Shavings (Epidermal tissue, fat body, hemolymph, muscles, but on gut tissue)
 B= Remainder (All larval tissues including the gut)

Possible impact on larval nutrition and regulation of diapause???

Potential restriction of IAPV infection to gut of ALCB larvae





Tackling the parasitoids of Alfalfa Leaf Cutting Bees-Validation and Development of Traps for Pests of Megachile rotundata

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Parasitoids- Threat to the Pollinators

Melittobia (Eulophidae)





Tetrastichus - mating



Sapyga -- Cleptoparasites of bee and some wasp nests



Testing Trap Designs and Lure (nesting odor for Osmia, another solitary bee)

Screened slices of polystyrene board A) painted black, B) with odor delivered on rolled filter paper in some holes, and C) with no odor added

PVC trap and filter paper lures being placed inside.





- PVC traps were more efficient at catching parasitoid wasps than the sticky traps
- Color of trap preferred differed between the species
- Osmia's nesting lure was not attractive to these parasitoids (Sapyga, a cleptoparasitoid, does like it)



Research Foci

- Continued Focus on Parasitoids- Bee Flies in Alkali Bees, Parasitoids in Leaf Cutter Bees and Osmia
- Production of ALCB's on NRCS Conservation Reserve Program (CRP) lands in US- how to maximize and create sustainable source of bees?
- Role of Environmental Stresses in viral and fungal pathogens in ALCB's and Alkali Bees





Our ARS team





