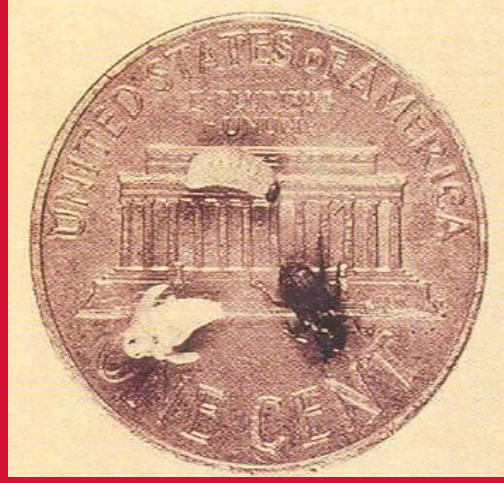
RUTGERS
New Jersey Agricultural Experiment Station



2nd Ag Innovations Conf.: Microbial Control
Aug 13, 2017, San Diego, CA

Microbial Control of Weevil Pests in Turfgrass

Albrecht Koppenhöfer

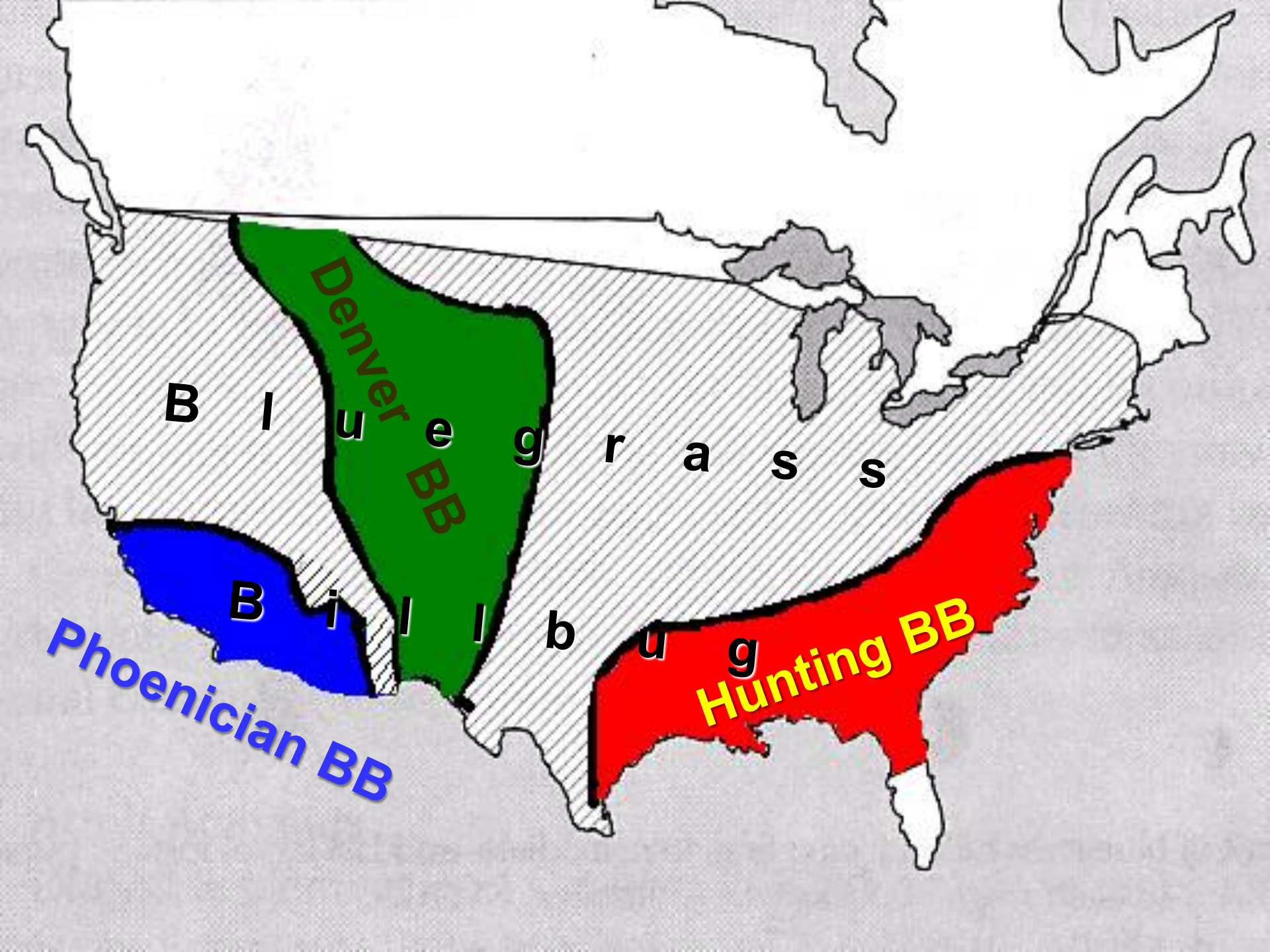
Dept. of Entomology

Billbugs

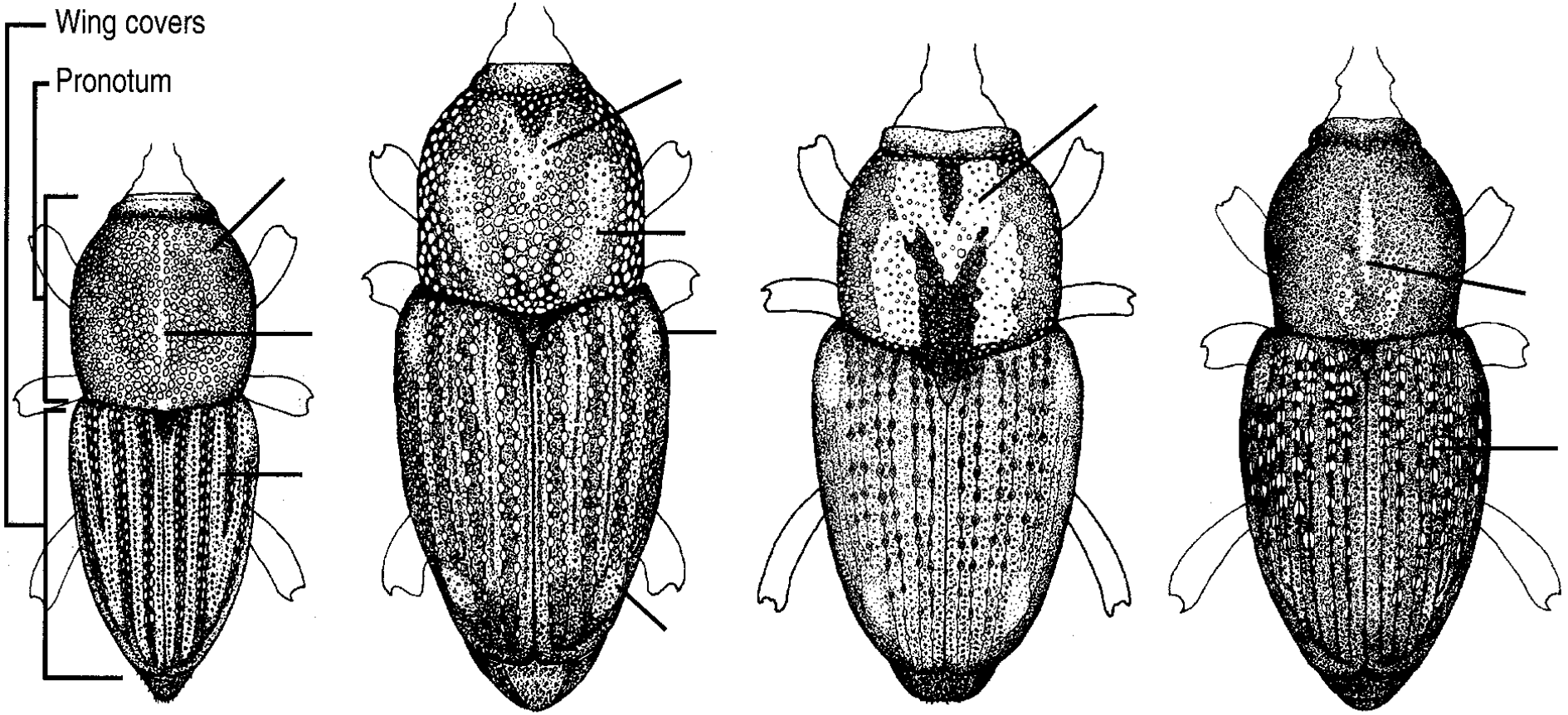
Sphenophorus spp.

(Coleoptera: Curculionidae)

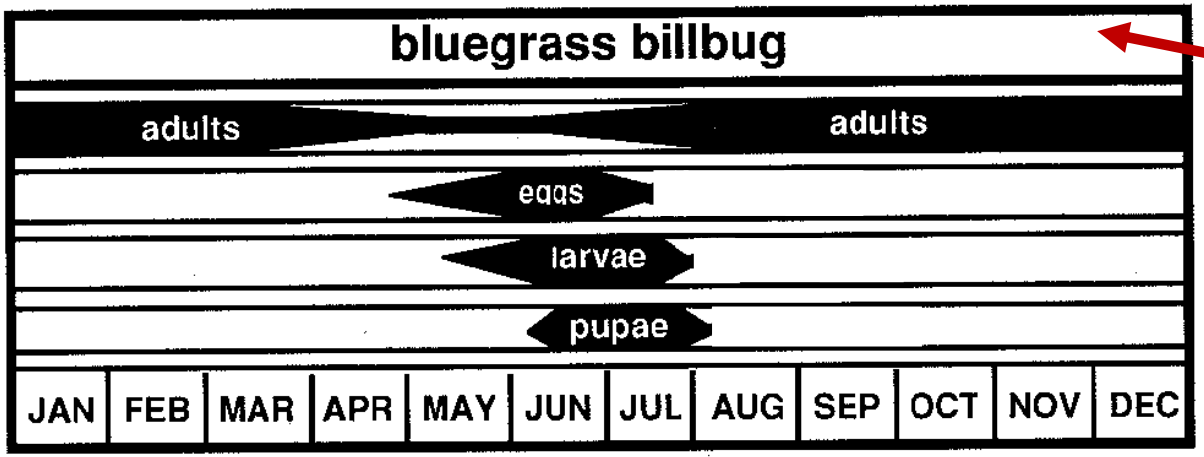
0.3-0.5"


Denver BB
Bluegrass
Billbug
Phoenician BB
Hunting BB

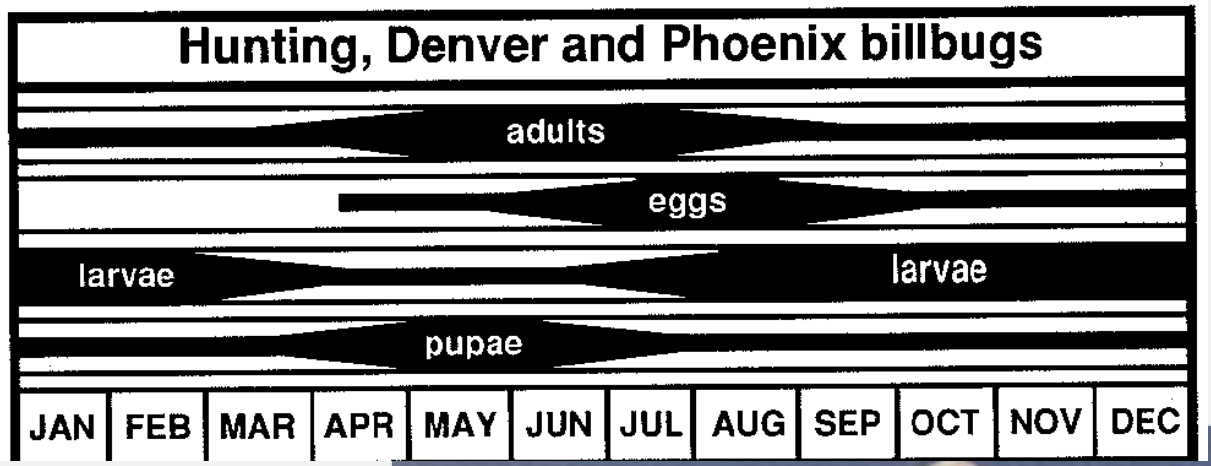
Billbugs – Identification of Species



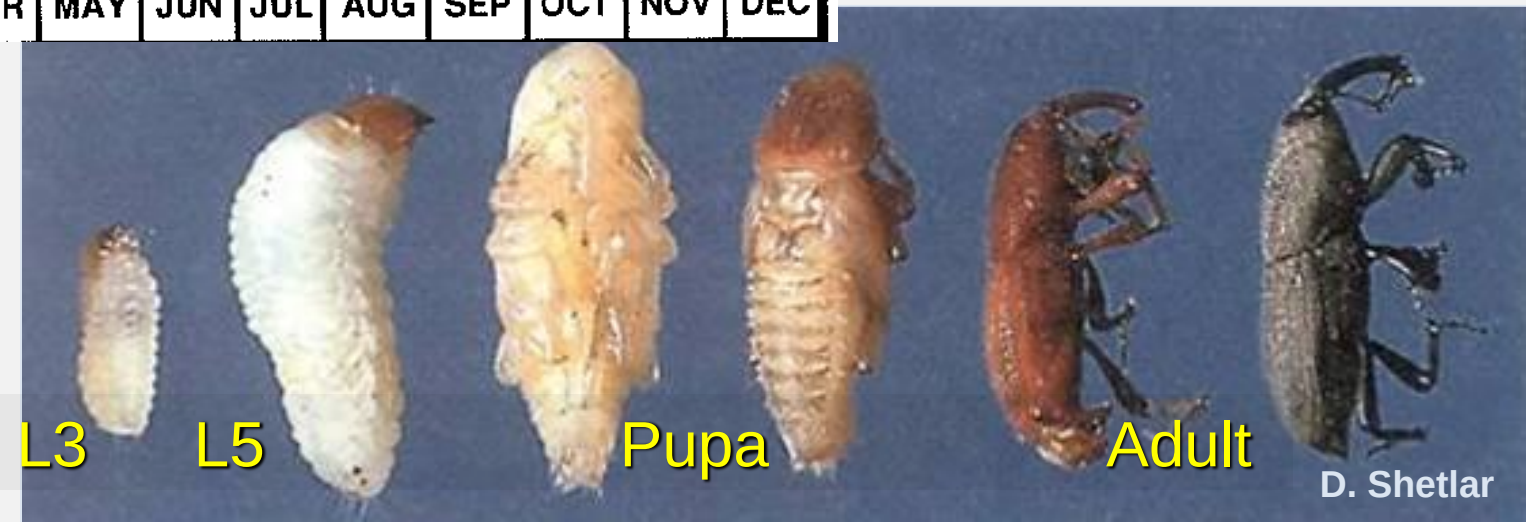
Bluegrass Hunting **Phoenician** Denver



Hunting BB and other spp. in NE probably similar

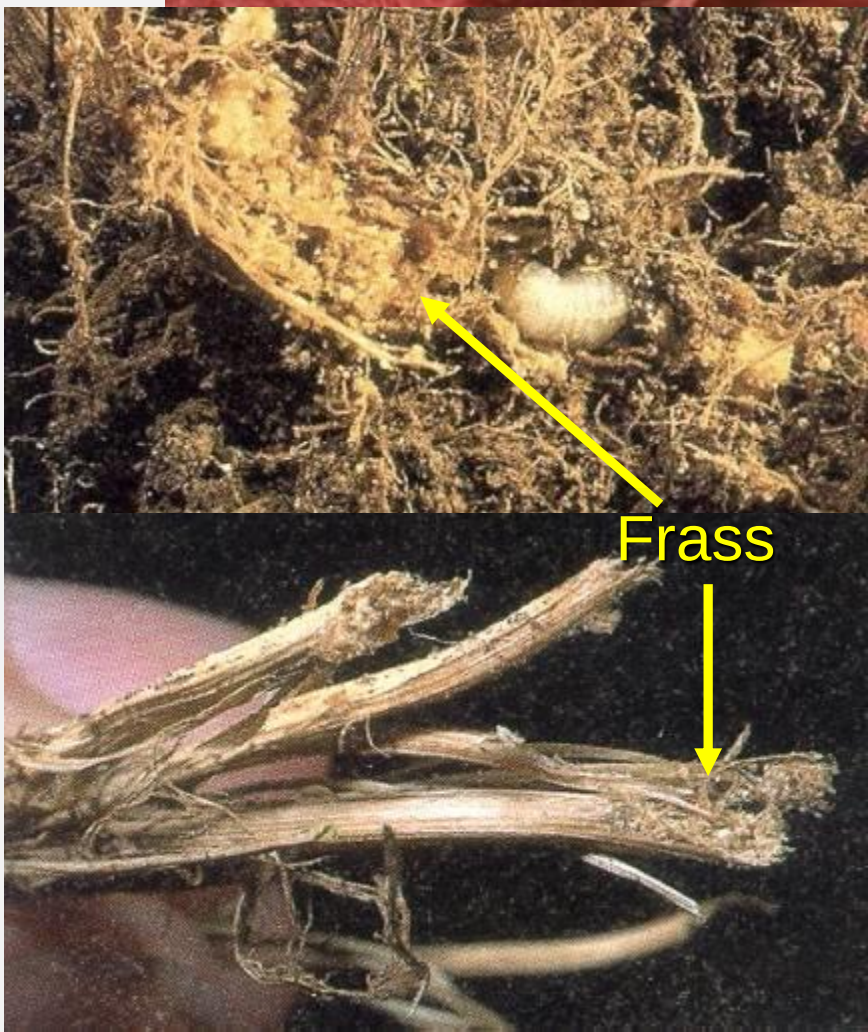


Billbugs - Development



Injury

- Young larvae feed inside grass stems, then burrow down to feed on crown.
- Older larvae feed externally on crowns, roots, and rhizomes.
- Stems break off at crown, are hollowed out or filled with sawdust-like frass.



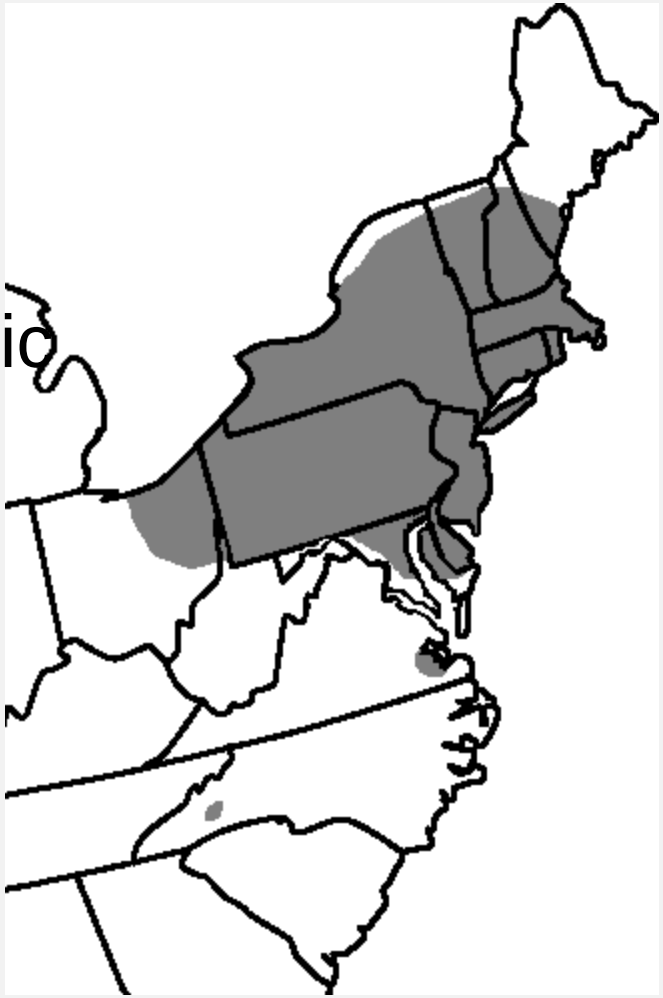
Injury

- Initially scattered dead stems, later growing patches of dead turf
- Damage in mid/late summer, especially during extended dry periods

Annual Bluegrass Weevil (ABW)

Listronotus maculicollis

- Serious pest of close-cut turf
- Throughout Northeast & mid-Atlantic
- Range expanding



ABW Damage

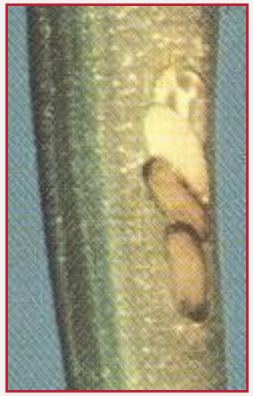
- Most difficult to control golf course insect pest in northeastern USA
- Up to 10 insecticide applications per year
- Poor resistance management practices

→ 20% (regionally up to 55%) of GCs have trouble controlling ABW

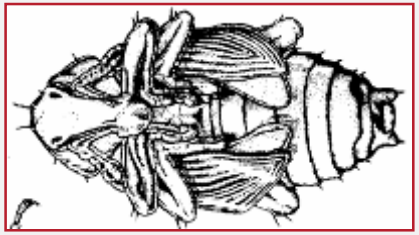
→ broad insecticide resistance.

B. McGraw

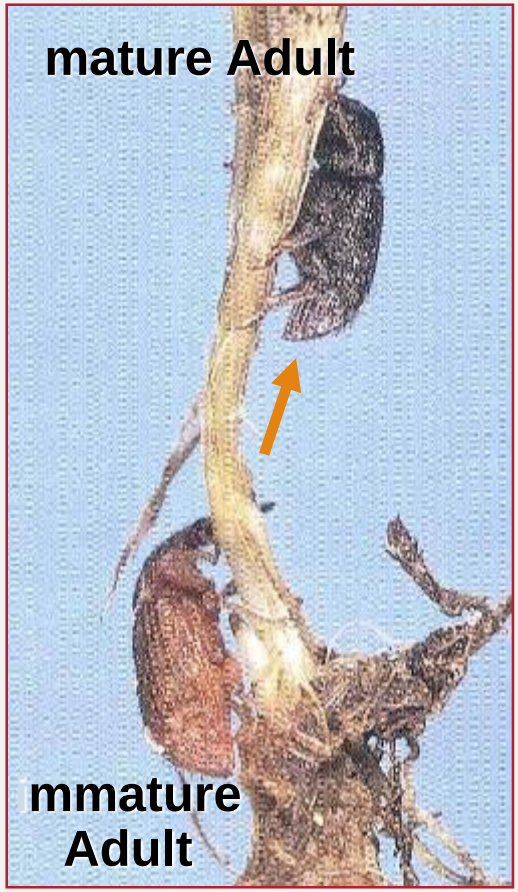
ABW Life Cycle



Eggs laid under sheath

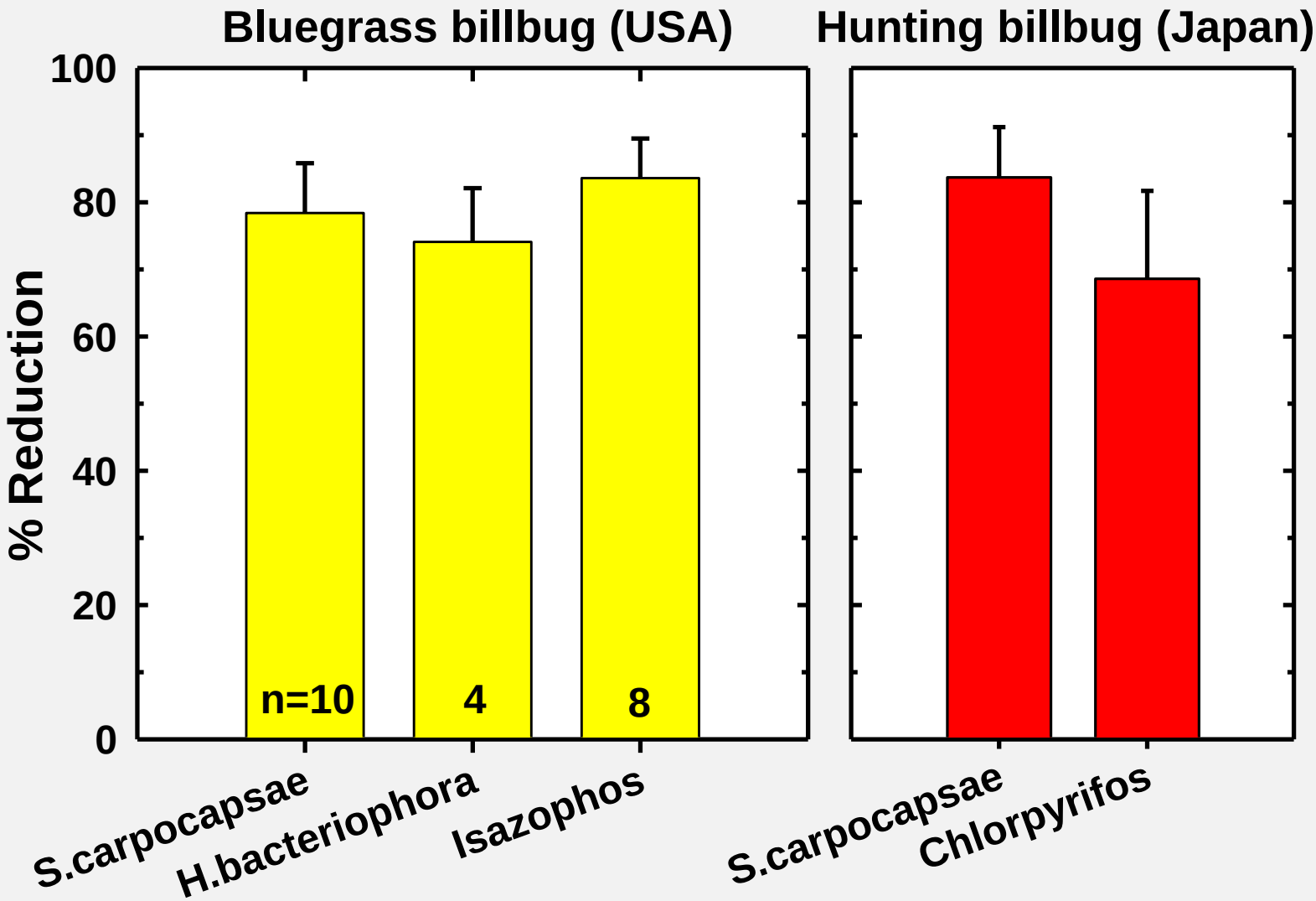


Pupation in soil



Entomopathogenic Nematodes
Efficacy vs. billbugs

Summary of multiple field trials



EPN vs. ABW larvae

- Fairway trials

vs. spring gen. L3-L5

1.0 b IJs/ac (2.5 b/ha)

EPN vs. ABW larvae

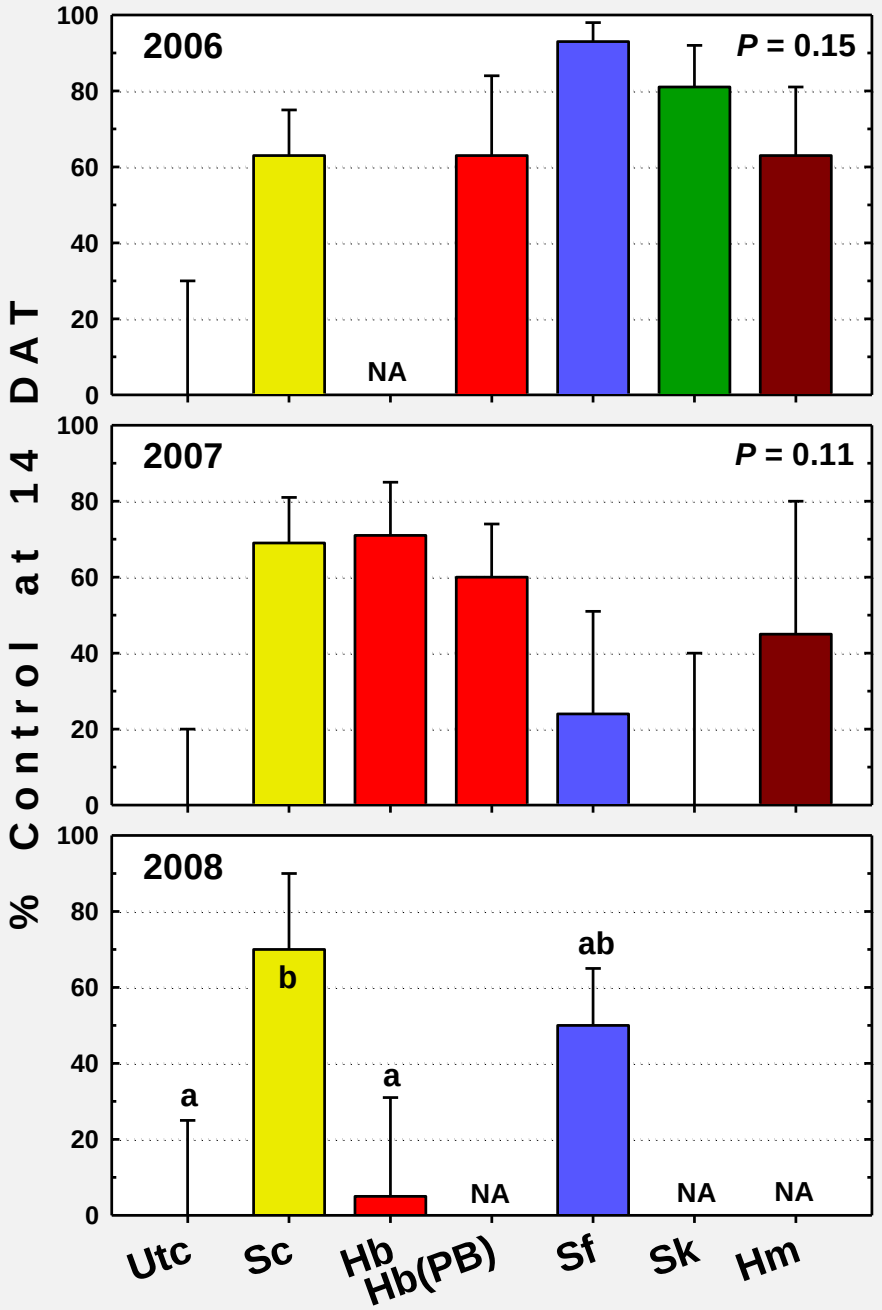
- Fairway trials

vs. spring gen. L3-L5

2.5 b IJs/ha

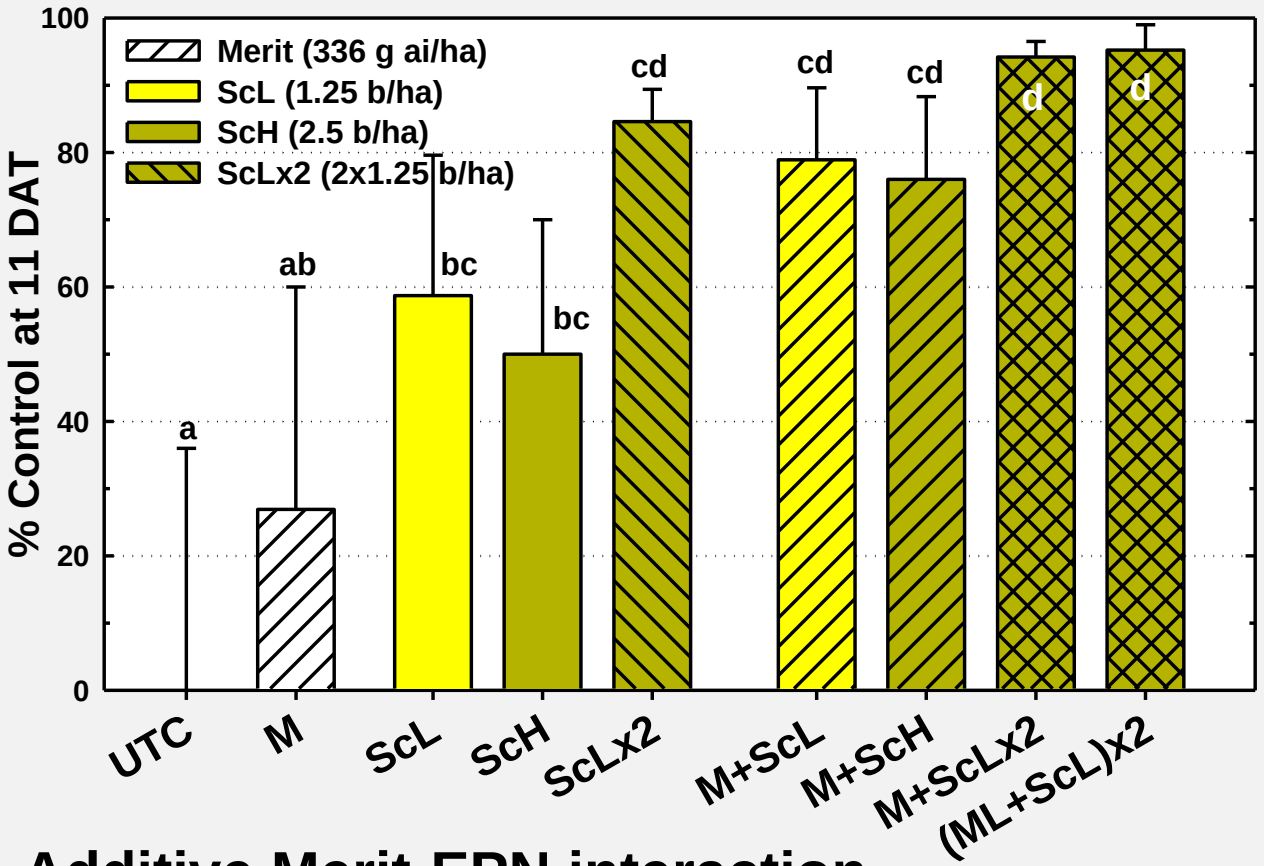
- ***Sc* most consistent suppression**
- **But 60-70% control not sufficient**

McGraw et al. (2010)



EPN + Merit - Field 2014

Merit: 0.3 lbs ai/ac; EPN: 0.5 or 1.0 bill IJs/ac



- **Additive Merit-EPN interaction**
- **Split application promising for improving EPN**
- **Merit + split *Sc* → excellent control**

EPN vs. Weevils

- *Steinernema carpocapsae* or *Heterorhabditis bacteriophora*.
- Apply when larvae start to appear in soil.
- If soil dry and/or hot, ~0.1” irrigation before application.
- ~0.25” post-treatment irrigation.
- Keep soil moderately moist at least 1 wk.
- Split application can improve efficacy.

Entomopathogenic Fungi

Beauveria bassiana GHA

Brand name: BotaniGard ES (oil-based formul.)

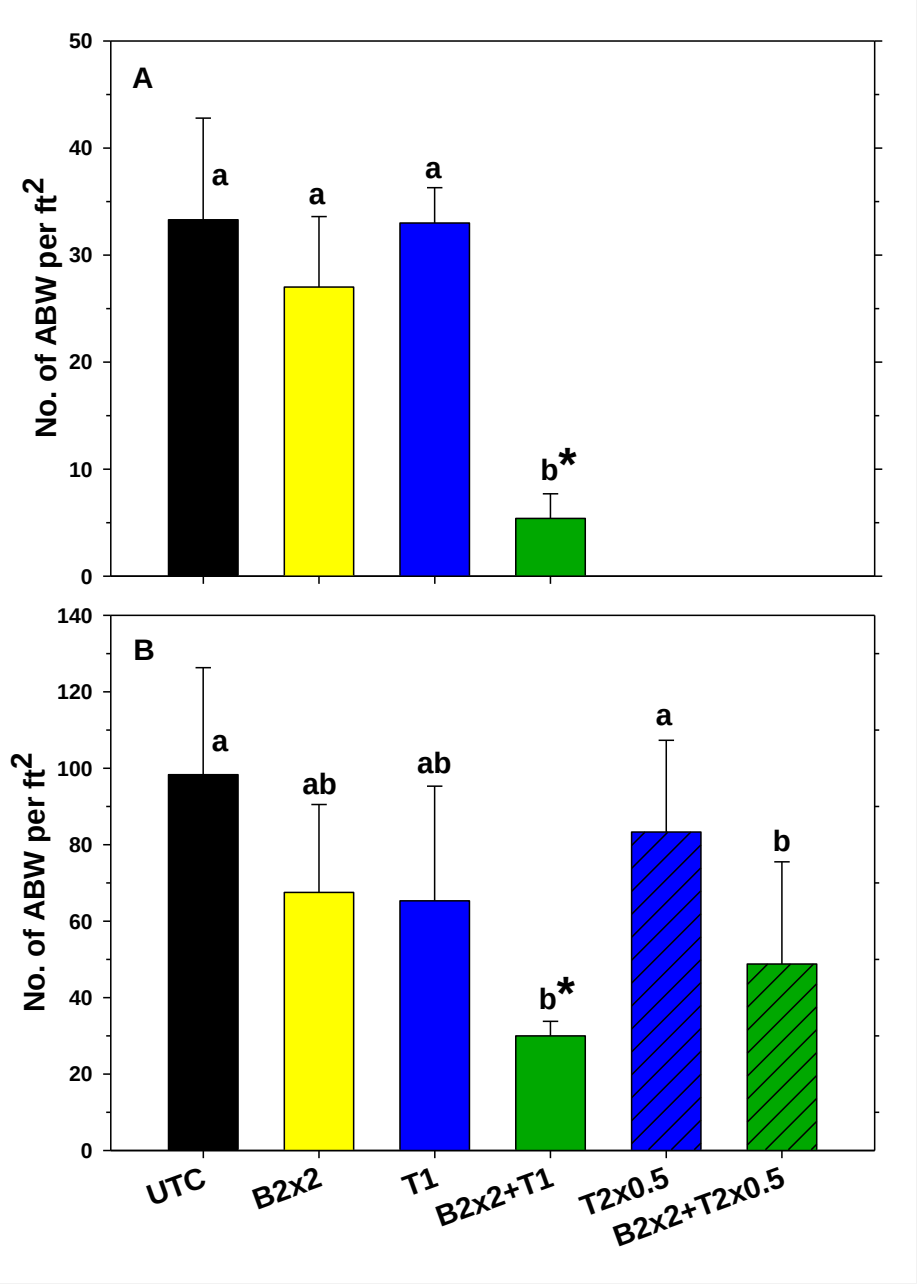
- Labeled for turf use
- Efficacy vs. ABW low and inconsistent

BotaniGard ES + Talstar Field Efficacy vs. ABW Adults (60x resistant popul.)

B2x2 = 2x 1.3 qt/ac
(7 d apart)
T1 = 1x 0.1 lb ai/ac
T2x0.5 = 2x 0.05 lb ai/ac
(7 d apart)

- BG & Tal ineffective
- BG+Tal 74-82% control; synergistic
- No synergism if Tal split

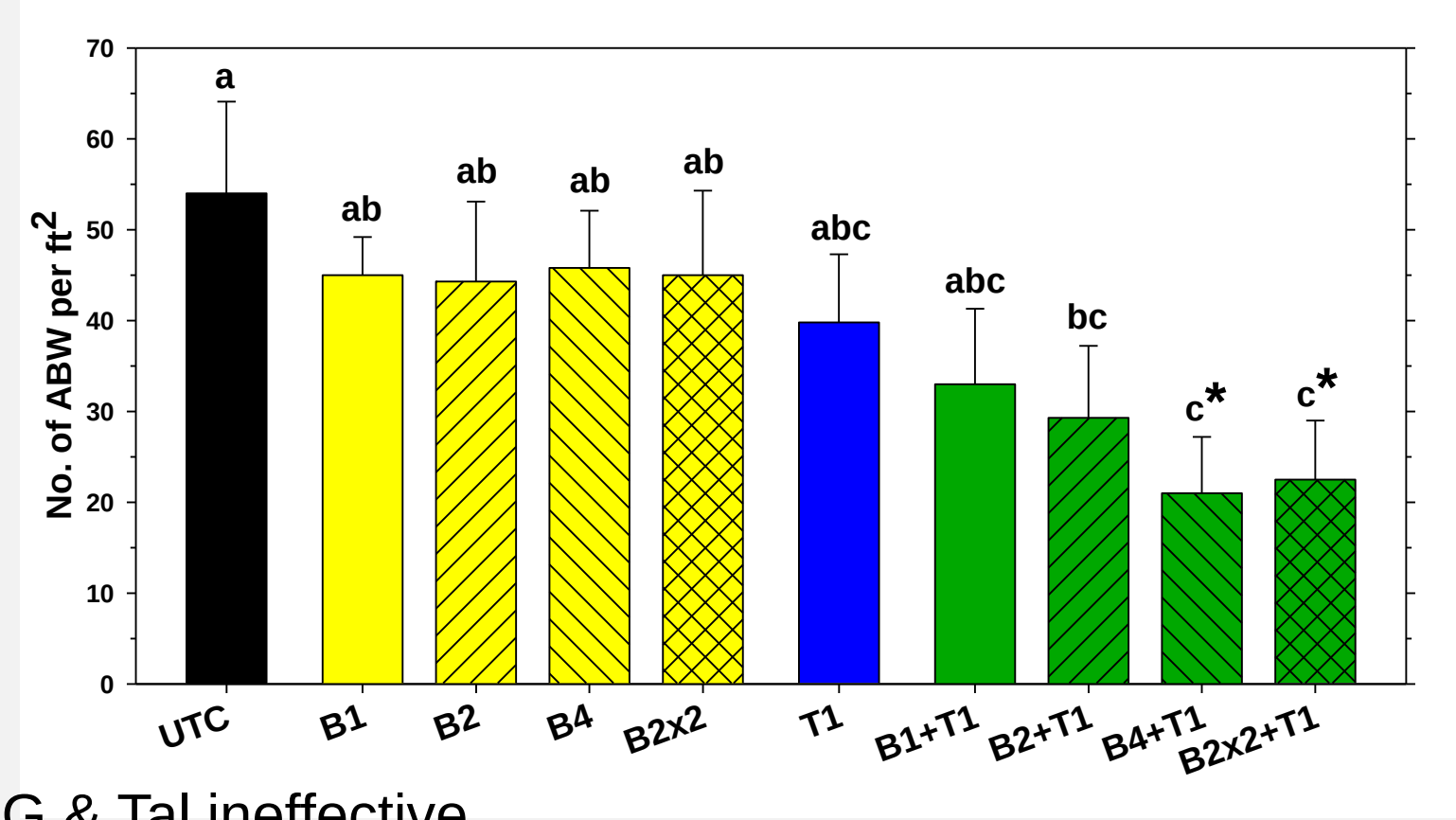
Wu et al. (2017)



BotaniGard + Talstar Field Efficacy vs. ABW Adults

(60x resistant popul.)

B1 / 2 / 4 = 0.7 / 1.3 / 2.6 qt/ac; T1 = 0.1 lb ai/ac



Wu et al. (2017)

- BG & Tal ineffective
- BG+Tal only effective at higher rates (46, 61, 58%)
- Synergistic only at highest rates (4, 2x2)

EPF vs. Weevils

- BotaniGard ES alone ineffective
- Synergistic BotaniGard-Talstar interaction
- Oil responsible for rapid death, GHA spores took effect at delayed time
- Potential for control of insecticide resistant ABWs

Chromobacterium subtsugae

- GRANDEVO® PTO ! - 30% ai
- *C. subtsugae* strain PRAA4-1 and spent fermentation media
- 2-4 lbs/ac f. surface feeders
- 10-20 lbs/ac f. white grubs
- OMRI approved
- Activity vs. white grubs (varies with species), chinch bugs, billbugs, sod webworms.

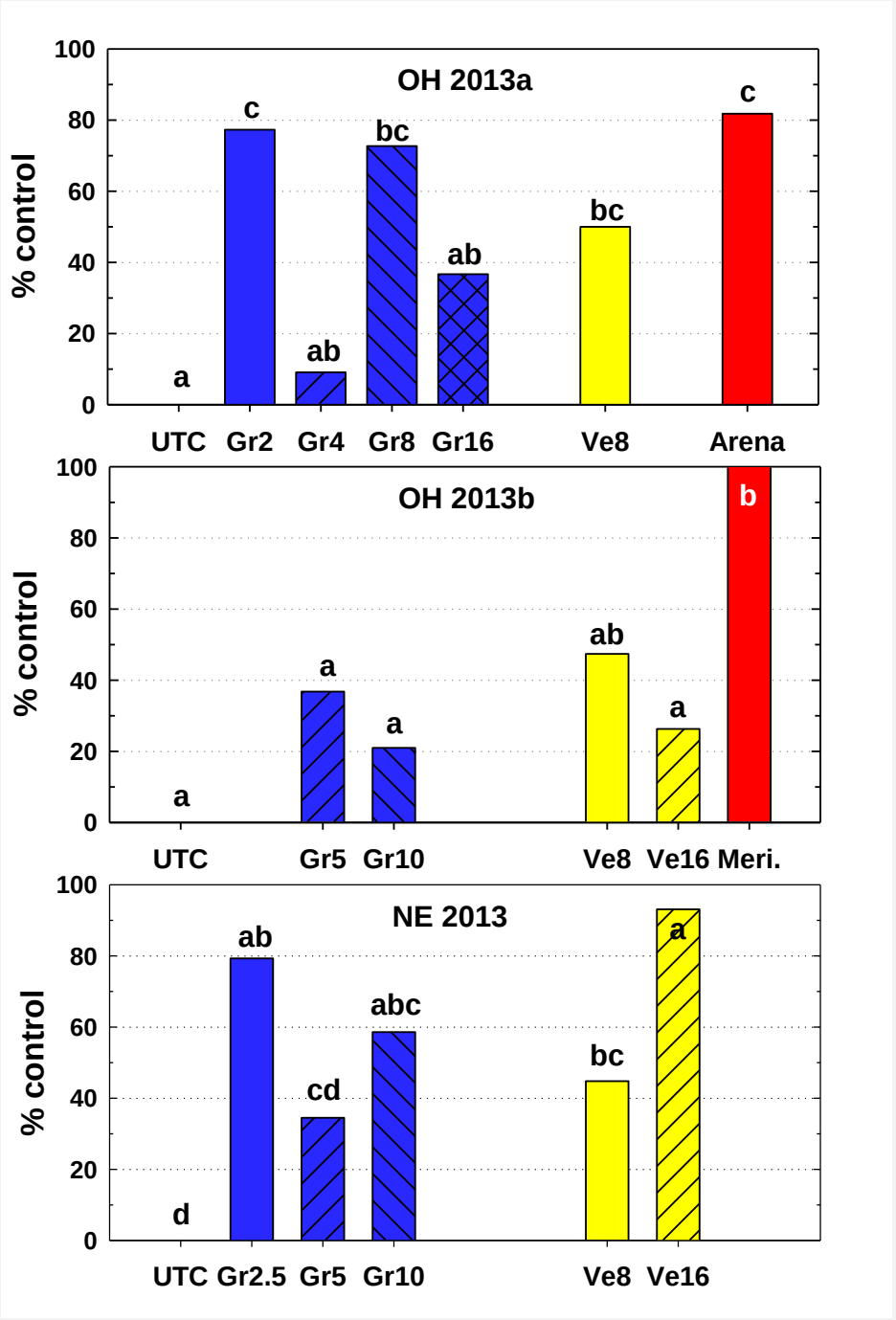
Burkholderia spp.

- VENERATE® xc ! – 94.46% ai
- *Burkholderia* spp. strain A396 cells and spent fermentation media
- For fruit and vegetables
- Turfgrass not on label!
- OMRI approved
- Activity vs. caterpillars and billbugs

Field Efficacy vs. Bluegrass BB

Grandevo
2-16 lbs/ac

Venerate
3-16 pt/ac

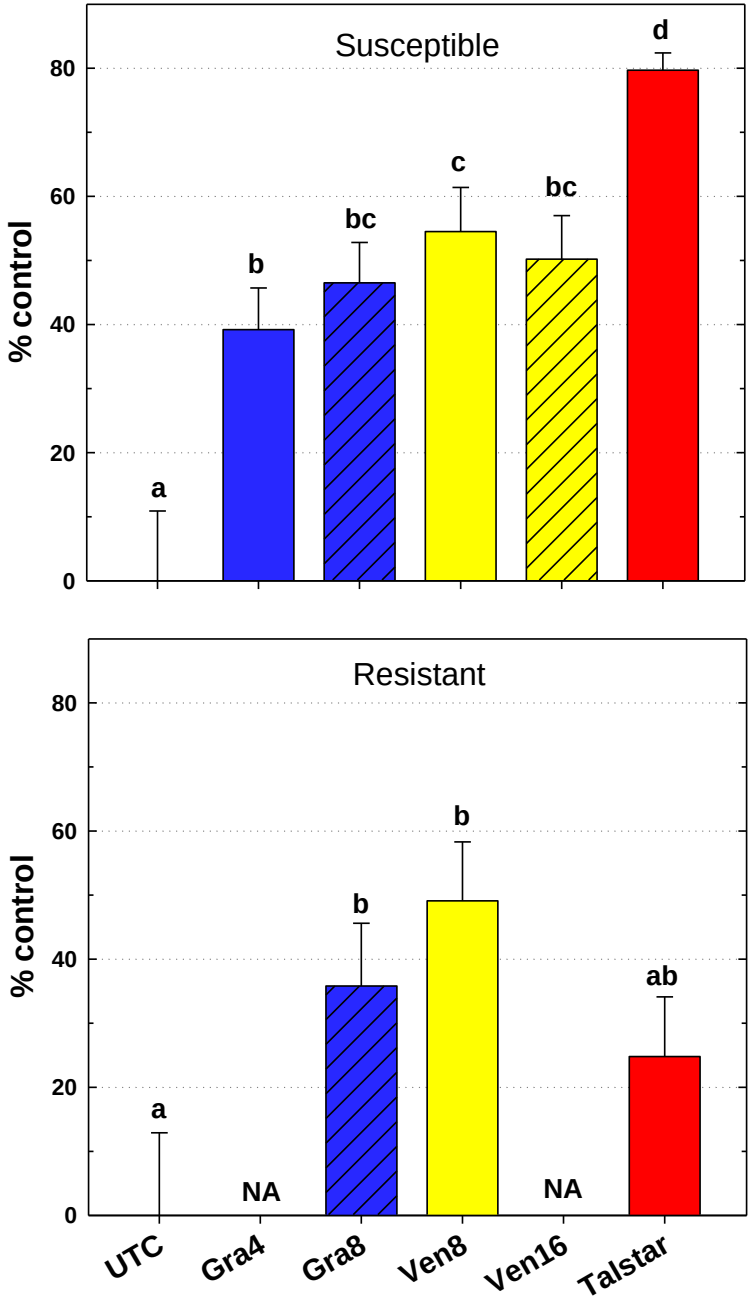


Field Efficacy vs. ABW Adults

susceptible (2x)
resistant (60x)

Grandevo
2x 4-8 lbs/ac

Venerate
2x 8-16 pt/ac

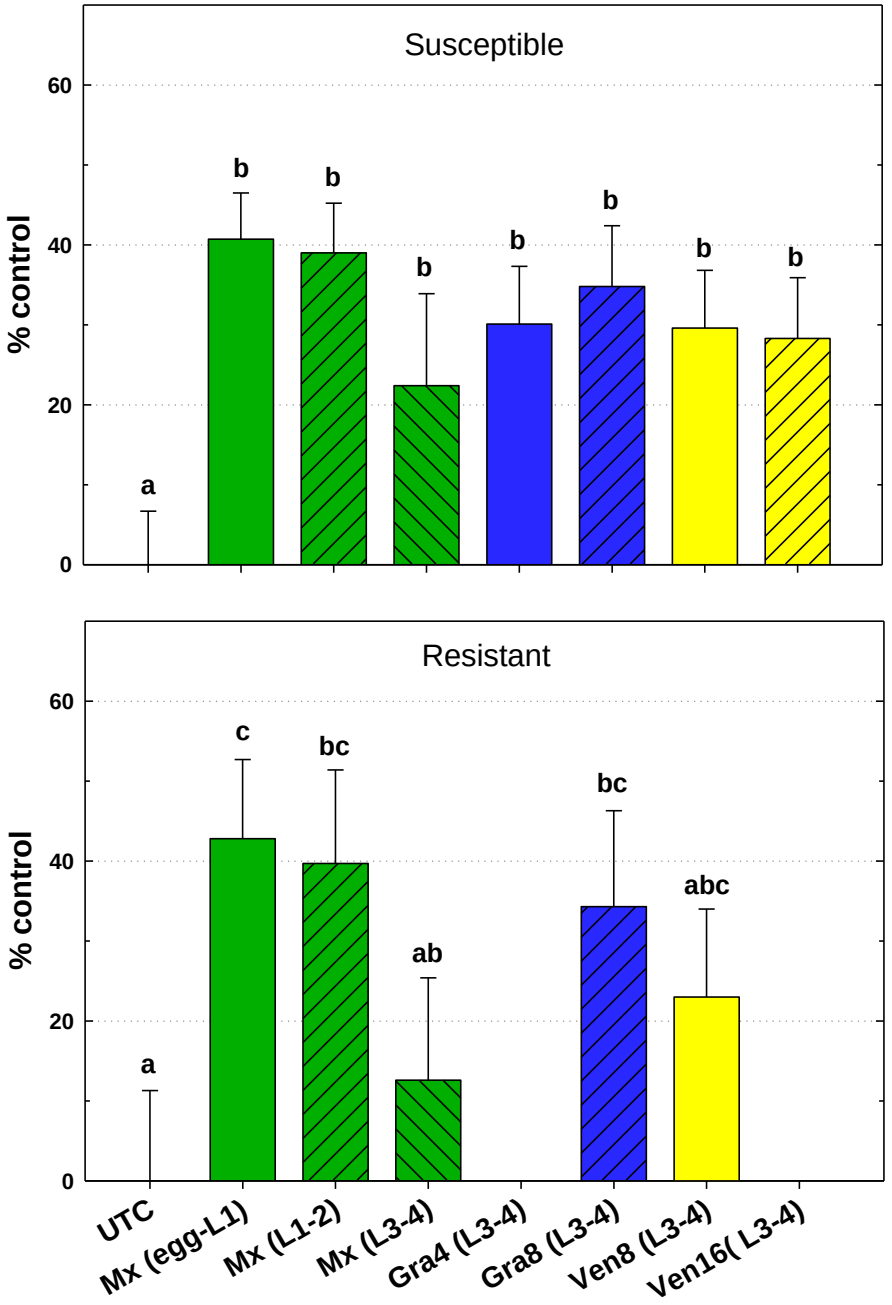


Field Efficacy vs. ABW Larvae

susceptible (2x)
resistant (60x)

Grandevo
2x 4-8 lbs/ac

Venerate
2x 8-16 pt/ac



Grandevo / Venerate vs. Weevils

- vs. billbugs: both can give excellent control but results variable and no clear dose response → split application better?
- Vs. ABW: more effective vs. adults, but only around 40% (Grandevo) and 50% (Venerate) control.
- Not affected by insecticide resistance in ABW → potential for control of insecticide resistant ABWs in rotations.

Acknowledgments

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