Pests in soybean and management Approaches

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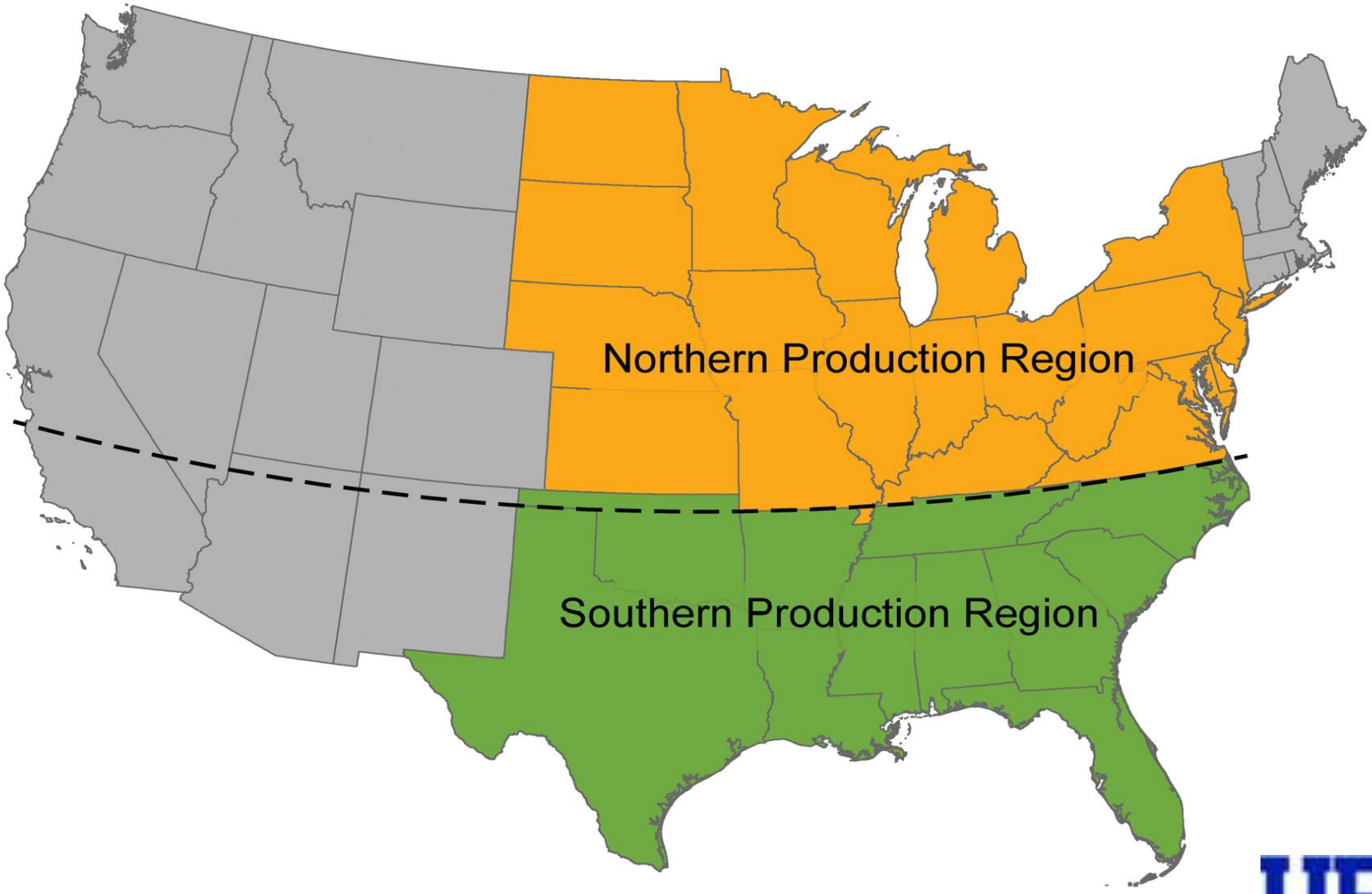
Florida Panhandle

Lepidopteran pests:

- **Diversity of species**
- **Pest overwintering**
- **Pest migratory intersection**
- **Source of annual infestation**
- **Insecticide and Bt resistant alleles**
- **Summer spread – North U.S and Canada**

Pests in soybean and management Approaches



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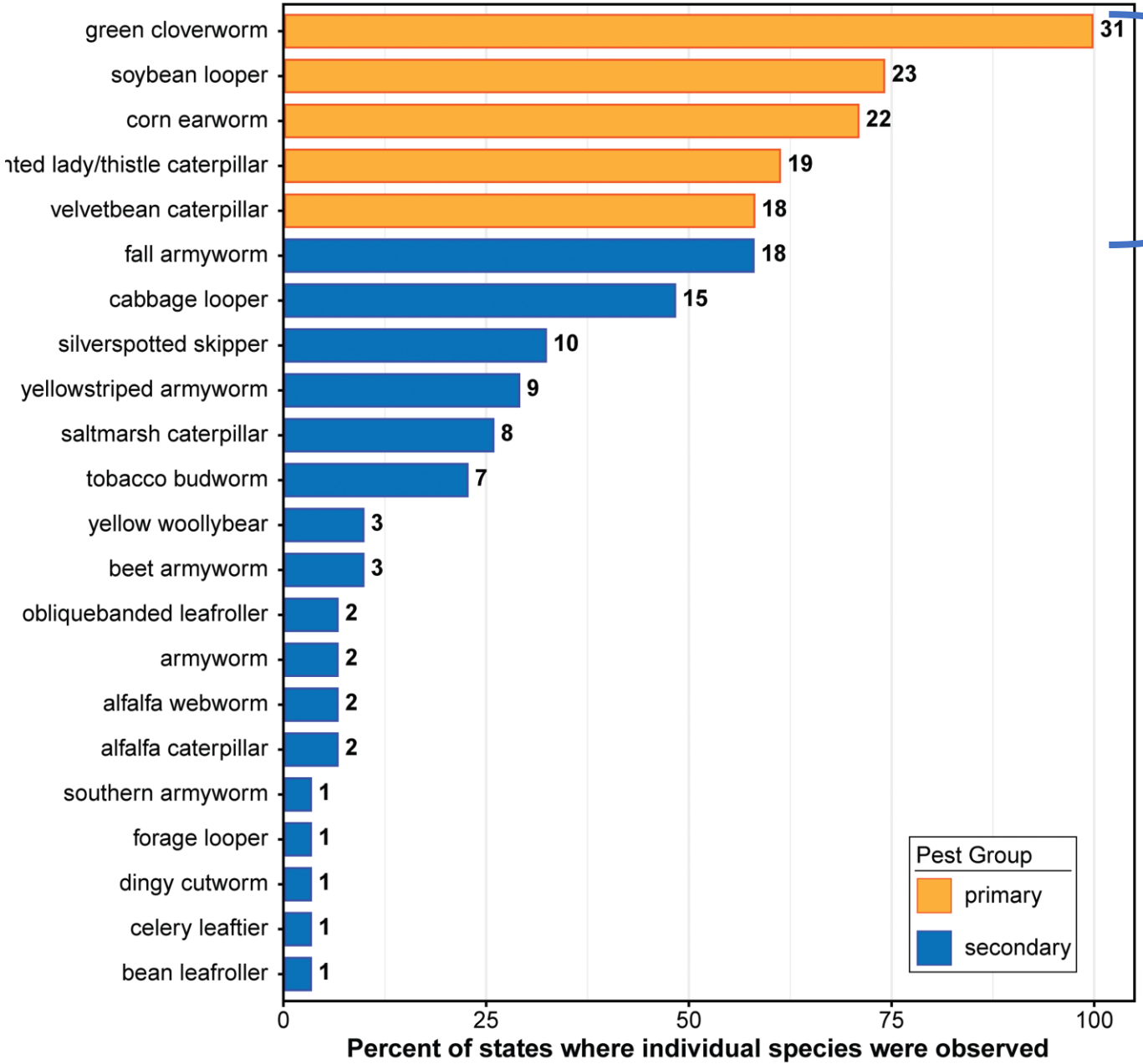
Huseth, A.S., Koch, R.L., Reisig, D., Davis, J.A., Paula-Moraes, S.V., Hodgson, E.W., 2021. Current distribution and population persistence of five lepidopteran pests in U.S. soybean. *Journal of Integrated Pest Management*, 12: 11: 1-10.

Lepidopteran pests associated with soybeans in the U.S.



Primary species in soybean

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Green Cloverworm:
Hypena scabra (Fabricius)
(formally *Plathypena scabra*) (Lepidoptera: Noctuidae)

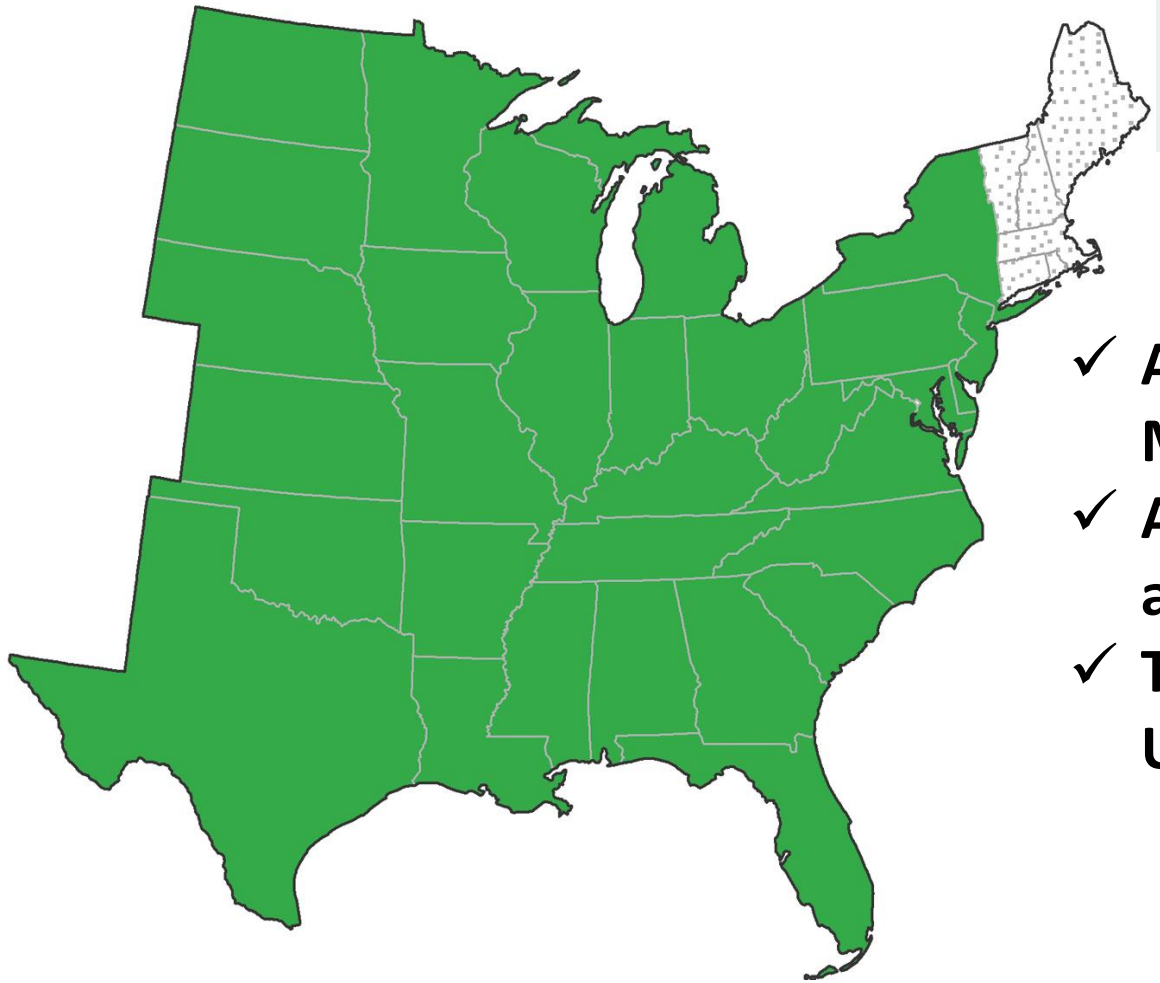

Photo by Natasha Wright, FDCAS


Photo by Kansas State University Extension Entomology

Adam Sisson, Iowa State University

- ✓ **Adults likely migrate - south central U.S. to the Midwest annually**
- ✓ **At least two generations annually in U.S. - first appearance of adults in May**
- ✓ **Three or four generations are reported in southern U.S.**

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Corn earworm: *Helicoverpa zea* Boddie (formerly *Heliothis zea*) (Lepidoptera: Noctuidae)

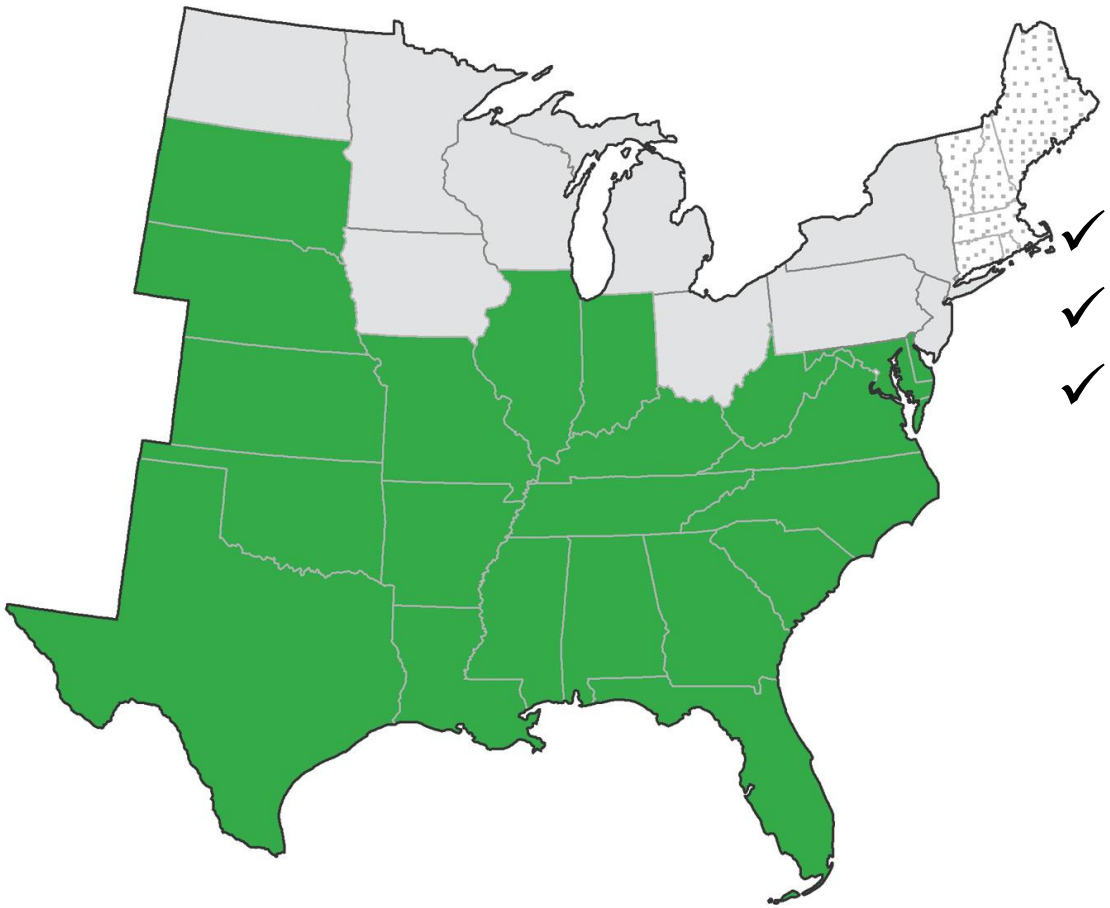

Photo by Adam Sisson, Iowa State University

Photo by Clemson University

Photo by Clemson University

- ✓ **Polyphagous pest**
- ✓ **Oviposition on flowering stages**
- ✓ **No differences in determinate and indeterminate soybean growth habitats**

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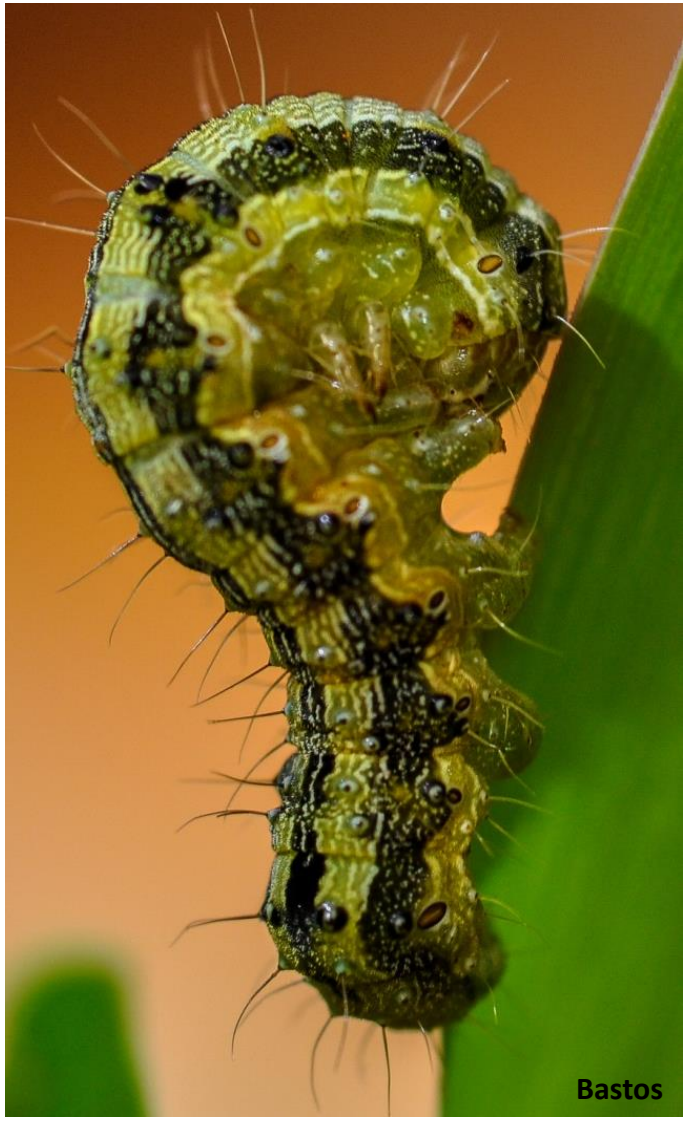
Helicoverpa armigera – introduction in the American continent



- **Quarantine pest in American continents – until 2013**
- **Pathways – ornamental plants, cut flowers and fruits**

(Pogue 2004, Venette 2003, CAB 2003)

- **Detection in Brazil – crop season 2012/2013**

(Embrapa 2013, Czepak et al. 2013; Tay et al. 2013; Specht et al. 2013)

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Helicoverpa zea vs *Helicoverpa armigera*

Taxonomic differentiation

Morphology of moth genitalia - Hardwick´s work – 1965

✓ ***Helicoverpa zea***

New world species

Derived from *H. armigera* - occurrence genetic bottleneck

2 million years ago

✓ ***Helicoverpa armigera* – Old world cotton bollworm – until 2013**

(Behere et al., 2007, Tay et al., 2013)

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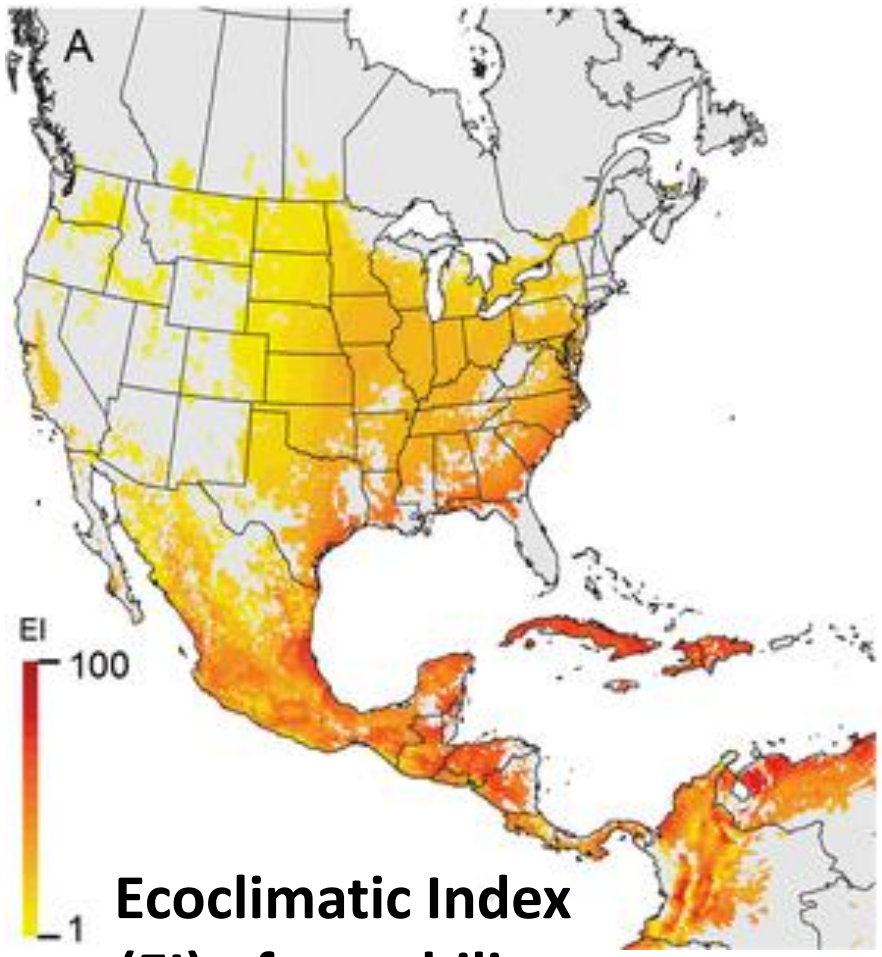
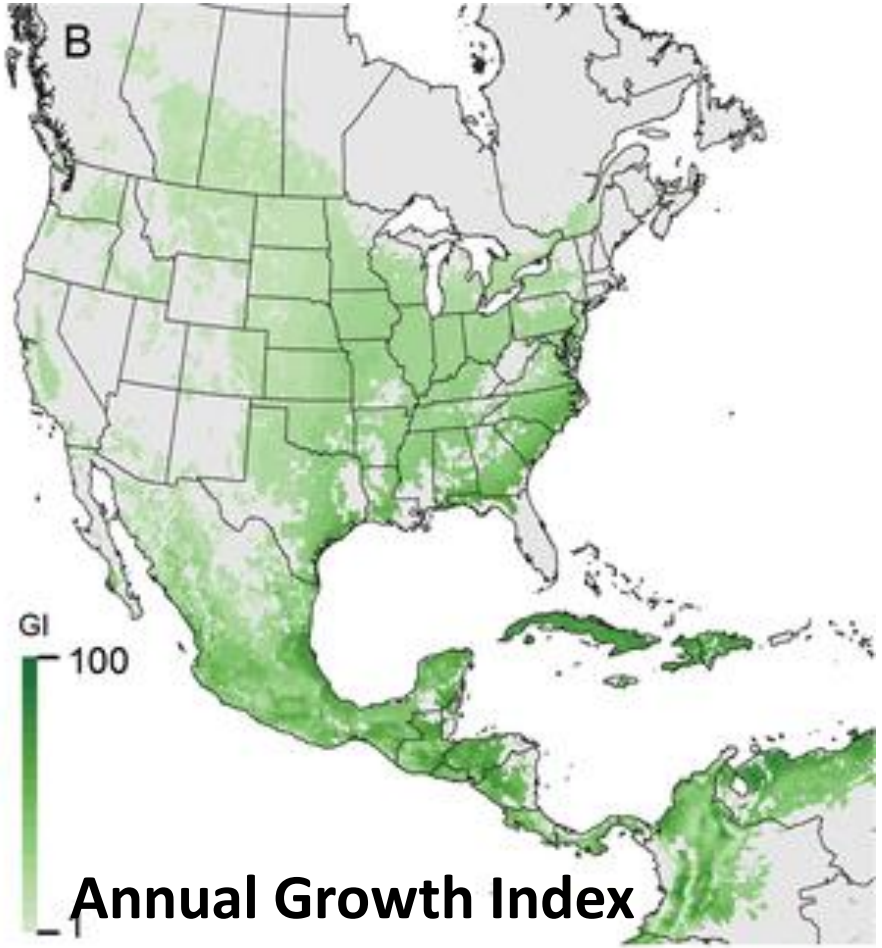
Potential distribution of *Helicoverpa armigera* in North America - climate suitability (modelled using Climex)

Kriticos et al. 2015



Ecoclimatic Index (EI) - favorability for persistence



Annual Growth Index (GI_A) - potential for population growth

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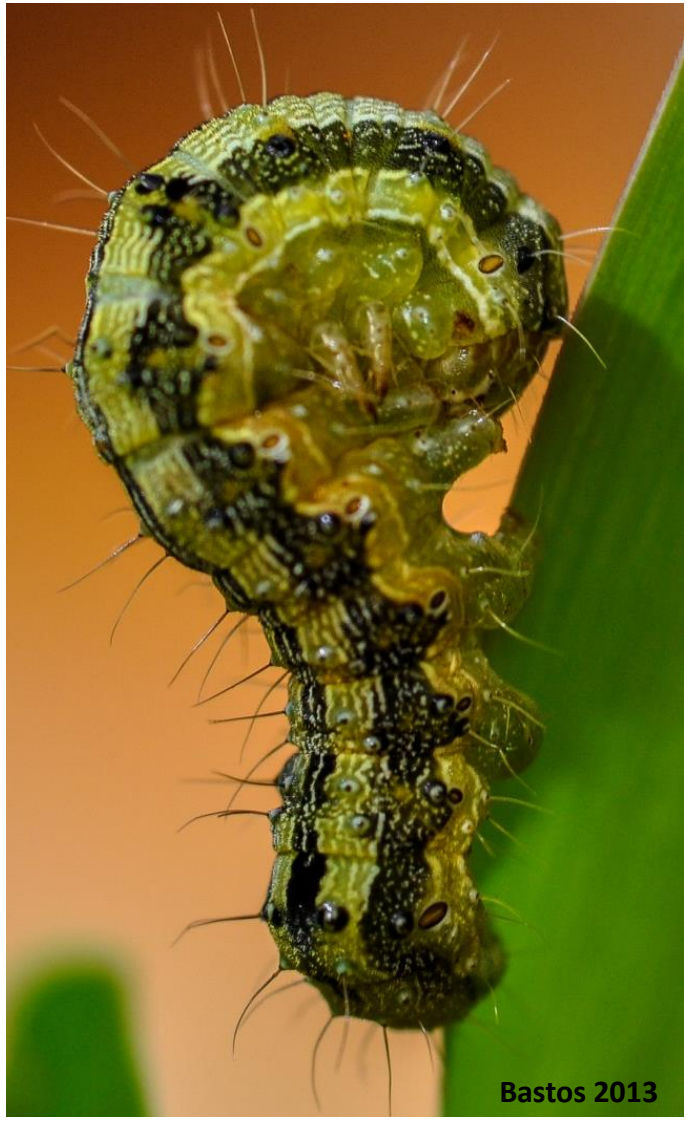
Bastos 2013

Kriticos et al. 2015

- **Puerto Rico – strategic region** (PPQ/USDA, Trujillo 2018)
- **Tracking performance of insecticides**
- **Advanced molecular tools – hybrids studies**

Field-derived populations from Salinas and Juana Diaz

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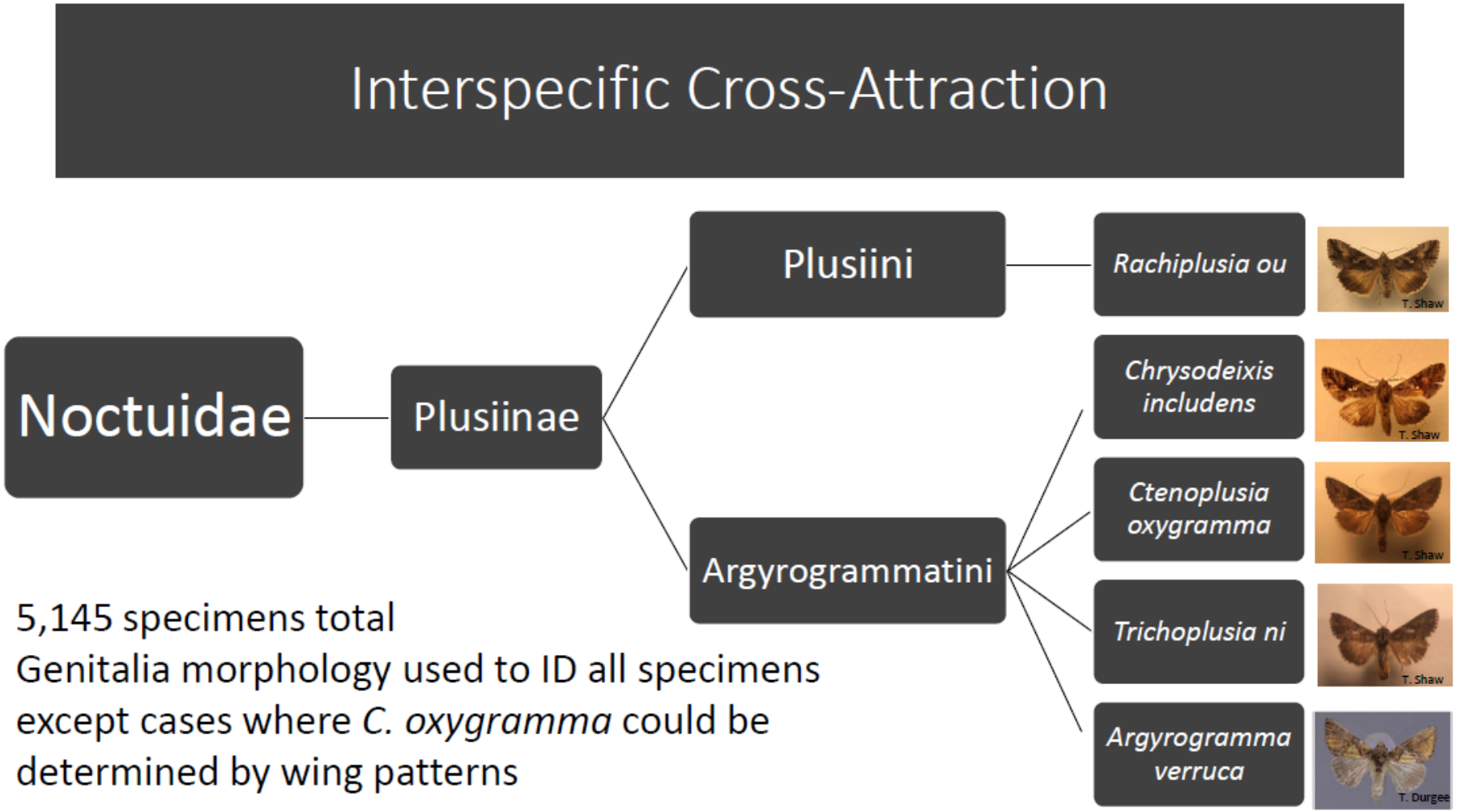
Soybean looper: *Chrysodeixis includens*
(Walker) (formerly *Pseudoplusia includens*) (Lepidoptera: Noctuidae)

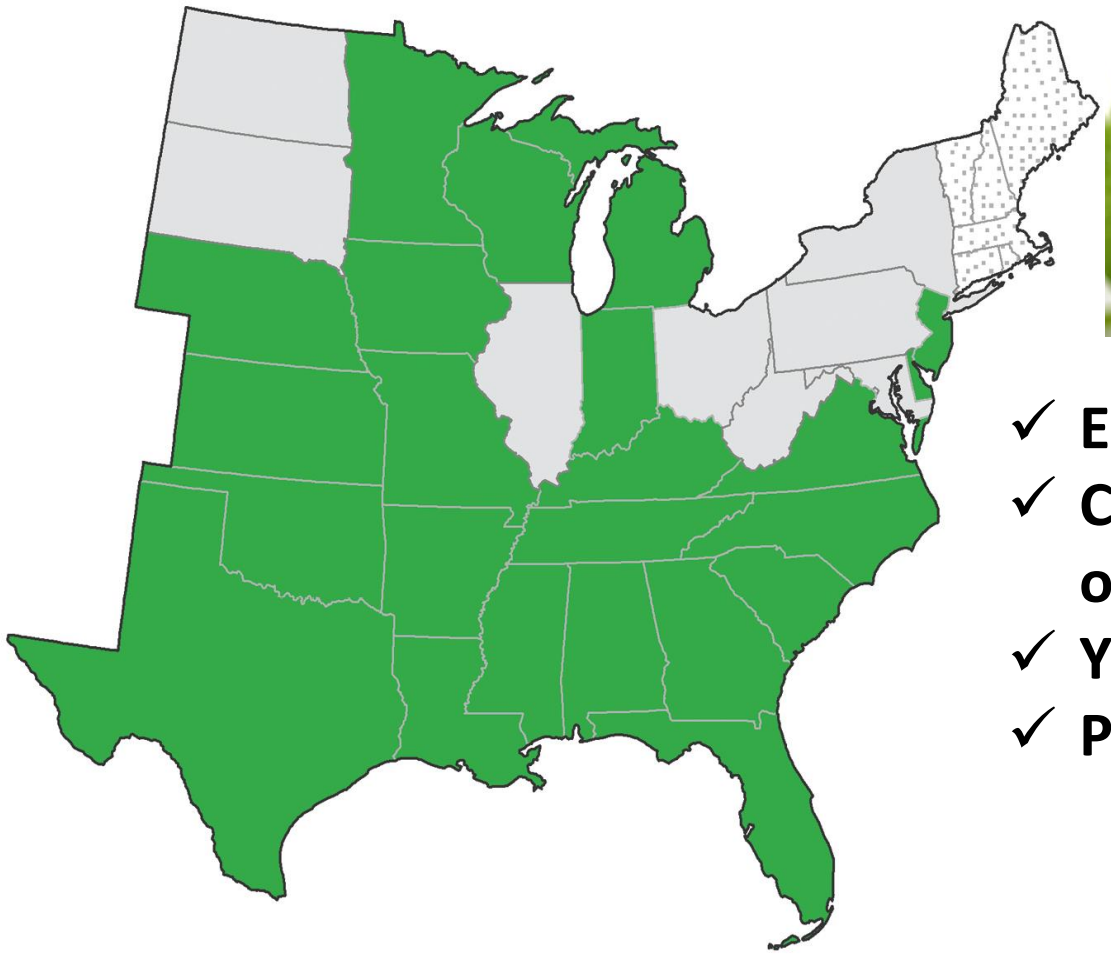
Year-around pheromone trapping



- 5,145 specimens total
- Genitalia morphology used to ID all specimens except cases where *C. oxygramma* could be determined by wing patterns

Shaw et al. 2021

Soybean looper: *Chrysodeixis includens* (Walker) (formerly *Pseudoplusia includens*) (Lepidoptera: Noctuidae)



WFREC/UF

Jeff Davis, Louisiana State University

WFREC/UF

- ✓ **Extremely polyphagous pest**
- ✓ **Consumes foliage inside of the canopy upward and outward**
- ✓ **Yield loss – R3 and R6 soybean stages**
- ✓ **Peak of occurrence – August**

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Velvetbean Caterpillar: *Anticarsia gemmatalis* Hübner (Lepidoptera: Noctuidae)

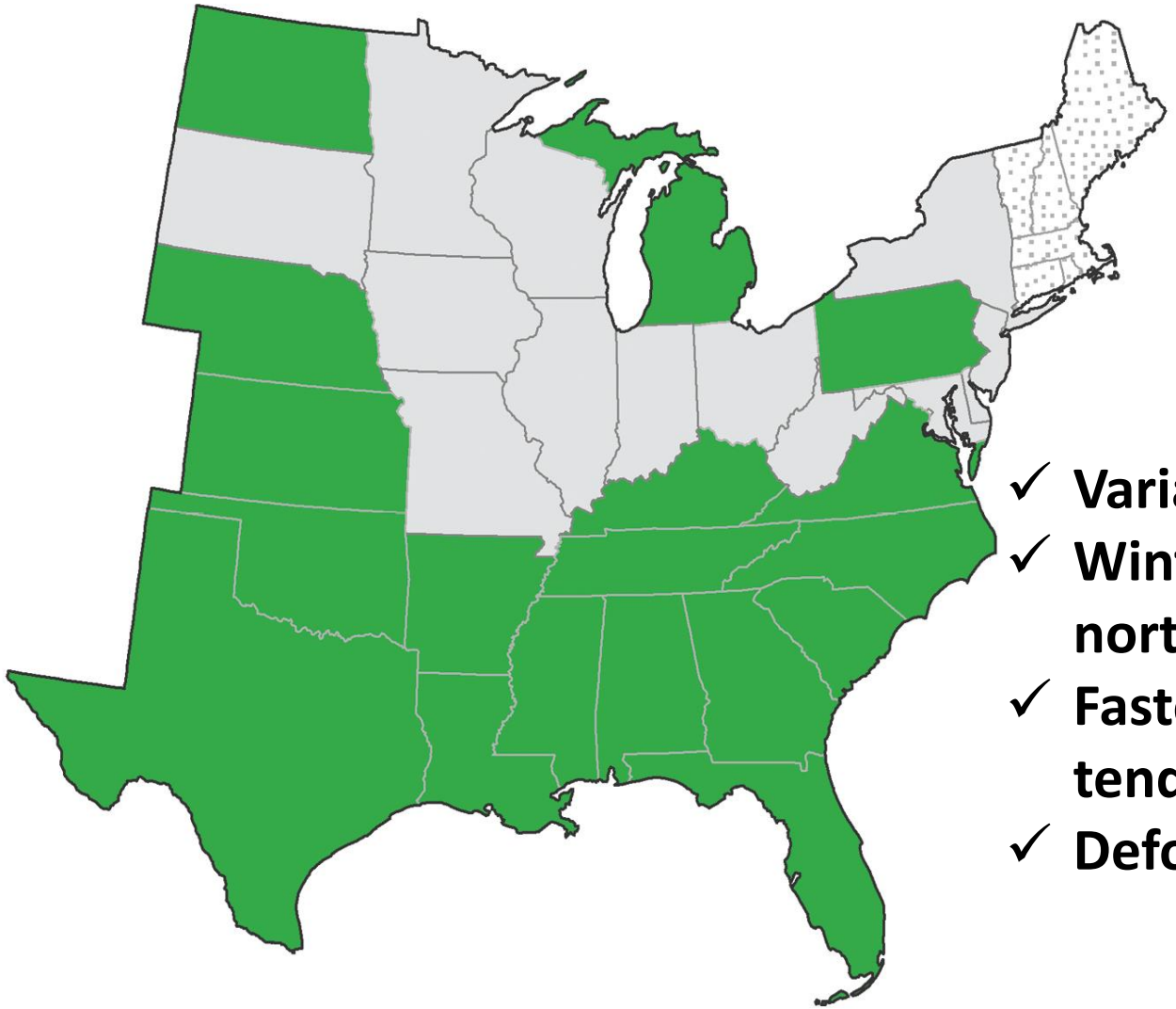

Photo by Jeff Davis, Louisiana State University

Photo by Mark Dreiling

- ✓ Variable coloration
- ✓ Winter survival in South Florida and migration northward during the spring/summer
- ✓ Faster defoliating pest starting on new leaves, and tender stems and pods
- ✓ Defoliation from upper to lower canopy

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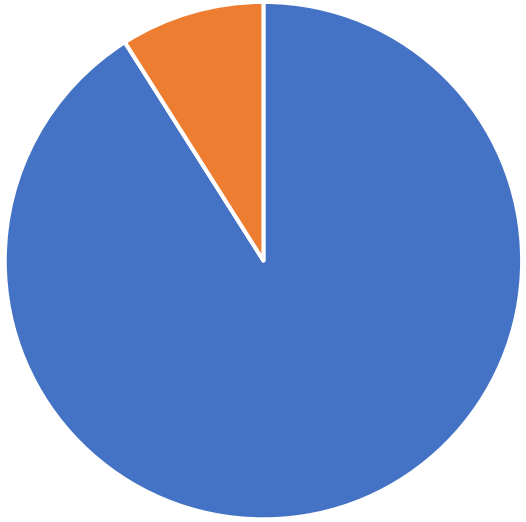
Management of caterpillars

Soybean

Proportion of lepidopteran pests in soybean – WFREC/UF – 2019 and 2020

Soybean looper 9%

High proportion of velvetbean caterpillar



Velvetbean Caterpillar 91%

Unpublished data

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Management of caterpillars

Soybean looper

✓ Challenging pest to manage

SBL eggs deposited on lower canopy

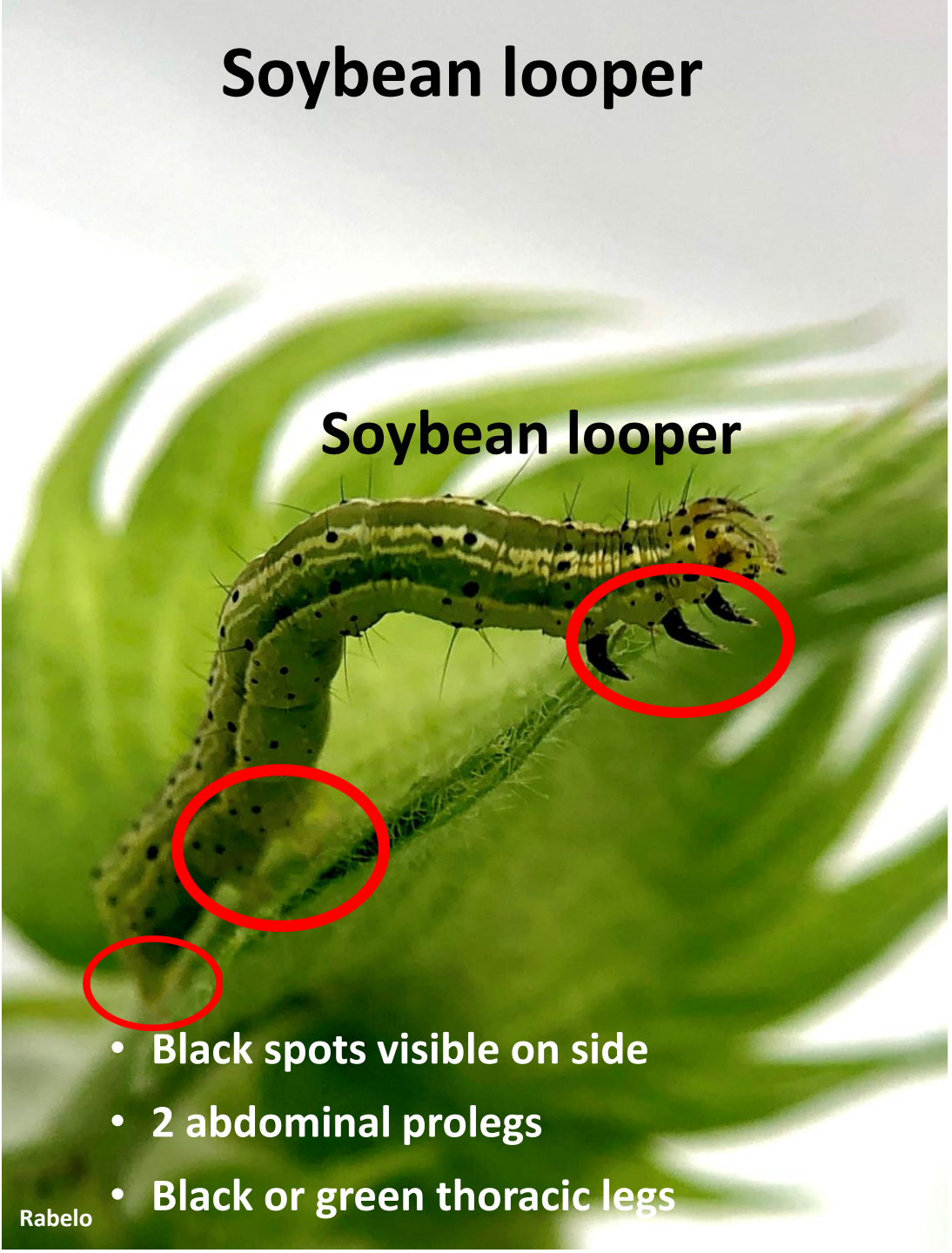
Larval distribution in the plant canopy:

- 2nd instar - lower
- 3rd & 4th instar - upper canopy
- 6th instar - middle canopy

✓ Key point in the chemical control:

Insecticide delivery in the lower plant canopy

Soybean looper



- Black spots visible on side
- 2 abdominal prolegs
- Black or green thoracic legs

Rabelo

Soybean looper

vs

Velvetbean caterpillar

Velvetbean caterpillar

4 abdominal prolegs

Green with white- yellow body stripes

wikimedia.org

Management of caterpillars

IPM improvement

Host plant resistance *"…the forgotten child in IPM"*

Initiating host breeding programs specifically to breed for resistance to pest injury

Peterson et al., 2018

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Host Plant Resistance

Plant characteristics that avoid, tolerate, or recover from pest attack

Mechanisms of Resistance:

Host Plant Resistance

Antixenosis

Repellence
Nonpreference

Antibiosis

Growth rate
Mortality
Fecundity

Tolerance

Plant withstand pest attack

Campos et al.

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(Painter, R.H., 1951)

Introduction

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(Painter, R.H., 1951)

Campos et al.

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Elite breeding lines – documentation of antibiosis resistance

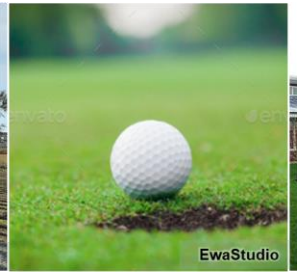
Turfgrass Breeding Program - UF

Fall armyworm and Tropical sod webworm

- ✓ **Life history traits**
- **Larval developmental time**
- **Larval survival**
- **Pupal weight**
- ✓**Fitness Index**

Sport fields

Sod production



Golf courses

Lawns

Elite breeding lines – documentation of antibiosis resistance

Peanut Breeding Program at UF

Peanut elite breeding lines performance against FAW

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Elite breeding lines – documentation of antibiosis resistance

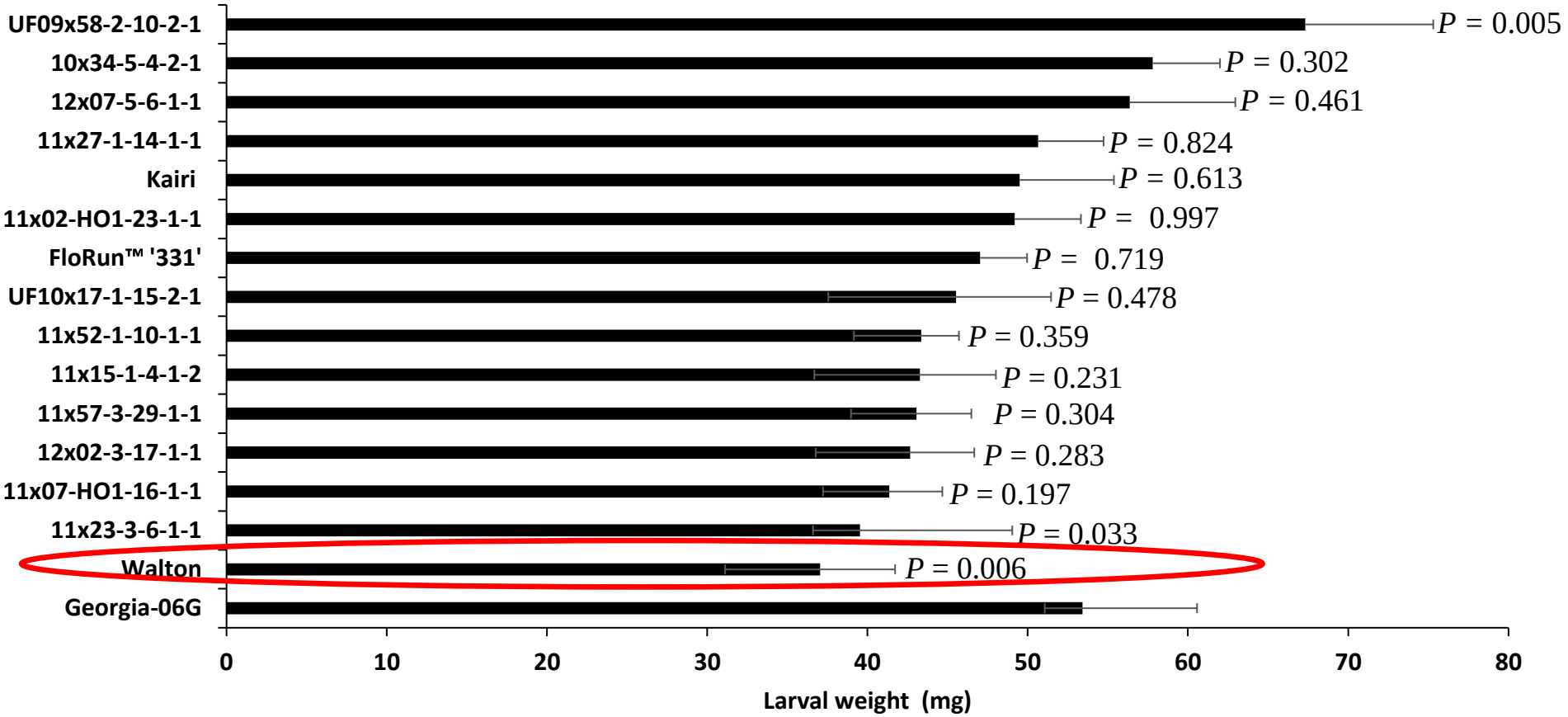

Figure 1. Larval weight in mg of soybean looper feeding on leaves of Walton, FloRun™ '331, Georgia-06G, Kairi, and 12 breeding lines at the vegetative growth stage. Error bars represent S.E.M. P-values ≤0.05 indicate individual means statistically significant from Georgia-06G, used as larval-feeding resistant reference (Dunnet test).

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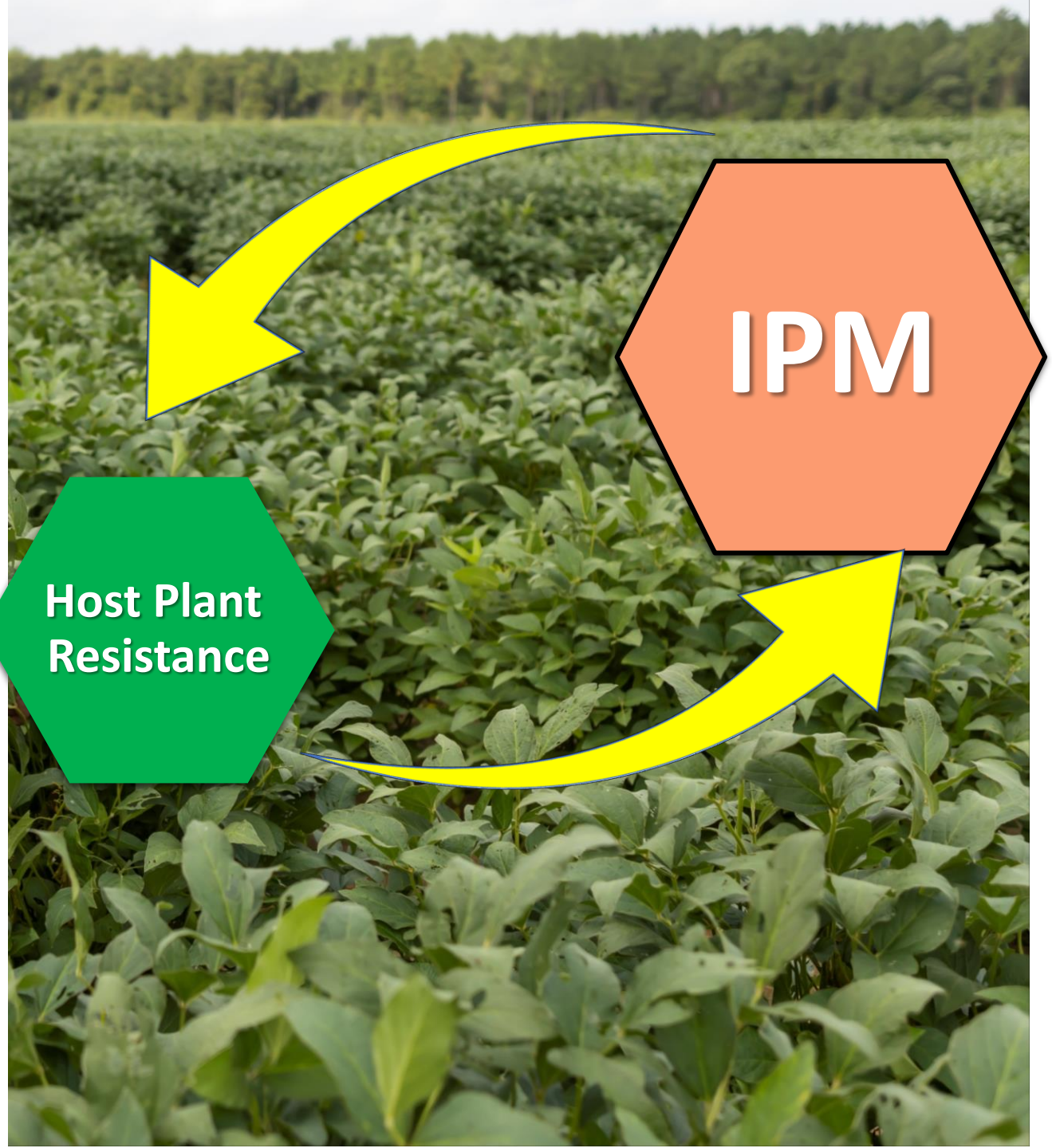
Balota, M., Tillman, B.L., Paula-Moraes, S.V., Anco, A. 2021. 'Walton', a new Virginia-type peanut suitable for Virginia and northern U.S. growing regions. *Journal Plant Registration*, 15: 422-434

The big picture

Antibiosis – host plant resistance to caterpillars

Fitness cost



Campos et al.

Acknowledge

Florida Peanut Check off

Cotton Incorporated

USDA United States Department of Agriculture

National Institute of Food and Agriculture

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