

Mexican Rice Borer: Biology of an Invasive Species

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Mexican rice borer (Lepidoptera: Crambidae)

Eoreuma loftini (Dyar)



\approx 0.2 inch

A. Mészáros

Mexican rice borer (Lepidoptera: Crambidae)

Eoreuma loftini (Dyar)



Mexican rice borer (Lepidoptera: Crambidae)

Eoreuma loftini (Dyar)



≈ 1 inch

A. Mészáros

Mexican rice borer (Lepidoptera: Crambidae)

Eoreuma loftini (Dyar)



A. Mészáros

Mexican rice borer (Lepidoptera: Crambidae)

Eoreuma loftini (Dyar)

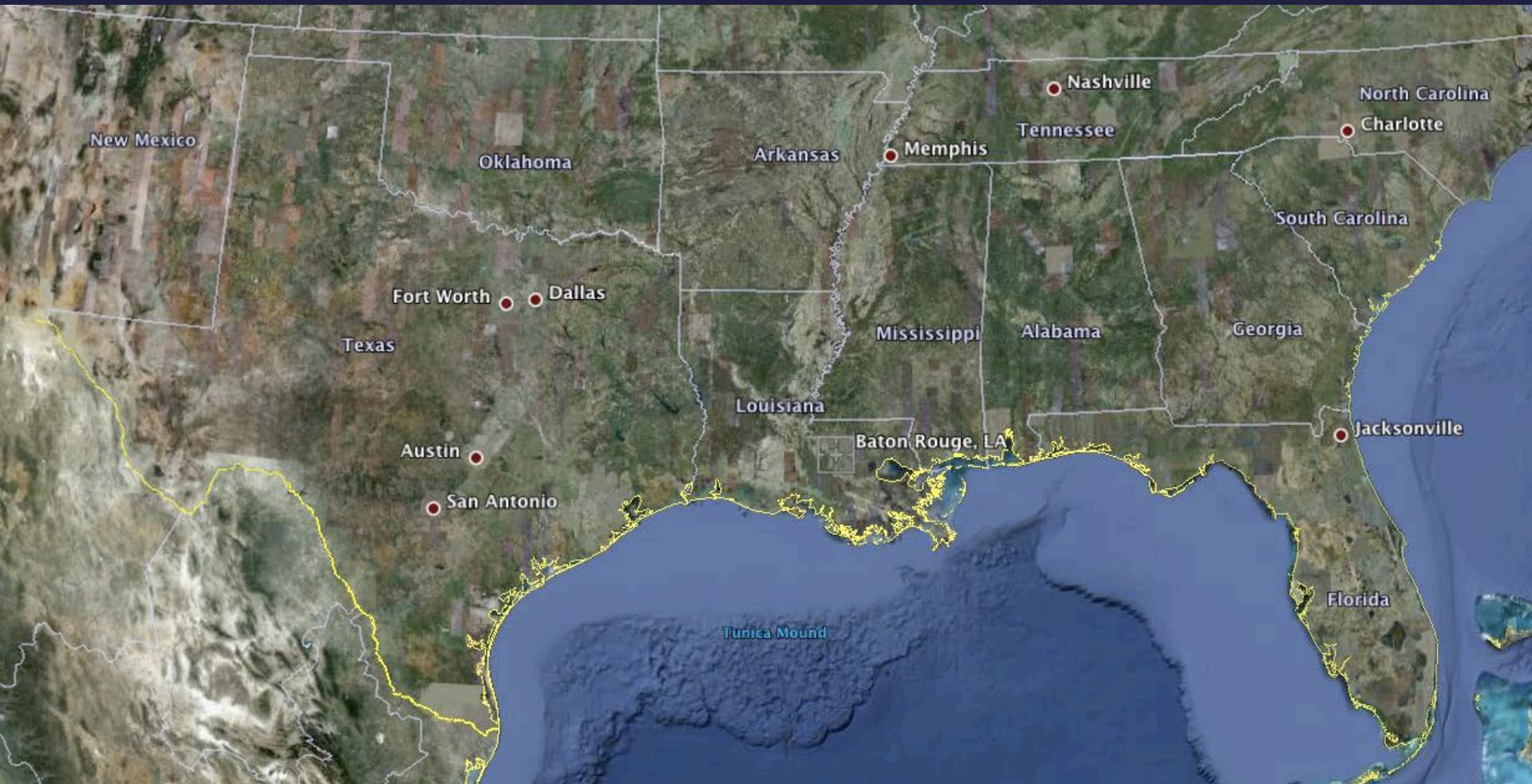


\approx 0.2 inch

A. Mészáros

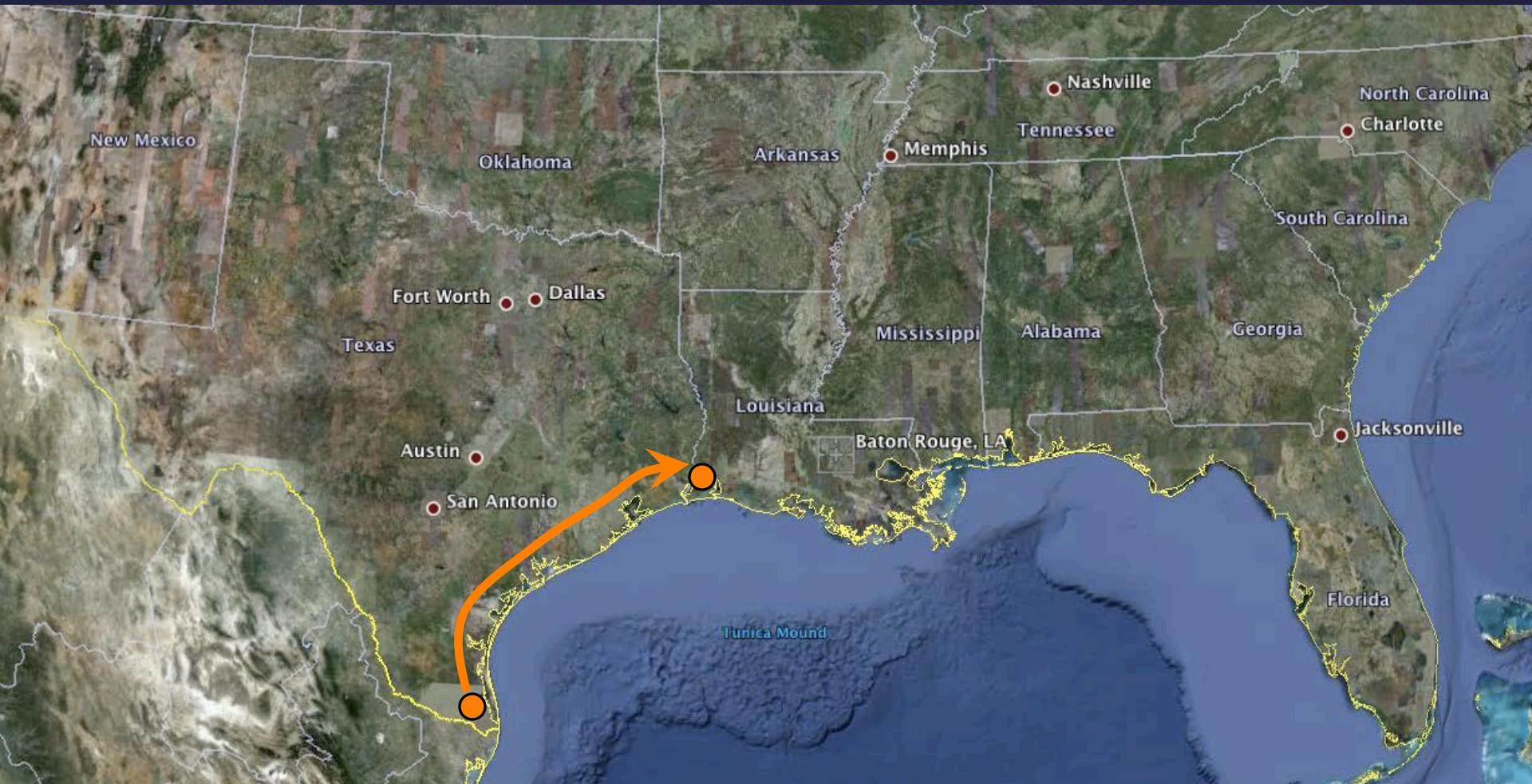
E. loftini: A successful biological invasion

- Prior to 1980: Mexico, California, Arizona



E. loftini: A successful biological invasion

- 1980-2008: range expansion towards Louisiana



Projected economic losses in Louisiana: Worst case scenario

- **\$220 million for sugarcane**
Sugarcane industry worth $\approx \$610$ million/year
- **\$40 million for rice**
Rice industry worth $\approx \$380$ million/year

E. Loftini research: Key players (USA)



K.J.R. Johnson, J.W. Smith, M.B. van
M.O. Way, I.T. Wilson, and Y. Yang
Leerdam, R.L. Meagher, J.C. Legaspi



T.E. Reagan, F.P.F Reay-Jones, J.M.
Beuzelin, B.E. Wilson, M.T. VanWeelden
M.J. Stout, N.A. Hummel, A. Mészáros



W.H. White, A.T. Showler

Biology of an insect pest

- **Reproduction**
Egg laying, fecundity
 - **Development**
Immature stage duration, adult longevity
 - **Survival**
 - **Movement**
Adult movement, larval movement
 - **Seasonality**
Population peak
 - **Predation, parasitism, and diseases**
Natural enemies
 - **Competition**
- 
- Host plant is a key factor

E. loftini plant hosts

Sugarcane, rice, corn, sorghum

Van Zwalunwenburg (1926): “*E. Loftini* attacks practically all the grasses large enough to afford it shelter within the stalk”

Family Poaceae

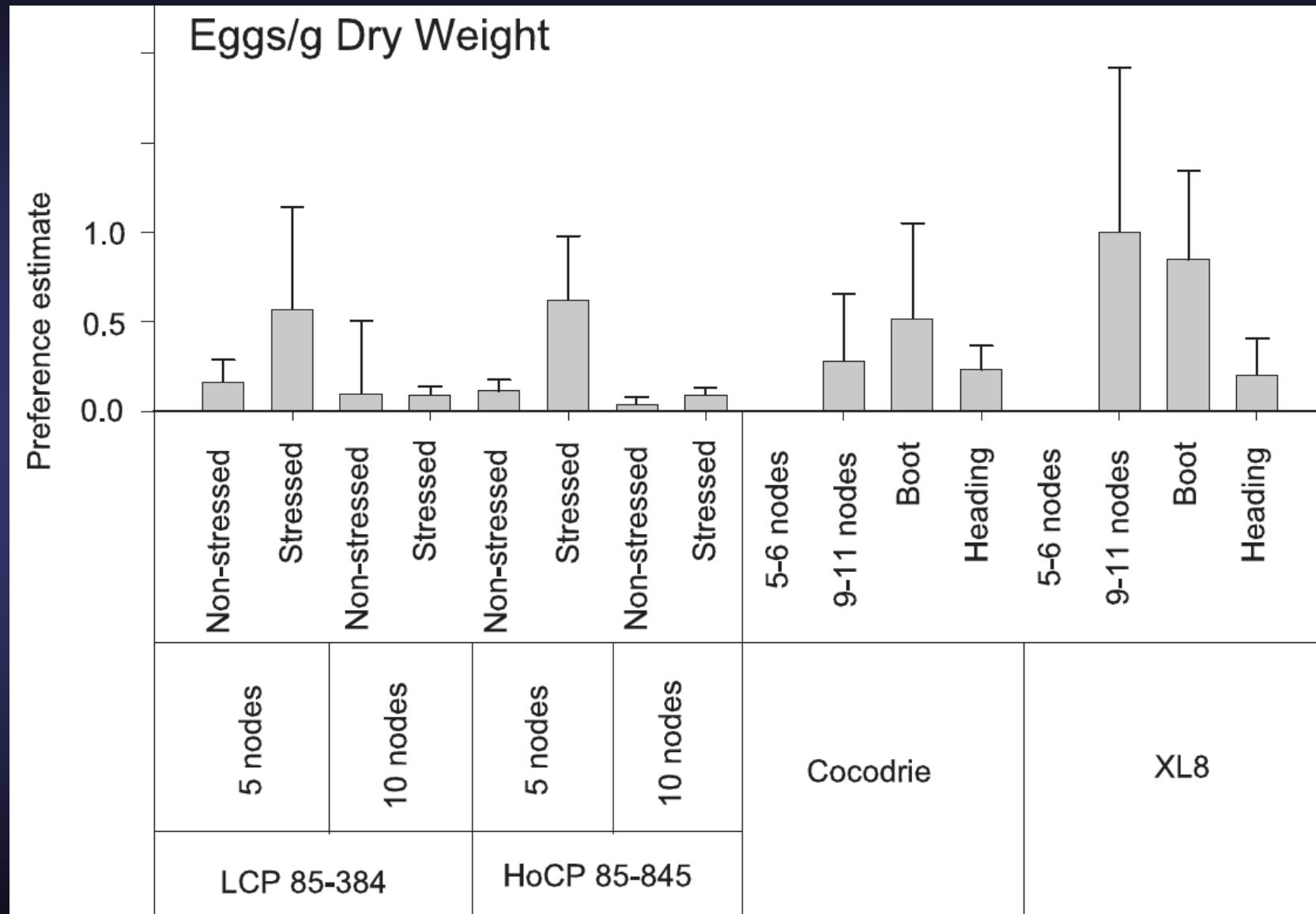
- *Echinochloa* grasses (e.g., barnyardgrass)
- *Leptochloa* grasses (e.g., sprangletop)
- *Panicum* grasses (e.g., fall panicum)
- *Paspalum* grasses (e.g., vaseygrass)
- *Sorghum* grasses (e.g., johnsongrass)

Sugarcane vs. Rice (greenhouse experiment)

Species	Cultivar	Stage	Stress
Sugarcane	LCP 85-384	5 internodes	No
			Yes
		11 internodes	No
	HoCP 85-845		Yes
		5 internodes	No
			Yes
Rice	Cocodrie	11 internodes	No
			Yes
		3-4 leaves	
		6-7 leaves	
	XL8	Boot	
		Heading	
		3-4 leaves	
		6-7 leaves	
		Boot	
		Heading	

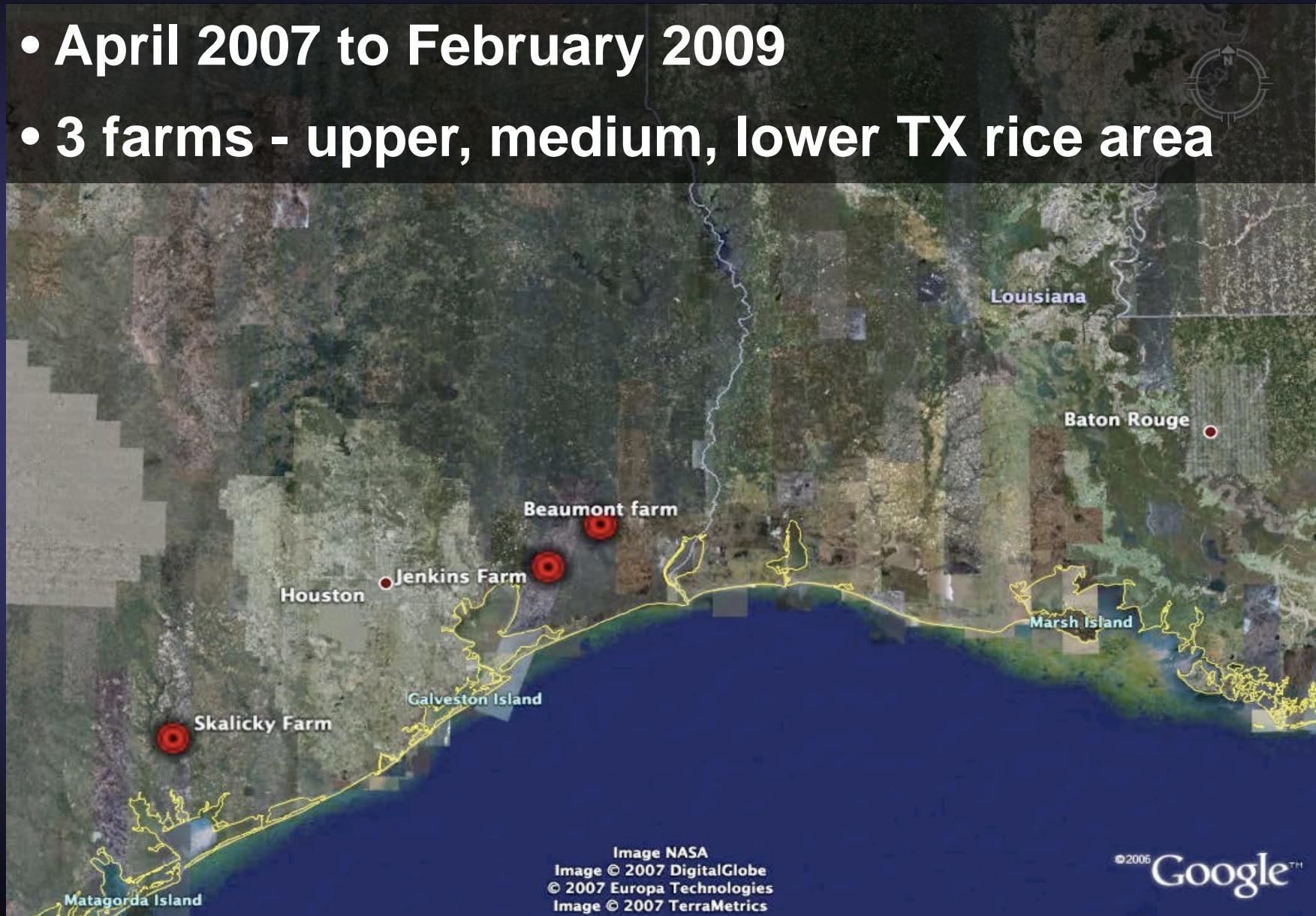
Reay-Jones et al. 2007.
Environ. Entomol. 36: 938-951

Oviposition preference (based on dry weight)

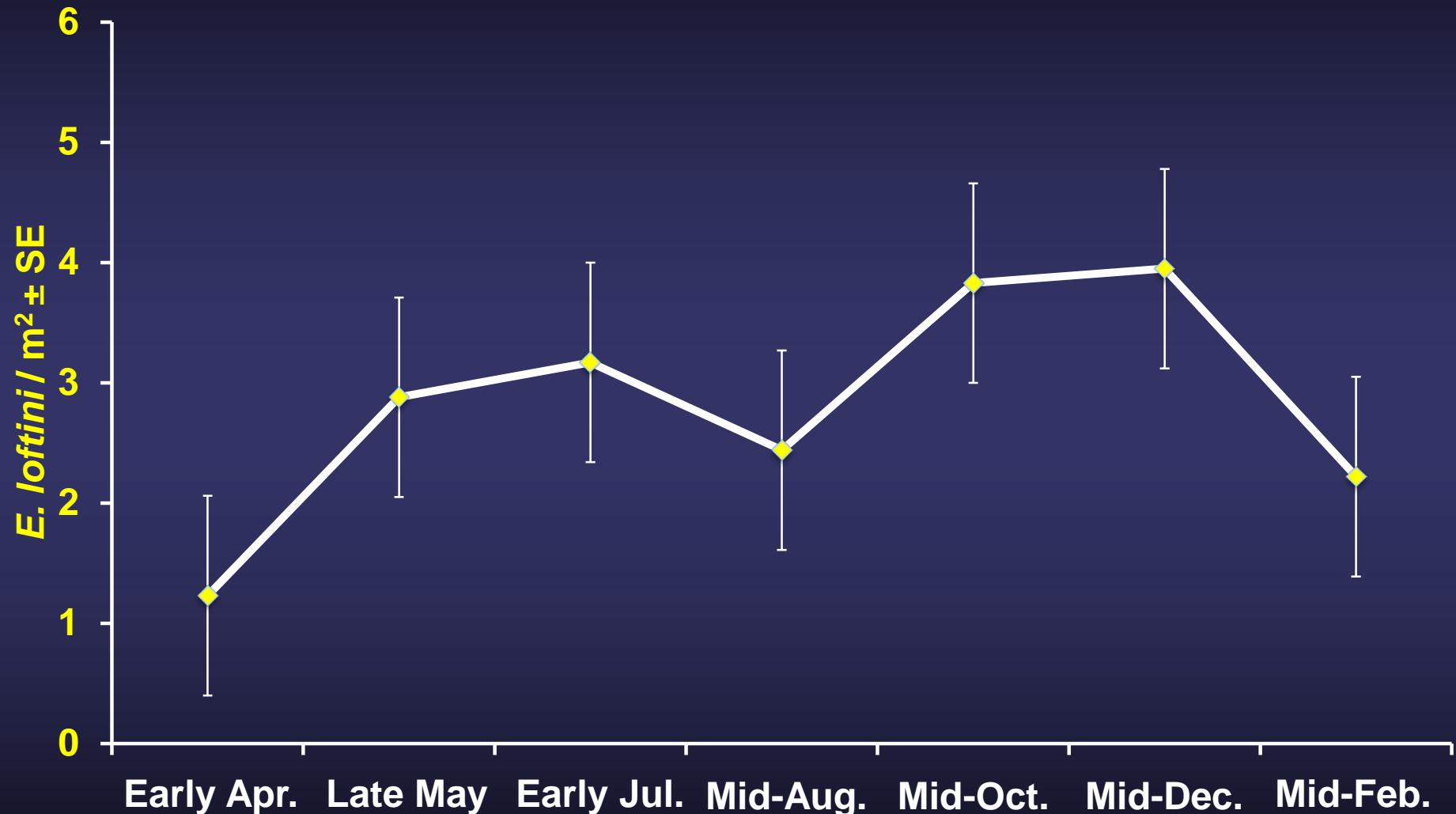


Weedy habitat surveys in southeast TX

- April 2007 to February 2009
- 3 farms - upper, medium, lower TX rice area



Seasonal *E. loftini* density in non-crop habitats (2 years)



Discussion – Seasonal role of non-crop grasses in rice agroecosystems

- Early rice growing season:
 - *E. loftini* built up in grasses found in field margins
 - *E. loftini* did not feed on young rice
- Late and post growing season:
 - *E. loftini* infestations were high in margin grasses
 - Overwintering habitat
 - Rice stubble can host *E. loftini* populations if not plowed early

Discussion – Role of non-crop grasses in rice agroecosystems

- *E. loftini* use of hosts in time
 - Early annual grasses as hosts during the spring
 - Late annual grasses as hosts during the late summer and fall
 - Johnsongrass and Vaseygrass as hosts throughout the year

Greenhouse Experiment

Greenhouse experiment with non-crop hosts

- Summer of 2009, Beaumont, TX

- Four non-crop grass species:

- Ryegrass, *Lolium* sp.
- Brome, *Bromus* sp.
- Johnsongrass, *S. halepense*
- Vaseygrass, *P. urvillei*

}

14, 10 & 6 wks after planting
@ three stages
17, 12 & 7 wks after planting

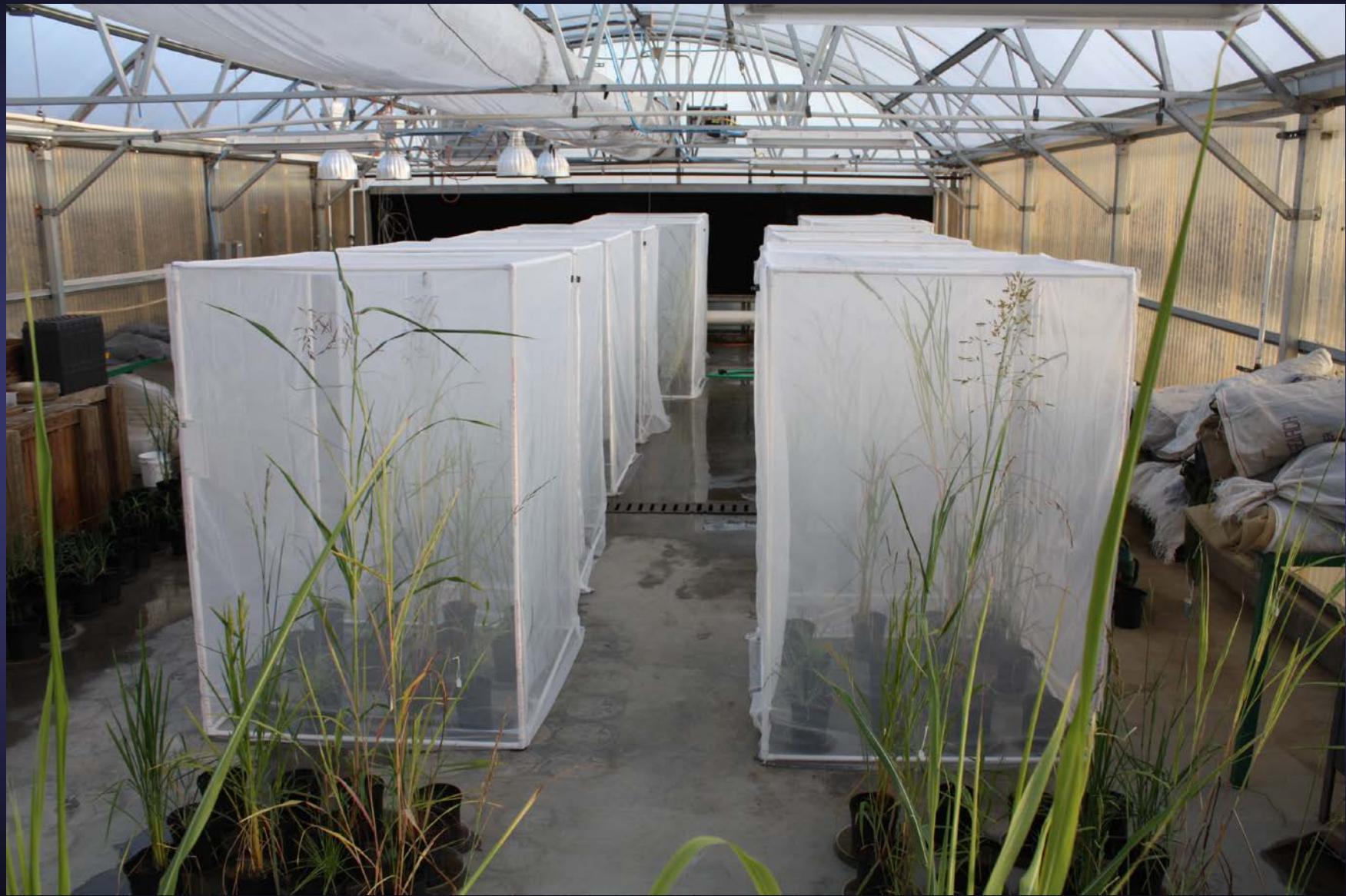
- Crop grass:

- Rice, cultivar Cocodrie

}

13, 10 & 5 wks after planting

Plants were grown in a greenhouse



Adult *E. Loftini* were released in the cages

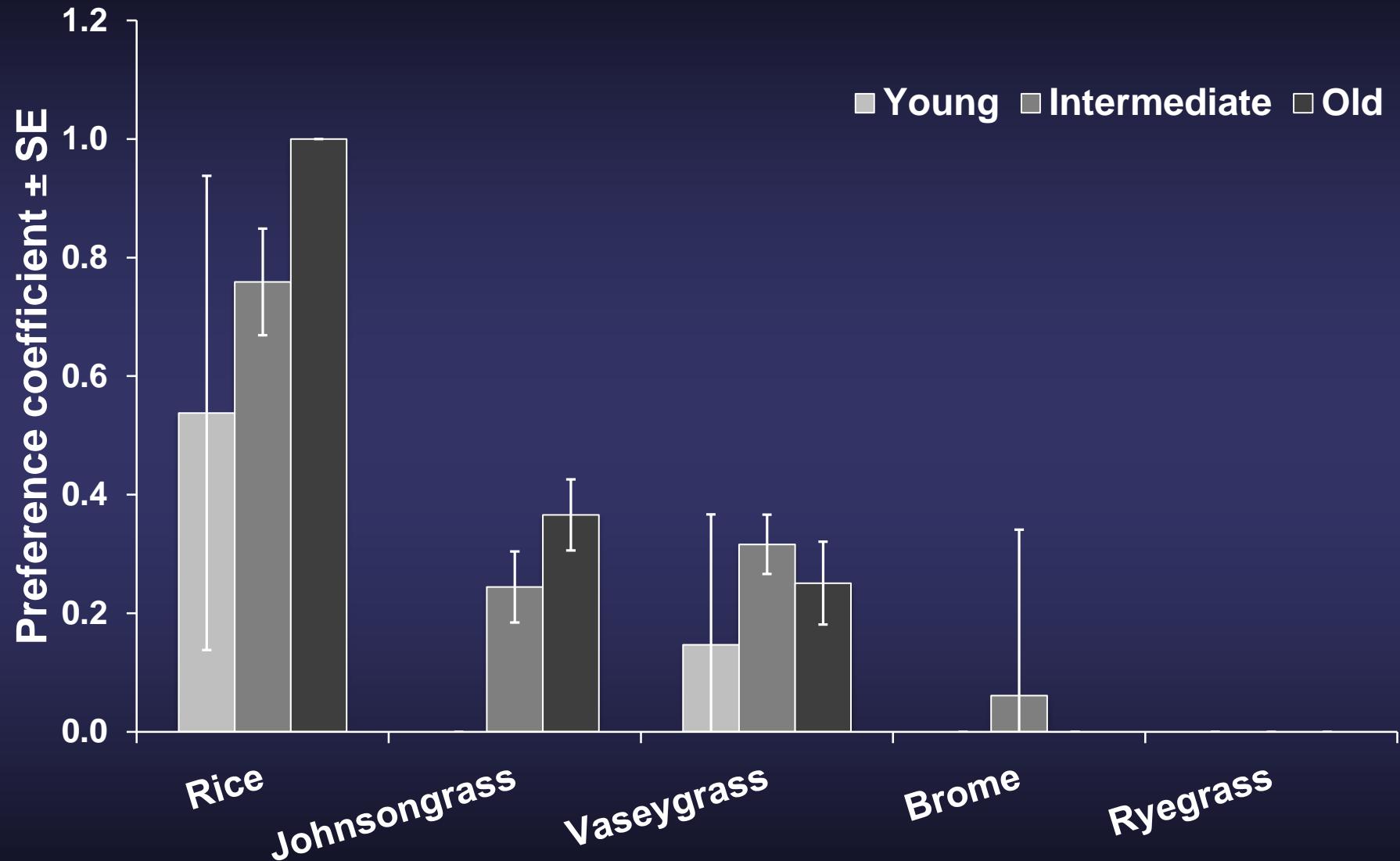


- ***E. loftini* colony**
 - < 3 month-old colony
 - Maintained in Weslaco, TX
- **Mating upon adult emergence**
 - 10 females and 5-10 males in container for 24h
- **Release**
 - 10 females and 5-10 males in each cage

Oviposition assessment after 3 days



Oviposition preference (based on fresh weight)



Regression model: $P < 0.001$, $R^2 = 0.59$

JMP, Non-linear modeling

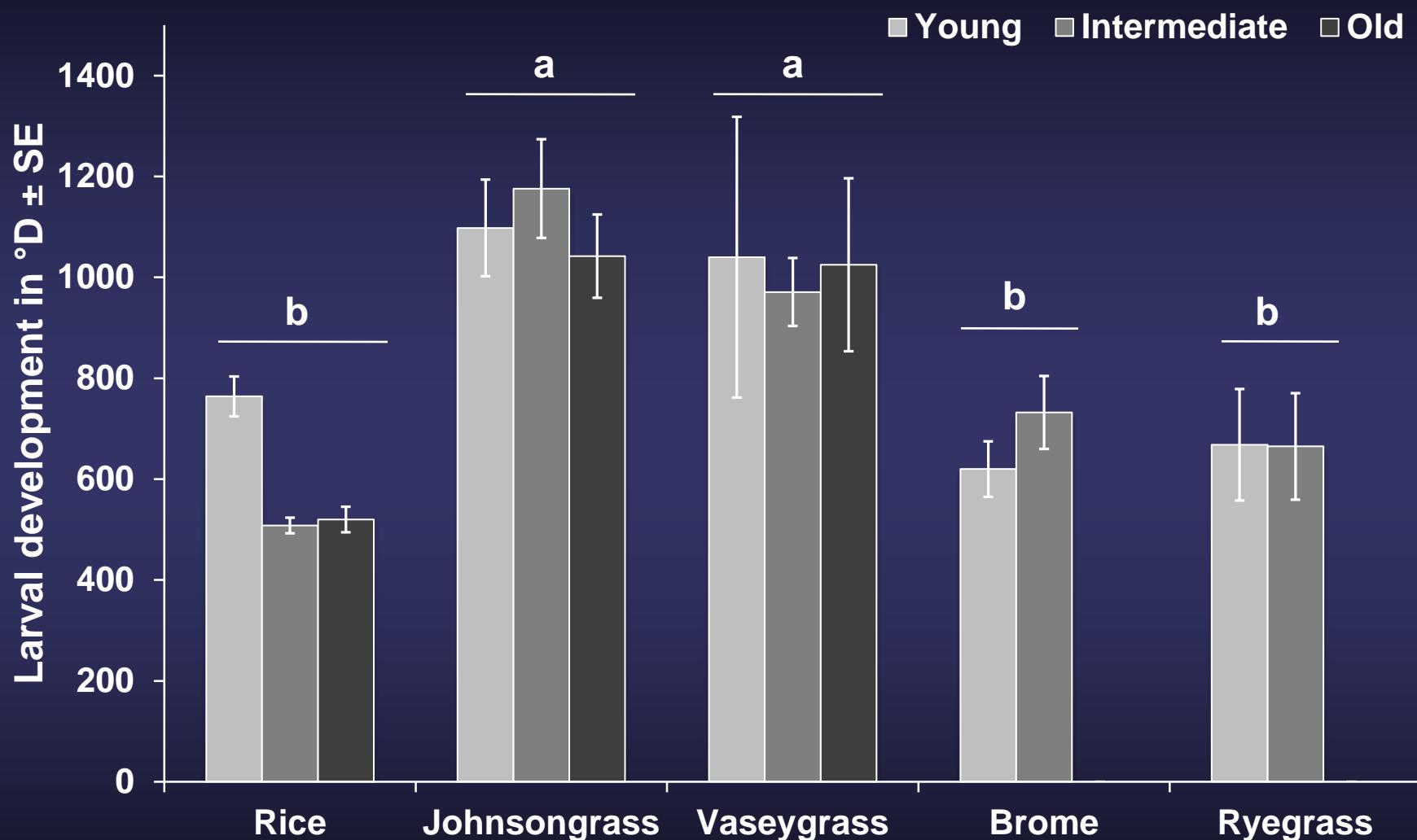
Larval stage duration estimation

- Plant dissection after 5-6 weeks



- Larvae reared on artificial diet
- Pupae kept until adult eclosion

E. loftini larval development duration



Host: $F = 10.45$; $df = 12, 90$; $P < 0.001$

SAS, Proc Mixed – Contrasts, bars with the same letters are not different ($P > 0.05$)

Discussion – *E. loftini* preference and performance

- **Rice:** preferred and very suitable
- **Perennials:** less preferred and less suitable
- **Early annuals:** not preferred but suitable
- **Plant characteristics involved**
 - Dry leaf material correlated with preference ($P < 0.05$)
 - Shoot diameter not correlated with preference ($P > 0.05$)
 - Plant metabolites (quantification of free amino acids)

Biology of an insect pest

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Pheromone trapping in southeast TX

- March, 2007 to April, 2009
- 3 farms - upper, medium, lower TX rice area
- 2 traps per farm, collection every 2-3 wks

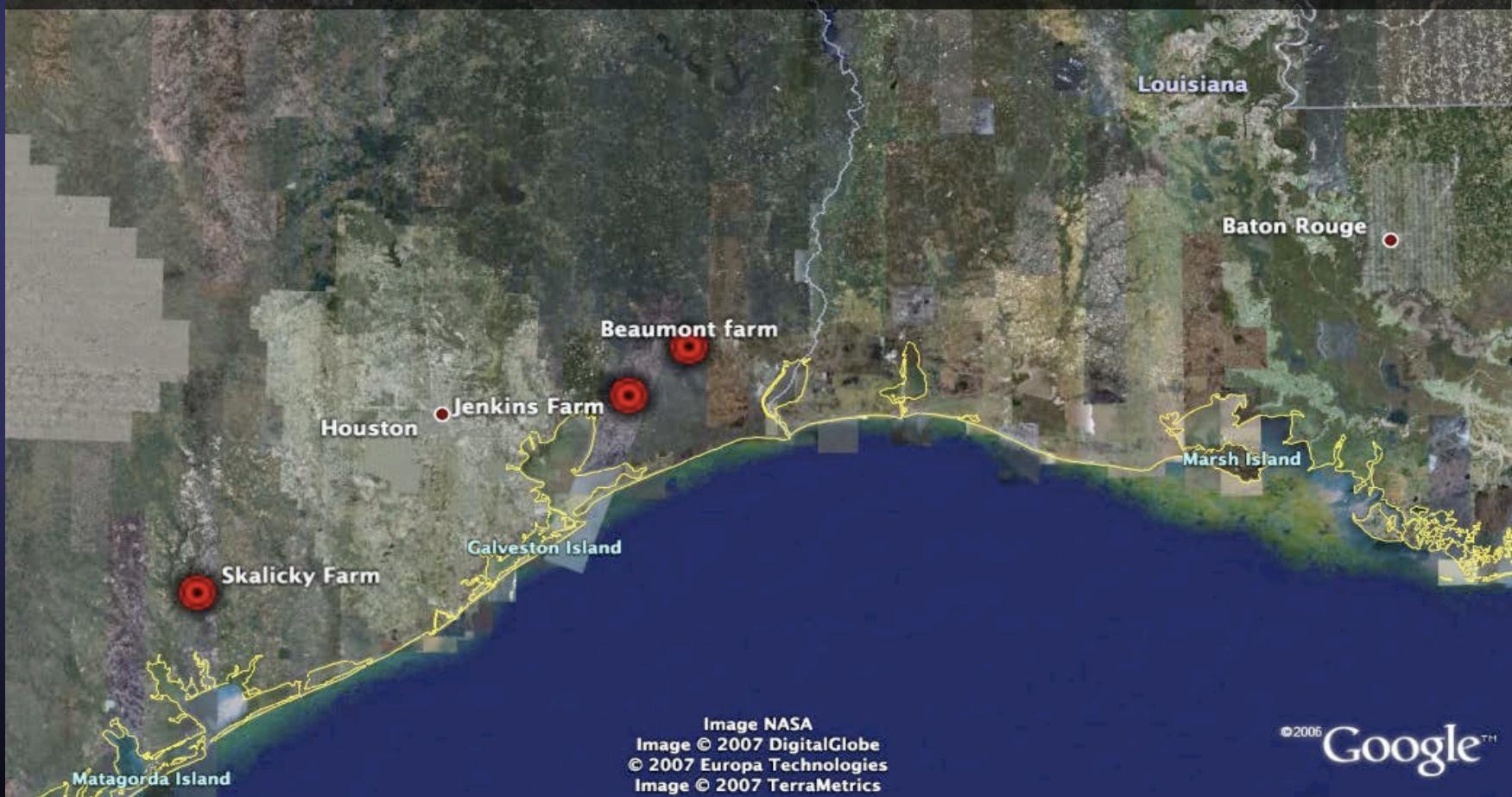
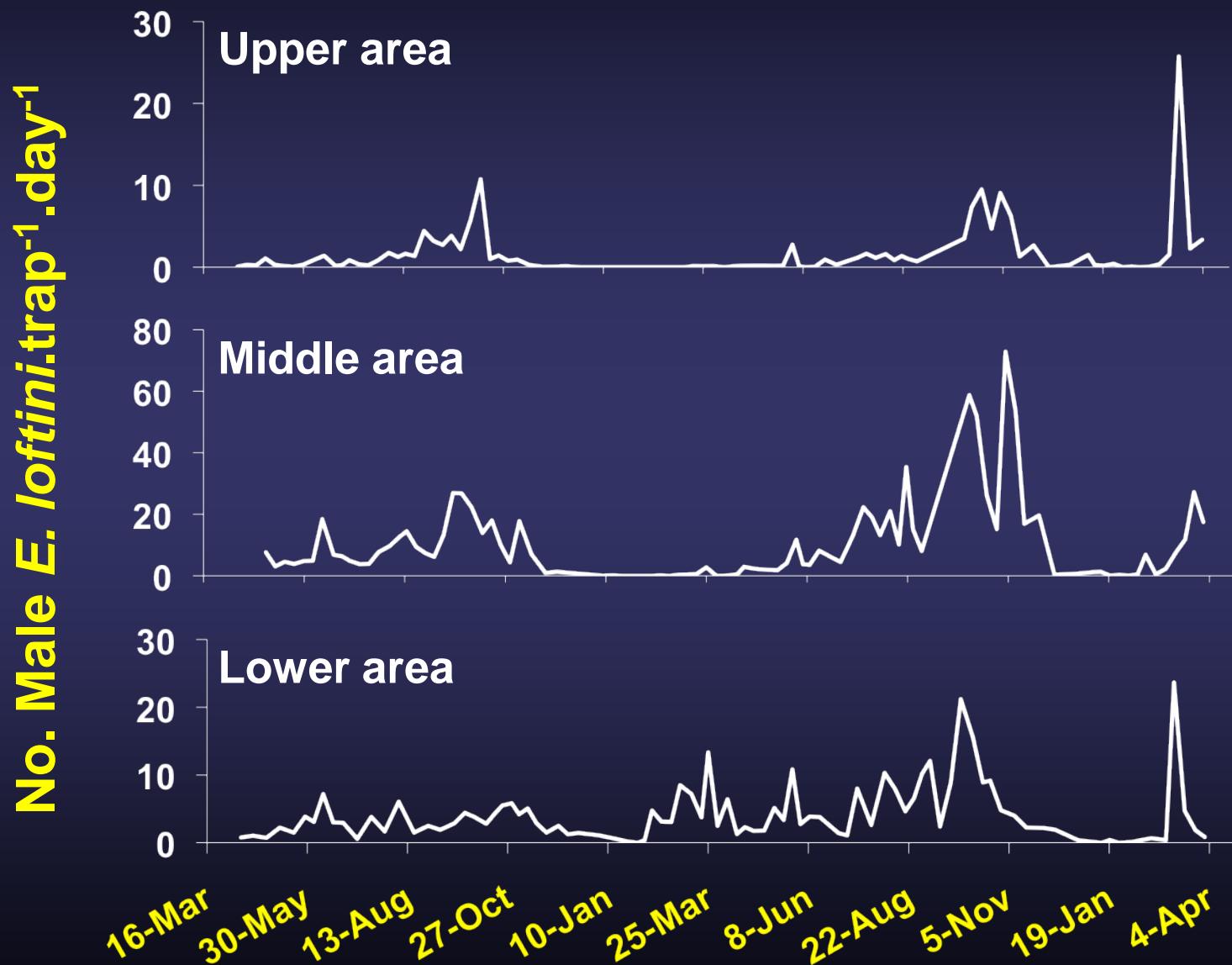


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Pheromone trapping in southeast TX



Rice stubble management experiments

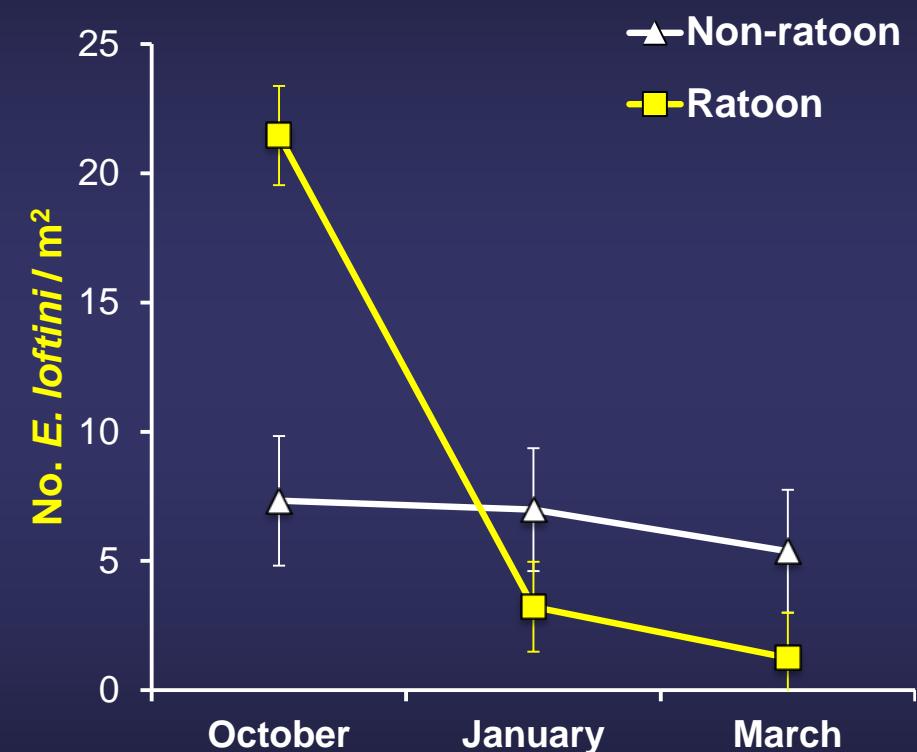
- **Two stubble management regimes**
 - Ratoon (stubble was fertilized, flooded, not treated with insecticides, harvested in November)
 - Non-ratoon (stubble was left unmanaged)



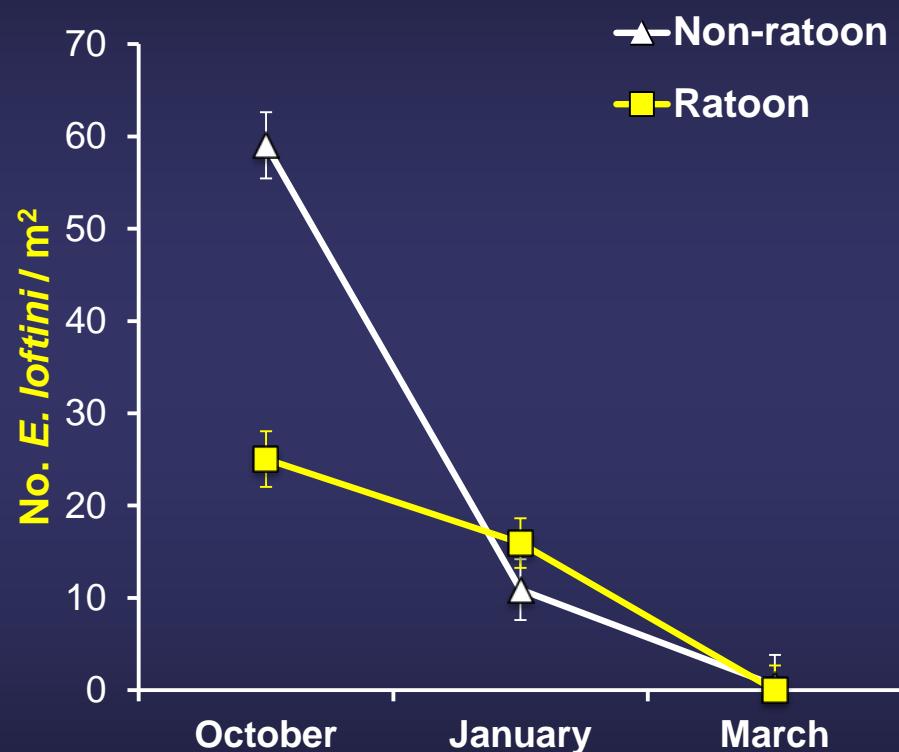
- **Data collection in late October, mid-January, and mid-March**

E. loftini late and post-growing season infestations in ratoon and non-ratoon rice (October-March)

2007-2008



2008-2009



- Rice stubble harbors late season and overwintering *E. loftini* populations

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Questions



M.O. Way, L.T. Wilson, and Y. Yang



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Larval feeding signs



Stem borer larvae

Sugarcane borer
Diatraea saccharalis



Mexican rice borer
Eoreuma loftini



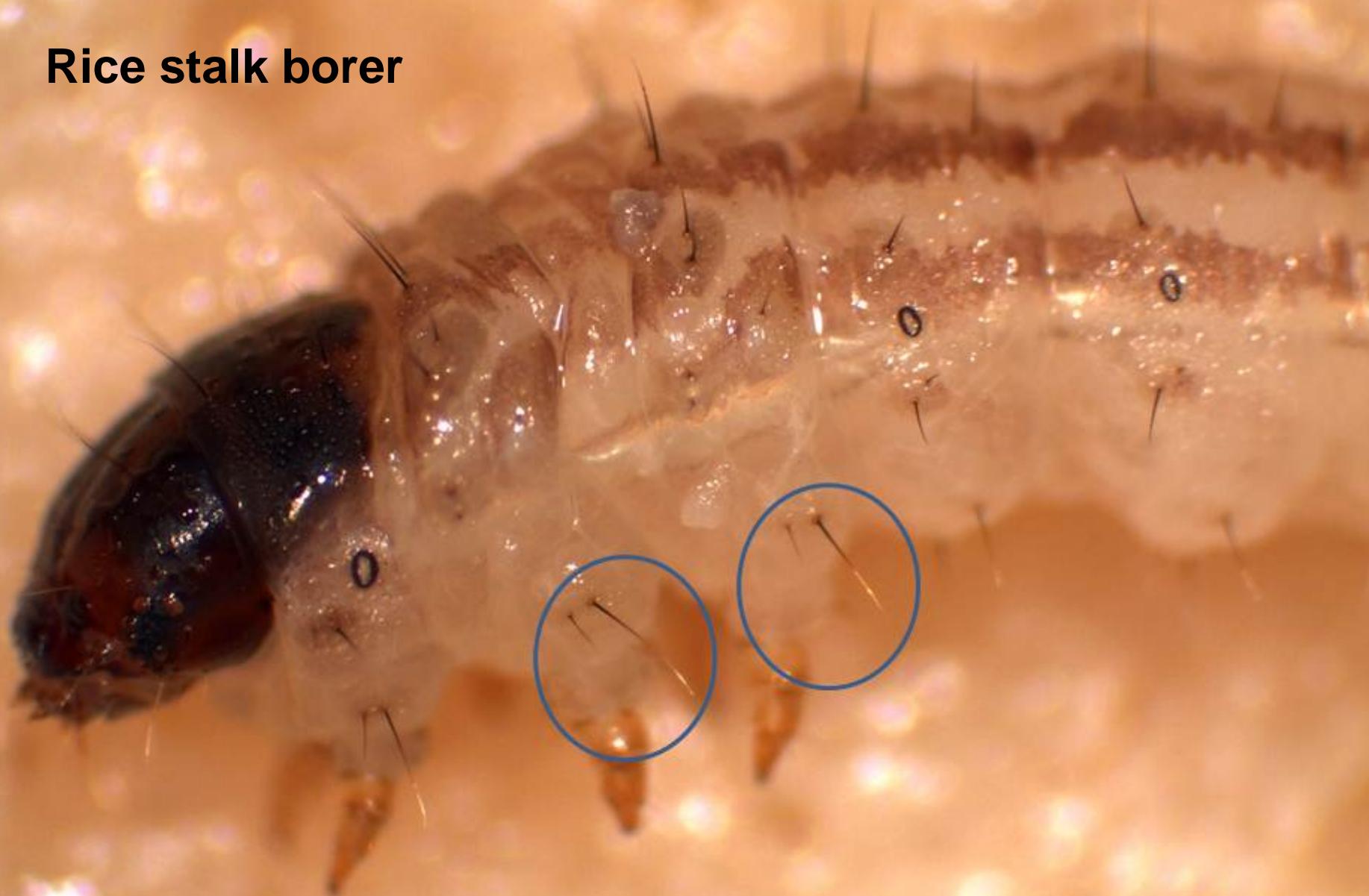
Rice stalk borer
Chilo plejadellus



Mexican rice borer



Rice stalk borer



Stem borer adults

SCB



MRB



RSB



Questions



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