Assessing the Relative Abundance of Invasive Stink Bugs (Hemiptera: Pentatomidae) Infesting Rice in Florida

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INTRODUCTION

Florida's stink bug complex in rice consists of the native rice stink bug, *Oebalus pugnax* (F.) as well as two invasive species, *Oebalus ypsilongriseus* (DeGeer) (Fig. 1) and *Oebalus insularis* (Stal) (Fig. 2) which were first detected in 1994 and 2007, respectively (Cherry et al. 1998; Cherry and Nuessly 2010). Stink bugs feed on developing rice grains, which can reduce yield and quality. Extensive surveys to quantify the relative abundance of each species were conducted in Florida's rice production region in 2008 and 2009, and determined that the invasive species *O. ypsilongriseus* and *O. insularis* constituted a small proportion of the overall stink bug complex (Cherry and Nuessly 2010), however, increases in rice acreages over the past 10 years have warranted additional surveys. In 2017, a study was initiated to determine changes in the relative abundance of invasive stink bugs in Florida rice.

Fig. 1. Adult *Oebalus ypsilongriseus* feeding on rice. (photo: M. T. VanWeelden, UF/IFAS)

Fig. 2. Adult *Oebalus insularis* feeding on rice. (photo: M. T. VanWeelden, UF/IFAS)

RESEARCH OBJECTIVES

A two-year study was conducted to determine the following:

- Changes in the relative abundance of species within Florida's rice stink bug complex since the industry's expansion over the past 10 years.
- Abundance of stink bug species in non-crop host plants adjacent to rice fields.

RESEARCH HYPOTHESIS

We hypothesize that the invasive species, *O. ypsilongriseus* and *O. insularis*, have increased in relative abundance over the past 10 years. If our hypothesis is correct, additional studies will need to be initiated to compare injury from feeding among each of the three stink bug species in order to develop new economic thresholds for Florida rice growers.

MATERIALS AND METHODS

- Sampling for *Oebalus* spp. was conducted in commercial rice fields located in the Everglades Agricultural Area of Florida.
- In both 2017 and 2018, sweep net sampling was conducted at eight locations, each at three sampling periods: 'Mid-summer' (Jun/Jul), 'Late-summer' (Aug/Sept), and 'Early-fall' (Oct).
- Each location consisted of a commercial rice ('Diamond') field and adjacent non-crop transect (Fig. 3).
- At milk or soft dough stage, three, 50 sweep samples were collected at each rice field and adjacent transect, 40, 80, and 120 m from the front of the field edge.
- Samples were placed into plastic bags and returned to the lab for identification.
- Stink bugs were identified to species, and the numbers of nymph and adults were recorded for each species.
- Numbers of each species were compared among sampling period, habitat (crop vs non-crop), and the interaction using linear mixed models (PROC GLIMMIX, SAS Institute, 2016).

Table 1. Numbers of *O. pugnax* collected per sweep net sample (± SEM), Belle Glade, FL, 2017-2018.

	Nymphs	Adults	Total
Mid summer			
Rice	**5.6±1.2**	**8.2±2.0**	**13.8±2.9**
Non-crop	**0.9±1.3**	**6.1±2.1**	**7.1±3.0**
Late summer			
Rice	**0.4±1.3**	**11.0±2.1**	**11.5±3.0**
Non-crop	**0.3±1.2**	**2.8±2.0**	**3.0±2.9**
Early fall			
Rice	**2.5±1.6**	**6.3±2.7**	**8.8±3.8**
Non-crop	**0.3±1.6**	**2.2±2.8**	**2.6±3.8**
Sampling Period	***F* = 2.40** **df = 2,36** ***P* = 0.1050**	***F* = 0.80** **df = 2,36** ***P* = 0.4590**	***F* = 1.21** **df = 2,36** ***P* = 0.3097**
Habitat	***F* = 7.30** **df = 1,36** ***P* = 0.0105**	***F* = 6.68** **df = 1,36** **P = 0.0140**	***F* = 8.77** **df = 1,36** **P = 0.0054**
Sampling Period x Habitat	***F* = 2.80** **df = 2,36** ***P* = 0.0739**	***F* = 6.68** **df = 2,36** ***P* = 0.3134**	***F* = 0.09** **df = 2,36** ***P* = 0.9140**

Table 2. Numbers of *O. ypsilongriseus* collected per sweep net sample (± SEM), Belle Glade, FL, 2017-2018.

	Nymphs	Adults	Total
Mid summer			
Rice	**0.0±0.0**	**0.8±0.7**	**0.9±0.7**
Non-crop	**0.0±0.0**	**0.3±0.7**	**0.3±0.7**
Late summer			
Rice	**0.0±0.0**	**2.8±0.7**	**2.8±0.7**
Non-crop	**0.0±0.0**	**0.3±0.7**	**0.3±0.7**
Early fall			
Rice	**0.0±0.0**	**0.1±0.9**	**0.3±0.7**
Non-crop	**0.0±0.0**	**0.0±0.9**	**0.1±0.9**
Sampling Period	***F* = 1.70** **df = 2,36** ***P* = 0.1967**	***F* = 1.85** **df = 2,36** ***P* = 0.1724**	***F* = 1.74** **df = 2,36** ***P* = 0.1892**
Habitat	**F = 0.49** **df = 1,36** ***P* = 0.4878**	***F* = 3.50** **df = 1,36** ***P* = 0.0696**	***F* = 3.54** **df = 1,36** ***P* = 0.0681**
Sampling Period x Habitat	***F* = 0.77** **df = 2,36** ***P* = 0.4685**	***F* = 1.88** **df = 2,36** ***P* = 0.1676**	***F* = 1.85** **df = 2,36** ***P* = 0.1725**

Table 3. Numbers of *O. insularis* collected per sweep net sample (± SEM), Belle Glade, FL, 2017-2018.

	Nymphs	Adults	Total
Mid summer			
Rice	**1.9±0.6**	**10.4±3.9**	**12.3±4.2**
Non-crop	**1.2±0.6**	**8.5±3.9**	**9.6±4.3**
Late summer			
Rice	**1.1±0.6**	**19.8±3.9**	**20.9±4.3**
Non-crop	**1.4±0.6**	**5.9±3.9**	**7.3±4.2**
Early fall			
Rice	**1.4±0.6**	**2.9±5.1**	**3.2±5.7**
Non-crop	**0.1±0.8**	**1.0±5.2**	**1.1±5.7**
Sampling Period	***F* = 1.31** **df = 2,36** ***P* = 0.2812**	***F* = 1.78** **df = 2,36** ***P* = 0.1835**	***F* = 1.80** **df = 2,36** ***P* = 0.1801**
Habitat	***F* = 0.22** **df = 1,36** ***P* = 0.6427**	**F = 6.39** **df = 1,36** ***P* = 0.0160**	***F* = 6.00** **df = 1,36** ***P* = 0.0193**
Sampling Period x Habitat	***F* = 0.47** **df = 2,36** ***P* = 0.6288**	**F = 3.34** **df = 2,36** ***P* = 0.0466**	***F* = 2.56** **df = 2,36** ***P* = 0.0917**

RESULTS

- A total of 4,536 stink bugs were collected in 2017 and 2018. Total relative abundance among the three *Oebalus* spp. was 42.2% (*Oebalus pugnax*), 4.5% (*Oebalus ypsilongriseus*), and 53.3% (*Oebalus insularis*).
- Numbers of *O. pugnax and O. insularis* nymphs and adults were significantly greater in rice compared to non-crop habitats (Tables 1 and 3), however significant changes in the abundance of adults between habitats by sampling period were only detected in *O. insularis*. Numbers of *O. ypsilongriseus* were relatively low throughout the course of the study (205 specimens), and differences in abundance were not detected (Table 2). Total *O. pugnax* numbers peaked in mid-summer in both rice and non-crop habitats, while *O. ypsilongriseus* and *O. insularis* numbers peaked in late summer, with all three species tapering off in the fall months.
- *Oebalus* spp. were observed feeding on 11 species of non-crop graminacious hosts. The predominant host plant was fall panicum (*Panicum dichotomiflorum* Michx.), representing 62.4% relative abundance among non-crop transects.

Fig. 3. Sampling location with commercial rice field and non-crop transect. (photo: M. T. VanWeelden, UF/IFAS)

CONCLUSIONS

- Results from this study agree with our hypothesis that *O. insularis* relative abundance has increased over the past 10 years, however, *O. ypsilongriseus* abundance remained low. Survey results indicate that the invasive *O. insularis* now exceeds the native rice stink bug, *O. puganx*, in terms of relative abundance, increasing over 2-fold compared to surveys in 2008 and 2009 (Cherry and Nuessly 2010).
- While non-crop host plants provided feeding sites for all three *Oebalus* spp., numbers were greater in rice. Reducing the abundance of non-crop hosts adjacent to rice fields has the potential to reduce infestations in rice.
- Stink bug populations peaked in the summer months, stressing the importance of early planting to avoid high infestation periods.
- Future studies should compare feeding behaviors among the three *Oebalus* spp. in order to modify economic thresholds.

REFERENCES

- **Cherry, R., D. Jones, and C. Deren. 1998.** Establishment of a new stink bug pest, Oebalus ypsilongriseus (Hemiptera: Pentatomidae) in Florida rice. Florida Entomol. 81: 216-220.
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- **SAS Institute. 2016.** User's Manual, Version 9.4. SAS Institute, Cary, NC.
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