Aphelinus nigritus as a key component to a sugarcane aphid regulatory system in a large acreage production region of the southern reaches of the U.S. Great Plains

M.J. Brewer[1,2], A.M. Faris[1,2], B.H. Elkins[2], J.B. Woolley[2]

[1]Texas A&M AgriLife Research and Extension Center, Corpus Christi, Texas; [2]Texas A&M University Department of Entomology, College Station, Texas

Objectives: A survey from 2016 to 2019 in five Texas sorghum growing locations was used to:

- ***Identify the members of the natural enemy complex across four years and from the southern Great Plains (northcentral Texas) to its southern reaches (Rio Grande Valley)***
- ***Assess if the natural enemy complex has responded to the invasive sugarcane aphid, and if the species complex has shifted in or space***

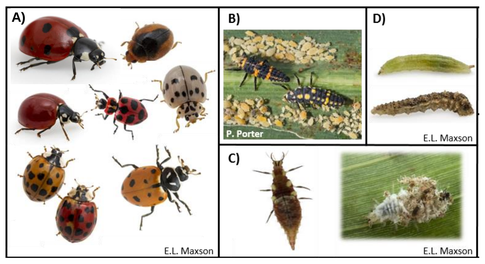
INTRODUCTION

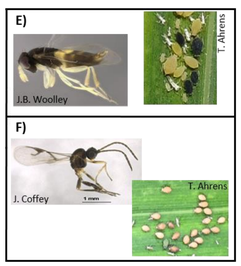
The sugarcane aphid is an invasive pest of sorghum that was first detected along the Texas Gulf Coast in 2013. Since 2013 the aphid has spread to 19 U.S. states including all of the southern Great Plains, spanning north into Kansas and south into Mexico. The sugarcane aphid is an economic and outbreak-prone pest. Sugarcane aphids can reproduce rapidly, allowing large numbers to establish on the underside of sorghum leaves resulting in yield decline and problems in machine harvest of grain.

Focusing on South Texas where sugarcane aphid outbreaks have regularly occurred since 2013, sorghum may be initially infested each year by a combination of local aphids overwintering on remnant and ratoon sorghum and johnson grass, and winged aphids flying northward from sorghum fields maturing farther south (such as in Mexico). In more northern parts of Texas sorghum and johnson grass are dormant or die in the winter; therefore annual winded-aided flights of aphids from the south are a principle source of infestation of sorghum planted each year.

Photo 1. Sugarcane aphids can result in economic loss. **A**) A sugarcane aphid colony on the underside of a sorghum leaf. **B**) Sooty mold on sorghum leaves due to honeydew secretions. **C**) A sorghum field heavily damaged by sugarcane aphid.

Natural enemies of sugarcane aphids may persist year-round in South Texas and Mexico, but also throughout the southern Great Plains given their history of praying on aphids of many cereals (Brewer et al. 2019) and possibly non-crop habitat.





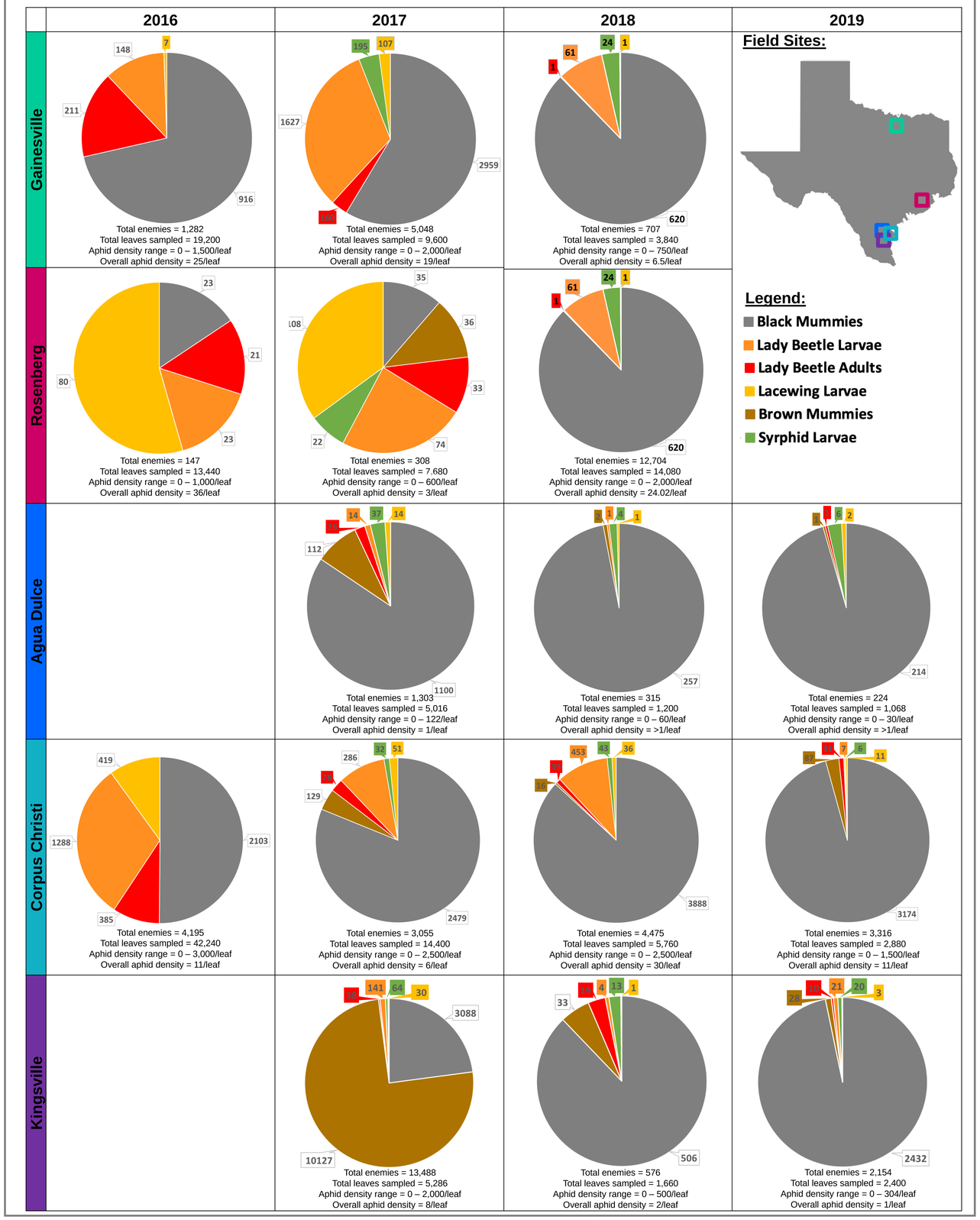
A) Lady beetle adults (Coleoptera: Coccinellidae), B) lady beetle larvae, C) lacewing larvae (Neuroptera: Chrysopidae and Hemerobiidae), D) syrphid fly larvae (Diptera: Syrphidae), E) *A. nigritus* that produces black mummies, F) and *L. testaceipes* that produces brown mummies.

METHODS

Sorghum fields were sampled for sugarcane aphids and natural enemies periodically across four years from the southern Great Plains (northcentral Texas) to its southern reaches (Rio Grande Valley). Sampling took place at the preboot to hard dough sorghum growth stage.

Two different field sampling schemes were used. At the Agua Dulce and Kingsville locations, transects were conducted in a V-shaped pattern with two separate points on the field edge converging towards the field center. The second sampling scheme at the Gainesville, Rosenberg, and Corpus Christi locations, used randomly selected plants across the field. At all locations, insect counts were conducted on a top and bottom leaf of each sampled plant. Insect counted per leaf at each location consisted of sugarcane aphids, black mummies (Hymenoptera: Aphelinidae), brown mummies (Hymenoptera: Braconidae), lady beetle larvae and adults (Coleoptera: Coccinellidae), syrphid fly larvae (Diptera: Syrphidae), and lacewing larvae (Neuroptera: Chrysopidae and Hemerobiidae).

RESULTS



KEY FINDINGS

Natural enemies have responded to the invasion of sugarcane aphid on sorghum

- **The diversity of natural enemies is similar to that observed attacking other aphids on cereals**
- **Abundance of natural enemies has increased since the aphid's 2013 invasion on sorghum**

Aphelinus nigritus *is a key natural enemy of sugarcane aphid*

- **Increased in dominance across years and occurs soon after first detection of sugarcane aphid on cultivated sorghum**
- **Very common in southern areas and becoming more common in northern areas**

FUTURE DIRECTIONS

The data may be used to form hypotheses on natural regulation of sugarcane aphid and provide guidance in monitoring natural enemies

Relative value of natural habitat and managed habitat such as pastures serving as refuge for natural enemies (conservation biocontrol)

Natural enemy-driven hypotheses on and ecological modeling projections of sugarcane aphid regulation in the southern Great Plains (aphid biocontrol potential)

Guidance to IPM practitioners on surveying for natural enemies when monitoring sorghum for sugarcane aphid

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