Abundance of Soil Insect Pests in Florida Sugarcane[1]

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Soil insects are economically important pests for Florida sugarcane growers in the Everglades Agricultural Area (EAA). This publication presents surveys of these pests from 2015 and 2016, compares them to several historical surveys, and examines the association of soil parameters (its acidity, calcium, magnesium, and silicon content, and depth) with the abundance of the pests. The intent of this document is to inform sugarcane growers, scouts, pesticide applicators, and researchers on fluctuations of economically important pests with implications on their management.

Figure 1. *Melanotus communis* wireworm (Coleoptera: Elateridae).
Credits: Mike Karounos

Wireworms

Historically, wireworms (Coleoptera: Elateridae) were the first soil insects surveyed causing significant damage in Florida sugarcane (Bregger et al. 1959). Hall (1988) reported twelve species of wireworms in the crop. Past surveys have shown that the corn wireworm, *Melanotus communis* (Gyllenhal) is the species causing the most economic damage (Figures 1 and 2).

Figure 2. *Melanotus communis* adult click beetle (Coleoptera: Elateridae).
Credits: Mike Karounos

Abundance of soil insect pests from 20 commercial sugarcane fields (sampled 2015 and 2016) is shown in Table 1. Insects were collected from intact sugarcane stools by hand. Sampling was done post-harvest for easier access to fields. For more detailed methods on survey sampling, see *Changes in the Relative Abundance of Soil-Dwelling Insect Pests in Sugarcane Grown in Florida*, on which this publication was based: Cherry et al. (2017), https://doi.org/10.18474/JES16-33.1.

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In our survey, the corn wireworm, *M. communis*, was clearly the dominant wireworm species (88%). This has been the most important wireworm species in Florida sugarcane for a long time (Hall 1988). The species was added to the EPPO A1 action list of quarantine pests in 2002 (OEPP/EPPO 2005).

White Grubs

The second group of soil insect pests reported causing significant damage in Florida sugarcane historically were white grubs (Coleoptera: Scarabaeidae) (Figure 3).

Figure 3. White grubs (Coleoptera: Scarabaeidae).
Credits: Mike Karounos

Gordon and Anderson (1981) reported on significant grub damage first observed in 1971. Six species were associated with the crop, with *Tomarus subtropicus* (Blatchley) causing the most economic damage. In 1988, Cherry found that *T. subtropicus* was the largest and most abundant grub. In 1994, Stansly et al. determined *T. subtropicus* was 23% of all grubs found in muck soils.

In recent years, however, R. H. Cherry has observed what appears to be a major change in the relative abundance of soil insect pests, especially scarabs, in Florida sugarcane (noted in the insect management chapter of the UF/IFAS *Sugarcane Handbook*).

In our 2015 and 2016 surveys, we observed four of the six scarab grub species ranging from 20% to 30% in relative abundance. *Cyclocephala parallela* Casey and *Phyllophaga latifrons* (LeConte) are occasional pests of Florida sugarcane; *Anomala marginata* (F.) and *Dycinetus morator* (F.) are not. Gordon and Anderson (1981) reported *Euphoria sepuchralis* (F.) to be associated with Florida sugarcane although not causing damage. We did not find this latter species in any of our samples. Of special interest are our findings with *T. subtropicus* (Figures 4 and 5).

Figure 4. *Diaprepes* grub (left), a typical scarab grub (middle), and a *Tomarus subtropicus* grub (right). Typical size differences.
Credits: Mike Karounos

Figure 5. *Tomarus subtropicus* adult female (Coleoptera: Scarabaeidae).
Credits: Emmy Engasser, Hawaiian Scarab ID, USDA APHIS PPQ, Bugwood.org

Our study was conducted using methods very similar to the historical surveys. However, despite sampling more fields, we found no *T. subtropicus* in our 2015 and 2016 surveys. This is consistent with R. H. Cherry's observation that no incidences of grub damage in Florida sugarcane have been reported during the last ca. 20 years while working in the heart of Florida sugarcane. Hence, what was once the most important soil insect pest of Florida sugarcane has essentially disappeared in sugarcane fields, ceasing to be a problem. What exactly caused this major shift is unknown.

Root Weevil

Diaprepes root weevil (Curculionidae), *Diaprepes abbreviatus* (L.), is an important pest of sugarcane and citrus in various islands of the Caribbean. It has long been a pest in Florida citrus. In 2010, infestations of the weevil were observed causing damage to Florida sugarcane for the first time (Cherry et al. 2011) (Figure 6).

Figure 6. *Diaprepes abbreviatus* sugarcane root weevil adult on sugarcane.
Credits: Ron Cherry

The only weevil (Coleoptera: Curculionidae) species found in the 2015 and 2016 surveys was *D. abbreviatus*. However, only 13 larvae were found in all samples from 20 fields. This would indicate the insect has not become a serious pest in Florida sugarcane.

Survey Summary

No new unknown soil insect pests were found in the 2015 and 2016 surveys. Very few sugarcane root weevils were found. This shows that in Florida sugarcane, this pest is still uncommon. The once important grub pest, *T. subtropicus* was not even detected in fields. Finally, wireworms and especially grubs found in fields were positively correlated with muck soil depth (Figure 7 and Table 2).

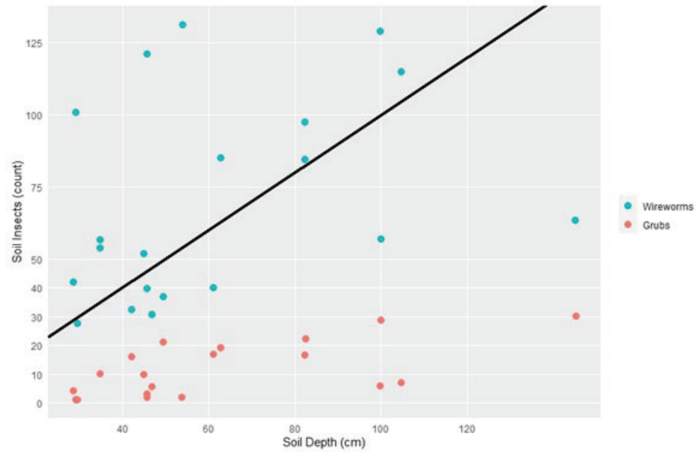

Figure 7. Linear regression of grubs/field in 20 sugarcane fields with soil depth of fields.

Two factors have increased flooding, which is effective in reducing soil insect populations, in the Everglades Agricultural Area (EAA). (See "Management by Flooding", below.) Best management practices (BMP) including water held during the rainy season by growers reducing phosphorous discharge is the first factor. Second is organic matter oxidation due to the drainage of organic (muck) soils. This has led to the prevalence of shallow soils in the EAA, and these shallow soils are frequently flooded (Jennewein et al. 2016). This phenomenon of soil subsidence has been documented and researched by soil and water scientists at the Everglades Research and Education Center for decades (Figure 8).

Figure 8. Subsidence post at the UF/IFAS EREC in Belle Glade, FL. Note: Post marks show soil depth in previous years. This may not be typical of other areas, because it has no crops and is drained most of the year.
Credits: Mike Karounos

Management by Flooding

There are more publications on flooding for soil insect control for southern Florida than for anywhere else in the world. Flooding either fallow fields or by rotation with rice cultivation is a part of best management practices in the EAA and is recommended in many other UF/IFAS publications for sugarcane soil insect IPM. Flooding can kill soil insects directly by drowning them, or it can kill them indirectly by exposing them to predation, often by diverse and abundant birds (Figure 9).

Figure 9. Wood storks foraging in a naturally flooded sugarcane field.
Credits: Mike Karounos

Wireworms in Florida sugarcane are more flood tolerant than grubs (Hall and Cherry 1993). Among grubs tested in the EAA, *T. subtropicus* is the least flood tolerant, which may partially explain its disappearance (Cherry et al. 1990).

For wireworms, flooding during late spring and summer will kill the wireworms and prevent egg-laying by the adult click beetles. Thus, flooding fallow fields or growing flooded rice as a rotation crop reduces wireworm infestations. Flooding can be effective if it is maintained continuously for a minimum of six weeks during the summer. Longer flooding periods are needed during colder months (Cherry 2017).

Short-term flooding for grubs is most efficient in August, when water temperatures are warm, rainfall is abundant, and grubs initiate feeding. Discing infested fields and decreasing the number of ratoon crops also reduce white grub infestations (Beuzelin et al. 2019).

For further information, please see Cherry, McCray, and Sandhu (2017), from which this publication was adapted.

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Table 1. Abundance of soil insect pests in Florida sugarcane fields.

		Abundance	
Family	% fields	Total	Relative[1]
<u>Curculionidae</u>			
Diaprepes abbreviatus (L.)	20	13	100
<u>Elateridae</u>			
Conoderus spp.	80	51	4
Glyphonyx bimarginatus Schaeffer	75	84	6
Ischiodontus spp.	10	21	2
Melanotus communis (Gyllenhal)	100	1232	88
<u>Scarabaeidae</u>			
Anomala marginata (Fab.)	45	47	20
Cyclocephala parallela Casey	70	68	29
Dyscinetus morator (Fab.)	15	47	20
Euphoria sepulchralis (Fab.)	0	0	0
Phyllophaga latiforons (LeConte)	75	69	30
Tomarus subtropicus (Blatchley)	0	0	0

[1] % of (total of species / total all insects in family).

Table 2. Linear correlations[1] of soil insects with different soil parameters.

Family	pH	Ca (g/m^3)	Mg (g/m^3)	Si (g/m^3)	Depth (cm)
<u>Elateridae</u>	0.390	-0.125	0.051	0.203	0.346
<u>Scarabaeidae</u>	-0.064	-0.195	-0.203	0.270	0.623
Total	0.379	-0.179	-0.002	0.278	0.518

[1] Linear correlation of total insects in taxon in a field with soil parameters of the field (N = 20 fields). Correlations greater than r= ±0.44 are significant at α = 0.05