

SURVEY OF SUGARCANE PESTS AND THEIR NATURAL ENEMIES ON THE ATHERTON TABLELAND, FAR NORTH QUEENSLAND

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KEY WORDS: Queensland, Sugarcane,
Dermolepida, *Anoplognathus*, Parasitoids.

Abstract

A STUDY ON insect pests of sugarcane on the Tableland (FNQ) revealed the existence of a number of scarab species inflicting variable degrees of damage to the crop. The greyback canegrub (*Dermolepida albohirtum*) was the dominant species followed by *Anoplognathus porosus* and *A. boisduvali*. Larvae of *Lepidiota sororia*, *L. laevis* and *L. sparsa* were found in different locations, however, these species are mainly associated with pasture and are unlikely to be of any economic importance in sugarcane. Other pests included the Sugarcane Weevil Borer (*Rhabdoscelus obscurus*) and several armyworm species belonging to the genera *Leucania*, *Athetis* and *Nodaria*, and these yielded a wide range of dipterous and hymenopterous parasitoids. In addition, the webworm *Oncopera* sp., which is mainly a pest of pasture, was encountered feeding on sugarcane setts near Tolga. Insecticides registered for the management of the greyback canegrub proved effective against species of *Anoplognathus*. This study revealed the existence of a different suite of pest species on the Tableland compared to coastal areas, possibly due to the Tableland's inland location and higher elevation and the fact that it is relatively new to cane plantations. It is possible that, due to the recent expansion of sugarcane plantations on the Tableland at the expense of pasture land, species associated with pasture are occasionally found in sugarcane fields. Pest monitoring is therefore recommended to continue on the Tableland in case any of these pests expand their host range to include sugarcane.

Introduction

The Tableland mill area comprises the Atherton Tableland and nearby drier areas around Mareeba. Until recently, areas that now produce sugarcane had been dominated by rainforest, open forest or pasture land. In sugarcane, a different suite of insect species is encountered compared to that in coastal areas, and in some cases the same species exhibit different behavioural patterns to that observed in other sugarcane growing regions.

For example, since the inception of the sugarcane industry on the Tableland in the 1990s, Tableland sugarcane growers have not experienced heavy canegrub damage and insecticides have not been regularly applied. However, following a canegrub outbreak in 2000–2001, and despite a rise in insecticide treatment, grub populations remained relatively high on the Tableland compared to coastal areas where populations crashed following a severe drought and also a significant rise in

chemical application (Hunt *et al.*, 2002, 2003; Sallam, personal observation). In addition, species of *Anoplognathus* (commonly known as Christmas beetles) are occasionally found under sugarcane in coastal areas but their impact on the crop is not regarded as significant (Allsopp and Logan, 1999; Logan, 1999), yet several anecdotal accounts have referred to the same species as pests of cane on the Tableland (Keith Chandler, personal communication; Drewe Burgess, personal observation).

Combined factors such as the Tableland's inland location, higher elevation, different soil types and the fact that the sugarcane industry has only been recently established probably contribute to this variation. The aim of this work was to survey sugarcane insect pests and their natural enemies in the Tableland cane growing area. In addition, the occurrence of species of *Anoplognathus* (Coleoptera: Scarabaeidae) under sugarcane in the Tableland allowed us to test insecticides used for the control of canegrubs in coastal areas on those species. This knowledge should ultimately assist Tableland canegrowers in managing their pest problems, which in some cases appear to be unique to that region.

Materials and methods

Species composition

We collected canegrub larvae from different farms in the Tableland area during March–May (2002 to 2004), or when damage symptoms were observed. Collected grubs were bred through to adult beetles for identification or until they produced a parasitoid or died due to a disease.

Adults were identified using the keys of Carne (1957), Britton (1978) and Miller and Allsopp (2000) as appropriate. The latter was also used to identify larvae. Larvae of armyworms were collected between September and December (under cane trash) in fields that showed damage symptoms, and were taken to the laboratory and fed on pieces of cane leaves until either the emergence of the adult moth or a parasitoid. Adult moths and emerged parasitoids were identified by CSIRO Entomology staff, Canberra (Australian National Insect collection). Other insect species that had or appeared to have a pest status were also collected whenever encountered and identified accordingly.

Insecticide field trials

In 2003, two insecticide trials were established in 1 ha sections of cane fields chosen because of a previous history of grub damage, mainly by *Anoplognathus* spp. The trials were on the farms of Gino Menniti at Chewko (TL0302) and Plum Murat at Paddy's Green (TL0304). Trials were randomised in a Latin-square design with five treatments each replicated five times (25 plots per trial). All plots were 20 m long and six rows wide, with a guard row between each column.

The five treatments tested were suSCon® Blue at 21 kg/ha, suSCon® Plus at 40 kg/ha, Grub Guard™ at 60 kg/ha, suSCon® Maxi/Confidor® CR (G38S05 formulation) at 15 kg/ha and an untreated control. These rates were used in accordance with label directions for greyback canegrubs. Grub Guard™ is not registered for greyback and was available under permit. All insecticides were applied manually in the furrow at the fill-in stage (September–December 2003). Plots were sampled for presence of grubs in April–May of the following year.

To sample for grubs, a hole 30 × 30 cm wide × 30 cm deep was dug under five randomly selected cane plants in each plot using a shovel. Collected grubs were taken to the laboratory and sorted based on their species.

Greyback canegrubs (*Dermolepida albohirtum*) were fed on pieces of carrot, while *Anoplognathus* spp. were fed on germinated lawn seed that was prepared by mixing 5–10 gm of lawn seeds with soil in containers, with moisture maintained at 10% for 2 weeks to enable germination. Data were analysed using analysis of variance to test for significant treatment effects.

Results

Species composition

Our study revealed the existence of a range of Coleopteran and Lepidopterous pest species associated with sugarcane crops on the Tableland (Table 1). The greyback canegrub *Dermolepida albohirtum* (Waterhouse) (Coleoptera: Scarabaeidae) was the most common species and was found in almost all regions of the Tableland area. Larvae of the Christmas beetles *Anoplognathus porosus* (Dalman) and *Anoplognathus boisduvalii* Boisduval (Coleoptera: Scarabaeidae) were also common and were found to damage cane crops.

Of 1453 scarab grubs collected during the course of this study, 965 (66.4%) were *Dermolepida albohirtum*, 474 (32.6%) were *Anoplognathus* spp., 5 (0.3%) were *Lepidiota sororia* Moser, 4 (0.3%) were *Lepidiota laevis* Arrow, 3 (0.2%) were *Lepidiota sparsa* Britton and 2 (0.1%) were unknown (possibly *L. frenchi*). The two *Anoplognathus* species occurred sympatrically in several locations and were difficult to separate as larvae.

There have been no previous published records of *Anoplognathus* spp. causing significant damage to sugarcane. However, there are records of *A. porosus* as a pest of pasture in its larval stage while adult beetles feed on leaves of a range of *Eucalyptus* spp. (especially *E. grandis*) in parts of Australia (Goodyer, 1985; Carne *et al.*, 1974). *Anoplognathus porosus* has also been recorded damaging strawberry plantations in south east Queensland (Murray, 1980).

Both *A. porosus* and *A. boisduvalii* are occasionally encountered under sugarcane in other parts of Queensland but are not regarded as significant pests (Allsopp and Logan, 1999; Logan, 1999). In our case, we observed that, while greyback canegrubs are more destructive and damage cane in the first year they attack a crop, *Anoplognathus* spp. weaken cane plants over a period of time and their damage is usually more apparent in older ratoons.

Larvae of *L. sororia* were encountered causing minor damage to sugarcane in the locality of Tabacum, while *L. sparsa* and *L. laevis* were present under sugarcane in Chewko and Kairi respectively, with the latter species causing minor damage to sugarcane roots in the red soils of the Atherton area. Again, there have been no previous records of *Lepidiota sparsa* or *L. laevis* in sugarcane, while *L. sororia* is a known pest of sugarcane in far north Queensland (Allsopp *et al.*, 1993).

Infestations by the Sugarcane Weevil Borer, *Rhabdoscelus obscurus* (Boisduval) (Coleoptera: Curculionidae) were encountered in all areas sampled except for Kairi, with cultivar Q151 in particular being highly susceptible to weevil damage.

In addition, four main species of armyworms were recovered from different locations on the Tableland, and these were *Leucania loreyi* Duponchel, *Leucania stenographa* Lower, *Leucania abdominalis* Walker and *Nodaria cornicalis* (Fabricius) (Lepidoptera: Noctuidae). A fifth species, *Athetis reclusa* Walker (Lepidoptera: Noctuidae), was also occasionally encountered in very low numbers. All five species coexisted in all the farms sampled, with *L. loreyi* being the dominant species.

Out of 1132 armyworm larvae collected during this study, 739 (65.3%) were *Leucania loreyi*, 248 (21.9%) were *Nodaria cornicalis*, 101 (8.9%) were *L. stenographa* and 44 were *L. abdominalis* (3.9%), with *A. reclusa* being found only occasionally. The same species structure of armyworms occurs in the coastal areas from South Johnstone to the Mulgrave region (Chandler and Benson, 1991; Sallam *et al.*, unpublished data).

The three *Leucania* species and *N. cornicalis* fed actively on cane leaves in the laboratory. However, *A. reclusa* larvae did not feed on cane leaves and pupated (or died as larvae) shortly after

they were collected. This species may either be a trash feeder or may possibly be feeding on weeds or wild grasses in cane fields. The observation that *N. cornicalis* fed on cane leaves in the laboratory contradicts previous observations made by Chandler and Benson (1991) who recorded death of caged larvae due to starvation despite provision of cane leaves. Reasons for this discrepancy are unknown.

Larvae of the pasture webworm, *Oncopera* sp. (possibly *Oncopera mitocera*) (Lepidoptera: Hepialidae) were observed feeding on cane setts in large numbers in a failed ratoon crop at Kairi. *Oncopera* sp. larvae are known to be mainly pasture-grass feeders.

Elder (1974) recorded *O. brachyphylla* Turner and *O. mitocera* (Turner) causing significant damage to pasture on the Tableland that necessitated insecticide treatment, while Quinlan *et al.* (1975) showed that infestations by late-instar larvae of the same two species caused significant dry matter reduction of *Setaria anceps*, *Desmodium intortum* and *Pennisetum clandestinum* on the Atherton Tablelands over the dry season.

This is the first record of an *Oncopera* species damaging sugarcane setts. No other occurrences of *Oncopera* sp. in sugarcane on the Tableland were encountered.

Natural enemies and pathogens

Two species of natural enemies were recorded attacking larvae of *Anoplognathus porosus*. They were the larval parasitoid *Rutilia (Donovanius) sabrata*. (Diptera: Tachinidae), which was responsible for a 13.5% parasitism rate, and the predatory robber fly *Zosteria* sp. (Diptera: Asilidae), which was encountered in the field in the larval stage only very occasionally.

A range of dipterous and hymenopterous parasitoids were recovered from the larval and pupal stages of armyworms (Tables 1 and 2). The same parasitoid species were recovered from the same armyworm hosts in sugarcane fields in the coastal areas of north Queensland (Chandler and Benson, 1991; Sallam *et al.*, unpublished data).

No microbial pathogens were recorded from any of the scarab larvae recovered, and major diseases (such as *Adelina* and *Metarhizium anisopliae*) were never detected in greyback canegrub larvae. However, milky disease, caused by the bacterium *Paenibacillus popilliae* was detected infecting 2.8% of all greyback larvae collected during the course of this study.

Insecticide trials

We were able to obtain results from plant cane and first ratoon crops in trial TL0302, while only first ratoon results were available from trial TL0304. There was no significant difference among numbers of *Anoplognathus* spp. in trial TL0302 in plant cane ($F=1.51$; $df=4$; $P=0.236$), while greyback numbers were too low to justify statistical analysis (Figure 1a).

In 2005 (1st ratoon), there was a significant difference among treatments in numbers of *Anoplognathus* spp. ($F=3.42$; $df=4$; $P=0.027$) (Figure 1b). In trial TL0304, there was a significant difference among treatments in numbers of *Anoplognathus* spp. ($F=3.84$; $df=4$; $P=0.017$), while very few greyback canegrubs were present (Figure 2).

Pest levels were considered too low to have any affect on cane yield and therefore treatment yields were not recorded.

Results from both trials show that all insecticides had a significant effect on numbers of Christmas beetle larvae (*Anoplognathus* spp.).

It is therefore confirmed that pesticides used for the management of *Dermolepida albohirtum* will also be effective against *Anoplognathus* spp.

Table 1—Main insect pest species associated with sugarcane and their natural enemies on the Atherton Tableland mill region.

Species	Location								Recovered natural enemies
	Arriga	Chewko	East Barron	Kairi	Mareeba	Muchilba	Paddy's Green	Tabacum	
<i>Anoplognathus aureus</i> (Coleoptera: Scarabaeidae)			*						
<i>Anoplognathus boisduvalii</i> (Coleoptera: Scarabaeidae)	*	*			*		*		10
<i>Anoplognathus porosus</i> (Coleoptera: Scarabaeidae)	*	*	*		*	*	*	*	9,10
<i>Dermolepida albohirtum</i> (Coleoptera: Scarabaeidae)	*	*	*		*	*	*	*	
<i>Lepidiota laevis</i> (Coleoptera: Scarabaeidae)				*					
<i>Lepidiota sororia</i> (Coleoptera: Scarabaeidae)								*	
<i>Lepidiota sparsa</i> (Coleoptera: Scarabaeidae)		*							
<i>Rhabdoscelus obscurus</i> (Coleoptera: Curculionidae)	*	*	*		*	*	*	*	
<i>Athetis reclusa</i> (Lepidoptera: Noctuidae)	*		*		*			*	
<i>Leucania loreyi</i> (Lepidoptera: Noctuidae)	*		*		*			*	1,2,3,4,5,6
<i>Leucania stenographa</i> (Lepidoptera: Noctuidae)	*		*		*			*	
<i>Leucania abdominalis</i> (Lepidoptera: Noctuidae)	*		*		*			*	1,2,3
<i>Nodaria cornicalis</i> (Lepidoptera: Noctuidae)	*		*		*			*	4,6,7,8
<i>Oncopera</i> sp. (Lepidoptera: Hepialidae)				*					

Empty cells indicate that the species has not been collected from that locality. See Table 2 for species identification of natural enemies.

Discussion and conclusion

We found that the canegrub fauna in the Tableland mill area differs from that in coastal regions. While the majority of damage was caused by the greyback canegrub (*Dermolepida albohirtum*), species of *Anoplognathus* were also found to inflict a degree of damage to cane crops, unlike the case in coastal areas.

Tableland growers are therefore encouraged to particularly pay attention to the subtle signs of *Anoplognathus* infestation which are usually difficult to detect compared to the obvious signs of *D. albohirtum* damage. It is not known why species of *Anoplognathus* are causing damage to sugarcane on the Tableland but not elsewhere.

Table 2—Species identification of natural enemies in Table 1.

No.	Species identification	Remarks
1	<i>Tritaxys milias</i> (Diptera: Tachinidae)	Larval or larval – pupal parasitoid
2	<i>Cuphocera javana</i> (Diptera: Tachinidae)	Larval parasitoid
3	<i>Palexorista</i> sp. (Diptera: Tachinidae)	Larval – pupal parasitoid
4	<i>Dicamptus fuscicornis</i> Erichson (Hymenoptera: Ichneumonidae) #	Larval parasitoid
5	<i>Zelomorpha</i> sp. (Hymenoptera: Braconidae)	Larval parasitoid
6	<i>Brachymeria</i> sp. (Hymenoptera: Chalcididae)	Pupal parasitoid
7	<i>Lissopimpla scutata</i> Krieger (Hymenoptera: Ichneumonidae) #	Pupal parasitoid
8	<i>Lissopimpla excelsa</i> (Costa) (Hymenoptera: Ichneumonidae)	Pupal parasitoid
9	<i>Rutilia (Donovanius) sabrata</i> (Diptera: Tachinidae) #	Larval parasitoid
10	<i>Zosteria</i> sp. (Diptera: Asilidae)	Larvae are predators of <i>Anoplognathus</i> spp. in soil

Indicates first record of natural enemy.

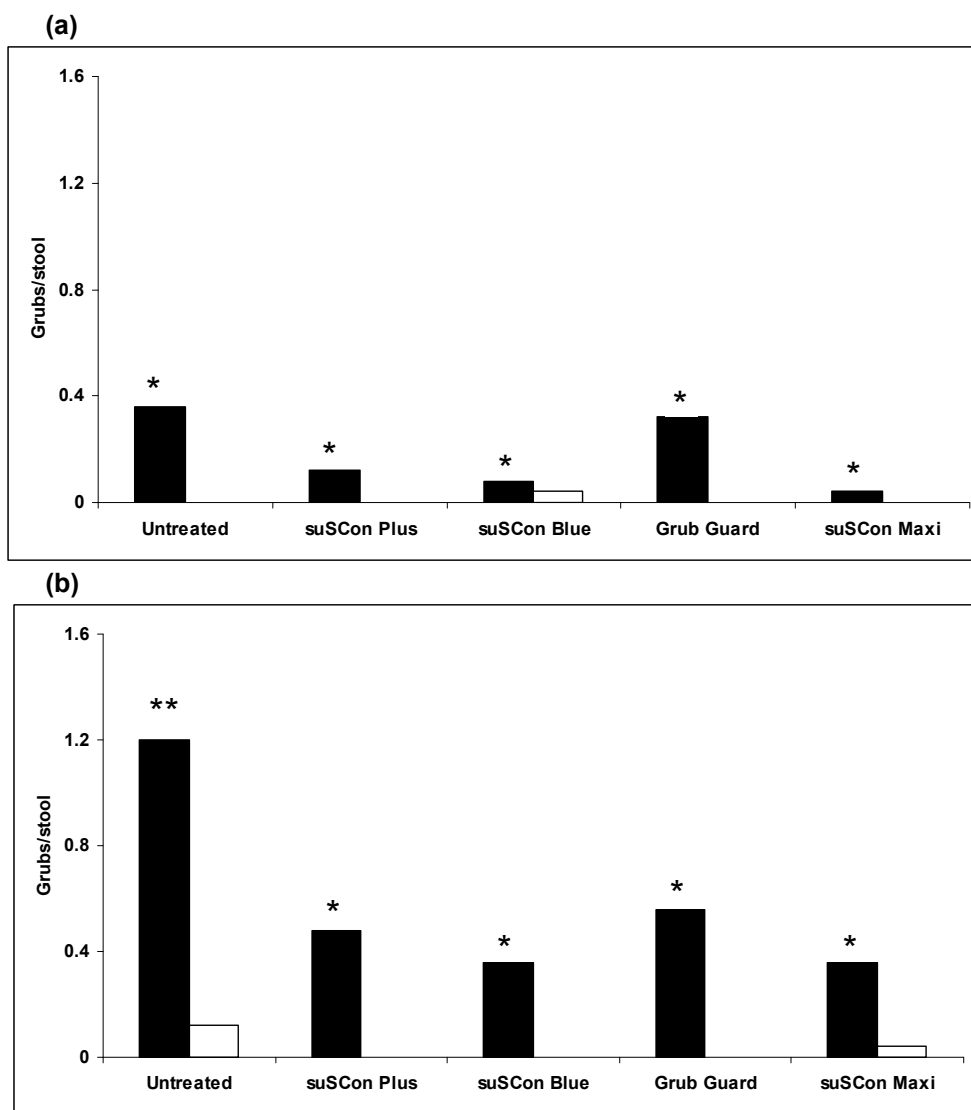


Fig. 1—Numbers of *Anoplognathus* spp. (black bars) and *Dermolepida albohirtum* (white bars) larvae per stool in plant (a) and 1st ratoon (b) crops (Trial TL0302). (*): Figures represented by columns with the same number of symbols are not significantly different.

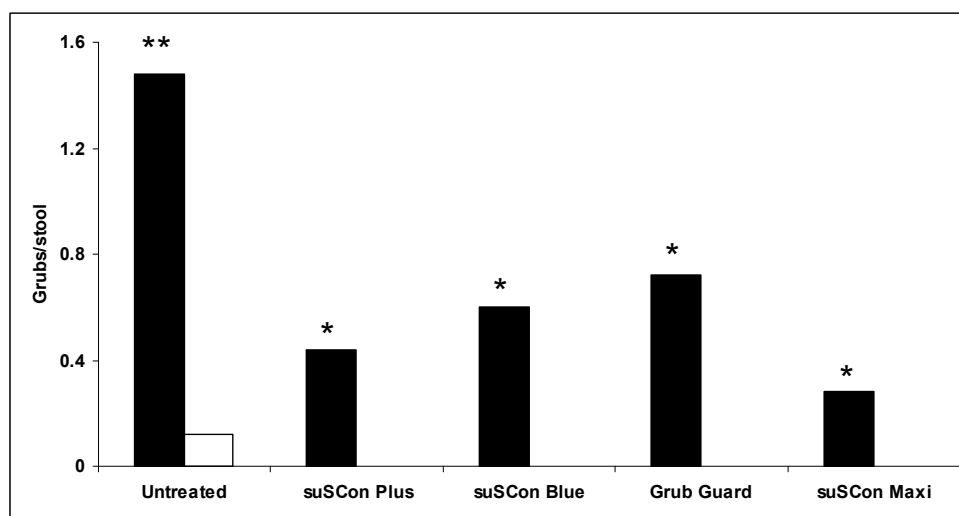


Fig. 2—Numbers of larvae of *Anoplognathus* spp. (black bars) and *Dermolepida albohirtum* (white bars) per stool – 1st ratoon crop (Trial TL0304). (*): Figures represented by columns with the same number of symbols are not significantly different.

In addition to differences in climatic conditions, latitude and soil types, it may be the case that lack of competition from other species such as *Lepidiota frenchi*, *L. consobrina* and *L. caudata*, which are common pests of sugarcane in North Queensland (and with *L. frenchi* being a major species on the coastal areas of Queensland), is another contributing factor.

It is not clear whether *Lepidiota laevis*, *L. sparsa* and *Oncopera* sp. will be of any significance to the sugarcane crops on the Tableland. It is possible that, due to the recent expansion of sugarcane plantations on the Tableland at the expense of pasture grassland, species usually associated with pasture will be found occasionally in sugarcane fields. However, their abundance may be diminishing gradually in areas now dominated by sugarcane.

On the other hand, the lack of pest species abundance at the locality of Kairi (Table 1) could be due to the fact that cane plantations are diminishing in that location and areas that grew sugarcane now grow other non-gramineous crops. In any case, pest monitoring is recommended to continue on the Tableland in case any of these pests expand their host-plant range to include sugarcane.

We also noticed total absence of key canegrub pathogens such as *Metarhizium anisopliae* and *Adelina* sp. from the Tableland region. This could be due to the fact that sugarcane is a recent introduction to the Tableland and canegrub pathogens have not yet built up to detectable levels. Absence of these key pathogens may be one of several factors causing the variations seen in dynamics of greyback canegrub populations compared to the coastal regions.

Finally, the species complex of armyworms and their parasitoids on the Tableland was similar to that in northern coastal areas. Further studies are required to quantify the impact of armyworms on sugarcane yield and investigate the role played by the wide range of natural enemies on armyworm populations.

Acknowledgements

We thank Fabian Gallo and John Erbacher for assistance with fieldwork. Thanks are also due to Drs Don Colless, Ted Edwards and John La Salle (CSIRO Entomology) and Peter Allsopp (BSES, Indooroopilly) for help with insect identification. Support from cane growers where we established our trials is acknowledged.

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