SHORT, NON-REFEREED PAPER

BIODIVERSITY OF LEPIDOPTERAN STEMBORERS AND ASSOCIATED PARASITOIDS IN WILD HOSTS SURROUNDING SUGARCANE FIELDS

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Abstract

Lepidopteran stemborers feed within stems of wild and cultivated plant species in the families Poaceae, Cyperaceae and Typhaceae. Due to the introduction of commercial sugarcane and consequent loss of natural habitat, some stemborer species might migrate from these wild host plants into cultivated sugarcane, becoming serious pests. However, stemborer pest densities may be regulated by indigenous parasitoids in these indigenous plant hosts. Although natural habitats play an important role in managing agricultural losses brought about by stemborer pests, ecological information regarding the interactions of wild host plants, stemborers and their parasitoids is limited. Field surveys in sugarcane and wild plant hosts were undertaken within agro-ecological and wetland habitats in four localites, *viz*. Eston, Mount Edgecombe, Tinley Manor and Sezela, in search of different species of stemborers and their parasitoids. In Sezela, 66.7% of *Cyperus dives* sampled was infested with *Eldana saccharina* and 25% of *Phragmites australis* sampled was infested with *Sesamia* spp. In Tinley Manor, signs of stemborer presence were not observed in *Phragmites australis*. The host plant, *Typha latifolia* in Eston and Tinley Manor was exclusively infested with *Speia* sp. In Eston and Mount Edgecombe *Cyperus sexangularis* was predominantly bored by C*hilo* spp. The gregarious endoparasitoid, *Cotesia sesamiae*, was found parasitising larvae in wild host plants, *Echinochloa crus-galli* and *Typha latifolia* and sugarcane in Tinley Manor *and Coix lacryma-jobi* in Sezela.

Keywords: stemborers, host plants, sugarcane, parasitoids, diversity

Introduction

Lepidopteran stemborers feed within stems of wild species of the families Poaceae, Cyperaceae and Typhaceae, found in wetlands, grasslands, along road verges, and dam and river banks (Le Rü *et al*., 2006; Mailifiya *et al*., 2009). Stem borer densities are regulated by indigenous parasitoids in wild host plants. However, since the establishment of extensive sugarcane plantations in South Africa, some stemborer species, such as *Eldana saccharina* Walker (Lepidoptera: Pyralidae), have become serious pests in the cultivated crops due to a lack of natural enemies and the high quality food source (Conlong, 1990; Le Rü *et al*., 2006). This begs the question whether other stemborer

species might be able to migrate from their respective wild host plants into cultivated sugarcane and become pests in the future. Ecological information concerning interactions of stemborers with wild hosts and parasitoids is limited in sugarcane agro-ecosystems. Thus, studying the natural habitat and their stemborers, plant hosts and parasitoid species will assist in managing the agricultural losses brought about by future stemborer pests.

Materials and Methods

Field sampling

Surveys in search of stemborers were carried out in selected plant populations adjacent to sugarcane fields in Eston (29°50'S 30°31'E), Mount Edgecombe (29°42'S 31°02'E), Tinley Manor (29°27'S 31°15'E) and Sezela (30°24'S 30°39'E). The indicators used to search for stemborers in target host plants included dried central shoots or yellowing leaves, borer holes in stems, and excretory material of stemborers known as 'frass'. In Eston and Mount Edgecombe, 2500 cm^2 quadrats were used in each plant population to sample for stemborers. In Tinley Manor and Sezela, in each plant population, only plants which possessed external indications of the presence of stem borers were selected for inspection in order to obtain the highest possible number of borers. All plants were examined for the presence of stemborer larvae, pupae and parasitoids via dissection of stalks. All specimens were collected and placed into individual vials containing *Busseola fusca* diet (Ong'amo *et al*., 2006).

Laboratory rearing

Stem borer larvae were placed in a quarantined laboratory with a temperature of 26-27°C and 70-78% humidity. The larvae were screened every 1-2 days for pupal formation and parasitoid and adult moth emergence. Pupae and emerged parasitoids were transferred into clean vials lined with moistened paper towel. Parasitoids and adult moths were euthanased by freezing for 24 hours and thereafter pinned, dried and labeled appropriately for identification.

Results and Discussion

Seven stemborer species have so far been identified from those collected in wild hosts (Table 1), of which four species belong to the family Noctuidae (*Sciomesa* sp., *Sesamia* sp., *Sesamia nonagrioides* and *Speia* sp.), one species belongs to the family Pyralidae (*Eldana saccharina*) and the remaining two species belong to the family Crambidae *(Chilo* sp. and *Chilo partellus).* Noctuids are most abundant in Eston, Tinley Manor and Mount Edgecombe. In contrast, in Sezela, pyralids outnumber the other two families.

Plant host ranges of different stemborers species vary in different regions (Le Rü *et al*., 2006). So far in this study, *S. nonagrioides* was found only in *Phragmites australis* in Eston, Mount Edgecombe and Sezela, suggesting it is monophagous. In contrast, *Chilo* sp., *E. saccharina*, *Sesamia* sp. and *Sciomesa* sp. are polyphagous, as they are found in plant species belonging to more than one family.

The study has also revealed that stemborer species richness and abundance differed between plant species. For example, *Cyperus sexangularis* is almost exclusively bored by a single species, C*hilo* sp. with the exception of one *Sciomesa* larva found. Conversely,

several stemborer species were found in *Phragmites australis* (*Chilo* sp., *S. nonagrioides*, *Sciomesa* sp.) and *Coix lacryma-jobi* (*Chilo* sp., *E. saccharina*, *Sesamia* spp., *Sciomesa* sp.). In addition, *E. saccharina*, *Chilo* sp. and *Sesamia* spp. were found within one stalk of *Coix lacryma-jobi* at the Sezela site. This may be due to the variation in quality of food resources offered by the different host plant species.

At Sezela, 66.7% of *Cyperus dives*, which is planted around cane crops, was infested with *E. saccharina*. In addition, 25% of *Phragmites australis* sampled in Sezela was infested with *Sesamia* spp. and three stalks of *Phragmites australis* (2.54%) sampled were infested with *S. nonagrioides*, a gregarious stemborer species. At the 2011 Entomology Workshop of the International Society of Sugar Cane Technologists (ISSCT) it was revealed that the latter species is a major pest of sugarcane in Iran (Conlong, personal communication[1]). At Tinley Manor, signs of stemborer presence have not yet been observed in *Phragmites australis*, indicating the sporadic nature of insect infestations. The host plant, *Typha latifolia*, in Eston and Tinley Manor is exclusively infested with *Speia* sp., with 6.2% and 5.6% of plants sampled being bored respectively.

The gregarious endoparasitoid, *Cotesia sesamiae* Cameron (Hymenoptera: Braconidae) was found parasitizing *Sesamia* spp. in wild *Echinochloa crus-galli* and *Typha latifolia* at Tinley Manor and *Chilo* sp. and *Sesamia* spp. in *Coix lacryma-jobi* at Sezela. The parasitoid, *Goniozus indicus* (Hymenoptera: Bethylidae), was found recently on *Chilo partellus* at Sezela (Conlong and Graham, 1988; Polaszek, 1998).

This preliminary report on stemborer diversity in KwaZulu-Natal sugarcane agro-ecosystems is part of a larger project in southern Africa. It is based on similar detailed studies completed in eastern and south-eastern Africa (Le Rü *et al*., 2006). Already, from the preliminary surveys reported in this paper, it is clear that there is large stemborer diversity present in wild host plants surrounding sugarcane fields. Also, the presence of parasitoids in these systems is encouraging, as these can thus be good population regulators of the stemborers they parasitise.

[1]DE Conlong, South African Sugarcane Research Institute, Mount Edgecombe, South Africa, 2011.

Table 1: Distribution and abundance of stemborers among wild host plant species.

			Stemborer species and numbers of infected stems						
			Noctuidae				Crambidae		Pyralidae
Plant family and species	Site	N_{stems}	*Sciomesa* sp.	*Sesamia nonagrioides*	*Sesamia* sp.	*Speia* sp.	*Chilo* sp.	*Chilo partellus*	*Eldana saccharina*
Poaceae									
Phragmites australis	E	4405	75	4	0	0	41	0	0
	M	602	43	1	0	0	0	0	0
	S	118	0	3	30	0	0	0	0
	T	191	0	0	0	0	0	0	0
Sorghum bicolour	M	7	0	0	0	0	0	1	0
*Echinochloa crus- galli**	T	418	0	0	195	0	0	0	0
Echinochloa sp.	M	37	0	0	7	0	0	0	0
*Coix lacryma-jobi**	S	140	0	0	4	0	69	0	34
	M	17	3	0	3	0	2	0	0
Cyperaceae									
Cyperus sexangularis	E	5392	1	0	0	0	20	0	0
	M	1311	0	0	0	0	6	0	0
Cyperus papyrus	M	11	0	0	0	0	0	0	5
Cyperus dives	S	622	0	0	0	0	0	0	415
Typhaceae									
Typha latifolia	E	534	0	0	0	33	0	0	0
	M	198	0	0	0	11	0	0	0
	S	14	0	0	0	0	0	0	0
	T	122	0	0	0	23	0	0	0
Asphodelaceae									
Kniphofia uvaria	E	6	0	0	0	0	2	0	0

E= Eston, M= Mount Edgecombe, S= Sezela, T= Tinley Manor

*Alien grass

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