SHORT COMMUNICATION

A NEW ASSOCIATION: *TRICHOGRAMMA BOURNIERI* PINTUREAU AND BABAULT (HYMENOPTERA: TRICHOGRAMMATIDAE) AND *CHILO SACCHARIPHAGUS* BOJER (LEPIDOPTERA: CRAMBIDAE) IN SUGARCANE IN MOZAMBIQUE

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Abstract

Chilo sacchariphagus Bojer, a sugarcane borer indigenous to South East Asia and the Indonesian Islands, was identified from Mozambican sugarcane in 1999. Prior to a biocontrol programme being implemented against it, intensive pre-release surveys for any indigenous natural enemies of the borer were completed. Negligible parasitism of larvae and pupae was recorded. In contrast, egg batches were heavily parasitised. Parasitoid adults emerging from eggs were *Trichogramma bournieri* Pintureau and Babault only. The impact of *T. bournieri* on *C. sacchariphagus* eggs in Mozambique are presented, and the potential of using this parasitoid against *C. sacchariphagus* in an augmentation biocontrol programme is discussed.

Keywords: sugarcane, new association, *Trichogramma*, *Chilo*, Mozambique, biocontrol

Introduction

The first exotic stalk borer to be found in high numbers in sub-Saharan African sugarcane was identified as *Chilo sacchariphagus* Bojer (Lepidoptera: Crambidae) (Way and Turner, 1999). It was collected from Açucareira de Moçambique (A de M), Mafambisse (34º10'E; 19º20'S), although its presence there was recorded in unpublished reports before 1989 (van Rensburg *et al*, 1989). In 2001, establishment was recorded at Companhia de Sena (Sena), Marromeu (18º17'S; 35º57'E) (Conlong and Goebel, 2002). It has not been found at other sugar estates in Mozambique, nor in African countries bordering Mozambique.

In 2000 and 2001, A de M and Sena respectively, requested that a biocontrol programme be implemented against *C. sacchariphagus* on their estates. Conlong and Goebel (2002) reported on the first field surveys completed at A de M. At that time, minimal indigenous parasitism of larval and pupal *C. sacchariphagus* life stages was found. However, egg parasitism was abundant. Parasitoids emerging from these eggs were identified as *Trichogramma bournieri* Pintureau and Babault (Hymenoptera: Trichogrammatidae) by INRA, Antibes, France (Entomology and Biological Control Unit). Voucher specimens are housed at the Natural History Museum in Paris, France (Conlong and Goebel, 2002). Subsequently, a number of visits have been made to both sugar estates, and quantitative surveys have shown that

T. bournieri is the only egg parasitoid of *C. sacchariphagus* there (Conlong and Goebel, 2005). This short communication summarises their findings.

Materials and Methods

Female *C. sacchariphagus* oviposit on all green leaf surfaces. Eggs are not cryptically hidden, and batches are easy to find. Searches were conducted by moving slowly along sugarcane rows, carefully inspecting all green leaf foliage for egg batches. When found, they were carefully removed by excising the piece of leaf to which they were attached, and leaf portions were placed in empty 30 ml plastic vials with lids with very fine gauze to prevent the escape of the parasitoid. Vials were labeled with date of collection, field number and variety of sugarcane.

In all collections, egg batches were identified as unparasitised and parasitised. Also, positions of batches on leaves was recorded, i.e. top or bottom, and blade or midrib. To determine stratification in *T. bournieri* foraging, green leaves were numbered, leaf 1 being the terminal newly formed leaf, leaf 2 next youngest, and so on until dead leaves were encountered.

The *C. sacchariphagus* eggs were sent to the South African Plant Protection Research Institute Quarantine Laboratory, where parasitoids emerged. All emerged adults were preserved in 95% ethyl alcohol, and sent to the INRA laboratories in Antibes, France, for identification verification.

Results

Extent of T. bournieri *parasitism of* C. sacchariphagus *egg batches*

T. bournieri parasitism in early spring (October) was negligible, with very few *C. sacchariphagus* egg batches found (Table 1). However, in mid-winter (May, June) parasitism along fields margins increased to 97% (Table 1). When parasitised egg batches were found, all the eggs in the batches were parasitised (Conlong and Goebel, 2005).

Table 1. Extent of parasitism of *Chilo sacchariphagus* egg batches by *Trichogramma bournieri* found at A de M* from October 2001 until May 2003, and at Sena* from April 2002 to May 2003.

Sugar estate	Survey date	Number of egg batches found			
		Parasitised	Unparasitised	Total	% Parasitism
A de M	Oct 2001	0	4	4	0
	Apr 2002	30	4	34	88.2
	Jun 2002	19	1	20	95.0
	Oct 2002	0	1	1	0
	May 2003	32	1	33	97.0
Sena	Apr 2002	264	30	294	89.8
	Jun 2002	38	7	45	84.4
	Oct 2002	0	6	6	0
	May 2003	77	7	84	91.7

*A de M = Açucareira de Moçambique Estate Sena = Companhia de Sena Estate

Position of C. sacchariphagus *egg batches, and ability of* T. bournieri *to find them*

In April/May 2005, the exact position of egg batches was recorded (Table 2). Only one unparasitised egg batch was found (on the blade of the top surface of leaf 7). Results given reflect only the position of parasitised egg batches.

Table 2. Number of batches of eggs oviposited on sugarcane leaves on sites favoured by *Chilo sacchariphagus* and found by *Trichogramma bournieri* (1=youngest green leaf; 13=oldest green leaf).

Sugar estate	Leaf number	Bottom leaf surface			Top leaf surface			Grand total
		Blade	Midrib	Total	Blade	Midrib	Total	
A de M	2	0	0	0	1	0	1	1
	3	1	0	1	1	0	1	2
	4	0	2	2	2	1	3	5
	5	0	0	0	3	1	4	4
	6	1	2	3	4	4	8	11
	7	1	0	1	2	1	3	4
	8	1	0	1	2	0	2	3
	9	1	0	1	2	0	2	3
	10	0	0	0	2	0	2	2
	Total	5	4	9	19	7	26	35
Sena	2	2	0	3	2	1	3	5
	3	1	1	2	4	0	4	6
	4	4	1	5	2	1	3	8
	5	7	4	11	5	3	8	19
	6	1	2	3	8	2	10	13
	7	2	2	4	2	1	2	7
	8	2	2	4	7	1	8	12
	9	2	2	4	9	1	10	14
	10	0	1	1	10	3	13	14
	11	0	1	1	1	1	2	3
	12	0	0	0	1	1	2	2
	Total	21	16	37	51	15	66	103

Although the same scouting time was spent at both estates, it was apparent from the total batches of eggs collected that *C. sacchariphagus* populations were lower at A de M than Sena (35 and 103 respectively; Table 2). Eggs were found on leaves 2 to 10 at A de M, and leaves 2 to 12 at Sena. At both estates, fifth and sixth leaves had the most batches. No eggs were found on the first leaf, and only a few on the second and third leaves. Numbers of egg batches found declined towards the oldest leaves (Table 2).

Discussion

Because parasitised eggs are black, they are much easier to see against green leaves than unparasitised eggs, which are creamy in colour (Goebel, 1999). Random scouting thus biases the sample towards finding parasitised eggs. However, the aim was to find as many parasitised eggs as possible, so that the egg parasitoid species complex could be determined. This is important to know before initiating a mass release programme with any one parasitoid. The most effective indigenous egg parasitoid species should be chosen for mass-rearing (Hassan, 1994; Smith, 1996), so that local species composition is not altered. As the

only egg parasitoid found on both estates was *T. bournieri*, no competition from other species will complicate an augmentation biocontrol programme.

T. bournieri populations were at their lowest in October. Wild populations could at this time be augmented with laboratory-reared individuals. In Reunion, this approach using *T. chilonis* Ishii (Hymenoptera: Trichogrammatidae) yielded good results (Goebel *et al*, 2001; Soula *et al*, 2003). For control of *C. saccharіphagus* in Mozambique, *T. bournieri* populations should be augmented from September through to December each year.

Field parasitism at the estates in Mozambique was higher than that found in coastal Kenya on *C. partellus* egg batches in maize (Bonhof, 2000). Haile *et al* (2002) reported *T. bournieri* as the main egg parasitoid of *C. partellus* in Mbita, Kenya, but did not give parasitism rates. *T. bournieri* attacking *C. saccharіphagus* in sugarcane could be a good strain, with high parasitism levels recorded. It is probably well suited to its host - a desirable character for a species being considered for augmentation (Smith, 1996; Haile *et al*, 2002).

Another good attribute of *T. bournieri* is that a female generally parasitises the whole egg batch (Conlong and Goebel, 2005), thus allowing no *C. saccharіphagus* offspring to develop and eat parasitised eggs in the same batch. In trying to establish a number of *Trichogramma* species on *E. saccharina* in South African sugarcane, egg batches were only partially parasitised, allowing *E. saccharina* neonates, which emerged before the parasitoids, to eat unemerged parasitoids (Conlong, 1997). Field parasitism could build up rapidly, as often more than one *T. bournieri* emerges from a parasitised *C. saccharіphagus* egg (Conlong and Goebel, 2005), another attribute of a good biological control agent (Smith, 1996).

The recovery of parasitised eggs (Table 2) from all the locations where *C. saccharіphagus* oviposits (Goebel, 1999) shows that this parasitoid has a good host searching ability. It also searches in young and old sugarcane with the same tenacity (Conlong *in lit.*). This makes *T. bournieri* a very successful candidate for an effective augmentation biocontrol programme (Hassan, 1994; Smith, 1996).

Conclusion

C. saccharіphagus is a new introduction into mainland Africa, being identified from two sugar estates in Mozambique. As such it has escaped its indigenous natural enemies. However, it has been colonised by *T. bournieri*, an African egg parasitoid whose host is most likely an indigenous *Chilo* species. On *C. saccharіphagus* it is a major mortality factor, with attributes making it an ideal candidate for an effective augmentation biocontrol programme.

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