TRAPPING *CHILO SACCHARIPHAGUS* (LEPIDOPTERA: CRAMBIDAE) IN SUGARCANE USING SYNTHETIC PHEROMONES

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Abstract

In June 2002, pheromone-trapping techniques were used successfully to detect the presence of *Chilo sacchariphagus* Bojer (Lepidoptera: Crambidae) in sugarcane at Mafambisse and Marromeu sugar estates in Mozambique. Trap design, bait concentration, trap placement and moth flight activity were examined. A simple trap constructed from a 2-litre plastic bottle and baited with two commercial synthetic sex pheromone vials (1 mg each) attracted and retained males. In mature sugarcane individuals were caught mostly at 2 m above ground. In the first experiment at Mafambisse, trap efficiency was the highest at 58%. The highest overnight catch in a single trap was nine males. Positive attributes of pheromone trapping as a monitoring tool are low cost, ease of operation, sensitivity at low population levels, and selectivity that negates the need for sorting.

Pheromone trapping was used as a complement to field scouting to determine the distribution of *C. sacchariphagus* in Mozambique on two other estates situated in the south of Mozambique. Moths were not detected. The pheromone-based trapping technique is being deployed in Malawi and South Africa as an early warning system for this pest. Additional uses include determining moth flight phenology and to examine the relationship between catches and infestation levels. Such knowledge would determine the period and intensity of moth attacks, and would help decide which and when control strategies are warranted.

Keywords: sugarcane, stalk borer, pheromones, baited traps, *Chilo sacchariphagus*, Mozambique, insect monitoring

Introduction

Monitoring of arthropod pest populations is essential for assessing their spread and management. Pheromone-baited traps have been developed to monitor the occurrence of *Chilo sacchariphagus* Bojer (Lepidoptera: Crambidae), a major pest of sugarcane in some countries (Nesbitt *et al.,* 1980; Rajabalee, 1990; Goebel, 1997), and for many other important agricultural pests (Howse *et al*., 1998). Such traps operate on the principle that many arthropod pests release natural sex pheromones, or chemicals, to attract mates. The advantages of this type of monitoring system are that the traps are simple to construct, they are selective due to the content of the lure, and they are convenient. No power source is required, which renders the traps effective in remote localities. Furthermore, results precede pest damage and trapping is effective even at low population densities. However, for these trapping systems the phenology of pests may affect catches, as might weather conditions, in particular temperature and moisture, which strongly influence insect flight patterns (Dent and Walton, 1997).

The objectives of the study in Mozambique were to obtain information on the feasibility and effectiveness of such a monitoring system.

Materials and methods

In June 2002, preliminary trials commenced at Marromeu sugar estate, Mozambique, with further trials run at Mafambisse. Three trap designs that were tested were a 2-litre bottle (Figure 1), a drip tray design (Figure 2) and a double funnel design (Figure 3). The bottle trap was constructed from a 2-litre plastic container. Apertures were cut in the side, and the flaps were bent to a horizontal position to serve as landing platforms for moths. Goebel (1997) describes the drip tray trap, which consists of a metal pole fitted with two plastic dishes. The double funnel trap was made from two bottle traps secured end to end to produce a funnel facing up and down in line with the sugarcane stalk. These traps were derived largely from information discussed in Muirhead-Thompson (1991).

The traps were baited with *C. sacchariphagus* pheromone dispensers commercially available from Biological Systems in the United Kingdom. Each dispenser vial is impregnated with 1 mg of synthetic pheromone, which is effective for 14 days after placement in the trap.

Figure 1. Bottle trap design.

Figure 2. Drip tray design.

Trap layout was in a straight line along the perimeter of arbitrarily selected fields of cane aged nine months. To test the effects of height, traps were placed at two (canopy height) and four metres above ground, the canopy being the level expected to attract maximum adults (females lay their eggs on the top leaves). Different numbers of lures were used to investigate bait concentration. In the first test, two bait concentrations of the chemical pheromone were tested, one and two dispensers (1 and 2 mg) with four replicates (traps). The second test included two higher bait concentrations (1, 3 and 5 mg) with five replicates. The traps were arranged in a line in the field, with increasing but alternating bait concentrations.

The catches were recorded daily. A night inspection was conducted between 20h00 and 22h00 to observe the approach behaviour of males, as this knowledge may assist with trap design. However, no moth activity was observed.

Figure 3. Double funnel trap design.

Figure 4. Moths trapped in the bottle trap design.

Results and discussion

During preliminary trials at Marromeu over three nights, a series of bottles attracted and retained 14 *C. sacchariphagus* moths (Figure 4) from highly infested fields (average 95% stalks bored; 18.8% internodes bored in irrigated fields). In contrast, for unknown reasons the drip tray design originally used in Réunion (Rajabalee, 1990; Goebel, 1997) did not catch anything. The double funnel trap also gave poor results, and these two designs were therefore not tested at Mafambisse sugar estate.

Table 1. Trap heights, baits per trap and number of *Chilo sacchariphagus* moths trapped using synthetic pheromones in a trial at Mafambisse sugar estate, Mozambique.

Bait concentration		Trap heights	
Number of baits per trap	*** Moths trapped (11-14/06/02)**	**Height above the ground**	**Moths trapped (11-14/06/02)**
1 dispenser	30 (41%)	2 m	72 (97%)
2 dispensers	44 (59%)	4 m	2 (0.03%)

* Note that the traps required an Agril/water mix for moth retention

The highest catches recorded were from traps baited with two dispensers (Table 1). In the most successful trial conducted at Mafambisse, overall trap efficiency was 58%, with 7 of 12 traps catching moths. A total of 74 moths were captured over five days, most of them at the canopy level (97%). The highest overnight catch in a single trap was nine individuals. Although this finding was expected, given the poor flight activity of *C. sacchariphagus* (Williams, 1983), confirmation was important as this characteristic might impact on the propensity of the pest to spread between fields. Fairly cool conditions were recorded (mean 22.7ºC) over the trapping period. The lowest temperature was 17.8ºC, therefore the threshold for flight activity is probably below this value. Minimal wind activity was recorded (0.13-0.61 m/sec), and this factor more than likely did not impact greatly on catches. On this estate, prior stalk survey results indicated that the borer population was at a relatively low level (average stalks bored = 35.6%; internodes bored = 2.6%), which suggests that there was probably minimal competition with feral females 'calling' during the trial period.

Results of using higher bait concentrations were inconclusive due to low catches. This was attributed to an over-saturation of the pheromone around the trap and in the field, which probably served to disrupt communication behaviour. This interference phenomenon is employed when pheromone traps are used as a control measure for the purpose of disrupting mating as tested successfully in Mauritius (Rajabalee, 1990), and could probably be investigated further.

The pheromone-baited traps effectively attracted and retained *C. sacchariphagus* moths, thus demonstrating that the features of this monitoring system are appropriate. As a supplement to field scouting, pheromone-baited traps represent a feasible early warning system for detecting *C. sacchariphagus*. As an example, this system showed that *C. sacchariphagus* is not present at Xinavane and Maragra sugar estates in Mozambique (Way and Goebel, 2003), nor at Dwangwa and Nchalo sugar estates and surrounds in Malawi (Rutherford and Way, 2003).

Trapping provides relevant information on the flight activity, which can be used to optimise and evaluate control tactics where *C. sacchariphagus* represents a threat.

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REFERENCES

Dent DR and Walton MP (1997). *Methods in Ecological and Agricultural Entomology*. CAB International, ISBN 0 85199 131 9 (Hbk), ISBN 0 85199 132 7 (Pbk), 387 pp.

Goebel FR (1997). Opération de lutte intégrée contre le foreur des tiges *Chilo sacchariphagus*. Annual report CIRAD-Réunion.

Howse P, Stevens I and Jones O (1998). *Insect Pheromones and Their Use in Pest Mangement*. Chapman and Hall, London, ISBN 0 412 80470 0 (Hbk) 0 412 44410 0 (Pbk), 369 pp.

Muirhead-Thomson RC (1991). *Trap Responses of Flying Insects*. St Edmundsbury Press Ltd, Bury St Edmunds, Suffolk, London NW1 7DX, ISBN 0-12-509755-7, 287 pp.

Nesbitt BF, Beevor PJ, Hall DR, Lester R and Williams JR (1980). Components of the sex pheromone of the female sugarcane borer *Chilo sacchariphagus* (Bojer) (Lepidoptera: Crambidae). Identification and field trials. *J Chem Ecol* 6: 385-394.

Rajabalee A (1990). Management of *Chilo* spp. on sugarcane with notes on mating disruption studies with the synthetic sex pheromone of *C. sacchariphagus* in Mauritius. *Insect Sci Appl* 11: 825-836.

Rutherford RS and Way MJ (2003). Reports on visits to Dwangwa and Nchalo, SUCOMA sugar estates in Malawi, 14-20 September 2003. Internal Report, South African Sugar Association Experiment Station, Mount Edgecombe, 4300, South Africa. 28 pp.

Way MJ and Goebel FR (2003). Visit to Xinavane and Maragra sugar estates in Mozambique, 5-9 May 2003. Internal Report, South African Sugar Association Experiment Station, Mount Edgecombe, 4300, South Africa. 6 pp.

Williams JR (1983). The sugar cane stem borer (*Chilo sacchariphagus*) in Mauritius. *Revue Agricole et Sucriére de I'Ile Maurice* 62: 5-23.