The potential of using pheromone traps for the control of the banana weevil *Cosmopolites sordidus* Germar in Uganda

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Introduction

The banana weevil *Cosmopolites sordidus* Germar is one of the major constraints to banana production especially in small-scale farming systems (Bujulu *et al.* 1983, Stover and Simmonds 1987, Sikora *et al.* 1989). Weevil control generally relies on the application of costly agrochemicals that are beyond the reach of resource-poor farmers. Resistance towards these chemicals has recently been reported in some countries (Bujulu *et al.* 1983, Collins *et al.* 1991). Cultural control practices in use include crop sanitation and trapping but are of limited application. Integrated pest management approach (IPM) appears to be a plausible method being developed for the control of this pest. Weevil trapping using banana pseudostem traps is the commonly advocated component of the IPM options (Gold 1997). This method however has not been easily adopted in Uganda due to being labour-intensive and to the unavailability of trapping material. An easy-to-use and effective method, involving use of pheromone traps, has been identified as a plausible alternative (Alpizar and Fallas 1997). It could be used in combination with other control measures, especially those based on cultural practice, as an IPM option.

The pheromone trapping system has been reported to be safe, long-lasting, effective and reasonably priced (Alpizar and Fallas 1997). The trapping system has been reported to reduce damage and increase yields in banana and plantains (Alpizar and Fallas 1997). Pheromone lures (Cosmolure+) increased the attractiveness of stem traps by 5-10 times in Costa Rica. Cosmolure-baited buried pitfall traps containing 3% laundry detergent in water were however 2.5 times more effective than Cosmolure-baited stem traps. The capture rate of the trap was reported increased by 20% when Cosmolure-baited plastic gallons with a ramp were used as compared to baited pitfall traps (Alpizar and Fallas 1997).

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This paper gives preliminary results of a study conducted at Kawanda Agricultural Research Institute (KARI), Uganda, to validate the efficacy of the technology under Uganda conditions.

Materials and methods

Site

The study was conducted on-station in a 4-year-old banana plantation of about 1 hectare, planted with the cultivar Mbwazirume (AAA-EA). The field consisted of 36 plots with 25 mats in each plot.

Types of traps and trapping

Four types of pheromone traps (Pitfall-Cosmolure+, Pitfall-RMD-1, Gallon-Cosmolure+ and Gallon-RMD-1) as described by Alpizar and Fallas (1997) were placed in the banana field as baits for the banana weevil. Pitfalls were prepared by cutting open 10-litre buckets at a height of 15 cm (Fig. 1a). A pheromone lure (Cosmolure+ or RMD-1) was hung from the roof of the bucket cover using a nylon string. A laundry detergent was added in the traps to reduce surface tension and therefore prohibit the weevils from climbing out. Gallon traps were made out of a 5-litre jerrycan (Fig. 1b). A "window" was cut in each side of the jerrycan and the flap folded down to make a walk-in ramp. Gallons were placed in the soil to make ramps touch on the ground. Either a Cosmolure or RMD-1 pheromone was hung from the cup of the jerrycan using a nylon string. Pseudostem pieces (5-10 cm long) soaked in a solution of Furadan (10 g Furadan to 1 litre of water) were placed at the bottom of the gallon to kill weevils whenever attracted into the trap.

The conventional split pseudostem traps were included as a check. Traps were made from 30 cm-long pieces of fresh material cut exactly in half longitudinally (Fig. 1c). The two halves were placed flat side down on the cleared soil surface close to and on opposite sides of the randomly selected mat (Mitchell 1978, Ogenga-Latigo and Bakyalire 1993). Pseudostem traps were placed at least 30 metres from the nearest pheromone trap.

Traps were checked every day for a month and the number of weevils caught in each trap recorded. Pseudostem traps were renewed every three days. Weevils caught in pheromone traps were sexed to determine sex ratios of weevils attracted to pheromone traps.

To determine the weevil attraction distance by pheromone traps (Pitfall-Cosmolure+), weevils were marked according to sex and distance of release by scratching on elytra using a dissecting blade. Weevils were released at 5, 10, 20, 30, 40, 50 and 60 metres from the Pitfall-Cosmolure+ trap. At each distance from the trap, 100 weevils (50 females and 50 males) were released. The marked weevils recaptured were recorded every day for four weeks.

The costs of pseudostem and Cosmolure+ to reduce weevil population by 50% in the trial were estimated.

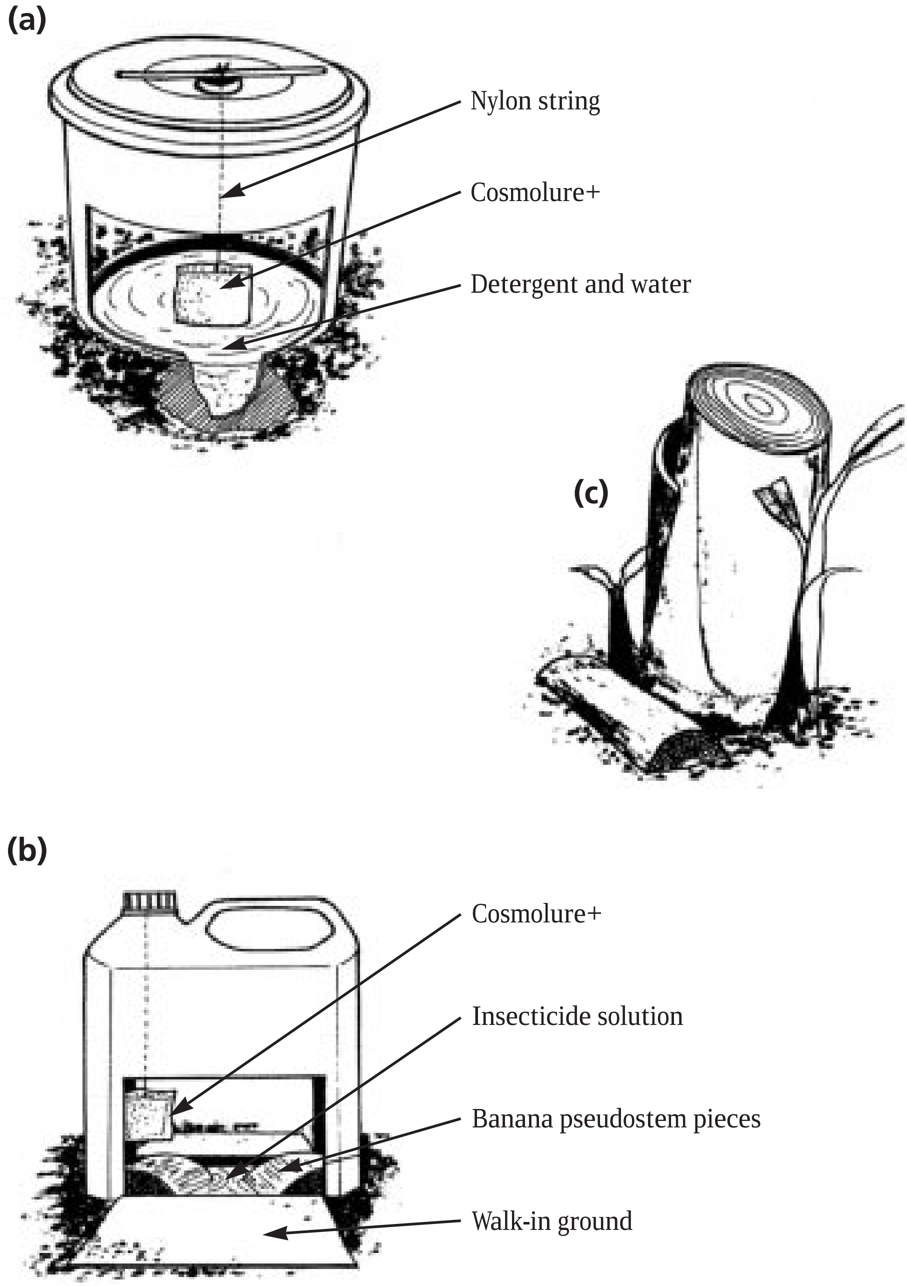

Figure 1. Trap type: (a) Pitfall trap, (b) Gallon trap with a ramp and (c) Pseudostem trap (a modified design from Alpizar and Fallas 1977).

Results and discussions

The Pitfall-Cosmolure+ traps caught 18 times the number of weevils as compared to the pseudostem traps (control), which caught a mean number of 1.3 weevils per trap per day (Fig. 2). The weevil catches of the other three pheromone traps were significantly lower than the Pitfall-Cosmolure+ trap catches and significantly (p = 0.05) higher than the pseudostem trap catches, but similar among themselves.

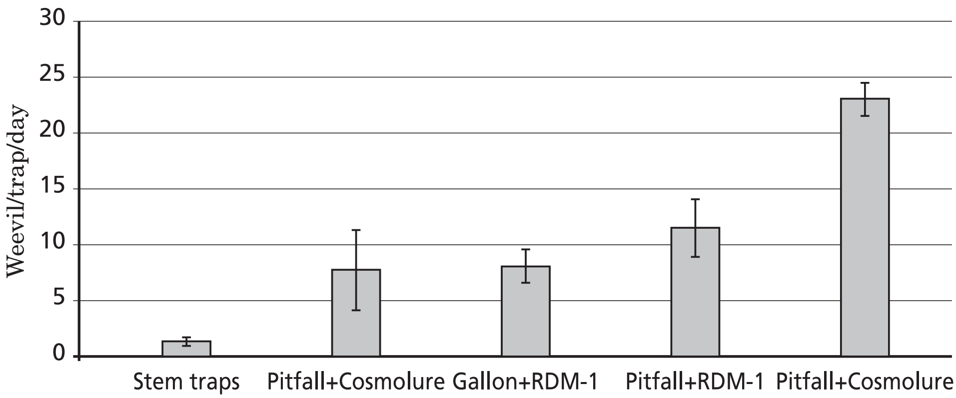

Figure 2. Mean weevil catches in different types of traps.

According to results, Pitfall-Cosmolure+ traps have the greatest potential in enhancing weevil trapping under the experimental conditions compared to other traps under study. In addition to its high weevil-capturing rate, the trap is less costly to use, as one needs only to add a laundry detergent. In contrast, the gallon with a ramp trap needs addition of banana pseudostem pieces treated with an insecticide, which are costly and may cause harm to the farmer. The weevil catches of Gallon traps baited with Cosmolure+ are not in agreement with what was reported in Costa Rica condition (Alpizar and Fallas 1997). According to the work conducted in Costa Rica, Gallon baited traps are expected to capture 20% more than pitfall traps baited with Cosmolure+. It was not clear why the Gallon-Cosmolure trap efficiency was low in Ugandan conditions.

The percentage of female and male weevils attracted by both pheromone traps and pseudostem traps were not significantly ($p<0.05$) different (Table 1). Pheromone traps equally attracted both female and male weevils ($p<0.05$).

Table 1. Sex ratios of weevils caught by pheromone traps.

Trap type	Number of weevils (n)	% weevils trapped		
		Males	Females	P-value
Pitfall + Cosmolure	274	50.9	49.1	0.838 NS
Gallon + Cosmolure	104	51.8	48.2	0.964 NS
Pitfall + RMD-1	169	54.7	45.3	0.312 NS
Gallon + RMD-1	127	45.4	54.6	0.433 NS

NS = not significant at P = 0.05

The pheromone-baited traps (Pitfall-Cosmolure trap) attracted weevils mainly from a radius of 10 metres with pheromone action decreasing greatly after 20 metres (Fig. 3). Few weevils in the distance of 60 metres from the traps were recaptured in the pheromone traps in a period of four weeks. This data suggests that 20 metres would be the optimum distance of separation between pheromone traps in case of mass trapping, which conforms to what was reported in Costa Rica (Oeschlager, personal communication). This would require at least 25 pheromone traps per hectare without changing the locations of traps in the field. The trap density of 25 traps per hectare might be more effective as compared to use of 4 traps per hectare with traps moved 20 metres along the 60 meter axis every month to cover the entire infested field (Alpizar and Fallas 1997). Using 4 traps per hectare was reported to reduce weevil population significantly within six months. The rate of reduction of the weevil population using 25 traps (non-movable) per hectare compared to 4 traps per hectare needs to be determined in Ugandan conditions.

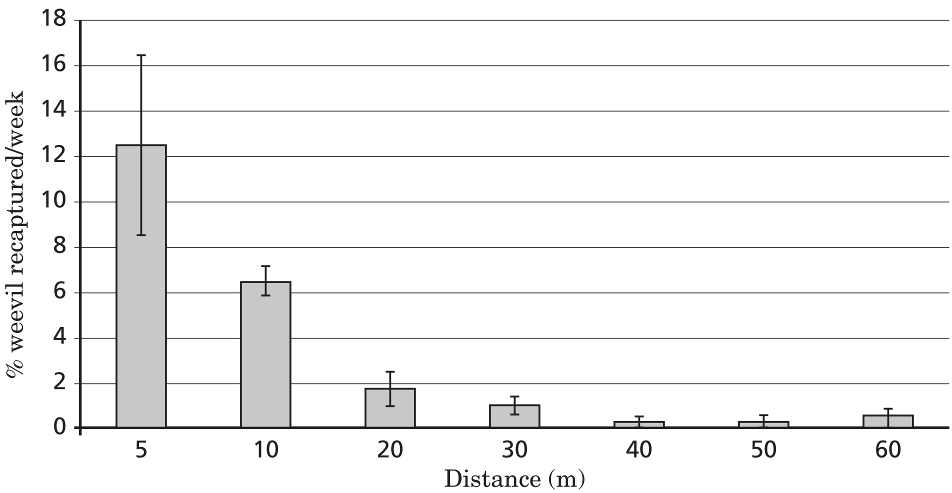

Figure 2. Mean weevil catches in different types of traps.

Compared to pseudostem trapping, the pheromone traps had a cost advantage (Table 2). The costs of pseudostem traps required to capture the same number of weevils as captured by pheromone traps in one hectare in three months was about three times. In addition to the cost advantage, pheromone traps have a simple design and are easy to use. They require little maintenance and can be used in remote locations where frequent visits are impractical. Besides, the pheromone traps are not known to have side effects on non-target organisms, and non-toxic and exhausted lures can be discarded with household garbage. The pheromone lures are however manufactured and are sold commercially in Costa Rica, and their importation and distribution may initially pose practical problems. However before large-scale application can be contemplated, their efficacy needs to be further tested on farm and under varying agroecological conditions.

Table 2. Comparative estimate costs (Ug. Shs) for using pheromone traps to reduce weevil population by 50% in 3 months per hectare.

Input	**PheromonePseudostems**					
	quantity for 3 months	**unit cost**	**total cost**	**quantity for 3 months**	**unit cost**	**total cost**
Trap material						
Purchase	75	2500	187,500	13500 traps	20	270,000
Transport	-	-	-	30 trips	3000	90,000
Buckets and design	25	2200	55,000	-	-	-
Labour (laying and removing weevils)	13 man-days	3000	39,000	150 man-days	3,000	450,000
Total			**281,500**			**810,000**

* Refers to pseudostems, assuming they are obtained in a distance within 5 km of application. These are also additional to those in the farmer's own field.

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