EFFECT OF SPRAYING AT PLANT COLLAR AND ADULT TRAPPING ON BANANA CORM WEEVIL, Cosmopolites sordidus (Coleoptera: Cucurlionidae) AT REMUN, SERIAN

Felicia Kueh Tai Fui

Agriculture Research Centre, Semongok, Department of Agriculture, Borneo Heights Road, 93720, Kuching, Sarawak, Malaysia

Abstract

The banana corm weevil, *Cosmopolites sordidus* (Coleoptera: Cucurlionidae) is the most concerned pest in all major banana and plantain countries. In Sarawak, the first incident of *C. sordidus* was detected in Kpg. Remun, Gedung, Serian where 90% of the banana plants were infested. An on farm trial to evaluate the effect of chemical spraying at plant collar and trapping was carried out. Untreated plot served as the control. Only chemical spraying at the plant collar showed significant reduction of weevil damage to the plant. Nevertheless the percentage of damage was still high. It is concluded that no single treatment has effectively control this pest. With the introduction of integrated pest management (IPM) strategy, which incorporates cultural and chemical controls, the pest infestation has been greatly reduced.

Keywords: banana, weevil, Cosmopolites sordidus, integrated, pest, management

Introduction

Banana (*Musa* spp.) is amongst the most important food and cash crops in Malaysia but its production is constrained by a number of pests, and one of them is the banana corm weevil, *Cosmopolites sordidus* (Coleoptera: Cucurlionidae). Gowen (1995) and Gold and Messiaen (2000) stressed that *C. sordidus* is the most concerned pest in all major banana and plantain growing countries. The banana weevil evolved in Southeast Asia and from there it spread throughout the world, presumably through the movement of infested planting materials (Gold, 2001) or adult crawling to the nearby plantations (Gowen, 1995; Seshu Reddy *et al.*, 1999). Waterhouse (1993) suggested that the weevil is unimportant in much of the Southeast Asia region. In Sarawak, the low weevil population might be attributable to their preference to crop residues rather than to standing plants. Similar observation was reported in Indonesia (Gold, 2001).

However, in recent years, the banana corm weevil, *C. sordidus* is becoming major and common pests in banana farms. The first incident of *C. sordidus* was detected in Kpg. Remun, Gedung, Serian in November 2011. Ninety percent of the Pisang Tanduk was infested with this pest. The infestations resulted in leaves yellowing, plant toppling and reduced bunch weight and size. Weakening of corm or pseudostem by the larvae tunneling cause the plants to be susceptible to wind damage and were unable to bear the weight of the maturing fruit bunch, and thus result in plant snapping. At present, no single management strategy appears likely to provide complete control of banana weevil (Gold, 2001).

The adult of banana corm weevil is black and measures 10–15 mm long. Adults have well developed wings but flight is rare (Gold and Messiaen, 2000). They display feigning death when disturbed. The white, elongate, oval eggs are laid singly in the small crevices chewed in the plant tissue. The larvae are whitish grubs, which upon emergence, immediately tunneled into the pseudostem and produced circular, debris-filled tunnels. Newly emerged adult may be black or reddish brown but soon becomes uniformly black. The life cycle of *C. sordidus* takes 34 to 63 days in laboratory conditions. The egg stage lasts 3–10 days, the larval stage 24–36 days and the pupal stage 7–17 days. All of the life stages are highly susceptible to dessication.

Materials and Method

Experimental site

On farm trial was initiated in December 2011 at Kpg. Remun, Gedung, Serian. This area is planted with Pisang Tanduk, Pisang Kepok and Pisang Keling. Staggered planting was practiced. The plot chosen for the trial was the plot planted with Pisang Tanduk.

Experimental design

There were three treatments with four replications in a complete randomized block design. The treatments were spraying at plant collar (T1), trapping using freshly cut pseudostems (T2) and control (T3). Spraying with dimethoate at the plant collar and up to a height of 45 cm was conducted at two weeks interval. The traps were prepared by cutting the pseudostem longitudinally into halves and placed near the treatment plant with split surface on the ground. The traps were then covered with banana leaves to delay desiccation and decomposition of the traps. Traps were replaced weekly. Pest count was done weekly and they were destroyed after counting.

Damage assessment

Plant damage was assessed through external and internal weevil damage. External damage was assessed through a modified percentage coefficient of infestation (PCI). The modified PCI, explained by Gold *et al*. (1994), was developed by scoring presence or absence of ten sections, each, from 0 to 5 cm and between 5 to 10 cm from the collar; thus PCI scores potentially ranged from 0 to 20. The two PCI values were summed to provide a total PCI. The PCI is basically a template conversion of external tunneling points into a percentage index representing the degree of banana infestation by the pest (Ogenga-Latigo and Bakyalire, 1993). Internal assessment of weevil damage was done by cross section cutting at 10 cm from the plant collar. Each cross section is divided into the cortex (X0) and central cylinder (X1) and the percentage of damage were recorded. The two cross section values were averaged to provide the mean cross sectional damage (X mean). All these parameters were measured before and after the treatments.

Statistical analysis

The six parameters, i.e. PCI from 0 to 5 cm from the collar, PCI from 5 to 10 cm from the collar, sum PCI, cortex damage, central cylinder damage and mean cross sectional damage were compared between treatments using anova test. The SAS version 9.1.3 software program was used for analysis.

Results and Discussion

Efficacy of treatments

Relative to control plants, only chemical spraying at plant collar showed significant reduction in the percentage damage to the PCI from 0 to 5 cm from the collar, cortex, central cylinder and X mean (Table 1). Although spraying of insecticide at the plant collar may hinder the weevil to lay eggs on the plants and resulting in reduction of weevil damage, the percentage of PCI and cross-sectional damage were still high.

Table 1. Banana corm weevil damage scores

Treatment	Mean					
	05	10	Sum PCI	X0	X1	Xm
T3	20.0[a]	25.0[a]	45.0[a]	52.50[a]	33.75[a]	43.125[a]
T2	17.5[a]	22.5[a]	40.0[a]	38.75[a]	27.50[a]	33.125[a]
T1	2.5[b]	15.0[a]	17.5[a]	15.00[b]	2.50[b]	8.750[b]

05: PCI from 0 to 5 cm from the collar
10: PCI from 5 to 10 cm from the collar
Sum PCI: sum of 05 and 10
X0: cross-sectional damage percentage of the cortex
X1: cross-sectional damage percentage of the central cylinder
Xm: mean cross-sectional damage of the corm
For each dependent variable, means with letter in common are not significantly different (P > 0.05) by DMRT.

Relationship of PCI and internal damage

Ogenga-Latigo and Bakyalire (1993) reported that surface damage may be poor indicator of internal damage and Rukazambuga *et al* (1998) also reported that larval feeding in the rhizome interior may be more destructive to plant then damage on the rhizome surface. However, the data in this experiment suggest a weak positive relationship between PCI and internal damage. This is in agreement with the study by Gold *et al.* (1994) which suggests a relationship does exist between PCI and internal damage.

Weevil population

A total of 810 banana weevils have been trapped from December 2011 to March 2012. Though intensive trapping was carried out weekly, the trap catches of the weevils fluctuated and remained high after 13 weeks of trapping (Figure 1). Although pseudostem trapping system have mostly been used for quantifying treatment effects, according to Seshu Reddy (1993) and Johan (2006), catches of traps do not necessarily provide accurate estimates of the weevil population in the field.

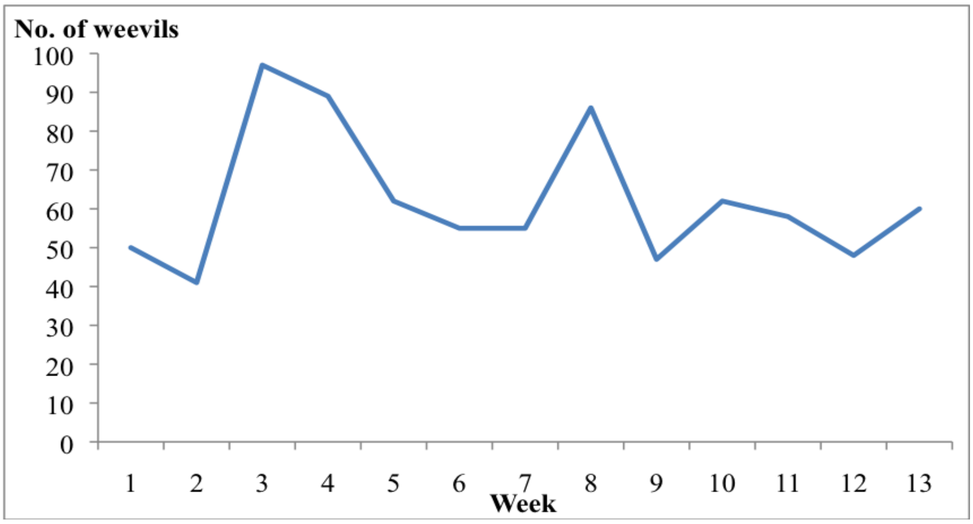

Figure 1. Trap catches of *Cosmopolites sordidus* in 13 weeks

Integrated pest management of C. sordidus

Since there is no single treatment that appears likely to control the *C. sordidus* effectively, an integrated pest management strategy was introduced to the farmer for a better control of this pest. The components of such a strategy include cultural control and chemical control. Cultural control is very valuable in preventing the establishment of the pest, especially for resource-limited, small scale growers (Gold and Messiaen, 2000). Sanitation plays a very important role in cultural control. Poor sanitation (Figure 2) can increase the weevil population and thus causing more severe damage (Masanza, 2003). The farmer was advised to cut the harvested stumps to ground level, cut fallen plants, either by wind damage or weevil damage, into pieces to accelerate plant desiccation rate, and remove the crop trash because all these materials can serve as sheltering and breeding sites of the pest. Plant residues may also act as trap crops, attracting more gravid females to lay eggs on them, rather than standing plants (Masanza, 2003 and Gold *et al*., 1999). Sound practices of desuckering and weeding also help in controlling *C. sordidus*.

Long term and systematic tapping using split pseudostems to reduce the weevil population was also recommended. The traps of 30–45 cm in length, sprayed with imidaclorpid, were recommended and they were changed in every two weeks. The harvested plants were used to make the traps. Nevertheless, trapping is laborious and sometimes the materials are lacking. Spraying the plant collar is also incorporated in this strategy. Farmer was advised to spray the plants fortnightly with dimethoate. This insecticide provides a protective treatment for plants and has short residual effect (Treverrow *et al*., 1992).

The trap catches for the pest were recorded from October 2012 to January 2013 to quantify the effectiveness of this IPM strategy. A total of 788 weevils were trapped, with no significant reduction in the pest population compared to the trap catches done earlier from December 2011 to March 2012. Although there was no significant reduction in pest population, the number of banana plants infested with the pest has greatly reduced (Figure 3). Therefore, this again is in agreement with Seshu Reddy (1993) and Johan (2006) where trap catches do not provide accurate estimates of the weevil population in the field. Trapped weevils only provided an indication of the adult activity at the base of the plant, and were not considered a measure of adult density (De Graaf, 2008).

For planting area previously infested with the pest, one round of carbofuran was applied when the suckers, taken from previously infested plot are planted. The application of carbofuran at planting time has greatly reduced the pest problem. The banana plants infested by *C. sordidus* were less than 5%. Due to the long residual actions, it is advised that carbofuran to be applied at time of planting and should not be applied to fruiting plants.

At ideal condition, planting area previously infested with *C. sordidus* should be left fallow or used for annual crops for a minimum of one year (Seshu Reddy *et al*., 1993), or preferably 18 to 24 months (Treverrow *et al*., 1992). Inadequate fallow period may lead to infestation of new banana plants by adults surviving in the old infested plant residues.

Use of clean planting materials is essential for healthy plants. Planting materials from infested areas should not be used as there is a high possibility that the suckers are also infested. If the suckers have to be used, dipping them in insecticide solutions can be effective in killing the weevil in planting materials (Cardenas Murillo *et al*., 1986). Tissue culture plants are recommended as they are free from pest and disease, making them ideal to “start clean, stay clean” (Peasley and Treverrow, 1986).

Figure 1. Before implementation of IPM

Figure 2. After implementation of IPM

Conclusion

There is no single treatment that appears to control the *C. sordidus* effectively and therefore IPM strategy, with the integration of cultural and chemical controls, was introduced for a better control of this pest. This IPM strategy include diligent crop hygiene, felling pseudostems at ground level, destruction and removal of fallen plants and crop residues, systematic trapping, and spraying of chemical at plant collar and up to a height of 45 cm to minimize the pest population. Tissue culture plant is recommended as the clean propagating materials.

References

Cardenas Murillo, R., Arroyave, R. F. P. and Arango Bernal, L. G. (1986). Treatment of plaintain (Musa AAB Simmonds) against the banana borer weevil (*Cosmopolites sordidus* Germar). *Cenicafé* 37, 61-71.

De Graaf, J., Govender, P., Schoeman, A. S. and Viljeon, A. (2008). The efficacy of cultural control measures against the banana weevil, Cosmopolites sordidus (Germar), in South Africa. *Journal of applied Entomology*, 132, 36-42.

De Graaf, J. (2006). Integrated pest management of the banana weevil, Cosmopolites sordidus (Germar), in South Africa. PhD Thesis. University of Pretoria, Pretoria.

Gowen, S. (ed). (1995). Bananas and Plantain. Chapman and Hall, London. 611p.

Gold, C. S. (2001). Biology and integrated pest management of banana weevil, *Cosmopolites sordidus* (Germar).. In: A. B. Molina, V. N. Roa and M. A. G. Maghuyop (eds). Advancing banana and plantain R&D in Asia and the Pacific, Vol. 10: Proceedings of the 10th INIBAP-ASPNET Regional Advisory Committee meeting held in Bangkok, 10-11 November 2000, INIBAP-ASPNET, Los Banos, 28-33.

Gold, C. S. and Messiaen, S. (2000). The banana weevil, *Cosmopolites sordidus*. *Musa* Pest Fact Sheet No.4.

Gold, C. S., Speijer, P. R., Rukazambuga, N. D. and Karamura, E. B. (1994). Assessment of banana weevils in East African highland banana systems and strategies for control. In: R. V. Valmayor, R. G. Davide, J. M. Stanton, N. I. Treverrow and V. N. Roa (eds). Banana nematodes and weevil borers in Asia and the Pacific: Proceedings of a workshop on nematodes and weevil borers affecting bananas in Asia and the Pacific, 18-22 April, 1994, Serdang, Selangor, 170-190.

Masanza, M. (2003). Effect of crop sanitation on banana weevil *Cosmopolites sordidus* (Germar) populations and associated damage. PhD Thesis. Wageningen University, Wageningen, The Netherlands.

Mitchell, G. A. (1978). The estimation of banana borer population and resistance levels. *WINBAN Technical Bulletin* (2), 34.

Ogenga-Latigo, M. W. and Bakyalire, R. (1993). Use of pseudostem traps and coefficient of infestation (PCI) for assessing banana infestation and damage by *Cosmopolites sordidus* Germar. *African Crop Science Journal* 1, 39-48.

Peasley, D. and Treverrow, N. (1986). Count, cut and dry: management of banana weevil borer in bananas. Agdex 231/62Z. NSW Agriculture and Fisheries, Sydney.

Seshu Reddy, K. V., Gold, C. S. and Ngode, L. (1999). Cultural control strategies for the banana weevil, *Cosmopolites sordidus* Germar. In: Proceeding of a Workshop on Banana IPM, November 1998, Nelspruit, South Africa, 51-57.

Seshu Reddy, K. V., Koppenhofer, A. M. and Uronu, B. (1993). Cultural practices for the control of the banana weevil. In: Biological and integrated control of highland banana and plantain pests and diseases. Ed. by Gold CS, Gemmil B. Proceedings of a Research Coordination Meeting in Cotonou, IITA, Benin, 140–146.

Treverrow, N., Peasley, D. and Ireland, G. (1992). Banana weevil borer, a pest management handbook for banana growers. Banana Industry Committee, New South Wales Agriculture, NSW, Australia.

Waterhouse, D.F. (1993). The major arthropod pests and weeds of agriculture in Southeast Asia. ACIAR, Canberra. 141 p.