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EFFICACY OF DIFFERENT TRAP TYPES TO CONTROL BANANA ROOT WEEVIL *COSMOPOLITES SORDIDUS* (GERMER, 1823)*

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Abstract

The banana weevil (*Cosmopolites sordidus*) is an important pest for banana growers. The objective of this study was to evaluate the most effectiveness of different trapping methods to control C. sordidus in Aithonesint village, Taungoo Township, Bago Region. A field trial comparing four treatments (T1: Pseudostem trap, T2: Pitfall trap, T3: Pheromone trap, and T4: Control) was conducted using a Randomized Complete Block Design (RCBD) over four months (October 2023 to April 2024). A total of 576 traps (144 traps per treatment) were distributed across the study site (one acre farm). The data of monthly averages of weevils captured by trap were recorded. The averages of the treatments were compared by the Tukey's Studentized rang (HSD) test at 5% significant level. A total of 1,412 adult weevils were captured. The results showed that the Pheromone trap (T3) was significantly superior to all other traps, attracting the highest number of adults (n=611, or 43.27% of the total catch). Conversely, the Pseudostem trap (T1) was the most attractive to larvae, capturing n=415 (or 88.87% of the total larvae). No significant correlation was found between the captured adult population and weather parameters (average temperature and relative humidity). In conclusion, the study recommends the use of Pheromone traps for monitoring and mass trapping of C. sordidus adults and Pseudostem traps for monitoring larval populations in the Taungoo area.

Keyword: *Cosmopolite sordidus*,adult, larvae, pheromone trap, pseudostem.

Introduction

Banana is one of the main staple starchy foods in developing countries, with its domestication originating in Southeast Asia (Ortiz,1997). In banana cultivation, arthropod pest play as a major difficulty for banana growers. There are 490 species of significant arthropod pests worldwide. The most important pests were *Cosomoplites sordidus* (root borer weevil), *Odoiporous longicollis* (stem borer weevil), Fruit capterillar and aphids (Ostmark, 1974).

The banana plants are highly susceptible to banana weevil *C. sordidus* which is considered as the most economically important pest because of its damage and host plant specific (Gold *et al*., 2001). The adult weevils were nocturnal and hiding during the day under the leaf sheaths of the plants, and inside the pseudostems and rhizomes of harvested plants that makes difficult to observe for farmers (Vinatier and Vinatier, 2013).

The use of agrochemicals to control banana weevils was expensive for resource-poor farmers and these chemicals have been resistant to this weevil that has been recently reported in some countries (Collins *et al*. 1991).The population dynamic and phytopathogens of banana plants are highly relationship because this weevil was the causal agents of the Fusarium wilt Race 4 and bacterial wilt (Were *et al*. 2015). It is essential to know the population dynamic of banana weevil to carry out the suitable control of that pest (Tinzaara *et al* , 2007).

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Integrated pest management approach (IPM) has been recently developed for control of weevil. In this approach, cultural control practices including crop sanitation and trapping method appears to be developed for weevil control. Pseudostem traps for weevil trapping are the most commonly advocated method of IPM option (Gold 1998). However, this method has not been easily used because of labour-intensive.

Pheromone trap has been used a plausible alternative due to easy to use and effective method. The pheromone trapping method has been reported to reduce and increase yields in banana production (Alpizer and Fallas, 1997). Intense split pseudostem trapping has been reported significantly reduce *C. sordidus* damaged after one year (Gold *et al.*, 2002), Semiochemical- enhanced mass trapping has also been shown as an effective control (Alpizar *et al.*, 1998). Pitfall traps were been used to monitoring the weevil population in Uganda (Tinzaara *et al.,* 1999).

The control potential of different trapping methods may depend on climate, cultivation practices, proportion of the population attracted and monetary cost of trapping. The possible occurrence of weevil biotypes may influence above factors and these factors may vary according to local areas. No research comparing pheromones to other traps has been reported and the only research was found in tropical countries (Tinzaara *et al.*, 1999).Therefore, the present study was to evaluate the effective trapping methods for management of banana root weevil *Cosmopolites sordidus.*

Materials and Methods

Study Area and Period

The study was conducted at Ai Thone Sint Village, Taungoo Township, Bago Region (located between 19∘01′05.5″N and 96∘25′11.9″E) (Fig. 1 and Plate 1). The study site was a 2 acre (8093.71 m2) banana farm. The study period lasted seven months from October 2023 to April 2024.

Experimental Design

As experimental design, the randomized complete block design was chosen. In this method, it contains equal size blocks (8093.71m$^{2)}$ and in which all treatments were be carried out. The research was worked out in 8093.71m^2 with four treatments and six replications in 4 months duration of trapping. The four treatments were T_1 – Pseduostem trap, T_2 – Pitfall trap, T_3 – Pheromone trap and T_4 – Control.

The 8093.71m^{2}was divided into six equal blocks. Each block was again divided into six equal parts, each part was represented as one subplots. Six traps of each treatment were distributed in each block, overall, totally 36 number traps of each trap type were be distributed in one month. After four months, finally 144 traps for each trap type were carried out. Totally 576 traps for all treatments were done during the experiment.

Data Collection

The collections of the weevil were conducted in 2, 4, 6, 8 and 10 days after the distribution of the traps. The number of collected specimen was also recorded.

Data analysis

The data of monthly collected insects were summarized and stated in graphs, tables and other descriptive methods were calculated in Excel. The averages of treatments were compared with the Tukey' Studentized range (HSD) test at 5% level. Statistical analysis was performed using the statistical software JMP 16 Pro.

Meteorological variables (average temperature and relative humidity) were obtained from Meteorological Department, Taungoo Township and correlated with the recorded weevil population for the four months study period using Microsoft Excel 2010.

Fig. 1 Map of study area (Google Earth,2018)

Plate 1. Study site

A. Pseudostem trap

B. Pitfall trap

C. Pheromone trap

D. Control

Plate 2. Different trap types used for sample collection

Results

Four treatments (T1 - Pseudostem trap, T2 - pitfall trap, T3 - Pheromone trap,T4-control) were conducted to collect the banana weevil *C. sordidus* at Ai Thone Sint Village, Bago region (Fig 1, Plate 1 and Plate 2).

During the study period, a total of 1412 adult populations were recorded from 576 traps. The mean numbers of adult in different traps were presented in Fig. 2.The highest population was found in November (Table 1). There were significantly differences among treatment plots and the control. The pheromone traps attracted significantly more (n=611) weevils than the other treated plots and control.

There was no significant monthly difference in the number of adults of *C. sordidus* (Table 1).There was no significant relationship between adult population numbers with relative humidity and average temperature (Fig. 4 and Fig. 5).

The collected numbers of larvae of *C. sordidus* during sampling period was presented in Table 2. In the result observed that no significant monthly difference of total population. However, a significant effect between the types of traps was noticed. Among them, the pseudostem trap attracted more insect (n=415) than those of other trap types and control. The number of recorded larvae from pheromone trap was almost similar to the pitfall trap (Fig. 6).

There was observed slightly relationship between larvae populations and weather conditions of study area (Fig. 8 and Fig. 9). Their population fluctuation of both adult and larvae *C. sordidus* at different sampling dates was also shown in Fig. 3 and Fig. 7.

Table 1 Total number of adults of *C. sordidus* collected per type of trap and per month

Type of trap	No. of trap	Total no.of *C.sordidus* (adult)				Total	Percent
		Nov;	Dec;	Jan;	Feb;		
T1 (Pseudostem trap)	144	92	79	69	66	306	21.67%
T2 (Pitfall trap)	144	89	81	78	63	311	22.03%
T3 (Pheromone trap)	144	158	148	150	155	611	43.27%
T4 (Control)	144	60	49	41	34	184	13.03%
Total	576	399	357	338	318	1412	100%

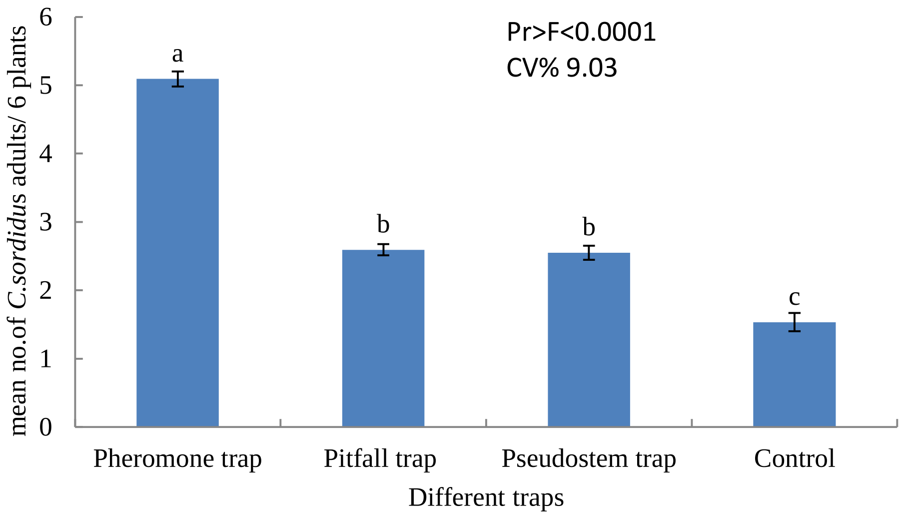

Figure. 2 Average number of adults *Cosmopolites sordidus* per 6 plants in different traps (averages followed by the same letters do not statistically differ from each other by Tukey' Studentized range test at 5% significant level)

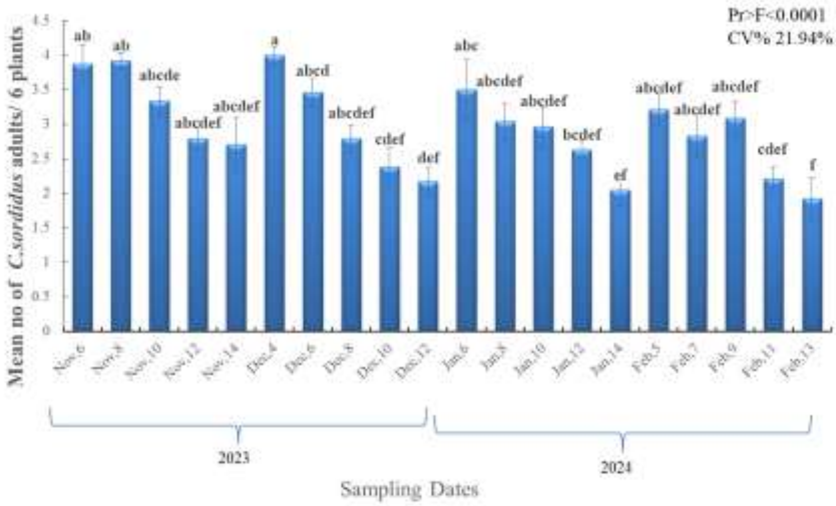

Figure. 3 Population fluctuation of *C. sordidus* adults at different sampling dates in November, 2023 to December 2024 in Taungoo Township (averages followed by the sameletters do not statistically differ from each other by Tukey' Studentized range test at 5% significant level)

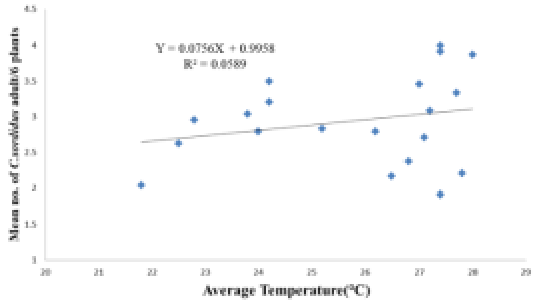

Figure. 4 Relationship between the mean numbers of *C. sordidus* adults/6 plants and average temperature at different sampling dates during study period

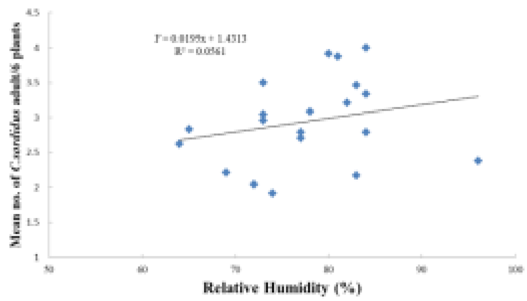

Figure. 5 Relationship between the mean numbers of *C. sordidus* adults/6 plants and relative humidity at different sampling dates during study period

Table 2 Total number of larvae of *C. sordidus* collected per type of trap and per month

Type of trap	No. of trap	Total no.of *C.sordidus* (larvae)				Total	Percent
		Nov;	Dec;	Jan;	Feb;		
T1 (Pseudostem trap)	144	128	99	96	92	415	88.87%
T2 (Pitfall trap)	144	3	1	2	1	7	1.49%
T3 (Pheromone trap)	144	2	1	1	2	6	1.28%
T4 (Control)	144	9	13	7	10	39	8.36%
Total	576	142	114	106	105	467	100%

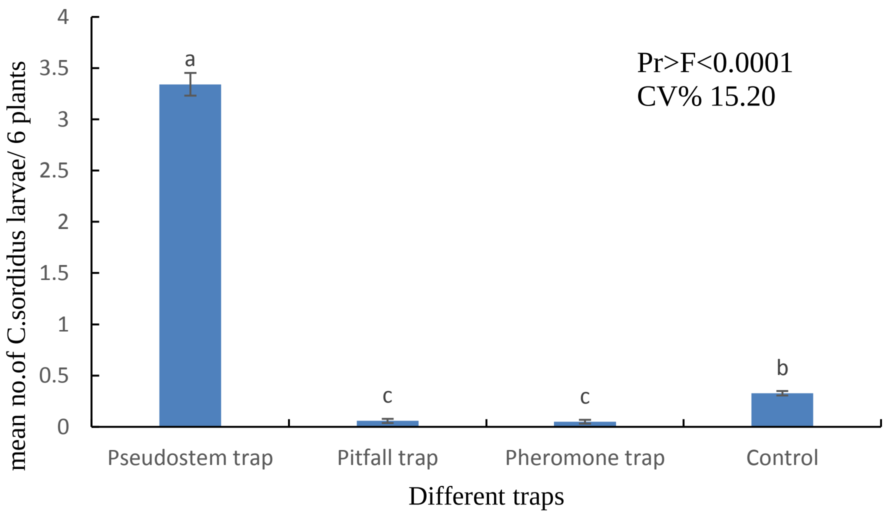

Figure. 6 Average number of larvae of *Cosmopolites sordidus* per 6 plants in different traps (averages followed by the same letters do not statistically differ from each other by Tukey' Studentized range test at 5% significant level)

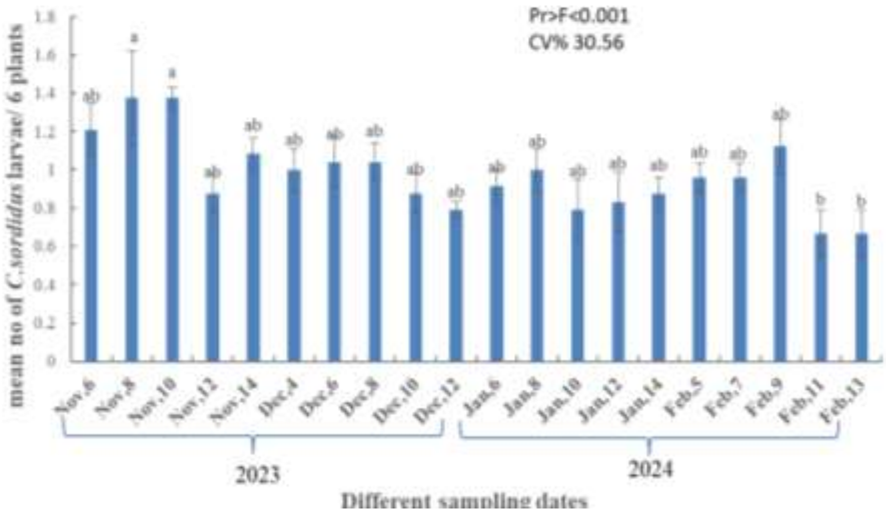

Figure. 7 Population fluctuation of *C. sordidus* larvae at different sampling dates in November, 2023 to December 2024 in Taungoo Township(averages followed by the same letters do not statistically differ from each other by Tukey' Studentized range test at 5% significant level)

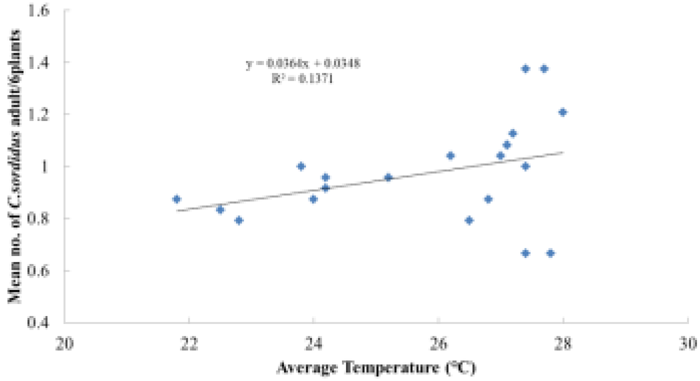

Figure. 8 Relationship between the mean numbers of *C. sordidus* larvae/6 plants and average temperature at different sampling dates during study period

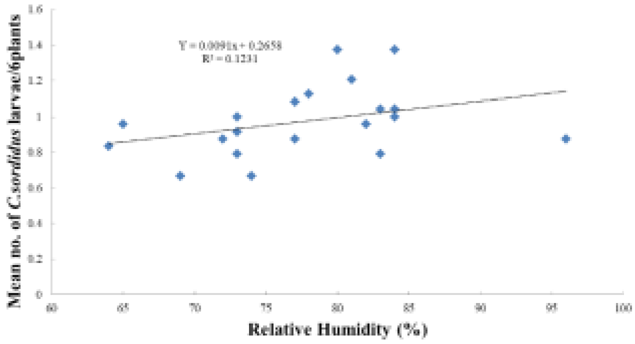

Figure. 9 Relationship between the mean numbers of *C. sordidus* larvae/6 plants and relative humidity at different sampling dates during study period

Discussion

In the present study, four treatments (T1 - Pseudostem trap, T2 - Pitfall trap, T3 - Pheromone trap, T4 - Control) were compared to examine the most effective trapping methods and to detect the incidence of *Cosmopolites sordidus*, banana root weevil population. During the present study, there was no significant difference in the numbers of both weevil adult and larva population considering between the month of evaluation and trap types. However, there was significantly difference between trap types was found. The pheromone trap type attracted more weevil adults (611) than those of other trap types, contributing about 43.27% of the total of insect captured. The average number of weevil captured in pheromone trap was statistically higher than the value of others recorded insect numbers from other traps. Tinzaara (2003) stated that pheromone trap was very effective to attract the *C. sordidus* adult. According to Jayaraman et al (1997), pheromones have been shown to attract significantly more weevil adults than plant material traps.

Especially, the larvae of *C. sordidus* were most significantly caught in pseudostem traps. The highest weevil larvae (n=415) were collected with 88.87% of total population than those of other trap types. Masonza (2003) reported that compared to pheromone traps, pseudostem traps were more attractive to *C. sordidus* larvae. Tinzaara (2003) mentioned that pseudostem traps were very effective to attract *C. sordidus* larvae.

Nevertheless, there was no significant influence of the month on the number of adults and larvae of *C. sordidus* captured. There was slightly different of catch in different sampling dates. The highest population number of adult was found in 2023, December 4 and the highest number of larvae was 2023, November 8 and 10. The lowest number of adults was observed in 2024 February 13 and the number of larvae were lowest in 2024, February 11 and 13. Juliana *et a*l (2017) reported that there was not relationship between the numbers of insect caught and the month.

There was no significant correlation between the number of adults captured in the traps with average ambient temperature and relative humidity at sampling dates during the study period. But, there was slightly relationship between the number of larvae collected in the traps with average temperature and relative humidity at different sampling dates was noticed. Tinzaara *et al* (2005) reported that the relationship between climate factors and the number of *C. sordidus* caught from traps was not related. Duyuk (2012) also stated that relative humidity and temperature was not significantly influence on the number of caught insects from the traps.

Analyzing the average of adults and larvae monthly captured, it was found that the collected insect numbers was closer to the inferior threshold for insect management. Moreover, it was also noticed that the traps of pheromone underestimated the number of adults captured and pseudostems traps was highest attractive to larvae. Fancelli *et al* (2013) mentioned that considering the threshold is based on the average number of insects collected from the traps, the suitable control measures may implement and it might contribute to reduce of weevil incidence.

The high attractiveness of pheromone traps and their durability attributed effectively to catch the weevils. Although, the reduction in pheromone efficacy for larvae was unclear. Pseudostems showed a high lava population. Pitfall traps and pseudostem traps were not significantly differ from each other in the number of adult caught. The collected larvae numbers was not also significantly differ between pitfall traps and pheromone traps.

Tinzaara *et al* (1999) reported that compare to pseudostem traps, pheromone traps generally attracted the highest total numbers of adult during all seasons. But in Costa Rica, pseudostem traps increased the attractiveness five to ten time and pitfall traps was two and a half time more effective than pheromone traps. The lower relative efficacy of pheromone may be weevil biotype, plant variety and/or climate factors (Alpizar and Tallas 1997).

In conclusion, the attractiveness of the pheromone traps for adults of *C. sordidus* was more effective to other traps. Consequently, the pseudostem traps were more attractive to larvae of *C. sordidus*. Thus, pheromone traps show potentials as an economical monitoring and mass trapping and pseudostem traps can be used preferably for the larval monitoring in plantains not yet harvested.

Conclusion

In the present study, four treatments (T1 - pseudostem trap, T2 - pitfall trap, T3 - pheromone trap, T4 - control) were conducted to examine the effectiveness for the monitoring of banana weevil *C. sordidus*. The experiment showed the pheromone traps were most effectiveness to monitor the adult weevils and pseudostem traps were most attracted to weevil larvae. The average numbers of weevil caught and the ambient weather parameters such as average temperature and relative humidity were not significantly related during the study period.

The findings provide localized data supporting the use of both trap types in an IPM strategy for *C. sordidus* control in Taungoo Township.

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