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INFLUENCE OF PHEROMONE LURES ON TRAPPING EFFICIENCY AND SEX RATIO OF *Lasioderma serricorne* (F.) (Coleoptera: Anobiidae) IN TNAU-STACK PROBE TRAP IN TURMERIC WAREHOUSES

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ABSTRACT

Lasioderma serricorne is a cosmopolitan, polyphagous and major insect pest of stored turmeric. TNAU Stack probe trap is recommended for detection and monitoring of insect pests in stored rice, wheat and turmeric. Practical studies were carried out to assess the trapping efficacy of the stack probe trap in combination with pheromone lure. The frequency of detection of *L. serricorne* at ten days after fumigation in stack probe trap alone, with lure inside and outside the trap was 36.67, 43.33 and 33.33 per cent, respectively. The mean number of beetles trapped in probe traps alone, with lure outside and inside was recorded as 1.88, 2.64 and 2.05 beetles per trap, respectively. The frequency of detection and mean number of beetles trapped per trap was low in traps with lure inside the trap compared to traps with lure outside. The sex ratio of beetles trapped in stack probe trap alone was 1.08: 1 (male: female) while in case of traps with lure outside and inside the trap, the ratio of male to female was 5.06: 1 and 4.13: 1 and the high male to female ratio in trap with lure might be due to attraction of more males to the sex pheromone. Though there was a slight increase in trapping efficiency of stack probe traps in combination with pheromone lures, it was found that combination of pheromone lure and traps was not economical in long run due to high cost of pheromone lure.

KEYWORDS: TNAU-Stack probe trap, *Lasioderma serricorne*, Pheromone lure, Fumigation, Turmeric warehouses.

INTRODUCTION

Lasioderma serricorne (F.), cigarette beetle or tropical warehouse beetle, is a serious insect pest of post-harvest agricultural products worldwide (Arbogast *et al.,* 2003). It utilizes dried plant materials, several grains, spices, and postharvest stored food products for its larval development. Insect pests are one of the major constraints for quality deterioration of stored turmeric. *L. serricorne* attacks dried turmeric rhizomes in storage causing huge losses to the extent of 39.8 per cent (Kavadia *et al.,* 1978). Female cigarette beetles attracted by the odor of stored products (Kohno *et al.,* 1983) oviposit in these products. Hatched larvae feed on stored products and cause damage to them (Howe, 1957). Larva bores extensively through dry turmeric rhizomes, deteriorates rhizome quality and reduces the nutritional and medicinal value of storedturmeric. Srinath and Prasad (1975) found that out of 115 market samples of stored turmeric collected across India, 88 were infested with the cigarette beetle. Early detection of insect infestations is essential for reducing storage losses and quality assurance in prolonged storage. Detection methods are useful in locating infestations, for early diagnosis of low level infestation and to ascertain the success of fumigation or other control measures undertaken (Shadia, 2011). Trapping methods are more sensitive than grain samples, so infestation is often detected earlier with traps than with spear sampling or sieving (Reed *et al.,* 2001).

Stack probe trap is a device used for monitoring of stored product insects in bag storage where normal probe trap cannot be used. It helps to detect insects in bag storage without any damage to bags (Mohan, 2008). TNAU stack probe trap can be used for detection, validation of fumigation and distribution of stored grain insects in bag stacks. The frequency of detection of *T. castaneum* by means of trapping and by spear sampling has been 90 per cent and 17.7 per cent respectively during one week before fumigation. Non baited stack probe trap was an effective device to monitor the presence of insects both in terms of numbers and species of insects caught than the spear sampling methods before and after fumigation (Hategekimana *et al.*, 2013).

Buchelos and Levinson (1993) revealed that multisurface traps (baited with 10 mg of anhydroserricornin) are very useful for mass-trapping of male *L. serricorne* and can promote insectistasis of this species in tobacco stores. Papadopouloua and

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Buchelos (2002a) found that electric trap caught 8912, the pheromone trap 6608, the food attractant trap 1974 and the control 1231 *L. serricorne* adults. The electric adhesive trap was significantly more effective than the other traps and the control. Papadopouloua and Buchelos (2002b) revealed that, identification of female adult *L. serricorne* (F.) can be done by simple external observation of the abdomen under a stereomicroscope after being placed in 70 per cent alcohol or benzene for about 5 min. The recognition of V-shaped apodeme through simple external observation without dissection simplified and accelerated the examination of a large number of *L. serricorne* adults.

MATERIAL AND METHODS

The studies on influence of pheromone lures on trap catches and sex ratio of *L. serricorne* (F.) in TNAU-stack probe trap in turmeric warehouses was carried out at turmeric storage godowns of M/s Ulavan Producers Company Ltd., Erode and State Warehouse Corporation, Coimbatore, Tamil Nadu.

Stack probe trap is a device used for monitoring of stored product insects in bag storage where normal probe trap cannot be used. It helps to detect insects in bag storage without any damage to bags. The stack probe trap devised by Mohan (2008) is made of stainless steel which comprises a main hollow tube having a diameter in the range of 1.8 to 2.0 cm with equi-spaced perforations in the range of 1.8 to 2.0 mm on its upper portion with a bend at one end which ends in a transparent collection unit to collect the insects falling down from the bend, the other end of main tube being closed (Plate 1).

Plate 1. TNAU- Stack Probe Trap

Thirty stack probe traps were used in the present study in which twenty were with pheromone septa and remaining ten without septa to assess the trapping efficiency of stack probe trap alone and in combination with pheromone lure *L. serricorne*. Pheromone septa of female sex pheromone of *L. serricorne* (serricornin) obtained from Pest Control India (PCI) was used in the study. Pheromone septa were tied at two different locations of the probe trap, one on the top of the perforated tube (outside) and another one inside the collection unit (inside). The traps were inserted in the interspaces of the bags at random all over the turmeric bag stacks at ten days before and ten days after fumigation of the warehouse and repeated thrice.

Observations were recorded on the number of beetles trapped per trap on daily basis continuously for ten days before and after fumigation. The trapped insects were identified by visual observation using microscope and confirmed as *L. serricorne* based on antennal characteristics (Howe, 1957). Comparison between the trap catches in stack probe trap without pheromone septa, trap with septa inside and trap with septa outside was done to assess the trapping efficiency.

In order to study the male/female ratio of the beetles caught in stack probe traps, a total of 600 numbers of *L. serricorne* adults (200 in each type of trap) collected from stack probe traps alone, traps with lure inside and traps with lure outside were examined for presence of genitalia. The separation of males and females was based on external observation of the abdominal sclerite bearing the genitalia without dissection (Papadopoulou and Buchelos, 2002b) (Plate 2).

The data obtained were analysed statistically by using analysis of variance (ANOVA). The frequency of detection was arrived by calculating the ratio between

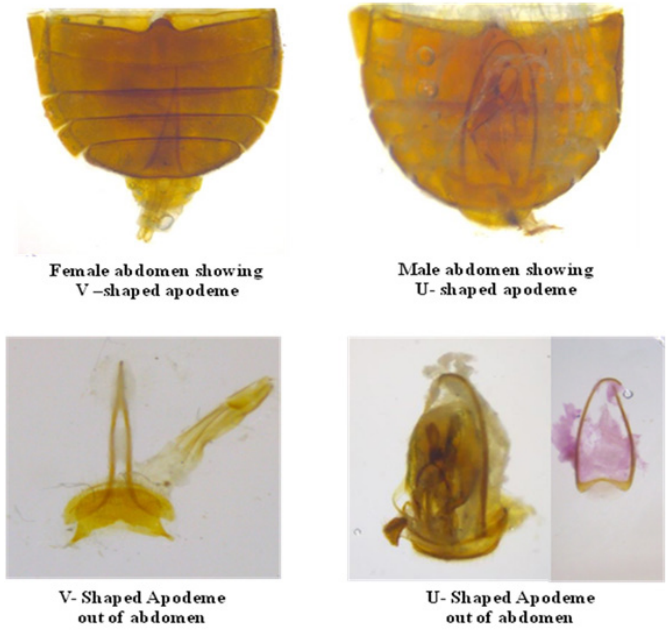

Plate 2. Sex-differentiation of male and female *Lasioderma serricorne.*

the number of observations (sites) in which pests have been detected and the total number of observations (n=50) expressed in percentage was an index of trapping efficiency.

RESULTS AND DISCUSSION

The results of the experiments conducted to assess the trapping efficiency of the stack probe trap alone and in combination of pheromone lure (inside & outside) indicated that the trap catches of *L. serricorne* was 53.24, 62.94 and 58.36 beetles/ trap in three types of traps (probe trap alone, with lure outside and inside) with a detection frequency of 86.67, 90.00 and 83.33 per cent, respectively at ten days before fumigation (Table 1). The mean number of beetles trapped in all the three types of traps was not significantly different at p= 0.05 per cent by LSD.

The frequency of detection of *L. serricorne* at ten days after fumigation in stack probe trap alone, with lure inside and outside the trap was 36.67, 43.33 and 33.33 per cent, respectively. The mean number of mean number of beetles trapped in probe traps alone, with lure outside and inside was recorded as 1.88, 2.64 and 2.05 beetles per trap, respectively which is not significantly different p= 0.05 per cent by LSD (Table 2).

A total of 200 adults of *L. serricorne* collected from each of the three different traps (probe trap alone, with lure outside and inside) were used to identify the sex ratio. Among them, 104 individuals were identified as males (52.00%) and 96 as female insects (48.00%) in case of un-baited probe traps. It's showed that the high proportion of males (>50%) trapped than female with a sex ratio of 1.08: 1 (male: female). In case of traps with lure outside and inside the trap, the ratio of male to female was recorded as 5.06: 1 and 4.13: 1 and the percentage of males was 83.50 and 80.50 per cent while that of females was16.50 and 19.50 per cent, respectively (Table 25). The high proportion of male (> 80%) was recorded in the stack probe traps baited with pheromone lure than the un-baited traps might be due to attraction of more males to the sex pheromone. The present findings were in agreement with Papadopouloua and Buchelos (2002a) who found that the ratio between female and male adults was 8.75: 91.25 for the pheromone trap, 51.57: 48.42 for the food attractant trap and 43.41: 56.58 for the control trap.

Attempts were made to increase the trapping efficiency of the stack probe trap through combination of pheromone lure with traps. The present study indicated that, the trap catches of *L. serricorne* was not significantly different in traps alone, in traps with lure inside and in traps with lure outside the trap. The frequency of detection and mean number of beetles trapped per trap was low in traps with lure inside when compared to traps with lure outside. This might be due to low level of permeation of pheromone volatiles when placed inside the trap. Though there was slight increase in trapping efficiency of stack probe traps in combination

Table 1. Comparison of trap catches of *L. serricorne* in stack probe trap baited with and without pheromone lure (serricornin) in turmeric bag stacks

Trap particulars	10 Days Before Fumigation			10 Days After Fumigation		
	Mean/trap/day (10 observations)	n	Frequency of detection	Mean/trap/day (10 observations)	n	Frequency of detection
Stack probe trap alone	53.24 (7.98)	26	86.67	1.88 (1.54)	11	36.67
Stack probe trap with pheromone lure (outside)	62.94 (8.57)	27	90.00	2.64 (1.77)	13	43.33
Stack probe trap with pheromone lure (inside)	58.36 (8.30)	25	83.33	2.05 (1.60)	10	33.33
CD at P = 0.05%	1.08			0.63		

Table 2. Sex ratio of *L. serricorne* catches in TNAU- Stack probe trap

Trap particulars	Number of *L. serricorne*					
	Total number observed	Male	Female	Per cent males	Per cent females	Ratio (M : F)
Stack probe trap alone	200	104	96	52.00	48.00	1.08 : 1
Stack probe trap with pheromone lure (outside)	200	167	33	83.50	16.50	5.06 : 1
Stack probe trap with pheromone lure (inside)	200	161	39	80.50	19.50	4.13 : 1

with pheromone lures, it was found that combination of pheromone lure and traps will not be economical in long run because the cost of lure is high.

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