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TNAU- Stack probe trap (Indian patent number: 284727): A tool for monitoring and detection of stored product insect pests in bag stacks of sesamum

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Abstract

A study was conducted for monitoring and detection of stored product insect pests in bag stacks of sesamum using TNAU- stack probe trap in a private oil mill warehouse for a period of weeks. The study was conducted by placing 6 traps at different position of the bag stack with 1224 bags of sesame. The collection unit of the trap was unscrewed after 7 days and data on the species and number of insects trapped on each species was recorded. The stored product insect pests trapped in TNAU- stack probe trap are adults of Red flour beetle- *Tribolium castaneum*, larvae of Tropical warehouse moth- *Ephestia cautella*, Flat grain beetle- *Cryptolestes pusillus* adults, nymphs and adults of Psocids- *Liposcelis* sp., and Saw toothed grain beetle- *Oryzaephilus surinamensis* adults. The mean number of *T. castaneum*, *C. pusillus*, *E. cautella*, *Liposcelis* Sp. and *O. surinamensis* trapped per week was 89.5 ± 3.80 , 42 ± 2.12 , 22 ± 3.89 , 4 ± 0.41 and 2.25 ± 0.48 respectively. The mean number of all the above listed insects trapped per week was 159.75 ± 9.98 . The mean percentage of *T. castaneum*, *C. pusillus*, *Liposcelis* Sp., *E. cautella* and *O. surinamensis* trapped was 56.03%, 26.29%, 13.77%, 2.50% and 1.41% respectively. The significant finding from the study is larvae of *E. cautella* were trapped in the device. Currently, *E. cautella* is found to be a major insect pest in stored sesame in warehouses causing loss by webbing of the seeds and feeding on the seeds. The mean number of *E. cautella* trapped per week using 6 traps was 4 ± 0.41 . Hence, TNAU- stack probe trap can be used for monitoring and detection of stored product insect pests in bag stacks of Sesamum. However further studies are needed to increase the trapping of *E. cautella* larvae.

Keywords: Monitoring, detection, storage pests, sesamum bag stacks, TNAU- stack probe trap, *Ephestia cautella* larvae

1. Introduction

Sesame- *Sesamum indicum*, a primary source of sesame oil and traditionally important oilseed crop used for culinary and medicinal purposes [1]. In sesame storage, Red flour beetle- *Tribolium castaneum* (Herbst.) (Coleoptera: Tenebrionidae) causes nearly 10-15% loss mostly damaging light colour sesame seeds than dark colour seeds and frequently infesting ship cargoes [2, 11] and also reported to be attacking sesame seeds and cake [3, 11]. In India, economic damage caused by *T. castaneum* on sesame storage was alarming [4, 11]. *T. castaneum* infestation in sesame storage leads to loss of seed weight (5.2-12.9%), seed viability (41.7-66.7%) and oil content [5]. Tropical warehouse moth- *Ephestia cautella* (Wlk.) (Lepidoptera: Pyralidae) was reported to be infesting sesame seeds by destroying large amount of sesame seeds to dusts and changes the colour of remaining seeds and also reported infesting in cargo ships [2, 6, 7, 8, 12]. Flat grain beetle- *Cryptolestes pusillus* (Schonherr) (Coleoptera: Cucujidae) infests stored sesame by feeding in its grub and adult stage [9, 10, 11, 12].

TNAU Stack probe trap (Indian patent number: 284727) can be used as an effective tool [13] for detection and monitoring of stored product insect pests in bag stacks and it exploits the behaviour of insects in detecting the insect population in stored products [14, 15].

Sesame was normally stored for a period of 6-8 months at seed processing to supply seeds to the farmers [16]. In large scale oilmill storage warehouses, sesame bags are arranged in stacks and stored for a period of 3-9 months. Within that storage time small and large scale sesame warehouses are facing problems of stored product insect pests in sesame. Hence the present study was carried out to monitor and detect the stored product insect pests in bag stacks of sesame using TNAU- Stack probe trap.

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2. Materials and Methods

2.1 Area of the study

The study was conducted in a large scale private oilmill sesame warehouse of 43×32×20 Sq. ft (length × breadth × height) in a stack of 1224 bags (75 kg/ bag) at Virudhunagar, Tamil Nadu, and India.

2.2 Description and working concept about TNAU- Stack probe trap

TNAU- Stack probe trap (Fig 1) is a device made of stainless steel or PVC plastic consists of main hollow tube in the range of 1.8 to 2.0 cm with equispaced perforation in the range of 1.8 to 2.0 cm. The upper end of the main tube with a bend is connected to transparent detachable collection unit and other end of the main tube being closed. The wandering behaviour of insects and 'Insect loves air and move towards it' is the basic concept of exploited in this device. By the concept the insects fall in to the small holes of the main tube in the device and finally trapped in the detachable collection unit at the bottom ^[13].



Fig 1: TNAU- stack probe trap

2.3 Monitoring and detection of stored product insects in sesame bag stacks using TNAU- Stack probe trap

The studies on the monitoring and detection of storage product insect pests in sesame bag stacks were conducted during the months of January and February, 2020. Here the sesame bags are collected from the areas of Tamil Nadu (Villupuram, Erode), Rajasthan (Nagaur) and Uttar Pradesh (Konch, Rath, and Satha). In a bag stack, totally six numbers of TNAU Stack probe trap were inserted among the bags placing one trap at the centre of each locations of top front, top back, middle front, middle back, bottom front and bottom back of the bag stacks (Fig. 2 & 3). The top Front and back trap was placed at 4 m height from the ground and middle front and back traps are placed 3 m height from the ground. Similarly, bottom front and back traps are placed 0.5 m from the ground.

The collection unit was unscrewed after 7 days and the data on number of insects species trapped and number of insects trapped on each species at the different locations of bag stacks was recorded. The insects trapped are stored in a glass container containing 70% ethyl alcohol (Killing and preserving agent) and it was separated, counted and identified with the help of hand lens or observation under stereo zoom microscope.



Fig 2: TNAU- stack probe trap inserted in the space between the bags in sesame warehouses

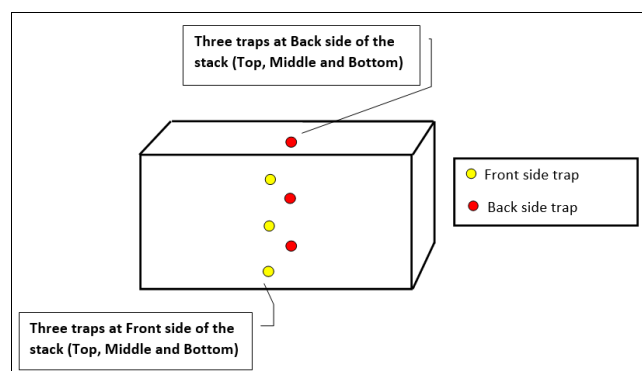


Fig 3: Diagrammatic representation of TNAU- Stack probe trap arrangement in sesame bag stacks

3. Results and Discussion

The results of the present study showed that the TNAU- Stack probe trap found effective in detecting- Red flour beetle- *Tribolium castaneum*, Tropical warehouse moth- *Ephestia cautella*, Flat grain beetle- *Cryptolestes pusillus*, Psocids- *Liposcelis* sp., and Saw toothed grain beetle- *Oryzaephilus surinamensis*. The TNAU Stack probe trap device trapped the adults of *T. castaneum*, larvae of *E. cautella*, *C. pusillus* adults, nymphs and adults of *Liposcelis* sp., and adults of *O. surinamensis* (Table 1). The significant finding in this study is that the larvae of *E. cautella* were trapped in this device. The trapped larva in the collection unit formed web cases around it using sesame seeds and found feeding on the seeds besides contaminating through dusts and faecal matters. It is inferred from the study that in the sesame warehouses *T. castaneum* adult population was trapped maximum in the collection unit (Fig 4). Trapped *E. cautella* larva found pupating in the collection unit (Fig 5).

Table 1: Storage pests detected in bag stacks at sesame storage warehouse

S. no	Storage pests detected in sesame bag stacks		
	Common name	Scientific name	Life stages trapped
1	Red flour beetle	<i>Tribolium castaneum</i>	adult
2	Tropical warehouse moth	<i>Ephestia cautella</i>	larvae
3	Flat grain beetle	<i>Cryptolestes pusillus</i>	adult
4	Psocids	<i>Liposcelis</i> sp.,	nymphs and adult
5	Saw toothed grain beetle	<i>Oryzaephilus surinamensis</i>	adult



Fig 4: *E. cautella* larval webbings and *T. castaneum* adults trapped in the collection unit of TNAU- Stack probe trap.



Fig 5: *E. cautella* Larvae trapped in TNAU- stack probe trap later pupates inside attached to the collection unit by silken webbings around it

From the data on the number of insects trapped at different position of the bag stacks it was found that the maximum population of the insect trapped were in the order of *T. castaneum* > *C. pusillus* > *Liposcelis* Sp. > *E. cautella* > *O. surinamensis* (Table 2 and 3).

Table 2: Monitoring of storage pests in bag stacks of sesame warehouses using TNAU- stack probe trap.

Week no.	Number of insects in each pest species trapped at different locations in a week					Sum of insect pests numbers trapped in a week
	<i>T. castaneum</i>	<i>E. cautella</i>	<i>C. pusillus</i>	<i>Liposcelis</i> sp.,	<i>O. surinamensis</i>	
Week 1	87	5	41	16	3	152
Week 2	82	3	38	26	2	151
Week 3	100	4	41	31	1	177
Week 4	89	4	48	15	3	159
	Mean					159.75

The mean numbers of *T. castaneum*, *E. cautella*, *C. pusillus*, *Liposcelis* Sp., and *O. surinamensis* trapped / week are 89.5 ± 3.80 , 4 ± 0.41 , 42 ± 2.12 , 22 ± 3.89 and 2.25 ± 0.48 respectively. From the mean data it is clear that *T. castaneum* (89.5 ± 3.80) is found to be maximum trapped / week in bag stacks of sesame warehouses followed by *C. pusillus* (42 ± 2.12), *Liposcelis* Sp. (22 ± 3.89), *E. cautella* (4 ± 0.41) and *O. surinamensis* (2.25 ± 0.48). The mean number of insects trapped per week using TNAU- stack probe trap was

159.75 ± 9.98 respectively. Currently, *E. cautella* population and infestation was maximum in the stored sesame warehouses. The mean number of *E. cautella* larva trapped per week was 4 ± 0.41 , a significant finding from the study (Table 3). The mean percentage of insects trapped data shows that from the total insect species trapped in TNAU-stack probe trap 56.03% was *T. castaneum* adults, 26.29% was *C. pusillus*, 13.77% was *Liposcelis* Sp., 2.50% was *E. cautella* and 1.41% was *O. surinamensis* (Fig. 6).

Table 3: Mean number of insects in each species detected from 6 traps per week in bag stacks of sesame warehouses.

Mean of Insect species trapped in 6 traps/week	Mean \pm SE	Mean Percentage of insect species trapped/week
Red flour beetle – <i>Tribolium castaneum</i>	89.5 ± 3.80	56.03
Tropical warehouse moth- <i>Ephestia cautella</i>	4 ± 0.41	2.50
Flat grain beetle – <i>Cryptolestes pusillus</i>	42 ± 2.12	26.29
Psocids – <i>Liposcelis</i> sp.	22 ± 3.89	13.77
Saw toothed grain beetle- <i>Oryzaephilus surinamensis</i>	2.25 ± 0.48	1.41
Mean of insects trapped per week	159.75 ± 9.98	

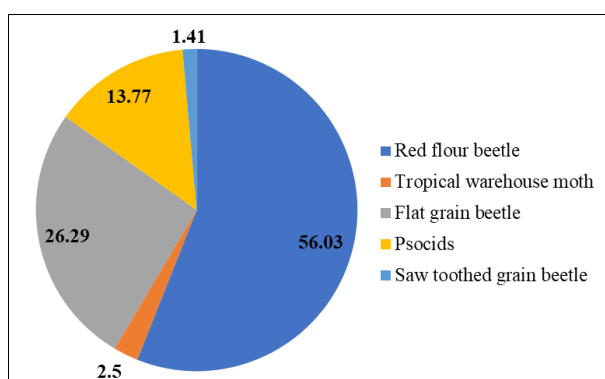


Fig 6: Mean percentage of insect species detected per week in sesame bag stacks using TNAU- stack probe trap

4. Conclusion

From the present study it is revealed that TNAU-Stack probe trap (Indian patent number: 284727) was found to be effective in both monitoring and detection of sesame stored product insect pests in bag stacks. TNAU- Stack probe trap detected effectively stored insect pests of sesamum: Red Flour beetle- *T. castaneum* adults, Tropical warehouse moth- *E. cautella* larvae, Flat grain beetle- *C. pusillus* adults, Psocids- *Liposcelis* Sp. nymphs and adults and Saw toothed grain beetle- *O. surinamensis* adults. The order of trapping with reference to number of insects trapped in stack probe trap, *T. castaneum* > *C. pusillus* > *Liposcelis* Sp. > *E. cautella* > *O. surinamensis*. It can be inferred from the present study that Red flour beetle- *T. castaneum* seems to be the major insect pest of stored sesame. Another significant observation is that

larvae of *E. cautella*, a major pest found to be infesting stored sesame were trapped in TNAU-stack probe trap. Hence, TNAU- stack probe trap can be recommended for monitoring and detection stored product insect pests in bag stacks of Sesamum. However further studies are needed in sesame storage warehouses to increase the trapping of *E. cautella* larvae using TNAU- stack probe trap.

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