

## Evaluation the (4S, 5R)-Sitophilure and some Food Attractants in the Aggregation of Stored-grain Pest *Sitophilus oryzae* (L.) (Coleoptera: Curculionidae) in Store-room

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### Abstract

In this study floor traps (close design) with the sticky floor provided were used inside the storage-room and its baited with aggregation pheromone of *Sitophilus oryzae*, (4S,5R)-Sitophilure and some food attractants (cracked maize, cracked wheat and rice kernels) to catch adults of rice weevil, *S. oryzae*. This study was conducted during April, 2013 at storage-room in agronomy research farm of Sam Higginbottom Institute of Agriculture, Science and Technology, Allahabad –UP, INDIA. The results of this study show that the ground trap (close design) was effective in capturing adult of rice weevil, *S. oryzae*. A strong synergistic effect was noticed between the (4S, 5R)-Sitophilure and addition of cracked maize, cracked wheat or rice kernel and this was demonstrated by the mean number of insects capturing which was as follows; T4(194.50), T2(180.50), T6(152.56), T7(53), T5(41.19), T1(39) and the control is T0(12.50) respectively. Higher weevil number was catch when baited with (4S, 5R)-Sitophilure and cracked maize in comparison with another treatments in storage-room. Male and female of rice weevil response to the aggregation pheromone alone or combined with food baits.

**Key Words:** *Sitophilus oryzae*, (4S,5R)-Sitophilure, Trapping and Food Attractants.

تقييم فرمون التجمع وبعض الجاذبات الغذائية في تجميع أفة الحبوب المخزونة سوسة الرز

*Sitophilus oryzae* (L.) (Coleoptera: Curculionidae)

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### الخلاصة

استعملت في هذه الدراسة المصائد الارضية (التصميم المغلق) ذات السطح اللاصق داخل المخزن وقد طعمت المصائد بفرمون التجمع لسوسة الرز، (4S, 5R) Sitophilure، وبعض جاذبات غذائية (جريش الذرة، جريش الحنطة، بذور الرز) لجذب بالغات سوسة الرز *Sitophilus oryzae*، أجريت هذه الدراسة خلال شهر نيسان من عام 2013 في مخزن الحبوب التابع لقسم بحوث المحاصيل الحقلية في معهد سام هيكن بوتوم للزراعة والعلوم والتكنولوجيا- آله اباد- الهند. النتائج في هذه الدراسة اظهرت ان المصائد الارضية (التصميم المغلق) كانت ذات كفاءة في مسك بالغات سوسة الرز *S. oryzae*. أن قوة التأثير بين (4S, 5R) Sitophilure و جريش الذرة الصفراء او جريش الحنطة او بذور الرز كانت واضحة وتبين ان معدل اعداد الحشرات الممسوكة كانت T4(194.50) أكبر عدد من السوس الممسوك كان في الطعم (4S, 5R) Sitophilure مع جريش الذرة مقارنة مع المعاملات الأخرى في المخزن. ذكور واثان سوسة الرز استجابات الى فرمون التجمع لوحده او ممزوج مع الطعم الغذائي.

الكلمات المفتاحية: سوسة الرز، فرمون التجمع، الصيد و الجاذبات الغذائية.

## Introduction

Rice weevil, *Sitophilus oryzae* (L.) Cause heavy losses of stored food grain quantitatively And Qualitatively throughout the world (Arannilewa, 2002). It is universally regarded as being one of the most destructive primary pests of stored cereal, such as rice, wheat, barley, and corn. It can attack cereal plants in the field's voracious feeding of whole grains by this insect (Baloch, 1992). Invasion by this primary pest may cause grain heating and may facilitate the establishment of fungal colonies, secondary insect pests, and mite pests. (Arannilewa, 2002). The use of fumigant and conventional organic insecticides to control insect pests of stored-products has given rise to problems of residual toxicity and development of resistant strains of insects (Smet *et al.*, 1990). These problems have enhanced the need to develop more effective and relatively safer insecticides (Smet *et al.*, 1990). Methyl bromide and phosphine are primary fumigants widely used against stored-product pests (Bond, 1984; Taylor, 1994) but under the terms of 1989 Montreal protocol to protect the environment, methyl bromide has already been withdraw as it depletes the protective ozone layer. Global survey conducted by FAO revealed that insects and developing to phosphine (Zettler, 1993). Male rice weevil, *Sitophilus oryzae* and its congener, the maize, *Sitophilus zeamais* (Motschulsky), release the same aggregation pheromone (4S, 5R)-5-hydroxy-4-methyl-3-heptanone or sitophinone (Schmuff *et al.*, 1984; Phillips *et al.*, 1985; Walgenbach *et al.*, 1987). This compound and some of its isomers have been shown to be attractive to both of these two species, as well as to the granary weevil *Sitophilus granarius*

(L.) (Phillips *et al.*, 1985). In case of pheromone traps, the lure slowly releases synthetic attractants that helps in detection of a single species of insect. Pheromone traps are very effective monitoring devices and are relatively cheap to purchase. Product assembly is very easy (Majumdra, 2002). Still populations of stored-product insect species, especially adults of beetles, seek refuge in cracks and crevices of grain stores and warehouses. However, detection of the populations is possible with the use of traps baited with food attractants or pheromones. Early detection of insects with food attractants, pheromones, or combinations of food attractants and pheromones may be important in quarantine management programs (Barak, 1989), also considerable early detection of the presence of a pest is the basis of sampling storage facilities. Several studies demonstrate that trapping is more effective than absolute estimates because initial infestations can be detected earlier using traps than by direct sampling (Subramanyam and Hagstrum, 1995; Hagstrum, 1998; Athanassiou and Buchelos, 2001). During this period considerable efforts were also made to develop ways of using these new tools to the benefit of farmers and ultimately consumers, the intention being to replace toxic synthetic insecticides with benign natural products, pheromones, for control insect pest (Srivastava and Satpathy, 2001; Cork and Lobos, 2003).

The results pertaining to evaluate the effect of floor trap with (4S, 5R)-Sitophilure and food attractants on capture of *Sitophilus oryzae* and observe the efficiency of different food attractants and (4S, 5R)-Sitophilure against *Sitophilus oryzae* under storage-room condition.

### Materials and Methods

The materials used and the methods are outlined below:

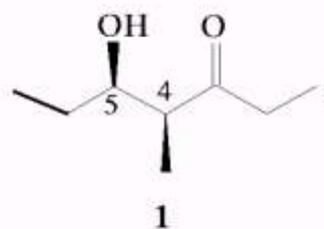
### Experiment

the experiment was conducted in April, 2013 at the storage-room where rice and wheat were stored. The area of storage-room was (15m x 25m=375 m<sup>2</sup>). This experiment were have 8 treatments and 4 replications for each treatment and the treatments are control( blank), cracked wheat, cracked wheat +(4S,5R)-Sitophilure, cracked maize ,cracked maize +(4S,5R)-Sitophilure, rice kernels , rice kernels+(4S,5R)-Sitophilure, and (4S,5R)-Sitophilure alone) respectively

### Lures of (4S, 5R)-sitophilure

Aggregation pheromone of the rice weevil *Sitophilus oryzae* (L.) named it Sitophilure, and identification it as (4R\*, 5S\*)-5-hydroxy-4-methyl-3-heptanone. (Pilli and Riatto, 1999), and also

identification as (4S, 5R)-Sitophilure was prepared at the Natural Recourse Institute (NRI),Greenwich University, UK and supplied by Dudley Farman ((NRI), Greenwich University, UK. The aggregation pheromone ((4S, 5R)-Sitophilure) was impregnated into rubber capsules which acted as slow-release dispensers. The capsules are loaded with 2 mg of (4S, 5R)-Sitophilure.Fig.(1).



**Fig.(1) Chemical Structure of Rice Weevil, *Sitophilus oryzae* (L.) Aggregation Pheromoe (4S, 5R)-Sitophilure.**

### Food Attractants

Three types of food were used as attractants:

- 1- Cracked wheat.
- 2- Cracked maize.
- 3- Rice kernels.

The wheat and maize freshly cracked and whole kernel of rice, used 5 gm in amount from each one in the replicate.

### The Trap

Ground traps (close design) It was used many layers of the white corrugated cardboard (15×15 cm and 1.5 cm thick) with a sticky floor provided. A plastic dish (30 mm diameter) it was place in the center of the trap, this traps placed on the floor of storage- room.

### Trapping

The number of insects caught in controlled traps was compare with the

Number caught in the corresponding treatment traps. The response defined as the

Difference between treatment and control. The adult weevils trapped collected weekly and kept in labeled vials containing with 70% alcohol for subsequent species identification .and also replace the sticky floor .The source (4S,5R)-Sitophilure or food attractants replace every 14 days. Response for each replicated will calculate, and mean responses for each treatment will compare by analysis of variance.

The traps choices were thus:

1. (4S, 5R)-Sitophilure alone.
2. Food attractants alone.
3. (4S, 5R)- Sitophilur plus food.

## Results and Discussion

The data pertaining to number of rice weevil (*Sitophilus oryzae* (L.)) captured by floor traps baited aggregation pheromone (4S, 5R)-Sitophilure with the food attractants, (4S, and 5R)-Sitophilure alone and food attractants alone were significantly superior in comparison control. Among all the treatments highest of rice weevils captured by floor traps was recorded 4T (4S, 5R)-Sitophilure + cracked maize (195.50) followed by 2T (4S, 5R)-Sitophilure + cracked wheat (180.50), then T6 (4S, 5R)-Sitophilure + rice kernels (152.56) and T7 (4S, 5R)-Sitophilure alone (53.00). Next effective were rice kernels T5 (41.19) and cracked wheat T1 (39.00) were at par with each other. Next effective recorded in cracked maize T3 (25.25). All treatments were superior over control T0 (12.50).



Plate( 1) a- Floor Trap Baited with (4S, 5R)-Sitophilure; b- Floor Trap Baited with (4S,5R)-Sitophilure + Cracked Maize

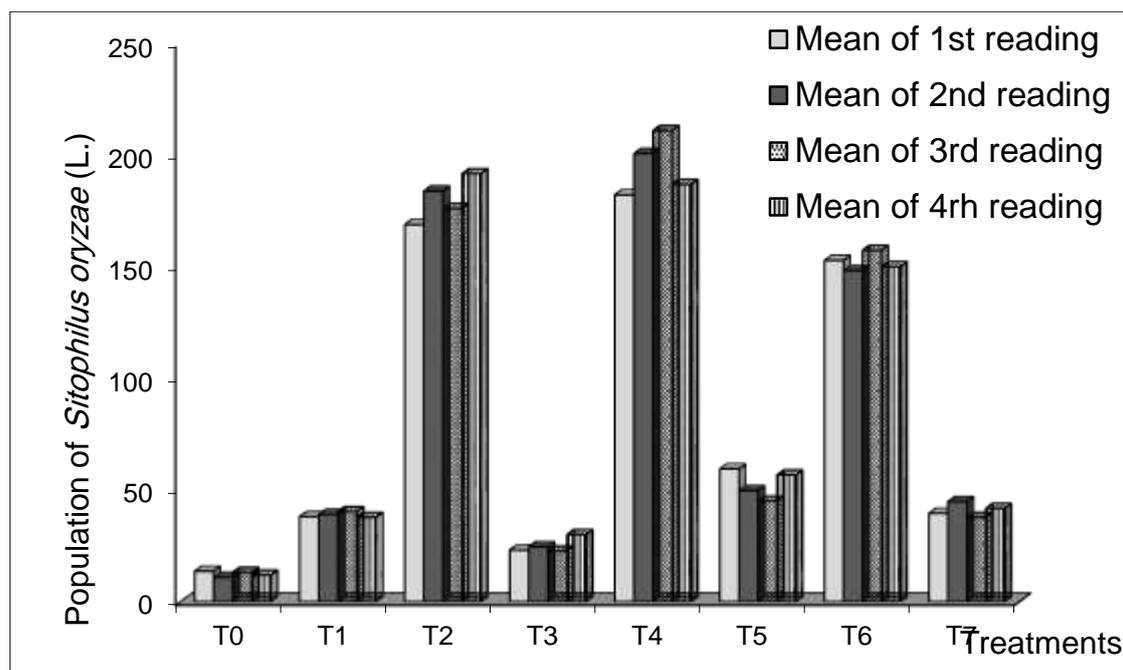


Fig.(2) Population of Rice Weevil, *Sitophilus oryzae* (L.) Capture by Floor Traps Placed in Storage-room During 1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup> and 4<sup>th</sup> ) Weeks of April, 2013

Rice weevil, *Sitophilus oryzae* (L.) captured by floor traps placed in storage-room baited with ((4S,5R)-Sitophilure + food attractants, food attractants alone, (4S,5R)-Sitophilure alone), under storage-room condition. are discussed in comparison with the available literatures and presented below:

The results in this experiment show floor traps (close design) were effective in capturing adult of rice weevil, *S. oryzae* (L.). Although larger number of insects were trapped in the difference among treatments and control. A strong synergistic effect among the (4S,5R)-Sitophilure added with cracked maize or cracked wheat or rice kernel was demonstrated. Higher weevil catch when baited with (4S, 5R)-Sitophilure and cracked maize combined ( $F_{2,49}=483.68$ ,  $P=0.05$ ) the mean catch (195.50) than another treatments in storage-room. The difference among the results depend on many factors such as insect activity and odor release from aggregation pheromone reaction with food volatiles gave as more powerful attractants which enhance treatments differentiation. These studies confirm the observations of (Trematerra, and Girgenti, 1989; Likhayo and Hodg . 2000; Phillips *et al.*, 1993; Bashir *et al.*, 2001; Athanassiou *et al.*, 2006). The food attractants such as cracked maize, cracked wheat and rice kernels for instance, used in a lure *S. oryzae* on its own exhibited a strong preference for the attractant lure, at 2 mg concentrations, suggesting that this source is attractive for this species.

Our study has shown that this obstacle may be overcome by combining, in the food attractants, with the aggregation pheromone. However, genetic and environmental factors, as well as the physiological state of insects, may dramatically influence their

responsiveness to both aggregation pheromone and food attractants.

The interpretation of catches data in the field and in the storage situation must, therefore, depend on knowledge of the behaviour and physiology of insects.

### Conclusions

The study conducted herein and results obtained clearly indicate that floor trap with the bait (aggregation pheromone+ food attractants, aggregation pheromone alone or food attractants alone) validated was effective in successful capture of rice weevil, *Sitophilus oryzae* (L.) under storage-room conditions. As well as observed the efficiency of different bait. A strong synergistic effect among the (4S,5R)-Sitophilure added with cracked maize or cracked wheat or rice kernel was demonstrated. Highest weevil catch when baited with (4S, 5R)-Sitophilure and cracked maize combined than another treatments in (rice, wheat fields and storage-room) are the best combination of attractants and show promise as monitoring tool for rice weevil in the storage-room.

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