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Development of an innovative and effective trap for rapid removal and collection of live adults of the pulse beetle, *Callosobruchus chinensis* (Coleoptera: Bruchidae) from infested stored pulses, for research studies in the laboratory conditions

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Abstract
As per the records in scientific literature, there are several hundred species of insects that are associated with stored grains/ stored grain products out of which about 14 species are largely responsible for most of the damage. The insect pests of stored grains mainly include the beetles and moths, and the pulse beetle, *Callosobruchus chinensis* is one of the most economically important insect pests of stored grains mainly pulses such as green gram, kala chana, kabuli chana, etc. The orientation behavior of insects is a fascinating aspect of their survival and interaction with the environment. Elucidation of the factors governing the orientational responses of insect pests can help in their management. The findings of this study can be incorporated in the eco-friendly IPM pest management programs that work in harmony with insect behaviors. Such techniques work in multiple ways, *viz.* by disrupting orientation towards food source &/or by disrupting orientation of mates towards each other, etc. Interference with orientation along with feeding disruption ultimately affects subsequent growth and development, and establishment of the pest population. Thus, the methods that target the orientation behavior of insects help to manage them effectively. In this study, an effort was made to study the orientational responses of an economically important insect pest of stored grains, the pulse beetle or *Callosobruchus chinensis* (Coleoptera: Bruchidae). An important outcome of this small-scale study was the development of an innovative, effective and time-saving method to remove and trap the pulse beetles from the infested pulses in the laboratory conditions, and the same can be upscaled for commercial use with slight modifications in future.

Keywords: Pulse beetle, insect pests of stored grains, bruchids, orientation, IPM

Introduction
Annual post-harvest losses resulting from insect damage, microbial deterioration, and other factors are estimated to be 10–25% of production worldwide. In India, there are about 200 species of pest insects which cause damage to stored grains and grain products in storage. *Callosobruchus chinensis* L. is a major economically important pest of all pulses and causes 40-50% in losses of pulses storage (Gosh *et al.*, 2003) [2]. Commonly known as the pulse beetle, it causes significant economic damage to stored legumes by reducing their nutritional quality, leading to lower market value. It is considered one of the most damaging pests to the stored pulses due to its wide distribution its larvae can cause up to 99.33% seed damage after 120 days of storage, and overall losses can range from 40-50% in pulse storage. It is a serious pest of peas, mung beans, cowpeas and lentil (Ahmed *et al.*, 2003) [1]. The present study was undertaken to devise an easy method to monitor the emergence of adults from the culture jars and analyze and predict the extent of damage caused by them in the lab conditions, and then to trap the live adults from the infested pulses in an easy manner. The studies carried out during the course of past 1 year have resulted in the development of an innovative and effective trap for the pulse beetles, which can also be used for other insect pests of stored grains after making certain modifications, if necessary.

Materials and Methods

The experimental pulse beetles were obtained from the culture maintained in a B.O.D. incubator (maintained at 30±2 °C, 16hL: 8hD, 50-60% RH) since September, 2022 in the Department of Zoology, Hindu College, University of Delhi. The packaged whole moong seeds were purchased from the local grocery shop and used as such for the experiments. The pulses were stored in 500 g storage containers but only 100 g moong sabut dal seeds were used for each replicate wherein 5 pairs of *C. chinensis* adults were released. These jars were stored in the B.O.D. incubator maintained at the environmental conditions stated above. The All the live/dead adults were removed from the containers within 7 days of their release. The containers with pulses and eggs/ immature stages of the pulse beetles were left undisturbed during their developmental period. Observations on the eclosion of adults was monitored 2-3 days prior to the expected date of eclosion (about 4 weeks after introduction of the pair/s of adults in the rearing containers. The experimental set up used for studying the orientational responses and collecting the adult beetles from the infested pulses, is shown in Fig. 1. The total number of beetle collected in the trap and the ones remaining in the culture jars were counted at the end of the experiment. 5 such replicates were conducted with 5 individual setups and 5 culture jars which had been setup on the same day with 5 pairs of adults in each jar.

Fig 1: Experimental setup for removing and collecting live pulse beetles from the infested pulses

Concept used while developing this trap

The pulse beetles exhibit negative geotaxis and positive phototaxis. This behavioural response of these beetles was exploited in this study as an effort towards managing them in an eco-friendly manner.

Requirements for the setup

1. Transparent, plastic storage containers.
2. Transparent, plastic funnel (diameter slightly lesser than that of the storage container).
3. Transparent, plastic salt/pepper container.
4. Infested pulses and live pulse beetle adults in the storage container (No. 1. above) used for maintaining the insect's culture.

Results

In all the 5 replicates conducted by using this setup, it was recorded that the number of beetles that could be removed (from the container with infested green gram seeds) and collected in the trap after 30 mins of the setup was as high as 95 (±3) %. It was also noted that as that the beetles moved upward faster as soon as the trap was set up after removing the container's lid but as the number of beetles that moved upwards into the trap increased, the beetles remaining in the bottom container showed slower upward movement which may be due to reduction in their population density/ crowding in culture container.

Discussion

During the maintenance of the culture of the pulse beetle, *C. chinensis*, it was observed that all the adults which emerged from the infested pulses upon completion of their pupal period, tended to move/orient themselves towards the upper end of the containers, irrespective of their size. On the basis of these observations, it was inferred that the pulse beetles exhibited positive phototaxis and negative geotaxis. After a number of trials and errors, this innovative experimental set up as depicted in Fig. 1 was designed so that this set up and findings of this research study could be incorporated in an effective plan for the management of stored grain pests using *C. chinensis* as the model organism. Although a number of traps have been designed and used earlier in storage godowns (Mohan, 2011; Rajesh *et al.* 2015; Mohan & Rajesh, 2016) [3, 4, 5], there are many advantages of this innovative method for trapping live pulse beetles from infested grains as listed below:

Advantages of this trap

- It is very simple, readily available, economical, and easy-to-be-used by anyone.
- It is ideal for separation of adults from the culture soon after emergence in a very little time and to prevent buildup of the pest population, if left unchecked.
- It can be easily used for monitoring the pest population and timely measures can be taken to prevent the population from reaching the Economic Injury Level (EIL).
- Researchers can use the collected adults to set up new experiments as per their requirements.

Efforts are on to modify the protocol for segregation of males and females which is necessary for certain specific experiments. Although currently it can be used only on a small scale in the lab conditions yet it can be easily customized for commercial applications after collating the inputs/ feedback from the scientists working in the area of management of pests of stored grains. In the experimental set up/ trap used in this study, live beetles can be collected from infested stored grains under different test conditions, which can be used for some other experiments. Different types of studies can be easily undertaken using this setup in lab conditions. Some pilot experiments have also been initiated to study the effect of certain aromatic botanicals on the

orientational responses of the pulse beetle, so that the same may be integrated to trap these economically important insect pests of stored grains in a much faster and more effective manner.

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References

1. Ahmed KS, Itino T, Ichikawa T. Duration of developmental stages of *Callosobruchus chinensis* L. (Coleoptera: Bruchidae) on adzuki bean and the effects of neem and sesame oils at different stages of their development. Pak J Biol. Sci. 2003;6:932-935.
2. Gosh SK, Durbey SL. Integrated management of stored grain pests. Int. Book Distrib. Co., 2003, 263.
3. Mohan S. A device to remove adult insects and crush eggs in stored grains. Success Spreading - India Rice; c2011 Jul-Sep. p. 35-36.
4. Rajesh A, Mohan S, Nelson SJ. Efficacy of TNAU-Stack probe trap in detection, monitoring of pests and validation of fumigation in turmeric bag-stack storage. Curr. Biotica. 2015;9(2):159-165.
5. Mohan S, Rajesh A. Tools for stored product insects management and technology transfer. J Grain Storage Res.; c2016. DOI No. 10.5958/0974-8172.2016.00026.2.
6. Venkatesham V, Meena RS, Laichattiwar MA. Assessment of losses due to pulse beetle *Callosobruchus chinensis* L. in chickpea. 2015;21(2):759-761.