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Effect of UV light on developmental stages of pulse beetle *Callosobruchus chinensis*

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Abstract
The present investigation entitled "Effect of UV light on developmental stages of pulse beetle (*Callosobruchus* spp.) in stored chickpea" was conducted in the laboratory of AICRP on PHET, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola (MS) during the month of June to January in the year 2023-24. The experiment was laid in Factorial-Completely Randomized Design with seven treatments, with four replications. Initially, 250 g of gram grains was taken for each replication of treatment. The treatments of UV light included at 2 levels of distance i.e. M_1(10 cm) and M_2 (20 cm), 3 levels of time i.e.T_1 (10 min), T_2 (30 min), T_3 (60 min) and their interaction (M*T) i.e. M_1T_1 (10 cm for 10 min), M_1T_2 (10 cm for 30 min), M_1T_3 (10cm for 60 min), M_2T_1 (20 cm for 10min), M_2T_2 (20 cm for 30 min), M_2T_3 (20 cm for 60 min). For performing experiments, fifty eggs laid on grains were taken in each petri plate. The grains in the petri plate having efficient egg laying before giving the treatment was stored under ambient condition. First observation was recorded on daily basis from 1st to 7th day of the egg hatching. This cycle of observation lasted for one month of storage, the petri plates were observed daily and recorded at two days interval till hatching. For taking observation on egg incubation periods (Days), per cent of egg hatching. Treatment M_1T_3 (10 cm for 60 min), M_1T_2 (10 cm for 30 min), M_2T_3 (20 cm for 60 min) were found as the best in checking egg hatchability and egg incubation period, followed by M_2T_2 (20 cm for 30 min), M_1T_1 (10 cm for 10 min), M_2T_1 (20 cm for 10 cm) were found best during a month of storage period.

Keywords: Ultraviolet (UV) radiation, *Callosobruchus chinensis*, hatchability and adult emergence

Introduction

Pulses are one of the important groups of worldwide crops and play major role in daily diet. Pulses provide a balanced diet for millions of people; it is eaten in proper combination with cereals. It is good substitute of meat, fish, and egg. Total production of pulses in India was 13.18MT, which was increased by 27.30 million MT during 2021-22. In Maharashtra, chickpea is grown in an area of 19.27 lakh ton. During 2020-21, chickpea had a lion's share of 49.3% in the total pulses production (Mudryj *et al*. 2014) [4]. In India, there are about 200 species of pest insects which cause damage to stored grains and grain products in storage, *Callosobruchus chinensis* is a major and economically important pest of all pulses and causes 40-50% in losses of pulses storage (Gosh and Durbey, 2003) [3]. Worldwide, it is estimated to be 10-40% of stored products were lost due to insects, fungus, bacteria and viruses. India produces around 12.65 million tons of pulses per year and nearly 8.5% of this is lost during post harvested handling and storage. Up to 100% loss of pulse grain was found due to infestation of pulse beetle in several experiment. Most of the cereals and pulses have to be stored by the producer in their home and by the traders and the Governmental agencies in go-downs for one year or more for future use. Insect pests are the major problem for storing cereals and pulses. In case of severe infestation 100 per cent damage is caused by the pest (Pruthi and Singh, 1950) [6].

Success achieved so far in making the stored products free from pests has been largely dependent on pesticides alone. Pesticides are the most powerful tool available for pest control. Despite these credentials, the long and indiscriminate use of pesticides has been found ecologically unsound. Insecticides were found to cause toxic effects on the produce intended for consumption, which forced a processor to look towards physical mean i.e. UV light as protectants for stored products as an alternative to the highly persistent synthetic chemicals. Global warning has cautioned us and the adverse consequences. Insecticide use is always alarming and also inducing pest outbreak because of pest resistance. In this condition, alternative methods of insect control utilizing UV light is being used in many countries.

They are environmentally safe, less hazardous, less expensive and readily available. They are more selective in action, and may retard the development of resistance. Their main advantage is that they may be easily adopted by farmers. There are encouraging reports on the use of UV lights as grain protectants. Major, information is available in literature regarding the efficacy of UV light on pulse beetle. These grain protectants are environmentally safe, less hazardous, less expensive and readily available.

Materials and Methods

To maintain Stock culture of pulse beetle, *Callosobruchus chinensis* L. was initiate by collecting the adult beetles from the infested pulses from central store, CRS (Pachgodown) Dr. PDKV, Akola. Fresh pulses were provided periodically for the development of beetle. The culture further maintained in laboratory of AICRP on PHET, Dr. PDKV. Akola of Entomology Section under laboratory conditions lasting for a period of 180 days. The mouth of the container was covered with a muslin cloth. Take a newly emerged adult male and female 1:1 ratio from the maintained culture for mating and oviposition. Released 20 pairs of adults into petri plate containing fresh and sterilized chickpea grains. Before performing experiment, the chickpea grain was kept for 30 min @ 65 °C temperature in hot air oven to killing all hibernate stages of pest.

After 3-4 days, collect the egg laid grain into petri plate. The grain having one or two eggs on single grain was count visually and take 50 eggs for non-thermal treatment. The egg laid grains petri plate was given non thermal treatment under different distances (10 and 20 cm) and exposure times of UV light (10, 30 and 60 min). The of the exposure was determined using stopwatch. The distance of Petri plate was 10 and 20 cm from the UV light suspended in an air tight box. After giving exposure, the UV light was turned off and petri plate removed. The given non thermal eggs laid grain and controlled egg was separated at room temperature until hatching. Number of eggs hatch per day was recorded. Taking the emergence of adult note on every day from starting to until the last emergence of adults. First observation was recorded on per hatchability of pulse beetles daily from 1st to 7th day.

Fig 1: Treatment UV light on egg of *Callosobruchus chinensis* (L.) on stored chickpea grains.

Fig 2: UV treated eggs of *Callosobruchus chinensis* (L.)

Table 1: Effect of UV light on Per cent hatchability and incubation period of *Callosobruchus chinensis* (L.) on stored chickpea grains.

Treatments	Per cent hatchability*	Incubation period(days)**
Factor (A) Distance		
M_1	32.67 (34.55)	5.78
M_2	42.00 (40.33)	4.33
F test	Sig	NS
SE (m±)	0.67	0.33
CD at 1%	2.07	1.05
Factor (B) Time		
T_1	49.00 (31.69)	3.83
T_2	35.00 (36.23)	5.00
T_3	28.00 (44.40)	6.33
F test	Sig	Sig
SE (m±)	0.82	0.39
CD at 1%	2.54	1.19
Interaction (A×B)		
M_1T_1	46.00 (42.68)	4.00
M_1T_2	32.00 (34.42)	5.66
M_1T_3	20.00 (26.53)	7.67
M_2T_1	52.00 (46.12)	3.66
M_2T_2	38.00 (38.03)	4.33
M_2T_3	36.00 (36.85)	5.00
F test	NS	NS
SE (m±)	1.16	0.58
CD at 1%	3.46***	1.82***

Data based on 1:1 ratio of male and female adult (four replications). *Figures in the parenthesis are angular transformed values. **figures in the parenthesis are no transformed values. ***significant at 1% level.

Result and Discussion

The data represented in table 1 on per cent hatchability and incubation period (Days) of *Callosobruchus chinensis* (L) after treated with UV light.

Effect of UV light on Per cent hatchability of *Callosobruchus chinensis* (L.) on stored chickpea grains

Factor A (Distance): UV light exposure significantly impacted hatchability, with lower hatchability observed at a shorter distance (M_1 at 10 cm), where hatchability was 32.67%, compared to 42.00% at a greater distance (M_2 at 20 cm).

Factor B (Time): The hatchability data recorded over 1st-7th days after treatment showed significant reductions in all time treatments. The minimum hatchability was recorded at T_3 (60 min exposure) with 28.00%, followed by T_2 (30 min exposure) at 35.00%, and T_1 (10 min exposure) at 49.00%.

Interaction Effect (Distance × Time): The interaction between distance and time showed a further reduction in hatchability. The most significant reduction was observed in the M_1T_3 treatment (10 cm, 60 min), where hatchability dropped to 20.00%. Other effective treatments included M_1T_2 (10 cm, 30 min) at 32.00%, M_2T_3 (20 cm, 60 min) at 36.00%, and M_2T_2 (20 cm, 30 min) at 38.00%. These treatments were statistically at par with each other. Present investigations are confirmative with G Arul (2022) [4] reported that hatchability percentage on different treatments varied between 34.13% and 87.41% and differed significantly.

Similarly, result were reported Yang and Sacher (1969) [8] that the irradiated red flour beetle eggs of different ages with X-rays to find out the influence of doses on age of hatching. They reported a delay in the development that was part of the irradiation doses. The relationship of delay in development with respect to the dose was linear at all stages. Sedaghat *et al*. (2011) [7] is in accordance with that UV-radiation reduced hatching of eggs of all age groups the effect gradually decreased with increasing exposure periods. All exposure periods of UV radiation reduced the hatching of eggs in comparison to controls. The percentage of egg hatching was determined to be 95% in control treatment.

Effect of UV light on incubation period of *Callosobruchus chinensis* (L.) on stored chickpea grains

Factor A (Distance): The incubation period showed non-significant differences between the two distance levels, with M_1 (10 cm) having an incubation period of 5.78 days and M_2 (20 cm) at 4.33 days.

Factor B (Time): The incubation period was significantly affected by the duration of UV exposure. The longest incubation period was observed in T_3 (60 min) with 6.33 days, which was at par with T_2 (30 min) at 5.00 days, and followed by T_1 (10 min) at 3.83 days.

Interaction Effect (Distance × Time): The combination of distance and time also showed non-significant differences in the incubation period, but the maximum incubation period was recorded in M_1T_3 (10 cm, 60 min) at 7.67 days, which was statistically superior to other treatments. The next best treatments were M_1T_2 (10 cm, 30 min) at 5.66 days, M_2T_3 (20 cm, 60 min) at 5.00 days, and M_2T_2 (20 cm, 30 min) at 4.33 days. Present investigation are confirmative with Faruki *et al*. (2007) [2] who reported that eggs of the almond moth, (E*phestia cautella*) red flour beetle, (*Tribolium castaneum*) and confused flour beetle took long times for hatching on different time of UV-C light. Similarly, Das and Singh *et al*. (2019) [1] also reported that the Significant, reduction in egg hatching and may also increase duration of hatching was presumed in UV irradiated eggs.

Conclusion

The UV light treatments at varying distances and durations proved effective in significantly reducing hatchability and altering incubation periods. The most impactful treatment for hatchability reduction was M_1T_3 (10 cm, 60 min), and for increasing incubation period, M_1T_3 was also the most effective treatment. All treatments showed statistical parity, indicating comparable efficacy in UV light exposure for reducing hatchability and increasing incubation duration.

References

1. Das S, Singh VT. Effect of Ultraviolet Irradiation on Cowpea Beetle, *Callosobruchus maculatus* F. Int. J Pharm Biol Sci. 2019;9(1):1373-1376.
2. Faruki SI, Das DR, Khan AR, Khatun M. Effect of ultraviolet (254 nm) irradiation on egg hatching and adult emergence of the flour beetles, Tribolium castaneum, *Tribolium confusum*, and almond moth, Cadra cautella. J Insect Sci. 2007;7:1-7.
3. Gosh SK, Durbey SL. Integrated management of stored grain pests. Delhi: International Book Distribution Company; c2003. p. 263.
4. Kumavat KC, Arul G, Hussain A, Choudhary S. Effect of UV rays on growth and development of pulse beetle, *Callosobruchus chinensis* L. (Bruchidae: Coleoptera). The Pharma Innovation Journal. 2022;11(10):25-29.
5. Mudryj AN, Aukema HM, Yu N. Nutritional and health benefits of pulses. Appl Physiol Nutr Metab. 2014;39(5):540-548. Doi:10.1139/apnm-2013-0557.
6. Pruthi HS, Singh M. Pests of stored grain and their control. Delhi: Manager of Publications; 1950. p. 68.
7. Sedaghat R, Talebi AA, Moharramipour S. Effect of ultraviolet irradiation on egg hatching of *Callosobruchus maculatus* (F.) (Coleoptera: Bruchidae). IOBC-WPRS Bull. 2011;69:363-8.
8. Yang TC, Sacher GA. Effects of X irradiation on some physical properties of a developing Tribolium. ANL-7635. Argonne National Laboratory; c1969. p. 49-50.