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Effect of UV radiation on hatchability in different ages of *C. cephalonica* (Stainton) lepidoptera: Pyralidae

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Abstract
The eggs of the stored grain pests, *Corcyra cephalonica* (Lepidoptera; Pyralidae) belonging to three age groups, 1, 2, and 3 days-old, were exposed to ultraviolet (UV) radiation with (254nm)wavelength(UV-C) for different durations (10,15minutes)to determine irradiation effects on egg-hatching. An increase in time 10, 15minutes of exposure to UV rays caused a gradual decrease in the percentage of 53.3,-33.38 respectively hatching of eggs in all age groups. The hatchability rate of younger eggs could be significantly less than older eggs.

Keywords: UV radiation, *C. cephalonica*, hatchability

1. Introduction

The rice moth *C. cephalonica* is a major pest of stored grain commodities in tropics. The insects cause substantial damages in stored food grains such as dry weight losses, impaired nutritional qualities, seed viability reduction and low market value [10, 11]. Simultaneously, the continued boom in human population has posed a great problem of food scarcity. The presence of insects in stored products results in both contamination and substantial economic damage due to the loss of the products and a decrease of nutritional value. Moreover, the injudicious use of synthetic pesticides and its concomitant impact on Environment has necessitated exploration for alternative non-toxic pest control methods. Irradiation has become an established technique for controlling stored grain insects because of residue free advantages over chemical fumigation [14, 17] demonstrated the acceptability of irradiation technology as an alternative treatment for food protection because irradiation can extend the shelf life of various fruits and vegetables, and maintain the quality of the product over a longer period of time. The Ultraviolet (UV) portion of the spectrum is widely used as germicide and as an attractant for insects [1] in embryological-physiological studies[2] and for the surface disinfection of insect eggs [9] A number of investigators have considered the possibility of using UV-rays to control, or at least to suppress development of various species of stored products insects [3-6, 16]. Irradiation is effective against stored grain pest as it causes mortality as well as sterility in insects depending on the dose and time of exposure [14]. One of the fundamental aims of radiation biology is to study the biological effects that follow the initial energy deposition by irradiation. Radiations can produce a variety of damage in terms of mutations, Chromosomal aberrations. Treatment with UV-radiation has obviously less penetrating effect than ionizing radiations and therefore has limited use for bulk grains [8]. The present investigation was, therefore, aimed at determining the effects of UV rays (UV-C) on hatching *C.cephalonica* eggs of various ages.

2. Material and methods

The present study is carried out during the study period of 2011-2012 in the laboratory, Department of Zoology, Scott Christian College Nagercoil. For collecting the eggs of *C.cephalonica* number of healthy pupae were sexed and kept in beakers until adult eclosion. Freshly emerged moths were allowed to mate and placed in beakers for oviposition. A piece of hard white paper was inserted inside the beaker for resting of the adults and the top of the beaker was covered with a netted cloth. The beakers with moths were inverted over Petri dishes for an easy collection of the eggs. On the following day 1 day-old eggs were collected. Some of these eggs were kept in Petri dishes to obtain 2 and 3 day-old eggs.

2.1. UV radiation technique of eggs

The radiation source was a 30 watts UV germicidal lamp (G30T8, Sankyo Denki, Japan) measuring 88 cm x 2.5 cm, and emitting radiation at a wavelength of 254 nm. The lamp was fixed to the ceiling of a Laminar Flow cabinet (120 cm x 63 cm x 50 cm) that served as a test chamber; another similar cabinet without the lamp was used for controls. Bioassays were conducted at a room temperature of 25±2 °C. Eggs were irradiated for 5, 10, 15 minutes. Exposure period was determined using a stopwatch. At the end of the exposure period the UV-lamp was turned off and the Petri dishes were removed immediately. After exposure, the irradiated and non-irradiated control eggs of different age groups were kept separately at 30 ± 2 °C until hatching. The experiment was replicated 3times with 20eggs for each exposure period and an equal number of non-irradiated eggs were raised as control for each age group. Eggs of different ages and exposure periods either radiated or non-irradiated were kept in separate pieces of black adhesive paper to observe hatching. Then the hatchability of eggs in different age groups was determined.

2.2. Statistical analysis

The data obtained are properly and statistically analyses the percent reduction in hatching of eggs in comparison to control was calculated using the formula: Percentage change over control is recorded.

3. Results

Table 1: Hatching (%) of UV radiated eggs of *C. cephalonica.*

Sl. No	Radiation in min	Total no. of eggs	Mean± s.deviation in hatchability			Percentage of hatching %
			1day	2day	3day	
1	0	20	7±0.8	3±0.4	2±0.18	80
2	10	20	3±0.35	2±0.26	3.0±0.16	53.3
3	15	20	4±0.48	4±0.42	2±0.26	(-33.38)
						86.6(8.25)

3.1. Effect on hatching

It was found that UV-irradiation reduced hatching of eggs of all age groups; the effect gradually increased with increasing exposure periods. All exposure periods of UV-radiation reduced the hatching of eggs in comparison to controls. It was observed that older eggs (2 and 3 day-old) of *C.cephalonica* were more sensitive to UV-rays than younger eggs (1 day-old) hatching of 1, 2 and 3 day-old eggs were reduced to 80, 53.3 -33.36 respectively, after 24 min of exposure to UV-radiation .The result on hatchability of different exposure of time was in the range of two and differed significantly each other. It was found that UV-irradiation reduced hatching of eggs of all age groups; the effect gradually decreased with increasing exposure periods.

4. Discussion

A reduction in egg hatching was observed when eggs of different ages were exposed to UV irradiation. The results also showed that the younger eggs of *C. cephalonica* were more sensitive to UV-rays than older ones that contrast with the findings of [3] who observed that older eggs of *Ephestia (=Cadra) cautella* were highly sensitive to UV-rays than younger eggs [9]. Reported that when eggs of *Heliothis virescens* and *H. zea* were exposed to UV-rays of a short wavelength (2537A°) the percentage of egg-hatch was gradually decreased with increasing time of exposure, The work of [15] may give a possible explanation of higher sensitivity of older eggs to UV rays than the younger eggs. New eggs were more resistant to ultraviolet radiation than older eggs. increased. Mohan S [12] reported the UV irradiation as a promising agent for controlling the cotton stainer, *Dysdercus koenigii* and observed significant decrease in survival with increasing exposure time. It was reported that an increase in exposure time to UV-rays caused a gradual decrease in the percentage of hatching eggs and no hatching occurred after 24 min of exposure in 2- and 3-day-old eggs of *T. confusum* [8].

5. Conclusion

The significantly reduced hatching caused by UV-irradiation in the experimental pests is promising from pest management point of view. It may be concluded that irradiation is a very safe and clean method for food preservation and pest control.

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