International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
IJCS 2017; 5(4): 961-963

Received: 02-05-2017
Accepted: 03-06-2017

MK Yadav
Department of Entomology, S.K.N. College of Agriculture, SKNAU, Jobner, Rajasthan, India

MC Bhargava
Department of Entomology, S.K.N. College of Agriculture, SKNAU, Jobner, Rajasthan, India

Mamta Devi Choudhary
Department of Entomology, S.K.N. College of Agriculture, SKNAU, Jobner, Rajasthan, India

Correspondence
MK Yadav
Department of Entomology, S.K.N. College of Agriculture, SKNAU, Jobner, Rajasthan, India

Effect of solar treatment and different colours on infestation of *Sitophilus oryzae* (Linn.) in wheat

MK Yadav, MC Bhargava and Mamta Devi Choudhary

Abstract
This work aimed to evaluate the efficiency of natural promising techniques in controlling rice weevil, *Sitophilus oryzae* (Linn.) the main pest of different cereals. To achieve this, the potential of solar energy to suppress rice weevil population were investigated. Effect of solar energy was evaluated using different coloured polythene bags at different exposure periods (8, 16 and 24 hrs). The colours resulted in maximum adult mortality within black colour at 24 hr exposure period. Solar energy treatment had no negative effect on germination of wheat seeds.

Keywords: solar heat, colour, *Sitophilus oryzae*, wheat

Introduction
Wheat (*Triticum aestivum* L.) of family Gramineae, is a staple food in the world and said to be originated from South Western Asia. In India, post harvest losses caused by the unscientific storage, rodents, insects, microorganism, moisture etc., account for about 10 per cent (Anonymous, 1971) [2]. Among the storage pests, the rice weevil, *Sitophilus oryzae* Linn. (Curculionidae: Coleoptera), is perhaps the most destructive pest of stored grains and their products (Pruthi and Singh, 1948) [12]. It was first discovered on rice, *Oryza sativa* and therefore named the rice weevil. But later on it was discovered that it attacks the stored grains of wheat, maize and *jowar* also. Its larvae and adults are internal feeder and cause a serious loss to cereals affecting the quantity as well as quality of the grains. Solar heat is frequently used in most parts of our country for drying the seed without impairing their germination and sometimes to minimize the insect infestation in various types of stored products. The current study, therefore, focuses on the use of solar heat raised by solar absorbance bed to disinfest wheat grain against different stages of *S. oryzae.*

Materials and Methods
The experiment was designed to investigate the effect of solar heat energy and to evaluate the effect of different coloured storage bag (black, blue, green, red and yellow) for *S. oryzae* management in stored wheat. Transparent plastic bags were used as control. To utilize full solar energy, the experiment was conducted in the month of June. For this purpose, 200 seeds after weighing were placed in each plastic bag (20 x 15 cm) and 10 newly emerged adults from stock culture were released in each bag and then bags exposed to sun for 8, 16 and 24 hours. An aliquot sample of 200 grains without releasing adults were also kept in separate bags and exposed for the same period to test the effect of solar heat on germination of seeds. Three replications were taken for each treatment of coloured bags and solar period exposure treatment. The bags were put on the roof of Entomology building from 9.00 a.m. to 5 p.m. in such a manner that a thin layer of grains was formed inside the bag. For 8, 16 and 24 hrs exposure periods, the bags were kept on the roof continuously for one, two and three days, respectively. The observation on mortality of adult was recorded in each exposure period of each treatment. Seed germination was carried out according to International Rules of Seed Testing (Anonymous, 1976) [3]. Three replications were taken for each treatment of colored bag and solar period exposure treatment.

Results and Discussion
In an experiment, wheat grains containing adults of *S. oryzae* were exposed to solar energy in different coloured polythene bags for 8, 16 and 24 hrs to determine their effect on the seed

germination. The seed germination decreased with the increase in solar time exposure. In black polythene bags for 24 hrs exposure, the minimum seed germination was 67.00 per cent, whereas maximum 81.00 per cent in colourless polythene bags. It appears that black coloured bags affected the seed germination, which was statistically inferior to germination in all exposure periods. Here again, adverse effect of solar radiation in black coloured polythene bags is due to higher temperature generated in them due to more heat absorption. These results are in agreement with the findings of Yadav *et al*. (2002) [15], Yadav *et al*. (2008c) [14], Bajiya (2010) [4] and Sharma (2013) [13], who claimed that black and blue polythene bags for 24 hrs exposures to sun affected the seed germination. From the foregoing results it was concluded that different coloured polythene bags are safe, economical and effective solar heat disinfestation devices for home and rural forms.

In the present investigation, the mortality of adult weevil increased with the increase in solar time exposure. The data revealed that mean per cent mortality of weevils in different coloured bags ranged from 70.00 to 93.22, being maximum (93.22%) in black polythene bags followed by blue, red, yellow, green and colourless polythene bags with 86.33, 84.00, 82.11, 79.89 and 70.00 per cent, respectively. While assessing the results of different exposure periods, the mortality of weevils increased with the increase in solar exposure period. In all colour bags, solar heat exposure of 24 hrs was quite effective and fetal, giving maximum adult mortality of *S. oryzae* in black, blue and red polythene bags. Krishnamurthy *et al*. (1991) [8] used polythene pouches of different dimensions and capacity for controlling insect species with solar heat and showed cent per cent mortality at all the stages. These findings are in agreement with the result obtained by Mohammed-Dawd *et al.* (2001) [10] who reported that hundred per cent adult mortality of *S. oryzae* and its variant was obtained with exposure to sun heat at different periods. Yadav *et al.* (2008c) [14] found the exposure of infested wheat for a period of 24 h to solar heat energy in black and blue coloured bags was most effective to cause adult mortality of *S. oryzae*. Similarly, Bajiya (2010) [4] who reported that solar heat exposure of 24 hrs and black colour polythene bags were quite effective and fetal, giving cent per cent adult mortality of *C. chinensis*.

Higher mortality of adults after their exposure to sunshine was recorded in present observations. This could be due to the fact that they come in direct contact to solar heat generated by the absorption of different coloured polythene and the temperature, thus, heat generated within the bag was lethal to them. The higher temperature requirement for adult stage is understandable, since the insect is an internal feeder, as such the mass heat transfer from heated environment, *i.e*. within the bag in the seed depends on many parameters *viz*., (a) the moisture content of the grain as the thermal properties (specific heat, thermal conductivity diffusiability and latent heat) of grains are moisture dependent (Pandey, 1980) [11]. The physical properties of grains (size, shape, surface area, volume, particle density, bulk density and porosity) also play important role in the transfer of heat to the site of action where the test insect was located (Kruger and Flenniken, 1961; Hussain *et al*., 1968 and Adhaoo *et al*., 1976) [9, 7, 1].

Death as a result of exposure to heat is usually considered to be caused by the coagulation of the soluble proteins of the body tissue. However, death frequently occurs as a result of exposure to temperatures that are not high enough to cause coagulation of the proteins. In such cases death may be caused by desiccation or by injury to the enzymes of the body tissue. The activities of reductase, oxidases and catalases are injured in a greater or less degree by temperature below that needed to coagulate the proteins in insect tissue (Cotton, 1963) [6]. It was also known that at low humidities, insects die from the effects of desiccation (Chapman, 1982) [5]. Death at high temperature may result from various factors that insects have a limited physiological capacity to regulate their body temperature. Proteins may be denatured or the balance of metabolic process may be disturbed so that toxic products may accumulate (Chapman, 1982) [5].

Table 1: Effect of colours and exposure periods on seed germination*

S. No	Polythene bag colour	Percent seed germination in different exposure periods (hrs)			Mean
		8	16	24	
1.	Black	81.22 (64.32)	75.00 (60.00)	67.00 (54.94)**	74.41 (59.61)
2.	Blue	82.33 (65.14)	77.00 (61.34)	72.33 (58.26)	77.22 (61.49)
3.	Red	82.33 (65.14)	80.67 (63.92)	78.33 (62.26)	80.44 (63.75)
4.	Yellow	84.33 (66.68)	81.00 (64.16)	80.33 (63.67)	81.89 (64.81)
5.	Green	86.67 (68.59)	84.33 (66.68)	80.67 (63.92)	83.89 (66.34)
6.	Colourless	89.33 (70.93)	86.33 (68.30)	81.00 (64.16)	85.55 (67.66)
	Mean	84.37 (66.71)	80.72 (63.96)	76.61 (61.08)	
		SEm±	CD at 5%	CV %	
	Colour	0.28	0.80		
	Period	0.20	0.57	4.30	
	Colour x period	0.48	1.39		

* Data based on 600 seeds (three replications of 200 seeds in each)

** Percentage transformed to angles; outside values are its back transformation to percentage

Table 2: Effect of colours and exposure periods on the adult mortality of *S. oryzae* (adult exposure)*

S. No	Polythene bag colour	Percent adult mortality in different exposure periods (hrs.)			Mean
		8	16	24	
1.	Black	85.67 (67.76)**	94.00 (75.82)	100.00 (90.00)	93.22 (74.91)
2.	Blue	71.33 (57.63)	89.67 (71.25)	98.00 (81.87)	86.33 (68.30)
3.	Red	68.00 (55.55)	87.67 (69.44)	96.33 (78.96)	84.00 (66.42)
4.	Yellow	66.67 (54.74)	85.00 (67.21)	94.67 (76.65)	82.11 (64.98)
5.	Green	65.00 (53.73)	83.33 (65.90)	91.33 (72.88)	79.89 (63.35)
6.	Colourless	55.33 (48.06)	74.00 (59.34)	80.67 (63.92)	70.00 (56.79)
	Mean	68.67 (55.96)	85.61 (67.71)	93.50 (75.23)	
		SEm±	CD at 5%	CV %	
	Colour	1.16	3.33		
	Period	0.82	2.36	4.21	
	Colour x period	2.01	5.78		

* Data based on 30 adults (three replications of 10 adults in each)

** Percentage transformed to angles; outside values are its back transformation to percentage

References

1. Adhaoo SH, Ingle ST, Dhawale SLI. Engineering properties of groundnut and jowar: Part-I Physical properties. Journal of Agricultural Engineering, 1976; 13:19-21
2. Anonymous. Report of the committee on post harvest losses of food grain India. Ministry of Food Agriculture, Government of India. 1971, 35.
3. Anonymous. Germination method part I agriculture and horticulture seeds. Seed Science & Technology, 1976; 4:120.
4. Bajiya RS. Ecology and management of pulse beetle, *Callosobruchus chinensis* (Linn.) on mung bean, *Vigna radiata* (Linn.) wilckzek. Ph.D. Thesis, submitted to Swami Keshwanand Rajasthan Agricultural University, Bikaner, 2010.
5. Chapman RF. The insects: structure and function (3rd edition). Kent, London, U.K. Holder and Stoughton Ltd. 1982, 919.
6. Cotton RT. Pests of stored grain and grain products. Burgess Publ. Comp. 426 South Sixth Street, Minneapolice 15, Minn. U.S.A. 1963, 26.
7. Hussain A, Agrawal KK, Pandey AC. Physical properties of wheat and paddy. Harvestor, 1968; 10:68-71.
8. Krishnamurthy TS, Muralidharan M, Muthu M. Disinfesting grain with solar heat. Appropriate Technology. 1991; 18(3):15-16.
9. Kruger HW, Flenniken R. Physical properties of cells determined by microscopic methods. Baush and Lomb Focus. 1961; 32:18-22.
10. Mohamad-Dawd E, Yadav TD, Singh VS, Siddiqui KH. Disinfesting maize grain from *Sitophilus oryzae* and its variant with solar heat. Indian Journal of Entomology, 2001; 63(4):413-420.
11. Pandey AC. Engineering properties of food material. Tech. Bull. No./CTAE / 80 / 15. Published by All India coordinated, ICAR scheme of studies on Harvest and Post Harvest Technology. 1980, 50.
12. Pruthi HS, Singh M. Pests of stored grains and their control. Indian Journal of Agricultural Sciences. 1948; 18:1-82.
13. Sharma R. Management of Khapra beetle, *Trogoderma granarium* Everts on wheat. Ph.D. Thesis, submitted to Swami Keshwanand Rajasthan Agricultural University, Bikaner, 2013.
14. Yadav JP, Bhargava MC, Yadav SR. Studies on effect of solar heat on *Sitophilus oryzae* infesting wheat. Indian Journal of Plant Protection. 2008c; 36(1):40-42.
15. Yadav RP, Bhargava MC, Yadav JP. Studies on the solar radiation as a means of eradicating *Rhyzopertha dominica* (Fab.) in wheat. Indian Journal of Plant Protection, 2002; 30:26-28.