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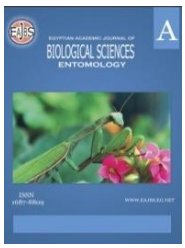

Study of the Colonization Behaviour of Stored Grains Pest, *Sitophilus oryzae* L. (Coleoptera: Curculionidae) Through Determining the Colour Preference.

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ABSTRACT

Stored products are the end products of the agriculture activities of some crops. These products are subject to attacks from some insect pests. The rice weevil *(Sitophilus oryzae* L., 1763) is an important stored product pest that attacks economically important stored grains such as rice and wheat. The current research aimed to study the colour preferences of *S. oryzae* through the free choice test method, the preference of adult insects to different colour cues was evaluated with a multi-choice test 24 hours after insect release. The research was conducted with three replicates using six colour cues; red, white, black, yellow, green, and blue under laboratory conditions. The observed parameter was the number of adults attracted to the different colour cues. The results showed that the highest preference of *S. oryzae* was recorded in the green and red colour cues, while the white colour was the least preferred colour. These results could be helpful in the integrated pest management programs to control the stored product insect pest *S. oryzae*.

INTRODUCTION

Sitophilus Schoenherr, 1838 (Coleoptera: Curculionidae) is a genus of great importance because it contains worldwide species reported infesting stored products (Plarre, 2010, Corrêa *et al.*, 2013). The rice weevil *S. oryzae* (L., 1763) is a serious pest of stored grains such as rice, maize, wheat, and sorghum (Rossetto, 1969; Gvozdenac et al., 2020).

It is a destructive species that is widely spread in tropical, sub-tropical, and warm zones (Antunes *et al.*, 2016; Devi *et al.*, 2017; Mansoor-ul-Hasan *et al.*, 2017; Astuti, 2019).Infestation of *S. oryzae* causes a decrease in the economic value of stored grains because it reduces the quality and quantity through weight loss, broken grain, the occurrence of insect body fragments, and excretions. The pest attacks also cause indirect losses through the establishment of secondary pathogens (Trematerra *et al.*, 2009; Sarwar, 2015).

Use of synthetic insecticides through fumigation and spraying is effective, but leads to many problems such as pest resistance and unpleasant pesticide residues in the stored products that are hazardous for consumers (Subramanyam *et al.*, 1995; Tarwotjo *et al.*, 2014).

Control methods other than chemical ones are important as they do not leave chemical residues and cause no resistance in insects (Padin *et al.*, 2002). One promising

way to fulfil the need for safe control strategies is by exploiting the orientation behaviour of insects. Integrated management of stored product pests relies on data to direct the management decisions (Barak *et al.,* 1990; Abo-Arab, 2015).

Briscoe & Chittka, 2001 reported Various Coleoptera to have colour vision to locate the host. Hence, the manipulation of the environment to decrease pest attacks can be conducted using the colour preferences of these pests. Monitoring traps have been developed in industrial processes in the developed countries and by farmers in the developing countries (Collins & Chambers, 2003; Arnold *et al.,* 2015).

This study aimed to determine the colonization preference of *S. oryzae* to various colour cues which may enhance the effectiveness of storage traps, coloured bags, or coloured surfaces to contribute to the design of better integrated pest management programs for the stored grain pest *S. oryzae*.

MATERIALS AND METHODS

Rearing of the Insects:

The adults of rice weevil were reared on wheat grains under the optimum laboratory conditions of humidity 65 ± 5%, temperature 25 ± 2◦C, and a 16:8 hours light/dark photoperiod. The required adult insects were obtained from the maintained laboratory culture. The research was conducted in the Department of Entomology, Faculty of Science, Ain Shams University.

The Free-choice Test Method:

A laboratory set including seven containers was used in the free choice test according to Shelja *et al.,* 2018 with modifications (Fig.1). The set consisted of a mother container and six lateral containers symmetrically attached to one main container through pipes (12cm in length, 2cm in diameter). The ends of the pipes were inserted through holes in the main and lateral containers to enable the insects' free movement. Lateral holes in the main chamber were glued with green, red, blue, yellow, black and white papers in addition to their respective pipes and walls of the mother container. 100 grams of wheat grains were put in each lateral container. Two hundred adult insects were released in the mother container to give the insects a free choice of any colour; three replicates of the treatments were conducted. The study of in-vitro migration of the insects was conducted by counting the number of insects in each lateral-coloured container after 24 hours of release.

Fig. 1: The free-choice set.

RESULTS AND DISCUSSION

Observations were taken 24 hours after release; the observed parameter was the number of adults attracted to the different colours colonizing the lateral containers (Table 1). The number of adults counted in the green container was between 13.9-39.3 % of the total insect number and 16.6 -33.3% in red, followed by 15.2 -15.7 %, black 13.1 -15.7 %, and yellow 11.7-17.2 %. While the lowest recorded number was in the white container (4.1 -9.3 %).

Table 1: Percentages of adult *S. oryzae* in the lateral chambers in response to the different colour cues after 24 hrs. release in the main chamber.

Replicate	Green	Red	Blue	Black	Yellow	White
1	13.88 %	33.33 %	15.74 %	15.74 %	12.03 %	9.25 %
2	22.29 %	23.31 %	14.86 %	14.86 %	17.22 %	7.43 %
3	39.31 %	16.55 %	15.17 %	13.10 %	11.72 %	4.13 %
Average	25.16 %	24.40 %	15.26 %	14.57 %	13.66 %	6.94 %

Based on the free-choice test, there was a difference in the total number of adult insects present in the lateral containers (Fig.2). It was found that the green and red colours were the most preferred cues, and significantly different from all the other treatments. The following preferred colours were blue, black and yellow colours, while the lowest preference was recorded from the white colour cue which was significantly lower than all the other treatments.

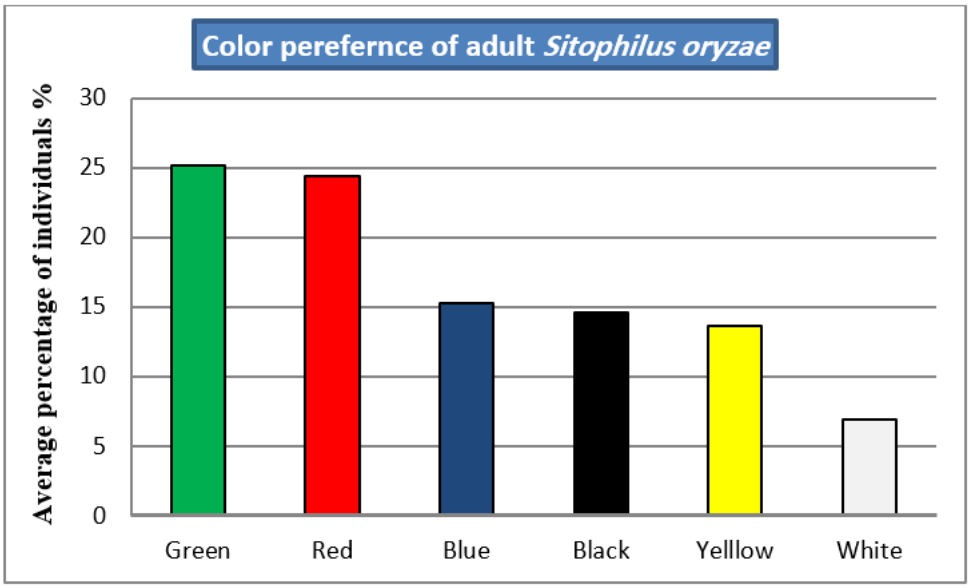

Fig. 2: Average percentages of adult *S. oryzae* in response to the different colour cues.

Our findings agreed with those of Astuti et al. 2019, who found that white colour was the least attractive colour for *S. oryzae* adults.

The colour preferences are not broadly studied in stored product pests, as their habits are generally nocturnal and they live in a low-level light environment of grain stores. However, such insects show dispersion behaviour and will need visual cues in order to navigate outside the storage places to locate new host material to feed and oviposit on. (Arnold, 2015)

Capinera & Walmsley (1978) reported that insect colour preferences differ in each

species. Pests of the stored product as *S. oryzae* and *S. zeamais* in one family Dryophthoridae showed attraction to different colours, while *Oryzaephilus surinamensis and O. mercator* in the family Silvanidae have the same colour preferences. This is because of the diversity of visual pigments in the different insect species (Wakakuwa et al., 2004). Some insects are sensitive to colours with a certain range of wavelengths (Barghini & Souza, 2012), which is controlled by the wavelength receptors found in the eyes of insects.

Colour preference is an important aspect of integrated pest management besides the other insect control application. Colour cues could be incorporated in low-cost traps in storage places in developing countries. On the other hand, sidestepping attractive colours of drawings and materials in storage places, e.g. using white bags not red and green ones for protection of stored grains. The results of the present research revealed that there is a difference in colour preference among adults; the behaviour of *S. oryzae* can be manipulated based on colour preference. Based on these results, we recommend that the use of green and red materials may serve to enhance the effectiveness of mass traps for monitoring *S. oryzae* in cereal stores.

Conclusion:

Based on this research, it is concluded that for the control of *S. oryzae* in the grain stores, white bags with no red or green paintings could be used to keep away the adults of this pest and to reduce the level of infestation. In addition, it is recommended to use red and green-colour traps for catching this pest. This strategy could be integrated with other pest management strategies to control the *S. oryzae* insect pest.

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REFERENCES

Abo-Arab, R. B., & Nariman, M. E. (2015). Exploiting the Colour Orientation Behaviour for Controlling the Stored Product Insects. *Egyptian Journal of Plant Protection Research,* 3, 113-122.

Antunes, C., Mendes, R., Lima, A., Barros, G., Fields, P., Da Costa, L. B., ... & Carvalho, M. O. (2016). Resistance of rice varieties to the stored-product insect, *Sitophilus zeamais* (Coleoptera: Curculionidae). *Journal of economic entomology,* 109(1), 445-453.

Arnold, S. E., Stevenson, P. C., & Belmain, S. R. (2015). Responses to colour and host odour cues in three cereal pest species, in the context of ecology and control. *Bulletin of Entomological Research,* 105(4), 417-425.

Astuti, L. P. (2019). Feeding Preference and Development of *Sitophilus oryzae* L. on Organic and Inorganic Rice Cultivation. *AGRIVITA, Journal of Agricultural Science,* 41(3), 561-568.

Barak, A. V., Burkholder, W. E., & Faustini, D. L. (1990). Factors affecting the design of traps for stored-product insects. *Journal of the Kansas Entomological Society,* 466-485.

Barghini, A., & Souza de Medeiros, B. A. (2012). UV radiation as an attractor for insects. *Leukos,* 9(1), 47-56.

Briscoe, A. D., & Chittka, L. (2001). The evolution of colour vision in insects. *Annual review of entomology,* 46(1), 471-510.

Capinera, J. L., & Walmsley, M. R. (1978). Visual responses of some sugarbeet insects to sticky traps and water pan traps of various colours. *Journal of Economic Entomology,* 71(6), 926-927.

Collins, L. E., & Chambers, J. (2003). The I-SPy Insect Indicator: an effective trap for the

detection of insect pests in empty stores and on flat surfaces in the cereal and food trades. *Journal of Stored Products Research,* 39(3), 277-292.

Corrêa, A. S., Orlando de Oliveira, L., Braga, L. S., & Guedes, R. N. C. (2013). Distribution of the related weevil species *Sitophilus oryzae* and *S. zeamais* in Brazil. *Insect Science,* 20(6), 763-770.

Devi, S. R., Thomas, A., Rebijith, K. B., & Ramamurthy, V. V. (2017). Biology, morphology and molecular characterization of *Sitophilus oryzae* and *S. zeamais* (Coleoptera: Curculionidae). *Journal of Stored Products Research,* 73, 135-141.

Gvozdenac, S., Tanasković, S., Vukajlović, F., Prvulović, D., Ovuka, J., Viacki, V., & Sedlar, A. (2020). Host and ovipositional preference of rice weevil (Sitophilus oryzae) depending on feeding experience. Applied Ecology & Environmental Research, 18(5), 6663-6673.

Mansoor-ul-Hasan, A. A., Jafir, M., Javed, M. W., Shehzad, M., Chaudhary, M. Z., & Aftab, M. (2017). Effect of temperature and relative humidity on development of *Sitophilus oryzae* L.(Coleoptera: Curculionidae). *Journal of Entomology and Zoology Studies,* 5(6), 85-90.

Padın, S., Dal Bello, G., & Fabrizio, M. (2002). Grain loss caused by Tribolium castaneum, *Sitophilus oryzae* and *Acanthoscelides obtectus* in stored durum wheat and beans treated with Beauveria bassiana. *Journal of Stored Products Research,* 38(1), 69-74.

Plarre, R. (2013). An attempt to reconstruct the natural and cultural history of the granary weevil, *Sitophilus granarius* (Coleoptera: Curculionidae). European journal of Entomology, 107(1), 1-11.

Rossetto, C. J. (1969). O complexo de *Sitophilus* spp (Coleoptera curculionidae) no Estado de São Paulo. *Bragantia*, 28, 127-148.

Sarwar, M. (2015). Distinguishing and controlling insect pests of stored foods for improving quality and safety. *American Journal of Marketing Research,* 1(3), 201-207.

Shelja, P., Patgiri, P., Bhattacharyya, B., & Sathish, K. (2019). Evaluation of red flour beetle, *Tribolium castaneum* (Coleoptera; Tenebrionidae) preference to different colour cues in storage. *Journal of Entomology and Zoology Studies,* 7(1), 604-607.

Subramanyam, B. (Ed.). (1995). Integrated management of insects in stored products. CRC Press.

Tarwotjo, U., Situmorang, J., Soesilohadi, H. R., & Martono, E. (2014). Monitoring Resistensi Populasi Plutella Xylostella, L Terhadap Residu Emamektin Benzoat Di Sentra Produksi Tanaman Kubis Propinsi Jawa Tengah (Monitoring the Resistance of *Plutella Xylostella*, L Population Against Emamektin Benzoate Residues). *Jurnal Manusia dan Lingkungan*, 21(2), 202-212.

Trematerra, P. (2009). Preferences of *Sitophilus zeamais* to different types of Italian commercial rice and cereal pasta. *Bulletin of Insectology,* 62(1), 103-106.

Wakakuwa, M., Stavenga, D. G., Kurasawa, M., & Arikawa, K. (2004). A unique visual pigment expressed in green, red and deep-red receptors in the eye of the small white butterfly, *Pieris rapae* crucivora. *Journal of Experimental Biology,* 207(16), 2803-2810.