International Journal of Genetics
ISSN: 0975-2862 & E-ISSN: 0975-9158, Volume 12, Issue 1, 2020, pp.-700-703.
Available online at https://www.bioinfopublication.org/jouarchive.php?opt=&jouid=BPJ0000226

Research Article

STUDY THE INFLUENCE OF WHEAT VARIETIES FOR ORIENTATIONAL PREFERENCE AND DEVELOPMENT PERIOD OF *SITOPHILUS ORYZAE*, UNDER LABORATORY CONDITION

SURYAWANSHI D.K.*[1], JATAV H.R.[2] AND KANOJIYA R.[3]

[1]Scientist, Plant Protection, Krishi Vigyan Kendra, Ujjain, 456010, Rajmata Vijayaraje Scindia Krishi Vishwavidyalaya, Gwalior, 474002, Madhya Pradesh, India
[2]Scientist, Agriculture Extension, Krishi Vigyan Kendra, Ujjain, 456010, Rajmata Vijayaraje Scindia Krishi Vishwavidyalaya, Gwalior, 474002, Madhya Pradesh, India
[3]Horticulture Assistant, Regional Agriculture Research Station, Ujjain, 456010, Rajmata Vijayaraje Scindia Krishi Vishwavidyalaya, Gwalior, 474002, MP, India
*Corresponding Author: Email - dksuryawanshi2008@gmail.com

Received: January 05, 2020; Revised: January 24, 2020; Accepted: January 27, 2020; Published: January 30, 2020

Abstract: The studies were carried out in laboratory condition in the Regional Agriculture Research Station, Krishi Vigyan Kendra, Ujjain, 456010, Rajmata Vijayaraje Scindia Krishi Vishwavidyalaya, Gwalior, 474002, Madhya Pradesh, during 2017-18 to Study the influence of wheat varieties for orientational preference and development period of *Sitophilus oryzae*, under laboratory condition Variety Sujata was least preferred orientation, while maximum orientation was on HI-8663 (Poshan), which was recorded significantly higher than rest of the varieties under test condition. The varieties significantly influenced the developmental period (egg to adult), which ranged from 28.9 days in Sujata to 40.3 days in HI-8663 (Poshan). The number of adults emerged from different varieties with same exposure period ranged from 3.5 in GW-173 to 9.2 in HI-8663 (Poshan). There was a positive correlation between volume of grain and adult emergence (r=0.999), however, there was a negative correlation between density of grains and adult's emergence (r= 0.837). Percentage of grain damage was comparatively low (2.35-9.20 %) in GW-273 and lok-1, while maximum (9.20 %) grains were damaged in Lok-1. The percent grain damage influenced positively with the volume Wheat variety Sujata was found less susceptible against *Sitophilus oryzae* in which lower numbers of adults were oriented and has least emergence of adults, percent grain damage and percent loss in grain weight. The other promising varieties were GW-173, GW-273, PBW-343 and Raj-1555. Variety HI-8663 (Poshan) was most susceptible on the basis of above parameters. of 100 seeds and negatively with the density of seeds.

Keywords: *Sitophilus oryzae (Lin.), Wheat store grain pest, Sujata*

Citation: Suryawanshi D.K., *et al*., (2020) Study the Influence of Wheat Varieties for Orientational Preference and Development Period of *Sitophilus oryzae*, Under Laboratory Condition. International Journal of Genetics, ISSN: 0975-2862 & E-ISSN: 0975-9158, Volume 12, Issue 1, pp.- 700-703.

Introduction

Wheat is a cereal grain of the monocot plant *Triticum* spp. and it is the world's most important cereal crop in relation to production and consumption [1]. It is the most important staple food for humans. World trade in wheat is greater as compare to all other crops combined. Wheat is one the very valuable source of carbohydrates and 20% of the food calories consumed globally. In addition to the carbohydrates wheat is also the leading source of protein in human foods, having higher protein contain than maize, rice or the other major cereal grains. In terms of the total production, it is currently second to rice as the main human food crops and ahead of maize. The global demand for wheat is gradually increasing due to the fact that wheat possesses unique viscoelastic and adhesive property of gluten proteins, which facilitate the production of processed food whose consumption is increasing worldwide due to industrialization process and westernization of the diet. Wheat is having a protein content of about 13% but relatively low in protein quality for supplying essential amino acids, when eaten as the whole grain, wheat is a source of multiple nutrients and dietary fiber. Wheat is having 13% water, 71% carbohydrates, and 1.5% fat. The total production of the wheat in India is about 97.44 million tons from an area 30.72 million hectare during 2017-18 (Anonymous, 2018). There is a great contribution of the high yielding improved varieties to achieve the higher production and productivity of this crop. One of the most important reasons for this success has been the relatively pest free field condition of the wheat. Farmers in general keep their produce in homemade storage primarily to increase the net value of the crop selling when prices are more favorable. However, the price of the produce is determined on the basis of the test weight, absence of insects and damage caused by insects.

The pest complex of wheat possesses serious limitation in the intensification of wheat cultivation in different agroclimatic region of India moreover wheat stored for future used as grain for seeds are also damaged by some insect pest of stored grain. The losses caused by the insect pest in stored are not only quantitative but qualitative [2]. The Rice weevil (*Sitophilus oryzae* Linn.) infests large varieties of stored products and is cosmopolitan in their distribution, being much more injurious in warm region of the country. Among the number of pest are associated with wheat in storage *Sitophilus oryzae* (Order-Coleoptera family-Curculionidae) commonly called rice weevil has become primary pest of stored wheat of warm climatic area. The pest causes damage to grain which stored at 25-30°C and low relative humidity as these conditions are favored for the development of these pests. Rice weevil ubiquitous of economic importance adult weevil bore into the endosperm reducing the carbohydrate content the larvae feed preferentially on the germ of grain resulting removing a large percentage of protein and vitamins. In recent years the laboratory studies established at many varieties have some degree of resistance against Rice weevil [3]. Among all the control measures available a variety possessing adequate level of resistance against pest may probably is a novel method of pest control with lowest possible imbalance of the natural ecosystem. Wheat in storage is infested by array of insect pests of which the rice weevil, *Sitophillus oryzae* (Linn.) causes qualitative as well as quantitative. At farmers level wheat suffers greater losses than stored in commercial godowns. The infestations also differ in different cultivated varieties which are replaced by farmers from time to time. The present studies, therefore undertaken on incidence of *Sitophilus oryzae* on different varieties of stored wheat.

Earlier, many researchers have made efforts to get the complete control of the stored grain by insecticidal application. Moreover, fumigation was widely used as potent method for the pest suppression in the stored produce. But with the time span it has been observed that none of the method is safe as for as the human health and environment is concerned [4]. In contrast the plant possessing insecticidal properties proved very effective for the management of pest population to the lowest possible level of population economic threshold level without any risk of non-target organism. Additionally, even consumption of extract from some of the medicinal plants is beneficial for human beings [5]. Very scanty information is available on the use of the plant material as a protectant against especially for the *S. oryzae* in the stored wheat grains. During present investigations, the study on reaction of wheat genotypes and efficacy of phyto-extracts against *S. oryzae* (Linn.) in stored wheat (*Triticum* spp.) was undertaken [6-18].

Materials and Methods

The present investigation entitled, was conducted under the laboratory conditions in the Regional Agriculture Research Station, Krishi Vigyan Kendra Ujjain, (M.P.) during 2017-2018.

Collection of seeds

The healthy, genetically pure, insect and disease free seeds of wheat varieties *i.e.* LOK-1, Sujata, GW-273, GW-173, GW-322, GW-190, GW-366, HI-1544, HI-8381, HI-8663 (Poshan), HI-1489, MP-4010, MP-4060, PBW-343 and Raj-1555 were obtained from Crop cafeteria at Regional Agriculture Research Station, Krishi Vigyan Kendra, Ujjain, 456010, Rajmata Vijayaraje Scindia Krishi Vishwavidyalaya, Gwalior, 474002, Madhya Pradesh, India. The seeds were further critically examined and foreign materials were removed from the lot. The seeds were stored in an air–tight plastic box, after the exposure period of 24 hours. The seeds were removed from the box and kept outside under room conditions for complete aeration. The seeds of wheat were further stored in plastic jars, the open tops of which covered with clean sterile muslin cloth, properly secured with rubber bands.

Insect culture

Large numbers of adult of *S. oryzae* were collected from infested stocks of wheat from local granaries at Ujjain market. The collected adults were released in two litre capacity plastic container. The container mouth was tied with muslin cloth and kept at room temperature. The culture was maintained on wheat varieties. After 48 hours old adults were removed from the container. Less than 48 hours newly emerged adults from these containers were used for experiment. Fresh culture on new seed material was raised time to time from newly emerged weevils to avoid fungus infection and build-up of parasite. Aspirator was used for transferring and handling of the weevils. Weevils used in the experiments were those that emerged from the culture and were of the age less than 24hrs old. For releasing the weevils; in pairs; in the experiments the males and females were sorted out, being easily detected by the form of rostrum.

Screening of varieties against *S. oryzae*

Fifteen varieties of wheat were screened against the *S. oryzae* for orientation, development and adult emergence. The weight of 100 seeds, volume of 100 seeds, and density of seeds (weight of 100 seeds/volume of 100 seeds) were recorded. The reaction of varieties against the pest was assessed on the basis of orientation of adults, developmental period (egg to adult) and emergence of adults in different varieties. The experiments were conducted on free choice and no-choice conditions and methodology adopted is described herewith.

Experiment under free choice condition

Hundred grains of each variety were arranged in circular manner in the glass through (40 cm 'd' x 15 cm 'h'). Seventy-five pairs of 10 days old adults were released in centre of the trough and then it was covered with muslin cloth. The experiment was replicated three times. The number of adults oriented in each variety was counted at 24, 48 and 72 hours after their release.

Experiments under no choice conditions

The fifteen varieties were also screened under no choice condition against pest insect for their orientation, development and adult emergence. Five-gram grains of each variety were kept separately in the plastic bottle (5 x 3 cm). Five pairs of *S. oryzae* were released in each variety. At 48 hours after release, all the adults were removed. The experiment was replicated three times.

Table-1 *Grain weight, volume and density of wheat varieties*

S	Varieties	Weight of 100 grains (g)	Volume of 100 grains (cm^3)	Density (g/ cm^3)
1	Lok-1	3.79	3.7	1.03
2	Sujata	2.95	2.5	1.18
3	GW-273	3.52	1.7	2.07
4	GW-173	3.86	1.5	2.57
5	GW-322	3.62	3.3	1.10
6	GW-190	3.55	3.3	1.08
7	GW-366	3.76	3.6	1.04
8	HI-1544	3.91	3.5	1.12
9	HI-8381	3.60	3.5	1.03
10	HI-8663 (Poshan)	4.11	4.0	1.03
11	HI-1489	3.97	3.4	1.17
12	MP-4010	3.72	2.9	1.28
13	MP-4060	3.93	3.0	1.31
14	PBW-343	3.52	3.4	1.04
15	Raj-1555	3.86	3.5	1.10

The grains were observed daily after 15 days onward to record the total number of weevils emerged after completion of one generation development period (egg to adult). The data were subjected to statistical analyzed as per procedure Fisher (1958) [19], Panse and Sukhatme (1978) and Gomez and Gomez (1984) [20].

(a) To study the total developmental period of *S. oryzae* on different wheat varieties, 15 gm. Of wheat of each variety was kept in 5 x 3 cm. Petri dishes and or 1.0 x 2.0 cm. plastic bottles. Five pairs of newly emerged adult (less than 24 hours old) were released in each Petri dish and removed 48 hours after their release; Experiment was done at room temperature and replicated three times. Total developmental period (egg to adult) were recorded by dissecting out 20 infested grains daily and number of adult emerged were also recorded in different varieties.

(b) Losses caused by *S. oryzae* (Linn.) out of 15 gm. of grains 100 healthy grains of each variety were kept in 25 x 5.0 cm. plastic containers and five pairs newly emerged weevil were released in each variety. The experiment was replicated three times from weight of the healthy grain, weight of equal number of damage grains were deducted, to get the loss in grain weight and the percentage loss in grain weight was calculated in each variety.

Result

The present studies were under taken on Study the influence of wheat varieties for orientational preference and development period of rice weevil, *Sitophilus oryzae* (Linn.) (Coleoptera-Curculionidae) in stored wheat (*Triticum* spp.)". The results obtained are presented here with:

Screening of wheat varieties against rice weevil, *Sitophilus oryzae*

Fifteen varieties of wheat were screened against the pest for orientational preference, development period (egg to adult), adult emergence and losses caused by this pest.

Orientation of preference under free choice condition

Orientational preference was recorded at 24, 48 and 72 hours after release of adults and data are present in [Table-2]. At 24 hrs after release, significant differences were observed among different varieties with regards to orientational preference of rice weevil. Minimum orientation (6.8) was on Sujata, which was significantly less than other varieties. Whereas, maximum orientation (9.5) was on HI-8663 (Poshan), which was recorded significantly higher than rest of the varieties under test. The orientations on other varieties were intermediate.

At 48 hours after release, orientation of adult weevil on different tested varieties was found differed significantly. Minimum number of adults was oriented on variety Sujata (5.9) which was significantly less than other varieties.

The maximum orientation of adults was recorded on variety HI-8663 (Poshan) (8.2) which was significantly higher than rest of the other varieties under test. The orientations on other varieties were intermediate. At 72 hours after release, orientation of adult weevil on different tested varieties was found differ significantly. Minimum orientation (5.3) of adult was on Sujata, which was significantly lower than other varieties which at par with GW-173 and RAJ-1555. Orientation of adults on HI-8663 (Poshan) was significantly higher than rest of the varieties.

Table-2 *Orientation of Sitophilus oryzae on varieties of wheat*

S	Varieties	Number of adults orientated hours after release		
		24	48	72
1	Lok-1	8.7	7.6	6.8
2	Sujata	6.8	5.9	5.3
3	GW-273	8.1	7.0	6.3
4	GW-173	8.9	7.7	6.9
5	GW-322	8.3	7.2	6.5
6	GW-190	8.2	7.1	6.4
7	GW-366	8.6	7.5	6.8
8	HI-1544	9.0	7.8	7.0
9	HI-8381	8.3	7.2	6.5
10	HI-8663 (Poshan)	9.5	8.2	7.4
11	HI-1489	9.1	7.9	7.1
12	MP-4010	8.6	7.4	6.7
13	MP-4060	9.0	7.9	7.1
14	PBW-343	8.1	7.0	6.3
15	Raj-1555	8.9	7.7	6.9
SE(m) ±		0.07	0.06	0.05
CD (P=0.05)		0.2	0.17	0.16

Effect of varieties on development period under no choice condition

The data on developmental period (in days) from egg to adult recorded on different varieties/genotypes influenced the total development of rice weevil significantly. The number of adults emerged in different varieties, varied significantly. The result revealed that the variety Sujata had significantly lowest number of adult emergence (8.00 adults) in no choice condition and less than the adults emerged in rest of the other varieties. Whereas, HI-8663 (Poshan) had significantly highest number of adult emergences than recorded on other varieties. The adult emergence recorded in rest of the varieties was intermediate.

Table-3 *Adult emergence and developmental period of Sitophilus oryzae on different varieties of wheat*

S	Varieties	Number of adults emerged	Total development period in days (removal of adults till found the emergence of new adults)
1	Lok-1	8.5	37.1
2	Sujata	5.8	28.9
3	GW-273	3.9	34.5
4	GW-173	3.5	37.8
5	GW-322	7.7	35.5
6	GW-190	7.7	34.8
7	GW-366	8.4	36.8
8	HI-1544	8.1	38.3
9	HI-8381	8.1	35.3
10	HI-8663 (Poshan)	9.2	40.3
11	HI-1489	7.9	38.9
12	MP-4010	6.7	36.5
13	MP-4060	7.0	38.5
14	PBW-343	7.9	34.5
15	Raj-1555	8.1	37.8
SE(m) ±		0.09	0.28
CD (P=0.05)		0.26	0.85

The total developmental period on different varieties ranged from 28.9 days to 40.3 days. Minimum developmental period was recorded on varieties Sujata which was significantly less than the period recorded on the remaining varieties. Whereas, maximum developmental period was recorded in HI-8663 (Poshan) (40.3), which was significantly higher than recorded on other varieties. The developmental period recorded in other varieties were intermediate.

Effect on extent of damages and losses caused by *Sitophilus oryzae* (Linn.)

Data on percentage grain damage and loss in grain weight caused by the pest in different varieties of wheat are presented in [Table-4].

Percent grain damage

The percent grain damaged by the pest was ranged from 2.35 in GW 273 to 9.20 in Lok-1. Significantly less percent damage was recorded in GW 273 and GW 173 than rest of the varieties which were at par with PBW-343. Whereas, significantly higher damage was recorded in Lok-1 than rest of the varieties.

Percent Loss in Grain weight

The percent loss in grain weight in different varieties ranged from 1.88 to 7.36. Minimum loss in grain weight was recorded in variety GW-273 (1.88) which was at par with GW-173 (1.96) but was lesser than rest of the variety. Maximum loss in grain weight observed in variety Lok-1 was significantly higher than rest of the varieties. Variety HI-8663 (Poshan), GW-366, HI-8381 and GW-322 followed by Lok-1 had significantly highest losses in comparison to rest of the varieties.

Table-4 *Percent grain damage and loss in grain weight caused by Sitophilus oryzae on different varieties of wheat*

S	Varieties	Percent grain damage	Percent loss in grain weight
1	Lok-1	9.20	7.36
2	Sujata	7.38	5.90
3	GW-273	2.35	1.88
4	GW-173	2.45	1.96
5	GW-322	8.84	7.07
6	GW-190	7.15	5.72
7	GW-366	8.88	7.10
8	HI-1544	8.12	6.50
9	HI-8381	8.86	7.09
10	HI-8663 (Poshan)	8.93	7.14
11	HI-1489	8.98	7.18
12	MP-4010	8.18	6.54
13	MP-4060	8.20	6.56
14	PBW-343	2.58	2.06
15	Raj-1555	2.99	2.39
SE(m) ±		0.04	0.03
CD (P=0.05)		0.12	0.09

Application of research: Study of orientational preference and development period of *Sitophilus oryzae* in different wheat variety

Research Category: Agriculture Entomology

Acknowledgement / Funding: Authors are thankful to Regional Agriculture Research Station, Krishi Vigyan Kendra, Ujjain, 456010, Rajmata Vijayaraje Scindia Krishi Vishwavidyalaya, Gwalior, 474002, Madhya Pradesh, India

****Principal Investigator or Chairperson of research: Dr D K Suryawanshi**
University: Rajmata Vijayaraje Scindia Krishi Vishwavidyalaya, Gwalior, 474002
Research project name or number: Research station study

Author Contributions: All authors equally contributed

Author statement: All authors read, reviewed, agreed and approved the final manuscript. Note-All authors agreed that- Written informed consent was obtained from all participants prior to publish / enrolment

Study area / Sample Collection: Regional Agriculture Research Station, Krishi Vigyan Kendra, Ujjain, 456010

Cultivar / Variety / Breed name: Wheat - LOK-1, Sujata, GW-273, GW-173, GW-322, GW-190, GW-366, HI-1544, HI-8381, HI-8663 (Poshan), HI-1489, MP-4010, MP-4060, PBW-343 and Raj-1555

Conflict of Interest: None declared

Ethical approval: This article does not contain any studies with human participants or animals performed by any of the authors.
Ethical Committee Approval Number: Nil

References

[1] Ileke K.D. (2011) *J. Phys. and Bio. Sci.*, 4(1), 7-12.
[2] Khare B.P. (1972) *Bulletin*, 5, 132-139.
[3] Ram C. and Singh V.S. (1996) *Indian J. Ent.*, 58(1), 79-90.
[4] Metcalf R.L. (1982) *Insecticides in pest management. In, R. L. Metcalf and W. H. luckman [Eds.]. Introduction to Insect Pest Management (2nd Ed.). John Wiley, New York, USA*, 235-273.
[5] Nawaz A. (1999) M.*Sc. (Hons) Thesis. Department of Entomology, NWFP Agricultural University, Peshawar*, pp. 39.
[6] Ahmad E. (2018) *Bull. Env. Pharmacol. Life Sci*., 7(9), 73-79.
[7] Akhter M., Sultana S., Akter T. and Begum S. (2017) *Bangladesh J. Zool.,* 45(2), 131-138.
[8] *Annual report (2017-2018) Department of Agriculture and Cooperation, Ministry of Agriculture, Government of India. Krishi Bhawan, New Delhi*, 5.
[9] Arve S.S., Chavan S.M. and Patel M.B. (2014) *Trends in Biosci*., 7(10), 925-934.
[10] Badii K.B., Asante S.K. and Adarkwa C. (2013) *Africa J. Agril. Res*., 8(16), 1375-1380.
[11] Patel Y. (2006) *Asian J. Biosci*., 1(2),106-108.
[12] Paul S.K., Banerjee A., Bandhopadhyaya B. and Jha S. (2005) *Insect Environ*., 11(1), 8-9.
[13] Phadke K.G. and Bhatia S.K. (2003) *Ind. J. Ent*., 36(4), 251-260.
[14] Rao N.S. and Sharma K. (2003) *Annals Pl. Prot. Sci*., 11(2), 250-254.
[15] Saljoqi A.U.R., Afridi M.K., Sajjad, Ahmad and Abdur Raqib (2002) *Sarhad J. Agri*., 18(2), 237-240.
[16] Singh K., Agrawal N.S. and Girish G.K. (1996) *Bull. Grain Tech*., 11(1), 50-58.
[17] Tiwari R. and Sharma V.K. (2002) *Ind. J. Ent*., 64(1), 1-11.
[18] Tiwari N. (2016) *M.Sc. (Ag) Thesis, JNKVV, Jabalpur*.
[19] Fisher R.A. (1958) *Statistical Methods for Research Workers. Oliver and Boyd, London.*
[20] Gomez S.R. and Gomez A.A. (1984) *Statistical Procedure for Agricultural Research (2nd Ed), John Wiley & Sons, New York.*