



ORIGINAL ARTICLE

Developmental Studies of Rice Weevil *Sitophilus oryzae* on Sorghum Pertaining to Hatching and Pupation**Sumedha¹, J.C. Gupta¹ and H.N. Sharma²**¹Department of Zoology, Ganjdundwara P.G. College, Ganjdundwara, U.P.²Department of Zoology, S.V. College, AligarhEmail: harendransharma@gmail.comReceived: 29th Aug. 2020, Revised: 10th Sept. 2020, Accepted: 21st Sept. 2020**ABSTRACT**

In India Sorghum crop is most important extensively production in many states but use are not up to date is proper position to meet out over its requirement because during storage conditions high degree damage is caused and stored insect pest. *Sitophilus oryzae* infest food grains and penetrate beyond certain depth into the grain. These grains become powder with their faecal matter. The grabs generally attack germplasm of grain but under heavy infestation other parts of grain may also damage. So this study highlights the hatching and pupation percentages of rice weevil in sorghum.

Key words: *Sitophilus oryzae*, Sorghum, Hatching, Pupation

INTRODUCTION

Sitophilus oryzae is known to feed on wheat, rice, maize, Sorghum, out of these if feed on wood, dry roots etc. but is a serious pest of Sorghum all over India (Davey, 1965). The pests which generally damage Sorghum grain in storage houses are mainly *Sitophilus oryzae* (L.); *Rizopertha dominica* (F); *Trogodarma granarium* Everts; *Tribolium castaneum* Herbst; *Candia cavellata* and *Sitotroga cerealiella* (Oliv.). According Pushpamma and Uma Reddy (1979) Jwar (Sorghum) is valuable extensively grown crop, occupying 30.0 million metric tones in India. Though synthetic pesticides have proceed to give a effective control of various stored grain pest but simultaneously they also responsible for several hazardous problems such as appearance of resistance of pests strain, resurgence of pests due to the destruction of natural enemies and toxic hazard due to chemical residue. Use of resistant varieties to alleviate storage losses is a promising approach. Considerable work on this aspect has been done in recent years, which shows existence of wide variability in Sorghum germplasm for resistance to various pests.

Rahman and Khan (1942) have given adequate attention for insect pest of stored grains, although *Sitophilus oryzae* is one of the most serious pest of Sorghum and other cereals. Pushpamma and Reddy (1979) have given attention to relative resistance of some varieties of Sorghum to stored grains pest, only few reports are available on resistance to stored grain pest in Sorghum. *Sitophilus oryzae* has not been given adequate attention by the research workers, so I decided to do this work in this direction. Among physical characteristics of grain hardness, husk covering and size of grain play an important role in resistance of insect pests in case Sorghum, certain characters like texture of husk, hardness of grain and site for oviposition on grains effects to reproduction behavior in stored grains Lubyaro, Ligan and Youdeowei (1985).

MATERIALS AND METHODS

Among different varieties Sorghum, the variety CSV8R was used for mass culture of *Sitophilus oryzae* was selected as the culture variety, because it is known to be susceptible of *Sitophilus oryzae* and other beetles (Prakash, A. 1981) and stored in glass bottles (5 litre capacity) after sterilization and cleaning, whenever, needed for culture grains were taken out from these bottles and conditioned in desicator having a relative humidity of 70% maintained by using KOH solution (Solaman, 1951). The grains were loosely filled in small muslin bags and kept inside the desicator for 2-3 weeks for counting, so that the grains acquire a moisture content level of 13-14%, which is most conducive for *Sitophilus oryzae*.

The nuclear culture of *Sitophilus oryzae* was obtained from the pure culture which maintain in the Deptt. of Zoology Ganj tundawara for several generation about 80 grabs of *Sitophilus oryzae* were taken as initial inoculation and rebased in glass jar (115.5 x 10.5) which were half filled with the conditioned grains with culture variety. The glass jars were kept inside a B.O.D. incubator maintaining constant temperature $35 \pm 1^\circ\text{C}$ and $60 \pm 2\%$ relative humidity. The incubated grabs of *Sitophilus oryzae* were allowed to develop into adults on the grains inside the Jar. Adult insects after emerging from a jar were used to start new cultures in fresh jars. Such process was repeated with succession of jar to have a continuous and adequate supply of the test insect for experimental on varietal screening.

LABORATORY APPARATUS USED:

Glassjars, specimen tubes, B.O.D. chamber, incubator, forcepts, needles, Petridishes, binocular microscope, camel hair brush, muslin cloth, corks and rubber rings, dry and wet bulb thermometer were used during the course of investigations.

EXPERIMENTAL VARIETIES OF SORGHUM:

Sorghum varieties were selected from those rebased for common cultivation for different zones of the country. The Sorghum grains of Seventeen different varieties were obtained from the Deptt. of Genetics and plant breeding, R.B.S. College, Agra. Five groups have to be used in the study; five A/B lines (296A, 296B, 2219B, AKMS14A, AKMS14B), Five R lines (CS3541, MR750, RS29, AKR 150, SPY 86), Five commercially rebased varieties (CSV8R, SPY462, CSV15), Swati and DJ6514, one germplasm occasional (IS2146 and one local Nizamabad. The Sorghum grains of selected varieties were cleaned and kept in sterilized glass bottle for varietal experiment grains samples were taken out and kept in small muslin cloth bags, placed inside desicator having 65-70% Relative humidity, for conditioning as in case of the culture variety. After 2-4 weeks of conditioning the grains, as the moisture rays 13-15% the strains were used for susceptibility tests rays 13-15% the grain were used for susceptibility tests.

DEVELOPMENTAL STUDIES OF RICE WEEVIL:

The various experiments were carried out under controlled condition at $35 \pm 1^\circ\text{C}$ temperature and $60 \pm 2\%$ relative humidity during the course investigation. Mating, Pre-oviposition and oviposition period- For observing the mating, preoviposition, 5 pair of freshly emerged male and female isolated from the stock culture were introduced in to tubes (10 x 4cm) containing 25gm conditioned grains of each selected variety at random. Each tube covered with perforated polythene paper and tighed with rubber band to prevent the scope of bottle. All the tube were placed in decicators at $60 \pm 2\%$ relative humidity and $35 \pm 1^\circ\text{C}$ temperature. The experimental replicated thrice eggs were isolated with the help of camel hair brash and their number counted with the help of bull lens. With a view of studying the grub and pupal period, 100 newly hatched grubs were kept in specimen jar separately, containing 100 grains of each variety. The observations were recorded daily to note the pupation for grub period. The grains toward their surface have paper, were detected full grown grabs changed into paper. The pupation stage converts into adult. This period is also recorded.

RESULTS AND DISCUSSION

It revealed from the results that the percentage of hatching varies from 59.58 to 92.25% in different Sorghum varieties. The minimum percentage of hatching was found in AKMS 14B (59.58%), which did not differ to 296B, AKMS14A and RS29 that is 60.98, 62.55, 66.37% respectively. The variety 2219B showed maximum percentage of hatching i.e. 92.25% which was followed by AKR- 150 (90.38%) and 296A (84.66%) and noted significantly higher number of eggs than rest of varieties. It is obvious from the above results that the larval period was highest in variety AKMS14B (31.02 days), while it was minimum in variety 2219B (20.28 days). The larval period in 296A, DJ6514, CSV15 and CSV8R did not differ significantly among themselves but it was significantly lesser than the variety IS2146, Nizamabad, AKR150 SPY86, RS29, MR750, Swati and AKMS14A having 24.25, 24.55, 24.62, 25.55, 26.12, 26.75 and 30.86 days respectively. The larval period in Sorghum varieties CSV15, 196A, IS2146, DJ6514, Nizamabad AKR-150, SPY86, SPY462,

RS29 and MR750 was found to be at par with each other and it varied from 23.21 to 26.12 days. The variety AKMS 14A did not differ significantly from AKMS14B (Table-1, Fig. 1).

The observed data recorded on pupation percentage of *Sitophilus oryzae* have been presented in table and fig, which clearly indicated that lowest population was 49.21% in 296B variety, being significantly lower to the rest of varieties except Nizamabad, CSV8R, CSV-15, SPY462, DJ6514, MR750, IS2146, AKR150, 296A and 2219B having 62.74, 64.80, 66.49, 68.29, 72.24, 72.56, 75.42, 76.58, 76.71 and 86.80% respectively. The maximum percentage of population was observed in 2219B (86.80%) which did not differ significantly from 296A, AKR-150, IS2146, MR750 and DJ6514 being 76.71, 76.58, 75.43, 72.56 and 72.24% respectively.

The rest of the varieties Nizamabad, CSV8R, AKR-150 and SPY462 being 62.74, 64.80, 76.58, 68.29% showing intermediary behavior. The pupal period range 70.47 to 14.66 days being minimum in 2219B and maximum in 296B. The minimum pupal period was in variety 2219B (70.47 days) which was at par with 296A, MR750, AKR-150, 152146, SPY462, CSV8R and CSV15 being 7.47, 8.38, 8.68, 9.28, 9.50, 10.25, 10.58 and 10.84 days respectively. The pupal period recorded in variety 296B was highest which did not differ significantly from varieties AKMS14B, AKMS14A, RS29, CS3541, Swati, DJ6514, Nizamabad and SPY86 being 13.72, 13.65, 12.62, 12.42, 12.22, 11.85, 11.49 and 11.47 days, respectively (Tab. 2, Fig. 2).

Table 1: Hatching % and incubation period of *Sitophilus oryzae*

Variety	% Hatching		
	Actual Value	Trans Formed Values	Larval Period
296A	84.66	67.33	23.64
296B	60.98	51.40	29.36
2219B	94.25	74.91	20.28
AKMS14A	62.55	52.36	30.86
AKMs14B	59.58	50.6	31.02
CS3541	68.48	55.86	27.55
MR750	78.53	60.74	26.12
RS29	66.37	54.77	25.92
AKR150	90.38	70.40	24.62
SPY86	68.68	56.12	25.55
CSV86	80.54	64.15	23.07
SPY462	74.48	59.78	25.82
CSV 15	73.54	59.15	23.21
Swati	69.31	56.57	26.75
DJ6514	77.42	61.87	24.37
IS2146	80.66	64.17	24.25
Nizamabad	71.21	57.63	24.55

Table 2: Pupation % and Pupal period of *Sitophilus oryzae*

Variety	Fecundity	Incubation period (days)
296A	76.71 (60.74)	8.38
296B	49.21 (44.52)	14.66
2219B	86.80 (69.64)	7.47
AKMS14A	50.85 (45.50)	13.65
AKMs14B	50.62 (46.52)	13.72
CS3541	59.11 (50.38)	12.42
MR750	72.56 (58.75)	8.68
RS29	60.38 (51.04)	12.62
AKR150	76.58 (61.49)	9.28
SPY86	53.52 (47.07)	11.47
CSV86	64.80 (53.86)	10.58
SPY462	62.72 (52.39)	11.49
CSV 15	66.49 (55.31)	10.84
Swati	55.86 (48.47)	12.22
DJ6514	72.24 (58.63)	11.85
IS2146	75.43 (60.92)	9.50
Nizamabad	62.74 (52.39)	11.49

Fig. 1: Hatching % and incubation period of *Sitophilus oryzae*

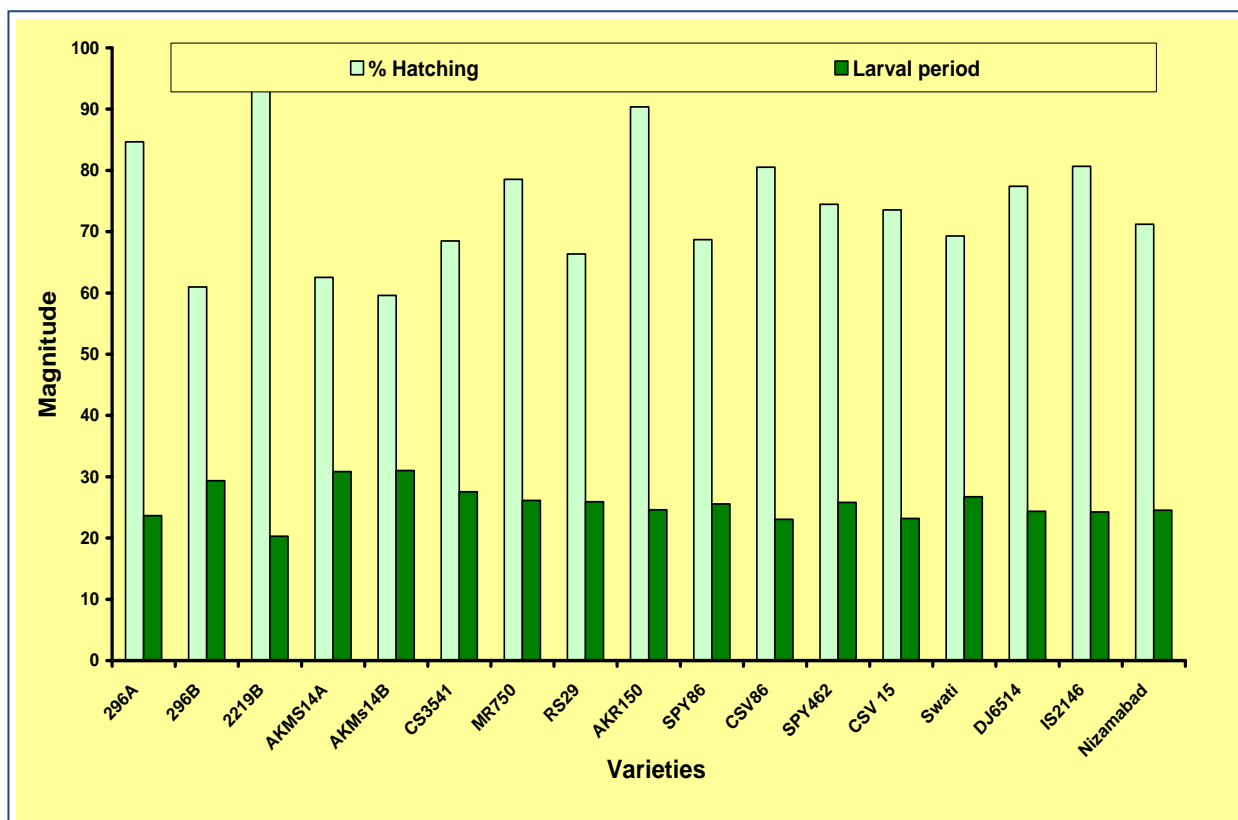
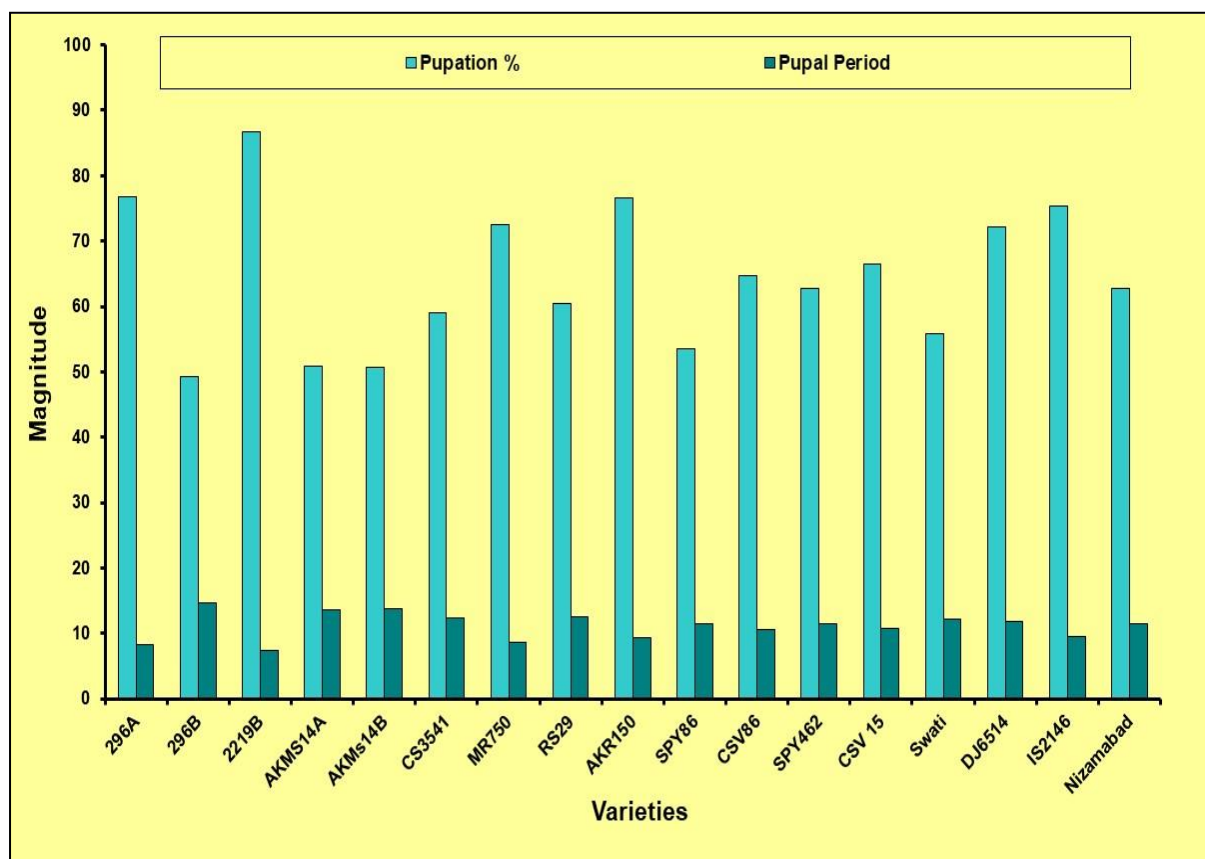


Fig. 2: Pupation % and Pupal period of *Sitophilus oryzae*



Experimental findings indicated that the minimum percentage of egg hatching was 59.58 in AKMS14B, which did not differ to 296B and AKMs14A i.e. 60.98 and 62.55 percent respectively. The maximum 94.25 percent egg hatching was obtained in Sorghum variety 2219B, which was followed by the varieties AKR150 and 296A that is 90.38 and 84.66% respectively Sharffudin (1986) supported the experimental findings.

During larval period significant variation was closed during the observation period. The highest 31.02 days larval period was recorded in AKMS14B variety and it was significantly higher than the varieties AKMS14A, 296B, CS3541, Swati, RS29, SPY462, AKR150, Nizamabad, DJ6514, CSV15, 296A, CSV8R. The minimum larval period 20.28 days was recorded 2219B.

The maximum pupation percentage has observed in 2219B (86.80%), which did not differ significantly from 296A, AKR150, IS2146, MR750 and DJ6514. The minimum percentage of pupation was found in 296B (49.21) being significantly lower to the rest of the varieties except AKMS14A, AKMS14B in which it varied from 50.85 to 52.62%. The experimental findings are simultaneously of the experimental findings of Sherfuddin (1986) in which he observed the percentage variation of pupation.

It was minimum 64.36 percent in CS3541 while maximum in AKR150 (92.54%) which was followed by SPY 86, and 2219B having 89.42 and 83.25% respectively. The percentage of pupation in remaining varieties was found non significant and represent intermediary behavior and varied from 79.35 to 82.28%. The pupal period of the pest range from 74.47 to 14.66 days. The minimum pupal period was in variety 2219B (7.47 days) which was at par with 296A, MR750, AKR150, IS2146, SPY462 and CSV8R.

The highest pupal period was observed in 296B (14.66 days) which did not differ significantly from AKMS14B, AKMS14A, RS29, CS3541, Swati, DJ6514 and Nizamabad. Earlier some expert of pest management also observed similar findings regarding pupal period of *S. oryzae*, Iubijaro *et al.* (1985) and Pant and Gupta (1959) observed that the pupal period of the pest varied from 6 to 17 and 13 to 26 days respectively.

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