“Response of chickpea (*Cicer* arietinum) Genotypes against pulse beetle (*Callosobruchus maculatus*) (Fab.)”

THESIS

Submitted to the

Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, Gwalior

In partial fulfilment of the requirements for the Degree of

MASTER OF SCIENCE

In

AGRICULTURE

(ENTOMOLOGY)

By

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Gwalior (M.P.)

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CERTIFICATE- I

This is to certify that the thesis entitled **"Response of chickpea *(Cicer arietinum)* genotypes against pulse beetle *(Callosobruchus maculatus) (Fab.)*"** submitted in partial fulfilment of the requirement for the degree of **MASTER OF SCIENCE IN AGRICULTURE (Entomology**) of Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, Gwalior is a record of the bona-fled research work carried out by **Mr. Mayank Yadav** under my guidance and supervision. The subject of the thesis has been approved by the Student's Advisory Committee and Director of Instruction.

No part of the thesis has been submitted for any other degree or diploma or has been published. All the assistance and help received during the course of this investigation has been acknowledged by the scholar.

Place: Gwalior (Dr. N.K.S. Bhadauria)

Date Chairman of the Advisory Committee

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This is to certify that thesis the entitled **“Response of chickpea *(Cicer arietinum)* genotypes against pulse beetle *(Callosobruchus maculatus) (Fab.)*”** submitted by **Mr. Mayank Yadav** to the Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, Gwalior in partial fulfilment of the requirements for the degree of **MASTER OF SCIENCE IN AGRICULTURE** in the department of **Entomology, College of Agriculture, Gwalior** has been accepted after evaluation by the External Examiner and approved by the Student's Advisory Committee after an oral examination of the same.

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Director Instruction (Signature) ....

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Place: Gwalior

Date: (Mayank Yadav)

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Introduction

Gram like other pulses is exclusively used for human and cattle feed, serving as a main source of protein in the diet cum nutrition. In human diet it is mostly used as dal (split pulse), began (flour), crushed of whole grain, boiled packed, or cooked, salted or unsalted or sweet roasted preparations and green foliage and grain as vegetable are important forms in which it is consumed by people.

Pulses play an important role in human diet as they are considered to be main source of protein. The protein content of pulses range from 17-20 per cent. Protein being one of the most important elements, supplying the building material for the body, thus the importance of pulses in our diet can be easily appreciated.

India produced 16470 thousand tonnes of total pulses during 2015-16 (Anonymous, 2016). During the first 15 years of 21st century (2000-01 to 2014-15) on an average India produced 150.54 lakh tonnes of total pulses form 231.73 lakh ha area with a productivity of 647 kg/ha. During the last 15 years, the productivity of total pulses has increased 2.53 per cent production has gone up by 4.08 percent and the growth in area by 1.20 per cent per annum (Anonoymous, 2016).

India produced 112.29 lakh tonnes and area 105.61 lakh hectare of total pulses during 2017-18.

Pulse beetle is an important pest of chickpea in India under storage condition. There are three species of pulse beetle, *C. analis* (Raina, 1971), *C. chinensis Lin*. (Raddy and Singh, 1972) and *callosobruchus maculatus* (Fab.) (Salunkhi and Jadhav, 1982).

Pulses are produced on 12-15 per cent of the global arable land and their contribution to total human dietary protein nitrogen requirement is about thirty per cent (Graham and Vance, 2003). During the period 2001 to 2013, the average world pulses production was 63.8 million tonnes with a Compound Annual Growth Rate [CAGR] of 2.18 per cent (Soni, 2015).

The per cent grain damage in chickpea under storage condition by pulse beetle was reported in the range 62.78 to 81.60 per cent and loss in weight, from 35.6 to 75.7 per cent (Pokharkar and Chauhan, 2010)

The losses in seed by insect damage due to inappropriate storage in India has been reported to be lesser in chickpea (4.8%) in comparison to pigeon pea (32.68%), black gram (14.87%), Cowpea (18.49%) (Mukarjee *et al*.1970). Keeping these points in view, the present study were carried out to screen chickpea genotypes against pulse beetle with the following objectives.

Objectives of the investigation:

1. To screen less preferred genotypes of chickpea against pulse beetle on the basis of orientation and oviposition.
2. Appraisal of the losses caused by pulse beetle in different genotypes of chickpea.

REVIEW OF LITERATURE

A brief review of work done in M.P, India and abroad:

Khattak *et al.* (1991) carried out in laboratory experiments with 6 chickpea varieties, at 28±2°C, 60.5 per cent RH and LD 12:12, cv. CM-72 was the most resistant to infestation of *Callosobruchus chinensis.*

Muhammad and Maqbool (2005) screened grains of 22 chickpea genotypes for resistance to pulse beetle *(Callosobruchus analis)* under laboratory conditions (28±2°C and 60±5% RH). The results revealed that free choice oviposition by the beetle, adult progeny development. Grain damage and weight loss varied significantly ($P<=0.05$) among chickpea cultivars. The genotypes CM 3142-2/92, CM 88, CM 3142-3/92, CM 72, and Pb91 harboured significantly lower number of eggs, adult progeny development, damage and grain weight loss indicating resistance to *C. analis.* The preference of the bruchidae for host selection/oviposition seemed to be sensory to a larger extent as lower number of eggs were laid on wrinkled and black grains genotypes. The various characteristics of chickpea for resistance to bruchidae are discussed,

Pokharkar and Chauhan (2010) screened 11 chickpea *(Cicer arietinum)* genotypes against pulse beetle, *C. chinensis (L.).* Differences in their susceptibility were recorded on the basis of percentage grain damage, per cent weight loss and per cent germination. Maximum chickpea seed damage (81.60%) and weight loss (75.67%) were found in variety 'Kabuli' and germination (33.83%) was found in variety 'Vishal', while minimum seed damage (62.79%) and weight loss (35.63%) were found in variety 'Vishal' and less germination (11.83%) was found in variety 'Kabuli'.

Pokharkar and Mehta (2011) studied the biology of pulse beetle, *Callosobruchus chinensis* in stored chickpea. The results showed that the adult life span for male was 6.30+1.53 days where as for female 7.67+1.18 days. The total life span for male and female was 31.24+3.92 days. The Pre-oviposition, oviposition and post-oviposition periods were 7.46+0.99 hours, 7.88+1.20 days and 1.56+0.58 days, respectively. The average egg laid by female was 77.8. The hatchability of eggs recorded as 92 per cent and sex ratio of male and female was 1:0.96.

Jat *et al.* (2013) studied the losses caused by pulse beetle were estimated by releasing 1, 2, 4, 8 and 16 pairs of adult in jars each containing 500g chickpea grains. The lowest mean grain damage, weight loss and germination loss were recorded in case of one pair of adult pulse beetle i.e., 7.79, 1.81 and 4.55 per cent. While, highest losses were recorded in case of release of 16 pair i.e., 60.93, 13.99 and 44.57 per cent after 30 days of storage, respectively. The losses followed the same trend after 90 days of storage and reached to highest i.e., 41.44, 19.26 and 29.27 per cent in case of release of one pair of adult. While, 100, 46.13 and 100 per cent, respectively, in case of release of 16 pair of adult pulse beetle. The losses were increased with increase in storage period.

Sharma and Thakur (2014) studied a comparative growth performance of *Callosobruchus maculatus* on genotypes of soybean, cowpea & chickpea, and reported that the highest percentage of adult emergence, growth index, percentage reduction in weight and low development period was recorded in cowpea followed by chickpea [Kabuli>Deshi] and least in soybean.

Zanke *et al.* (2015) studied the food preferences of pulse beetle, *Callosobruchus maculatus (F.)* on six types of pulses under laboratory conditions, showed 5% attractions in *Cajanus cajan*,7.14 % in *Lens esculenta* (lentil), 27.6% in *Phaseolus mungo* (black gram), 31.9 % in *Vigna sinensis* (cowpea),7.35 % in *Cicer arietinum* (chickpea) and 9.25% in *Vigna aconitifolia* (matki), *Vigna sinensis* (cowpea) and *Phaseolus mungo* (black gram) were most preferred food for this species while *Cajanus cajan (*red gram) was comparatively less preferred for oviposition and further growth. Highest mean number of eggs were deposited on *Vigna sinensis* (61.56), while in *Cajanus cajan* least number of eggs were deposited (10.09). Eggs deposited on *Lens esculenta* (lentil) were 15.57, on *Phaseolus mungo* (black gram) were 50 09, on *Cicer arietinum* (chickpea) were 20.09 while in *Vigna aconitifolia* (matki) were 25.75 *Vigna sinensis* (cowpea) and *Phaseolus mungo* (black gram) were most preferred food and for oviposition and hence are suitable to prepare baits.

Singh *et al.* (2017) studied on the biology of pulse beetle, *Callosobruchus chinensis (L.)* (Coleoptera:Bruchidae) in stored chickpea under laboratory condition during 2016-17. The average incubation period, larval + pupa period, and adult longevity of male and female were 4.17, 27.7, 7.07 and 8.8 days respectively. The average of the total developmental period (egg to adult) was 34.62 days, and pre-oviposition, oviposition and post-oviposition period and fecundity were 0.4, 6.35, 1.95 and 89.7 days, respectively. The sex ratio of *C. chinensis* in case of chickpea produce more males as compared to females, resulted in 1:0 92

Mahmud *et al.* (2018) studied thereaction of pulse beetle, *Callosobruchus chinensis L.* to 20 genotypes of pulses belonging to lentil *(Lens culinarys Medik.)*, mung bean *(Vigna radiata (L) R. Wilczek)*, chickpea *(Cicerari etinum L.)* and black gram *(Vigna mungo. Hepper)* was evaluated in no choice test in the laboratory of the *Departmen*t *of Entomology, Bangladesh Agricultural University*, My men singh for observing the number of eggs deposition on seeds and percentage of damage of seed. Highest (73.1) number of eggs was laid on chickpea, while the lowest (19.5) was in black gram. The results revealed that all the genotypes of chickpea were found to have highly susceptible to pulse beetle and black gram genotypes were least susceptible. The susceptibility of lentil and mung bean were observed intermediate. Maximum (24.4%) of seed damage was observed on chickpea and the minimum (6-9%) was recorded in black gram. Except black gram, all the tested genotypes of chickpea, lentil and mung bean differed significantly for their susceptibility to the pulse beetle. The genotypes ML-22 of lentil, MC-21 of mung bean, Hyprosola of chickpea and MAK-1-79 of black gram were marked least susceptible in comparison with the tested genotypes of respective pulse species. Seed surface smoothness, seed coat thickness and chemical stimuli influenced on the oviposition and damage of pulses by the pulse beetle.

MATERIAL AND METHODS

A research experiment entitled, Response of chickpea *(Cicer arietinum*) genotypes against infestation of pulse beetle *(Callosobruchus maculatus) (Fab.)* was carried out in the Laboratory of Department of Entomology, College of Agriculture, Gwalior. The material used and methods followed in this investigation are as given below.

Pulse beetle *(Callosobruchus maculatus) (Fab.)* was reared in the laboratory to raise experimental culture of the insect. For rearing the insect in large numbers, about 500 g seed of local variety of chickpea was taken in glass jar and 100 pair of newly emerged adults were released in Jar. Jar was covered with muslin cloth and kept in incubators at 28±1°C temperature. After egg laying dead adults were removed by skiving. Fresh adults started merging after 22 to 28 days. The newly emerged adults were used for experiment.

Studies were conducted with 10 genotypes of chickpea having variation in seed size and seed coat colour. The genotypes were categorized as under (Table 3.1):

1. Seed size (on the basis of weight of 100 seeds)

(i) Small (less than 18 g/ 100 seeds)

(ii) Medium (18 to 21 g/ 100 seeds)

(iii) Bold (more than 21 g/ 100 seeds)

2. Seed coat colour (on the basis of visual observations)

(i) Light yellow

(ii) Brown

(iii) Dark brown

Table 3.1: The chickpea genotypes, their seed size and seed coat colour

S.N.	Genotypes	Weight of 100 seeds (g)	Seed size category	Seed coat colour Category
1.	RVKG-111	28.00	Bold	Light Yellow
2.	JG-14	22.90	Bold	Dark Brown
3.	RVSSG-32	19.10	Medium	Green Dark
4.	JG-12	18.42	Medium	Brown
5.	JG-18	23.02	Bold	Brown
6.	JG-63	16.92	Small	Light Brown
7.	RVG-202	20.56	Medium	Brown
8.	JAKI-9218	22.59	Bold	Brown
9.	JG-130	21.10	Bold	Brown
10.	BGD-112	17.20	Small	Green

Details of the experiment:

(A) Design : CRD

(B) Replication : 3

(C) Number of genotypes : 10

1. RVKG-111
2. JG-14
3. RVSSG-32
4. JG-12
5. JG-18
6. JG-63
7. RVG-202
8. JAKI-9218
9. JG-130
10. BGD-112

Two experiments were conducted during the present investigations. The details of which are as under:

Experiment No. 1:

Orientation and ovipositional preference were assessed under free choice conditions. Fifty seeds of each genotype were kept in open Petridis and arranged randomly in glass trough. Fifty pairs of freshly emerged beetles were released in the centre of the trough and the glass trough was then covered with muslin cloth. The adult oriented in every genotype w counted at 72 hours after their release and then were removed. The experiment was replicated three times. Seven days after removing the adult, the eggs laid in each genotype was counted to note the ovipositional preferences.

Experiment No. 2:

Fifty seed of each genotype were kept in Petridis replicated three times. Five pairs of pulse beetle were released in each Petridis for 72 hours and then removed. Petridis were observed daily to record the beetle emerged. Extent of grain damage was worked out. Weight of healthy and damaged seed were also recorded to work out the per cent loss in grain weight.

The data obtained statistically analysed by using the analysis of variance as described by (C.R.D.) Completely Randomized Design.

RESULTS

During the present investigation, chickpea genotypes were screened against pulse beetle on the basis of orientation and ovipositional preference, losses caused by the pest. The obtained results are presented here with:

A. RESPONSE OF GENOTYPES UNDER FREE CHOICE CONDITION

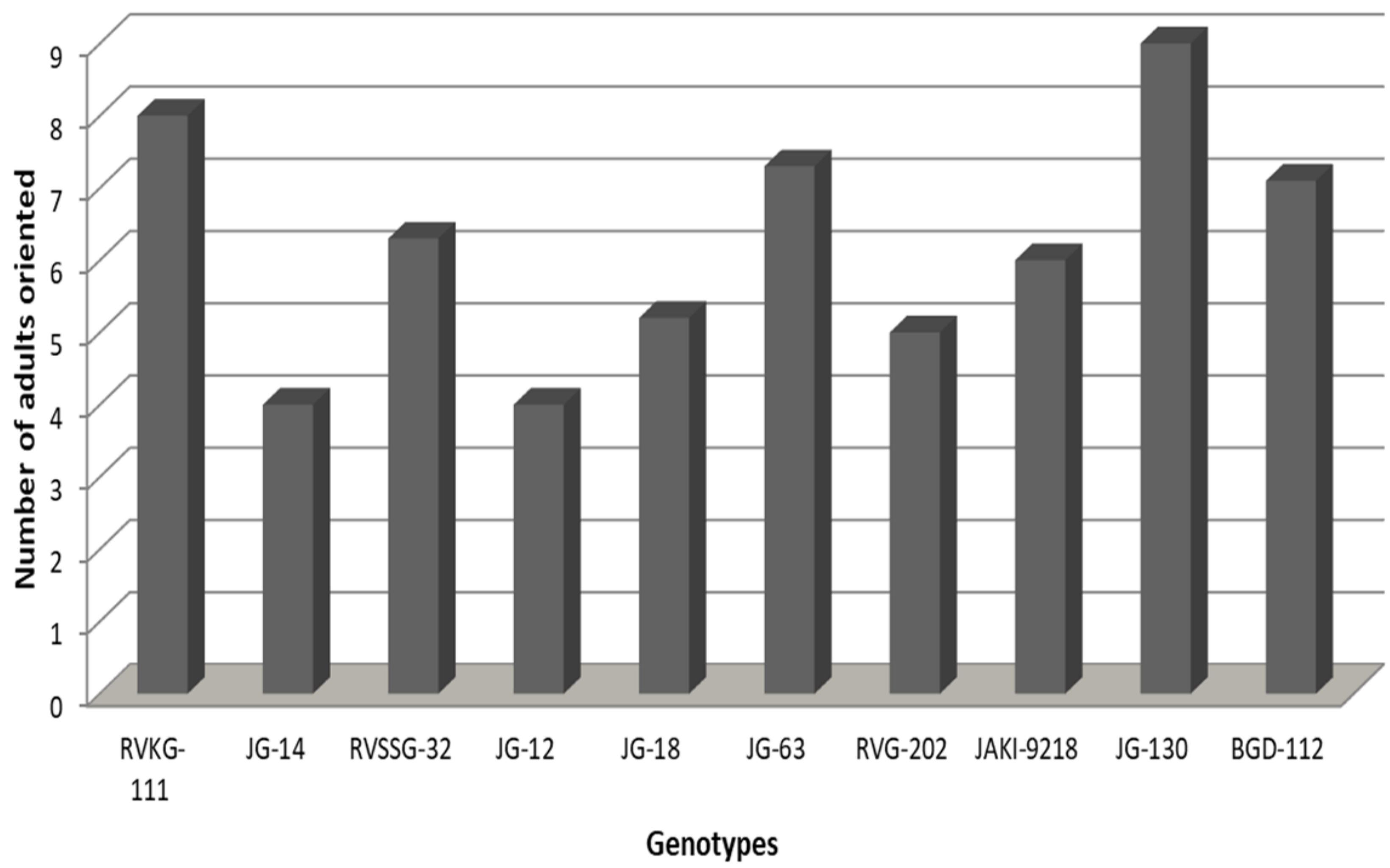
Orientational preference

Data recorded on number of adults oriented on different genotypes showed significant differences among the genotypes (table 4.1 and Fig1). Minimum number of adult (4.0) were oriented on JG-12 and JG-14 which was found Significantly less than the adults oriented on genotypes RVG-202 (5.0), JG-18 (5.2), JAKI-9218 (6.0), RVSSG-32 (6.3).

Table 4.1: Number of adults oriented on different genotypes of chickpea

	Genotypes	Number of adults oriented
1.	RVKG-111	8.00
2.	JG-14	4.00
3.	RVSSG-32	6.30
4.	JG-12	4.00
5.	JG-18	5.20
6.	JG-63	7.30
7.	RVG-202	5.00
8.	JAKI-9218	6.00
9.	JG-130	9.00
10.	BGD-112	7.10
SE (m)±		0.613
CD at 5 %		1.821

Fig 1: Number of adults oriented on different genotypes of chickpea



The maximum adult orientation (9.0) was observed in genotypes JG-130, which was found significantly higher than the adults oriented on genotypes RVKG-111, JG-63, BGD-112, RVSSG-32, but was at par with rest of the genotypes.

Ovipositional preference

There were significant differences in the egg deposition on different genotypes (Table 4.2 and Fig 2). Significant lower number of eggs (10.4) was laid on genotypes JG-14 and JG-12 than rest of the genotypes, except RVG-202, JG-18, JAKI-9218, RVSSG-32. Whereas, maximum number of eggs (20.2) were laid in genotypes JG-130, which was found significantly higher than the number of eggs laid on genotypes RVKG-111, JG-63, BGD-112, RVSSG-32, but was at par with rest of the genotypes.

Table 4.2: Number of eggs laid on different genotypes under free choice

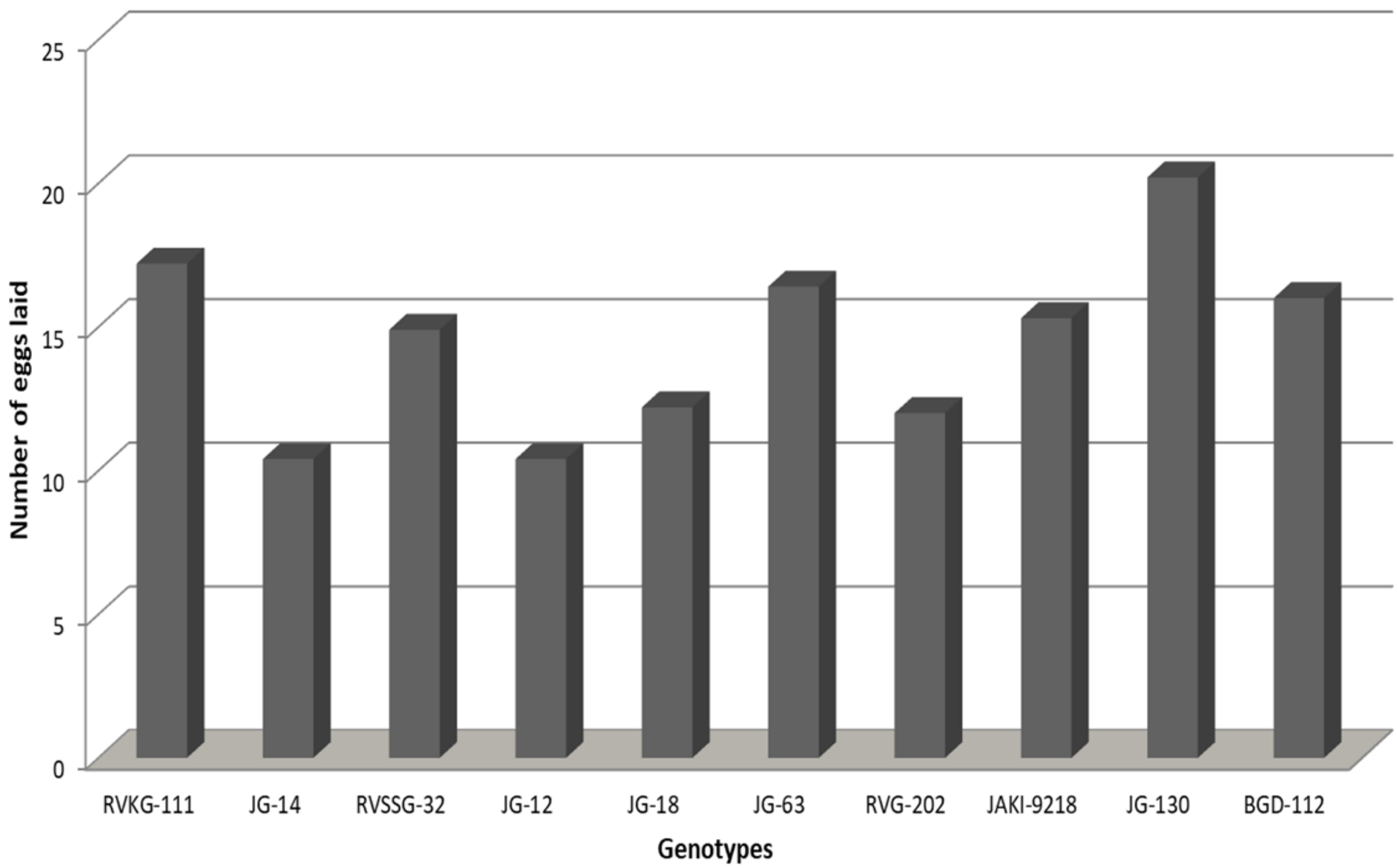
	Genotype	Number of eggs laid
1.	RVKG-111	17.20
2.	JG-14	10.40
3.	RVSSG-32	14.90
4.	JG-12	10.40
5.	JG-18	12.20
6.	JG-63	16.40
7.	RVG-202	12.00
8.	JAKI-9218	15.30
9.	JG-130	20.20
10.	BGD-112	16.00
SE (m) ±		0.383
CD at 5 %		1.137

B. RESPONSE UNDER FORCED CONDITION

Ovipositional preference

Data recorded on number of eggs laid on different genotypes showed significant differences among the genotypes (Table 4.3 and Fig 3).

Fig 2: Number of eggs laid on different genotypes under free choice



Minimum and significantly less egg deposition (41.0) was recorded on genotypes BGD-112 than the egg deposition RVSSG-32 (55.3), JG-14 (66.9), JG-130 (74.4), RVG-202 (79.5). Whereas, maximum number of eggs was laid on genotypes JG-12 (116.0), which was found significantly higher than the egg deposition on remaining genotypes, except RVKG-111 (107.0), JG-18 (99.7) and JAKI-9218 (92.0).

Table 4.3: Number of eggs laid different genotypes under forced condition

	Genotypes	Number of eggs laid
1.	RVKG-111	107.00
2.	JG-14	66.90
3.	RVSSG-32	55.30
4.	JG-12	116.00
5.	JG-18	99.70
6.	JG-63	83.20
7.	RVG-202	79.50
8.	JAKI-9218	92.00
9.	JG-130	74.40
10.	BGD-112	41.00
SE (m)±		0.445
CD at 5 %		1.323

Number of adults emerged under forced condition

The number of adult emerged from different genotypes of chickpea under forced condition were significantly different (Table 4.4 and Fig 4). Minimum per cent adult emergence (22.0) was recorded from genotype BGD-112, followed by RVSSG-32 (23.2) and JG-14. Whereas, maximum per cent adult emergence (41.8) was recorded in genotype RVKG-111 (40.3), followed by RVG-202 (38.1), JG-63 (36.7), JG-130 (33.4), JAKI-9218 (29.0).

Fig 3: Number of eggs laid different genotypes under forced condition

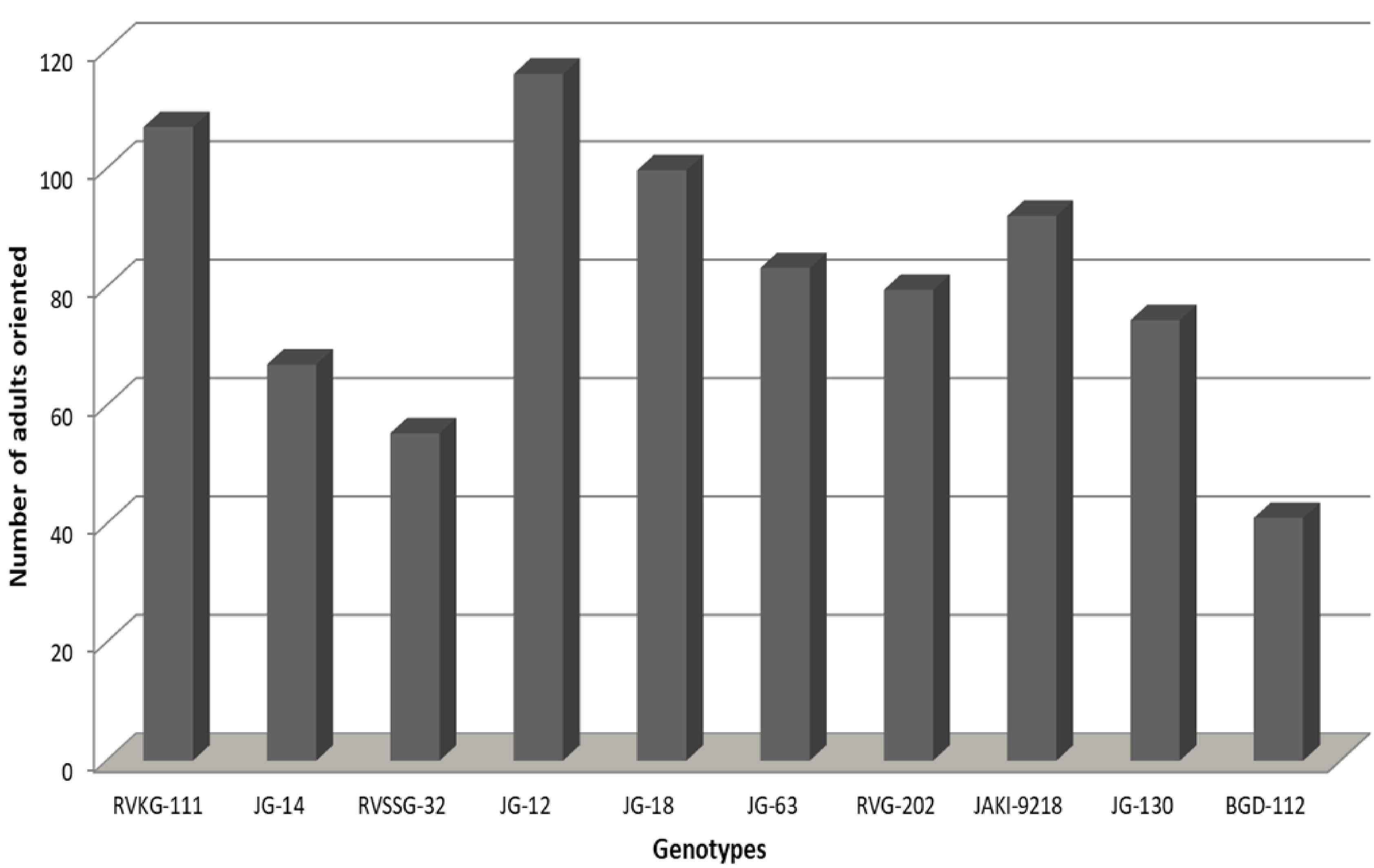


Table 4.4 Number of adults emerged on different genotypes under forced condition

	Genotypes	Number of adults emerged
1.	RVKG-111	40.30
2.	JG-14	24.70
3.	RVSSG-32	23.20
4.	JG-12	41.80
5.	JG-18	26.60
6.	JG-63	36.70
7.	RVG-202	38.10
8.	JAKI-9218	29.00
9.	JG-130	33.40
10.	BGD-112	22.00
SE (m)±		0.638
CD at 5 %		1.896

Percentage of seed infestation (Table 4.5)

Significant differences were observed among different genotypes of chickpea with regards to per cent seed infestation (Fig 5). Genotype 'RVSSG-32' had minimum (36.40%) of seed infestation, which was significantly less than rest of the genotypes, except JG-12 (38.1%), RVG-202(39.5%) and BGD-112 (40.6%). On the other hand genotype RVKG-111 recorded maximum (36.4) per cent of seed infestation, which was found significantly higher than the seed infestation in rest of the genotypes, except JG-18 (57.9%), JG-130 (57.0%) and JG-63 (51.7%).

Per cent loss in seed weight (table 4.5)

Per cent loss in weight was in range of 18.7 to 29.0 in different genotypes with significant differences among genotypes (Fig 5). Significantly less per cent loss in seed weight was observed in genotype RVSSG-32 (18.7%) than rest of the genotypes, except JG-12 (19.3%), RVG-202 (20.0%) and BGD-112 (21.9%).

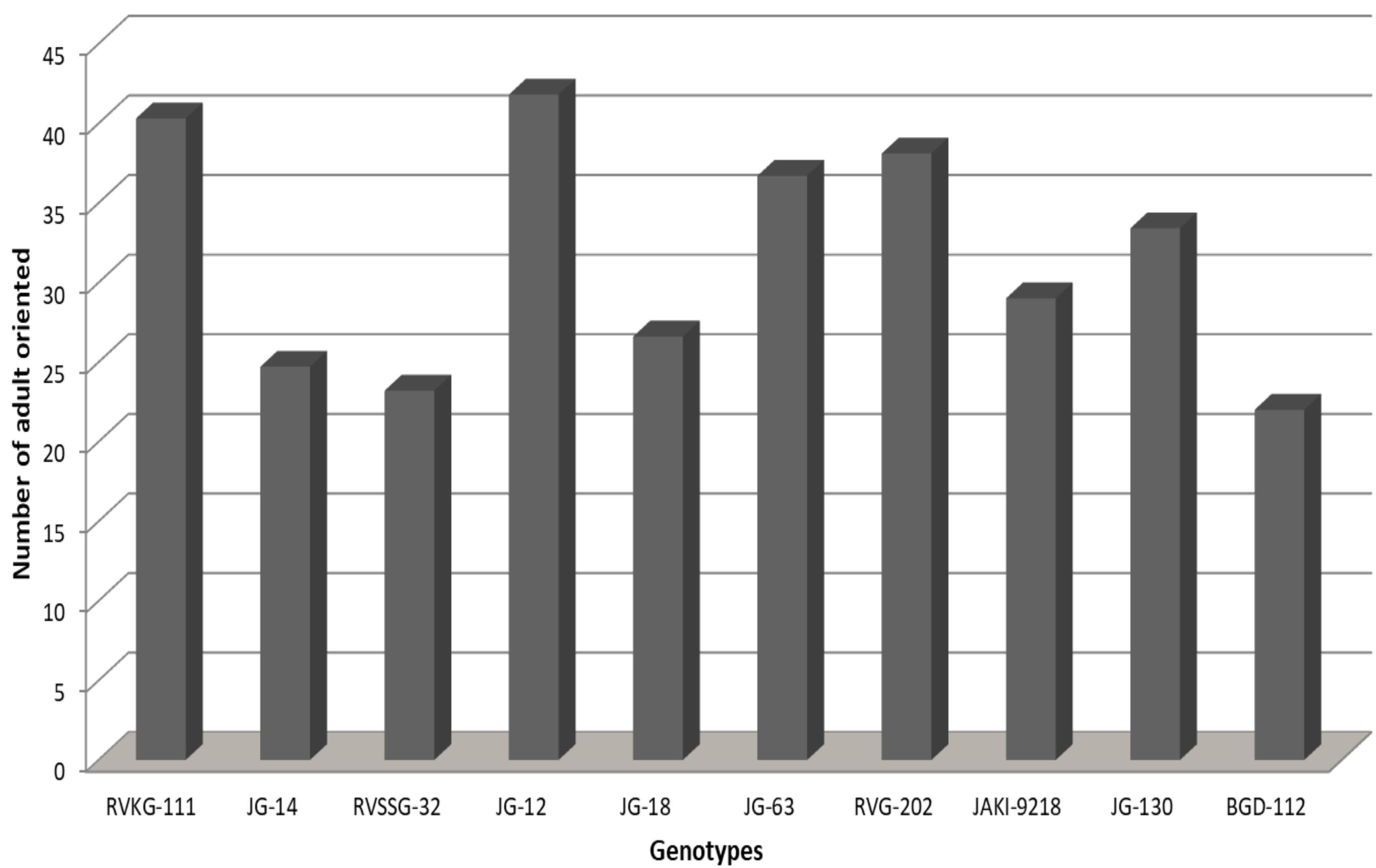


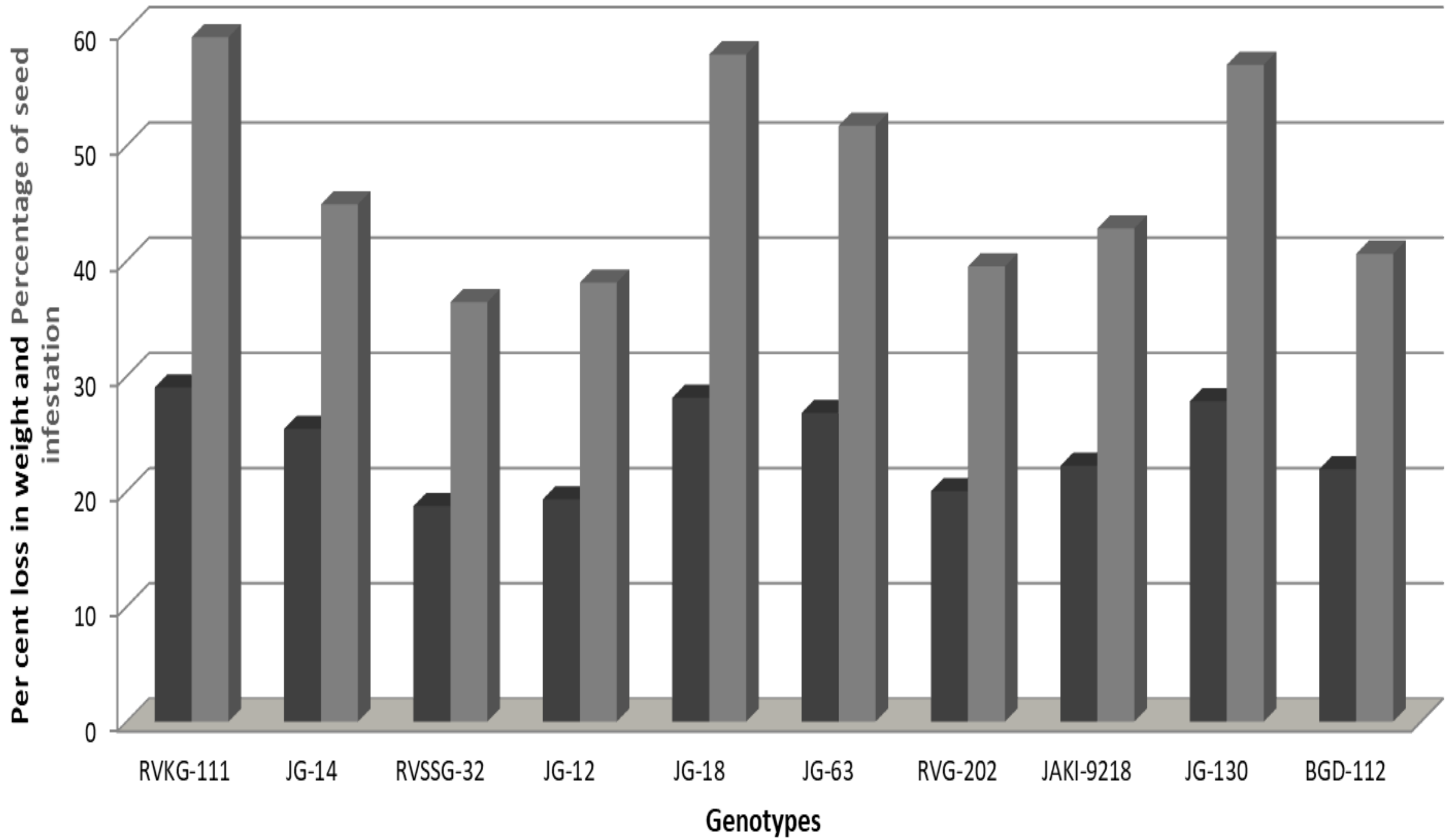
Fig 4: Number of adults emerged on different genotypes under forced condition

On the other hand genotype RVKG-111 recorded maximum (29.0) per cent loss in seed weight, but at par to JG-18 (28.1%), JG-130 (27.8%) and JG-63 (26.8%).

Table 4.5: Per cent seed infestation (damage) and loss in seed weight caused by pulse beetle in different genotypes

S.N.	Genotypes	Percentage of seed Infestation (damage)	Per cent loss in weight
1.	RVKG-111	59.40	29.00
2.	JG-14	34.90	25.40
3.	RVSSG-32	36.40	18.70
4.	JG-12	38.10	19.30
5.	JG-18	57.90	28.10
6.	JG-63	51.70	26.80
7.	RVG-202	39.50	20.00
8.	JAKI-9218	32.80	22.20
9.	JG-130	57.00	27.80
10.	BGD-112	40.60	21.90
	SE (m)±	0.368	0.373
	CD at 5 %	1.092	1.107

Fig 5: Per cent loss in weight and per cent seed infestation due to pulse beetle in different genotypes of chickpea



DISCUSSION

During the course of present investigations, influence of ten genotypes of chickpea having variation was studied for their response to orientation, ovipositional preference of pulse beetle, *Callosobruchus maculatus*. The loss in seed weight due to pulse beetle were also recorded. The obtained data during present investigation are discussed here with.

Observation recorded on number of adults oriented on different genotypes showed that genotype JG-14 was less preferred for orientation followed by JG-14 and RVG-202, whereas, genotype JG-130 was found highly preferred for orientation of the C. *maculatus.*

The minimum and similar egg deposition on genotypes JG-12 and JG-14 indicate that these genotypes were less preferred by the pulse beetle for oviposition, followed by RVG-202, JG-18, and RVSSG-32. Whereas, genotypes JG-130 was highly preferred by pulse beetle for oviposition.

The egg deposition on all the genotypes under free choice condition was observed in correspondence to the orientation of the beetle on different genotypes.

Minimum oviposition on genotype BGD-112 indicated their less suitability by the beetle. The egg deposition on genotypes JG-12, JG-18 and RVG-202 was less under free choice condition and highly under forced conditions.

The variation in oviposition on presence of these genotypes may be due to different number of adults on similar quality of seed.

The egg deposition on genotype JG-12 under forced condition was significantly higher, whereas under free choice condition the egg deposition was significantly less, this indicate that JG-12 was most preferred for oviposition and less preferred for orientation.

Minimum adult emerged on genotype BGD-112, followed by genotypes RVSSG-32, JG-14, and JG-18. The adult emerged on genotypes JG-12, RVKG-111 and RVG-202 under forced condition was comparatively higher.

During present Investigation JG-12 and JG-14 were found less preferred for orientation and oviposition.

During present investigation the per cent seed infestation and loss in seed weight among different genotypes ranged from 36.4 to 59.4 per cent and 18.7 to 29.0 per cent respectively.

Pokharkar and Chauhan (2010) also reported 62.79 to 81.60per cent seed damaged and 36.63 to 75.67 per cent loss in grain weight by pulse beetle in different genotypes of chickpea.

On the basis of per cent seed infestation and per cent loss in seed weight genotype RVSSG-32 was found less preferred by pulse beetle followed by JG-12 and RVG-202.Whereas, genotype RVKG-111 was found most preferred by the beetle followed by JG-18 and JG-130.

Muhammad and Maqbool (2005) screened grains of 22 chickpea genotypes for resistance to pulse beetle *(Callosobruchus analis)* under laboratory conditions (28±2°C and 60±5% RH). The genotypes CM 3142-2/92, CM 88, CM 3142-3/92, CM 72, and Pb91 harboured significantly lower number of eggs, adult progeny development, damage and grain weight loss indicating resistance to *C. analis.*

Sharma and Thakur (2014) studied a comparative growth performance of *Callosobruchus maculatus* on genotypes of soybean, cowpea & chickpea, and reported that the highest percentage of adult emergence, growth index, percentage reduction in weight and low development period was recorded in cowpea followed by chickpea [Kabuli>Deshi] and least in soybean.

Singh *et al.* (2017) studied on the biology of pulse beetle, *Callosobruchus chinensis (L.)* (Coleoptera:Bruchidae) in stored chickpea under laboratory condition during 2016-17. The sex ratio of *C. chinensis* in case of chickpea produce more males as compared to females, resulted in 1:0 92

SUMMARY, CONCLUSIONS AND SUGGESTIONS FOR FURTHER WORK

During the present investigation, chickpea genotypes were screened against pulse beetle on the basis of orientation and ovipositional preference, losses caused by the pest. *Callosbruchus maculatus (Fab.)* were conducted under laboratory conditions in the Department of Entomology, College of Agriculture, Gwalior (M.P.) during 2020-21. Per cent seed infestation and per cent loss in Seed weight due to beetle attack was also studied. Ten genotypes with variation seed weight and were included for the Study. The findings are summarized here with.

Observation recorded on number of adults oriented on different genotypes showed that genotype JG-14 was less preferred for orientation followed by JG-14 and RVG-202, whereas, genotype JG-130 was found highly preferred for orientation of the C. *maculatus.*

The minimum and similar egg deposition on genotypes JG-12 and JG-14 indicate that these genotypes were less preferred by the pulse beetle for oviposition, followed by RVG-202, JG-18, and RVSSG-32. Whereas, genotype JG-130 was highly preferred by pulse beetle for oviposition.

The egg deposition on all the genotypes under free choice condition was observed in correspondence to the orientation of the beetle on different genotypes.

Minimum oviposition on genotype BGD-112 indicated their less suitability by the beetle. The egg deposition on genotypes JG-12, JG-18 and RVG-202 was less under free choice condition and high under forced conditions.

The variation in oviposition on presence of these genotypes may be due to different number of adults on similar quality of seed.

The egg deposition on genotype JG-12 under forced condition was significantly higher, whereas under free choice condition the egg deposition was significantly less, this indicate that JG-12 was most preferred for oviposition and less preferred for orientation.

Minimum adult emerged on genotype BGD-112, followed by genotypes RVSSG-32, JG-14, and JG-18. The adult emerged on genotypes JG-12, RVKG-111 and RVG-202 under forced condition was comparatively higher.

During present Investigation JG-12 and JG-14 were found less preferred for orientation and oviposition.

During present investigation the per cent seed infestation and loss in seed weight among different genotypes ranged from 36.40 to 59.40 per cent and 18.70 to 29.00 per cent respectively.

On the basis of per cent seed infestation and per cent loss in seed weight genotype RVSSG-32 was found less preferred by pulse beetle followed by JG-12 and RVG-202.Whereas, genotype RVKG-111 was found most preferred by the beetle followed by JG-18 and JG-130.

CONCLUSIONS

Genotype JG-12 and JG-14 were found less preferred for orientation and oviposition by the pulse beetle, followed by RVG-202, JG-18, JAKI-9218 and RVSSG-32.

Genotype JG-130 was found highly preferred for orientation and oviposition by the pulse beetle, followed by RVKG-111.

The per cent loss in seed weight due to pulse beetle ranged from18.7 to 29.0% in different genotypes of chickpea.

Genotype RVSSG-32 was found less susceptible, followed by JG-12 and RVG-202 with regard to seed damage and loss in seed weight due to pulse beetle.

SUGGESTIONS FOR FURTHER RESEARCH WORK

The physical parameters have not shown very clear indication for deciding cause of resistance; it is felt necessary to undertake the biochemical studies on the multiplication of pules beetle for a considerable period.

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