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Relative Susceptibility of Groundnut Genotypes to the Storage Insect, *Caryedon serratus*

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Abstract An experiment was conducted to know the relative preference of groundnut bruchid to groundnut genotypes under laboratory conditions. Based on different parameters viz., oviposition, per cent adult emergence, mean development period and growth index of *C. serratus*. Out of 19 genotypes, Narayani and K 9 were found to be less susceptible under both no choice and free choice conditions. Narayani, K 9 and ICGV 87846 had less number of eggs and adult emergence, prolonged mean developmental period, less growth index with low per cent pod damage and were categorized as Less susceptible genotypes. Similarly the genotypes, Dharani, K 1535 and ICGV 00350 with high number of eggs and adult emergence, shorter mean development period, high growth index with high per cent pod damage were considered as highly susceptible genotypes.

Keywords *C. serratus*, Growth index, Pod damage.

Introduction

Groundnut is the most important oilseeds crop grown in Andhra Pradesh mainly cultivated in Rayalaseema districts viz., Anantapur, Cuddapah, Kurnool and Chittoor districts followed by Coastal districts, covering an area of 1.38 M ha with a production of 1.23 Mt [1]. In India, total loss of groundnut produce in storage was up to 12.3% with an estimated monitory loss of 911 crore rupees [2]. Groundnut bruchid, *C. serratus* (Olivier) (Bruchidae : Coleoptera), a major insect pest that can inflict colossal losses to pods as well as kernels. This insect pest also causes qualitative losses such as, maximum loss in the oil percentage, increase in free fatty acids and crude protein percentage [3]. Management of this insect pest has become a problem due to its continued exposure to various synthetic insecticides over the period and subsequent development of resistance. However, identification of extent of tolerance against *C. serratus* will be helpful in management or for improving the existing varieties genetically. Keeping this in view, an attempt was made to

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screen some groundnut genotypes for resistance to the groundnut bruchid.

Materials and Methods

As many as nineteen groundnut genotypes, Abhaya, Dharani, Narayani, TPT 4, TCGS 1157, TCGS 1342, TCGS 1343 and TCGS 1273, Harithandra, K6, K9, K 1501, K 1535 and K 1454, ICGV 03057, ICGV 91114, ICGV 00350, ICGV 87846 and ICGV 93468 were screened. Healthy groundnut pods (100 g) of each genotype were taken in a jar and three pairs of newly emerged *C. serratus* beetles were released into each jar. Three replications were maintained for each treatment. The adult beetles were removed after 10 days and the number of eggs laid on pods of different genotypes was counted. Later the jars were kept for observation under laboratory conditions till the emergence of adults. The adults of *C. serratus* that emerged from different treatments were counted daily and removed from the respective jars. Counting was continued till they cease to emerge. Final data was pooled to get the total number of adults emerged and per cent adult emergence was calculated. The mean developmental period of immature phases (i.e., egg to adult emergence) of the bruchid on different genotypes was calculated by using the formula given by Howe [4], damaged groundnut pods were separated, counted and expressed as per cent pod damage and growth index was measured by dividing per cent adult emergence by developmental period of *C. serratus.*

Free-Choice test was also conducted with groundnut pods (5 No.) of each genotype in five replications. Fifteen pairs of 2-3 days old adults were released at the center. Adults were removed after one day of release and the egg count was taken using illuminayted magnifying lens. Later the jars were kept undisturbed till the emergence of adults under laboratory conditions. Adult emergence and development period of the bruchid were recorded and analysed. The categorization of groundnut genotypes

Table 1. Relative preference of *Caryedon serratus* to groundnut genotypes under no-choice condition. *Values in parenthes are square root transformed values, **Values in parentheses are angular transformed values, In each column values with similar alphabet do not vary significantly at p=0.05.

Sl. No.	Genotype	Eggs/100g (No.)*	Adult emergence (No.)*	Mean development period (days)	Growth index	Pod damage (%)**
1	TCGS 1273	23.00 (4.78)^{a}	17.33 (4.14)^{abc}	42.65^{abc}	1.60^{cdef}	30.37 (3.16)^{defg}
2	TCGS 1157	28.67 (5.35)^{b}	22.33 (4.71)^{cde}	43.36^{abc}	1.56^{bcde}	35.66 (3.42)^{ghi}
3	TCGS 1342	33.33 (5.77)^{bcd}	27.00 (5.19)^{efgh}	42.60^{abc}	1.62^{cdefg}	34.76 (3.38)^{ghi}
4	TCGS 1343	40.67 (6.37)^{ef}	33.33 (5.77)^{hijk}	42.95^{abc}	1.41^{abc}	34.32 (3.35)^{fghi}
5	TPT4	21.67 (4.65)^{a}	16.33 (4.03)^{ab}	43.40^{abc}	1.73^{defgh}	37.15 (3.49)^{hi}
6	Abhaya	22.67 (4.75)^{a}	17.33 (4.14)^{abc}	44.89^{abcd}	1.51^{abcd}	27.54 (3.01)^{cde}
7	Narayani	20.33 (4.50)^{a}	13.67 (3.69)^{a}	50.12^{d}	1.36^{ab}	20.26 (2.58)^{ab}
8	Dharani	44.00 (6.63)^{fg}	39.00 (6.24)^{jk}	40.08^{a}	2.01^{ij}	38.97 (3.58)^{hi}
9	K 6	42.00 (6.48)^{efg}	33.67 (5.80)^{hijk}	42.96^{abc}	1.83^{fghi}	27.93 (3.03)^{cdef}
10	Harithandra	32.33 (5.68)^{bc}	25.33 (5.02)^{def}	42.23^{abc}	1.87^{hij}	35.69 (3.42)^{ghi}
11	K 6	21.00 (4.57)^{a}	14.33 (3.77)^{a}	49.56^{d}	1.29^{a}	17.71 (2.41)^{a}
12	K 1501	32.33 (5.68)^{bc}	26.00 (5.08)^{defg}	45.57^{bcd}	1.76^{efgh}	23.58 (2.78)^{bc}
13	K 1535	41.00 (6.40)^{efg}	36.00 (5.99)^{ijk}	41.18^{ab}	1.93^{hij}	41.06 (3.67)^{i}
14	K 1454	31.67 (5.62)^{bc}	25.67 (5.06)^{def}	44.01^{abc}	1.85^{ghi}	25.73 (2.91)^{cd}
15	ICGV 91114	39.33 (6.27)^{def}	31.67 (5.63)^{fghi}	43.82^{abc}	1.82^{fghi}	33.62 (3.32)^{efgh}
16	ICGV 00350	47.33 (6.88)^{g}	40.33 (6.35)^{k}	41.68^{a}	2.10^{j}	37.76 (3.52)^{hi}
17	ICGV 93468	42.00 (6.48)^{efg}	32.33 (5.67)^{ghij}	42.43^{abc}	1.83^{fghi}	33.63 (3.32)^{efgh}
18	ICGV 03057	37.00 (6.08)^{cde}	29.00 (5.37)^{fgh}	43.30^{abc}	1.78^{efgh}	33.14 (3.30)^{efgh}
19	ICGV 87846	30.33 (5.50)^{b}	21.0 (4.58)^{bcd}	47.36^{cd}	1.46^{abc}	24.68 (2.84)^{bcd}
	SEm±	0.18	0.21	1.90	0.08	0.12
	CD (0.05)	0.50	0.60	5.43	0.24	0.33
	CV%	5.34	7.22	7.48	8.43	6.26

Table 2. Relative preference of *Caryedon serrotus* to groundnut (pods) genotypes under free-choice condition. Values in parentheses are square root transformed values, In each column values with similar alphabet do not vary significantly at p=0.05.

Sl. No.	Genotype	Eggs/5 pods (No.)	Adult emergence (No.)	Mean development period (days)	Growth index
1	TCGS 1273	28.0 (5.29)^{ab}12.33	(3.51)^{def}	39.60^{a}	1.12^{i}
2	TCGS 1157	39.7 (6.28)^{cde}	16.00 (3.99)^{ghi}	42.21^{ab}	0.97^{h}
3	TCGS 1342	28.7 (5.31)^{ab}	12.33 (3.46)^{def}	42.92^{ab}	0.99^{h}
4	TCGS 1343	37.0 (5.99)^{bc}	13.00 (3.58)^{ef}	43.72^{abc}	0.86^{fg}
5	TPT 4	23.0 (4.78)^{a}	9.33 (3.05)^{bc}	40.16^{a}	1.02^{h}
6	Abhaya	26.0 (5.09)^{a}	11.00 (3.26)^{cde}	43.32^{abc}	0.96^{hg}
7	Narayani	21.7 (4.65)^{a}	7.00 (2.64)^{ab}	49.84^{de}	0.66^{cd}
8	Dharani	49.7 (7.02)^{fg}	23.33 (4.83)^{j}	39.05^{a}	1.24^{j}
9	K 6	42.3 (6.47)^{cdef}	13.00 (3.60)^{efg}	43.60^{abc}	0.74^{de}
10	Harithandra	45.0 (6.71)^{defg}	13.33 (3.65)^{efg}	45.13^{bcd}	0.66^{d}
11	K 9	23.3 (4.82)^{a}	5.33 (2.29)^{a}	47.90^{cde}	0.47^{a}
12	K 1501	52.7 (7.24)^{g}	15.00 (3.87)^{fgh}	45.83^{bcd}	0.64^{c}
13	K 1535	52.0 (7.20)^{g}	18.00 (4.24)^{hi}	42.09^{ab}	0.83^{ef}
14	K 1454	39.3 (6.27)^{cde}	9.67 (3.11)^{cd}	40.14^{a}	0.62^{c}
15	ICGV 91114	45.0 (6.66)^{cdefg}	15.00 (3.85)^{fgh}	43.16^{abc}	0.79^{ef}
16	ICGV 00350	48.0 (6.92)^{efg}	19.33 (4.39)^{i}	41.16^{ab}	0.98^{h}
17	ICGV 93468	47.7 (6.89)^{efg}	14.00 (3.73)^{fg}	52.65^{ef}	0.58^{bc}
18	ICGV 03057	41.7 (6.44)^{cdef}	13.67 (3.69)^{fg}	49.87^{de}	0.67^{cd}
19	ICGV 87846	36.7 (6.05)^{cd}	9.67 (3.11)^{cd}	54.93^{f}	0.49^{ab}
	SEm±	0.25	0.14	1.71	0.03
	CD (0.05)	0.71	0.41	4.91	0.09
	CV%	7.01	6.91	6.65	6.90

was done based on the criteria developed by Shivalingaswamy and balasubramanian [5].

Results and Discussion

The genotypes screened under no-choice test, data recorded on different parameters are presented in Table 1. Results indicated that the insects reacted differently on different genotypes for oviposition and none of the genotypes was free from oviposition. The number of eggs laid varied from 20.33 to 47.33 eggs on 100 g of groundnut pods of different genotypes. Lowest number of eggs was laid in Narayani (20.33) and K 9 (21.00), TPT 4 (21.67), Abhaya (22.67) were at par with Narayani. The highest number of eggs was laid in ICGV 00350. The lowest oviposition on Narayani may be due to prominent reticulations on pod surface Haritha et al. [6], also recorded lowest egg laying on ICGS 76 pods with prominent reticulation. Highest number of eggs were noticed in ICGV 00350 (47.33). Bigger size of the pods might have contributed for high egg laying as reported by Dick [7]. True to this, lowest number of eggs were recorded in K 9 (21.0) which are of small sized pod compared to other genotypes . There were significant differences in the number of adults emerged from the pods of different groundnut genotypes. The number of adults emerged was lowest in Narayani (13.67) and the highest number of adults emerged recorded in ICGV 00350 (40.33). The lowest developmental period was recorded in Dharani (40.08 days) and the highest developmental period in genotype Narayani (50.12 days). The growth index of *C. serratus* on different groundnut genotypes ranged from 1.29 to 2.10. The growth index of *C. serratus* on K 9 (1.29) was the lowest which was followed by Narayani (1.36) and TCGS 1343 (1.41) and the highest growth index was in ICGV 00350 (2.10). It was inferred that preferred genotypes resulted in higher growth index, while less preferred genotypes showed lesser growth index. Prasad et al. [8], also observed maximum growth index in cultivars K 4 and ICG (FDRS) 10 that these cultivars were highly susceptible to groundnut

Table 3. Relative susceptibility of groundnut (pods) genotypes to *C. serratus* (no-choice test).

Parameters	Less susceptible (Mean-SD)	Moderately susceptible (Mean-SD to Mean+SD)	Highly susceptible (Mean + SD)
Oviposition (eggs/1oog) Mean=33.19 SD = 8.61	TCGS 1273, TPT 4, Abhaya, Narayani K 9	TCGS 1157, TCGS 1342, TCGS 1343, Harithandra, K 1501, K 1535, K 1454, ICGV 91114, ICGV 03057, ICGV 87846	Dharani, K 6 ICGV 00350 ICGV 93468
Adult Emergence (No.) Mean = 26.40 SD = 8.29	TCGS 1273, TPT 4, Abhaya Narayani, K 9	TCGS 1157, TCGS 1342, TCGS 1343, K 6 Harithandra, K 1501, K 1454, ICGV 91114, ICGV 93468, ICGV 03057, ICGV 87846	Dharani, K 1535, ICGV 00350
Mean Development Period (Days) Mean = 43.88 SD = 2.65	Narayani, K 9, ICGV 87846	TCGS 1273,TCGS 1157, TCGS 1342, TCGS 1343, TPT 4, Abhaya, K 6, Harithandra, K 1501, K 1454, ICGV 91114, ICGV 93468, ICGV 03057	Dharani, K 1535, ICGV 00350
Growth Index Mean = 1.70 SD = 0.23	TCGS 1343, Narayani, K 9, ICGV 87846	TCGS 1273, TCGS 1157, TCGS 1342, TPT 4, Abhaya, K 6, Harithandra, K 1501, K 1454, ICGV 91114, ICGV 93468, ICGV 03057	Dharani, K 1535, ICGV 00350
Pod Damage (%) Mean = 31.24 SD = 6.54	Narayani, K 9, K 1501, ICGV 87846	TCGS 1273, TCGS 1157, TCGS 1342, TCGS 1343, TPT 4, Abhaya, K 6, Harithandra, K 1454, ICGV 91114, ICGV 93468, ICGV 03057	Dharani, K 1535, ICGV 00350
Weight Loss (%) Mean = 9.81 SD = 2.11	Narayani, K 6, K 9, ICGV 87846	TCGS 1273, TCGS 1157, TCGS 1342, TCGS 1343, Abhaya , Harithandra, K 1501, K 1454, ICGV 91114, ICGV 93468, ICGV 03057	TPT 4, Dharani,K 1535, ICGV 00350

bruchid. The per cent pod damage was ranged from 17.71 to 41.06%. Najitha et al. [9], also recorded minimum pod damage in genotypes Abhaya and K 1576.

Under free-choice condition, the results indicated that the number of eggs laid by *C. serratus* varied from 21.7 to 52.7 eggs/5 pods. (Table 2). The lowest number of eggs was recorded in Narayani (21.7) and the highest number of eggs was recorded in K 1501 (52.7). Harish et al. [10],reported lowest number of eggs 19.30 in T 28 variety. The number of emerged adults varied from 5.33 to 23.33/5 pods from the tested goundnut genotypes. The minimum number of adult emergence was noticed in genotypes K 9 (5.33 /5 pods) and was at par with Narayani (7.0/ 5 pods) . The maximum number of adult emergence recorded in genotype Dharani (23.33). The mean development period of *C. serratus* ranged between 39.05 to 54.93 days with significant differences between the groundnut genotypes. The highest mean development period was recorded in genotypes ICGV 87846 (54.93), indicating least susceptibility to *C. serratus* growth and development and Dharani (39.05 days) recorded lowest mean development period indicating high susceptibility. These results on adult emergence and mean development period were in accordance with the reports of Haritha et al. [6]. Growth index for different groundnut genotypes were significantly differed and values varied from 0.47 and 1.24. The genotype Dharani (1.24) recorded highest GI and lowest was in K 9 (0.47) indicating highest and lowest suscetibility to C. serratus.

The genotypes were categorized based on the criteria suggested by Shivalingaswamy and Balasubramanian [5], among the 19 genptypes (no choice test), Narayani and K 9 were found to be most superior i.e. least susceptible (Tables 3 and 4). The genotype, ICGV 87846 was grouped in least susceptible category based on longer mean development period and less growth index and pod damage. The moderately susceptible category includes the genotypes viz., TCGS 1157, K 1501, ICGV 03057, which

Table 4. Relative susceptibility of groundnut (pods) genotypes to *C. serratus* (free-choice test).

Parameters	Less Susceptible (<Mean-SD)	Moderately Susceptible (Mean-SD to Mean + SD)	Highly susceptible (>Mean + SD)
Oviposition (eggs/five pods) Mean = 38.3 SD = 10.3	TPT 4, Abhaya, Narayani, K 9	TCGS 1273, TCGS 1157, TCGS 1342, TCGS 1343, K 1454, ICGV 87846	Dharani, K 6, Harithandra, K 1501, K 1535, 91114, ICGV 00350, ICGV 93468, ICGV
Adult Emergence (No.) Mean =13.18 SD = 4.25	Narayani, K 9	TCGS 1273, TCGS 1157, TCGS 1342, TCGS 1343, TPT 4, Abhaya, K 6, Harithandra, K 1501 K 1454, ICGV 91114, ICGV 93468, ICGV 03057, ICGV 87846	Dharani, K 1535, ICGV 00350
Mean Development Period (days) Mean = 44.59 SD = 4.52	Narayani, ICGV 93468, ICGV 03057, ICGV 87846	TCGS 1157, TCGS 1342, TCGS 1343, TPT 4, Abhaya, K 6, Harithandra, K 9, K 1501, K 1535, K 1454, ICGV 91114, ICGV 00350	TCGS 1273, Dharani
Growth Index Mean = 0.80 SD = 02	K 9, ICGV 93468, ICGV 87846	TCGS 1157, TCGS 1342, TCGS 1343, TPT 4, Abhaya, Narayani, K 6, Harithandra, K 1501, K 1535, K 1454, ICGV 91114, ICGV 00350, ICGV 03057	TCGS 1273, Dharani

were found to be moderately susceptible based on ovipostion, adult emergence, mean development period, growth index of *C. serratus* and pod damage caused. The genotypes , Dharani, K 6, ICGV 00350 and ICGV 93468 were highly susceptible for ovipostion. Categorization for free choice test.

Based on categorization (free-choice tests) Narayani, K 9 and ICGV 87846 categorized as Less susceptible genotypes. Similarly the genotypes, Dharani, K 1535 and ICGV 00350 were considered as Highly susceptible genotypes, whereas, the remaining genotypes were categorized as Moderately susceptible genotypes.

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