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Screening of different chickpea varieties against termite infestation

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Abstract

The susceptibility of different chickpea varieties were evaluated based on the per cent termite damaged plants. Out of the ten chickpea varieties, the lowest 10.91 per cent termite damaged plants were observed in variety RSG-807 followed by RSG-991 (12.31) and GNG-663 (13.32). The highest termite damaged plants were observed in GNG-1488 (34.09) followed by GNG-1581 (29.09) and RSG-973 (28.97). In other varieties termite damaged plants were varied from 18.14 to 24.81 per cent. Based on per cent termite damaged plants, chickpea varieties RSG-807, RSG-901 and GNG-663 in which the termite damaged plants were noticed less than 13.42 per cent and categorized as resistant. However, GNG-2144, CSJ-515, GNG-2171 and CSJD-884 recorded less than 28.88 but more than 13.42 per cent termite damaged plants considered as susceptible varieties whereas, RSG-973, GNG-1581 and GNG-1488 had more than 28.88 per cent termite damaged plants and categorized as highly susceptible.

Keywords: Chickpea, screening, termite, varieties

Introduction

Chickpea, *Cicer arietinum* (L.) also known as gram or bengal gram belongs to family leguminosae is one of the most important and remunerative pulse crop of *rabi* season grown around the world. Although all the pulses occupy a unique position in Indian agriculture as well as in the world but chickpea is considered as “king of pulses”. India has the largest producer of pulses in the world. In India, it is cultivated in an area of 10.2 million hectares having an annual production of 9.90 million tonnes (Anonymous, 2014a) ^[1]. The major chickpea growing states in the country are Madhya Pradesh, Uttar Pradesh, Rajasthan, Maharashtra, Gujarat and Bihar. Rajasthan is one of the major states which occupies an area of 15.36 lakh hectares with an annual production of 12.52 lakh tonnes (Anonymous, 2014b) ^[2]. More than 150 species of insects are known to attack pulse crops in India and out of these, about 25 species causes damage winter pulse crops (Bindra, 1968) ^[3]. Chickpea crop is attacked by 24 species of insect pests (Singh, 1998) ^[10]. Among them termite are most primitive social insects in the animal kingdom belongs to order Isoptera. The termites present in a colony consist of several castes *viz.*, workers, soldiers, reproductive queen and king (Watson *et al.*, 1983) ^[12]. These are the most problematic pests in the buildings and important pests of agricultural crops in tropical and sub-tropical regions of the world. Mehta and Verma (1968) ^[6] calculated the loss due to termite up to 230 million rupees for all the agricultural crops. It also causes damage to chickpea, maize, bajra, rice, barley and sorghum. Loss of 15–25 per cent of maize yield and about 1478 million rupees was estimated in India (Joshi *et al.*, 2005) ^[4]. In wheat, yield losses of 80% (Roonwal, 1979) ^[8], 43% (Sattar and Salihah, 2001) ^[9] 60% (Kakde *et al.*, 2006) ^[5] and in chickpea 60% (Panigrahi, 2010) ^[7] was reported due to termite infestation.

Termites damaged the seedlings by cutting either just below or above the soil surface. In mature plant, termites feed on root system and inside the stems, which directly kills the plant or indirectly lowers yield through decreased translocation of water and nutrients. Severely infested plants wilt, dry up and can be easily pulled up. It inflicts heavy damage to the crop cultivated in sandy loam soil and damage the crops right from sowing till harvest. Infestation is particularly serious in dry season (Mehta and Verma, 1968) ^[6]. Use of resistant varieties is recognized as an important tool in bio-intensive pest management system. Certain varieties bears least losses caused by the pest that are resistant against termite, so screening of different chickpea varieties for resistance against termite is also proposed. The work on different aspect in relation to termite in chickpea is lacking in the arid ecosystem of Rajasthan.

Materials and Methods

The present investigations were conducted at Research farm, Agriculture Research Station, Swami Keshwanad Rajasthan Agricultural University, Bikaner during *rabi* season 2016-17 in randomized block design with ten varieties each replicated thrice. Each variety was grown in individual plot of size 3 x 4 m². The spacing between row to row and plant to plant was kept 30 and 10 cm, respectively. The varieties were sown on 15th November 2016. Observations of termite damage were recorded on different varieties of chickpea at 10 days interval starting from 20 DAS to the harvesting of the crop.

Results and Discussion

Termite damage

Ten varieties of chickpea were screened for their relative susceptibility against termite through a field trial during *rabi* 2016-17. The data on termite damage is presented in table 2 and figure 1.

The first observation was taken on 20 day after sowing. The termite damage noted in different varieties ranged from 0.50 to 4.41 per cent. The minimum termite damage was observed on variety GNG-663 (0.50%), RSG-991 (0.50%) and RSG-807 (0.50%) which was at par with RSG-973 (1.61%), CSJD-884 (1.73%), CSJ-515 (1.73%), GNG-2171 (2.85%) and GNG-2144 (2.97%). The maximum termite damage was recorded on variety GNG-1581 (4.41%) followed by GNG-1488 (4.31%).

The second observation was taken on 30 day after sowing. The termite damage was noted in different varieties ranged from 0.50 to 4.43 per cent. The termite damage was observed on variety RSG-807 (0.50%) which was at par with RSG-991 (1.61%) and GNG-663 (1.73%). The varieties CSJD-884 (2.85%) was statistically at par with RSG-973 (2.97%), GNG-2171 (3.17%), CSJ-515 (3.75%) and GNG-2144 (4.08%). The maximum infestation was recorded on variety GNG-1581 (6.43%) which was at par with GNG-1488 (6.19%).

40 day after sowing (third observation) the lowest termite damage (0.54%) was noted in varieties RSG-807 which was at par with RSG-991 (2.51%) and GNG-663 (2.85%). The varieties CSJ-515 (3.84%) was statistically at par with RSG-973 (5.44%), CSJD-884 (6.43%), GNG-2144 (7.54%) and GNG-2171 (7.78%). The maximum termite damage was recorded on variety GNG-1488 (13.12%) followed by GNG-1581 (12.57) and both were at par.

50 day after sowing (Fourth observation) the lowest termite damage (1.34%) was noted in varieties RSG-807 which at par with GNG-663 (4.01%) and RSG-991 (4.20%). The maximum infestation was recorded on variety GNG-1488 (13.71%) followed by GNG-1581 (12.61), GNG-2171 (10.13%) and GNG-2144 (10.01%).

Fifth Observation taken on 60 day after sowing, the termite damage in different varieties ranged from 4.08 to 19.51 per cent. The minimum termite damage 4.08 per cent was observed on variety RSG-807 which was at par with RSG-991 (5.19%) and GNG-663 (6.43%). The varieties CSJ-515 (9.67%), CSJD-884 (10.13%), GNG-2144 (10.29%), GNG-2171 (11.36%) and RSG-973 (12.48%) were moderate in termite damage. The maximum infestation was recorded on variety GNG-1488 (16.00%) followed by GNG-1581 (13.71%).

70 day after sowing (sixth observation), the lowest termite damage (6.67%) was noted in varieties RSG-807 which was at par with RSG-991 (7.91%) and GNG-663 (9.78%). The varieties CSJ-515 (13.12%) was statistically at par with GNG-

2144 (14.08%), GNG-2171 (16.55%) and CSJD-884 (17.78%). The maximum infestation was recorded on variety GNG-1488 (26.43%) which was at par with GNG-1581 (23.70%) and RSG-973 (20.74%).

80 day after sowing (seventh observation), the lowest termite damage (8.77%) was noted in varieties RSG-807 which was at par with RSG-991 (9.88%) and GNG-663 (10.01%). The maximum infestation was recorded on variety GNG-1488 (30.38%) followed by GNG-1581 (26.00%) and RSG-973 (25.83%). However, these were at par. Rest of the varieties was moderate in termite damage.

Eighth observation taken on 90 day after sowing, the lowest termite damage (10.01%) was noted in varieties RSG-807 which was at par with RSG-991 (11.36%) and GNG-663 (11.82%). The varieties CSJ-515 (16.06%) was statistically at par with GNG-2144 (18.52%), GNG-2171 (19.64%) and CSJD-884 (23.22%). The maximum infestation was recorded on variety GNG-1488 (30.62%) followed by GNG-1581 (28.03%) and RSG-973 (25.99%). However, these were at par. Rest of the varieties was moderate in termite damage.

100 day after sowing (ninth observation), the lowest termite damage (10.81%) was noted in varieties RSG-807 which at par with RSG-991 (12.20%) and GNG-663 (13.12%). The maximum infestation was recorded on variety GNG-1488 (31.30%) which was at par with GNG-1581 (28.08%). Rest of the varieties was moderate in termite damage.

The last observation taken on 110 day after sowing, the termite damage in different varieties ranged from 10.91 to 34.09 per cent. The minimum infestation 10.91 per cent was observed on variety RSG-807 which was at par with RSG-991 (12.31%) and GNG-663 (13.32%). The varieties CSJ-515 (18.14%) was statistically at par with GNG-2144 (18.90%), GNG-2171 (23.07%), CSJD-884 (24.81%), RSG-973 (28.97%) and GNG-1488 (29.09%). The maximum infestation was recorded on variety GNG-1488 (34.09%) followed by GNG-1581 (29.09%) and both were at par. The order of susceptibility of varieties were as follows GNG-1488 (34.09%) > GNG-1581 (29.09%) > RSG-973 (28.97%) > CSJD-884 (24.81%) > GNG-2171 (23.07%) > GNG-2144 (18.90%) > CSJ-515 (18.14%) > GNG-663 (13.32%) > RSG-991 (12.31%) > RSG-807 (10.91%).

Categorization of chickpea varieties

The ten different tested varieties of chickpea were also grouped in to three category of resistance *viz.*, resistant (R), susceptible (S) and highly susceptible (HS) based on per cent termite damaged plants by comparing the mean termite damaged plants of individual varieties (\bar{x}_i) with mean termite damaged plant of all varieties (\bar{x}) and standard deviation (sd). The categorization of different chickpea varieties is presented in (Table 1).

Based on per cent termite damaged plants of chickpea varieties RSG-807, RSG-991 and GNG-663, noticed less than 13.42 per cent plant damage and categorized as resistant. The varieties GNG-2144, CSJ-515, GNG-2171 and CSJD-884 recorded less than 28.88 but more than 13.42 per cent damage were considered as susceptible varieties whereas, RSG-973, GNG-1581 and GNG-1488 registered more than 28.88 per cent damage and categorized as highly susceptible against termites.

These findings are in agreement with Shukla, (2008) [11] they screened four varieties of wheat against termite and found that the lowest infestation was observed in variety Lok-1 whereas variety Raj.-3077 showed higher infestation of termite. While

G.W.-173 and Raj.-3765 were found moderate susceptible to termite infestation.

Table 1: Categorization of chickpea varieties for their susceptibility against termite.

Category of resistance	Scale	Varieties \bar{x}_i
1	2	3
Resistant	$\bar{x}_i = 21.15 - 7.73 < 13.42$	RSG-807 RSG-991 GNG-663
Susceptible	$\bar{x}_i > 13.42 < 28.88$	GNG-2144 CSJ-515 GNG-2171 CSJD-884
Highly Susceptible	$\bar{x}_i = 21.15 + 7.73 > 28.88$	RSG-973 GNG-1581 GNG-1488

Based on per cent damage: $\bar{x} = 21.15$ and $sd = 7.73$

Table 2: Susceptibility of gram varieties to termite during Rabi, 2016-17

S. No	Varieties	Termite damaged plants (%) day after sowing									
		20	30	40	50	60	70	80	90	100	110
1.	GNG-1488	4.31 (11.97)*	6.19 (14.31)	13.12 (21.16)	13.71 (21.66)	16.00 (23.37)	26.43 (30.93)	30.38 (33.38)	30.62 (33.59)	31.30 (34.01)	34.09 (35.72)
2.	GNG-1581	4.41 (12.12)	6.43 (14.56)	12.57 (20.71)	12.61 (20.79)	13.71 (21.66)	23.70 (29.13)	26.00 (30.55)	28.03 (31.94)	28.08 (31.97)	29.09 (32.63)
3.	GNG-2144	2.97 (9.24)	4.08 (11.62)	7.54 (15.69)	10.13 (18.39)	10.29 (18.46)	14.08 (22.00)	16.06 (23.58)	18.52 (25.39)	18.84 (25.60)	18.90 (25.65)
4.	GNG-2171	2.85 (9.06)	3.17 (10.22)	7.78 (15.85)	10.01 (18.30)	11.36 (19.50)	16.55 (23.98)	17.29 (24.52)	19.64 (26.27)	22.17 (28.09)	23.07 (28.71)
5.	GNG-663	0.50 (4.05)	1.73 (6.65)	2.51 (9.10)	4.20 (11.55)	6.43 (14.56)	9.78 (17.57)	10.01 (18.39)	11.82 (20.08)	13.12 (21.24)	13.32 (21.40)
6.	RSG-991	0.50 (4.05)	1.61 (6.47)	2.85 (9.06)	4.01 (10.74)	5.19 (13.06)	7.91 (16.33)	9.88 (18.17)	11.36 (19.50)	12.20 (20.36)	12.31 (20.47)
7.	RSG-807	0.50 (4.05)	0.50 (4.05)	0.54 (4.22)	1.34 (6.63)	4.08 (11.56)	6.67 (14.53)	8.77 (17.19)	10.01 (18.30)	10.81 (19.11)	10.91 (19.21)
8.	RSG-973	1.61 (6.47)	2.97 (9.82)	5.44 (13.33)	9.50 (17.51)	12.48 (20.62)	20.74 (27.08)	25.83 (30.52)	25.99 (30.63)	26.20 (30.78)	28.97 (32.56)
9.	CSJD-884	1.73 (6.65)	2.85 (9.06)	6.43 (14.56)	9.76 (18.15)	10.13 (18.39)	17.78 (24.92)	18.93 (25.77)	23.22 (28.77)	24.14 (29.41)	24.81 (29.87)
10.	CSJ-515	1.73 (7.23)	3.75 (11.14)	3.84 (11.24)	9.05 (17.48)	9.67 (18.04)	13.12 (21.17)	13.86 (21.79)	16.06 (23.58)	16.41 (23.85)	18.14 (25.50)
	S.Em. \pm	1.77	1.54	1.65	1.86	1.16	1.52	1.54	1.18	1.03	1.13
	CD at 5%	5.24	4.57	4.89	5.52	3.46	4.51	4.98	3.51	3.07	3.36

*Figures in parentheses are arcsine value

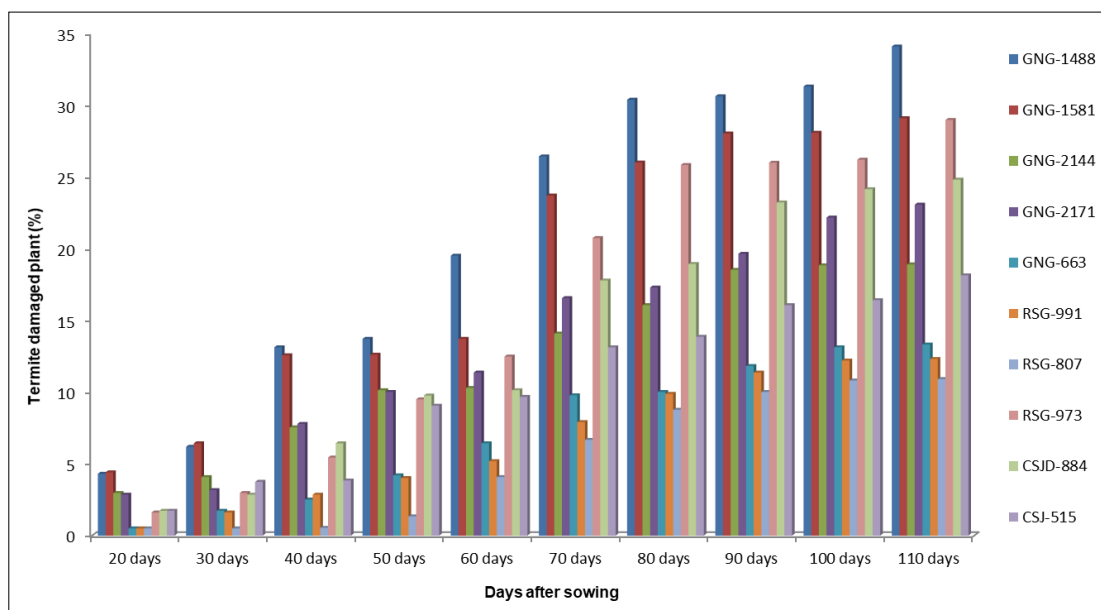


Fig 1: Susceptibility of chickpea varieties to termites during Rabi, 2016-17

Conclusion

Among the 10 varieties of chickpea tested against termite, RSG-973, GNG-1581, and GNG-1488 were found highly susceptible whereas, the varieties GNG-2144, CSJ-515, GNG-2171 and CSJD-884 were found susceptible. However, RSG-807, RSG-991 and GNG-663 were found resistant.

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