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Evaluation of groundnut genotypes for resistance against aphid (*Aphis craccivora* Koch) in semi-arid region of Rajasthan

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Abstract
It is well known that certain varieties or strains of crop are less attacked by a given insect pests than others because of natural resistance. In the cultural practices to minimize the losses caused by aphid, growing of resistant varieties is most important one in the crop management. To evaluate ten groundnut (*Arachis hypogaea* L.) varieties and improved lines for resistance against sucking insect aphid (*Aphis craccivora* Koch), field experiment was laid out in a simple Randomized Block Design (RBD) during *Kharif* 2018. The aphid population commenced in the last week of July and peaked in the second week of September. On the basis of aphid population the groundnut varieties TAG-24, RG-510 and genotype RG-632 were proved to be highly resistant, the varieties RG-578, RG-425 and RG-382 were least resistant. The remaining varieties, RG559-3, TG-37A and genotypes RG-622, RG-625 showed intermediary behavior. Field experiments to further assess the aphid populations and screening trials to establish the mechanisms of resistance in these genotypes should be considered as a priority area for immediate research work.

Keywords: *Aphis craccivora*, *Arachis hypogaea*, evaluation, insect resistance, sucking insect pest

Introduction
Groundnut (*Arachis hypogaea* L.) is grown in many countries in the tropical, sub tropical and warm temperate regions and, is one of the most important legume crops in the world. It is mainly cultivated for its high quality edible oil and digestible protein. About 90% of the global groundnut production comes from Asia and Africa, where it is mostly produced by smallholder farmers under rainfed conditions [5]. The number of factors responsible for low productivity of groundnut includes adverse climatic conditions, poor quality seeds, diseases and insects which significantly affect both the quality and production of groundnut. Among these insect pests are major limiting factor to reduce pod yield. As many as 52 species of insects and two species of mites have been recorded infecting the groundnut crop in India [13]. Among various sucking insect pests' leafhoppers, *E. kerri*, aphid, *A. craccivora,* whiteflies, *B. tabaci and* thrips, *T. dorsalis* are most important [2]. They suck the sap from tender parts of the plants, as a result plants wilted and dry up. Most of the species of sucking insects are also known to be vectors of diseases of groundnut. The Aphid, *A. craccivora* is a vector of groundnut rosette virus, peanut mottle virus and peanut stripe virus, cause yield losses up to 40 per cent [8]. The damage is severe in drought situation when the crop is young. The critical vegetative stage *viz*., pegging, pod formation and pod development in groundnut play an important role in production of the crop. The damage done by aphid, leafhopper and thrips at these stages showed maximum reduction in potential yield. Therefore, the crop should be protected at proper stage from these pests [12]. The growing of insect resistant varieties offers the most economical way of reducing losses however, this is not a new concept, but has assumed importance in the recent years because of increased dependence on chemicals. Further, the new varieties of groundnut are also released continuously. Therefore, some new varieties and genotypes of groundnut were evaluated for resistance to the major sucking insect pests aphid (*Aphis craccivora*).

Materials and Methods
The present investigations were conducted at the Agronomy farm of S.K.N. College of Agriculture, Jobner (S.K.N. Agriculture University, Jobner) during *Kharif*, 2018. The climate of this area is typically semi-arid which is characterized by extremes of temperature both in summer and winter with low rainfall and moderate humidity. The experiment was laid out in a simple Randomized Block Design (RBD) with ten varieties as treatments, each replicated thrice.

The crop was sown on 21st June, 2018 in the plot of size 2.4 m x 3.0 m with row to row and plant to plant distance of 40 cm and 15 cm, respectively. Out of ten treatments, seven were released variety (RG-382, RG-559-3, RG-510, RG-425, TAG-24, RG-578, TG-37A) and three were improved genotypes (RG-622, RG-625, RG-632) obtained from Rajasthan Agriculture Research Institute (RARI), Durgapura (Jaipur).

Method of observations and data interpretation

The population of sucking insect aphid was recorded at weekly interval early in morning hours on five randomly selected and tagged plants in each plot as per method suggested by Satpathy (1973) [11]. For recording the aphid population marked leaf was grasped at the petiole and twisted until underside of the leaf was clearly visible. Aphid population was expressed as number per trifoliate. The data obtained on population of major sucking insect pests of groundnut from experimental field were transformed into $\sqrt{X + 0.5}$ and were subjected to analysis of variance [4]. The peak population of aphid on groundnut was categorized on the basis of formula given below [10]:

$\bar{X} \pm \sigma$

Where

$\bar{X}$ = Mean of peak insect population and

σ = Standard deviation of peak insect population

Mean insect population/ three leaves	Category
Below $\bar{X} - \sigma$	Highly resistant
$\bar{X} - \sigma$ to $\bar{X} + \sigma$	Moderately resistant
Above $X + \sigma$	Least resistant

Results and Discussion

The aphid population started from last week of July as evident in table 1 and figure 1. In the first observation (30th July, 2018), the aphid population was observed on all the genotypes and varieties which ranged from 0.04 to 0.96 aphids per three leaves. The minimum mean aphid population was observed on variety TAG-24 (0.04 aphids/ three leaves), followed by RG-510 (0.08 aphids /three leaves) and RG-632 (0.12 aphids/ three leaves) and these were found at par with each other in their degree of infestation. The maximum aphid population was recorded on RG-382 (0.96 aphids/ three leaves), followed by RG-425 (0.88 aphids /three leaves) and RG-578 (0.80 aphids/ three leaves) and these were differed non-significantly, with each other in their degree of infestation. The aphid population gradually increased and reached to peak in the second week of September (10 September, 2018) in all the genotypes/ varieties screened, which ranged from 4.00 to 9.93 aphids per three leaves. The minimum and maximum aphid population was recorded on variety TAG-24 (4.00 aphids /three leaves) and RG-382 (9.93 aphids /three leaves). After peak the aphid population started to decline. In the last observation (22nd October, 2018), the aphid population was observed on all the genotypes and varieties except variety RG-510 and TAG-24. The aphid population was drastically reduced and a very low aphid population was recorded, being minimum on genotype RG-632 (0.02 aphids /three leaves) and maximum on varieties RG-382 (0.48 aphids /three leaves).

The mean aphid population of all the observations ranged from 1.70 to 4.93 aphids per three leaves (table 1 and fig. 1). The minimum mean aphid population was found on variety TAG-24 (1.70 aphids /three leaves), followed by RG-510 (1.84 aphids /three leaves) and genotype RG-632 (2.00 aphids/ three leaves) and these were differed non-significantly in their degree of infestation and differed significantly with rest of the genotypes and varieties. The maximum mean aphid population was found on variety RG-382 (4.93 aphids/ three leaves), followed by RG-425 (4.72 aphids/ three leaves) and RG-578 (4.52 aphids/ three leaves) and these were statistically at par with each other in their degree of infestation. Based on overall mean population of the season on different genotypes/ varieties of groundnut crop the ascending order of aphid infestation in different varieties of groundnut was found in order: TAG-24 < RG-510 < RG-632 < RG-559-3 < RG-622< RG-625 < TG-37A < RG-578 < RG-425 < RG-382. Further, on the basis of statistical categorization ($\bar{X} \pm \sigma$), the varieties/ genotypes having mean aphid population below 2.05 per three leaves, were categorized as highly resistant, between 2.05 to 4.43 per three leaves were categorized as moderately resistant and above 4.43 per three leaves, were categorized as least resistant (table 2).

It is well known that certain varieties or strains of crop are less attacked by a given insect pests than others because of natural resistance. The work on genotypes/ varieties screened in the present investigation was not available, hence discussed by work done on the more or less same pattern on other varieties of groundnut and Other crop also. Amarshibhai (2004) [1] found that the variety GG-7 was less susceptible to aphid whereas, ICGS- 9531 was highly susceptible. Kandakoor (2011) [7], Gadad *et al.* (2014) [3], Javed *et al.* (2014) [6], Naik and Somasekhar (2015) [9] reported that some biochemical and gentic factors may be Playing the role with regard to aphid and jassid preference for genotypes/ varieties of groundnut also supports the present findings.

Table 1: Mean population of aphid, *Aphis craccivora* Koch on different genotypes/ varieties of groundnut

S.N.	Genotypes/ Varieties	Population of aphid/ three leaves at weekly interval													
		30/07/18	06/08/18	13/08/18	20/08/18	27/08/18	03/09/18	10/09/18*	17/09/18	24/09/18	01/10/18	08/10/18	15/10/18	22/10/18	Mean
1.	RG-382	0.96 (1.21)	3.00 (1.87)	4.80 (2.30)	7.38 (2.81)	7.88 (2.89)	9.26 (3.12)	9.93 (3.23)	7.18 (2.77)	5.46 (2.44)	3.88 (2.09)	2.48 (1.72)	1.34 (1.36)	0.48 (0.99)	4.93 (2.33)
2.	RG-559-3	0.26 (0.87)	1.66 (1.47)	3.16 (1.91)	4.78 (2.30)	5.36 (2.42)	5.24 (2.53)	6.48 (2.64)	3.96 (2.11)	3.10 (1.89)	1.84 (1.53)	1.12 (1.26)	0.43 (0.96)	0.14 (0.80)	2.94 (1.85)
3.	RG-622	0.32 (0.90)	1.74 (1.50)	3.28 (1.94)	4.96 (2.34)	5.60 (2.47)	6.10 (2.56)	6.74 (2.69)	4.25 (2.17)	3.22 (1.93)	2.00 (1.58)	1.20 (1.30)	0.50 (1.00)	0.15 (0.81)	3.08 (1.89)
4.	RG-510	0.08 (0.76)	1.00 (1.22)	1.80 (1.51)	3.12 (1.90)	3.78 (2.07)	4.00 (2.11)	4.26 (2.18)	2.42 (1.70)	1.80 (1.51)	0.88 (1.17)	0.63 (1.06)	0.16 (0.81)	0.00 (0.71)	1.84 (1.52)
5.	RG-425	0.88 (1.17)	2.88 (1.84)	4.64 (2.27)	7.10 (2.75)	7.64 (2.85)	8.90 (3.06)	9.60 (3.17)	6.84 (2.71)	5.28 (2.40)	3.72 (2.05)	2.30 (1.67)	1.20 (1.30)	0.42 (0.96)	4.72 (2.28)
6.	RG-632	0.12 (0.79)	1.10 (1.26)	2.00 (1.57)	3.38 (1.97)	4.00 (2.11)	4.16 (2.15)	4.58 (2.24)	2.68 (1.78)	2.00 (1.57)	1.00 (1.22)	0.72 (1.10)	0.22 (0.85)	0.02 (0.72)	2.00 (1.57)
7.	TAG-24	0.04	0.87	1.66	2.94	3.54	3.82	4.00	2.26	1.66	0.76	0.46	0.10	0.00	1.70

		(0.73)	(1.17)	(1.47)	(1.84)	(.01)	(2.07)	(2.11)	(1.66)	(1.47)	(1.12)	(0.98)	(0.77)	(0.71)	(1.48)
8.	RG-578	0.80 (1.14)	2.72 (1.79)	4.46 (2.22)	6.81 (2.70)	7.46 (2.82)	8.48 (2.99)	9.22 (3.12)	6.52 (2.65)	5.14 (2.37)	3.50 (2.00)	2.16 (1.63)	1.12 (1.27)	0.36 (0.92)	4.52 (2.24)
9.	RG-625	0.40 (0.95)	1.86 (1.54)	3.38 (1.97)	5.18 (2.38)	5.82 (2.51)	6.32 (2.61)	6.86 (2.71)	4.66 (2.27)	3.50 (2.00)	2.15 (1.63)	1.28 (1.33)	0.57 (1.03)	0.18 (0.82)	3.24 (1.93)
10.	TG-37A	0.46 (0.97)	2.00 (1.58)	3.54 (2.01)	5.44 (2.43)	5.98 (2.54)	6.78 (2.69)	7.04 (2.74)	4.90 (2.32)	3.76 (2.06)	2.32 (1.68)	1.40 (1.38)	0.66 (1.07)	0.20 (0.83)	3.42 (1.98)
	S.Em±	0.03	0.06	0.07	0.09	0.10	0.11	0.13	0.10	0.09	0.08	0.07	0.05	0.04	0.08
	C.D.(p=0.05)	0.10	0.17	0.21	0.26	0.28	0.33	0.37	0.30	0.26	0.23	0.19	0.14	0.10	0.24

Figures in the parentheses are √X+0.5 values.
* Peak population of aphid during the crop season

Table 2: Categorization of groundnut genotypes/ varieties into degree of resistant against aphid, *Aphis craccivora* Koch.

S. No.	Mean aphid population per three leaves	Name of genotypes/ varieties	Category
1.	Below 2.05	TAG-24, RG-510, RG-632	Highly resistant
2.	2.05-4.43	RG-559-3, RG-622, RG-625, TG-37A	Moderately resistant
3.	Above 4.43	RG-578, RG-425, RG-382	Least resistant

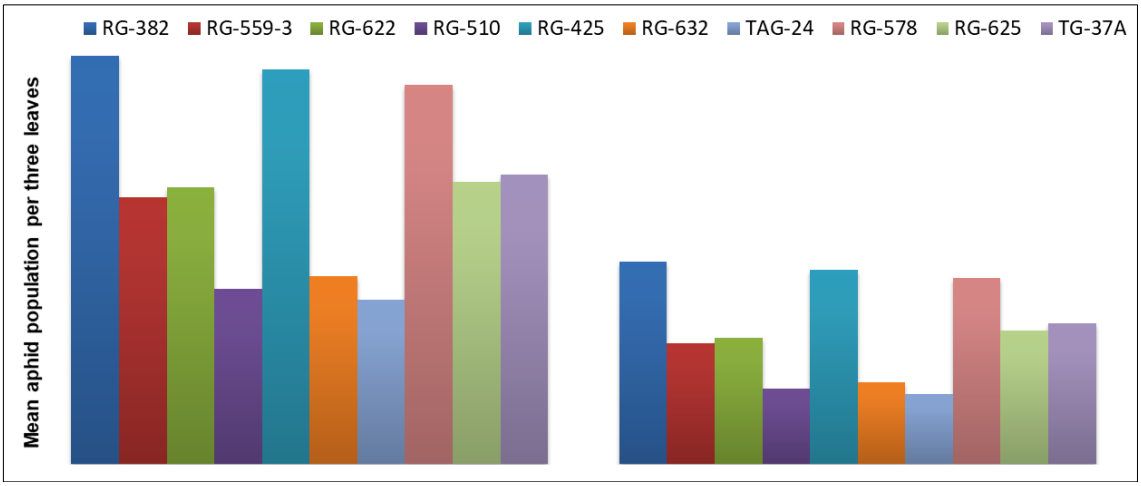

Fig 1: Mean population of aphid, Aphis craccivora Koch on different genotypes/ varieties of groundnut

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