Journal of Entomology and Zoology Studies

Available online at www.entomoljournal.com

J E Z S Journal of Entomology and Zoology Studies

E-ISSN: 2320-7078
P-ISSN: 2349-6800
JEZS 2017; 5(3): 1651-1654

Received: 14-03-2017
Accepted: 15-04-2017

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Screening of chickpea varieties against gram aphid *Aphis craccivora* (Koch.) in field

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Abstract
The study was carried out at Pulse Section, Agriculture Research Institute, Tandojam, during Rabi season 2016. The highest infestation of aphid was observed in 3rd week of Jan. on C-612 (21.66) per plant followed by Sanyasi (6.66), DG-92 (6.00) and DG-89 (5.66). Similarly minimum infestation of aphid was observed during last week of Nov. on Sanyasi variety (2.00) followed by DG-92 (2.33), DG-89 (2.33) and C-612 (3.00). The data further showed the overall mean population of aphid on chickpea varieties i.e., C-612 (9.99 ± 6.31) followed by DG-92 (4.15 ± 1.06), DG-89 (3.92 ± 1.08) and Sanyasi (3.88 ± 1.25). There was significant difference (p<0.05) in population fluctuation of aphid on different chickpea varieties and observation dates. Maximum aphid population (9.91) was recorded on 3rd week of Jan., whereas minimum aphid population (2.64) was observed on last week of Nov. 2016. The aphid population significantly (p<0.05) higher on C-612 chickpea variety compared to DG-92 and DG-89 varieties and lowest aphid population was noted on Sanyasi variety.

Keywords: *Cicer aurietinum* L., varieties, resistsnce, *Aphis craccivora* (koch), population

1. Introduction
Gram (*Cicer aurietinum* L.) is a major Rabi pulse crop belongs to Leguminosae family. It is grown in areas after rain and floods. It is a short duration crop and can be grown between September and November. The best time for sowing is the second week of October [1]. Being a leguminous crop it is well suited under dry tracks. It requires winter climate weather condition and is allergic to frost. In normal condition the gram matures within four months or a little later. After reaching maturity stage the gram plant cannot stand heavy rains or hail storm. The crop demand rainy condition but it can be grown in less irrigated areas also. The crop is heat resistant and flourishes under good moisture condition. It can bear drought condition due to long taproot which allows using water from great depths than other pulse. It tolerates acidity but is sensitive to salinity and alkalinity [2]. It has the ability to stick to 60-80 percent of its nitrogen requirement and excessive nitrogen fertilizer may delay maturity. In normal condition the gram matures within four months or a little later. In Pakistan there are two kinds of gram crop namely Desi and Kabuli [3]. Cowpea aphid (*Aphis craccivora* Koch.) is a serious pest in legume agriculture and has been reported on all continents except the Antarctic. This species has been described as the most important worldwide pest of cowpea, *Vigna unguiculata* L. Walpers, causing significant yield losses when either young seedlings or the pods of adult plants are attacked [4]. Cowpea is a protein-rich legume relied on by over 200 million people in Africa and is highly adapted to poor soils and drought conditions. In recent years, cowpea genetic resources have been developed to aid breeding efforts to improve the crop with a focus on drought tolerance and resistance to diseases, nematodes and pests including cowpea weevil (*Callosobruchus maculates*), thrips (*Thrips tabaci and Frankliniella schultzei) Aphis craccivora* and viruses vectored by *Aphis craccivora* [5]. *Aphis craccivora* also causes serious yield losses in chickpea, a major pulse crop in the Indian sub-continent, where transgenic chickpeas expressing the Allium sativum leaf agglutinin (ASAL) gene resulted in a significant reduction in survival and fedundancy of *Aphis craccivora* [1]. *Aphis craccivora* has also been reported to be a pest on peanuts in Africa, where it vectors several viruses which cause groundnut rosette disease [6] and can also be a serious pest of lentils on the Indian subcontinent [7]. In Australia, *Aphis craccivora* has been reported to infest pasture legumes such as subterranean clover (*Trifolium subterraneum* L.), common burr medic (*Medicago polymorpha* L.), alfalfa (*M. sativa* L.) and barrel medic (*M. truncatula* Gaertn.) as well as

Australia's major grain legume, narrow leaf lupin (*Lupinus angustifolius* L.). Apart from resistance to *Aphis craccivora* in lupins [7] and several resistance loci in cowpea, most of which have been overcome by newly emerged CPA biotypes, natural resistance to CPA has not been identified in other cultivated legumes including Medicago species [1]. The most common aphid species recorded on legumes in Australia include: bluegreen aphid (*Acyrthosiphon kondoi* Shinji), pea aphid (*Acyrthosiphon pisum* Harris), spotted alfalfa aphid (*Therioaphis trifolii* f. maculata Buckton), spotted clover aphid (*Therioaphis trifolii* Monell), green peach aphid (*Myzus persicae* Sulzer) and cowpea aphid (*A. craccivora*) [8]. In recent years resistance to most of these aphid species has been identified and characterized in the model legume *Medicago truncatula* Gaertn [9] with the exception of *Aphis craccivora* resistance. No resistance to CPA was found in this pair of closely related lines and neither in two other pairs of closely related lines (Mogul/Borung and Cyprus/Caliph) [10].

2. Materials and methods

The present study was carried out during Rabi season 2016 at Pulse Section, Agriculture Research Institute, Tandojam. The experiment was conducted using a randomized complete block design with three replications. The following varieties was used to varietal preference of gram against Gram aphid *Aphis craccivora* (Koch) Varieties = 04 DG-89, DG-92, C-612 and Sanyasi. Twenty five plants were selected from each variety for the collection of data. The plot size 6m x 3m ($18m^2$) was maintained. The observation was taken from the appearance of pest till crop harvest. The collected data were subjected to statistical analysis using analysis of variance to know the significance of differences among lines, and LSD (Least Significance Difference) check was also applied.

3. Results

Mean population of aphid on different chickpea varieties during first observation in last week of Nov. 2016. The data in table-1 shows that the population of aphid were counted as 2.33/plant on DG-89 variety of chickpea. The population fluctuation linearly increased and reaches at peak level of 5.33/plant during 7th observation 2nd week of Jan. 2017. Afterwards the population of aphid simultaneously declined and reached up to 3.06/plant at last observation 1st week of Feb. 2017. Overall mean population of aphid on DG-89 variety was calculated as (3.92/plant).

In DG-92 variety, the population of aphid were counted as 3.0/plant on first observation (29-11-2016). The population fluctuation linearly increased and reaches at peak level of 6.00/plant on 8th observation (17-01-2017). Afterwards the population of aphid simultaneously declined and reached up to 2.33/plant at last observation (7-02-2017). Overall mean population of aphid on DG-92 variety was calculated as (4.15/plant) in table-1.

Data reveals in table-1, the population of aphid in C-612 variety were counted as 3.0/plant on first observation (29-11-2016). The population fluctuation linearly increased and reaches at peak level of 21.66/plant on 8th observation (17-01-2017). Afterwards the population of aphid simultaneously declined and reached up to 3.66/plant at last observation (7-02-2017). Overall mean population of aphid on C-612 variety was calculated as (9.99/plant).

In Sanyasi variety, the population of aphid were counted as 2.26/plant on first observation (29-11-2016) in table-1. The population fluctuation linearly increased and reaches at peak level of 6.66/plant on 8th observation (17-01-2017). Afterwards the population of aphid simultaneously declined and reached up to 2.00/plant at last observation (7-02-2017). Overall mean population of aphid on Sanyasi variety was calculated as (3.88/plant).

On average, the maximum aphid population (9.99/plant) was observed on C-612 variety followed by 4.15/plant, 3.92/plant and 3.88/plant on DG-89, DG-92 and Sanyasi varieties. Minimum aphid population (3.88/plant) was noted on Sanyasi variety. There was significant difference ($p<0.05$) in population fluctuation of aphid on different chickpea varieties and observation dates.

Table 1: Mean population of *Aphis craccivora* (Koch) on different chickpea varieties during Rabi season 2016.

Observation dates	Varieties				Mean
	DG-89	DG-92	C-612	SANYASI	
29-11-2016	2.33	3.0	3.0	2.26	2.64
6-12-2016	2.73	2.66	4.33	2.66	3.09
13-12-2016	3.33	3.66	5.33	3.00	3.83
20-12-2016	3.0	3.86	7.66	3.66	4.54
27-12-2016	4.0	4.43	8.33	3.66	5.10
03-01-2017	4.36	4.66	15.66	4.33	7.25
10-01-2017	5.66	5.66	18.33	5.00	8.66
17-01-2017	5.33	6.00	21.66	6.66	9.91
24-01-2017	4.33	3.66	8.33	4.00	5.08
31-01-2017	4.16	4.00	7.33	3.66	4.78
7-02-2017	3.06	2.33	3.66	2.00	2.76
Mean	3.92±1.08	4.15±1.06	9.99±6.31	3.88±1.25	-

		Varieties	Obs. dates	Variety*Observation
SE	=	0.2853	0.4731	0.9461
LSD	=	0.5671	0.9404	1.8808
P-value	=	0.0000	0.0000	0.0000

Table 2: Coefficient Correlation (r) of aphid population with abiotic factors.

Variable	Population
Temperature	-0.65849**
Relative humidity	0.193998**

Table 3: Meteorological data during Rabi season 2016.

Recording Dates	Temperature (C^0)	Relative Humidity (%)
29-11-2016	32.5	54
6-12-2016	30.5	58
13-12-2016	26.0	58
20-12-2016	26.0	49
27-12-2016	31.5	64
03-01-2017	24.5	72
10-01-2017	21.0	56
17-01-2017	21.0	58
24-01-2017	22.5	56
31-01-2017	26.0	58
7-02-2017	23.5	62

4. Discussions

Cowpea aphid *Aphis craccivora* (Koch) is a serious pest in legume agriculture and has been reported on all continents except the Antarctic. This species has been described as the most important worldwide pest of cowpea, *Vigna unguiculata* L. Walpers, causing significant yield losses when either young seedlings or the pods of adult plants are attacked [4].

The findings of present study indicated that the maximum aphid population (9.99/plant) was observed on C-612 variety followed by 4.15 and 3.92/plant on DG-89 and DG-92 varieties. Minimum aphid population (3.88/plant) was noted for Sanyasi variety. There was significant difference (p<0.05) in population fluctuation of aphid on different chickpea varieties and observation dates. Aphid populations show periodic fluctuations and many causes are attributed to their dynamic. These results are in agreement with the study of [11] who reported that aphid population started from 1st week after sowing i.e., the 3rd week of October with 0.2 aphid index and the population increased continuously up to 8th week after sowing with a peak level of 3.4 aphid index, coinciding with peak stage of flowering and pod formation in 1st week of December. The peak activity of aphids was seen from 7th week to 10th week after sowing. Thereafter, the population decreased but remained active throughout the crop period. The results are in agreement with [12] who stated that peak activity of aphids was from 7th to 10th week after sowing and remained active throughout the crop period and also more or less in agreement with [13] who stated that population of *A. craccivora* on cowpea increased rapidly with crop growth and their peak coincided with peak pod formation. [14] Stated that aphid was the main vegetative pest of cowpea. The present findings are also in agreement with them. Earlier, [15] stated that morning and evening relative humidity were significantly positive; they also stated that minimum temperature showed significant negative correlation with aphid population.

5. Conclusion

The maximum aphid population was observed on C-612 chickpea variety compared to DG-92 and DG-89 varieties and lowest aphid population was noted on Sanyasi variety. The chickpea varieties viz., C-612, DG-92 and DG-89 were found susceptible whereas chickpea variety Sanyasi was found resistant. Aphid population was at minimum level during the month of November and the population fluctuation started increasing from 1st week of December and reached at peak level during 3nd week of January. Afterwards the aphid population simultaneously declined during last observation date 1st week of February.

6. Acknowledgment

Thankful to friends who helped to make this research complete.

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