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Research article

SPATIAL DISTRIBUTION OF APHID, *UROLEUCON COMPOSITAE* THEOBALD ON SAFFLOWER

N Jemimah[1*], S R K Rao[1], T Ramesh Babu[1] and D Raja Ram Reddy[2]

[1] Department of Entomology, College of Agriculture, Acharya NG Ranga Agricultural University, Rajendranagar, Hyderabad - 500030, Andhra Pradesh, India

[2] Department of Plant Pathology, College of Agriculture, Acharya NG Ranga Agricultural University, Rajendranagar, Hyderabad - 500030, Andhra Pradesh, India

*Part of thesis submitted to ANGRAU E-mail: jemimahjems27@gmail.com

ABSTRACT: A Field experiment was carried out during 2011-12 *rabi* to study the spatial distribution of aphid, *Uroleucon compositae* (Theobald) on safflower. Various indices of dispersion, *i.e.* variance-mean ratio, dispersion parameter, David and Moore's index, Charlier coefficient, Index of Lexis and Llyods index of patchiness revealed that safflower aphid followed aggregated distribution throughout the crop growth.

Key Words: Spatial distribution, *Uroleucon compositae*, safflower

INTRODUCTION

The aphid, *Uroleucon compositae* (Theobald) is the most destructive and regular pest on safflower. It badly affects the crop growth and yield. Nymphs as well as adults suck the cell sap from the lower surface of the leaves and tender shoots and impair the vitality of the plants. The severely infested plant may die before maturity without producing any seeds. The moderately affected crop also suffers heavy losses in yield as the plants remain stunted and produce small sized capsules than the normal ones. Seed and oil content losses due to this pest to an extent of 20 to 80 per cent have been reported from different parts of the country (Singh *et al.*, 2000). To achieve satisfactory suppression of this destructive pest, there is a need to develop population models for need based spraying. Spatial distribution is one of the most important characteristics of ecological significance of a species. It yields characteristic parameters that segregate species. The spatial pattern of an insect is of specific interest in both applied and fundamental studies. No field sample is viable without understanding the underlying spatial distribution. Some insect species reproduce so rapidly that population density can change greatly during the course of field experiment as in case of aphids. Hence, spatial distribution of the aphid, *U. compositae* on safflower was studied.

MATERIALS AND METHODS

The safflower cultivar Manjeera was sown on 15th October 2011. The crop was sown at a spacing of 45x20 cm as bulk in an area of 15x10 m providing all package of practices. Fifty plants were randomly selected and tagged. Observations on population of aphid per 5 cm apical twig, predators like coccinellids and green lacewings were recorded upto harvest of the crop on the tagged plants at weekly interval.

Figure. 1. Infestation of twig by safflower aphid, *Uroleucon compositae*

Figure. 2. Infestation of flower head by safflower aphid, *Uroleucon compositae*

The observations recorded on aphid population at weekly interval in bulk plot were used for calculating spatial distribution of safflower aphid. Various indices were used to analyze the safflower aphid distribution. Three basic units used for fitting the distribution were mean, variance and the number of sample on which the mean is based. The mean number of aphids per their respective sampling units and the variance was calculated for each date of observation. The simplest approach used was Variance Mean Ratio (VMR). The value of VMR is one for random distribution and less than one for regular distribution and more than one for aggregated distribution. The index of David & Moore was calculated with which gives a value of zero for a random, positive value for aggregated and negative value for regular distribution. The value ‘K; is a measure of amount of clumping and is often referred to as dispersion parameter. As 1/K approaches 0 and K approaches infinity, the distribution converges to the poission series ($\overline{X} = S^2$). Conversely, if clumping increases 1/K approaches infinity K approaches zero, the distribution converges to the logarithmic series. Llyod (1967) developed an index of mean crowding ($X^* = \overline{X} + (S^2/\overline{X} - 1)$). The ratio of mean crowding to mean density is a suitable measure of pachiness. When mean crowding is regressed against mean density the value of slope is more than one in case of aggregated (contagious) distribution at higher densities. Pachiness index ($X^*/\overline{X} = 1 + {}^{1}/_{K}$) describes how many times as crowded individual is on the average, as it would be if the same population had a random distribution. The values of pachiness index > 1 indicate an aggregated distribution, pachiness = 1 random distribution and pachiness < 1, a regular distribution.

RESULTS AND DISCUSSION

The results indicated that the aphid made its first appearance in the seventh week (first week of December) after sowing of 49th standard week, when the crop was in elongation stage of growth. Later, the population gradually increased and reached the peak (68 aphids/5 cm apical twig) in second standard week when the crop was eleven weeks old. Afterwards, the population started declining owing to maturity of the crop (Fig. 3).

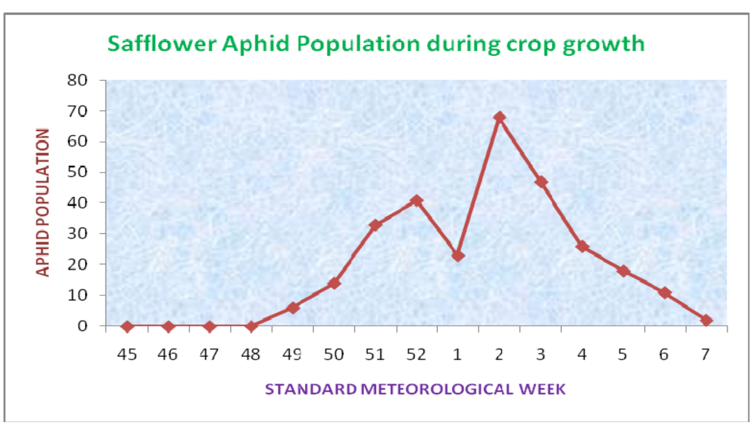

Figure. 3. Safflower aphid, *U. compositae* population during crop growth, *rabi* 2011-12.

The various parameters used to describe the distribution of the safflower aphid, *U. compositae* are presented in the Table 1. The variance values were more than mean on all the weeks of observation during the season. This indicated the aggregated distribution pattern of *U. compositae* population. Since, the values of 'K' (0.88 to 7.58) were less than 8, it exhibited aggregated nature of distribution. If the 'K' value is small, it indicates a greater aggregation of population. David and Moore's index values were more than zero in all the weeks of observation, which suggested that, the population distribution was contagious. The values of Lexis index values showed an intermittent increase and decrease. But it was never less than one which indicated that the population was always aggregated. Charlier coefficient values, on the other hand were also more than zero suggesting an aggregated nature on all the observations. The pachiness index values varied between 1.13 to 2.13, showing an intermittent increase and decrease during the season. Pachiness index values being more than one suggested aggregated nature of the distribution. Aggregation in aphid population was mainly due to aphid colonies rather than individuals. The reason for aggregation was the comprehensive effects of the species properties and environmental factors (Zheng, 2008). The results are in line to the findings of Singh and Singh (2002) who reported that *U. compositae* in safflower followed contagious (aggregated) pattern of distribution. Similar findings were reported by Rao and Lal (2004), Muthukumar and Sharma (2007) and Dey and Akhtar (2008) who reported that mustard aphid, *Lipaphis erysimi* followed aggregated distribution.

Table 1. Distribution pattern of aphid, *Uroleucon compositae* in safflower during *rabi* 2011-12

Standard week	Mean ($\overline{X}$)	Variance (S^2)	Variance-mean ratio (VMR)	Dispersion parameter (K)	David and Moore's index (IDM)	Index of Lexis (IL)	Charlier coefficient (CC)	Llyod index of mean crowding (X*)	Llyod pachiness index (X*/$\overline{X}$)
49	6.00	46.69	7.78	0.88	6.77	2.78	106.31	15.33	2.13
50	14.32	52.42	3.66	5.38	2.66	1.91	43.10	18.25	1.18
51	33.14	523.83	15.80	2.23	14.80	3.97	66.84	49.43	1.44
52	40.68	498.91	12.26	3.06	11.26	3.50	52.62	53.25	1.32
1	22.98	525.53	22.86	1.05	21.86	4.78	97.55	46.88	1.95
2	68.42	734.98	10.74	7.02	9.74	3.27	37.73	79.32	1.14
3	46.74	641.54	13.72	3.67	12.72	3.70	52.17	60.76	1.27
4	26.16	390.74	14.93	1.87	13.93	3.86	72.98	41.69	1.53
5	17.46	160.99	9.22	2.30	8.22	3.03	68.61	27.24	1.43
6	11.27	28.01	2.48	7.58	1.48	1.57	36.30	13.99	1.13
7	1.98	4.81	2.42	1.38	1.42	1.55	84.96	6.88	1.72

CONCLUSION

The data revealed that the aphid made its first appearance in the seventh week after sowing of the crop, and its population gradually increased. The present study concludes that the safflower aphid followed aggregated distribution throughout its presence in the field.

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