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Seasonal incidence of safflower aphid (*Uroleucon compositae*: Theobald) and its natural enemies correlation with weather parameters

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Abstract

The investigation entitled “Seasonal incidence of safflower aphid (*Uroleucon compositae*: Theobald) and its natural enemies was carried out at the Department of Agricultural Entomology, VNMKV, Parbhani, during rabi 2021-22. Seasonal incidence study revealed that, first incidence of *Uroleucon compositae* (Theobald) was observed during the 51st MW (5 aphids/5cm apical twig/plant). The aphid population increased gradually and reached peak reading of 234 aphids/5cm apical twig/ plant during 5th standard meteorological week. Thereafter, gradual decrease in the population of aphid and showed fluctuation in response to weather parameters viz., maximum temperature, minimum temperature, morning relative humidity, evening relative humidity, rainfall and bright sunshine hours. Correlation between aphid population and weather parameters indicated that maximum and minimum temperature had negatively significant correlation and positive non-significant correlation with morning relative humidity, evening relative humidity, rainfall and bright sunshine hours.

The population of lady bird beetle and chrysopa was recorded 21 days after germination recorded 0.33 lady bird beetle/5cm twig/plant during 1st meteorological week it gradually increases upto 5th standard meteorological week recorded peak of 4 lady bird beetle/5cm twig/plant when the corresponding weather parameters i.e. maximum temperature, minimum temperature, morning relative humidity and evening relative humidity were 30 °C, 8 °C, 83% and 19% respectively.

Keywords: *Uroleucon compositae*, weather parameters, lady bird beetle, chrysopa

Introduction

Safflower (*Carthamus tinctorius* L.) is a bushy, herbaceous annual plant that belongs to the Compositae family. In India, it is also known as kardai in ‘Marathi’ and kusum in ‘Hindi’. *Carthamus* has 25 species among which *Carthamus tinctorius* being the only cultivated one, having 2n = 24 chromosomes and a composite type of inflorescence, with each plant producing several flowering heads known as capitula. Each capitulum has numerous flowers, ranging in number from 20 to 250. The ovary in each flower matures into a single-seeded fruit called an achene, which is generally referred to as a seed. The crop is mostly grown as an edible oilseed crop in rabi season^[1].

India has rich diversity of annual oilseed crops on accounts of different agro- ecological zones. Nine annual oilseeds, which include seven edible oilseeds, viz., groundnut, rapeseed, mustard, soybean, sesame, safflower, niger and two non-edible crops viz., linseed and castor are grown in our country. Safflower crop is multipurpose crop rich in Vitamin A, iron, calcium and phosphorous. The use of this crop is as edible and vegetable oil for human being and as dye and drying oil for trade. Safflower oil which is sold as saffola considered to be more preferred because of rich in polyunsaturated fatty acid (73-79% linoleic), help in reducing blood cholesterol. The blossoms are said to contain therapeutic characteristics that can treat a variety of chronic diseases like hypertension, cardiovascular disease, arthritis, spondylosis and sterility. Safflower flowers contain all necessary amino acids except tryptophan^[2]. India, United States, Mexico, and China are the world's top safflower producers in the ascending order. In India, safflower production is primarily limited to rainfed conditions throughout the winter season, particularly in the Rabi track. In the year 2021-22, India is the largest producer of safflower (2.0

lakh tones) in the world with highest acreage (4.3 lakh hectares) but with average productivity of only 465 kg/ha [4]. Although India is the world's greatest producer of safflower, the yield per hectare is low. Aphid infestation is one of the main reasons for decreased productivity. The safflower aphid, *Uroleucon compositae* (Aphididae: Hemiptera) is the most well-known and damaging insect pest in India. It is a soft-bodied insect with a length of 1.5-2 mm. The adult is black, whereas the nymph is reddish dark brown. In Karnataka and Maharashtra yield losses caused by the aphid alone have been estimated to be 56-60% and 20-55% respectively [3]. Both nymph and adult aphids suck the cell sap from the leaves, stems and tender parts of the plant, including the shoot, affecting the crop's vitality and health.

A total of 101 pests have been identified as attacking safflower at various phases of growth and development [5]. However, it is harmed by a variety of insect pests and diseases, resulting in significant yield losses [6]. Of these, insect pests viz., aphid (*Uroleucon compositae*), pod borer (*Helicoverpa armigera*) and diseases viz., wilt (*Fusarium oxysporum*), leaf spot (*Alternaria carthami*), root rot (*Rhizoctonia bataticola* Butl.) are the most damaging [7]. However [8], recorded 75 insect species in India, whereas [11], identified 36 insect species on safflower in Maharashtra state. In Karnataka, 20 insect pests and 9 natural enemies have been identified on safflower [9]. Among the insect pests that attacks safflower crop, the aphid, *Uroleucon compositae* (Aphididae: Hemiptera) is the most destructive and frequent pest and infesting crop particularly from elongation stage to flowering stage [10]. Nymphs and adults sucking the cell sap from the lower surface of leaves and tender shoots deplete the plants vitality. Besides sucking the sap from the plants, aphids also exudes honeydew which attracts a black sooty mould that badly affects the photosynthesis process. Seed and oil content losses due to this pest ranging from 20% to 80% have been reported across the country [6].

Materials and Methods

The experiment was carried out with Safflower crop using variety A-1 were conducted at research farm of Oilseed research station Latur, VNMKV, Parbhani during Rabi 2021- 22. The experiment was conducted non replicated. Sowing field plot were prepared by applying well decomposed farm yard manure. Plot size 10x10 m. and spacing 45 x 20 cm² Weekly observations of aphids count was taken by observing 5 cm twig 10 randomly selected and tagged plants from experimental plot.

Results and Discussion

The seasonal incidences of *U compositae* on safflower were observed during Rabi 2021-22. The data recorded on population of Safflower aphid presented in Table 1 and graphically depicted in Figure 1.

The pertained data given in Table 1 revealed that the incidence of aphid started during 51st standard meteorological week and recorded 5 aphids/5cm twig/plant. It gradually increases up to 5th standard meteorological week and recorded peak of 234 aphids/5cm twig/plant when the corresponding maximum temperature, minimum temperature, morning relative humidity, evening relative humidity and bright sunshine hours were 30 °C, 8 °C, 83%, 19% and 9.6 hours, respectively. The most conducive conditions for aphid multiplication were found to be maximum (30 °C), minimum temperature (8 °C-10 °C) and relative humidity (83%). The result found of [10], reported that

minimum temperature between 10.5 °C to 13.5 °C and relative humidity 47 to 70% were favorable for aphid multiplication in safflower during December and January [12]. Reported that low temperature and high humidity with cloudy weather are conducive for the safflower aphid multiplication, he also mention that maximum temperature and minimum temperature ranged between 30-35 °C and 14 to17 °C respectively which were conducive for aphid multiplication [13]. reported that temperature showed negative and significant correlation with aphid population [4]. reported that there was positive correlation with aphid population while the wind speed was negatively correlated.

Correlation between safflower aphid and weather parameters

Maximum temperature: Maximum temperature exhibited a negative significant correlation ($r=-0.533^*$) with aphid population (Table 2). The number of aphids (*Uroleucon compositae* Theobald) increased when the maximum temperature decreased.

Minimum temperature: Minimum temperature exhibited a negative significant correlation ($r=-0.632^*$) with aphid population (Table 2).

Morning relative humidity: Results indicated that a positive non-significant correlation ($r=0.392$) between morning relative humidity and aphid population (Table 2).

Evening relative humidity: Aphid incidence was positively correlated with evening relative humidity and found non-significant ($r=0.290$) (Table 2).

Rainfall

The data revealed that a positive non-significant ($r=0.153$) correlation between rainfall and aphid population (Table 2).

Sunshine hours

Sunshine hours showed a positive non-significant correlation with aphid population ($r= 0.210$) (Table 2).

Table 1: Incidence of safflower aphid (*Uroleucon compositae* Theobald) in different meteorological weeks during 2021-22.

Sr. No.	SMW	Temperature (°C)		Relative Humidity (%)		Rainfall (mm)	BSS (Hrs/day)	Aphids/5cm/plant
		Max temp	Min temp	Morning R.H.	Evening R.H.			
1	50	29.20	13.21	88.00	35.0	0.00	5.9	0
2	51	27.70	9.41	91.00	30.0	0.00	7.1	5
3	52	28.90	13.56	88.00	44.0	0.00	4.9	37
4	1	28.00	13.00	89.00	39.0	0.00	6.3	64
5	2	27.10	15.90	87.00	55.0	0.20	4.1	119
6	3	26.70	11.80	92.00	44.0	0.00	5.9	168
7	4	26.80	9.90	78.00	34.0	0.00	7.6	189
8	5	30.00	8.00	83.00	19.0	0.00	9.6	234
9	6	30.40	11.80	75.00	28.0	0.00	8.3	133
10	7	31.10	14.40	72.00	25.0	0.00	8.0	100
11	8	34.00	14.60	74.00	20.0	0.00	8.9	64
12	9	34.90	16.40	62.00	16.0	0.00	8.6	23
13	10	34.30	17.50	62.00	21.0	0.00	6.9	9
14	11	37.40	16.30	56.00	10.0	0.00	8.4	3

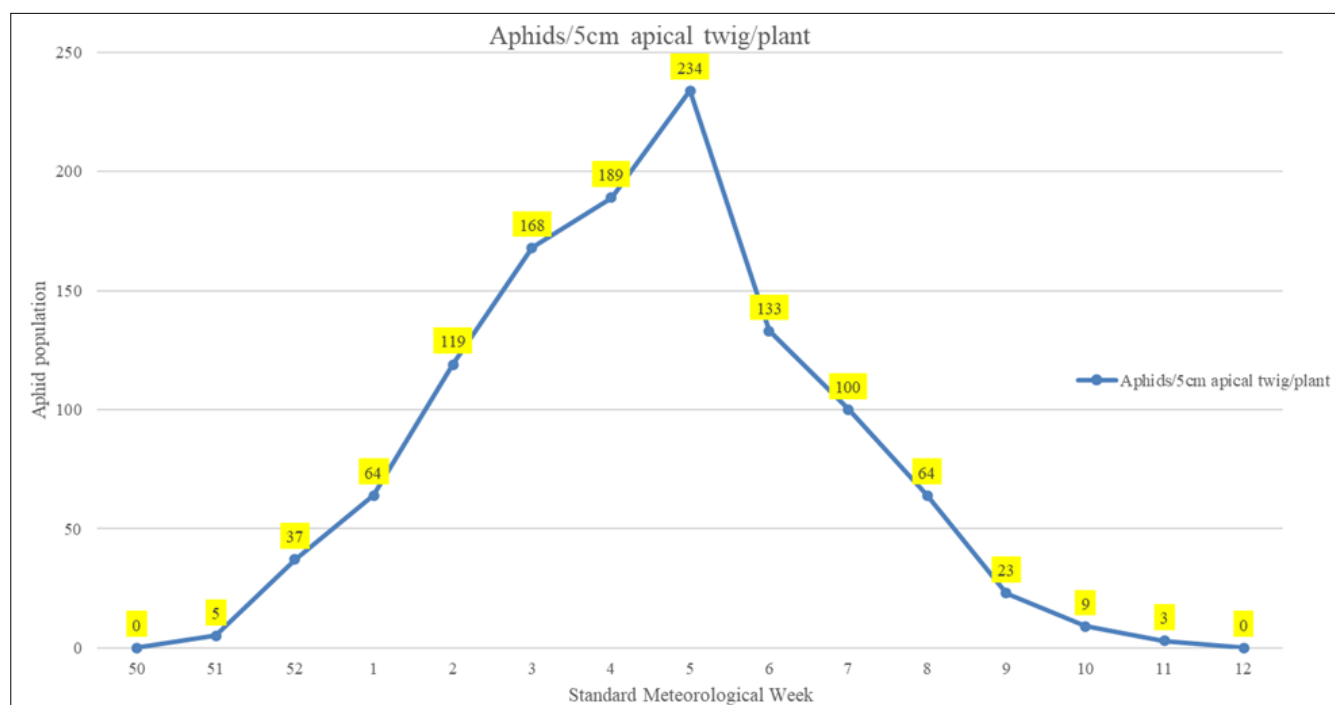


Fig 1: Incidence of *Uroleucon compositae*

Table 2: Correlation between weather parameters and aphid population on safflower during 2021-22.

Weather parameters	Correlation coefficient (r values) aphid population
Maximum temperature (°C)	-0.533*
Minimum temperature (°C)	-0.632*
Morning RH (%)	0.392 ^{NS}
Evening RH (%)	0.290 ^{NS}
Rainfall (mm)	0.153 ^{NS}
Bright sunshine hours (Hrs./day)	0.210 ^{NS}

Significance 5%

Table 3: Correlation between weather parameters and natural enemies on safflower crops during 2021-22.

Sr. No.	SMW	Temperature (°C)		Relative Humidity (%)		Rainfall (mm)	BSS (Hrs./day)	LBB/plant	Chrysopa/ Plant
		Max temp	Min temp	Morning R.H.	Evening R.H.				
1	50	29.20	13.21	88.00	35.0	0.00	5.9	0.00	0
2	51	27.70	9.41	91.00	30.0	0.00	7.1	0.00	0
3	52	28.90	13.56	88.00	44.0	0.00	4.9	0.00	0
4	1	28.00	13.00	89.00	39.0	0.00	6.3	0.33	0.1
5	2	27.10	15.90	87.00	55.0	0.20	4.1	1.26	0.65
6	3	26.70	11.80	92.00	44.0	0.00	5.9	2.13	1.33
7	4	26.80	9.90	78.00	34.0	0.00	7.6	3.78	2
8	5	30.00	8.00	83.00	19.0	0.00	9.6	4.00	1.33
9	6	30.40	11.80	75.00	28.0	0.00	8.3	3.00	0.7
10	7	31.10	14.40	72.00	25.0	0.00	8.0	1.32	0.3
11	8	34.00	14.60	74.00	20.0	0.00	8.9	0.35	0.1
12	9	34.90	16.40	62.00	16.0	0.00	8.6	0.60	0
13	10	34.30	17.50	62.00	21.0	0.00	6.9	0.00	0
14	11	37.40	16.30	56.00	10.0	0.00	8.4	0.00	0
15	12	39.30	20.60	43.00	13.0	0.00	6.5	0.00	0

Seasonal incidence of natural enemies in relation to weather parameters on normal sown A-1.

Seasonal incidence of Lady Bird beetle

The data presented in Table 3 revealed that the incidence of lady bird beetle started about 21 days after germination recorded 0.33 lady bird beetle/5cm twig/plant during 1st meteorological week it gradually increases upto 5th standard meteorological week recorded peak of 4 lady bird beetle/5cm twig/plant when the corresponding weather parameters i.e. maximum temperature, minimum temperature, morning relative humidity and evening

relative humidity were 30 °C, 8 °C, 83% and 19% respectively. Lady bird beetle had negative significant correlation with low temperature and positive non-significant correlation with relative humidity.

^[15] Reported that the predatory population was peaked during third week of January when the temperature was minimum with high humidity which supports the present finding.

Seasonal incidence of Chrysopa

The data presented in Table No.3 revealed that the incidence of

Chrysopa started about 21 days after germination recorded 0.1 *Chrysopa*/5cm twig/plant during 1st meteorological week it gradually increases upto 4th recorded peak of 2 *Chrysopa*/5cm twig/plant when the corresponding weather parameters i.e. maximum temperature, minimum temperature, morning relative humidity and evening relative humidity were 26.80 °C, 9.9 °C, 78% and 34% respectively. *Chrysopa* had negative significant correlation with maximum and minimum temperature.

^[14], reported that the predator, *Chrysopa sexmaculata* had a significantly negative correlation with maximum and minimum temperature.

Summery and Conclusion

Seasonal incidence of safflower aphid and natural enemies shown fluctuation in the population due to the influence of abiotic factors viz., maximum temperature, minimum temperature, relative humidity, rainfall and bright sunshine hours. Correlation between aphid population and weather parameters indicated that maximum and minimum temperature had negatively significant correlation and positive non-significant correlation with relative humidity, rainfall and bright sunshine hours. Correlation between lady bird beetle, *Chrysopa* and weather parameters indicated that minimum temperature had negatively significant correlation, while relative humidity, rainfall and bright sunshine hours had positive non-significant correlation.

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Declaration: The author declare that they have no conflict of interest

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