The Pharma Innovation Journal 2022; SP-11(8): 1964-1967

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; SP-11(8): 1964-1967

www.thepharmajournal.com
Received: 11-06-2022
Accepted: 17-07-2022

Kumbhani MB
Department of Entomology,
N.M.College of Agriculture,
Navsari Agricultural University,
Navsari, Gujarat, India

Shinde CU
Department of Entomology,
N.M.College of Agriculture,
Navsari Agricultural University,
Navsari, Gujarat, India

Corresponding Author
Kumbhani MB
Department of Entomology,
N.M.College of Agriculture,
Navsari Agricultural University,
Navsari, Gujarat, India

Population dynamics of Niger aphid, *Uroleucon compositae* (Theobald) (Hemiptera: Aphididae)

Kumbhani MB and Shinde CU

Abstract
An investigation of the population of Niger aphid, *Uroleucon compositae* (Theobald) revealed that the aphid population commenced from the 4th week after sowing (WAS) *i.e.*, the fourth week of December (51st SMW) with 0.08 aphids per leaf. The population of aphids increased slowly and reached its peak level (42.59 aphids/leaf) at 11th WAS. It disappeared during the 10th SMW (the Second week of March). The activity of the ladybird beetle, *C. sexmaculata* and green lacewing, *Chrysoperla* sp. showed a significantly positive correlation with the aphid population. Among the abiotic factors, minimum temperature had a significantly positive correlation with aphid during the study period, while minimum and average temperature showed a significantly negative correlation. The population of the ladybird beetle, *C. sexmaculata* was started in the 5th WAS (52nd SMW) with an initial population of 0.02 adults per plant and the highest population was recorded at the 11th WAS (0.26 adult/plant). It disappeared in the first week of March (10th SMW). The predator, *C. sexmaculata* had a significantly negative correlation with maximum temperature, minimum temperature and average temperature. The population of green lacewing was recorded as 0.02 adults per plant at 6th WAS (1st SMW) and consciously increased till (0.14 adult/plant) 11th WAS (6th SMW). There was a rapid decline in the predator population and it disappeared in the fourth week of February (9th SMW). Further, *Chrysoperla* sp. had a significantly negative correlation between maximum temperature and average temperature.

Keywords: *U. compositae*, Niger aphid, population dynamics, natural enemies, Niger crop, etc.

Introduction
Niger [*Guizotia abyssinica* (L. f.) Cass.] Is an oilseed crop cultivated in Ethiopia, Germany, Brazil, Mexico and India? It constitutes about 50% of Ethiopian and 3% of Indian oilseed production. It is known by various names like *ramtil* or *kalatil* in India and *noog* in Ethiopia. The genus Guizotia consists of six species, of which five, including Niger, are native to the Ethiopian highlands. Niger oils can be used for birth control and treatments of Syphilis (Salunkhe *et al.*, 1992) [10]. Niger seed cake is valuable cattle feed particularly for milch animals and the low-grade oil cakes are also used as concentrated organic manures in the field crops. It is cultivated in a 2.5 lakh hectare area and its yield is reported about 3 q/ha. While the production of Niger was 0.76 lakh metric tonnes by 2015-16. Andhra Pradesh stood highest on average show area and average production. The production volume of Niger seed across India from the financial year 2019 was 45 thousand metric tonnes, estimated at about 63 thousand tonnes until 2020-21 (Anonymous, 2020) [3]. The seed contains about 40% oil with the fatty acid composition of 75-80% linoleic acid, 7-8% palmitic and stearic acids, and 5-8% oleic acid and the Indian types contain 25% oleic and 55% linoleic acids (Nasirullah *et al.*, 1982) [9]. India is one of the Niger growing countries accounting for more than 50 percent of the world's area and production. Niger is grown on an area of 156.46 lakh per ha with a production of 45.42 lakh tonnes with average productivity of 290 kg/ha (Anonymous, 2019) [2]. Niger aphid, *U. compositae* is a most distractive pest and is also known as artichoke aphid or safflower aphid. During the pre-flowering stage, both nymphs and adults suck the cell sap from shoot apices, peduncles, leaves, and stem thereby secreting a honeydew-like secretion on the leaves and plant parts thereafter leaves had a black sooty mold which hinders photosynthetic activity thereby resulting in stunted growth. Thus, it is an urgent need to develop the required remedy against *U. compositae*. To avoid yield losses caused by these destructive pests and encourage the cultivation of Niger crops in large areas and increase the production and productivity of oilseeds in India as well as Gujarat, all our efforts are needed to tackle these major insect pests by knowing their peak period of infestation through studies on seasonal incidence.

Materials and Methods

To study the population dynamics of Niger aphid, the crop was sown at College farm (Block-B), NMCA. N.A.U., Navsari, Gujarat during the year 2019-20. All the other agronomical practices were adopted as per farming recommendations. The crop was kept free from insecticidal spray throughout the experiment area throughout the season. The experiment field was prepared as per the requirement of the Niger crop. The fertilizer basal dose was given at the sowing time. The entire plot was sown with good quality seeds of Niger crop (variety Gujarat Niger-2). The remaining agronomical operations *viz*., intercultural, weeding and irrigation, etc. were done as per the recommendation.

To find out the incidence of aphids in the Niger crop, fifty plants were randomly selected and tagged from the entire experimental area. The population of aphids was recorded at weekly intervals from tagged plants starting from one week after sowing till the harvest of the crop. The number of nymphs and adult aphids was recorded from three leaves each one from top, middle, and bottom at weekly intervals by observing tagged plants from the experimental plot till the maturity of the crop. Thus, the mean aphid population was worked out and data were analyzed statistically. The regular survey was carried out during cropping to know the natural enemies. Nymphs and adults of aphids' specimens were collected and kept individually in glass vials (5x3 cm) with 95 percent alcohol. The specimen of aphid was identified based on a recent identification report of aphid of south Gujarat by Trivedi *et al*. (2020) [11].

Data on the maximum, minimum, average temperature, morning, evening, and average relative humidity, wind velocity, bright sunshine hours and evaporation recorded at the Meteorological Observatory, College farm, N.A.U., Navsari and were used to study the effect of weather parameters on the population of insect pest and its natural enemies. The simple correlation coefficient was worked out with the weather parameters, its host aphid, and its natural enemies.

Result and Discussion

It can be seen from the data (Table-1.1) that the pest population started from the fourth week after sowing (WAS) *i.e.*, the fourth week of December (51st SMW) with 0.08 aphids per leaf. Further, the population of aphids increased gradually and reached its peak level (42.59 aphids/leaf) at 11th WAS (6th SMW) coinciding with the second week of February. Minimum temperature, maximum temperature, average relative humidity, wind velocity, sunshine hours, and evaporation rate influenced the peak activity (6th SMW) of *U. compositae* on Niger were 28.80 °C, 11.80 °C, 68.60%, 1.60 Km/hrs, 8.30 hrs and 2.90 mm per day, respectively. There was a dramatic decline observed due to the rapidly physiological drying of the Niger crop and aphids eventually disappeared during the 10th SMW (Second week of March).

The findings of the present investigation are in close confirmation with the report of Patil and Kamath (2012) [6] who reported that the first appearance of *U. compositae* on safflower after seven weeks after sowing (51st SMW) when the plants were in the elongation stage (13.36 aphids/5 cm apical twig). The population gradually increased and attained a peak level (103.24 aphids/plant) during the eleventh week after sowing (3rd SMW). Finally, the aphid population declined and disappeared during the 10th SMW; Darandale (2013) [13] also found that the incidence of sucking pest of aphid, *U. compositae* started from the 2nd week of December and reached its peak (63.20 aphids/leaf) during the 1st week of February; the initial aphid population recorded as 15.6 aphids (5 cm apical twig) from the 51st SMW and reached up to the peak level of 93.20 to 110.24 aphids during the 3rd and 5th SMW when the crop was 55 to 70 days old. Then, the population decreased slowly to 10.4 aphids (5 cm apical twig) from 6th to 10th SMW (Rani *et al*., 2015) [14]. The incidence of aphid, *U. compositae* on AnNigeri-1 and Annigri-2 was commended from 44th SMW and reached the maximum level (86.95±1.58 and 86.58 aphid/5 cm central twig) in 49th SMW when fed on safflower by Matti *et al*. (2017) [8]; Upadhyay *et al*. (1980) [12] who studied that the aphid, *U. compositae*, population commenced on safflower leaf whorls during the first week of December and reached to its peak level between mid-January and mid-February. The present findings are in line with the earlier report made by different workers *viz*; Bhatt (2005) [5], Kamant and Hugar (2001) [15], and Akashe *et al*. (2010) [1]. The present findings disagreed with the report of Bade and Kadam (2001) [4] who reported that the incidence of safflower aphid, *U. compositae* started during the last week of November and continued up to 4th January; Kumbhar *et al*. (2018) [7] who studied that the maximum level of infestation of *U. compositae* (142 aphid/5cm twig) was recorded during the 3rd SMW in January. The variation in the population of *U. compositae* might be due to prevailing weather conditions in a particular locality.

A ladybird beetle, *C. sexmaculata* is an important predator and fed upon the Niger aphid. The data presented in Table-1.1 revealed that the population of ladybird beetle, *C. sexmaculata* was started in the 5th WAS (52nd SMW) with a low level (0.02 adult/plant) and the highest population was recorded at the 11th WAS, which was 0.26 adults per plant coinciding with the first and second week of February (6th SMW). Thereafter, the population of the ladybird beetle disappeared in the second week of March (10th SMW). The data of Chrysoperla presented in Table-1.1 revealed that the initial population of predators was recorded as 0.02 adults per plant at the 6th WAS (1st SMW) and consciously increased till the 11th WAS (6th SMW) with the population of 0.14 adults per plant. However, there was a rapid decrease in the population and it disappeared in the fourth week of February (9th SMW).

In nature, the population of insect pests is truly unstable. The rise and fall in population density of an organism depend on surrounding biotic and abiotic factors like natural enemies, temperature, humidity, sunshine hours and wind velocity, etc. To know the effect of various parameters on the population fluctuation of Niger aphid, *U. compositae*, a simple correlation was worked out between weekly mean incidence of Niger aphid and weekly mean values of biotic and abiotic parameters (Table-1.2). The correlation coefficient analysis revealed that the biotic factors *C. sexmaculata* (r = 0.981**) and *Chrysoperla* sp. (r = 0.986**) showed highly significant positive effects on the aphid population. In the past, Bhatt (2005) [5] also recorded the biotic factors impact on the population of *U. compositae* on gaillardia and found that coccinellids (r = 0.957) and chrysopid (r = 0.878) had significantly positive effects. Thus, past results support the present findings. The aphid population exhibited highly significant negative correlation with minimum temperature (r = -0.571), maximum temperature (r = -0.610), average temperature (r = -0.628). However, morning relative humidity (r = 0.145), wind velocity (r = 0.256) sunshine hours (r =

0.314) and evaporation (r = 0.131) had non-significant correlation with aphid population. Moreover, evening relative humidity and average relative humidity gave non-significantly negative influences on the population, which were r = -0.291 and r = - 0.165, respectively. In past, Kamant and Hugar (2001) stated that the population of *U. compositae* on safflower was negatively correlated with maximum temperature with aphid population whereas minimum temperature alone had a highly significant and negative correlation (r = -0.82) with aphid population; Bade and Kadam (2001) [4] who reported that the significant and negative correlation between the safflower aphid, *U. compositae* population, and the minimum temperature; The minimum temperature had highly significant negative correlation (r = -0.82**) with aphid population (Patil and Kamath, 2012) [6]; Darandale (2013) [14] who revealed that the maximum (r = -.509*), minimum (r = -0.551*) and average temperature (r = -0.601*) had a highly significant negative influence on the population of Niger aphid. The present findings are more or less in confirmation of the earlier report.

It can be seen from the data presented in Table-1.3 that the predator, *C. sexmaculata* had a significantly negative correlation with maximum temperature (r = -595*), minimum temperature (r = -0.650*), and average temperature (r = -0.665*). Moreover, Predator (*Chrysoperla* sp.) had significantly negative correlation with maximum temperature (r = -0.670**) and average temperature (r = -0.677**). Morning relative humidity, wind velocity, sunshine hours, and evaporation had non-significant associations with both predators during the study period. A more or less similar effect is reported by Bhatt (2005) [5] who found that the relative humidity had a significantly negative influence on the aphid predators such as coccinellid and chrysopid.

Table 1: Population dynamics of Niger aphid, *U. compositae* with its natural enemies on Niger during the year 2019-20

SMW	Number of aphids/leaf	Mean population of predators	
		Adults of *Cheilomenes sexmaculata*/ plant	Adult of *Chrysoperla* sp./plant
49	0.00	0.00	0.00
50	0.00	0.00	0.00
51	0.08	0.00	0.00
52	1.87	0.02	0.00
1	5.82	0.04	0.02
2	12.34	0.08	0.04
3	22.84	0.10	0.06
4	27.61	0.14	0.10
5	34.25	0.18	0.12
6	42.59	0.26	0.14
7	24.81	0.12	0.08
8	13.20	0.04	0.02
9	1.64	0.02	0.00
10	0.00	0.00	0.00

WAS= Week after Sowing; SMW= Slandered Meteorological Week

Table 2: Correlation studies between biotic and abiotic factors with Niger aphid, *U. compositae* during the year 2019-20

Target pest	Biotic factors		Abiotic factors								
	C. sexmaculata	*Chrysoperla* sp.	Temperature (°C)			Relative Humidity (%)			Wind Velocity (km/hr)	Sunshine (Hours)	Evaporation (mm/day)
			Minimum	Maximum	Average	Morning	Evening	Average			
Aphid	0.981**	0.986**	0.571*	-0.610*	-0.628*	0.145^{NS}	-0.291^{NS}	-0.165^{NS}	0.256^{NS}	0.314^{NS}	0.131^{NS}

*Significant at 5 per cent level (r =±0.532); **Significant at 1 per cent level (r =±0.661); NS = Non- Significant

Table 3: Correlation studies between weather parameters and predators of Niger aphid, *U. compositae* during the year 2019-20

Sr. No.	Weather parameters	Ladybird beetle, *C. sexmaculata*	Green lacewing, *Chrysoperla* sp.
1	Minimum temperature ^{0}C	-0.595*	-0.598*
2	Maximum temperature ^{0}c	-0.650*	-0.670**
3	Average temperature (^{0}c)	-0.665**	-0.677**
4	Morning relative humidity (%)	0.248^{NS}	0.195^{NS}
5	Evening relative humidity (%)	-0.222^{NS}	-0.229^{NS}
6	Average relative humidity (%)	-0.070^{NS}	-0.097^{NS}
7	Wind velocity (km/hr)	0.224^{NS}	0.250^{NS}
8	Bright Sunshine hours (hrs)	0.286^{NS}	0.305^{NS}
9	Evaporation (mm/day)	0.050^{NS}	0.062^{NS}

*Significant at 5 per cent level (r =±0.532); **Significant at 1 per cent level (r =±0.661)
NS = Non- Significant

Conclusion

Studies on population dynamics showed that the pest population was initiated from the fourth week after sowing (51st SMW) and reached its peak (42.59 aphids/ leaf) during the second week of February (6th SMW). The predatory population (*C. sexmaculata* and *Chrysoperla* sp.), as well as maximum temperature, had a significant positive correlation with *U. compositae*. However, the aphid had a positive correlation with other remaining weather parameters *viz.*, relative humidity (%), wind velocity (km/hr), sunshine hours, and evaporation (mm/day). The activity of natural enemies on *U. compositae* was noted after one week of pest appearance and continuous till the harvest of the crop. The maximum activity of ladybird beetle, *C. sexmaculata* (0.26 adult/plant), and Green lacewing, *Chrysoperla* sp. (0.14 adult/plant) was observed during the second week of February (6th SMW). The predators, *C. sexmaculata* and *Chrysoperla* sp. had a significantly negative correlation with maximum temperature, minimum temperature, and average temperature.

Acknowledgement

We are grateful to the Director of Research and Dean of Post Graduate Studies, Navsari Agricultural University, Navsari for providing the necessary facilities to conduct the research. Authors are thankful to Dr. P. K. Jagtap, Assistant Research Scientist, NAU, Vanarasi (Dist-Navsari) for providing the seed material during the present investigation. The author is also thankful to the Professor and Head, Department of Entomology, N. M. College of Agriculture, Navsari Agricultural University, Navsari (Gujarat) for providing laboratory facilities throughout the research work.

References

1. Akashe VB, Gud MA, Shinde SK, Kadam JR. Population

dynamics of safflower aphid, Uroleucon compositae (Theobald) as influenced by weather parameters. J. Agrometeorology. 2010;12(1): 102-104.
2. Anonymous. Agricultural Statistics at a glance 2019. Retrieved from [https://eands.dacnet.nic.in/PDF/At%20a%20Glance%202019%20Eng.pdf](Accessed 6 March, 2020)
3. Anonymous. The First Advance Estimates of production of major Kharif crops for 2020-21. [https://static.pib.gov.in/WriteReadData/userfiles/Time%20Series%201%20AE.%202020-21-English.pdf]. (Accessed 16 Dec, 2020)
4. Bade BA, Kadam JR. Studies on bionomics and population density of safflower aphid in relation to different dates of sowing. J. Maharashtra Agric. Univ. 2001;26(1-3):166-169.
5. Bhatt NA. Bionomics, population dynamics and management of Uroleucon compositae (Theobald) infesting Gallardia pulchella Foug. Thesis M. Sc. (Agri.), Anand Agricultural University, Anand; 2005, p. 32-45.
6. Patil RH Kamath SP. Studies on population dynamics, economic threshold and management of safflower aphid, Uroleucon compositae Theobald. J Oilseeds Res. 2012;29:370-374.
7. Kumbhar SC, Mutkule DS, Sarukh PL, Bade AS. Population dynamics of safflower aphid (Uroleucon compositae Theobald) in relation to weather parameters. J. Entomol. Zool. 2018;6(4):1745-1747.
8. Matti PV, Balikai RA, Naragund VB. Population dynamics and weather based forewarning models for safflower aphid (*Uroleucon compositae* T.). J. Exp. Zool. 2017;20(2):1141-1144.
9. Nasirullah K, Mallika T, Rajalakshmi S, Pashupathi KS, Ankaiah KN, Vibhakar S, *et al*. Studies on Niger seed oil (*Guizotia abyssinica*) seed oil. J. Food Sci. and Technol. 1982;19:147-149.
10. Salunkhe DK, Chavan JK, Adsule RN, Kadam SS. World oilseeds, Chemistry, Technology and Utilization, AVI-Verleg, New York; c1992, p. 451.
11. Trivedi NP, Patel JJ, Ghetiya LV. Diversity of aphids in South Gujarat. J. Entomol. Zool. 2020;8(5):127-131.
12. Upadhyay VR, Kaul CL, Talati GM. Seasonal incidence of aphid, Dactynotus carthami and coccinellids in correlation to weather conditions. Indian J. Pl. Pro. 1980;8(2):117-121.
13. Darandale SA. Population dynamics, varietal screening and bio-efficacy of newer insecticides against pest complex of Nigar (*Guizotia abyssinica* L). Thesis M.Sc. (Agri.), Navsari Agricultural University, Navsari; c2013, p. 33-39.
14. Rani MN, Kharbade SB. Biology and population dynamics of safflower aphid Uroleucon compositae (Theobald) in correlation with weather parameters. Biosci. Trends. 2015;8(19):5195-5199.
15. Kamath SP, Hugar PS. Population dynamics of aphid, Uroleucon compositae Theobald (Aphididae: Hemiptera) on safflower. Karnataka J. Agric. Sci. 2001;14(1):154-156.