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RESEARCH PAPER

Population dynamics of major insect pests infesting chrysanthemum

H. S. HARSHA[1], C. M. RAFEE[1], M.G. HEGDE[1] AND V. S. PATIL[2]

[1] Department of Entomology, [2] Department of Horticulture
University of Agricultural Sciences, Dharwad - 580 005, India
E-mail: harsha05062000@gmail.com

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Abstract: Chrysanthemum (*Dendranthema grandiflora* Borkh) is one of the most popular and widely grown flower crop in both the tropics and subtropics of the world. It is a member of the family Asteraceae. Low yields and poor quality of flowers have been attributed to a variety of issues, including poor seedling quality, pest infestations and severe weather conditions. The field study conducted in Gadag revealed that the peak incidence of aphid, whitefly and leaf miner was observed during the last week of January, the first week of January and second week of January, respectively. The peak incidence of thrips and bud borer was observed during the third and fourth weeks of February, respectively. The correlation coefficient between different weather parameters and the population of chrysanthemum pests revealed that maximum temperature recorded a negative correlation with the incidence of aphids, whiteflies and leaf miner but positively correlated with thrips and bud borer. Further, all the insect pests exhibited a non-significant and negative correlation with rainfall, except leaf miner, which showed a positive correlation with rainfall.

Key words: Chrysanthemum, Correlation, Pests, Population dynamics

Introduction

Chrysanthemum, scientifically known as *Dendranthema grandiflora* Borkh, holds a position of significant prominence in global and Indian flower cultivation, ranking second in importance next to rose. Chrysanthemum is infested by various insect pests; among these, the infestation due to aphids, whiteflies, thrips, leaf miner and bud borer are of major and causes significant damage to the crop and affects the quality of the flower produced. The reproduction, growth and survival of these insect pests are influenced by various abiotic factors, including temperature, humidity and rainfall, as highlighted by (Ajij *et al*., 2009). Temperature, in particular, plays a pivotal role in the population dynamics of these pests, as it impacts their egg-laying and ovipositional behaviour (Cammel and Knight, 1992). Similarly, frequent and high intensity precipitation dislodged the eggs and washed away the neonates of insects (Kadam and Khaire, 1995). Among the biotic factors, natural enemies such as coccinellids and spiders are important because they are most prevalent in natural conditions. These natural enemies are affected by temperature, which ultimately affects the pest population (Yadav *et al*., 2012). So, to understand the relationship between insect pests, biotic and abiotic factors of the environment and to generate general population trends and estimations of the role of natural control, there is a need to carry out a study. It prevents the indiscriminate use of pesticides and saves agro ecosystem balance. Therefore, keeping the above information in view, a study of the influence of abiotic and biotic factors on the incidence of various insect pests and their natural enemies under field conditions on chrysanthemum was carried out.

Material and methods

The field experiment was conducted at farmers field, Gadag, during *rabi/summer* 2022-23. The Poornima variety chrysanthemum cuttings were transplanted in a plot size of 10×10 m with 30×30 cm spacing. The crop was raised by following the recommended package of practices. The experimental plot was kept free from insecticidal spray throughout the cropping season in order to record the incidence of insect pests on chrysanthemum. Ten plants were randomly selected and tagged in the experimental plot and observations were recorded at weekly intervals throughout the crop season, starting from 7 days after transplanting. Plants were randomly observed for infestation of insects by counting a total number of aphids in three randomly selected twigs, whiteflies from three leaves (one each from three randomly selected shoots) of the plant canopy on both sides of the leaves, thrips were observed by using a 10X magnifying hand lens. Bud borer (*Helicoverpa armigera*) and leaf miner (*Liriomyza trifoli*) incidences were recorded on the basis of per cent bud infestation and per cent leaf miner infestation per plant, respectively. To assess the bud borer damage, number of damaged buds out of total number of buds observed from three randomly selected twigs. Further leaf damage by *L. trifoli* was assessed by counting the number of damaged leaves out of total number of leaves on three randomly selected twigs from the plant. Natural enemies like coccinellids (adults and grubs), chrysophids, syrphids (maggots) and spider populations were recorded on the chrysanthemum ecosystem at a weekly interval on randomly selected ten plants and expressed as a number per plant.

Results and discussion

Incidence of chrysanthemum pests in relation to weather parameters

Aphids

Incidence of aphids on chrysanthemum initiated from third week of October with population of 6.34 aphids per three twigs

on 5 cm area and peak population of 40.24 aphids per 3 twigs (Table 1) was attained during last week of January. From third week of December to last week of January there was gradually increase in population but after January fourth week population showed decreasing trend up to last week of March 2023 (3.78 aphids/3 twigs). A significant negative correlation was observed between aphids population and minimum temperature (r = -0.518**) and non significant negative correlation with maximum temperature (r = -0.319). Aphids population also exhibited a non significant positive correlation with relative humidity (r = 0.288) and non significant negative correlation with rainfall (r = -0.015). These observance were in accordance with the studies reported by Saicharan *et al.* (2017) and Smitha (2018) who reported the peak period of aphids in *rabi* grown chrysanthemum was in January and that the incidence of aphids gradually decreased as the crop passed through senescence. Chaudhari and Kumar (2020) who reported rainfall, maximum and minimum temperature showed negative correlation with aphids population.

Whitefly

Whiteflies appeared from third week of October with the population of 1.12 whiteflies per leaf afterwards it remained a constant with peak incidence during first week of January (11.12 whiteflies per leaf). Thereafter, the population of whiteflies decreased and there was no incidence at the end of the cropping season Table 1. The correlation coefficient values indicated that the whitefly population exhibited a significant negative correlation with both maximum temperature (r = -0.557**) and minimum temperature (r = -0.507**) and non significant negative correlation with rainfall (r = -0.002). Whereas, a significant positive correlation was observed between whitefly populations and relative humidity (r = 0.495**). Present results are in agreement with Anjali *et al*. (2012) and Indirakumar *et al*. (2016), who reported maximum whitefly population during (2nd SMW) and lowest in March (12th SMW). Further Anjali *et al*. (2012) and Indirakumar *et al*. (2016) reported that the population of whiteflies was negatively correlated with both maximum and minimum temperatures.

Thrips

Incidence of thrips on chrysanthemum flowers was noticed from fourth week of November with population of 2.96 thrips per flower and peak population of 16.17 per flower was attained during third week of February. From third week of January to third week of February there was gradually increase in population but after March first week population showed gradual decreasing trend upto last week of March (7.12 thrips/ flower) Table.1 Thrips population showed a significant positive correlation with maximum temperature (r = 0.580) and non significant negative correlation with minimum temperature (r = -0.081). Thrips population also exhibited a significant and non significant negative correlation with relative humidity (r = -0.630) and rainfall (r = -0.318), respectively Table 2. The results are in close agreement with the findings of Vijayalakshmi *et al.* (2017) who reported that maximum population of thrips during

Table 1. Population dynamics of major insect pests and their predators in chrysanthemum during *rabi/summer* 2022-23

Month and Year	SMW	DAT	Sucking pests			Leaf miner infestation (%)	Bud borer infestation (%)
			Aphids/5cm apical twig	Thrips/ flower	Whiteflies/ leaf		
Oct-22	42	7	0	0	0	2.12	0
	43	14	6.34	0	0	4.56	0
	44	21	6.72	0	1.12	8.12	0
Nov-22	45	28	10.12	0	2.36	7.12	0
	46	35	11.78	0	3.72	7.02	0
	47	42	14.02	0	5.42	8.22	0
	48	49	16.56	2.96	5.96	7.98	3.36
Dec-22	49	56	16.26	4.96	7.18	14.86	7.02
	50	63	18.78	4.68	6.93	17.68	6.34
	51	70	21.68	7.78	7.98	19.34	8.12
	52	77	26.56	9.46	8.38	19.12	8.84
Jan-23	1	84	33.46	9.64	11.12	23.78	9.12
	2	91	31.98	8.12	9.76	32.84	9.08
	3	98	34.46	10.12	7.58	27.12	10.16
	4	105	38.78	11.03	6.24	27.02	12.12
	5	112	40.24	11.75	4.12	25.68	16.56
Feb-23	6	119	31.78	12.03	4.34	23.68	18.12
	7	126	18.78	13.37	3.98	20.96	21.24
	8	133	14.78	16.17	3.56	18.84	22.07
	9	140	12.84	15.38	3.17	16.78	23.68
Mar-23	10	147	13.84	12.56	2.08	16.62	12.34
	11	154	10.34	10.84	1.26	17.64	7.56
	12	161	8.78	8.46	0.84	13.12	8.78
	13	168	3.78	7.12	0	8.24	8.96

SMW- Standard Meteorological Week

Table 2. Correlation studies between weather parameters and insect pests

Insect pests	Maximum temperature (°C)	Minimum temperature (°C)	RH (%)	Rainfall (mm)
Aphids	-0.319	-0.518**	0.288	-0.015
Thrips	0.580**	-0.081	-0.630**	-0.318
Whiteflies	-0.557**	-0.507**	0.495**	-0.002
Leaf miner	-0.028	-0.402*	-0.045	0.040
Bud borer	0.258	-0.288	-0.521**	-0.193

* Significant at P≤ 0.05, **Significant at P≤ 0.01

mid February and March. Duraimurugan and Jagadish (2002) and Vijayalakshmi *et al.* (2017) reported that thrips population had a positive correlation with maximum temperature and negative correlation with relative humidity and rainfall.

Leaf miner

leaf miner infestation was observed from second week of October with the infestation of 2.12 per cent per plant afterwards it increased gradually with a peak infestation during second week of January (32.84 %). Thereafter, the incidence of leaf miner decreased towards the end of the cropping season. The correlation coefficient values indicated that the leaf miner infestation exhibited a non significant negative correlation with maximum temperature (r = -0.028) and significant with minimum temperature (r = -0.402**) and non significant positive correlation with rainfall (r = 0.040). The present results are in line with Choudary and Rosaiah (2000), who recorded peak leaf miner incidence in the 4th week of January. Further Mustafa *et al.* (2014) and Prabhudev *et al.* (2021), reported that the leaf miner infestation was negatively correlated with both maximum and minimum temperatures and a positive correlation with rainfall.

Bud borer

Incidence by bud borer on chrysanthemum was first noticed from fourth week of November with infestation of 3.36 per cent per plant and peak infestation of 23.68 per plant was attained during fourth week of February. From third week of January to third week of February there was gradually increase in infestation but after March first week infestation showed gradual decreasing trend up to last week of March (8.96 % / plant). Bud borer infestation showed a non significant positive correlation with maximum temperature (r = 0.258) and a negative correlation with minimum temperature (r = -0.288). Bud borer infestation also exhibited a significant and non significant negative correlation with relative humidity (r = -521) and rainfall (r = -0.193), respectively. The present findings are in close association with Reddy *et al.* (2009) and Kumar *et al.* (2015) who reported that pod borer populations on chickpea were at their maximum during February and March. Pandey *et al.* (2012) and Pankaj *et al.* (2018), who noticed positive correlation with maximum temperature and a negative correlation with relative humidity and rainfall.

Conclusion

From the foregoing discussion it can be concluded that the peak incidence of aphids and whiteflies and leaf miner was observed during last week (5th SMW) and first week (1st SMW) and second week (2nd SMW) of January, respectively. The peak incidence of thrips and bud borer was observed during third and fourth week of February respectively, coinciding with the peak flowering stage of the crop. Further, from the correlation studies, it was found that aphids and whiteflies exhibited a negative correlation with maximum temperature. However, thrips exhibited a positive correlation with temperature.

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