



ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; SP-11(5): 245-248
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www.thepharmajournal.com
Received: 22-03-2022
Accepted: 24-04-2022

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Seasonal abundance of insect pests and natural enemies in sunflower in the Western Undulating zone of Odisha

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Abstract

Study on seasonal incidence of insect pests and their predators in sunflower in the Western Undulating Zone of Odisha during 2019-20 revealed that the sucking pest like white fly, jassids and aphids appeared at early growth stage of sunflower and continued to build up and attained the peak during 50-51 MW with highest population of 4.8, 2.3, 1.8 nos. /leaf respectively. However, the bug population increase at the crop maturity stage and maximum population was recorded at 8th MW with a population of 2.4 bugs / plant. The larvae of lepidopteran pests recorded was highest at the fag end of the crop (5th SW), which coincides with the flowering and seed maturity stage of the crop and the predators population at the seed maturity stage of the crop.

The bugs are significantly negatively correlated with both maximum and minimum temperature, however, the maximum RH showed a positive correlation on population build up. Maximum temperature ($r = -0.851$) had significant negative correlation and maximum relative humidity had significant positive correlation ($r = 0.554$) on the lepidopteran pest build up. Spider showed a significant positive correlation with maximum temperature ($r = 0.455$) and minimum temperature ($r = 0.432$) and significant negative correlation with maximum relative humidity ($r = -0.461$) and minimum relative humidity ($r = -0.563$).

The regression analysis of white fly, jassids, aphids, grasshoppers, bugs and larvae with predators implies that with increase in insect pests population the population of predators also increased.

Keywords: Sunflower, insect pests, seasonal incidence

Introduction

Insect pests infestation is one of the major constraint for sunflower (*Helianthus annuus* L.) production. In India more than 50 insect species have been recorded to damage the crop at different growth stages and nine are major pests. Meteorological variables plays a vital role in multiplication and distribution of insect pests, which directly influence the abundance of natural enemies (Zafar *et al.*, 2013) [5]. To formulate an effective, economic and sustainable pest management strategy for a specific agro- ecosystem, complete knowledge on abundance and distribution of pest in relation to weather factors is a basic requirement (Patel and Shekh, 2006) [3].

Keeping this point in view the present study was undertaken to assess the seasonal incidence of major insect pests of sunflower and to workout correlation between the insect pests and predators with the abiotic factors in the Western Undulating Zone of Odisha.

Materials and Methods

A field experiment was conducted at College of Agriculture, Bhawanipatna, Odisha University of Agriculture and Technology, Bhubaneswar to study the incidence and multiplication of insect pests of sunflower in relation to meteorological variables in the Western Undulating Zone of Odisha during Rabi, 2019-20. Sunflower, hybrid NSFH-145(Swathi) of Nuziveedu seeds company was shown on 6th Nov. 2019 with 60.0 x 30 cm spacing in three replications. Fertilizer applications and agronomic practices were used according to standard recommendations. No insecticidal treatment was done during crop growth periods.

The population of insect pests and predators were recorded after one month of germination till harvest of the crop at weekly interval during morning hours (8-9.0 AM) without disturbing the insect fauna of the plants. Insect counts were made on ten randomly selected plants. Sucking insect pests such as whitefly, green leaf hopper and aphid were recorded from upper, middle and lower leaves of the plants. The population of defoliators like Semilooper, *H. armigera*, *Spodoptera litura*, Hairy caterpillars, grass hoppers, beetles etc and the predators *i.e.*, Spiders, Syrphid larvae, Ppreying mantids, Predatory wasp, *Epilachana* beetles, Carabid beetles etc.

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were recorded per plant by visual observation.

Finally mean data was calculated and the simple correlation of the population of insect pests and predators was computed with weekly mean meteorological observations to see the relationship of weather factors with population change in the Western Undulating zone of Odisha.

Results and Discussion

Sucking insect pests

During the study period a large number of sap feeders such as white fly, jassids, aphids, thrips and different bugs were recorded. Both the nymphs and adults suck the plant sap and cause the damage and is in agreement with the finding of Sattar *et al.*, 1984^[4]; Basit *et al.*, 2016^[11].

White fly: The population ranged from 0.1- 4.8 individuals/leaf. The incidence appeared from 48th meteorological week (MW) with a peak incidence of 4.8 individuals / leaf (51st MW) *i.e.*, mid December and decrease to reach 0.1 individuals / leaf at 7th MW (Table 1). The whitefly population trend implies that the population was

more before flowering *i.e.*, 48th to 3rd MW.

Jassids: The incidence of jassid ranged from 0.1- 2.3 individuals/leaf. The jassid appeared from 48th MW and attained its peak of 2.3 individuals / leaf at 51 SW and decreased slowly to reach nil at 6th MW. Present investigation indicates the jassid population was more during vegetative period of crop growth.

Aphid: Aphid population was very low ranged from 0.1- 1.8 individuals/leaf. The incidence of aphid appeared from 48 MW and highest incidence of 1.8 individuals / leaf was recorded at 51 MW (Table 1). The population later decreased to reach nil after 3rd MW.

Bugs: The bugs (Pentatomid bugs, red cotton and dusky cotton bugs etc) incidence was appeared from 3rd MW with a population of 0.2 bugs/plant and maximum bugs population (2.4 bugs/plant) was recorded during crop maturity stage *i.e.*, 8th MW. The bug population ranged from 0.2- 2.4 bugs/plant during the crop periods (Table 1).

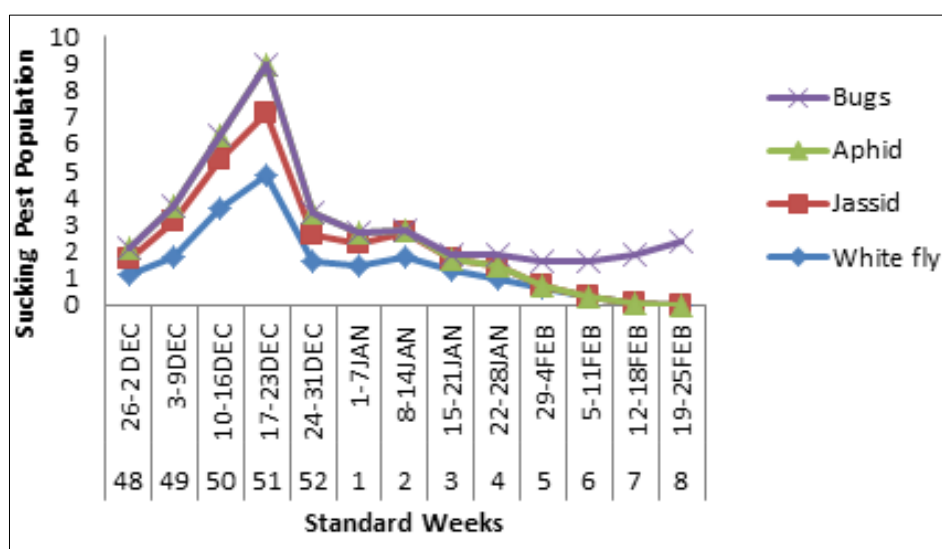


Fig 1: Seasonal activity of sucking pests in sunflower during 2019-20

Foliage feeders

Grass hopper: These are polyphagous insect pests and observed in low numbers throughout the crop growth period of sunflower. Population of grass hopper was very low and ranged from 0.1- 0.8 individuals/plant. Maximum number of grass hopper (0.8 individuals/plant) was recorded in 52 SW (Table 1). There was no definite pattern of grass hopper population was recorded during crop growth of sunflower.

Flea beetles: The incidence appeared from 48th MW (0.5/plant) and attained its peak (0.7/plant) at 50 MW. The flea beetle population was recorded throughout the crop growth

period with no definite pattern of increase or decrease (Table 1). However it has been observed that during the vegetative phase of crop growth the flea beetles population is more compared to maturity stage of the crop.

Larvae: Very low incidence of larvae (*Spodoptera*, *Heliothis*, semiloopers, *Spilosoma* and other hairy caterpillars) appeared at the mid phase of the crop growth *i.e.*, 12th – 13th weeks of the crop and the maximum larval population (1.5 larvae/plant) was recorded during 5th MW (Table 1) and after 7th MW the larval population drastically reduced.

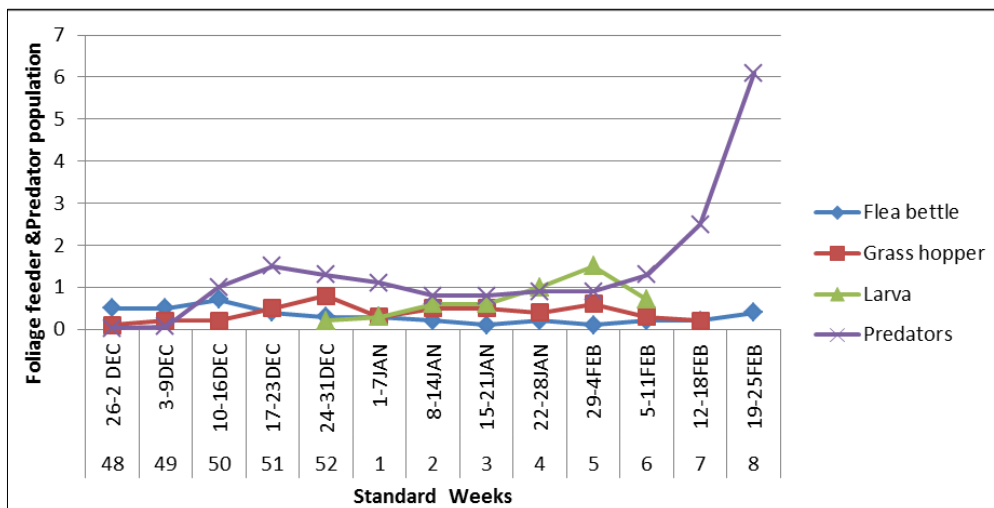


Fig 2: Seasonal activity of foliage feeders and predators in sunflower during 2019-2020

Natural enemies

Predators: During crop period numbers of predators like coccinellids beetles, carabid beetles, green lace wing, different spiders spp, preying mantids, assassin bus, syrphid larvae and predatory wasp were recorded. Among them the spiders and coccinellids beetles are the major predators in the sunflower ecosystem and same was reported by Basit et. al, 2016 [1]. Coccinellids are found throughout the crop season

and are the major predators of white fly, jassids and aphids. The predators population were recorded through the crop growth and ranged from 0.2-6.1/plant. The maximum number of predators population was recorded at 8th MW (6.1/plant) i.e, fag end of the crop (Table 1).

Besides entomophagous, two vertebrates predators i.e, Black drongo and Common mynah are recorded during the study period.

Table 1: Seasonal abundance of sunflower insect pests and predators in the Western Undulating Zone of Odisha during 2019-20

MW	White fly	Jassid	Aphid	Flea beetle	Grass hopper	Bugs	Larva	Predators
48	1.1	0.6	0.4	0.5	0.1	-	-	0.2
49	1.8	1.3	0.6	0.5	0.2	-	-	0.6
50	3.6	1.8	0.9	0.7	0.2	-	-	1.0
51	4.8	2.3	1.8	0.4	0.5	-	-	1.5
52	1.6	1.0	0.8	0.3	0.8	-	0.2	1.3
1	1.5	0.8	0.4	0.3	0.3	-	0.3	1.1
2	1.8	0.9	0.1	0.2	0.5	-	0.6	0.8
3	1.3	0.4	-	0.1	0.5	0.2	0.6	0.8
4	1.0	0.5	-	0.2	0.4	0.4	1.0	0.9
5	0.6	0.1	-	0.1	0.6	0.9	1.5	0.9
6	0.3	-	-	0.2	0.3	1.3	0.7	1.3
7	0.1	-	-	0.2	0.2	1.8	-	2.5
8	-	-	-	0.4	-	2.4	-	6.1
Mean	1.62	0.97	0.71	0.32	0.38	1.17	0.70	1.46

Correlation study of insect pest and natural enemies with abiotic factors:

Present study revealed that the bugs are significantly negatively correlated with both maximum temperature (r= -0.877) and minimum temperature (r= -0.507) implies that with increase of both minimum and maximum temperature the bug population decrease. However, the maximum relative humidity showed a positive correlation (r= 0.591) on population build up.

Correlation of lepidopterans larvae population with meteorological parameters indicated that maximum temperature (r= -0.851) had significant negative correlation and maximum relative humidity had significant positive correlation (r= 0.554) on the lepidopterans pest build up and

is in agreement with the finding of Jayewar et. al, 2019. The data presented in Table 2 revealed that the spider showed a significant positive correlation with maximum temperature (r=0.455) and minimum temperature (r=0.432) and significant negative correlation with maximum relative humidity (r= -0.461) and minimum relative humidity (r= -0.563). Correlation with rainfall was non-significant and positive.

Correlation of white fly and jassids with meteorological parameters indicated that both temperature (max. and min) had negative correlation on population build up and is contradict with the finding of Basit et al, 2016 [1]. The jassid population also had negative correlation with both maximum and minimum humidity.

Table 2: Correlation (r) between insect pests population and weather parameters on sun flower.

Insect pests and predators	Temperature (°C)		Relative humidity (%)		Rain fall (mm)
	Max	Min.	Max.	Min.	
White fly	-0.024	-0.170	0.065	-0.031	0.283
Jassid	-0.145	-0.313	-0.257	-0.286	0.089
Aphid	0.136	0.143	0.077	-0.246	0.252
Flea beetle	0.148	0.140	-0.122	-0.036	0.183
Grasshopper	-0.277	-0.285	0.234	0.071	0.187
Bugs	-0.877*	-0.507**	0.591**	0.305	0.078
Larvae	-0.851*	-0.340	0.554**	0.407	0.250
Predators	0.455**	0.432**	-0.461**	-0.563*	0.071

*Significance at 5% level **Significance at 10% level

The regression of white fly, jassids, aphids, grasshoppers, bugs and larvae with predators showed positive value with whitefly ($r^2= 0.040$), jassids ($r^2= 0.115$), aphids ($r^2= 0.316$), bugs ($r^2= 0.038$), grasshoppers ($r^2= 0.760$) and larvae ($r^2= 0.202$), which means that with increase in insect pests

population the population of predators also increase (Table 3) and the same was finding by Basit et. al, 2016. Regression analysis showed a great influence of predators on white fly (4.0%), jassids (11.5%), Aphids (31.6%), grass hoppers (3.8%), bugs (76.0%) and larvae (2.02%).

Table 3: Impact of predators on the insect pests of sunflower during 2019-20

Parameters	R ²	Intercept(a)	Regression coefficient (b)	SE of 'b'	't' value
White fly	0.040	1.062	-0.029	0.315	3.365**
Jassid	0.115	0.605	0.240	0.274	2.211
Aphid	0.316	0.401	0.595	0.343	1.170
Grass hopper	0.038	0.801	0.558	0.426	1.878
Bug	0.760	-0.418	2.144	0.840	0.023*
Larvae	0.202	1.171	-0.224	0.161	7.258

Conclusion

The information so gathered during present study could be useful to predict the population of insect pests of sunflower with relation to the changing meteorological parameters in the Western Undulating Zone of Odisha and can be utilized in formulating appropriate management strategies for the major pests of sunflower through location specific IPM strategy to avoid excess reliance of chemical insecticides and the yield loss cause by the insect pests.

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