Journal of Entomology and Zoology Studies

Available online at www.entomoljournal.com

E-ISSN: 2320-7078
P-ISSN: 2349-6800
JEZS 2019; 7(5): 576-580

Received: 07-07-2019
Accepted: 09-08-2019

VK Bhamare
Department of Agricultural Entomology, College of Agriculture, Latur, Maharashtra, India

RD Dhembare
Department of Agricultural Entomology, College of Agriculture, Latur, Maharashtra, India

PK Nalwandikar
Department of Agricultural Entomology, College of Agriculture, Latur, Maharashtra, India

KV Deshmukh
Department of Agricultural Entomology, College of Agriculture, Latur, Maharashtra, India

AS Ingale
Department of Agricultural Entomology, College of Agriculture, Latur, Maharashtra, India

Correspondence
MA Laichattiwar
Department of Agricultural Entomology, College of Agriculture, Latur, Maharashtra, India

Influence of ambient weather on the incidence of hairy caterpillars infesting sole sunflower and sunflower intercropped with pigeonpea

VK Bhamare, RD Dhembare, PK Nalwandikar, KV Deshmukh and AS Ingale

Abstract
Investigations were carried out during *Kharif* 2017 at the Research Farm of Department of Agricultural Entomology, College of Agriculture, Latur (VNKMV, Parbhani) on influence of ambient weather on seasonal incidence of *Euproctis* sp. and *Spilosoma obliqua* (Walker) infesting sole sunflower and sunflower intercropped with pigeonpea. During the investigation, *Euproctis* sp. and *S. obliqua* were emerged as major hairy caterpillars on sole sunflower and sunflower intercropped with pigeonpea. The peak population of *Euproctis* sp. was noticed to the extent of 1.8 and 3.2 larvae per quadrat during 40th and 39th SMW and the peak population of *S. obliqua* was registered to the tune of 1.4 and 2.8 larvae per quadrat during 39th and 39th SMW on sole sunflower and sunflower intercropped with pigeonpea, respectively. The larval population of *Euproctis* sp. infesting sole sunflower exhibited positive correlation with rainy days and minimum temperature while, negative correlation with before noon relative humidity. However, the larval population of *Euproctis* sp. infesting sunflower intercropped with pigeonpea exhibited positive correlation with relative humidity while, negative correlation with maximum temperature. None of the factor exhibited significantly direct positive effect on the larval population of *S. obliqua* infesting sole sunflower while, rainfall showed negative correlation with larval population. However, the larval population of *S. obliqua* exhibited direct positive correlation with after noon relative humidity while, rainfall and maximum temperature showed negative correlation with larval population of *S. oblique* when sunflower intercropped with pigeonpea.

Keywords: Weather, sunflower, intercropping, pigeonpea, *Euproctis* sp, *Spilosoma oblique*

Introduction
Sunflower, *Helianthus annus* Linnaeus (Family Asteraceae or Compositae) is grown in India as an ornamental plant since ancient time. It was introduced in 1969 and its commercial cultivation was started in India during 1972. Globally sunflower is cultivated over an area of more than 26.20 million hectares in about 70 countries with 47.34 million tonnes of production and 1806.7 kg per ha of productivity during 2016 [7]. In India, sunflower is cultivated on an area of 0.40 million hectares with 0.33 million tonnes of production and 830 kg per hectare of productivity during 2016 [7]. In Maharashtra, sunflower is grown on an area of 0.61 lakh hectare with 27.67 thousand tonnes of production and 407 kg per hectare of productivity during 2014-2015 [1].

Sunflower is attacked by more than fifty insect species in India. Among them, nine are major pests which are broadly categorized as seedling pests, sucking pests, defoliators, inflorescence pests and soil insects [5]. These insect-pests inflicted crop losses resulting 30 per cent failure in crop stand [4]. The defoliators are important insect-pests of sunflower [10], out of which capitulum borer; *Helicoverpa armigera* (Hubner), Tobacco caterpillar; *Spodoptera litura* (Fabricius), hairy caterpillar; *Euproctis* sp., Bihar hairy caterpillar *Spilosoma obliqua* (Walker) and various semiloopers are reported as regular and key pests in Marathwada region of Maharashtra state [6]. The loss in seed yield due to defoliators in a rain fed *Kharif* sunflower was up to 58.06 per cent per ha [13].

Sunflower is being mainly grown as intercrop with pulses. The systematic studies are lacking particularly with respect to management of sunflower pests through inter crops. It is reported that mixed cropping of sunflower with red gram reduced the population of *Helicoverpa armigera* on sunflower to some extent compared with sole crop [12]. A detailed understanding of such type of manipulation may be helpful in forecasting of pest outbreak on one hand and

development of integrated crop management practices on the other [11]. The population dynamics and ecology of many sunflower insect-pests was not well studied with respect to cultivars and cropping system of sunflower. Very scanty information is available on variations in the pattern of infestation caused by insect-pests when sunflower is intercropped with pigeonpea. With this background, an attempt was made to study the population dynamics of major insect-pests of sole sunflower and sunflower intercropped with pigeonpea.

Material and Methods

The non-replicated field experiment comprising two hundred and forty quadrats (eighty quadrats of sole sunflower of 2.4 x 2.4 sq. m sizes each, eighty quadrats of sunflower intercropped with pigeonpea of 2.4 x 2.4 sq. m sizes each) was laid to investigate field life-tables and population dynamics of major insect-pests of sole sunflower and sunflower intercropped with pigeonpea at the Research Farm of Department of Agricultural Entomology, College of Agriculture, Latur (MS) during *kharif* season, 2017. The sunflower variety LSFH-171 and pigeonpea variety BDN-716 were used during the investigation. The sole sunflower and sunflower intercropped with pigeonpea was sown at the spacing of 60 x 30 cm. The field experiment was conducted under pesticide free conditions. Weekly observations on population counts on larval stage of insects were taken until crop turned yellow. Five quadrates of crop were observed twice in each meteorological week for observations on hairy caterpillars infesting sunflower and sunflower intercropped with pigeonpea. The population was pooled together and average population per quadrat was calculated for each meteorological week. Average weekly meteorological data during the observation period, such as temperature, relative humidity, rainfall and number of rainy days were also recorded. The statistical analysis of data on incidence of *Euproctis* sp., *S. obliqua* and its relation with ambient weather were carried out by simple correlation using excel worksheet.

Results and Discussion

Population dynamics of hairy caterpillars infesting sole sunflower and sunflower intercropped with pigeonpea

The population dynamics of hairy caterpillars infesting sole sunflower and sunflower intercropped with pigeonpea was studied during *kharif* season 2017. During the course of investigation the weather parameters *viz.*, minimum temperature, maximum temperature, beforenoon relative humidity, afternoon relative humidity, rainfall and number of rainy days were varied from 11.6 ºC to 22.8 ºC, 27.9 ºC to 31.7 ºC, 73 to 100 per cent, 29 to 82 per cent, 0.00 to 184.0 mm and 0 to 4 days, respectively. The data pertaining to the population of hairy caterpillars infesting sole sunflower and sunflower intercropped with pigeonpea in relation to weather parameters during *kharif* season 2017 are presented in Table 1 to 4.

Euproctis sp. on sole sunflower

The first incidence of *Euproctis* sp. on sole sunflower was recorded in 33th standard meteorological week (0.2 larva per quadrat) with its peak population level (1.8 larvae per quadrat) in 40th standard meteorological week. At maximum level of population of *Euproctis* sp. the prevailing weather factors *viz.*, rainfall, number of rainy days, maximum temperature, minimum temperature, beforenoon relative humidity and afternoon relative humidity were 0.0 mm, 0 day, 31.5 ºC, 22.6 ºC, 90 per cent and 74 per cent, respectively (Table 1).

Euproctis sp. on sunflower intercropped with pigeonpea

The first incidence of *Euproctis* sp. on sunflower intercropped with pigeonpea was recorded in 34th standard meteorological week (1.0 larva per quadrat) with its peak population level (3.2 larvae per quadrat) in 39th standard meteorological week. At maximum level of population of *Euproctis* sp. the prevailing weather factors *viz.*, rainfall, number of rainy days, maximum temperature, minimum temperature, beforenoon relative humidity and afternoon relative humidity were 8.0 mm, 1 day, 31.7 ºC, 21.6 ºC, 100 per cent and 82 per cent, respectively (Table 2).

The results of present investigation are in acquiescence with the findings of Rahmathulla *et al.* (2015) [9] who revealed that the peak incidence of hairy caterpillar (*Amsacta mori*) was reported during the rainy season (June-October) on mulberry. The correlation results revealed that the incidence of *A. mori* (r = -0.737) was significantly and negatively correlated with maximum temperature and positively correlated with maximum relative humidity.

Table 1: Population dynamics of *Euproctis* sp. and *S. obliqua* infesting sole sunflower in relation to weather parameters during *kharif* 2017

Month	Standard meteoro-logical weeks	Rainfall (mm)	Number of rainy days	Temperature		Relative Humidity (%)		Mean number of larvae per quadrat	
				Min	Max	Before noon	After noon	*Euproctis* sp.	*S. obliqua*
Aug.	32	4.0	1	22.8	29.7	94	54	-	-
	33	21.0	2	22.1	28.3	98	58	0.2	-
	34	184.0	4	21.5	27.9	100	74	0.2	-
Sept.	35	22.0	2	22.8	29.9	97	74	0.6	0.2
	36	4.0	1	22.0	30.9	98	61	0.2	0.8
	37	137.0	4	21.6	30.3	100	70	1.2	1.2
	38	20.0	2	21.9	28.6	100	74	0.4	1.2
	39	8.0	1	21.6	31.7	100	82	0.4	1.4
Oct.	40	0.0	0	22.6	31.5	90	74	1.8	0.4
	41	101.0	3	21.1	30.5	100	66	1.6	-
	42	13.0	1	21.0	31.2	89	52	1.2	-

Spilosoma obliqua (Walker) on sole sunflower

The first incidence of *S. obliqua* on sole sunflower was recorded in 35th standard meteorological week (0.2 larva per quadrat) with its peak population level (1.4 larvae per quadrat) in 39th standard meteorological week. At maximum level of population of *S. obliqua* the prevailing weather

factors *viz.*, rainfall, number of rainy days, maximum temperature, minimum temperature, beforenoon relative humidity and afternoon relative humidity were 8.0 mm, 1 day, 31.7 ºC, 21.6 ºC, 100 per cent and 82 per cent, respectively (Table 1).

***Spilosoma obliqua* (Walker) on sunflower intercropped with pigeonpea**

The first incidence of *S. obliqua* on sunflower intercropped with pigeonpea was recorded in 35th standard meteorological week (0.4 larva per quadrat) with its peak population level (2.8 larvae per quadrat) in 39th standard meteorological week. At maximum level of population of *S. obliqua* the prevailing weather factors *viz.*, rainfall, number of rainy days, maximum temperature, minimum temperature, beforenoon relative humidity and afternoon relative humidity were 8.0 mm, 1 day, 31.7 ºC, 21.6 ºC, 100 per cent and 82 per cent, respectively (Table 2).

The results of present investigation are in harmony with the findings of (Mohapatra *et al*., 2018) [8] who divulged that *S. obliqua* was first appeared in 35 SMW (2.20 larvae per plant) and reached a peak level in 39SMW (12.60 larvae per plant). (Yadav *et al*., 2015) [14] revealed that *S. oblique* on blackgram marked its first appearance during 39th SMW (11.27 larvae per m^2) and attained peak population during 40th SMW (29.50 larvae per m^2).

Table 2: Population dynamics of *Euproctis* sp. and *S. obliqua* infesting sunflower intercropped with pigeonpea in relation to weather parameters during *kharif* 2017

Month	Standard meteoro-logical weeks	Rainfall (mm)	Number of rainy days	Temperature		Relative Humidity (%)		Mean number of larvae per quadrat	
				Min	Max	Before noon	After noon	*Euproctis* sp.	*S. obliqua*
Aug.	33	21.0	2	22.1	28.3	98	58	-	-
	34	184.0	4	21.5	27.9	100	74	1	-
Sept.	35	22.0	2	22.8	29.9	97	74	0.8	0.4
	36	4.0	1	22.0	30.9	98	61	0	0.2
	37	137.0	4	21.6	30.3	100	70	0.6	0.4
	38	20.0	2	21.9	28.6	100	74	1.4	2.2
	39	8.0	1	21.6	31.7	100	82	3.2	2.8
Oct.	40	0.0	0	22.6	31.5	90	74	1.6	1.6
	41	101.0	3	21.1	30.5	100	66	1.8	0.2
	42	13.0	1	21.0	31.2	89	52	0.8	-

Correlation between incidence of hairy caterpillars infesting sole sunflower and sunflower intercropped with pigeonpea with weather parameters

***Euproctis* sp. on sole sunflower**

The results in respect of simple correlation between larval population of *Euproctis* sp. infesting sole sunflower and weather parameters during *kharif* 2017 are tabulated in Table 3. The data presented on correlation coefficient indicated that rainy days (1.0627*) and minimum temperature (0.5755*) exhibited significantly direct positive effect on larval population of *Euproctis* sp. infesting sole sunflower, whereas beforenoon relative humidity (-0.8821*) showed negative correlation with larval population.

***Euproctis* sp. on sunflower intercropped with pigeonpea**

The results in respect of simple correlation between larval population of *Euproctis* sp. infesting sunflower intercropped with pigeonpea and weather parameters during *kharif* 2017 are tabulated in Table 4. The data presented on correlation coefficient indicated that afternoon relative humidity (1.0795*) exhibited significantly direct positive effect on larval population of *Euproctis* sp. infesting sunflower intercropped with pigeonpea, whereas maximum temperature (-0.7659*) showed negative correlation with larval population. Similar trend in results were obtained by (Baig *et al*., 2015) [2] who reported that rainfall and relative humidity had significant and positive effect on population of red hairy caterpillar. (Rahmathulla *et al*., 2015) [9] revealed that the incidence of *A. mori* was significantly and negatively correlated with maximum temperature and positively correlated with maximum relative humidity.

Table 3: Simple regression coefficients, path analysis showing direct and indirect effects of weather parameters on larval population of *Euproctis* sp. infesting sole sunflower during *kharif* 2017

Weather Parameters	Rainfall (mm)	Number of rainy days	Maximum temperature (^{0}C)	Minimum temperature (^{0}C)	Before noon relative humidity (%)	Afternoon relative humidity (%)
Rainfall (mm)	-0.3483	-0.3206	0.1624	0.1479	-0.1741	-0.0824
Number of rainy days	0.9782	1.0627*	-0.4410	-0.5977	0.7141	0.2037
Maximum temperature (ºC)	0.0740	0.0659	-0.1588	0.0156	0.0338	-0.0083
Minimum temperature (ºC)	-0.2443	-0.3237	-0.0564	0.5755*	-0.2461	0.0314
Before noon relative humidity (%)	-0.4409	-0.5927	0.1875	0.3771	-0.8821*	-0.4162
Afternoon relative humidity (%)	0.0898	0.0728	0.0198	0.0207	0.1792	0.3798
Correlation coefficient (r)	0.108	-0.036	-0.286	0.539	-0.375	0.108
Simple regression coefficient (bi)	-3.4440	5.1358	-1.5877	2.7684	-1.3487	2.4594

***** = Significant at 5%. Diagonal elements are direct effects while off-diagonal elements are indirect effects

Table 4: Simple regression coefficients, path analysis showing direct and indirect effects of weather parameters on larval population of *Euproctis* sp. infesting sunflower intercropped with pigeonpea during *kharif* 2017

Weather Parameters	Rainfall (mm)	Number of rainy days	Maximum temperature (0C)	Minimum temperature (0C)	Before noon relative humidity (%)	Afternoon relative humidity (%)
Rainfall (mm)	-0.4074	-0.3732	0.1712	0.1863	-0.1924	-0.0637
Number of rainy days	-0.0534	-0.0583	0.0208	0.0351	-0.0381	-0.0059
Maximum temperature (ºC)	0.3218	0.2729	-0.7659*	0.0494	0.0913	-0.2566
Minimum temperature (ºC)	-0.0186	-0.0244	-0.0026	0.0406	-0.0188	0.0007
Before noon relative humidity (%)	-0.0858	-0.1186	0.0216	0.0840	-0.1816	-0.0766
Afternoon relative humidity (%)	0.1687	0.1084	0.3617	0.0182	0.4554	1.0795*
Correlation coefficient (r)	-0.075	-0.193	-0.193	0.414	0.116	0.677*
Simple regression coefficient (bi)	-5.9160	-4.1497	-1.2425	2.8096	-4.0902	1.1211

***** = Significant at 5%. Diagonal elements are direct effects while off-diagonal elements are indirect effects

Spilosoma obliqua (Walker) on sole sunflower

The results in respect of simple correlation between larval population of *S. obliqua* infesting sole sunflower and weather parameters during *kharif* 2017 are tabulated in Table 5. The data presented on correlation coefficient indicated that none of the factor exhibited significantly direct positive effect on larval population of *S. obliqua* infesting sole sunflower, hereas rainfall (-0.7043*) showed negative correlation with larval population.

Spilosoma obliqua (Walker) on sunflower intercropped with pigeonpea

The results in respect of simple correlation between larval population of *S. obliqua* infesting sunflower intercropped with pigeonpea and weather parameters during *kharif* 2017 are tabulated in Table 6. The data presented on correlation coefficient indicated that afternoon relative humidity (1.0564*) exhibited significantly direct positive effect on larval population of *S. obliqua* infesting sunflower intercropped with pigeonpea, whereas rainfall (-0.8435*) and maximum temperature (-0.5443*) showed negative correlation with larval population. Similar results were obtained by (Yadav *et al*., 2015) [14] who revealed that larval population of *S. oblique* had significant negative correlation with rainfall and wind velocity. (Mohapatra *et al*., 2018) [8] indicated that the population of *S. obliqua* showed non-significant positive correlation with temperature (maximum and minimum) and rainfall and non-significant negative correlation with relative humidity.

Table 5: Simple regression coefficients, path analysis showing direct and indirect effects of weather parameters on larval population of *S. obliqua* infesting sole sunflower during *kharif* 2017

Weather Parameters	Rainfall (mm)	Number of rainy days	Maximum temperature (ºC)	Minimum temperature (ºC)	Before noon relative humidity (%)	Afternoon relative humidity (%)
Rainfall (mm)	-0.7043*	-0.6483	0.3285	0.2990	-0.3521	-0.1666
Number of rainy days	0.3794	0.4122	-0.1711	-0.2318	0.2770	0.0790
Maximum temperature (ºC)	0.0658	0.0586	-0.1412	0.0138	0.0300	-0.0074
Minimum temperature (ºC)	-0.1500	-0.1987	-0.0346	0.3534	-0.1511	0.0193
Before noon relative humidity (%)	0.2020	0.2716	-0.0859	-0.1728	0.4042	0.1907
Afternoon relative humidity (%)	0.1078	0.0874	0.0238	0.0249	0.2152	0.4560
Correlation coefficient (r)	0.099	0.017	0.081	0.286	0.423	0.571*
Simple regression coefficient (bi)	-6.2898	1.7994	-1.2752	1.5353	5.5819	2.6675

***** = Significant at 5%. Diagonal elements are direct effects while off-diagonal elements are indirect effects

Table 6: Simple regression coefficients, path analysis showing direct and indirect effects of weather parameters on larval population of *S. obliqua* infesting sunflower intercropped with pigeonpea during *kharif* 2017

Weather Parameters	Rainfall (mm)	Number of rainy days	Maximum temperature (ºC)	Minimum temperature (ºC)	Before noon relative humidity (%)	Afternoon relative humidity (%)
Rainfall (mm)	-0.8435*	-0.7728	0.3545	0.3857	-0.3984	-0.1318
Number of rainy days	0.0022	0.0024	-0.0009	-0.0015	0.0016	0.0002
Maximum temperature (ºC)	0.2287	0.1940	-0.5443*	0.0351	0.0649	-0.1824
Minimum temperature (ºC)	0.0812	0.1068	0.0115	-0.1777	0.0822	-0.0030
Before noon relative humidity (%)	-0.0413	-0.0571	0.0104	0.0404	-0.0874	-0.0369
Afternoon relative humidity (%)	0.1651	0.1060	0.3540	0.0178	0.4457	1.0564*
Correlation coefficient (r)	0.407	0.421	0.185	0.300	0.109	0.703*
Simple regression coefficient (bi)	-1.3308	1.8906	-9.5932	-1.3344	-2.1382	1.1921

***** = Significant at 5%. Diagonal elements are direct effects while off-diagonal elements are indirect effect

Conclusion

Thus it can be concluded that *Euproctis* sp. and *S. obliqua* were emerged as hairy caterpillars on sole sunflower and sunflower intercropped with pigeonpea. The population of *Euproctis* sp. and *S. obliqua* was increased when sunflower was intercropped with pigeonpea. This might be due to polyphagous nature of the pest.

References

1. Anonymous. Annual Progress Report (Sunflower), All India Coordinated Research Project on Oilseed. Directorate of Oilseed Research, Hyderabad: 2015, 167
2. Baig F, Ayyaz M, Javed H. Screening of different groundnut, *Aarachis hypogaea* L. (Fabaceae: Fabales) cultivars against red hairy caterpillar, *Amsacta albistriga*

W. (Arctiidae: Lepidoptera) population in relation to leaf infestation, physico-morphic characters, abiotic factors and yield. Pakistan J Zool. 2015; 47(6):1691-1698.
3. Basappa H. Insect-pest management in sunflower-innovative approaches, In: Subject Matter Workshop Cum Seminar on Integrated Pest Management in Oilseeds, October 10-17, Directorate of Oilseeds Research, Hyderabad, 1995.
4. Basappa H, Bhatt NSK, Ranganathan ARG, Reddy BN. Directorate of Oilseeds Research, Hyderabad, 1998, 62-66.
5. Basappa H, Santhalakshmiprasad M. Insect-pests and diseases of sunflower and their management (Ed. Hegde, D.M., Directorate of Oilseeds Research, Hyderabad. 2005, 80.
6. Bilapate GG, Jadhav RN. Key pests of sunflower and their parasites in Marathwada, Proc. Indian natn. Sci. Acad., 1995; 61(4):275-280.
7. FAOSTAT. http://www.fao.org/faostat/en/#data/QC. 01 August 2018.
8. Mohapatra MM, Singh DC, Gupta PK, Chandra U, Patro B, Mohapatra SD. Seasonal incidence of major insect-pests on Blackgram, *Vigna mungo* (Linn.) and its correlation with weather parameters. Int. J Curr. Microbiol. App. Sci. 2018; 7(06):3886-3890.
9. Rahmathulla VK, Sathyanarayana K, Angadi BS. Influence of abiotic factors on population dynamics of major insect-pests of Mulberry. Pakistan J Biol. Sci. 2015; 18(5):215-223.
10. Rogers CE. Insect pests and strategies for their management in cultivated sunflower. Field Crops Res., 1992; 30(3, 4):301-332.
11. Singh RN, Singh KM. Influence of intercropping on succession and population building of insect-pests in early variety of red gram, *Cajanus cajan* (L.) Millsp. Indian J Entomol. 1978; 40:361-375.
12. Singh S, Singh N, Bhat NS, Singh SB. Development and validation of IPM in oilseed based production systems. In: Proceedings and recommendations of the NATP interactive Workshop on Integrated Pest Management, 2003.
13. Suhas Y, Balikai RA, Shantappanavar NB, Naganagouda A, Lingappa S, Gumaste SK. Studies on artificial defoliation in dry land sunflower, Karnataka J Agric. Sci., 1996; 9(2):250-252.
14. Yadav SK, Agnihotri M, Bisht RS. Seasonal incidence of insect-pests of blackgram, *Vigna mungo* (Linn.) and its correlation with abiotic factors. Agric. Sci. Digest. 2015; 35(2):146-148.