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Studies on the population dynamics of different insect pest of groundnut

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Abstract

Investigations on population dynamics of different insect pests of groundnut was carried out at Oilseeds Research Station, Latur, Maharashtra during *Rabi*, 2020. Studies on population dynamics of groundnut pests indicated that the leaf miner incidence prevailed during last week of November to first week of March. However its maximum activity was found during first week of January. The pest incidence was found positively influenced by morning relative humidity and evening relative humidity, while, the incidence of leaf miner was found negatively influenced by maximum temperature and wind speed. The peak activity of hairy caterpillar was in 1st SMW. The pest incidence was negatively influenced by maximum temperature and minimum temperature. The population of aphids, leafhoppers, whiteflies & thrips remained throughout the crop period with peak incidence during 1st & 10th SMW. The aphids & leafhoppers population influenced by evening & morning relative humidity. The whiteflies and thrips incidence was found positively influenced by maximum and minimum temperature while the population of predator was maximum in 1st SMW and positively correlated with morning relative humidity.

Keywords: groundnut, population dynamics, sucking pests, leaf miner, hairy caterpillar, aphid, leafhopper, thrips

Introduction

Peanut or groundnut (*Arachis hypogaea*), is a species in the legume or "bean" family. The peanut was probably first domesticated and cultivated in the valleys of Paraguay. It is native of South America. It is an annual herbaceous plant growing 30 to 50 cm (1.0 to 1.6 ft.) tall. The leaves are opposite, pinnate with four leaflets (two opposite pairs; no terminal leaflet), each leaflet 1 to 7 cm long and 1 to 3 cm broad. It is a valuable cash crop for millions of small scale farmers in the semi-arid tropics and is the principle oilseed crop in India. The groundnut seeds are rich source of edible oil (48 to 50 per cent), protein (26 to 28 per cent) and also a valuable source of dietary fiber, minerals and vitamins namely B, E and K Smith (2002)^[6]. Among the total fatty acid in groundnut oil Oleic acid and linoleic acid accounts for 75 to 80 per cent of the total fatty acid in groundnut oil Mercer *et al.*, (1990)^[3].

The important insect pests causing damage to the crop are leaf miner, tobacco caterpillar, aphid, thrips, jassids and whitefly. Amongst which *Approaerema modicella* Deventer, *Amrasca biguttula biguttula*, *Spodoptera litura* Fabricus, *Helicoverpa armigera* Hubner, *Aphis craccivora* Koch, *Scirtothrips dorsalis* H. are considered as important destructive pests on groundnut (Amin and Mohammad (1980)^[2]. In early stage of the crop growth, leaf miner larvae initially mine into the leaflets, feed on the mesophyll and form small brown blotches on the leaf. Afterwards larvae web the leaflets together and feed on them, remaining within the folds. The tobacco caterpillar and gram pod borer are known to inflict direct damage to the crop by consuming the photo-synthetically active foliage. Sucking pests suck the sap from tender plant parts as a result plant or part of plant dry up. Most of the species of sucking insects are known to be vectors of disease of groundnut. Thrips mainly feed by lacerating and sucking the sap from the leaves is known to transmit groundnut bud necrosis virus. Jassids suck the sap from the leaves and petioles and mainly it prefers the first three terminal leaves and feeding symptoms induce yellowing of foliage that begins at the tip, known as hopper burn. A heavy infestation on young plant causes stunting and leaf tip turn yellow with a typical 'v-shape' marking.

The extent of losses incurred by various insect-pests *viz.*, leaf miner, tobacco leaf eating caterpillar, gram pod borer, aphids, thrips and jassids were 24 to 92, 13 to 71, 30 to 40, 16 to 42, 17 to 40 and 9 to 22 per cent, respectively in groundnut Amin (1987)^[1].

Material and Methods

Preparatory Cultivation

A representative field of black clay loamy soil was selected, ploughed and levelled with tractor drawn implements thoroughly to obtain fine tilth suitable for seed germination.

Field layout

The field experiment with groundnut crop using variety LGN-1 in *Rabi*, 2020 was conducted at the Research Farm of Department of Agricultural Entomology, Oilseeds Research Station, Latur, VNMKV, Parbhani (MS)-India. The experiment was conducted in a non replicated design with 10 m × 10 m plot size. The groundnut crop was sown on 10th November, 2020 in a gross plot of 10 × 10 sq. m. The row to row distance of 30 cm and plant to plant distance of 10 cm was maintained. The crop was sown under protective irrigation.

Sowing

Sowing was done manually and one seed was sown per hill (seed rate 100 kg/ha) with a spacing of 30 cm × 10 cm during second week of November.

Cultural Practices

All the agronomic practices were followed as per the recommendations of VNMKV, Parbhani in raising groundnut crop during the experimental period.

Inter cultivation

Two hand weeding were done during the crop period to keep the crop weeds free.

Fertilization

The fertilizers were applied @ 20:40:40 NPK kg/ha as per the recommendations.

Experimental details

- | | | |
|-------------------|---|----------------------------------|
| 1. Location | : | Oilseeds Research Station, Latur |
| 2. Season | : | Rabi-2020 |
| 3. Date of sowing | : | 10/11/2020 |
| 4. Crop | : | Groundnut |
| 5. Variety | : | LGN-1 |
| 6. Plot size | : | 10 m × 10 m |
| 7. Spacing | : | 30 cm × 10 cm |

Recording data

Weekly observations was recorded from sowing to till harvest of the crop on incidence of different insect pests of groundnut from 10 randomly selected plants in 10 m × 10 m plot. At 10 m × 10 m plot 10 plants was selected randomly and tagged for recording observations. The observations were recorded as per procedure described below. Groundnut crop was raised successfully by adopting recommended agronomical practices.

A. Sucking pests

The weekly observations were recorded on trifoliolate leaves for sucking pest *viz.*, Aphids, Thrips, Leafhoppers and Whiteflies.

B. Lepidopterans pests

The weekly observations were recorded on vegetative parts of plant for lepidopterans pests *viz.*, Red hairy caterpillars and leaf miners.

C. Natural enemies

The population of different natural enemies of the pests *viz.*, spiders, lady bird beetles etc. observed per plant was recorded at weekly interval.

Statistical analysis

In order to find out the specific impact of different weather parameters on pests and natural enemies in groundnut. The data were correlated with the different meteorological parameters (temperature, humidity, rainfall and wind speed) recorded at standard meteorological weeks by Department of Agricultural Entomology, Oilseeds Research Station, Latur. The correlation was worked out by standard procedure using WASP 2.0 software.

Results and Discussion

During the course of investigations, the weather parameters *viz.*, rainfall, maximum temperature, minimum temperature, morning relative humidity, evening relative humidity and wind speed varied from 0 to 6.25 mm, 14.10 to 36.96 °C, 11.99 to 21.9 °C, 39.79 to 91.20 per cent, 20.23 to 63 per cent and 18.4 to 26.1 km/hr respectively. At Latur location groundnut aphid, leafhopper, whitefly, thrips, leaf miners and hairy caterpillars are the major pests of groundnut. The data pertaining to the population dynamics of pests on groundnut in relation to weather factor during *Rabi* season 2020 on groundnut variety LGN-1 are presented in Tables 1 to 6. Also, the population of natural enemies of the pests which are found during the course of investigation are recorded and presented in Tables 7 to 8.

Population dynamics of aphids infesting groundnut

The aphids were first observed during 48th SMW (26 Nov - 02 Dec) by recording 3.5 aphids / trifoliolate leaves of plant when the corresponding rainfall, maximum temperature, minimum temperature, morning, evening relative humidity and wind speed recorded were 0.00 mm, 29.4 °C, 17.5 °C, 79.4%, 64.5% and 22.3 km/hr respectively. Thereafter the maximum population observed 7 aphids / trifoliolate leaves of plant in 1st SMW (01 Jan-07 Jan) when the corresponding rainfall, maximum temperature, minimum temperature, morning, evening relative humidity and wind speed recorded were 0 mm, 30.4 °C, 16.1 °C, 91.2%, 53.4% and 18.7 km/hr respectively. Then the aphid population showed slight reduction in the number but were present throughout the season and at harvest 1.2 aphids/ trifoliolate leaves of plant were recorded. During *rabi* season the aphid population initially observed by Saritha *et al.* (2020)^[5], on 51th SMW then steadily increased till 9th SMW and peaked with 16.5 aphids/plant, thereafter population decreased slowly and finally reported 7.9 aphids on 12th SMW. According to the Saritha and coworkers aphids cause damage throughout the season. Overall the result of investigations follow more or less similar trend with the earlier reports. Difference in seasonal incidence may be due to local climatic conditions and different in date of sowing. The corresponding data is given in Table 1

Table 1: Population dynamics of aphids infesting groundnut

Sr. No.	Std. Met. Week	Period	Rainfall (mm)	Temperature (°C)		Humidity% (per cent)		Wind speed (km/h)	No of Aphids/Trifoliolate leaves of plant
				Max.	Min.	AM	PM		
1	48	26-02Dec	0.0	29.4	17.5	79.4	64.5	22.3	3.5
2	49	03-09Dec	0.0	31.3	13.1	67.4	39.5	21.6	4.0
3	50	10-16Dec	0.0	31.2	15.6	67.7	45.2	21.4	4.1
4	51	17-23Dec	0.0	29.5	12.2	74.4	42.4	20.0	4.3
5	52	24-31Dec	0.0	30.5	12.8	75.4	43.6	18.4	5.0
6	1	01-07Jan	0.0	30.4	16.1	91.2	53.4	18.7	7.0
7	2	08-14Jan	1.0	31.9	16.9	82.6	51.5	19.9	6.5
8	3	15-21Jan	0.0	31.9	16.1	81.5	48.1	19.7	6.2
9	4	22-28Jan	0.0	32.8	16.1	75.9	43.5	20.0	5.0
10	5	29-04Feb	1.25	31.6	15.4	77.0	37.7	23.1	4.1
11	6	05-11Feb	0.5	30.9	12.0	60.3	32.5	21.7	3.3
12	7	12-18Feb	0.0	32.9	15.5	65.9	36.3	24.0	3.0
13	8	19-25Feb	6.25	30.8	14.6	72.9	39.6	23.7	2.7
14	9	26-04Mar	0.0	36.0	18.5	48.9	24.8	26.1	1.4
15	10	05-11Mar	0.0	37.0	23.4	42.5	25.8	26.1	1.2

Population dynamics of leafhoppers infesting groundnut

The leafhopper were first observed during 48th SMW (26 Nov - 02 Dec) by recording 3.8 leafhoppers / trifoliolate leaves of plant when the corresponding rainfall, maximum temperature, minimum temperature, morning, evening relative humidity and wind speed recorded were 0.00 mm, 29.4 °C, 17.5 °C, 79.4%, 64.5% and 22.3 km/hr respectively. Thereafter the maximum population observed 7.2 leafhoppers / trifoliolate leaves of plant in 1st SMW (01 Jan-07 Jan) when the corresponding rainfall, maximum temperature, minimum temperature, morning, evening relative humidity and wind speed recorded were 0 mm, 30.4 °C, 16.1 °C, 91.2%, 53.4% and 18.7 km/hr respectively. Then the leafhoppers population

showed slight reduction in the number but were present throughout the season and at harvest 2.1 leafhoppers/ trifoliolate leaves of plant were recorded. Similar trend was also observed during *rabi* season by Saritha *et al.* (2020) [5], the leaf hopper population observed on 51 SMW with an average population of 0.7 leaf hopper/ plant and steadily increased till 7th SMW and peaked with 3.64 leaf hoppers / plant, thereafter population decreased slowly and finally reported 0.86 leaf hoppers on 12th SMW. Overall the result of investigations follow more or less similar trend with the earlier reports. Difference in seasonal incidence may be due to local climatic conditions and different in date of sowing. The corresponding data is given in Table 2

Table 2: Population dynamics of leafhoppers infesting groundnut

Sr. No.	Std. Met. Week	Period	Rainfall (mm)	Temperature (°C)		Humidity% (per cent)		Wind speed (km/h)	No of Leafhoppers/ Trifoliolate leaves of plant
				Max.	Min.	AM	PM		
1	48	26-02Dec	0.0	29.4	17.5	79.4	64.5	22.3	3.8
2	49	03-09Dec	0.0	31.3	13.1	67.4	39.5	21.6	5.3
3	50	10-16Dec	0.0	31.2	15.6	67.7	45.2	21.4	5.4
4	51	17-23Dec	0.0	29.5	12.2	74.4	42.4	20.0	6.0
5	52	24-31Dec	0.0	30.5	12.8	75.4	43.6	18.4	6.2
6	1	01-07Jan	0.0	30.4	16.1	91.2	53.4	18.7	7.2
7	2	08-14Jan	1.0	31.9	16.9	82.6	51.5	19.9	6.4
8	3	15-21Jan	0.0	31.9	16.1	81.5	48.1	19.7	6.0
9	4	22-28Jan	0.0	32.8	16.1	75.9	43.5	20.0	5.8
10	5	29-04Feb	1.25	31.6	15.4	77.0	37.7	23.1	6.1
11	6	05-11Feb	0.5	30.9	12.0	60.3	32.5	21.7	4.0
12	7	12-18Feb	0.0	32.9	15.5	65.9	36.3	24.0	4.3
13	8	19-25Feb	6.25	30.8	14.6	72.9	39.6	23.7	4.6
14	9	26-04Mar	0.0	36.0	18.5	48.9	24.8	26.1	2.8
15	10	05-11Mar	0.0	37.0	23.4	42.5	25.8	26.1	2.1

Population dynamics of whiteflies infesting groundnut

The whitefly were first observed during 48th SMW (26 Nov - 02 Dec) by recording 1.4 whiteflies / trifoliolate leaves of plant when the corresponding rainfall, maximum temperature, minimum temperature, morning, evening relative humidity and wind speed recorded were 0.00 mm, 29.4 °C, 17.5 °C, 79.4%, 64.5% and 22.3 km/hr respectively. Thereafter the maximum population observed 4.5 whiteflies/trifoliolate leaves of plant in 10th SMW (05 Mar - 11 Mar) when the

corresponding rainfall, maximum temperature, minimum temperature, morning, evening relative humidity and wind speed recorded were 0 mm, 37 °C, 23.4 °C, 42.5%, 25.8% and 26.1 km/hr respectively. Then the whiteflies population showed slight increases in the number but were present throughout the season and at harvest 4.5 whiteflies / trifoliolate leaves of plant were recorded. The corresponding data is given in Table 3.

Table 3: Population dynamics of whiteflies infesting groundnut

Sr. No.	Std. Met. Week	Period	Rainfall (mm)	Temperature (°C)		Humidity% (per cent)		Wind speed (km/h)	No of Whiteflies/ Trifoliolate leaves of plant
				Max.	Min.	AM	PM		
1	48	26-02Dec	0.0	29.4	17.5	79.4	64.5	22.3	1.40
2	49	03-09Dec	0.0	31.3	13.1	67.4	39.5	21.6	1.20
3	50	10-16Dec	0.0	31.2	15.6	67.7	45.2	21.4	1.30
4	51	17-23Dec	0.0	29.5	12.2	74.4	42.4	20.0	1.80
5	52	24-31Dec	0.0	30.5	12.8	75.4	43.6	18.4	1.70
6	1	01-07Jan	0.0	30.4	16.1	91.2	53.4	18.7	2.20
7	2	08-14Jan	1.0	31.9	16.9	82.6	51.5	19.9	4.00
8	3	15-21Jan	0.0	31.9	16.1	81.5	48.1	19.7	3.00
9	4	22-28Jan	0.0	32.8	16.1	75.9	43.5	20.0	3.10
10	5	29-04Feb	1.25	31.6	15.4	77.0	37.7	23.1	2.90
11	6	05-11Feb	0.5	30.9	12.0	60.3	32.5	21.7	2.40
12	7	12-18Feb	0.0	32.9	15.5	65.9	36.3	24.0	3.00
13	8	19-25Feb	6.25	30.8	14.6	72.9	39.6	23.7	2.70
14	9	26-04Mar	0.0	36.0	18.5	48.9	24.8	26.1	3.40
15	10	05-11Mar	0.0	37.0	23.4	42.5	25.8	26.1	4.50

Population dynamics of thrips infesting groundnut

The thrips were first observed during 48th SMW (26 Nov - 02 Dec) by recording 1.60 thrips / trifoliolate leaves of plant when the corresponding rainfall, maximum temperature, minimum temperature, morning, evening relative humidity and wind speed recorded were 0.00 mm, 29.4 °C, 17.5 °C, 79.4%, 64.5% and 22.3 km/hr respectively. Thereafter the maximum population observed 4.5 thrips / trifoliolate leaves of plant in 10th SMW (05 Mar - 11 Mar) when the corresponding rainfall, maximum temperature, minimum temperature, morning, evening relative humidity and wind speed recorded were 0 mm, 37 °C, 23.4 °C, 42.5%, 25.8% and 26.1 km/hr

respectively. Then the thrips population showed slight increases in the number but were present throughout the season and at harvest 4.5 thrips / trifoliolate leaves of plant were recorded. Saritha *et al.* (2020) [5] reported that during *rabi* season, the thrips population observed on 51 SMW with an average population of 1.9 thrips/plant and increased till 5th SMW and peaked with 7.14 thrips/plant, thereafter population decreased slowly and finally reported 3.22 thrips on 12th SMW. Similar trend with the earlier finding. Difference in seasonal incidence may be due to local climatic conditions and different in date of sowing. The corresponding data is given in Table 4.

Table 4: Population dynamics of thrips infesting groundnut

Sr. No.	Std. Met. Week	Period	Rainfall (mm)	Temperature (°C)		Humidity% (per cent)		Wind speed (km/h)	No of Thrips/ Trifoliolate leaves of plant
				Max.	Min.	AM	PM		
1	48	26-02Dec	0.0	29.4	17.5	79.4	64.5	22.3	1.60
2	49	03-09Dec	0.0	31.3	13.1	67.4	39.5	21.6	1.40
3	50	10-16Dec	0.0	31.2	15.6	67.7	45.2	21.4	1.50
4	51	17-23Dec	0.0	29.5	12.2	74.4	42.4	20.0	1.70
5	52	24-31Dec	0.0	30.5	12.8	75.4	43.6	18.4	1.70
6	1	01-07Jan	0.0	30.4	16.1	91.2	53.4	18.7	2.20
7	2	08-14Jan	1.0	31.9	16.9	82.6	51.5	19.9	4.20
8	3	15-21Jan	0.0	31.9	16.1	81.5	48.1	19.7	3.00
9	4	22-28Jan	0.0	32.8	16.1	75.9	43.5	20.0	3.50
10	5	29-04Feb	1.25	31.6	15.4	77.0	37.7	23.1	2.90
11	6	05-11Feb	0.5	30.9	12.0	60.3	32.5	21.7	2.40
12	7	12-18Feb	0.0	32.9	15.5	65.9	36.3	24.0	3.00
13	8	19-25Feb	6.25	30.8	14.6	72.9	39.6	23.7	2.70
14	9	26-04Mar	0.0	36.0	18.5	48.9	24.8	26.1	3.40
15	10	05-11Mar	0.0	37.0	23.4	42.5	25.8	26.1	4.50

Population dynamics of leaf miners infesting groundnut

The leaf miners were first observed during 48th SMW (26 Nov - 02 Dec) by recording 2.20 leaf miners larvae / plant when the corresponding rainfall, maximum temperature, minimum temperature, morning, evening relative humidity and wind speed recorded were 0.00 mm, 29.4 °C, 17.5 °C, 79.4%, 64.5% and 22.3 km/hr respectively. Thereafter the maximum population observed 4.0 larvae of leaf miners / plant in 1st SMW (01 Jan-07 Jan) when the corresponding rainfall, maximum temperature, minimum temperature, morning, evening relative humidity and wind speed recorded were 0 mm, 30.4 °C, 16.1 °C, 91.2%, 53.4% and 18.7 km/hr

respectively.

Then the larvae of leaf miners population showed slight decreases in the number but were present throughout the season and at harvest 0.5 larvae of leaf miners/ plant were recorded. According to Pazhanisamy and Hariprasad (2014) [4] maximum leaf miners population were recorded during 9th SMW (7.4 larvae/plant) followed by 10th SMW (6.8 larvae/plant) in *Rabi* 2010. Overall the result of investigations follow more or less similar trend with the earlier finding. Difference in seasonal incidence may be due to local climatic conditions and different in date of sowing.

The corresponding data is given in Table 5.

Table 5: Population dynamics of leaf miners infesting groundnut

Sr. No.	Std. Met. Week	Period	Rainfall (mm)	Temperature (°C)		Humidity% (per cent)		Wind speed (km/h)	No. of larvae/plant
				Max.	Min.	AM	PM		
1	48	26-02Dec	0.0	29.4	17.5	79.4	64.5	22.3	2.20
2	49	03-09Dec	0.0	31.3	13.1	67.4	39.5	21.6	1.80
3	50	10-16Dec	0.0	31.2	15.6	67.7	45.2	21.4	1.90
4	51	17-23Dec	0.0	29.5	12.2	74.4	42.4	20.0	2.30
5	52	24-31Dec	0.0	30.5	12.8	75.4	43.6	18.4	2.50
6	1	01-07Jan	0.0	30.4	16.1	91.2	53.4	18.7	4.00
7	2	08-14Jan	1.0	31.9	16.9	82.6	51.5	19.9	3.80
8	3	15-21Jan	0.0	31.9	16.1	81.5	48.1	19.7	3.50
9	4	22-28Jan	0.0	32.8	16.1	75.9	43.5	20.0	2.80
10	5	29-04Feb	1.25	31.6	15.4	77.0	37.7	23.1	3.00
11	6	05-11Feb	0.5	30.9	12.0	60.3	32.5	21.7	1.20
12	7	12-18Feb	0.0	32.9	15.5	65.9	36.3	24.0	1.50
13	8	19-25Feb	6.25	30.8	14.6	72.9	39.6	23.7	2.10
14	9	26-04Mar	0.0	36.0	18.5	48.9	24.8	26.1	0.90
15	10	05-11Mar	0.0	37.0	23.4	42.5	25.8	26.1	0.50

Population dynamics of hairy caterpillars infesting groundnut

The hairy caterpillars were first observed during 48th SMW (26 Nov - 02 Dec) by recording 3.5 hairy caterpillars larvae / plant when the corresponding rainfall, maximum temperature, minimum temperature, morning, evening relative humidity and wind speed recorded were 0.00 mm, 29.4 °C, 17.5 °C, 79.4%, 64.5% and 22.3 km/hr respectively. Thereafter the maximum population observed 4 larvae of hairy caterpillars / plant in 6th SMW (05 Feb – 11 Feb) when the corresponding rainfall, maximum temperature, minimum temperature, morning, evening relative humidity and wind speed recorded

were 0.5 mm, 30.9 °C, 12.0 °C, 60.3%, 32.5% and 21.7 km/hr respectively. Then the larvae of hairy caterpillars population showed slight decreases in the number but were present throughout the season and at harvest 0.60 larvae of hairy caterpillars / plant were recorded. Thus from the population dynamics study it was clear that the overall pest population / infestation during the period of investigation (*rabi 2020*) was comparatively Maximum 4.0 larvae of hairy caterpillars / plant were observed during second fortnight of February. The findings came out from the present study for hairy caterpillars remains un-discussed due to lack of information. The corresponding data is given in Table 6.

Table 6: Population dynamics of hairy caterpillars infesting groundnut

Sr. No.	Met. Week	Period	Rainfall (mm)	Temperature (°C)		Humidity% (per cent)		Wind speed (km/h)	No. of larvae/plant
				Max.	Min.	AM	PM		
1	48	26-02Dec	0.0	29.4	17.5	79.4	64.5	22.3	1.10
2	49	03-09Dec	0.0	31.3	13.1	67.4	39.5	21.6	3.20
3	50	10-16Dec	0.0	31.2	15.6	67.7	45.2	21.4	2.50
4	51	17-23Dec	0.0	29.5	12.2	74.4	42.4	20.0	3.70
5	52	24-31Dec	0.0	30.5	12.8	75.4	43.6	18.4	3.50
6	1	01-07Jan	0.0	30.4	16.1	91.2	53.4	18.7	2.20
7	2	08-14Jan	1.0	31.9	16.9	82.6	51.5	19.9	1.70
8	3	15-21Jan	0.0	31.9	16.1	81.5	48.1	19.7	2.20
9	4	22-28Jan	0.0	32.8	16.1	75.9	43.5	20.0	2.20
10	5	29-04Feb	1.25	31.6	15.4	77.0	37.7	23.1	2.90
11	6	05-11Feb	0.5	30.9	12.0	60.3	32.5	21.7	4.00
12	7	12-18Feb	0.0	32.9	15.5	65.9	36.3	24.0	2.70
13	8	19-25Feb	6.25	30.8	14.6	72.9	39.6	23.7	3.00
14	9	26-04Mar	0.0	36.0	18.5	48.9	24.8	26.1	1.00
15	10	05-11Mar	0.0	37.0	23.4	42.5	25.8	26.1	0.60

Population of natural enemies - Lady Bird beetles

The lady bird beetles were first observed during 50th SMW (10 Dec – 16 Dec) by recording 0.20 lady bird beetles / plant when the corresponding rainfall, maximum temperature, minimum temperature, morning, evening relative humidity and wind speed recorded were 0.00 mm, 31.20 °C, 15.60 °C, 67.7%, 45.2% and 21.4 km/hr respectively. Thereafter the maximum population observed 1 lady bird beetles / plant in 1st SMW (01 Jan-07 Jan) when the corresponding rainfall, maximum temperature, minimum temperature, morning, evening relative humidity and wind speed recorded were 0

mm, 30.4 °C, 16.1 °C, 91.2%, 53.4% and 18.7 km/hr respectively. Then the lady bird beetles population showed slight reduction in the number but were do not present throughout the season and at harvest 0 lady bird beetles / plant were recorded. Thus from the population dynamics study it was clear that the overall natural enemies population during the period of investigation (*rabi 2020*) was comparatively fluctuated due to fluctuation in pest population. The findings came out from the present study for predators remains un-discussed due to lack of information. The corresponding data is given in table 7.

Table 7: Population dynamics of natural enemies lady bird beetle

Sr. No.	Met. Week	Period	Rainfall (mm)	Temperature (°C)		Humidity% (per cent)		Wind speed (km/h)	No. of Grub & adult/plant
				Max.	Min.	AM	PM		
1	48	26-02Dec	0.0	29.4	17.5	79.4	64.5	22.3	0.00
2	49	03-09Dec	0.0	31.3	13.1	67.4	39.5	21.6	0.00
3	50	10-16Dec	0.0	31.2	15.6	67.7	45.2	21.4	0.20
4	51	17-23Dec	0.0	29.5	12.2	74.4	42.4	20.0	0.40
5	52	24-31Dec	0.0	30.5	12.8	75.4	43.6	18.4	0.60
6	1	01-07Jan	0.0	30.4	16.1	91.2	53.4	18.7	1.00
7	2	08-14Jan	1.0	31.9	16.9	82.6	51.5	19.9	0.80
8	3	15-21Jan	0.0	31.9	16.1	81.5	48.1	19.7	0.80
9	4	22-28Jan	0.0	32.8	16.1	75.9	43.5	20.0	0.60
10	5	29-04Feb	1.25	31.6	15.4	77.0	37.7	23.1	0.50
11	6	05-11Feb	0.5	30.9	12.0	60.3	32.5	21.7	0.50
12	7	12-18Feb	0.0	32.9	15.5	65.9	36.3	24.0	0.40
13	8	19-25Feb	6.25	30.8	14.6	72.9	39.6	23.7	0.30
14	9	26-04Mar	0.0	36.0	18.5	48.9	24.8	26.1	0.00
15	10	05-11Mar	0.0	37.0	23.4	42.5	25.8	26.1	0.00

Population of natural enemies–Spiders

The spider were first observed during 50th SMW (10 Dec – 16 Dec) by recording 0.10 spider / plant when the corresponding rainfall, maximum temperature, minimum temperature, morning, evening relative humidity and wind speed recorded were 0.00 mm, 31.20 °C, 15.60 °C, 67.7%, 45.2% and 21.4 km/hr respectively. Thereafter the maximum population observed 0.40 spider / plant in 1st SMW (01 Jan-07 Jan) when the corresponding rainfall, maximum temperature, minimum temperature, morning, evening relative humidity and wind speed recorded were 0 mm, 30.4 °C, 16.1 °C, 91.2%, 53.4%

and 18.7 km/hr respectively. Then the spider population showed slight reduction in the number but were do not present throughout the season and at harvest no single spider / plant were recorded. Thus form the population dynamics study it was clear that the overall natural enemies population during the period of investigation (*rabi* 2020) was comparatively fluctuated due to fluctuation in pest population. The findings came out from the present study for predators remains un-discussed due to lack of information. The corresponding data is given in Table 8.

Table 8: Population dynamics of natural enemies Spider

Sr. No.	Met. Week	Period	Rainfall (mm)	Temperature (°C)		Humidity% (per cent)		Wind speed (km/h)	No. of adult/plant
				Max.	Min.	AM	PM		
1	48	26-02Dec	0.0	29.4	17.5	79.4	64.5	22.3	0.00
2	49	03-09Dec	0.0	31.3	13.1	67.4	39.5	21.6	0.00
3	50	10-16Dec	0.0	31.2	15.6	67.7	45.2	21.4	0.10
4	51	17-23Dec	0.0	29.5	12.2	74.4	42.4	20.0	0.10
5	52	24-31Dec	0.0	30.5	12.8	75.4	43.6	18.4	0.20
6	1	01-07Jan	0.0	30.4	16.1	91.2	53.4	18.7	0.40
7	2	08-14Jan	1.0	31.9	16.9	82.6	51.5	19.9	0.30
8	3	15-21Jan	0.0	31.9	16.1	81.5	48.1	19.7	0.20
9	4	22-28Jan	0.0	32.8	16.1	75.9	43.5	20.0	0.20
10	5	29-04Feb	1.25	31.6	15.4	77.0	37.7	23.1	0.10
11	6	05-11Feb	0.5	30.9	12.0	60.3	32.5	21.7	0.10
12	7	12-18Feb	0.0	32.9	15.5	65.9	36.3	24.0	0.10
13	8	19-25Feb	6.25	30.8	14.6	72.9	39.6	23.7	0.10
14	9	26-04Mar	0.0	36.0	18.5	48.9	24.8	26.1	0.00
15	10	05-11Mar	0.0	37.0	23.4	42.5	25.8	26.1	0.00

Table 9: Correlation of abiotic factors with sucking pests of groundnut

Weather parameter	Correlation coefficient ('r' values)			
	Aphids	Leafhoppers	Whiteflies	Thrips
Rainfall (mm)	-0.173 ^{NS}	-0.022 ^{NS}	0.114 ^{NS}	0.094 ^{NS}
Maximum Temperature (°C)	-0.559*	-0.645**	0.757**	0.756**
Minimum temperature (°C)	-0.355 ^{NS}	-0.554*	0.664**	0.681**
Morning relative humidity (%)	0.881**	0.868**	-0.354 ^{NS}	-0.331 ^{NS}
Evening relative humidity (%)	0.691**	0.560*	-0.449 ^{NS}	-0.401 ^{NS}
Wind speed (km/ h)	-0.906**	-0.869**	0.434 ^{NS}	0.409 ^{NS}

N= 16 *Significant at 5% **Significant at 1%

Table 10: Correlation of abiotic factors with lepidopterans pests & natural enemies of pests of groundnut

Weather parameter	Correlation coefficient ('r' values)			
	Leaf miners	Hairy caterpillars	Lady bird beetles	Spiders
Rainfall (mm)	0.038 ^{NS}	0.183 ^{NS}	-0.015 ^{NS}	-0.015 ^{NS}
Maximum Temperature (°C)	-0.525*	-0.624*	-0.342 ^{NS}	-0.316 ^{NS}
Minimum temperature (°C)	-0.237 ^{NS}	-0.934**	-0.291 ^{NS}	-0.178 ^{NS}
Morning relative humidity (%)	0.933**	0.264 ^{NS}	0.711**	0.721**
Evening relative humidity (%)	0.708**	-0.043 ^{NS}	0.370 ^{NS}	0.454 ^{NS}
Wind speed (km/ h)	-0.765**	-0.454 ^{NS}	-0.728**	-0.736**

N= 16 *Significant at 5% **Significant at 1%

Conclusion

The population of aphids, leaf hoppers, whiteflies, thrips, leaf miners, hairy caterpillar and predators like lady bird beetle & spider on groundnut ranged from 1.2 to 7, 2.1 to 7, 1.20 to 4.5, 1.4 to 4.5, 0.5 to 4, 0.60 to 2.2 and 0 to 1 & 0 to 0.4 larvae/adult per trifoliolate leaves / plant, respectively during *Rabi* 2020 the maximum population of aphids, leaf hoppers, leaf miners and predators on groundnut to the extent of 7, 7, 4 and 1 larvae/adult per plant, respectively was noticed during 1th standard meteorological weeks, respectively and also whiteflies & thrips population recorded during 10th standard meteorological weeks.

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