Population dynamics of defoliator pests of groundnut in different staggered sowings

ABSTRACT

Three treatments and seven replications were used in the current experiment, which was carried out at RARS (Regional Agricultural Research Station), Palem, Nagarkurnool district, Telangana state. Data has been correlated with various weather parameters, including maximum temperature, maximum temperature, RH-I and RH-II. The variety K-6 was grown in three staggered sowings (D1: 1st Oct; D2: 15th Oct; D3: 1st Nov). There was a less population of leaf miner during D1 the correlation studies revealed that tobacco caterpillar showed a non-significant negative correlation with the Tmax ºC (r= -0.233) and a significant positive correlation with Tmin ºC (r= 0.370) and RH-Ⅱ (r=0.640). whereas gram caterpillar showed a positive significant correlation to Tmax (r= 0.256) and Tmin (r= 0.097) and a negative significant correlation towards RH-Ⅰ (r= -0.186) and RH-Ⅱ (r= -0.501).

Key words: *Spodoptera litura, Helicoverpaarmigera,* Groudnut, Staggered Sowing.

1. INTRODUCTION

Groundnut (*Arachis hypogea* L.), an annual legume crop, is a member of the Leguminosae or Fabaceae family of legumes. Like other legumes, it has symbiotic nitrogen-fixing nodules in its roots. Additionally, it is a common oilseed crop in India and other tropical and subtropical countriesKandakooret al.,[9].The major groundnut-producing countries are China, India, Nigeria, USA, Taiwan, Indonesia, Ghana, Argentina and Brazil. China is the world's largest producer of groundnut, followed by India (6.70 M t). In India, approximately 4.76 l ha were planted in 2021, with Karnataka leading the way with 1.32 l ha, followed by Telangana with 1.32 l ha (0.87 lakh ha) www. Agricoop.gov.in [3]. Insect pests play an important role in reducing the yield and productivity of groundnut crop where 52 species of insects affect the groundnut crop.Singh et al. [17].The altered climatic circumstances enhance thrips and defoliator activity, which peaks during the flowering and pod-formation stagesNaresh *et al*., [12] and results in significant crop losses of 24 to 92%, 16 to 42%, 17 to 40%, and 9 to 22%, respectively Amin, [2]. The larval stage of *Spodoptera litura*Devaki et al [5] is the only damaging stage, which at first aggressively scrapes the leaf tissue, feeds in a cluster, and quickly skeletonizes the leaves. The larvae of *Helicoverpaarmigera*feed on foliage, flowers and leaf buds and make symmetrical holes or cuttings on the leaves. Farmers are continuously spraying a few chemicals with high doses which may lead to resistance. The population dynamics and yield losses of pests are significantly influenced by weather parameters Naresh et al [13]. So, the present study was formulated to know the incidence of defoliator pests at different dates of sowings. And also, the study emphasizes the incidence of different weather parameters on the pest population.

2. MATERIALS AND METHODS

A field study was conducted on the prevalence of defoliator pests at Regional Agricultural Research Station (RARS), Palemin a 5 × 5 m^2 patch with three treatments and seven replications.

The experiment was laid with the K-6 groundnut variety in three staggered sowings (D1: 1.10.2021, D2: 15.10.2021, and D3: 1.11.2021) at every 15 days interval with a spacing of 22.5 cm row to row and 10 cm plant to plant. Regular hand weeding was done to keep the crop free of weeds.

3. RESULTS AND DISCUSSION

Tobacco caterpillar*Spodoptera litura*

The population dynamics on the incidence of *S. litura* revealed that the per cent damage by *S. litura* in D1was started during the 42nd SMW with 0.5% infestation and it continued up to 51st SMW with 0.2% (Fig 2). There was a peak increase in the population during the 48th SMW with 11.2% damage where in the temperature maximum was 28.9°C, the temperature minimum was 18.7°C, morning relative humidity was 92.3%, and evening relative humidity was 92.7%, respectively. Then the infestation slowly started to decline at 51st SMW with a 0.2% per cent infestation.In case of D2, the populationstarted at the 45th SMW with an infestation of 2.1% and it continued up to the 2nd SMW. The highest infestation (42.6%) was noticed during the 50th SMW where the temperature maximum, temperature minimum, morning relative humidity, and evening relative humidity were found to be 29.7°C, 17.3°C, 82.4%, and 65.3%, respectively. And then it started decline from 2nd SMW with an infestation of 0.4%.*S. litura* in D3 was initially appeared during the 48th SMW with a 2.1% infestation and lasted until the 3rd SMW and it continuously increased and reached the peak of 21.2% infestation at the 51st SMW where the temperature maximum was 29.3°C, temperature minimum was 17.3°C, morning relative humidity was 80.7%, and evening relative humidity was 62.0%, respectively. However, in the 3rd SMW it began to fall with a 0.2% damage (Table 1).

Yadav et al.[18] found that the population of *S. litura* population on groundnut started from the 36th SMW with 0.27 larvae/plant and it reached a maximum during the 41st SMW with 1.07 larvae/plant. According to Ahir et al.[1] the incidence of *S. litura* on groundnut reached a peak during the 40th and 41st SMW with a population of 1.20 and 1.40 larvae/plant, respectively.Arpit et al.[4] observed the incidence of tobacco caterpillar from the first week of the august 33rd SMW and it continued up to the October last week 44th SMW on groundnut.Kumar et al.[9] observed the maximum incidence of *S. litura* during the second fortnight of October on soybean.

The correlation studies revealed during D1 that the *S. litura* larval population showed a non-significant negative correlation with the Tmax ºC (r= -0.233) and a significant positive correlation with Tmin ºC (r= 0.370) and RH-Ⅱ (r=0.640). While a non-significant positive correlation was occurred with RH-Ⅰ (r= 0.572). Whereas in D2 there was a non-significant positive correlation between RH-Ⅰ (r= 0.245) and RH-Ⅱ (r=0.376) and a non-significant negative correlation at Tmin ºC (r=-0.053) and Tmax ºC (r= - 0.323). Similarly, the D3 crop showed a negative non-significant correlation with Tmax ºC (r= -0.461) and RH-Ⅱ (r=-0.430) and a negative significant correlation with RH-Ⅰ (r= -0.533) and Tmin ºC (r=-0.553) (Table 2).

Nadaf and Kulkarni [11] observed that there was a positive and significant correlation of *S. litura* with the temperature minimum. According to Pazhanisamy*et al.*[13] reported that there was a negative correlation between the temperature maximum during the *kharif* 2010 and 2011 on *S.*

litura of groundnut.Harsihet al.[8] found that a positive association between *S. litura* population and the relative humidity on groundnut.

The data on regression analysis (Table 3) resulted that In the D1 sown crop, the results revealed the weather parameters shown an influence of 44.7 per cent (R^2 =44.7) on the *S. litura* population. At D2 75.1 per cent (R^2 = 75.1) influence of temperature maximum, and morning, evening relative humidity was observed. While there was a 58.7 per cent (R^2 =58.7%) influence of weather parameters on the incidence was noticed in D3 sown crop. Our results are more are less in line with the findings of Pazhanisamyet al.[15] who reported that there was an influence of 71.7 per cent (R^2=71.7%) of weather parameters on incidence of *S. litura.*

Table: 1 Seasonal incidence of *S. litura* in relation to the weather parameters

SMW	Temperature(°C)		Relative Humidity (%)		% Damage by *S. litura*		
	Tmax	**Tmin**	**RH-Ⅰ**	**RH-Ⅱ**	**D1**	**D2**	**D3**
42	32.0	21.0	91.1	90.0	0.5	00	00
43	31.6	19.2	87.9	60.4	1.2	00	00
44	31.2	20.2	85.1	48.0	2.0	00	00
45	29.8	19.6	87.6	69.7	3.2	2.1	00
46	29.1	19.1	84.1	69.4	9.1	6.7	00
47	29.1	18.1	85.4	84.4	9.2	22.5	00
48	28.9	18.7	92.3	92.7	11.2	28.5	2.1
49	29.7	18.2	87.6	79.9	8.5	39.2	5.2
50	29.7	17.3	82.4	65.3	2.2	42.6	6.7
51	29.3	17.3	80.7	62.0	0.2	23.1	21.2
52	28.2	15.0	69.0	42.3	00	11.4	20.2
1	29.1	15.1	66.1	30.9	00	4.1	10.4
2	29.4	15.5	75.9	52.7	00	0.4	3.2
3	29.5	16.8	76.4	70.9	00	00	0.2
4	29.2	16.3	77.3	55.3	00	00	00

SMW-StandardMeteorologicalWeek, Tmax- Temperature maximum, Tmin- Temperature minimum, RH-Ⅰ- Morning relative humidity morning, RH-Ⅱ- Evening relative humidity

Table: 2 Correlation coefficient of *S. litura* in relation to the weather parameters

Dates of sowing	Tmax(°C)	Tmin(°C)	RH-Ⅰ%	RH-Ⅱ%
D1	-0.233^{NS}	0.370*	0.572^{NS}	0.640*
D2	-0.323^{NS}	-0.053^{NS}	0.245^{NS}	0.376^{NS}
D3	-0.461^{NS}	-0.553*	-0.533^{NS}	-0.430^{NS}

*Significantat5%level
**Significantat1%level

NS- Non significant

Table: 3 Multiple regression equation of *S. litura* in relation to the weather parameters

Different dates ofsowings	Regressionequation	R^2
D1	Y= 59.25+(-3.436) Tmax + (0.8394) Tmin + (0.3790) RH- I +(0.0185)RH-II	44.7
D2	Y=7.603+(-4.865)Tmax+(-7.235)Tmin+(2.438)RH-I+(-0.0266)RH-II	75.1
D3	Y= 33.74 + (-1.7492) Tmax + (-0.8314) Tmin + (-0.0658)RH-I+(0.1088)RH-II	58.7

Y: incidence of *S. litura*, Tmax: Temperature maximum, Tmin: Temperature minimum, RH- Ⅰ: Morning relative humidity morning, RH-Ⅱ: Evening relative humidity.

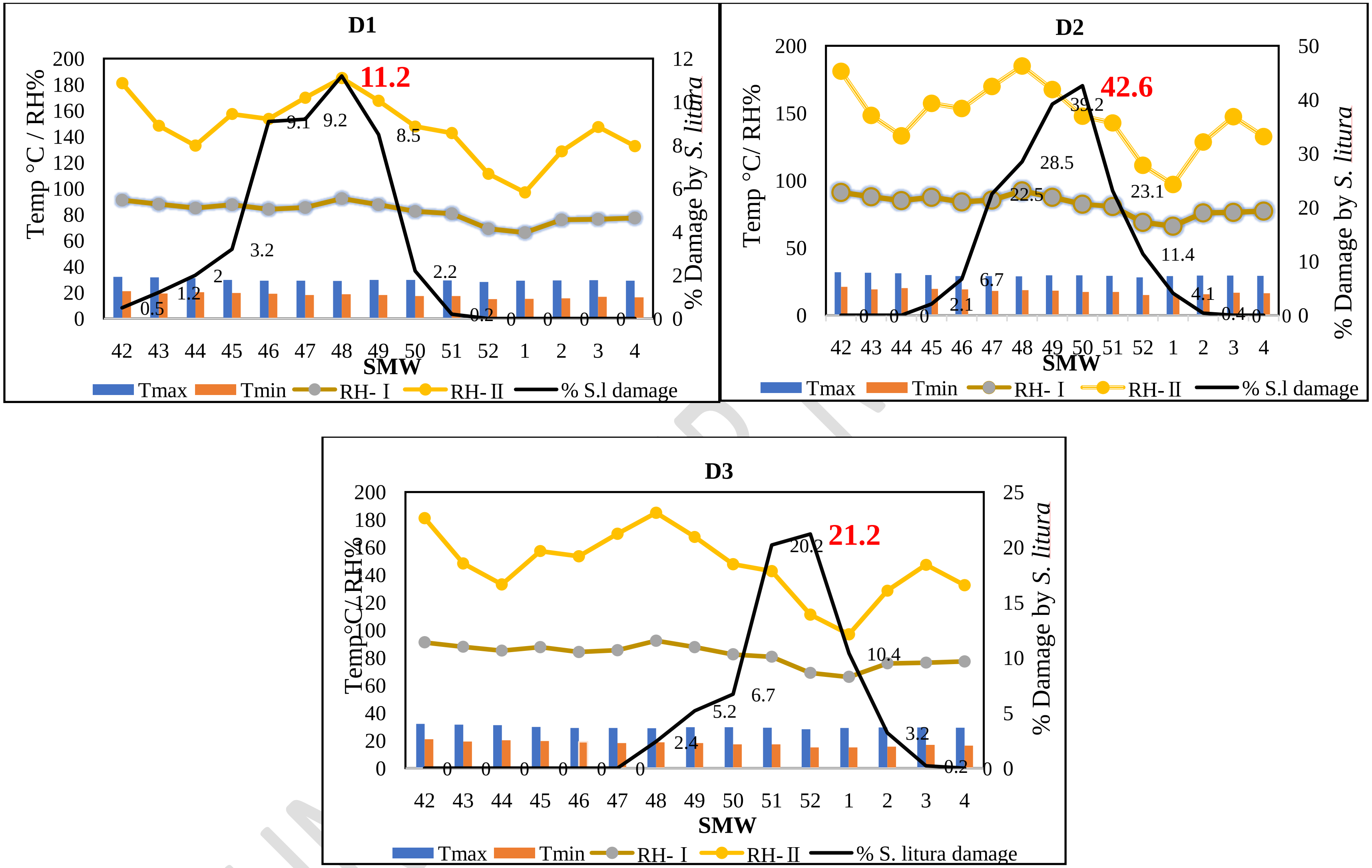

Fig: 1. Incidence of tobacco caterpillarin relation to weather parameters at different dates of sowings

Gram caterpillar*Helicoverpaarmigera*

The first appearance of the *H. armigera*occurred during the 43rd SMW, with an average number of 0.2 larvae/plant, and continued until the 52nd SMW during D1 (Fig 2). Then it gradually increased to a maximum of 1.8 larvae/plant at the 47th SMW where the highest temperature was 29.1°C, the temperature minimum was 18.1°C, and the morning relative humidity was found to be 85.4% and in the evening was 84.4%, respectively. However, during the 52nd SMW the infestation was gradually reduced to 0.2 larvae/plant.In D2, the population of *H. armigera* was initially noticed at the 46th SMW with an average of 1.3 larvae/plant, Then it gradually increased and reached the peak on the 49th SMW with 2.9 larvae/plant where the temperature maximum of 29.7°C, temperature minimum of 18.2°C, and morning relative humidity of 87.6% and 79.9% in the evening. Furthermore, at the 3rd SMW, just 0.2 larvae/plants were detected, indicating a reduction.*H. armigera* was observed in the 50th SMW with a 1.1 larvae/plant and the infestation lasted until the 2nd SMW during D3. And then, it started to increase and reached a maximum during the 52nd SMW with (2.2 larvae/plant) where the temperature maximum was 28.2°C, the temperature minimum was 15°C, morning relative humidity 69% and evening 42.3% and then it started to decline at 2nd SMW with 0.2 larvae/plant(Table 4).

The results are in line with our current work Pawar et al.[14] who found that the *H. armigera* was more during the 44th and 45th SMW with 0.35 larvae/plant and it continued up to the 1st SMW with 0.15 larvae/plant. Sardar et al.[16] found the incidence of *H. armigera* was observed at 47th SMW with 0.14 larvae/plant on desi chickpea and 0.56 larvae/plant on Kabuli chickpea varieties.

The correlation analysis in D1 revealed that the pest showed a positive significant correlation to Tmax (r= 0.256) and Tmin (r= 0.097) and a negative significant correlation towards RH-Ⅰ (r= -0.186) and RH-Ⅱ (r= -0.501). And in case of D2, the pest build-up was negatively non-significant towards the Tmax (r= -0.464) and Tmin (r= -0.090), and a positive non-significant correlation towards the relative RH-Ⅰ (r= 0.179) and RH-Ⅱ (r= 0.389). However, in D3, the pest showed a negative significant correlation with the RH-Ⅰ (r= - 0.626) and RH-Ⅱ (r=-0.528) and Tmax. And a negative, non-significant correlation with Tmax with r=-0.452(Table 5).The present findings are in line with Gadhiya et al.[6] reported that the pest showed a positive response to mean temperature and significant negative correlation with relative humidity. Harish et al.[7] found that the incidence of *H. armigera* was significantly positively correlated to the temperature maximum.

The population of *H. armigera* in the D1 crop with 42.6 per cent (R^2 =42.6). In D2 sown crop, there was a positive association with all the weather parameters except the temperature maximum with the influence of 68 per cent (R^2= 68%). While the D3 had a negative association to temperature maximum and evening relative humidity and a positive association to temperature minimum and morning relative humidity. There was an influence of 45.3 per cent (R^2 =45.3) with weather parameters(Table 6).

Table: 4 Seasonal incidence of *H. armigera*in relation to weather parameters

SMW	Temperature(°C)		Relative Humidity(%)		*H.armigera*larvae/plant		
	Tmax	Tmin	RH-Ⅰ	RH-Ⅱ	D1	D2	D3
42	32.0	21.0	91.1	90.0	00	00	00
43	31.6	19.2	87.9	60.4	0.2	00	00
44	31.2	20.2	85.1	48	0.5	00	00
45	29.8	19.6	87.6	69.7	0.2	00	00
46	29.1	19.1	84.1	69.4	1.1	1.3	00
47	29.1	18.1	85.4	84.4	1.8	1.7	00
48	28.9	18.7	92.3	92.7	1.0	2.0	00
49	29.7	18.2	87.6	79.9	0.7	2.9	00
50	29.7	17.3	82.4	65.3	0.4	1.5	1.1
51	29.3	17.3	80.7	62.0	0.4	1.0	1.4
52	28.2	15.0	69.0	42.3	0.2	1.0	2.2
1	29.1	15.1	66.1	30.9	00	0.7	1.0
2	29.4	15.5	75.9	52.7	00	0.4	0.2
3	29.5	16.8	76.4	70.9	00	0.2	00
4	29.2	16.3	77.3	55.3	00	00	00

SMW-StandardMeteorologicalWeek, Tmax- Temperature maximum, Tmin- Temperature minimum, RH-Ⅰ- Morning relative humidity morning, RH-Ⅱ- Eveningrelative humidity

Table: 5 Correlation coefficient of *H. armigera* in relation to the weather parameters

Dates of sowing	Tmax(°C)	Tmin(°C)	RH-Ⅰ%	RH-Ⅱ%
D1	0.256*	0.097*	-0.186*	-0.501*
D2	-0.464^{NS}	-0.090^{NS}	0.179^{NS}	0.389^{NS}
D3	-0.452^{NS}	-0.596*	-0.626*	-0.528*

*Significantat5%level
**Significantat1%level
NS- Non significant

Table: 6Multiple regression equation of *H. armigera* in relation to the weather parameters

Different dates ofsowings	**Regressionequation**	**R^2**
D1	Y=8.209+(0.4287)Tmax+(0.1608)Tmin+(0.0252)RH-Ⅰ+(0.5225)RH-Ⅱ	42.6
D2	Y=11.527+(-0.4884)Tmax+(0.2342)Tmin+(0.0962)RH-Ⅰ+(0.06673)RH-Ⅱ	68.0
D3	Y=7.6423+(-0.1452)Tmax+(0.2448)Tmin+(0.0232)RH-Ⅰ+(-0.9240)RH-Ⅱ	45.3

Y: incidence of *H. armigera*, Tmax: Temperature maximum, Tmin: Temperature minimum, RH-Ⅰ: Morning relative humidity morning, RH-Ⅱ: Evening relative humidity evening.

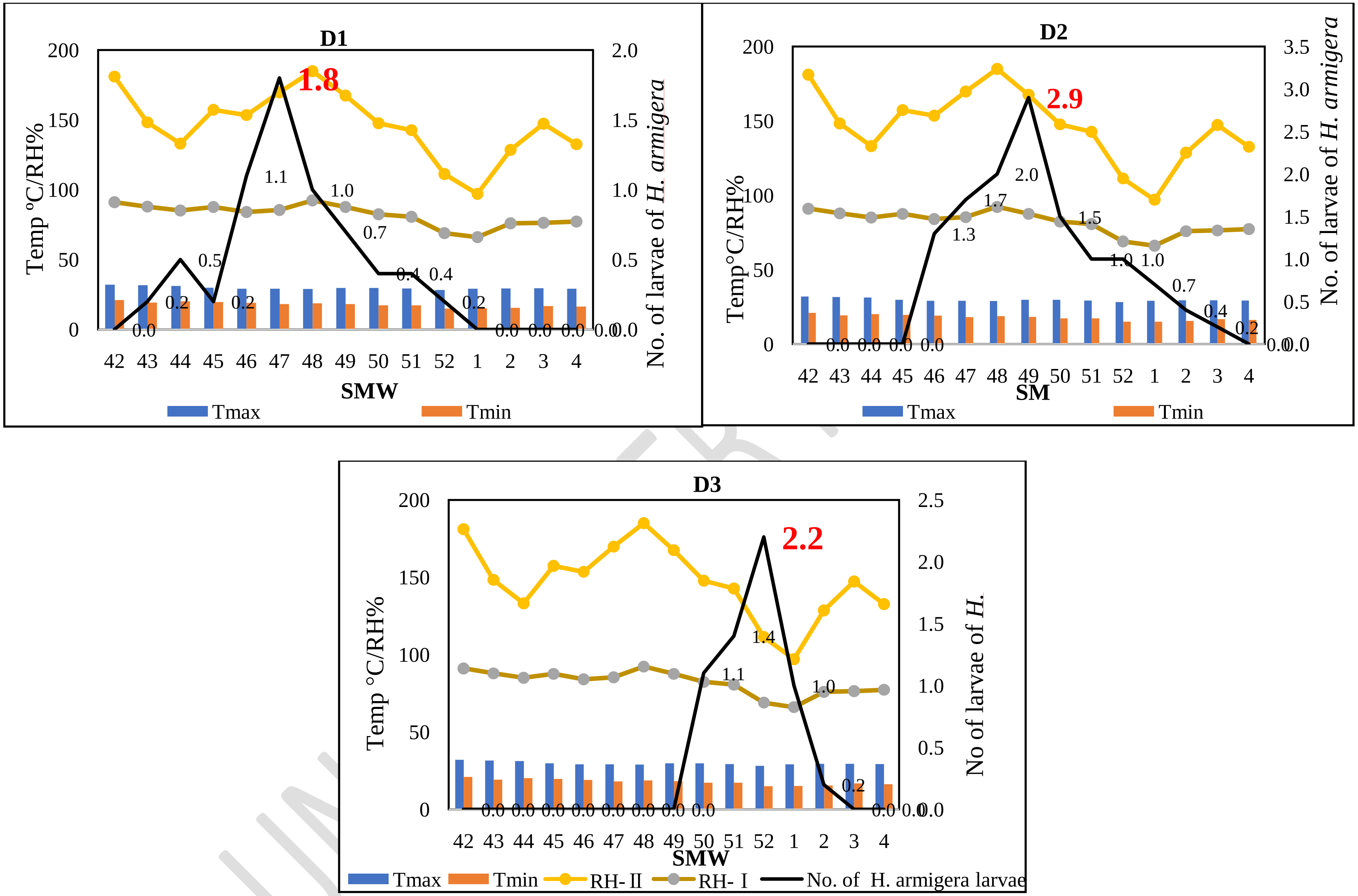

Fig: 2. Incidence of gram caterpillarin relation to weather parameters at different dates of sowings

4. CONCLUSION:

The study highlights the advantage of early sowing of the groundnut crop in the first week of October helps in less incidence of the pests population. This will help us in scheduling defoliator pest management strategies in groundnut crop.

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