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Effect of different dates of sowing and weather parameters on vector whitefly (*Bemisia tabaci* Gennadius) and incidence of yellow vein mosaic disease in okra (*Abelmoschus esculentus* L. Moench)

Rosevellina Mohanta, Dr. Ranjan Nath, Nitish Kumar Jena and Abinash Mishra

Abstract
A field experiment was conducted at Agricultural Farm of Palli-Siksha Bhavan (Institute of Agriculture), Visva-Bharati, Sriniketan, West Bengal during *Kharif* season, 2018. The present study was initiated with a view to gather some information regarding effect of different dates of sowing and weather parameters on vector whitefly and disease incidence of yellow vein mosaic disease in okra (*Abelmoschus esculentus* L. Moench) in Birbhum district. Out of five different dates of sowing highest yellow vein disease incidence was recorded in 3rd date of sowing (11.64) PDI as well as highest vector population 4.75 whiteflies/plant, followed by 2nd date of sowing 9.82 PDI and 3.55 whiteflies/plant, 4th date of sowing 7.38 PDI and 3.55 whiteflies/plant. Lowest PDI was observed in 5th date of sowing 3.38 and 2.35whiteflies/plant followed by 1st date of sowing 4.99 and 2.95 whiteflies/plant. At last day of observation (90DAS), 5th and 1st dates of sowing were found most effective having lowest PDI 12.65 & 15.31 and 3.45 & 3.60 whiteflies/plant respectively. Third date of sowing recorded significantly highest YVMD incidence 24.12 and 5.90 whiteflies/plant. Among all the treatments, 5th DOS recorded significantly higher yield (65.49q/ha) followed by 1st DOS (53.67q/ha), 4th DOS (45.4q/ha), 2nd DOS (43.92q/ha). While lowest yield (37.25q/ha) was recorded in 3rd DOS.

Keywords: Yellow vein mosaic disease (YVMD), yellow vein mosaic virus (YVMV), *Bemisia tabaci*, percentage of disease incidence (PDI), weather parameters

1. Introduction
Okra is a multipurpose crop. Its tender pods are cooked as vegetables, stewed with meat, cooked to make soup and also canned and dried. Okra is probably originated in tropical Africa or possibly in tropical Asia, and is now widely grown throughout the tropics. The crop is well distributed throughout the Indian subcontinent and East Asia [21]. Okra is a nutritious and delicious vegetable, fairly rich in vitamins and minerals [16]. The edible portion of pod (100 gm) has moderate levels of vitamin A (0.01 mg) and vitamin C (18 gm), calcium (90 mg), phosphorus and potassium. The content of thiamine (0.07 mg), riboflavin (0.08 mg) and niacin (0.08 mg) per 100 gm edible portion of pod is higher than that of many vegetables [21]. It is also the good sources of gum, starch, spice etc. Okra is very useful against genito-urinary disorders, spermatorrhoea and chronic dysentery. Its medicinal value has also been reported in curing ulcers and relief from haemorrhoids [1]. Okra contains special fiber which takes sugar levels in blood under control, providing sugar quantity, acceptable for the bowels. Mucilage found in okra, is responsible for washing away toxic substances and bad cholesterol, which loads the liver. Okra ensures recovery from psychological and mental conditions, like, depression and general weakness. Okra is additionally applied for pulmonary inflammations, irritations and sore throat. According to Indian researches, okra is a complex replacement for human blood plasma. In order to keep the valuable substances safe, it's necessary to cook okra as shortly as possible, processing it either with steam, or on low heat [20]. The yield and quality of okra depend on several factors like disease, insects, soils and climatic conditions. Among the factors responsible for limiting the yield and quality of okra, Yellow vein clearing mosaic virus (YVCMV) is the most important one as reported by Sastry and Singh [22].

The virus may cause more than 90% yield loss. Kulkarni first reported the virus in 1942 as a destructive disease of okra prevalent in Bombay area of India. Later on, the virus was systematically studied and characterized by different Indian scientists [25]. They concluded that *Yellow vein clearing mosaic virus* is a member of *geminivirus* group which is semi-persistently transmitted by whitefly (*Bemesia tabaci*). The virus is also transmitted through grafting, but not mechanically or through seeds. *Yellow vein clearing mosaic virus* has been considered as the most important factor of yield reduction in India and some other okra growing regions of the sub-continent [22-24]. The main symptom of the disease in okra is vein clearing followed by veinal chlorosis of the leaves. The yellow network of vein is very conspicuous and the vein and vein lets become thick. In sever case, the chlorosis may extend to interveinal areas and may result in the complete yellowing of leaves. Fruits are dwarfed, malformed and are yellowish green in colour. Sever damage occurs in case of early infection. If plants are infected within 20 days after germination, their growth is retarded, few leaves and small sized fruits are formed and the losses are very high. The extent of damage declines with delay in infection of the plants.

Now a day's many resurgence of pest, resistance to different insecticides are emerging due to heavy and inadequate application of chemicals. Hence, it was thought to take up the studies on incidence of whitefly in okra with ecologically sound management strategies, so that we can suggest to the farmer to this zone with least disturbance of agro-climatic condition of Birbhum district, West Bengal. So as per seriousness of the pest and economic importance of this crop the present study was planned to evaluate the effect of different dates of sowing and weather parameters like maximum & minimum temperature, rainfall, humidity and sunshine hour against whitefly population and disease incidence in field condition.

2. Materials and Method

The experimental design taken for the present experiment was Randomized Block Design (RBD) to study effect of different dates of sowing that is environmental impact (maximum & minimum temperature, relative humidity, rainfall and sunshine) on YVMD incidence. Okra variety "Japaneese Jahar" was taken for this experiment. There were total five different dates of sowing i.e. (1st DOS- 11th August 2018, 2nd DOS- 18th August 2018, 3rd DOS -25th August 2018, 4th DOS – 1st September 2018, & 5th DOS - 8th September 2018) and four replications. Normally seed rate 8-10 kg/ha was in line sowing. The spacing was maintained as 50cm (Row to Row) and 35cm (Plant to Plant) for each plot. Normal fertilizer doses and recommended agronomical practices were adopted. Intercultural operations like thinning, gape filling, weeding, hoeing, rouging, irrigation, spraying etc. were done as and when required. Harvesting from different plots was done from 29th September to 18th November, 2018 at 4days interval. The fresh weight of green tender fruits were taken and converted to appropriate unit. Observations of YVMD incidence were recorded at 5days interval starting from 30DAS i.e. 5th September to 90DAS i.e. 8th November 2018. Weather data for minimum and maximum temperature (^{0}C), relative humidity (%), rainfall (mm), sunshine hour and disease incidence were recorded and converted to 5 days average for drawing correlation of disease development with different weather factors. The independent variables (i.e. weather parameters) were correlated with dependant variable (whitefly population / plant) of next interval. The data on above weather parameters were collected from India meteorological department, sriniketan centre.

To study the incidence pattern of YVMV, numbers of infected plants at 5 days interval from 30 days after sowing were recorded and percentage of infected plants was worked out. Per cent disease incidence (PDI) was calculated using following formula.

$$\text{PDI (\%)} = \frac{\text{Number of diseased plants}}{\text{Total number of plants observed}} \times 100$$

Whitefly population was recorded during the crop growing period by counting the number of whiteflies from bottom, middle and top leaves of five randomly selected plants from each plot. Observations were recorded early in the morning from 6:30am to 7:30am at an interval of five days throughout the season. The average numbers of whiteflies per plant were worked out.

To find out the best effective treatment in terms of PDI and whitefly population analysis of variance was done in randomized block design (RBD). For finding out the effect of abiotic factors on PDI and whitefly population correlation analysis was carried out between no. of whitefly per plant and different weather parameters. Square root transformation and angular transformation were done for number and percent data respectively. The results obtained during present investigation were analyzed statistically at 1% & 5% level of significance, following standard statistical method [13].

3. Results and Discussion

The data on yellow vein mosaic disease incidence (Table 1 & Fig. 1) and whitefly population are depicted in (Table 2 & Fig. 2). Five different dates of sowing of seven days interval was carried out in the experimental plot for this objective. The data indicated that the occurrence of YVMD incidence and whitefly was observed at 30 days after sowing and it became significant after 40 days of sowing. It was observed that PDI increased in each successive observation of 5days interval and maximum whitefly population was observed in 80 to 90 days after sowing in all five different dates.

The data recorded on PDI and whitefly population at five days interval starting from 40DAS till 90DAS was statistically analysed and presented in Table 1 and 2 which revealed that at 40DAS, the disease incidence was very low and vector population fluctuate throughout the crop growing period. Highest yellow vein disease incidence was recorded in 3rd date of sowing (11.64) as well as highest vector population 4.75 whiteflies/plant, followed by 2nd date of sowing 9.82 PDI and 3.55 whiteflies/plant, 4th date of sowing 7.38 PDI and 3.55 whiteflies/plant. Lowest PDI was observed in 5th date of sowing 3.38 and 2.35whiteflies/plant followed by 1st date of sowing 4.99 and 2.95 whiteflies/plant.

Data presented in Table 1 & 2 revealed that at 45DAS, again highest PDI and whiteflies population were recorded in 3rd, 2nd and 4th date of sowing 13.24, 11.35 &8.90 and 4.50, 3.85 &3.30 whiteflies/plant respectively. Whereas lowest PDI and whiteflies population was found in 5th and 1st date of sowing 5.83 PDI, 6.63 PDI & 2.40 whiteflies/plant, 2.60 whiteflies/plant respectively.

Almost same trend of yellow vein mosaic disease incidence and whitefly population was recorded on 50DAS to 90DAS. Among the all five dates of sowing it was revealed that 5th and 1st date of sowing best over 2nd, 3rd, 4th date of sowing having significantly low PDI and vector population.

At 90DAS, 5th and 1st dates of sowing were found most effective having lowest PDI 12.65 & 15.31 and 3.45 & 3.60 whiteflies/plant respectively. Third date of sowing showed significantly high YVMD incidence (24.12 PDI) and 5.90 whiteflies/plant.

The order of effectiveness of these treatments was 5th date of sowing > 1st date of sowing > 4th date of sowing > 2nd date of sowing > 3rd date of sowing. Effect of different dates of sowing on whitefly population and percent of disease incidence are in agreement with the results obtained by [4, 17, 23].

3.1 Effect of different dates of sowing on yield

Among all the treatments, 5th DOS recorded significantly higher yield (65.49q/ha) followed by 1st DOS (53.67q/ha), 4th DOS (45.4q/ha), 2nd DOS (43.92q/ha). While lowest yield (37.25q/ha) was recorded in 3rd DOS (Table 3 & Fig. 3). Same result has also been reported from [8, 9, 15, 22].

3.2 Effect of weather parameters on PDI and whitefly population in okra with 1st, 3rd and 5th dates of sowing

Out of five different dates of sowing 1st, 3rd and 5th dates of sowing were chosen for find out correlation with the weather parameters (maximum and minimum temperature, rainfall (mm), humidity (%) and sunshine hour) and rate of change of disease incidence and whitefly population.

3.2.1 Correlation of environmental factors with yellow vein mosaic disease incidence and whitefly population

The role of environmental conditions cannot be denied in case of creation of epiphytotic situations in plant diseases. Each parameter of environmental factor plays its role in reducing or enhancing of pathogenic activity as well as vectors especially insect vectors. Different environment variables (max. temperature, min. temperature, rainfall, relative humidity and sunshine hour) significantly influenced the disease incidence (Table 4) [6]. Their relationship was explained by graphical representation.

3.2.2 Effect of Maximum & Minimum temperature on whitefly population as well as the change in per cent disease incidence

Max. and Min. temperature had significant influence on the increase or decrease in per cent of disease incidence and whitefly population on 1st , 3rd and 5th dates of sowing. The (Table 5, 6 & 7) and (Fig. 4, 8 & 12) showed that with the increase in maximum and minimum temperature the whitefly population increased with an increase in the amount of change in PDI. At 5th DOS whitefly population showed highly positive significant correlation (0.77213**) with maximum temperature. Whereas at 3rd DOS highly positive correlation (0.78426**) between whitefly population minimum temperature, followed by 5th DOS (0.6636**) (Table 4).

3.2.3 Effect of rainfall on whitefly population as well as the change in per cent disease incidence

Rainfall showed negative correlation with whitefly population as well as the change in per cent disease incidence on 1st ,3rd and 5th dates of sowing. With the increase in rainfall whitefly population decreased and the amount of change in PDI was also decreased (Table 5, 6 & 7) and (Fig. 5, 9 & 13). At 1st DOS highly negative correlation (-0.74601**) was observed between whitefly population and rainfall followed by 5th DOS (-0.69163**) (Table 4).

3.2.4 Effect of relative humidity on whitefly population as well as the change in per cent disease incidence

Relative humidity showed positive correlation with whitefly population as well as the change in percent disease incidence on 1st, 3rd and 5th dates of sowing. With the increase in relative humidity whitefly population increased and the amount of change in PDI was also increased (Table 5, 6 & 7) and (Fig. 6, 10 & 14). 1st DOS showed highly positive correlation (0.55277**) between whitefly population relative humidity (Table 4).

3.2.5 Effect of sunshine hour on whitefly population as well as the change in percent disease incidence

Sunshine hour showed positive correlation with the amount of change in PDI and whitefly population. The table (5, 6 & 7) and (fig. 7, 11 & 15) showed that longer sunshine hour per day favoured increase in whitefly population with increased amount of change in PDI. 3rd DOS showed highly significant correlation (0.9421**) between whitefly population and sunshine hour followed by in 5th DOS (0.79125**) (Table 4).

Table 1: Percent Disease Index (PDI) for Yellow Vein Mosaic Disease of Okra at different days after sowing (DAS) in different dates of sowing

Treatments	40DAS	45DAS	50DAS	55DAS	60DAS	65DAS	70DAS	75DAS	80DAS	85DAS	90DAS
T1 (1st DOS)	4.99 (12.71)	6.63 (14.91)	7.88 (16.09)	7.9 (16.04)	7.96 (16.28)	8.96 (17.38)	9.55 (17.94)	9.72 (17.96)	11.19 (19.42)	13.75 (21.66)	15.31 (22.93)
T2 (2nd DOS)	9.82 (18.24)	11.35 (19.58)	11.71 (20.00)	11.94 (20.18)	12.76 (20.86)	12.88 (20.96)	12.96 (20.97)	13.38 (21.44)	14.5 (22.37)	16.33 (23.78)	17.16 (24.42)
T3 (3rd DOS)	11.64 (19.91)	13.24 (21.31)	13.58 (21.57)	14.06 (22.00)	14.26 (22.10)	14.63 (22.44)	14.90 (22.63)	15.90 (23.46)	17.53 (24.53)	20.07 (26.50)	24.12 (29.33)
T4 (4th DOS)	7.38 (15.65)	8.90 (17.30)	9.73 (18.07)	9.83 (18.12)	10.56 (18.87)	10.80 (19.02)	11.07 (19.34)	11.46 (19.73)	12.68 (20.82)	15.36 (23.03)	16.66 (23.95)
T5 (5th DOS)	3.38 (10.58)	5.83 (13.52)	7.42 (15.66)	7.54 (15.81)	7.54 (15.71)	8.03 (16.35)	8.75 (17.15)	9.48 (17.82)	10.28 (18.59)	11.29 (19.49)	12.65 (20.70)
SE m	0.93	1.06	1.13	1.14	1.18	1.23	1.18	1.24	1.31	1.31	1.47
CD	2.76**	3.12**	3.33*	3.37**	3.48**	3.63*	3.50*	3.67*	3.87*	3.89*	4.36*

DAS= Days after sowing, DOS= Dates of sowing, Average of three replications. Figure in parenthesis are agcsign transformed value

*5% level of significance

**1% level of significance

Table 2: Effect of different dates of sowing on white fly population at different stages of plant growth

Treatments	40das	45das	50das	55das	60das	65das	70das	75das	80das	85das	90das
T1 (1st DOS)	2.95 (1.85)	2.60 (1.75)	3.30 (1.93)	3.60 (2.02)	3.2 (1.92)	3.00 (1.86)	3.10 (1.88)	3.45 (1.97)	3.25 (1.92)	3.50 (1.99)	3.60 (2.02)
T2 (2nd DOS)	3.55 (2.00)	3.85 (2.08)	4.55 (2.25)	4.35 (2.20)	4.25 (2.18)	4.35 (2.19)	4.25 (2.17)	4.35 (2.20)	4.60 (2.25)	4.45 (2.21)	4.35 (2.19)
T3 (3rd DOS)	4.75 (2.28)	4.50 (2.23)	4.20 (2.16)	4.55 (2.24)	4.65 (2.26)	4.55 (2.24)	5.20 (2.38)	5.35 (2.42)	5.65 (2.48)	5.55 (2.45)	5.90 (2.53)
T4 (5th DOS)	3.55 (2.01)	3.30 (1.94)	3.90 (2.09)	3.95 (2.11)	3.35 (1.95)	4.00 (2.12)	3.85 (2.08)	3.70 (2.04)	3.75 (2.05)	3.85 (2.07)	3.95 (2.10)
T5 (5th DOS)	2.35 (1.67)	2.40 (1.69)	2.20 (1.63)	2.85 (1.82)	3.00 (1.86)	2.9 (1.83)	2.95 (1.84)	3.10 (1.88)	3.05 (1.86)	3.20 (1.91)	3.45 (1.97)
SE m	0.12	0.12	0.11	0.09	0.10	0.10	0.12	0.12	0.12	0.12	0.10
CD at 5%	0.36	0.36	0.31	0.26	0.28	0.31	0.35	0.34	0.35	0.34	0.30

DAS= Days after sowing, DOS= Dates of sowing, Average of three replications

**Figures in parenthesis are square root transformed value

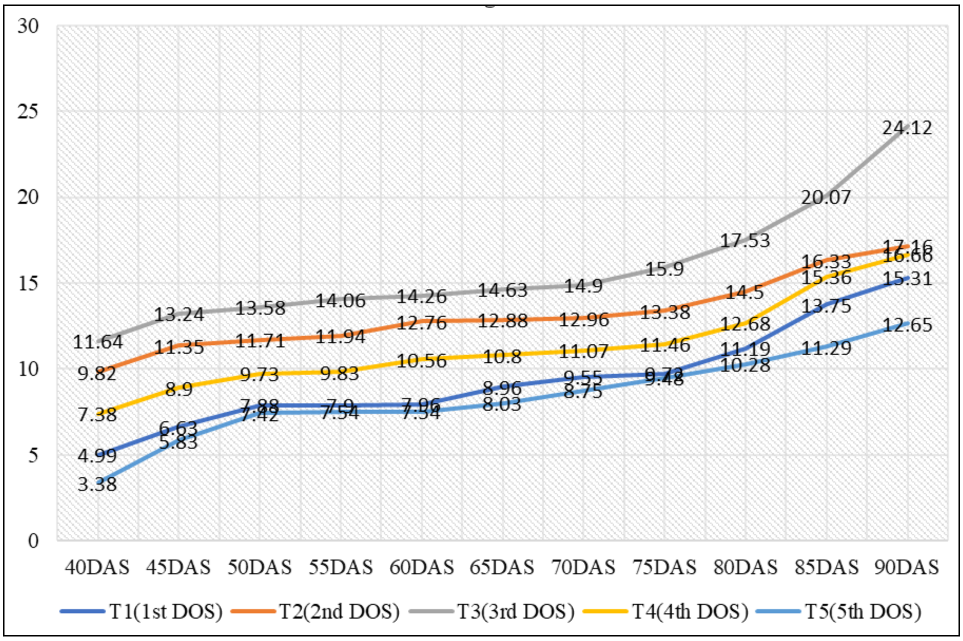

Fig 1: PDI of yellow vein mosaic disease of okra in different dates of sowing

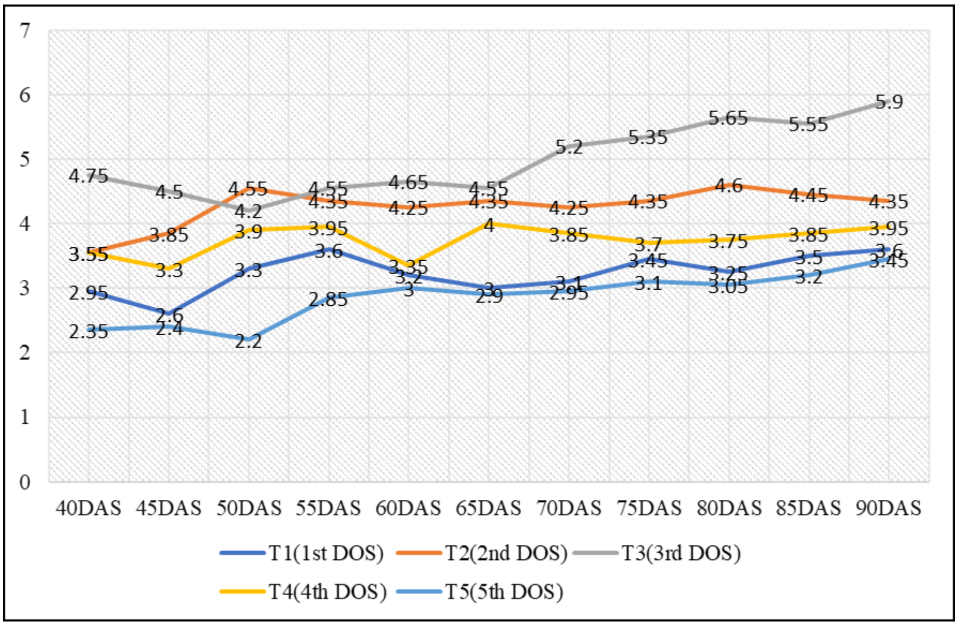

Fig 2: Effect of different dates of sowing on whitefly population at different stages of plant growth

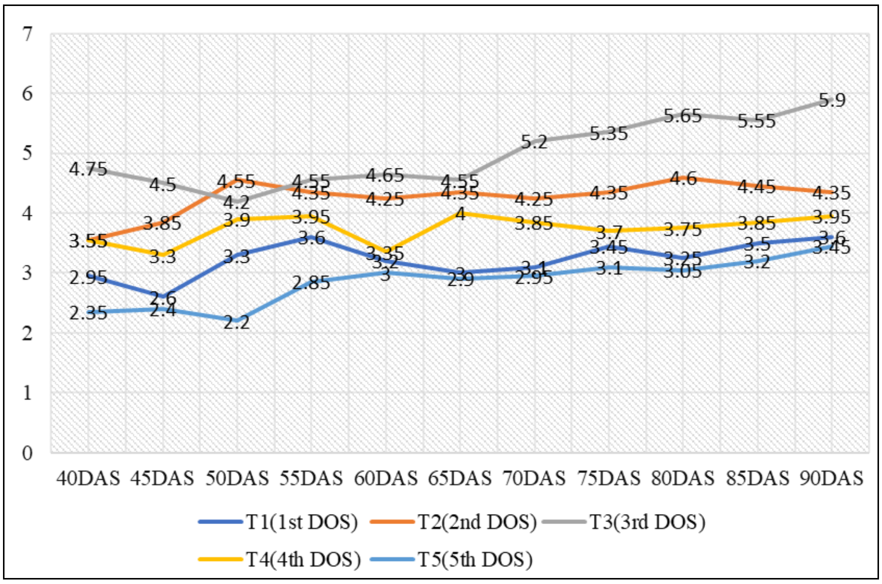

Fig 3: Effect of different dates of sowing on yield

Table 3: Effect of different dates of sowing on yield

Treatment no.	Treatments	Yield(q/ha)
T1	1st DOS	53.67
T2	2nd DOS	43.92
T3	3rd DOS	37.25
T4	4th DOS	45.4
T5	5th DOS	65.49
SE m		4.58
CD at 1%		13.56

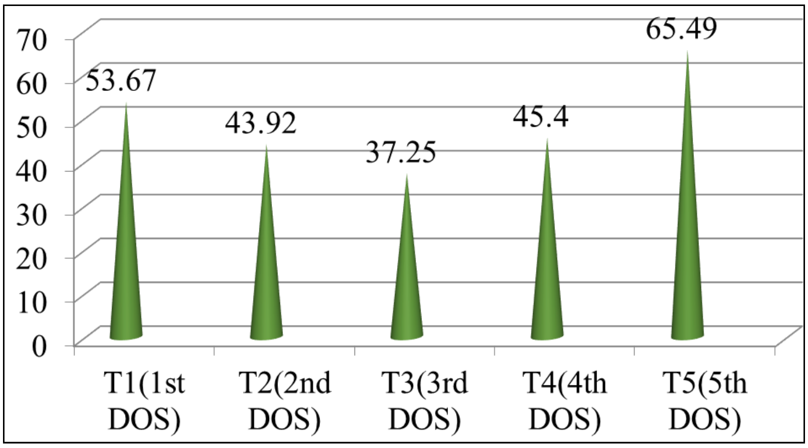

Table 4: Correlation between weather parameters and whitefly population

	Max. temp.	Min. temp.	Rainfall	Humidity	Sunshine hr.
1st DOS	0.15723(NS)	0.43798*	-0.74601**	0.55277**	0.11411(NS)
3rd DOS	0.29494*	0.78426**	-0.48709*	0.32009*	0.9421**
5th DOS	0.77213**	0.6636**	-0.69163**	0.11972(NS)	0.79125**

*Significant at 5%, **Signifiance at1%, NS(Non-Significant)

Table 5: Meteorological observation for first date of sowing(11th Aug. 2018)

No. of observations at 5days interval	Rate of change of PDI	No. of whitefly per plant	Temperature (^{0}C)		Rainfall (mm)	Relative humidity (%)	Bright Sunshine (hr/day)
			Maximum	Minimum			
1st Obs. At 30das(10.9.18)	0	0.25	32.64	25.82	11.58	85.6	5.54
2nd obs. At 35das(15.9.18)	0	0.20	34.8	25.74	15.86	85.2	5.02
3rd obs. At 40das(20.9.18)	4.99	2.95	34.7	26.02	0.7	79.4	7.88
4th obs. At 45 das(25.9.18)	1.64	2.60	32.56	24.74	9.2	83.6	4.72
5th obs. At 50das(30.9.18)	1.25	3.30	35.32	25.8	1.48	81.6	5.9
6th obs. At 55das(5.10.18)	0.02	3.60	35.4	23.56	0	74.8	4.86
7th obs. At 60das(10.10.18)	0.06	3.2	34.86	23.3	0	72.2	2.96
8th obs. At 65das(15.10.18)	1	3	28.44	22.38	7.16	87.4	2.2

9th obs. At 70das(20.10.18)	0.59	3.10	33.3	20.42	0	79.6	2.62
10th obs. At 75das(25.10.18)	0.17	3.45	33.08	20.68	0.44	77.8	2.46
11th obs. At 80das(30.10.18)	1.47	3.25	31.2	18.06	0	74.4	2.56
12th obs at 85das(4.11.18)	2.56	3.50	31.44	20.38	0	78.8	6.54
13th obs at 90das(9.11.18)	1.56	3.60	32.08	19.9	0	76.8	6.32

Table 6: Meteorological observation for third date of sowing (25th Aug. 2018)

No. of observations at 5days interval	Rate of change of PDI	No. of whitefly per plant	Temperature (0c)		Rainfall (mm)	Relative Humidity (%)	Bright sunshine (hr/day)
			Max.	Min.			
1st Obs. At 30das(24.9.18)	0	0.80	32.4	24.84	9.2	82.8	4.64
2nd obs. At 35das(29.9.18)	0	1.35	35.34	25.68	1.48	82	5.9
3rd obs. At 40das(4.10.18)	11.64	4.75	35.5	24.04	0	75	5.64
4th obs. At 45 das(9.10.18)	1.6	4.50	34.7	23.5	0	73.4	3.08
5th obs. At 50das(14.10.18)	0.34	4.20	28.86	22.88	7.02	84.8	2.36
6th obs. At 55das(19.10.18)	0.48	4.55	32.92	20.1	0.14	80.2	2.66
7th obs. At 60das(24.10.18)	0.2	4.65	33.28	20.92	0	78.6	2.46
8th obs. At 65das(29.10.18)	0.37	4.55	31.72	18.14	0.44	73.8	2.56
9th obs. At 70das(3.11.18)	0.27	5.20	30.54	20.44	0	79.2	5.16
10th obs. At 75das(8.11.18)	1	5.35	32.84	20.56	0	78.6	6.68
11th obs. At 80 das(13.11.18)	1.63	5.65	30.38	15.92	0	70	7.3
12th obs. at 85das(18.11.18)	2.54	5.55	31.64	16.8	0	79.6	6.82
13th obs. at 90das(23.11.18)	4.05	5.90	30.14	12.98	0	76.2	8.04

Table 7: Meteorological observation for fifth date of sowing (8th Sep. 2018)

No. of observations at 5days interval	Rate of change of PDI	No. of whitefly per plant	Temperature (^{0}C)		Rainfall (mm)	Relative humidity (%)	Bright sunshine (hr/day)
			Max.	Min.			
1st Obs. At 30das(9.10.18)	0	3.05	34.7	23.5	0	73.4	3.08
2nd obs. At 35das(14.10.18)	0	2.35	28.86	22.88	7.02	84.8	2.36
3rd obs. At 40das(19.10.18)	3.38	2.35	32.92	20.1	0.14	80.2	2.66
4th obs. At 45 das(24.10.18)	2.45	2.40	33.6	20.92	0	78.6	2.46
5th obs. At 50das(29.10.18)	1.59	2.20	31.72	18.14	0.44	73.8	2.56
6th obs. At 55das(3.11.18)	0.12	2.85	30.54	20.44	0	79.2	5.16
7th obs. At 60das(8.11.18)	0	3	32.84	20.56	0	78.6	6.68
8th obs. At 65das(13.11.18)	0.49	2.9	30.38	15.92	0	74	8.1
9th obs. At 70das(18.11.18)	0.72	2.95	31.64	16.5	0	79.6	6.82
10th obs. At 75das(23.11.18)	0.73	3.10	30.14	12.98	0	76.2	8.04
11th obs. At 80das(28.11.18)	0.6	3.05	29.52	13.34	0	73.6	7.8
12th obs. at 85das(3.12.18)	1.01	3.20	29.56	16.5	0	74	5.42
13th obs. at 90das(8.12.18)	1.63	3.45	27.82	12.7	0	78	6.38

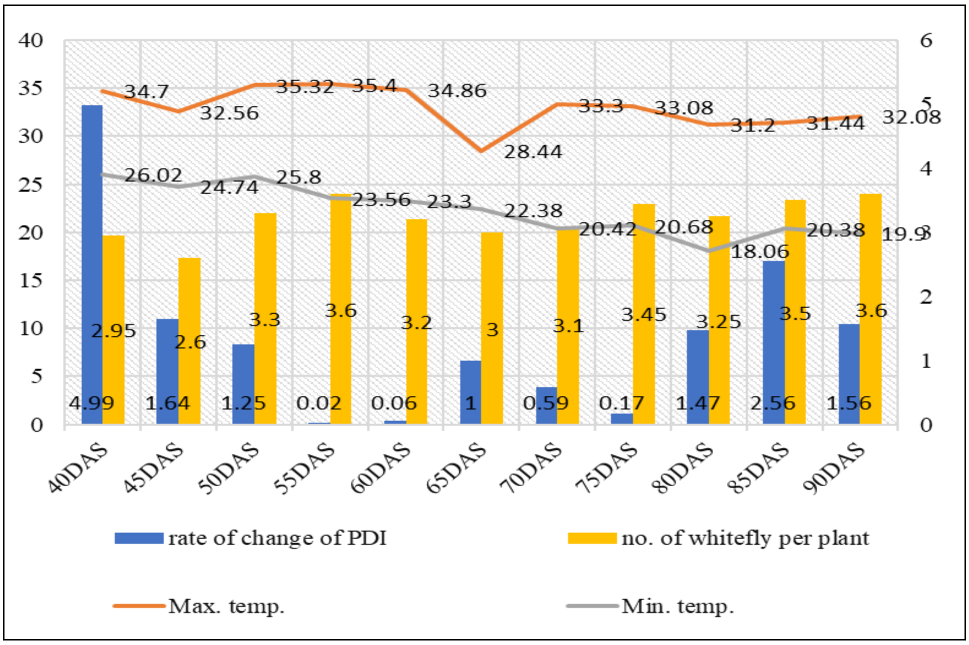

Fig 4: Effect of Max. & Min. temp. on change in PDI in 1st DOS

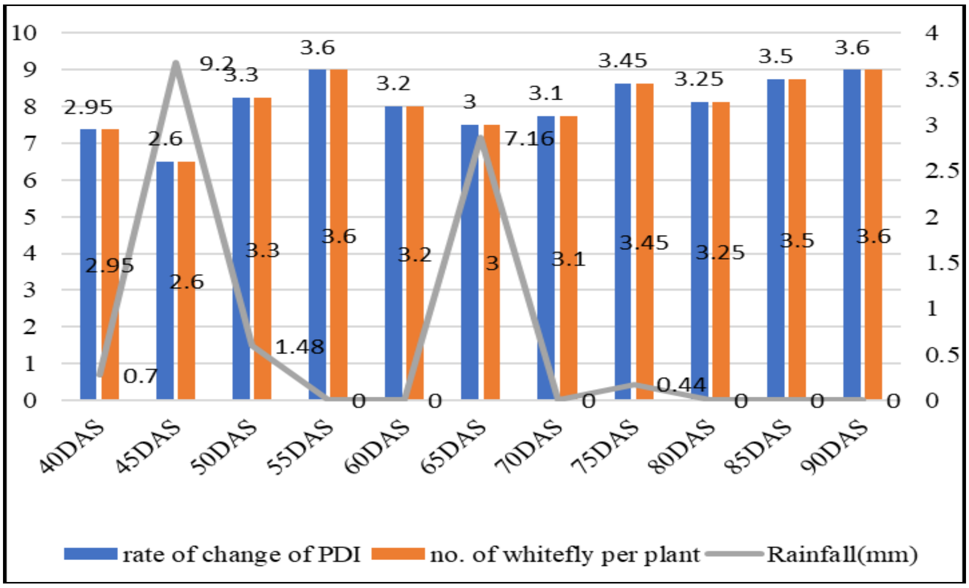

Fig 5: Effect of Rainfall on change in PDI and whitrfly population in 1st DOS

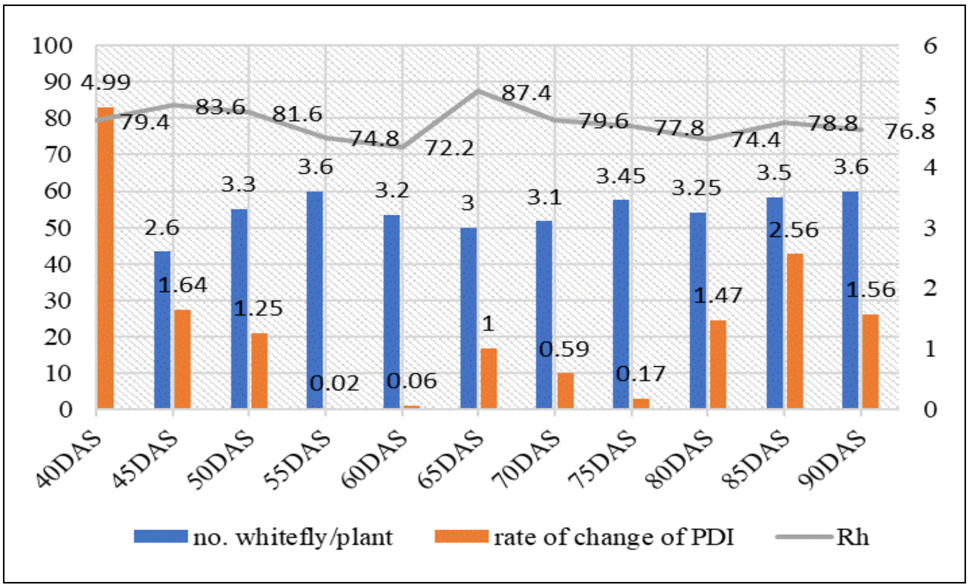

Fig 6: Effect of Rh on change in PDI and whitefly population in 1st DOS

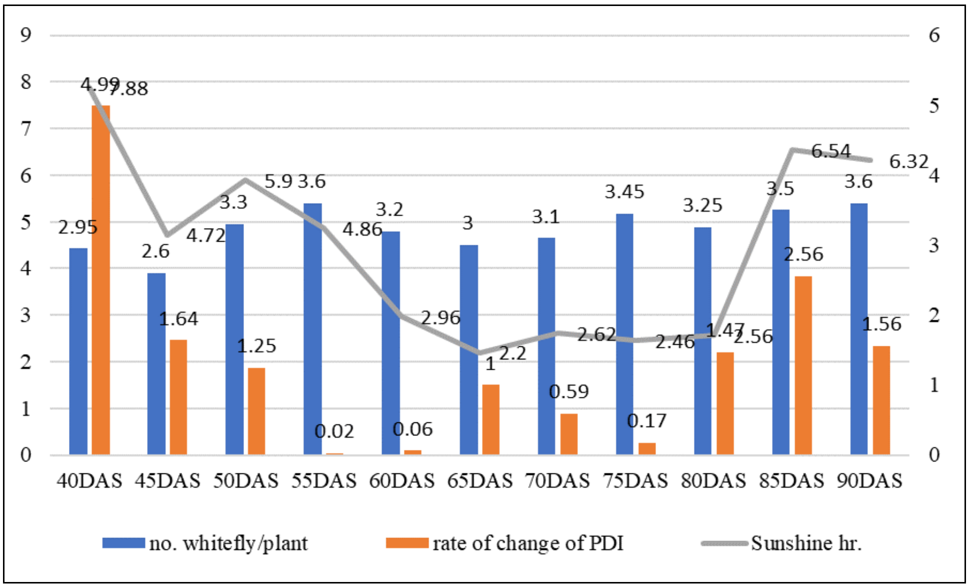

Fig 8: Effect of Max. & Min. temperature on change in PDI and whitefly population in 3rd DOS

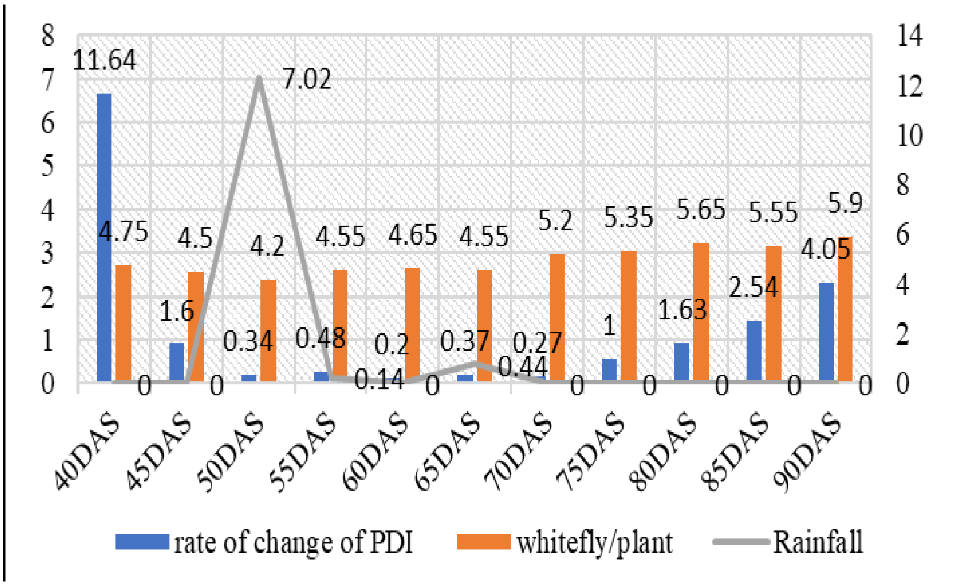

Fig 9: Effect of Rainfall on change in PDI and whitefly population in 3rd DOS

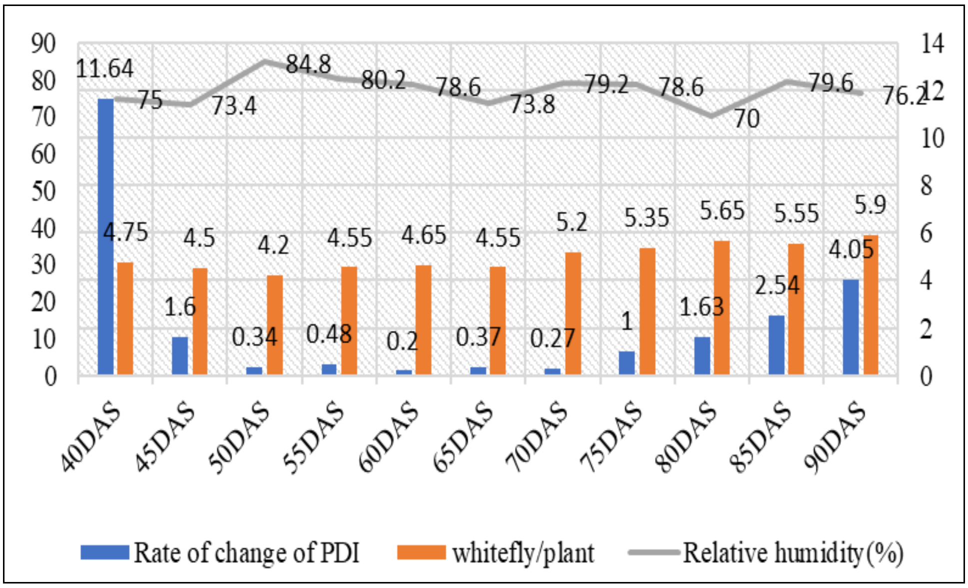

Fig 10: Effect of Rh on change in PDI and no. of whitefly paer plant in 3rd D0S

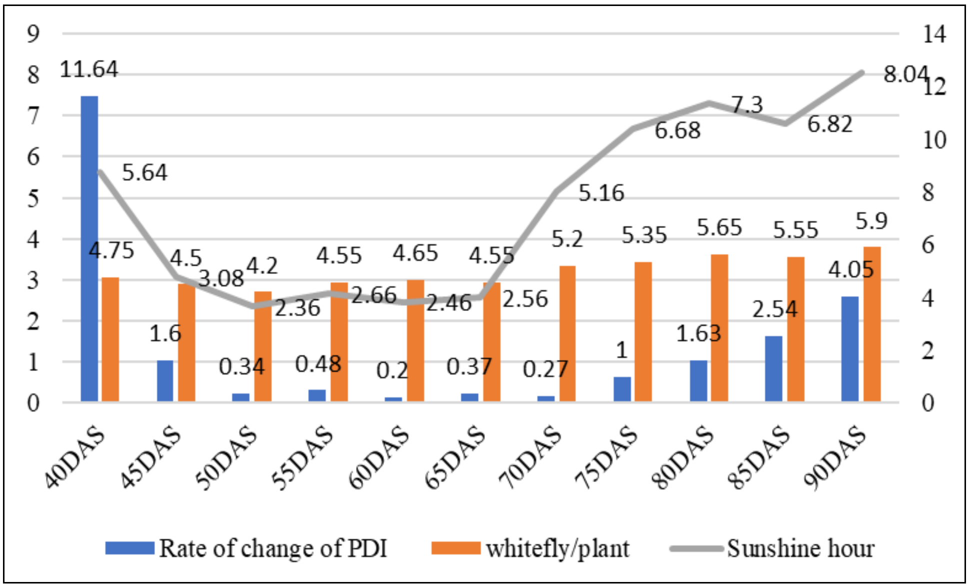

Fig 11: Effect of sunshine hour on change in PDI and no. of whitefly per plant in 3rd DOS

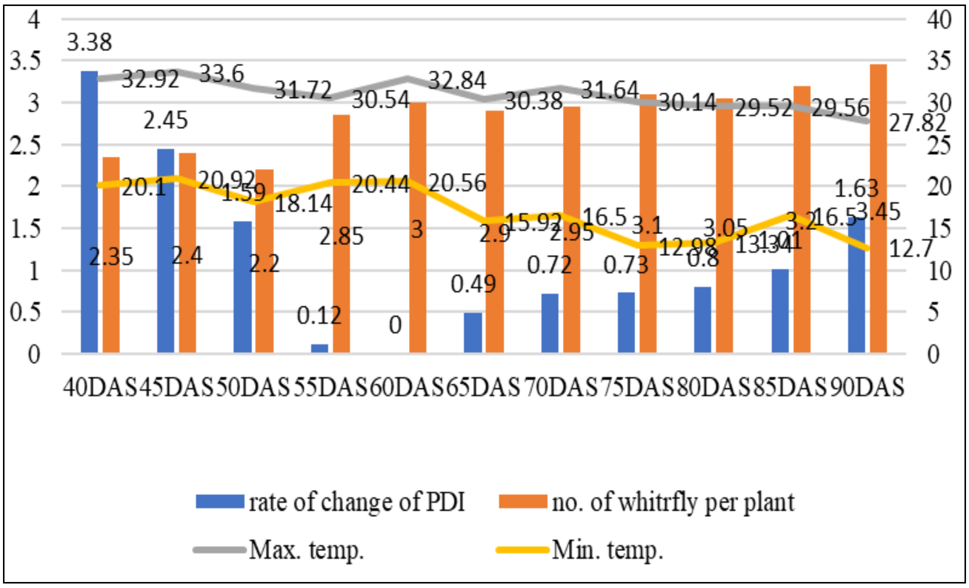

Fig 12: Effect of Max. & Min. temperature on change in PDI and whitefly population in 5th DOS

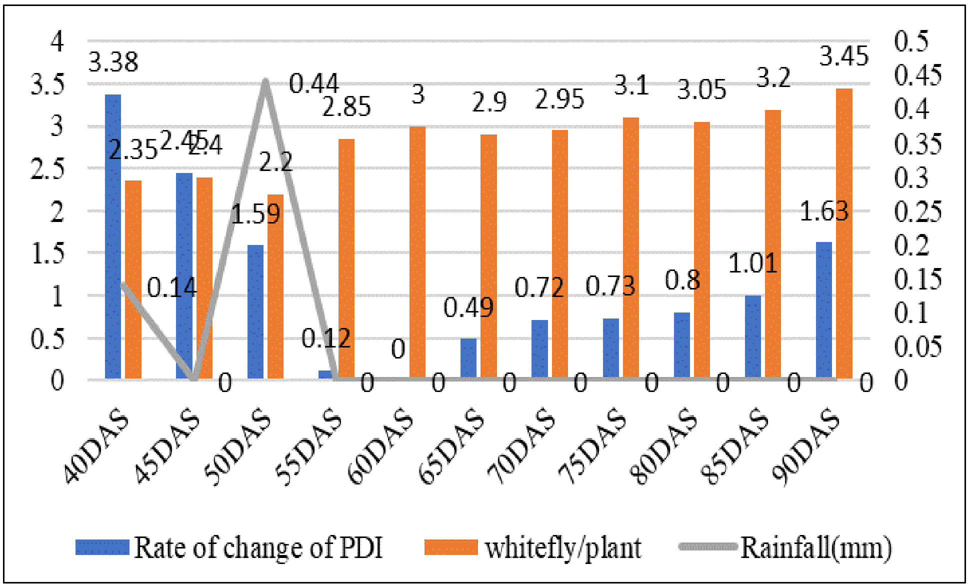

Fig 13: Effect of rainfal on change in PDI & whitefly population in 5th DOS

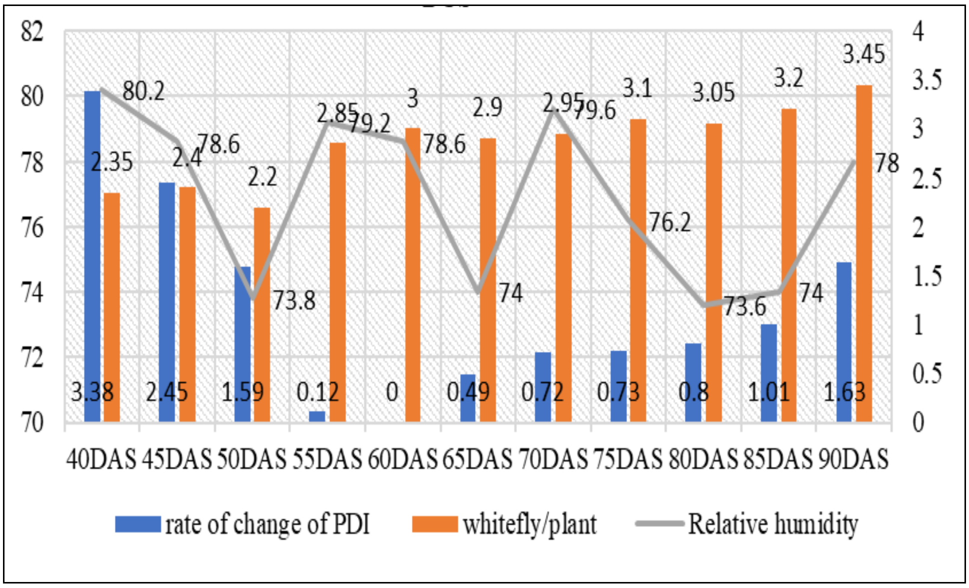

Fig 14: Effect of Rh on change in PDI and whitefly population in 5th DOS

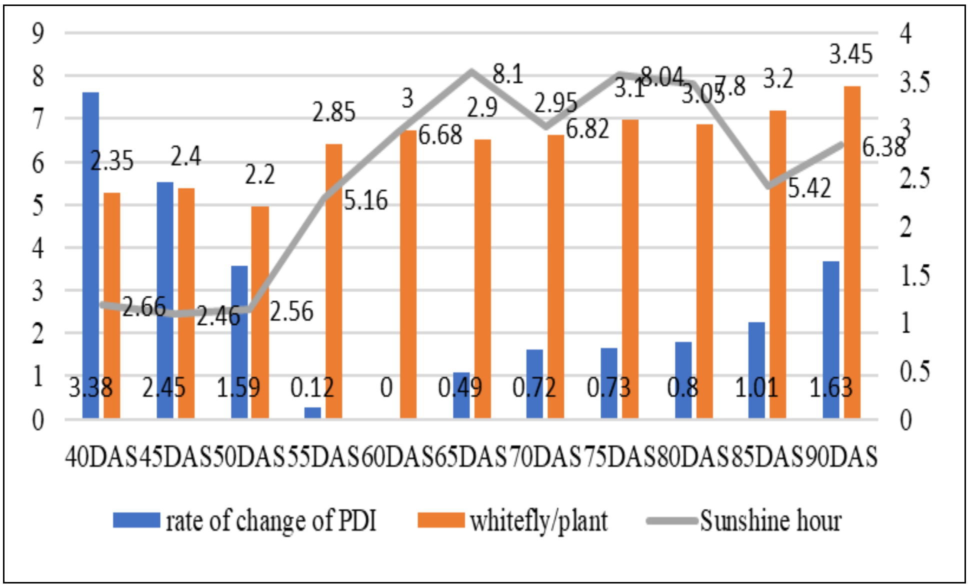

Fig 15: Effect of sunshine hour on change in PDI and whitefl popuation in 5th DOS

4. Conclusion

Among different dates of sowing, 5th one (8.9.2018) showed significantly lowest PDI and whitefly population and highest fruit yield as compared to other dates. However, third date (25.8.2018) of sowing showed significantly highest PDI and whitefly population and lowest fruit yield. It was clearly revealed that with increase in maximum and minimum temperature, relative humidity and sunshine hour favoured the whitefly population and thereby increase in amount of change in PDI. Whereas with increase in rainfall reduced whitefly population as well as decreased in PDI [18, 19].

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