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Incidence of *Encarsia guadeloupae* in spiralling whitefly on king chilli and its correlation with abiotic factors

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Abstract
The investigation on the incidence of *Encarsia guadeloupae* in spiralling whitefly on king chilli was recorded on 26th Standard Meteorological Week in both 2017 and 2018 with 1.20 adults per leaf, while the highest mean abundance of *Encarsia guadeloupae* was recorded on 34th SMW with 4.20 adults per leaf on 2017 and 4.40 adults per leaf on 32nd SMW on 2018. The correlation of *Encarsia guadeloupae* with abiotic factors revealed a positive significant correlation effect with maximum temperature and negative non-significant correlation with maximum relative humidity but a positive non-significant effect with minimum temperature and rainfall in both the years of investigations.

Keywords: *Encarsia guadeloupae*, spiralling whitefly, king chilli, rainfall, temperature, relative humidity

1. Introduction
Encarsia guadeloupae (Hymenoptera: Aphelinidae) is a minute, specific nymphal endoparasitoid of the spiraling whitefly (Viggiani, 1987) [3]. Spiralling Whitefly, *Aleurodicus dispersus* Russell (Hemiptera: Aleyrodidae) is a highly polyphagous pest and a native of the Caribbean region and Central America (Russell, 1965) [2]. The pest is highly polyphagous and is a threat to many crops as 280 plants species are host and the cause of 53% yield loss of tapioca and heavy losses also observed in groundnut, banana, guava, chilli, coconut, rubber in Indian (Mani, 2010) [6]. The efficacy of *Encarsia guadeloupae* in controlling *Aleurodicus dispersus* has been reported in Hawaii, Malaysia, India, Philippines, Togo, Ghana, Nigeria and Taiwan (Kajita *et al*., 1991, Chien *et al*., 2000, Mani and Krishnamoorthy, 2002) [4, 7, 6].

2. Materials and Method
The investigation was conducted in experimental farm of Department of entomology, School of Agricultural Sciences and Rural Development, Nagaland University, Medziphema campus during the year 2017 and 2018. The meteorological data was collected from Indian Council of Agricultural Research, Jharnapani. The experiment was carried out using Randomized Block Design (RBD) with 3 replications of ecological plots. Six leaves (2 each from top, middle and bottom part of the plant) were selected from five randomly selected plants per plot and parasitized whiteflies were counted from the randomly selected leaves. The observation was initiated with the incidence of the spiralling whitefly and thereafter the observations were taken at 15 days interval.

2.1 Statistical analysis
Simple linear correlation analysis was performed to find out the relationship of weather parameters like temperature, relative humidity and rainfall with the population of *Encarsia quadeloupae*.

3. Results and Discussion
It was observed that the incidence of natural enemy, *Encarsia guadeloupae* during the year 2017 appeared on 26th SMW i.e., from 1st July 2017 with mean parasitized whitefly of 1.20 per leaflet. The highest mean abundance of *Encarsia guadeloupe* was recorded on 34th SMW i.e., 26th August 2017 with mean parasitized whitefly of 4.20 per leaflet followed by 32nd SMW i.e., from 12th August 2017 with 12.67 per leaflet and 36th SMW i.e., from 9th September 2017 with 3.20 per leaflet.
The incidence of natural enemies, *Encarsia guadeloupe* on the second year of investigation was also recorded on the 26th SMW i.e., from 1st July 2018 with mean parasitized whitefly of

1.20 per leaflet. The highest mean abundance was recorded on 32nd SMW i.e., from 12th of August 2018 with mean parasitized whitefly of 4.40 per leaflet followed by 34th SMW i.e., from 26th August 2018 with 4.40 per leaflet and 36th SMW i.e., from 9th September 2017 with 3.40 per leaflet.

For *Encarsia guadeloupe* the finding was in collaboration with the findings of Hochmuth and Davis (1996) [5] who reported that during 1994-1995 the highest mean parasitized of whitefly by *Encarsia guadeloupe* was observed in the month of November with about 4.00 per leaflet.

Similar finding was reported by Muhammad *et al*. (2006) [1] who observed that the peak of whitefly population was found during the 4th week of August and continue till the 1st week of September in an experiment carried out in Punjab, Pakistan.

Table 1: Abiotic factors and the abundance of *Encarsia quadaloupae* in spiralling whitefly on King Chilli in 2017

Standard Meteorological week	Date of observation	Temperature (ºC)		Relative humidity (%)		Rainfall (mm)	Mean parasitized whitefly per leaflet
		Maximum	Minimum	Maximum	Minimum		
24	17 June 2017	31.13	24.14	94.57	82.71	127.90	0.00
26	01 July 2017	31.84	24.39	92.71	74.71	134.40	1.20
28	15 July 2017	29.87	23.60	94.57	73.71	104.50	1.00
30	29 July 2017	31.90	24.67	93.14	73.14	61.50	2.33
32	12 August 2017	31.80	25.06	93.14	73.71	81.20	3.67
34	26 August 2017	32.34	24.13	92.71	74.14	271.90	4.20
36	09 September 2017	33.04	24.80	94.14	65.14	4.50	3.20
38	23 September 2017	31.19	24.77	95.57	75.86	8.80	1.87
40	7 October 2017	31.83	23.69	95.86	77.86	33.90	1.00
42	21 October 2017	30.91	23.70	95.29	76.29	17.90	0.87

Table 2: Abiotic factors and the abundance of *Encarsia quadaloupae* in spiralling whitefly on King Chilli in 2018

Standard Meteorological week	Date of observation	Temperature (ºC)		Relative humidity (%)		Rainfall (mm)	Mean parasitized whitefly per leaflet
		Maximum	Minimum	Maximum	Minimum		
24	17 June 2018	31.43	24.07	97.57	79.14	72.90	0.00
26	01 July 2018	33.31	24.73	93.29	72.29	107.30	1.20
28	15 July 2018	33.79	25.27	90.86	69.14	30.00	2.20
30	29 July 2018	32.59	24.56	93.29	77.57	90.10	3.33
32	12 August 2018	34.24	25.17	92.71	67.86	55.20	4.40
34	26 August 2018	34.49	24.94	95.86	71.86	98.60	4.00
36	09 September 2018	34.01	24.41	93.29	69.14	32.40	3.40
38	23 September 2018	34.03	23.77	92.71	65.71	44.80	1.87
40	7 October 2018	32.21	21.69	94.14	62.86	0.00	1.33
42	21 October 2018	29.56	18.61	96.57	61.86	0.20	1.00

Table 3: Correlation coefficient (r) of *Encarsia quadaloupae* with abiotic factors in King chilli during 2017 and 2018

Year	Temperature (ºC)		Relative humidity (%)		Rainfall (mm)
	Max.	Min.	Max.	Min.	
2017	0.641*	0.584^{NS}	-0.574^{NS}	-0.642*	0.290^{NS}
2018	0.683*	0.491^{NS}	-0.417^{NS}	0.018^{NS}	0.235^{NS}

4. Conclusion

The finding of the experiment provides us information on the effect of the weather parameters *viz.*, temperature, relative humidity and rainfall on the population of the *Encarsia quadeloupae*. And it can be concluded that abiotic factors plays an important role in determining the population build up of parasitoid, this information can be used as a tool for timely intervention for sustainable management of spiralling whitefly.

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