Available online at www.ijpab.com

DOI: http://dx.doi.org/10.18782/2582-2845.8921

ISSN: 2582 – 2845

Ind. J. Pure App. Biosci. (2020) *8*(4), 747-752

Indian Journal of Pure & Applied Biosciences

Peer-Reviewed, Refereed, Open Access Journal

Research Article

Seasonal Abundance of *Bemisia tabaci* (Gennadius) and Its Parasitization by *Encarsia* spp. on Greengram [*Vigna radiata* (L.) R. Wilczek]

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Received: 7.07.2020 | Revised: 20.08.2020 | Accepted: 27.08.2020

ABSTRACT

The present study on seasonal abundance of whitefly, Bemisia tabaci (Gennadius) and its parasitization by Encarsia spp. on greengram (var. MH-421) was carried out at the experimental area of Department of Entomology, CCS HAU, Hisar during Kharif 2017. The whitefly population and nymphal parasitization by Encarsia spp. were observed from June to September at ten-day intervals during Kharif 2017. The peak population of whitefly adults i.e., 17.4 per leaf was recorded during 21st to 30th July, 2017. The peak population of whitefly nymphs i.e., 21.8 per leaf was observed during 31st July to 9th August, 2017. Maximum nymphal parasitization of B. tabaci by Encarsia spp. on greengram (25.1%) coincided with the peak population of whitefly nymphs. Correlation analysis revealed that whitefly adult and nymphal population had significant negative correlation with the maximum temperature [(r = -0.60), (r = -0.59)] and positive with the morning relative humidity [(r = 0.57), (r = 0.58)], respectively.

Keywords: *Greengram, Bemisia tabaci, Encarsia spp., weather parameters, correlation.*

INTRODUCTION

Greengram [(*Vigna radiata* L.) Wilczek], vernacularly known as mungbean, belonging to the family Fabaceae, is a suitable short duration pulse crop for diversification, green manuring, higher income and improving soil microbial biomass and fertility in rice-wheat cropping system in Haryana. The productivity of legume crops is less than the potential yield of recommended varieties due to their cultivation on poor or rainfed soils, aberrant weather conditions especially heavy rainfall, diseases and insect-pests. Its luxurious vegetative growth, however, invites a number of insects attack from seedling to harvesting stage which causes heavy yield losses and limits the production (Mahalakshmi et al., 2018). In India, 64 species of insect-pests are known to infest greengram (Lal, 2008). Duraimurugan and Tyagi (2014) recorded 35 species of insect-pests that collectively resulted in 27.0-38.0 per cent yield losses on *Kharif* sown greengram at Kanpur.

Cite this article: Mehra, S., Rolania, K., Rathee, M., Kumar, A., & Meenu (2020). Seasonal Abundance of *Bemisia tabaci* (Gennadius) and Its Parasitization by *Encarsia* spp. on Greengram [*Vigna radiata* (L.) R. Wilczek], *Ind. J. Pure App. Biosci. 8*(4), 747-752. doi: http://dx.doi.org/10.18782/2582-2845.8921

Of these, whitefly, *Bemisia tabaci* (Gennadius) (Hemiptera: Aleyrodidae) is the most serious insect-pest, which starts infesting 15-20-day old seedlings and remain active through the growing season of the crop. *B. tabaci* is undoubtedly the most challenging polyphagous pest with more than 900 host plant species belonging to more than 89 families (Li et al., 2011; & Singh et al., 2013). Whitefly adults and nymphs directly feed on the cell sap and indirectly the adults vector the mungbean yellow mosaic virus and mungbean yellow mosaic India virus that cause the yellow mosaic disease in mungbean (Ramesh et al., 2017). The overall yield losses may range from 10.0-100.0 per cent depending on greengram genotype, whitefly population density and stage of the crop infection (Marimuthu et al., 1981; & Bashir et al., 2006). Yellowing of leaves appears as indefinite spots along the veins which reduces photosynthetic activity of leaves, moreover leaves dry premature, crinkle and wither under severe attack. Affected plants bear less flowers and pods, pods shrivel and bear smaller grains, which ultimately reduces the yields (Malathi & John, 2009).

In Haryana state, greengram is a confirmed host of *B. tabaci* (Kedar et al., 2018; & Mehra, 2020) and highly vulnerable to the attack of whitefly under favourable weather conditions. Abiotic (temperature, humidity, rainfall, etc.) and biotic (predator, parasitoids, pathogens, etc.) influence the population build-up of whitefly on various crops (Naranjo & Ellsworth, 2005; & Perring et al., 2018). Over 112 species of parasitoids are known to suppress *B. tabaci* naturally in the field (Liu *et al.*, 2015). Of these, *Encarsia* genera is the primary nymphal parasitoid of whitefly (Kedar et al., 2014; & Sangha et al., 2018). In Haryana, however, the major cultivated variety of greengram i.e., MH-421 is resistant to yellow vein mosaic virus, but the infestation of whitefly is recorded regularly. Hence, it was decided to investigate the seasonal abundance of whitefly and its parasitoid, *Encarsia* spp. on greengram.

MATERIALS AND METHODS

Seasonal abundance of whitefly and its parasitization by *Encarsia* spp. was studied on greengram (var. MH-421) grown in an area of 30 square meters at the experimental area of Department of Entomology, CCS HAU, Hisar during *Kharif* 2017. The crop was sown and raised as per the recommended package and practices of CCS HAU, Hisar expect insecticidal application. Whitefly adult population was recorded from the upper, middle and lower leaves of ten randomly selected plants from the greengram plot at 10-day intervals from June to September, 2017. Further, thirty sampled leaves were brought at 10-day intervals to the Biocontrol Laboratory (Department of Entomology, CCS HAU, Hisar) in polybags to examine the presence of immature stages and parasitization of whitefly under a stereo zoom binocular microscope. Black pupae of whitefly were considered as parasitized pupae by *Encarsia* spp. (Sharma et al., 2003). The observations on whitefly parasitoid, *Encarsia* spp. were recorded by counting the black parasitized pupae on sampled leaves at ten days intervals and converted into per cent parasitism. The mean whitefly population and per cent parasitization was subjected to correlation analysis with weather parameters at the 5.0 per cent level of significance using OP STAT software (Sheoran et al., 1998).

RESULTS AND DISCUSSION

Seasonal abundance of *B. tabaci* and its parasitization by *Encarsia* spp. on greengram

On greengram (*V. radiata*), the whitefly population and nymphal parasitization was noticed from June to September at ten-day intervals during *Kharif* 2017. The peak population of whitefly adults i.e., 17.4 per leaf was recorded during 21st to 30th July, 2017 when temperature ranged from 26.9 ºC (T_{min}) to 33.6

ºC (T_{max}) and relative humidity (RH) ranged from 75.0 (evening) to 91.0 per cent (morning) (Fig. 1). Garg and Patel (2018) recorded the peak population of *B. tabaci* adults (21.1 per plant) during 36th SMW i.e., first week of September on greengram at Ganj Basoda, Madhya Pradesh. Jat et al. (2018) recorded maximum number of whitefly adults on greengram during the last week of August i.e., 24.4 per five plants, and for the period, the mean temperature and mean relative humidity was 27.2 ºC and 69.9 per cent, respectively. Whitefly adult population on greengram reached its peak during the first week of September i.e., 36th SMW (14.2 per three leaves) when maximum temperature, minimum temperature and RH was 36.1 ºC, 21.7 ºC and 90.0 per cent, respectively at Jobner, Rajasthan (Singh et al., 2019).

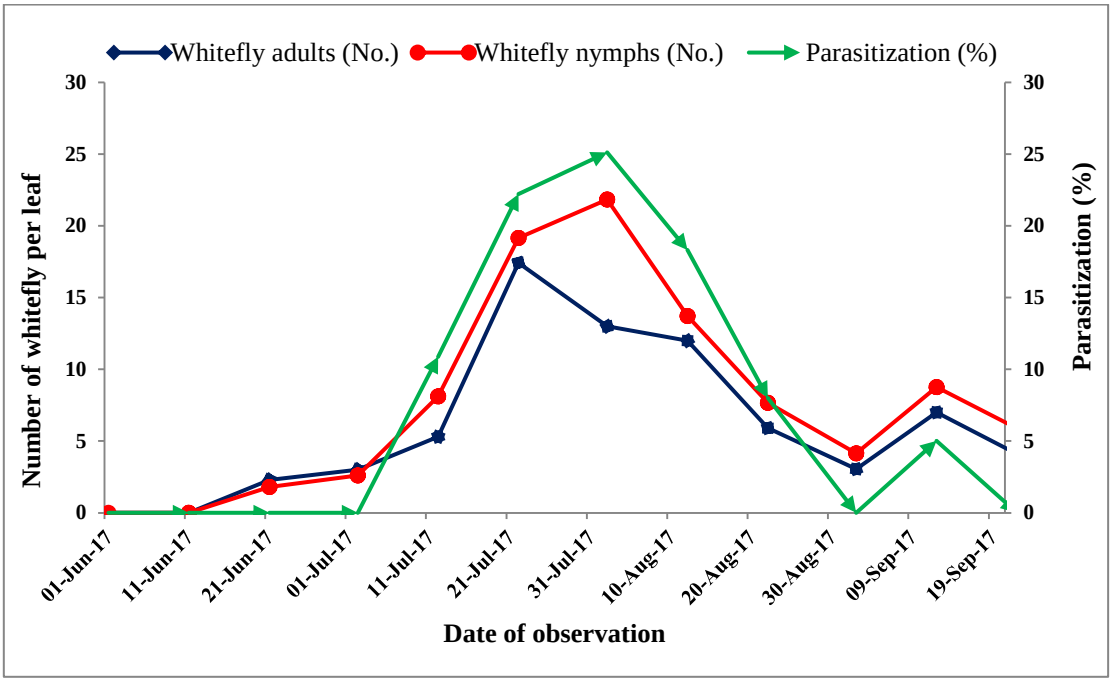

Fig. 1: Seasonal abundance of whitefly and its parasitization by *Encarsia* spp. on greengram (2017)

In the present investigation, the highest population of whitefly nymphs i.e., 21.8 per leaf and parasitization by *Encarsia* spp. (25.1%) on greengram was noticed during 31st July to 9th August, 2017 when temperature ranged from 26.6 ºC (T_{min}) to 34.2 ºC (T_{max}) and RH ranged from 70.0 (evening) to 90.0 per cent (morning) (Fig. 1). Simmons et al. (2002) reported *Encarsia pergandiella* Howard as the most abundant parasitoid of whitefly on urdbean, *Vigna unguiculata* (L.) Walpers. Sharma et al. (2003) also reported 5.0 to 17.6 per cent parasitization of whitefly nymphs by *Encarsia lutea* (Masi) on urdbean from July to October. Romba et al. (2018) reported 10.0-15.0 per cent parasitization of *B. tabaci* nymphs on *V. unguiculata* by *Encarsia vandrieschei* Japoshvili and *Eretmocerus mundus* (Mercet).

Correlation of *B. tabaci* and parasitization by *Encarsia* spp. with weather parameters on greengram

The correlation analysis revealed that whitefly adult and nymphal population had significant negative correlation with maximum temperature (r = -0.60), (r = -0.59). While the morning relative humidity had significant positive correlation with whitefly adult (r = 0.57) and nymphal (r = 0.58) population. All the other remaining weather factors showed non-significant correlation with whitefly population. Moreover, no significant correlation was observed between nymphal parasitization and weather factors, except for evening relative humidity (r = 0.58) (Table 1).

Table 1: Correlation of *B. tabaci* and *Encarsia* spp. with weather parameters on greengram (2017)

Weather Parameters	Correlation coefficient (r)		
	Whitefly Adult	Whitefly Nymph	Parasitization by *Encarsia* spp.
Maximum Temperature (°C)	-0.60*	-0.59*	-0.46
Minimum Temperature (°C)	0.28	0.27	0.47
Morning Relative Humidity (%)	0.57*	0.58*	0.47
Evening Relative Humidity (%)	0.54	0.52	0.58*
Total Rainfall (mm)	-0.39	-0.44	-0.36

*Significant at p=0.05

Yadav et al. (2015) reported non-significant negative correlation of rainfall and non-significant positive correlation of temperature, relative humidity and sunshine hours with whitefly population on black gram. The findings are in accordance with Bairwa et al. (2016) who reported significant negative correlation of whitefly population with maximum temperature and positive with relative humidity on greengram. Contrary to the present findings, Srivastava and Prajapati (2012) reported positive correlation of whitefly population on blackgram with mean maximum temperature (r = 0.59) and negative with relative humidity (r = -0.53) and rainfall (r = -0.50), depicting the detrimental effect of higher relative humidity and heavy rainfall on the whitefly population. Significant positive correlation with maximum temperature was exhibited (r = 0.65), whereas rainfall (r = -0.80) showed highly negative significant association with the whitefly population on blackgram (Marabi et al., 2017). Likewise, Singh et al. (2019) reported positive and significant correlation of whitefly adult population with maximum temperature (r = 0.74) on greengram. Several workers have reported the parasitization of whitefly nymphs (Simmons et al., 2002; Sharma et al., 2003; Malik & Karut, 2012; & Rawal et al., 2018) but no further information on the impact of weather factors on per cent nymphal parasitization is available. Whitefly population on greengram may help in the pre-cotton season buildup of whitefly population in addition to early sown cotton. Better and timely management of the whitefly based on population dynamics and mortality factors on greengram hosts will significantly help to reduce the carry-over to major cash crop of *Kharif* season.

CONCLUSION

It is concluded the peak activity of whitefly and its parasitoid, *Encarsia* spp. was observed in the month of July-August on greengram. Further, *B. tabaci* adult and nymphal populations showed significant negative and positive correlation with mean maximum temperature and morning relative humidity, respectively. Whereas, evening relative humidity showed significant positive correlation with per cent parasitization.

Acknowledgement:

The authors are highly thankful to Dr. Yogesh Kumar, HOD, Department of Entomology, Dr. Pala Ram (Ex-Advisor), Department of Entomology, CCS HAU, Hisar for providing excellent facilities to conduct research smoothly both in the field and under laboratory conditions.

Authors' contribution:

Krishna Rolania was the major advisor. Swati Mehra conducted the experiments, collected and analyzed the data and led the writing of the manuscript in assistance with Meenu and Mandeep Rathee.

Research content:

The research content is original and has not been submitted or published elsewhere.

Conflict of Interest:

The authors declare that they have no conflict of interest.

Consent to publish:

The authors agree to publish the paper in the Indian Journal of Pure and Applied Biosciences.

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