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Short communication

Population buildup of whitefly, *Bemisia tabaci* (Gennadius) on parthenocarpic cucumber in relation to weather parameters under protected environment in Punjab

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Parthenocarpic cucumbers are one of the important commercial crops grown throughout the year under protected environment and are the money spinners for the farming community (Sood *et al.,* 2018). Congenial growing environmental conditions and adequate plant nutrition favours the crop as well as the buildup of associated pests under protected environment. Production of cucumber under protected condition is affected primarily by the incidence of many insect-pests. The whitefly, *Bemisia tabaci* (Gennadius) (Hemiptera: Aleyrodidae), is a serious pest and one of the important limiting factors in the production of cucumber plants during its three growth stages, seedling, flowering, and fruiting. Climatic factors like temperature (maximum, minimum and average) and relative humidity (morning, evening and average) play vital role in multiplication and distribution of insect-pests. Whitefly population showed negative correlation for minimum and maximum temperature and rainfall, while, positive correlation with morning and evening relative humidity and bright sunshine hours (Kataria *et al*., 2019). Kumar and Gupta (2016) reported that the population of *B. tabaci* in potato crop decreased gradually with the decrease in both maximum and minimum temperatures. Predictive model for pest forecast is an important tool for effective integrated pest management strategy. Therefore, a good understanding of pest population dynamics is of vital importance for crop protection. Keeping in view the importance of the crop and the damage caused by this pest, the present investigations were initiated to study the population buildup of *B. tabaci* and to deduce relationship with the abiotic factors, which would help in planning strategies for the management of the whitefly under polyhouse cultivation situations.

The present studies on 'Population buildup of whitefly, *B. tabaci* on parthenocarpic cucumber under protected environment' were undertaken in the experimental farm of the Department of Vegetable Science, PAU, Ludhiana, India during autumn 2017 and 2018. Parthenocarpic cucumber crop (*Cucumis sativus* Linn.) F_1 hybrid "*Punjab Kheera-1*" was raised under naturally ventilated net house of 105 m^2 by following all agronomic practices except plant protection measures. Nursery was raised in soil-less medium in order to avoid any incidence of soil-borne diseases. The pro-trays were filled with a mixture of cocopeat, perlite and vermiculite (3:1:1) and seeds were sown singly in each cavity. Twenty day old seedlings were transplanted in raised beds (15 cm) of 90 cm width, spaced 70 cm apart at a spacing of 70×30 cm. The seedlings were transplanted in August during 2017 and 2018 for raising the autumn crop (August to December). The plants were trained on single shoots and extra shoots were pruned regularly to optimize the growth of plants. The *B. tabaci* population was allowed to buildup naturally after transplanting of the crop. The experiment was laid out in randomized block design (RBD), replicating six times. For recording the population buildup, weekly in-situ observations on number of whitefly, eggs and nymphs from single leaf of middle canopy and adults from 3 leaves from top, middle and bottom leaves of randomly plucked 10 leaves per plot were observed, respectively. These leaves were collected and kept in separate polythene bags and then brought to laboratory. The number of whiteflies (egg and nymph) was recorded per leaf under stereo zoom binocular microscope. The population of adult whiteflies was recorded in site. Based on the observations recorded mean population per plant was worked out.

To study the impact of climatic factors on the population buildup of whitefly, the meteorological data

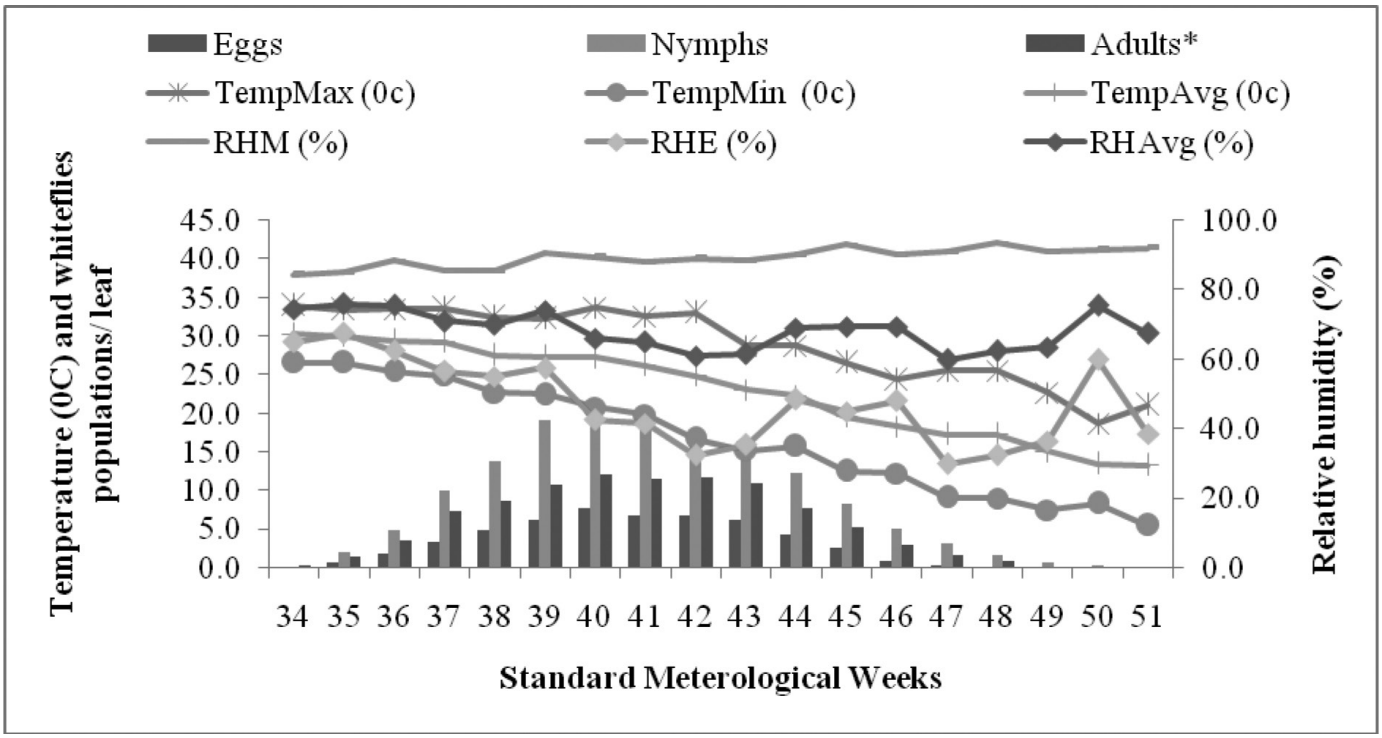

Fig. 1: Population buildup of *Bemisia tabaci* in relation to different weather parameters in cucumber under net house condition (pooled data).

(weekly means) for temperature (maximum, minimum and average) and relative humidity (morning, evening and average) recorded during the observation period were obtained from the Department of Climate Change & Agricultural Meteorology, PAU, Ludhiana. To find out the specific impact of different weather parameters on whiteflies (egg, nymph and adult) in parthenocarpic cucumber, the data on whitefly (adult) population were correlated with meteorological parameters using IBM SPSS 25 version software *i.e.* online platform for on-campus user. Further, step-wise linear regression model was evolved for predicting population buildup of whitefly based upon relationships between abundance of *B. tabaci* as dependent variable (Y) and abiotic factors namely, temperature and relative humidity (maximum, minimum and average) as independent variables (X).

Egg, nymph and adult counts of B. tabaci in relation to weather parameters

On clubbing the data of both the years (2017 and 2018 autumn cropping seasons), commencement of egg, nymph and adult populations of *B. tabaci* was first noticed during 34th SMW (3rd week of August) which followed an increasing trend up to 40th SMW and then experienced a declining trend which continued up to 51th SMW (Fig. 1). Analysis of data across cropping seasons revealed that whitefly population remained higher during August to October months as compared to the other months. Under field conditions the appearance of whiteflies on chilli was recorded in the last week of July with its peak population in the second week of September (Saini *et al.,* 2017). The variation can be attributed to the variability in the abiotic factors, different location, sowing time and crop. Similarly, Moanaro and Choudhary (2018) in capsicum also observed that the population of whitefly appeared in the first week of September (36 SMW) and continued up to the third week of December (51 SMW). The population gradually increased and reached its maximum with 1.88 whiteflies per three leaves in the third week of October (42 SMW) and thereafter, it gradually declined and reached to 0.26 whiteflies per three leaves. Bharadia and Patel (2005) also reported that the maximum population of whitefly was in the fourth week of October.

Relationship of abiotic factors with population buildup of B. tabaci

Table 1: Correlation between adults of *Bemisia tabaci* population and abiotic factors in autumn crop of cucumber under net house condition.

Abiotic parameters	Correlation values (r)		
	2017	2018	Pooled
Max. temp. (^{0}C)	0.55*	0.54*	0.53**
Min. temp. (^{0}C)	0.29	0.46	0.37*
Avg. temp. (^{0}C)	0.42	0.51*	0.45**
Morning RH (%)	-0.07	-0.19	-0.12
Evening RH (%)	-0.32	0.19	-0.08
Avg. RH (%)	-0.35	0.13	-0.13

** Significant at 1 per cent level of significance * Significant at 5 per cent level of significance

Pooled analysis (2017 and 2018 autumn cropping seasons), revealed that the whitefly population showed (r = 0.37) significantly positive correlation with T_{Min} (significant at p= 0.05). T_{Max} and T_{Avg} also exhibited significantly positive correlation (Table 1) with *B. tabaci* population (r= 0.53 and 0.45; significant at p= 0.01). However, relative humidity (morning, evening and average) influenced the *B. tabaci* population negatively (NS). On similar pattern, whitefly pest on organic green chili were positively correlated with T_{Max} (0.778), T_{Min} (0.952*) and canopy temperature (^{o}C) (0.965**) and negatively correlated with RH I (- 0.662), RH II (-0.281) and BS (-0.408) reported by Misal *et al*., (2016). Moanaro and Choudhary (2018) also revealed a positive correlation between whitefly population with minimum and maximum temperature on capsicum which is in line with the present study.

Relationships based upon step wise regression analysis

Based on the pooled data for autumn cropping seasons (2017 and 2018) an equation was developed using step-wise regression approach, as given below

$$Y=-7.202+0.711\ T_{max}^{**} - 0.168\ RH_e^{*}\ \ R^2=0.36$$

It is evident that maximum temperature and evening relative humidity influenced the buildup of whitefly population to the extent of 36 per cent (R^2 = 0.36). The present findings on extent of whitefly population by maximum temperature and evening relative humidity corroborates the findings of Singh (2017) who also assessed the greenhouse whitefly was influenced to an extent of 62 per cent by the combination of weather parameters *viz*., maximum temperature and minimum relative humidity in tomato under polyhouse condition.

It is evident from the two year study that peak egg, nymph and adult populations occurred during 40th SMW coinciding with vegetative stage of the crop. The whitefly population under net house conditions had significant positive correlation with temperature and negative correlation with relative humidity. The maximum temperature and evening relative humidity altogether explained 36 per cent variability in pest population buildup.

Conflict of Interest Statement: The author(s) declare(s) that there is no conflict of interest.

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