POPULATION DYNAMICS OF MAJOR SUCKING PESTS INFESTING RABI GROUNDNUT IN WEST BENGAL

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ABSTRACT

A field investigation was carried out at the Central research Farm, Gayeshpur, Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, Nadia, West Bengal during rabi 2021-2022 to study the seasonal incidence of the major sucking pests infesting the summer groundnut. The silverleaf whitefly (*Bemisia tabaci* Genn.), jassids (*Empoasca kerri* Pruthi), black aphids (*Aphis craccivora* Koch) and flower thrips (*Megalurothrips usitatus* Bagnall) were considered as the major sucking pests; *B. tabaci* was first observed on the 49th standard meteorological week, whereas *M. usitatus*, *E. kerri* and *A. craccivora* were first seen during the 5th, 6th and 7th standard meteorological week. The whitefly population showed a significant negative correlation (-0.586) with average temperature, while the thrips showed a significant negative correlation (-0.578) with average relative humidity.

Key words: *Bemisia tabaci*, *Empoasca kerri*, *Aphis craccivora*, *Megalurothrips usitatus*, geoundnut, standard meteorological week, temperature, relative humidity, rainfall, correlation, regression

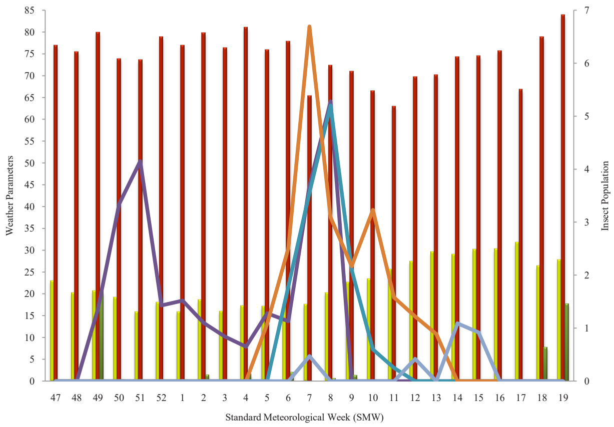
Groundnut is one of the major oilseed crops cultivated in India. Although groundnut is the host of over 100 species of insects and mites in India, only a few are pests of economic importance over wide areas (P.W. Amin, 1987). The major sucking pests that are found infesting in groundnut are silverleaf whitefly (*Bemisia tabaci* Genn.), jassids (*Empoasca kerri* Pruthi), black aphids (*Aphis craccivora* Koch) and bean flower thrips (*Megalurothrips usitatus* Bagnall). The nymphs and adults of *B. tabaci* suck the plant sap by remaining on the under surface of the leaves. As a result of their feeding, yellowish chlorotic spots appear on the leaves and plants vitality decreases. Nymphs and adults of *E. kerri* inject toxins resulting in whitening of veins and chlorotic patches especially at the tips of leaflets, in a typical 'V' shape. Heavily attacked groundnut crop exhibited a scorched appearance, known as 'hopper burn'. Whereas, the nymphs and adults of *A. craccivora* are found in clusters sucking the leaves or around the tender shoots leading to wilting of young shoots. On the other hand, *M. usitatus* feeds on the leaves and flowers, where leaves show numerous whitish specks and deformity of pods. These four sucking insect pests cause serious economic damage. Therefore, the present study to understand the population dynamics of these insects.

MATERIALS AND METHODS

Field experiment was carried out during the rabi 2021-22 in a randomized block design at the Central Research Farm, Gayeshpur, Bidhan Chandra Krishi Viswavidyalaya, Nadia, West Bengal (22˚58'N, 88˚29'E). The variety 'TAG-24' was sown during 3rd week of November, 2021 in plots of size 4 x 4 m. No chemical intervention was made for controlling the pests. 5 plants were selected from each plot and weakly observations were recorded. The population of *B. tabaci* was counted from upper, middle and lower leaf as the no. of whiteflies/ leaf/ plant; *M. usitatus* were counted as no. of thrips/terminal bud; *A. craccivora* were counted as the no. of aphids/ terminal 5 cm of twigs; *E. kerri* were counted as number of jassids/plant. Weather data was collected and statistically analyzed for correlation and regression. For statistical analysis, OPSTAT software was used.

RESULTS AND DISCUSSION

The data on the population dynamics obtained with in correlation crop growth stages revealed fluctuations over season (Fig. 1). The *B. tabaci* populations were first observed on the 3rd week of the crop growing season during branching stage; this remained consistently low



Insects	Avg. Daily Temp. (x_1)	Avg. Daily RH (x_2)	Rain (x_3)	R^2	Regression Equation ($y = A+Bx_1+Cx_2+Dx_3$)
Whitefly	-0.586*	-0.066	-0.091	0.404	$y = 11.771 - 0.193x_1 - 0.087x_2 - 0.034x_3$
Jassid	-0.216	-0.313	-0.115	0.211	$y = 11.398 - 0.087x_1 - 0.121x_2 - 0.039x_3$
Thrips	-0.18	-0.578*	-0.185	0.499	$y = 22.184 - 0.126x_1 - 0.251x_2 - 0.079x_3$
Aphids	0.378	-0.162	-0.163	0.184	$y = -0.636 - 0.023x_1 - 0.004x_2 - 0.013x_3$

Fig. 1. Population dynamics of sucking pests of groundnut

during germination and early growth stages (SMW 47-52 of 2021). Notable rise occurred during peak vegetative, flower initiation, and flowering stages (SMW 1-6 of 2022). Highest population of *B. tabaci* was recorded during the peg initiation stage (SMW 8), after which declined steadily towards the maturity (SMW 9-19). Results showed a significant negative correlation with the average temperature. The R^2 value of 0.404 suggests that the regression model accounts for 40.4% of the variability in whitefly populations humidity, and rainfall. These findings are in close conformity with those of Kumbhar et al. (2021). Similar results were also found by Nissar et al. (2019) on tomato and by Pal et al. (2020) in Bt cotton. The present results are in contrast with Bala et al. (2019) and Patil et al. (2021). Similar to *B. tabaci*, the *E. kerri* showed rises during peak vegetative, flower initiation, and flowering stages (SMW 1-6). The peak occurred during peak flowering and pegging initiation (SMW 7-8). The R^2 value of 0.211 indicates that the regression model explains 21.1% of the variability in *E. kerri* populations, indicating a weaker fit compared to whiteflies. These findings were in accordance with Mer et al. (2016) and Saritha et al. (2020), and partially in contrast with those of Choudhary (2015), Ahir et al. (2017) and Gocher and Ahmad (2019).

The *M. usitatus* populations exhibited a consistent increase throughout growth stages, peaking notably during flowering and pegging initiation (SMW 5-9). *M. usitatus* reached their highest activity during peak flowering (SMW 7-9), displaying a significant surge in population. *M. usitatus* populations showed a gradual decline post-flowering towards maturity and subsequent stages (SMW 10-19). The population of *M. usitatus* showed a significant negative correlation with average daily relative humidity. This implies that higher humidity significantly decreases *M. usitatus* populations. Elevated humidity levels might adversely impact their life cycles or reproductive patterns. This suggests that *M. usitatus* might struggle to thrive in more humid environments, potentially leading to lower populations during such conditions. The *M. usitatus* population displayed a relatively higher R^2 value of 0.499, suggesting that the regression model explains 49.9% of the variability in *M. usitatus* populations based on temperature, humidity, and rainfall. This higher R^2 value indicates a better fit compared to *B. tabaci* and *E. kerri*, suggesting that the study captures a substantial portion of the variability, but there might still be additional factors affecting thrips dynamics. These findings were partially in accordance with Naresh et al. (2018), Vijayalakshmi et al. (2017) and Mithapara et al. (2021), who found that the insect population showed a significant negative correlation (-0.576 and -0.587, respectively) with morning and evening relative humidity. But the findings of this study opposed the findings of Kumbhar et al. (2021) who found that the population of *M. usitatus* had a significant negative relation with temperature, while a non-significant negative correlation with relative humidity.

The *A. craccivora* populations remained extremely low throughout most growth stages. Occurrence of *A. craccivora* was first observed on the 13th week of the crop growing season, following the occurrence of *E. kerri* and *M. usitatus* during peak flowering stage (SMW 7 of 2022). Slight rises were observed during full pod and full seed stages (SMW 12-15). Even during slight increases, their populations remained insignificant compared to other insects, maintaining minimal activity across the growth season. These findings were partially in accordance with Saritha et al. (2020), Ahir et al. (2017), Nayak et al. (2019), Kandakoor et al. (2012) and Priyanka et al. (2022). But, the results of this study were found opposing the findings of Shakya et al. (2021). Their study indicated a significant positive correlation with maximum temperature (r =0.535) with *A. craccivora* infestation and significant negative correlation with average relative humidity (r = -0.820) and total rainfall (r = -0.513), while non-significant negatively correlated with minimum temperature (r= -0.386).

This detailed analysis accounts for both significant and non-significant factors, providing a broader perspective on the potential influence of temperature, humidity, and rainfall on the populations of these insects during groundnut crop growth stages. These findings suggest varying insect behaviours across the groundnut crop's growth stages, with certain stages being more conducive to population surges for specific insect types. The peaks in insect populations during critical stages like flowering, pegging, and pod initiation could indicate a need for targeted pest management strategies during these periods to safeguard the crop yield.

ACKNOWLEDGEMENTS

The authors thank the Department of Agricultural Entomology, BCKV, Mohanpur, Nadia for providing facilities and space to conduct experiments. The authors will also like to thank all the field workers who helped them throughout the experimental period.

FINANCIAL SUPPORT

The research received no external funding.

AUTHOR CONTRIBUTION STATEMENT

Ajoy Kumar Mukhopadhyay conceptualized and framed the research proposal, Soumik Dey Roy conducted the experiment, curated data, analyzed the results and prepared the draft. All authors read and approved the manuscript.

CONFLICT OF INTEREST

No conflict of interest.

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(Manuscript Received: October, 2023; Revised: December, 2023;
Accepted: December, 2023; Online Published: February, 2024)
Online First in www.entosocindia.org and indianentomology.org Ref. No. e24736