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Case Report

Prediction of mango thrips using thermal indices

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The authors declare no conflict of interests.

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Abstract

Wide variations in thrips populations were observed across different critical crop phenological stages and seasons. The thrips population was observed between 13th SMW to 24th SMW during 2013 cropping season, whereas it was found from 15th SMW to 28th SMW in the subsequent year. Step wise regression analysis revealed that maximum temperature, minimum temperature, maximum relative humidity, minimum relative humidity, sunshine hours and evaporation could explained 55 per cent variations in thrips population. Different thermal indices *viz*., growing degree days (GDD), heliothermal units (HTU), photothermal units (PTU), were cumulated up to peak population density and a positive and significant correlation was revealed. Thus, it was concluded that use of all these robust indices may be useful in assessing the pest-weather dynamics of mango growing region and serve as a basis for real time pest management advisory.

Key words: Mango, Thrips, Thermal indices, prediction model

Introduction

Mango is the most important fruit crop of the country, as it occupies maximum area, i.e., 2.31 million ha accounting for about 37 per cent of the total area under fruits. It is attacked by several pests during its vegetative and reproductive phases (1). During the reproductive phase of the crop, pests like hoppers and thrips pose a threat to mango production. In recent years thrips emerged as serious pest on mango (2). Two species of thrips, *Scirtothrips dorsalis* and *Thrips hawaiiensis* have mostly been recorded on mango. The severe loss occurs when infestation on immature fruits of mango by lacerates and sucks the juice from the epicarp in addition to leaves, buds and flowers. The lysis of affected epicarp occurs and the fruits show rusty appearance on their skin. The curling up of leaves and wilting of inflorescence are common symptoms. This pest use to feed on tender tissue and the entire new growth may be distorted if proper measures are not applied to manage it (3).Indiscriminate use of synthetic insecticides for routine thrips control is detrimental to non-target organisms and causes pesticide residues in fruits and in the environment. Other destructive consequences include the development of resistant pest populations, pest resurgence and the outbreak of secondary pest infestations (4). To minimize harmful effects of synthetic pesticides, development of non-polluting plant protection strategies are necessary. For rational use of synthetic pesticides forewarning/ prediction models are need of the hour. The pest forecasting models facilitate better preparedness to combat outbreaks of serious insect pests by developing effective pest management strategies well in advance.

Materials and Methods

Study was conducted for two seasons (2013 and 2014) in Lucknow, Uttar Pradesh, India at 22 locations. Orchards of mango *cv. Dashehari* of 20-35 years age were selected with planting 10 × 10 mt. Each orchard had at least 25 trees. Data on thrips population was recorded on weekly interval from 5 randomly selected trees in four direction of the tree. Thrips count was taken after gently tapping shoot or panicle by holding white paper in the palm. For analysis, mean count per shoot or panicle was taken and expressed as number of thrips per shoot or panicle per tap. Daily weather data of temperature (maximum and minimum), relative humidity (morning and evening), rainfall, wind speed, bright sunshine hours and evaporation rates were recorded in the agromet observatory located within the experimental area. Temperature, solar radiation and day length data were used to compute agro climatic models.

Results and discussion

A wide variation in thrips occurrence on the mango crop at its different phenological stages was revealed in 22mango fixed orchards during two consecutive mango cropping season (Fig. 1). Among the 22mango orchards, highest thrips population density (13.6 /panicle) was recorded in 15th SMW at Kakori orchard (II), followed by 10.5/ panicle and 10.3/panicle in Kakori (I) and NB Dhanewa (I) orchard in 2013 season. The thrips population was observed between 13th SMW to 24th SMW during 2013. Whereas, in the year 2014 thrips population was observed from 15th SMW and its incidence was observed up to 28th SMW (Fig. 2). Peak occurrence of thrips was found during the flowering and fruiting developmental stages of mango. Appearance of thrips population on mango was delayed one week during the year 2014 compared to 2013, this is attributed to the maximum temperature which was higher and influenced the faster growth and development of thrips. Higher temperature also play key role in the development of vegetative as well as reproductive growth of the mango. The peak infestation of thrips on mango was synchronized with the flowering, fruit development and vegetative stages of mango in the Lucknow region. Changes in the phenology of crop may also influence the pest occurrence (5). In this study, thrips population was found negatively correlated with maximum and minimum relative humidity during the year 2013. Whereas, during the year 2014, its population was found negatively correlated with minimum temperature, minimum and maximum relative humidity and evaporation. Step wise regression analysis revealed that maximum temperature, minimum temperature and maximum relative humidity, minimum relative humidity, sunshine hours and evaporation together had explained up to 55 per cent of variation in thrips population.

Different thermal indices (growing degree days, Photothermal units and heliothermal unit) were calculated for mango based on the weather data of experimental area. The significantly positive relationship was observed between thermal indices of mango with the thrips population. The regression analysis revealed that during the year 2013 exponential model had explained highest variation for thermal indices compare to linear and logarithmic models. Whereas, during the year 2014, compared to exponential and logarithmic models linear models for thermal indices had explained highest variation. Stepwise regression analysis between different thermal indices and thrips population had explained considerable amount of variation up to 97 per cent. It indicated that thermal indices plays key role for prediction of mango thrips population. Positive relation between thrips populations up to its peak value was observed against these thermal indices, the progressive changes in peak thrips incidence and population. Weather variables including rainfall, temperature, relative humidity and wind have been reported as important factors that significantly affect thrips population (6).The thermal indices during the reproductive stages particularly, during flowering and fruit set, varied across the seasons and thereby influenced the thrips populations. Normally with the progress of reproductive phases of mango *viz.*, flowering, panicle emergence, fruit set and development, thrips started shoots up based on exiting hydrothermal conditions. Application of thermal indices in this study confirmed that variations in thrips populations may be predicted >93 %. Thus, it was concluded that use of all these robust indices may be useful in assessing the pest-weather dynamics of region. Based on all these information, region specific crop simulation dynamics models may be developed to predict and forecast the thrips population so that farmers can adopt control measures well in advance to save the fruit crop being lost.

Conclusion

Thrips emerged as serious pest on mango and cause considerable yield loss. For efficient use of pesticides forewarning/prediction model was developed using the thermal indices. Application of thermal indices in this study confirmed that variations in thrips populations may be predicted >93 %. Thus, it was concluded that use of all

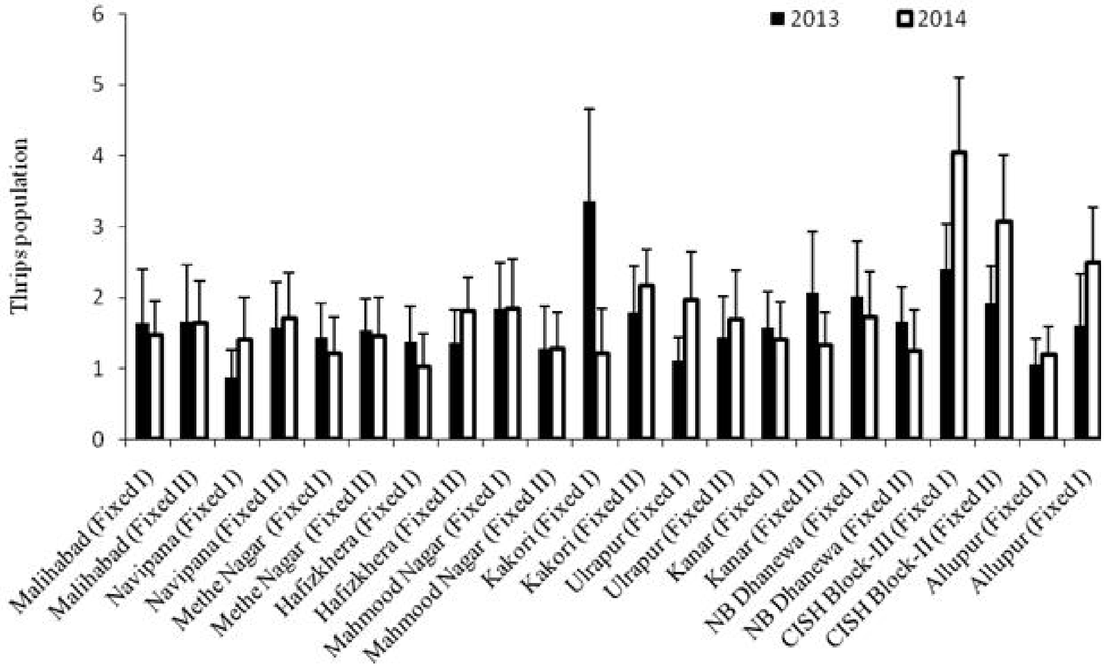

Fig. 1: Thrips population in fixed plots

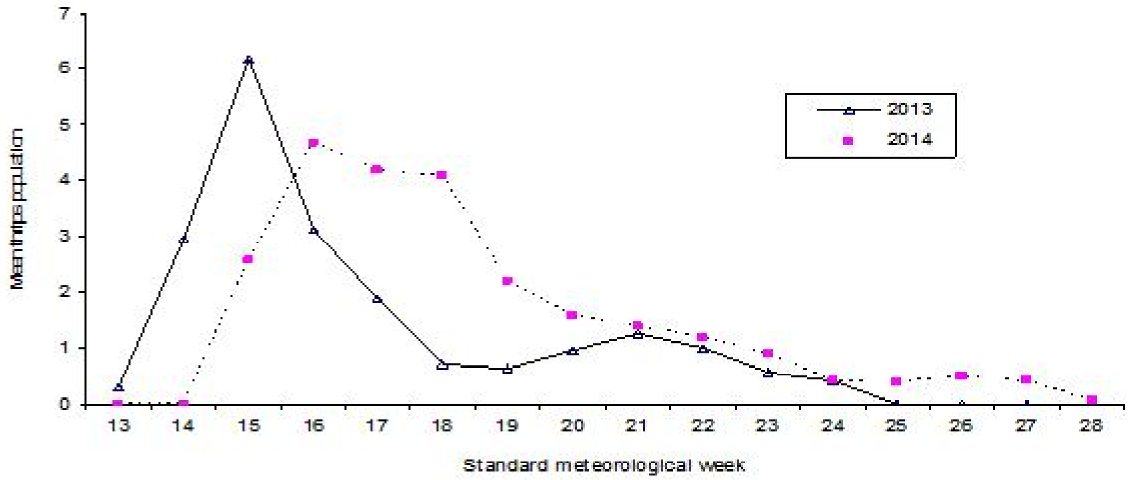

Fig 2: Mean thrips population across different standard meteorological weeks

these robust indices may be useful in assessing the pest-weather dynamics of the region. This model facilitate better preparedness to combat thrips infest station in advance.

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Author contributions

Dr. Gundappa designed the study, collected data, per formed the experiments, Collected data from different experimental sites, analysed the data and wrote the manuscript. Dr. P K Shukla designed the study, Collected data from different experimental sites, analysed the data, and wrote the manuscript. Dr. Tarun Adak analysed the data and wrote the manuscript. All authors read and approved the final manuscript.

References

1. Srivastava RP. Mango insect pest management 1st ed. International Book Distributing Co., Lucknow, India.1997.
2. Rajkumar B, Gundappa, Khan RM, Kumar HK. Integrated pest management for enhancing quality production of subtropical fruits under high density planting with canopy modification. In: Singh VK, Ravishankar H editors. Canopy management and high density planting in subtropical fruit crops. CISH, Lucknow, 2013. pp. 269.
3. Aliakbarpour H, Rawi CS. Seasonal Abundance of *Thrips hawaiiensis* (Morgan) and *Scirtothrips dorsalis* (Hood) (Thysanoptera: Thripidae) in Mango Orchards in Malaysia. Pertanika J Trop Agric Sci. 2012; 35 (3): 637- 645.
4. Desneux N, Decourtye A, Delpuech, JM. The sub-lethal effects of pesticides on beneficial arthropods. Ann Rev Entomol. 2007; 52**:** 81-106 .
5. Gundappa, Kamala Jayanthi PD, Verghese A. Migratory behaviour of mango hopper, *Idioscopus* spp. In relation to host plant flowering phenology: A synchronous shift. An International J Life Sci: The Bioscan. 2014; 9 (2): 639-641.
6. Kirk WDJ Distribution, abundance and population dynamics, p. 217-258. In: Lewis T. ed. Thrips as Crop Pests. CABI, Oxon, UK. 1997.