



Seasonal incidence and influence of weather factors on two spotted spider mite, *Tetranychus urticae* Koch in Jasmine (*Jasminum sambac* L.) ecosystem

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ABSTRACT: A study was conducted to assess the population dynamics of two spotted spider mite in jasmine in two different climate zones *ie.*, Madurai and Coimbatore District of Tamil Nadu. From the study, it was evident that the occurrence of two spotted mite, *Tetranychus urticae* was less severe during November till March and the mite population density varied from 5.28 to 8.61 mites / 2 cm² leaf area in Madurai District, while the incidence was minimum from December till April in Coimbatore district with the population varying from 4.82 to 9.65 mites / 2 cm² leaf area. The mite population was found to increase steadily in summer months in both the districts. From the present investigation it is evident that the two-spotted spider mite population in jasmine had a significant positive correlation with maximum temperature ($r = +0.934$) and ($r = +0.368$) and negatively for relative humidity ($r = -0.919$) and ($r = -0.465$) and rainfall ($r = -0.496$) and ($r = -0.548$) in Madurai and Coimbatore districts respectively. A significant positive correlation was recorded for sunshine hours and wind velocity on both the investigated districts.

Keywords: *Jasminum sambac*, population dynamics, *Tetranychus urticae*

INTRODUCTION

Jasmine (*Jasminum sambac* L.) known in Persian as yasmin *ie.* 'Gift of God' is one of the oldest fragrant flowers of India. It is traditionally as well as commercially cultivated for its sweet-scented flowers. In India, jasmine occupies an area of about 8,000 ha with an annual production of flowers worth Rs. 80-100 million. Tamil Nadu is the leading producer of jasmine in the country with an annual production of 77, 247 tonnes in an area of 9,360 ha (Prakash and Muniandi, 2014). There are many factors that affect jasmine production, of which pest incidence takes major lead. Among the arthropods attacking jasmine, the two-spotted mite, *Tetranychus urticae* Koch is one of the prime pests which devastate the productivity of the crop. In jasmine, flowering commences during March-April and comes to peak in May-July. During this period, the weather is too hot and is favourable for multiplication and so the population increases rapidly. These tiny eight-legged arthropods lay eggs on the underside of leaves. An adult female can lay more than 100 eggs in three weeks. Eggs hatch in four to five days and the entire life cycle from egg to adult is completed in one to three weeks, depending on the temperature. The life-cycle of *T. urticae* consists of five different stages such as egg, larva, protonymph, deutonymph and the adult. Mites are typically found on the underside of leaves, but may colonise entire plants during outbreaks. The mites suck sap from cells on the underside of plant leaves, in the early stages and

characteristic white speckles can be seen from the upper leaf surface. As mite number increases, these white speckles also increase and the leaf exhibits a bleached appearance (Brandenburg and Kennedy, 1987; Martinez-Ferrer *et al.* 2006). In case of severe infestation, the whole plant becomes pale in colour, and affects production and size of the flower buds. Damage to the leaves inhibits photosynthesis, and severe infestations can result in premature leaf fall, shoot dieback, and decreased plant vigor. Although the individual lesions are very small, attack by hundreds or thousands of spider mites can cause thousands of lesions and thus can significantly reduce the photosynthetic capability of plants (Zhang, 2003). Such buds fetch a low market price. Silk webbing on the undersides of leaves are characteristic signs of spider mites. Under high population densities, the mites move to the tip of the leaf or top of the plant and congregate using strands of silk to form a ball-like mass, which will be blown by winds to new leaves or plants, in a process known as "ballooning."

In view of this, it is of prime importance to monitor the population build up of mite as influenced by weather factors, so that suitable management strategy could be taken up when such a favourable climatic changes occur besides forecasting the likelihood of occurrence of mite incidence. With this idea, field investigations were conducted in two different climatic zones of Tamil Nadu, Madurai and Coimbatore district.

MATERIALS AND METHODS

Field investigations were carried out in two different agro climatic regions *viz.*, Coimbatore and Madurai district to assess the seasonal fluctuation or temporal variation of two spotted mite, *Tetranychus urticae* in local variety of jasmine “Ramnad Local’ at Agricultural College and Research Institute, Madurai and Botanical Garden premises, Tamil Nadu Agricultural University Coimbatore-3. The mite incidence was recorded on five randomly selected plants per plot at fortnightly interval, continuously for one year (June 2015 – May 2016) using a 10 X magnifying hand lens. The mean population of jasmine mite was correlated with the following weather parameters *viz.*, maximum and minimum temperature, sunshine hours, rainfall, relative humidity and wind velocity. The weather data of Madurai and Coimbatore district was collected from the Meteorological observatory of Department of Agronomy, Agricultural College and Research Institute, Madurai and Tamil Nadu Agricultural University Coimbatore.

RESULTS AND DISCUSSION

The data of the population load in each month was correlated with weather parameters and the linear regression equation was fitted to know the degree and extent of influence of the weather factors on the population build up of two spotted mite, *T. urticae*. The distribution of mite population was more observed on bottom leaves than middle and top leaves. Jasmine being a shrub, the senescence of leaves is much slower than annuals. Thus, the leaves at the bottom remain fit for feeding by the mites for longer period. Hence the abundance of mites on bottom leaves are normally more than on other leaves. When quality of bottom leaves deteriorates, then the mites move towards middle and top leaves. Similar nature of distribution of two spotted mite, *T. urticae* on rose was noticed by Onkarappa (1999). The study revealed that the occurrence of two spotted spider mite, *Tetranychus urticae* was less severe in winter months, *ie.*, from November till March and December till April in both the investigated region due to the prevalence of moderate temperature and RH, along with receipt of frequent and sharp showers (Table 1). The mite population varied from 7.63 to 8.61 mites per 2 cm² area from October till March with the lowest population of 3.64 mites per 2 cm² area in Madurai District. It is evident that the mite population reached its peak during July (19.72 mites per 2 cm² area) followed by June (16.94 mites per 2 cm² area) and August months (16.13 mites per 2 cm² area), owing to the extremely hot weather in Madurai district. The peak population of mites started declining from September

month (12.46 mites per 2 cm² area), with sharp decline in November, December and January (5.28, 4.30 and 3.64 mites per 2 cm² area). Yet, the mite population, started to rebound in March month (13.00 mites per 2 cm² area), steadily increasing in April, May and June (14.27, 15.46 and 16.94 mites per 2 cm² area), attaining peak status in July (19.72 mites per 2 cm² area). This findings were in confirmation with the findings of Rajkumar *et al.* (2005) who corroborated the maximum incidence of mites in summer months with steady decrease in winter months (Fig 1).

The incidence of two spotted mite, *Tetranychus urticae* also showed a similar trend in Coimbatore district. The maximum occurrence was recorded in the month of October (16.36 mites per 2 cm² area) and May (15.47 mites per 2 cm² area) and minimum occurrence in the month of February (3.45 mites per 2 cm² area). The population started increasing with the onset of summer months recording 9.65 mites per 2 cm² area and 15.47 mites per 2 cm² area in April and May months. However, the mite population started declining further with the onset of monsoon and heavy rainfall in June month (13.65 mites per 2 cm² area) and furthermore in July month (9.20 mites per 2 cm² area) and again the population rebound in August (12.36 mites per 2 cm² area) and reached maximum in October (16.36 mites per 2 cm² area). The population decline with the onset of winter months. Shah *et al.* (2014) reported similar trend with reference to population dynamics of *T. urticae* in Gerbera. Kanika *et al.*, (2013) corroborated that the mite population became significant from April which is in conformity with the present study (Fig 2).

Simple correlation and multiple regression were worked out to study the influence of weather parameters like maximum and minimum temperature, relative humidity, rainfall, solar radiation and wind velocity over the incidence of jasmine pests during June 2015 to May 2016 at Madurai (Agricultural college and research Institute, Madurai) and Coimbatore (The Botanical garden premises, TNAU) and the data were presented in Table 2 and 3. The two spotted mites were also positively correlated for maximum temperature ($r = +0.934$) and ($r = +0.368$) and negatively for relative humidity ($r = -0.919$) and ($r = -0.465$) and rainfall ($r = -0.496$) and ($r = -0.548$) in Madurai and Coimbatore districts respectively. Similar results were obtained by Panigrahi (2010), that phytophagous mite, *T. urticae* showed a significant positive correlation with maximum temperature and negative correlation with Relative Humidity and rainfall. Gulathi (2004) also proved beyond doubt that

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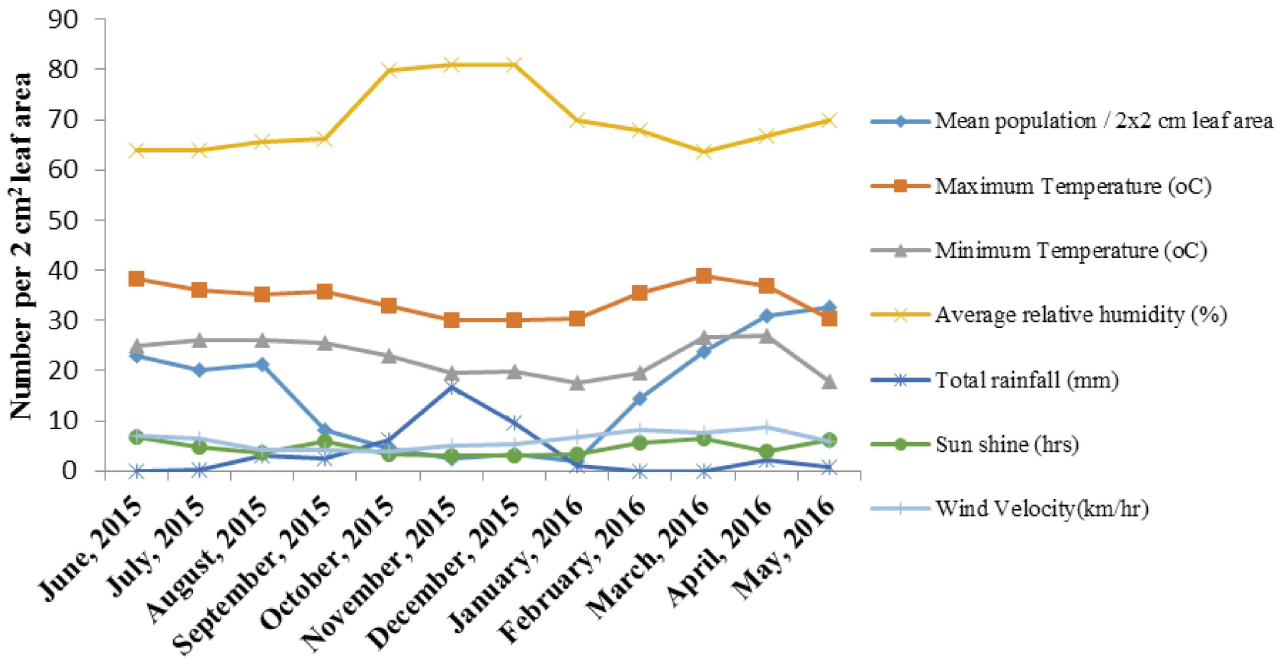


Fig 1. Influence of weather parameters on seasonal abundance of two spotted mite, *Tetranychus urticae* in Madurai district

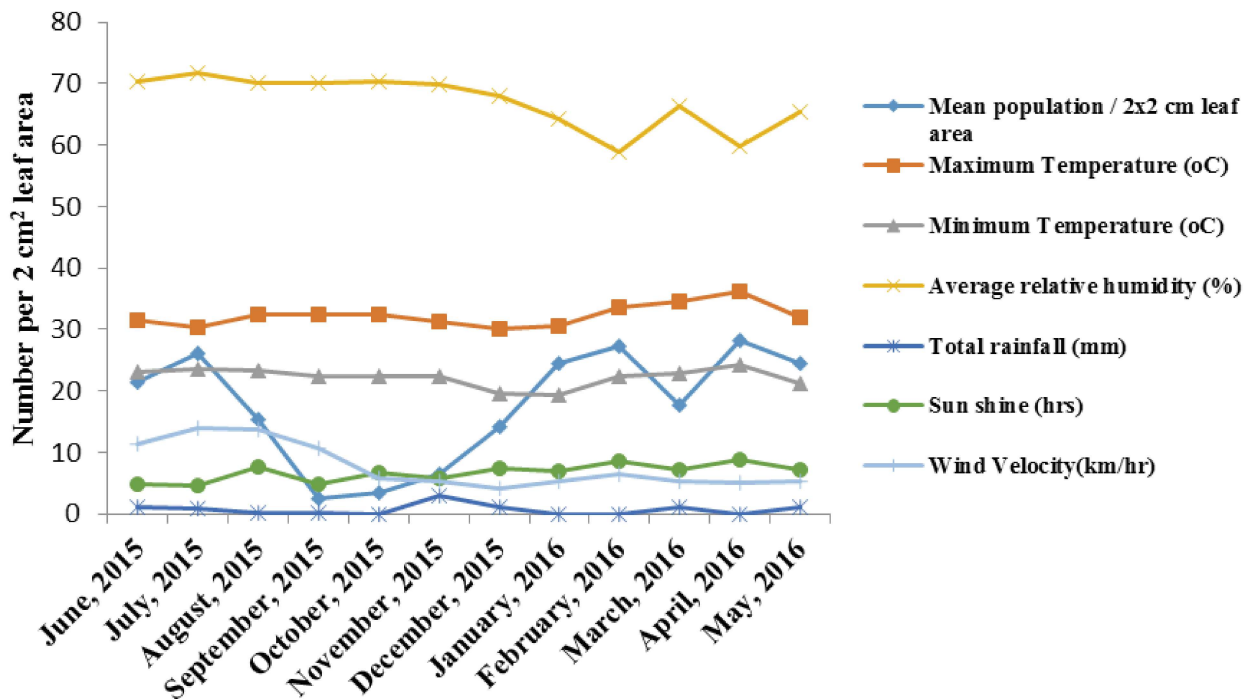


Fig 2. Influence of weather parameters on seasonal abundance of two spotted mite, *Tetranychus urticae* in Coimbatore district

Table 1. Correlation between weather parameters on seasonal abundance of two spotted mite, *Tetranychus urticae* in Jasmine eco-system in Madurai and Coimbatore district during 2015-2016

Weather parameter	Correlation coefficient	
	Madurai District	Coimbatore District
Maximum temperature (T _{max})(°C)	0.934*	0.368 ^{NS}
Minimum temperature (T _{min}) (°C)	0.170 ^{NS}	0.238 ^{NS}
Relative humidity (%)	-0.919*	-0.465 ^{NS}
Rainfall (mm)	-0.496 ^{NS}	-0.548 ^{NS}
Sunshine (hrs)	0.404 ^{NS}	0.455 ^{NS}
Wind Velocity(Km/hr)	0.087	0.027 ^{NS}

Correlation coefficient is significant at 0.05 % level (one-tailed)

Table 2. Multiple linear regression analysis for the prediction of two spotted mite, *Tetranychus urticae* in Jasmine eco-system in Madurai and Coimbatore district during 2015-2016

Variables	Regression Coefficient	
	Madurai District	Coimbatore District
Intercept (a)	67.94*	-69.35*
Maximum temperature (T _{max})(°C)	2.45*	0.352**
Minimum temperature (T _{min}) (°C)	-0.031*	-0.005**
Relative humidity (%)	-0.54*	0.667**
Rainfall (mm)	-1.71*	-0.537**
Sunshine (hrs)	1.64*	1.532**
Wind Velocity(Km/hr)	5.34*	3.181**
R ²	0.872	0.808

Regression equations

$$1) Y_1 = 67.94* + 2.45*X_1 + 0.031*X_2 - 0.54X_3* - 1.71 X_4* + 1.64 X_5* + 5.34* X_6$$

$$2) Y_2 = -69.35* + 0.152X_1 - 0.005X_2 + 0.667*X_3 - 0.537X_4 + 1.532*X_5 + 3.181*X_6$$

the population of *T. urticae* had a significant positive correlation with maximum temperature and significant negative correlation with rainfall and Relative Humidity. Similar results, reported by Neelima (2005) also supported that both maximum as well as the minimum temperatures were positively correlated with two spotted mite population. Rainfall caused a wash out effect over the mite population significantly reducing their spread and intensity of damage and could observe a drastic decrease in incidence and population in rainy period (Table 3).

From the multiple linear regression analysis between weather parameters and abundance of two spotted mite, *Tetranychus urticae* it is evident that the maximum temperature (T_{max}) and minimum temperature (T_{min}) had significant contribution towards the abundance of mites with the R^2 value 0.872 and 0.825 in Madurai and Coimbatore districts with 1°C increase in maximum temperature (T_{min}), mite population increased by 2.45 and 0.352 percent whereas, with 1°C decrease in minimum temperature (T_{min}), mite population decreased by 0.31 and 0.05 respectively in Madurai and Coimbatore districts. Nevertheless, an increase in RH by one per cent there was a decrease in two spotted mite population by 0.54 and 0.67 number in both districts respectively. The increase in sunshine hours by 1 hour increased the mite number by 1.64 and 1.53 in both the districts and an increase in wind velocity by 1 km/hr boosted the mite population significantly by 5.34 and 3.181 numbers.

The influence of weather parameters on jasmine mite, *T. urticae* population is immensely needed for chemical interventions. There is a sudden decrement in the mite population in December and January. In winter months, flower production is very low due to mist damage and hence most gardens are pruned and hence there is less access to food. Moreover, two spotted mites require hot weather for their survival and hence their population is inevitable in cooler months. Similar reports were previously reported by Gunasekaran (1989) and Isabel (1996). The positive correlation with maximum temperature indicates the scope of build up of jasmine pests with the increase in temperature which demands timely intervention to check the population. On the contrary, negative correlation with rainfall highlights the natural reduction of pest population.

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