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Spatial distribution of false spider mite, *Tenuipalpus punicae* on pomegranate in arid region of Rajasthan

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Abstract
The investigation were conducted at Agricultural Research Station and Laboratory, Department of Entomology, College of Agriculture, Swami Keshwanand Rajasthan Agricultural University, Bikaner from July 2022 to December 2022 in pomegranate orchard to evaluate the spatial distribution of false spider mites on pomegranate during *Mrig* bahar. The study revealed that the intraplant distribution of false spider mite, *Tenuipalpus punicae on plant* recorded that the overall mite population including eggs and active stages was significantly more on top canopy (17.23 mites per leave) leaves followed by middle canopy (14.76 mites per leave) leaves. In general, the mite population preferred leaves in south (18.86 mites per leave) and east (14.36 mites per leave) direction.

Keywords: Mites, spatial distribution, intraplant, orchard, *Mrig* bahar etc.

Introduction

The pomegranate (*Punica granatum* L.), also known as Anar, is a fruit that belongs to the family *Punicaceae*. It is native to Iran, where it has been cultivated for over 5,000 years. India is one of the world's leading producers of pomegranates, providing a source of income for farmers and employment for many people. In 2023-24, the country produced 28.42 lakh metric tonnes of pomegranates, with pomegranates being cultivated across 2.24 lakh hectares in India. (Anonymous, 2023-24) [1]. In the year 2023-23, pomegranates were cultivated across 21,490 hectares in Rajasthan, resulting in an annual production of 1,65,880 metric tonnes (Anonymous, 2023-24) [1].

Pomegranate fruits are packed with nutritional value, containing approximately 67.95 kcal of energy, 1.41 g of protein, 1.60 g of fiber, 2.50 mg of calcium, 10.22 mg of magnesium, 34.3 mg of phosphorus, 0.39 mg of iron, 0.26 mg of zinc, 0.09 mg of thymine, 0.22 mg of niacin, 23.38 mg of ascorbic acid, and 26.00 mg of total carotenoids per 100 g of fresh fruit. (Debjit *et al*., 2013) [2].

Pomegranate cultivation is often affected by various insect and mite pests, including fruit borers and foliage feeders. Among non-insect pests, mites are notorious pests and gaining tremendous importance in recent years owing to their destructive nature and damage potential. Several species of mites have been identified as damaging to pomegranate plants, namely *Tenuipalpus punicae* Pritchard and Baker, *Brevipalpus phoenicis* Geijeskes, *Aceria gradate* Canestrini & Massalongo, and *Oligonychus punicae* (Hirst). These mites have a particular affinity for the younger leaves of the pomegranate plant. When infested by tenuipalpid mites like *T. punicae* and *B. phoenicis*, the leaves undergo a distressing transformation, turning yellowish and dry, ultimately affecting the entire leaf surface. On the other hand, when eriophyid mites, particularly *Aceria granati*, invade the plant, the edges of the leaves begin to curl and narrow, significantly hindering the overall growth of the pomegranate.

Materials and Methods

The experiments were conducted at Agricultural Research Station and Laboratory, Department of Entomology, College of Agriculture, Swami Keshwanand Rajasthan Agricultural University, Bikaner to evaluate the spatial distribution of false spider mites on pomegranate during *Mrig* bahar, 2022. In order to study the spatial distribution of *T. punicae* on pomegranate plants, four plants were carefully selected (Figure 1). Observations of mites were recorded at weekly intervals from each plant. From each pomegranate plant, a total of twelve leaves were chosen for examination, with three leaves selected from each cardinal direction (north, south, east, and west). Additionally, leaf samples were collected from three canopy levels: top, middle, and bottom. The collected leaf samples were individually placed in polythene bags and transported to the laboratory. In the laboratory, the eggs and active stages of the mites present on all the leaves were examined using a stereo binocular microscope, and the number of mites was recorded for each sample.

Results

Distribution of *T. punicae* on pomegranate plant was studied by recording the population of mite on different leaflets of a compound leaf sampled from three different canopy levels (i.e., top canopy, middle canopy and bottom canopy). The number of mites (eggs and active stages) present in different directions namely north, south, east and west was also recorded.

At different canopy levels

The distribution of mites at different canopy levels, leaves sampled from the top canopy, middle canopy, and bottom canopy were analyzed.

Regarding the number of mites, including all life stages, it was higher on leaves in the top canopy (17.23 per leaf) and significantly different from the abundance of mites on leaves in the bottom canopy (11.45 per leaf). Overall, the

mite population was highest in the top canopy, followed by the middle canopy (Table 1).

In different directions

At the top canopy level, there was a significant difference in the distribution of the mites among different directions. Leaves in the south direction had the highest number of mites (21.61 per leaf), followed by the east, west, and north directions (17.11, 15.86, and 14.36 per leaf, respectively). In the middle canopy, leaves in the south direction also harboured the highest number of mites (19.23 per leaf), followed by the east, west, and north directions (14.61, 13.36, and 11.86 per leaf, respectively). However, there were no significant differences among the directions. In the bottom canopy level, mites were more abundant on leaves in the south direction (15.73 per leaf), followed by the east direction (11.36 per leaf) (Table 1). The mean number of mites across different canopy levels indicated a greater preference for leaves in the south direction (18.86 per leaf) and east direction (14.36 per leaf) (Table 1).

Table 1: Distribution of false spider mite, *T. punicae on* different directions and canopy levels of pomegranate

Canopy levels	Directions				Mean
	North	South	East	West	
Top	14.36^{ab}	21.61^{a}	17.11^{ab}	15.86^{ab}	17.23^{a}
Middle	11.86^{ab}	19.23^{ab}	14.61^{ab}	13.36^{ab}	14.76^{ab}
Bottom	8.61^{b}	15.73^{ab}	11.36^{ab}	10.11^{ab}	11.45^{b}
Mean	11.61^{b}	18.86^{a}	14.36^{ab}	13.11^{ab}	

Same alphabetical superscript is statistically on par.

Discussion

At different canopy levels

In terms of the total number of mites, including all life stages, leaves in the top canopy had the highest abundance (17.23 per leaf), which was significantly different from the abundance of mites on leaves in the bottom canopy (11.45 per leaf). The number of mites in the total population was similar between the top and middle canopies, while the top canopy had a higher overall population. These findings partially align with the study conducted by Mohammad Y. A. (2008) [3], who reported that the total mite population was highest in the middle canopy, followed by the top canopy. Similarly, Tan, J. L. *et al*. (2024) [4] found that in cultivated raspberry, both groups of phytophagous mites preferred the upper zone of the raspberry floricanes, whereas in non-cultivated raspberry, they preferred the middle zone.

At different directions

The total population of mites, including eggs and active stages, was significantly higher in the top canopy (17.23 per leaf), followed by the middle canopy (14.76 per leaf) and the bottom canopy (11.45 per leaf). The distribution in different directions of the canopy followed a similar pattern as that of eggs and active stages, with the southern part of the canopy harbouring the highest number of mites (18.86 per leaf), followed by the eastern (14.36 per leaf), western (13.11 per leaf), and northern (11.66 per leaf) portions. These findings are in agreement with the study conducted by Mohammad Y. A. (2008) [2], who reported a greater preference for leaves in the south and east directions in terms of mite abundance. In the Bikaner conditions, the south-western and south-eastern portions of the plant receive more sunlight throughout the year, resulting in higher temperatures. As *T. punicae* is a slow-moving mite, its population tends to build up in regions of the canopy where the temperature is slightly higher.

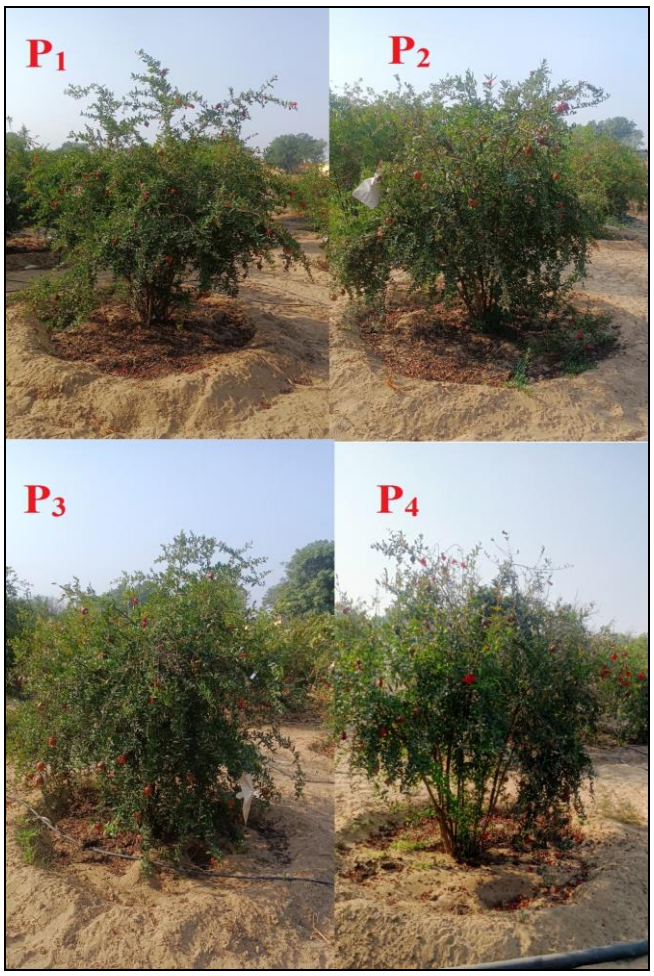

Fig 1: Four plants were selected for the study of the spatial distribution of false spider mites on pomegranate.

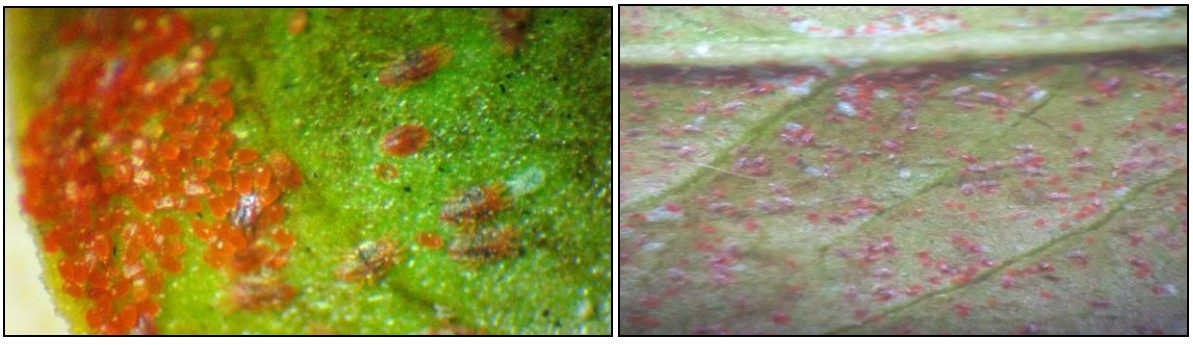

Fig 2: False spider mite, *Tenuipalpus punicae* on pomegranate leaf

Conclusion

The mites showed preference for top canopy leaves of different canopy levels for oviposition. Active stages preferred to feed on the leaves in the middle canopy compared to top and bottom canopy leaves. The overall mite population was significantly more on top canopy leaves (17.23/ leaf) followed by middle canopy leaves (14.76/leaf). In general, the mites preferred leaves in south and east direction compared to northern and western leaves.

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