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First report of garlic mite, *Aceria* sp. on garlic crop at Raipur, Chhattisgarh

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Abstract
The present investigation was conducted to study the Seasonal Incidence of garlic mite at Horticulture farm, Indira Gandhi Krishi Vishwavidyalaya, Raipur (C.G.) during *rabi* season in the year, 2024-25 on garlic crop. The incidence of mite on garlic started during fourth week of January (4th SMW) with a mean population of 3 mites/cm^2 leaf area and reached to its peak in the second week of February (6th SMW) with a mean population of 18.67 mites/cm^2 leaf area. The garlic mite cause severe damage to garlic leaves which shows curling, yellowing of leaves, foliage stunt, twist, and discoloration. Both adults and immature stages of the mite feed around the midrib of young leaves. The correlation studies revealed that the mite population had non-significant positive correlation with the temperature and non-significant negative with the relative humidity and rainfall.

Keywords: Immature stages, garlic mite, seasonal incidence

Introduction

Garlic (*Allium sativum* L.) is the second important member of Alliaceae family after onion grown in India (Lawande *et al.*, 2009) [15]. It is also used for its high content of vitamins, enzymes and bactericidal effect. The sulphur compounds Allicin, Ajoene and Vinyl dithiins are responsible for the pungency of garlic. After China, India is the world's second-largest producer of garlic (FAOSTAT, 2021) [8]. In India, it is mainly cultivated in *rabi* season and harvested in March-April (Karuppaiah *et al.*, 2018) [11]. The main garlic producing states in India are Rajasthan, Madhya Pradesh, Gujarat, Uttar Pradesh, Maharashtra, Himachal Pradesh, Karnataka, Tamil Nadu, and Chhattisgarh (National Horticulture Board, 2021-22) [19]. In India garlic is infested by several insects and mite pest in field and storage condition. One of the most damaging and severe pest is garlic leaf mite which is also called as dry bulb mite, tulip mite, and onion leaf mite.

Garlic production can be severely harmed by this eriophyid mite species, which can result in a 23% decrease in yield (Larrain, 1986) [14]. It also targets cultivated and wild Allium plants, including as leeks, onions, and garlic.

Garlic mite (Acari: Eriophyidae) was first reported by Keifer in Tulip bulbs in 1937. Later, in 1952, Keifer discovered it in onion and garlic bulbs. In India, Puttarudriah and Channabasavanna (1958) [23] described *A. tulipae* infesting garlic crops in Mysore. In Maharashtra, Pawar *et al.*, (1990) [22] investigated how different garlic varieties responded to *A. tulipae*. Eriophyid mites are cylindrical/ cigar shaped, tapering from head to rear with only two pairs of legs in all life stages, translucent white in colour and microscopic. and use needle-like mouthparts to puncture and feed on plant cell contents (Nuzzaci and Alberti, 1996) [20].

The life stages consist of an egg, larvae (first instar) and a nymph (second instar) and adult stage (Manson and Oldfield, 1996) [16]. The larvae is smaller than the nymph but otherwise appears the same, between each instar mites remain stiff and motionless to prepare for moulting. Adult mite is about 200 to 250 µm length and width 36 to 52 µm and the average fecundity of female is 80-100 eggs in its lifetime and eggs are oval, translucent and 20-60 µm in diameter. Total life cycle constitutes of 7-10 days (Mariay, 1977) [17]. Eriophyid mites are arrhenotokous, meaning that unfertilized eggs become males and fertilized eggs become females (Oldfield and Michalska, 1996) [21]. Theoretically, because they can reproduce asexually, only one female is necessary to establish a population. (Michalska, 1996) [21].

The damage symptoms due to mite attack appeared as twisting and curling of leaves, which did not open properly, creating a micro-environment on the upper leaf surface where all the biological stages of the mite, namely eggs, nymphs and adults, colonized along the mid-rib. The infested leaves typically arched downwards with the tip tucked into the next young leaves (Channabasavanna, 1966) [3]. In heavy infestations, leaves showed yellow streaks, most often along the mid-rib and leaf margin. (Yamashita *et al.*, 1996) [24] and (Koo *et al.*, 1998) [13] demonstrated that mosaic and streak symptoms were induced by the garlic mite-borne mosaic virus of the genus Rymovirus (Potyviridae) vectored by *A. tulipae*. This mite was also reported to transmit onion mite-borne latent virus in onion and shallot mite-borne latent virus in shallot (Dijk *et al.*, 1991) [6]. Hence viewing this point present study with regarding to seasonal incidence and abundance of garlic mite seems to be highly effective in creating awareness in farmers community and also researchers for further need full works in present aspect.

Materials and Methods

The present investigation was conducted at Horticulture farm, Indira Gandhi Krishi Vishwavidyalaya, Raipur (C.G.) on garlic crop during 2024-25. To assess the seasonal incidence of garlic mite, weekly populations were recorded on garlic variety (Jamnagar local). Garlic seedlings were transplanted on 3rd November, 2024. Keeping row to row and plant to plant distance of 15 cm and 10 cm respectively in five plots of 2.25 m^2 each by adopting standard horticultural practices except control measure taken against any insect pest. The observation on mite population were taken on a weekly interval by collecting the leaves in polythene zipper bags. Total ten leaves were collected from ten randomly selected plants (i.e. one leaf per plant) in each of the five plots of 2.25 m^2 and the number of immature and mature stages of mite was assessed per cm^2 leaf area using stereo-binocular microscope. The data on weather parameters such as minimum and maximum temperature, relative humidity and rainfall were collected from Meteorological Observatory, IGKV, Raipur.

Statistical analysis

The data recorded were used for statistical analysis. The statistical analysis was performed using OPTSTAT. The correlation was studied to ascertain whether abiotic parameters had a significant effect on the population dynamics of the mite.

$$\frac{r = N(\sum xy) - (\Sigma x)(\Sigma y)}{\sqrt{(N\sum x^2 - (\sum x)^2)}\ (n\Sigma y^2 - (\sum y)^2}$$

Where,
r = Simple correlation coefficient
x = Independent variable *i.e.* abiotic component
y = Dependent variable *i.e.* pest
N = Number of observations

After correlating significant and non-significant findings, t-test value n-2 degrees of freedom were calculated on following formula:

$$t = \frac{r_{xy}\sqrt{n-2}}{\sqrt{1-r_{xy}^2}}$$

t-t value n-2 d.f.

The calculated t-value obtained was compared with tabulated t-value at 5% and 1% level of significance

Results and Discussion

The damage by this mite was first observed in vegetative stage in the last week of January at Horticulture farm, Indira Gandhi Krishi Vishwavidyalaya, Raipur (C.G.) during 2024-25 on garlic crop. The data presented in Figure-1 revealed that mite population on garlic crop first commenced in the fourth week of January (4th SMW) with a mean population of 3 mites/cm^2 leaf area and gradually increased and reached to its peak in the second week of February (6th SMW) with a mean population of 18.67 mites/cm^2 leaf area, when the mean maximum temperature, minimum temperature and relative humidity (RH-1) and (RH-2) of standard meteorological week were 30.8 °C, 15.8 °C, 75.1% and 33.1% respectively and thereafter the population declined possibly because of high mean temperature exceeded 33 °C during the secondweek of March. In the present study the incidence of mite was not affected by weather parameters significantly however, the mite population showed non-significant positive correlation with temperature and negative non-significant correlation with relative humidity and rainfall. The present results are in agreement with those of Debnath and Karmakar (2013) [5] who reported that temperature and relative humidity had non-significant positive correlation with the mite population, in their study under West Bengal conditions. Courtin *et al.*, (2000) [4] who reported high mortality of the mite at temperature above 31 °C.

Weather parameters	Pearson's r (n=9)
Maximum temperature	0.065
Minimum Temperature	0.160
Rainfall	-0.411
Morning relative humidity	-0.085
Evening relative humidity	-0.402

*None were significant
Correlation coefficient (r) for weather variables affecting mite populations on garlic during 2024-25, rabi season.

The symptoms of mite infestation start to appear as the leaves exhibited curling downwards and become yellow with their tips tucked under the subsequent leaves, due to this foliage stunt, twist and discolour, have yellowish or pale green streaks on the leaves, and plants become deformed. Both adults and immature stages of the garlic mite feed around the midrib of the young leaves and the spaces between layers of garlic. Contrarily, Channabasavanna (1966) [3] described the infested leaves to be tucked into the next younger leaves. In a heavily infested field, the leaves showed typical symptoms of curling, leading to the formation of a "pig tail".

All the four stages of mite namely eggs, two immature stages and adult were observed under microscope. Eggs appeared oval and translucent in shape present in scattered form on the upper-side of the leaves. Two immature stages, larvae (first instar) and nymph (second instar) were also seen. The larvae appear smaller than nymph in size otherwise same in structure. The adult mite is slender in shape, translucent and tapering towards the end and consist of two pair of legs and needle like mouthpart to puncture the plant tissue. Adult measures about 250-300 µm in length and 40 to 51 µm in width.

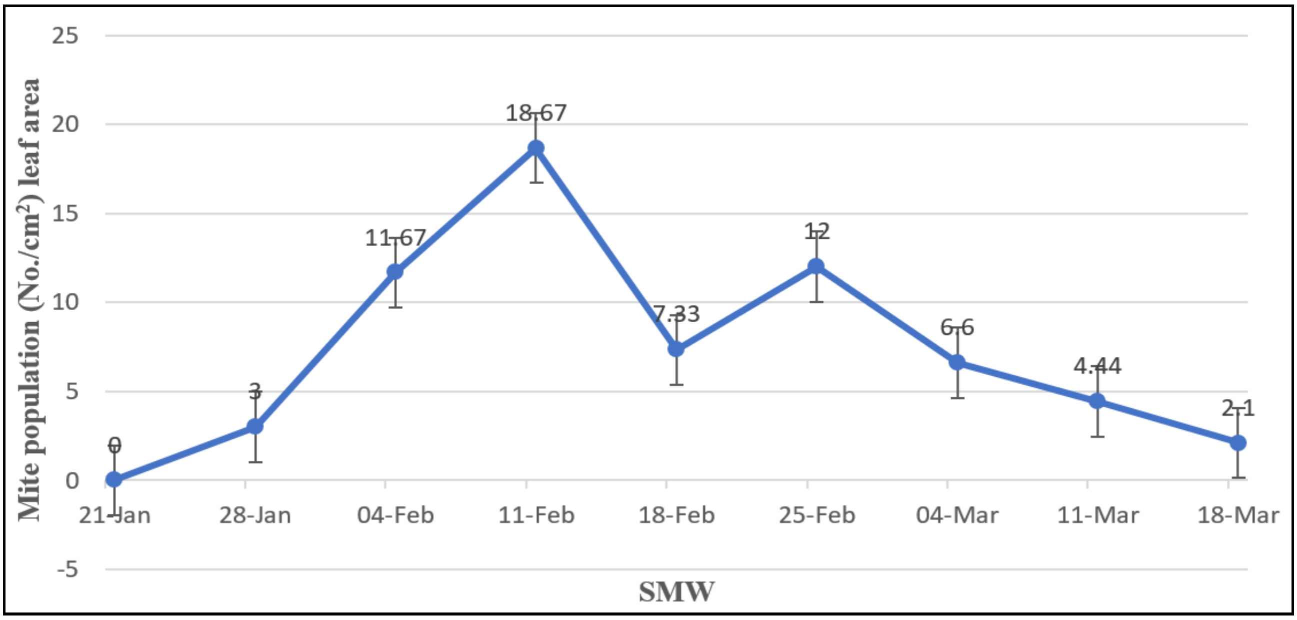

Fig 1: This represents mite population on garlic leaves during 2024-25 *Rabi* season

Fig 2: (A) Eggs of Garlic mite. (B) Immature stages of mite with oval shaped eggs. (C) Garlic leaf showing typical infestation of mite. (D) Adult mite. (E) Represent population of mites on the inner surface of the garlic leaves. (F) Showing yellowing, curling and twisted leaves of garlic.

Conclusion

From the present investigation it can be concluded that the incidence of mite was not affected by any weather parameters significantly however, temperature showed non-significant positive correlation with mite incidence on garlic crop.

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