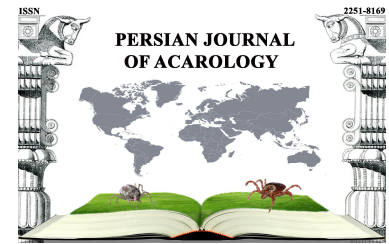




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Phytophagous mites infesting vegetable crops of Kerala, India

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More than 700 plant mites have been known in India, out of which about half of the species are phytophagous in nature (Gupta 2012). Most phytophagous mites belong to the families Tetranychidae, Tenuipalpidae, Tarsonemidae, and Eriophyidae (Gupta 2012). Studies on phytophagous mites are meagre in Kerala especially from northern districts.

The present survey was carried out in various agricultural fields of Kasaragod district from January to December 2016 excluding rainy seasons from June to August. In this order, 12 vegetable crops were randomly selected. Leaves infested by mites were collected in polythene bags and brought to the laboratory. Mites were removed from leaves with a hair brush under Leica-S6D stereo zoom microscope and transferred to vials containing 70% ethyl alcohol. Then, extracted mites were mounted on micro slides in Hoyer's medium. Mites were identified under Leica DM750 Research Microscope by using taxonomic keys and expert opinions.

In total, 12 phytophagous species belonging to four families - Tetranychidae, Tenuipalpidae, Tarsonemidae and Eriophyidae - were collected from vegetable plants of Kasaragod district. Collected mite species, their prevalence and damage symptoms in different host plants are presented in Table 1.

Spider mites with seven identified species were the most prominent mites collected during our survey. Among 12 vegetable plants surveyed, *Solanum melongena* L. showed the highest diversity in terms of mite attack. Eight species of mites belonging to three families were extracted from this plant - of them, five species were tetranychids which damaged the leaves and caused intense webbing, yellowing, drying and premature leaf fall leading to reduced yield and stunted growth. Younger plants were often totally destroyed within a few days of attack. *Tetranychus macfarlanei* Baker & Pritchard was the most prevalent and damaging mite. *Solanum melongena* is the third most important vegetable crop in India and contributes to about 17.8 percent of the total production of vegetables in this country (Chakrabarti *et al.* 2015). Many studies have been done on seasonal incidence of mites on *S. melongena* outside Kerala (Pande and Sharma 1985; Rizvi 1996; Sharma 2005, Chakrabarti *et al.* 2015, Jadhav 2017). Binisha and Haseena (2013) reported that *Tetranychus urticae* Koch was the most important phytophagous mite species on *S. melongena* in Thrissur district, Kerala. However, *T. macfarlanei* was the most prevalent tetranychid mite collected during our study.

Abelmoschus esculentus L. plants stand next to *S. melongena* in intensity of mite infestation, with four mites representing two families. *Vigna unguiculata* L., *Cucumis sativus* L., *Momordica charantia* L., *Ipomoea muricata* L., *Moringa oleifera* Lam. and *Lycopersicon esculentum* L. come

after it in terms of intensity of attack. In all these plants, tetranychids represented similar damages as in *S. melongena*, but to a lesser extent. Naga *et al.* (2017) and Dharmendra *et al.* (2015) in Uttar Pradesh reported the presence of *T. urticae* on *A. esculentus* plants. In our study, *Tetranychus ludeni* Zacher was found as the major mite pest in *A. esculentus*. Also, *T. macfarlanei*, *T. neocaledonicus* Andre, and *Brevipalpus californicus* (Banks) were collected from this plant. Binisha and Haseena (2013) reported the presence of *T. urticae* in cucumber. But in this study *T. macfarlanei* was recovered from this plant. *Eutetranychus* sp. and *Schizotetranychus* sp. were found from *Murraya koenigii* L. that the infected leaves presented whitish spots which eventually dried up.

Out of three species of collected tenuipalpids, *Brevipalpus phoenicis* Geijskes exhibited more damage and prevalence. It caused bronzing of leaves, rupturing of skin of fruits, deformities in plants and stunted growth in *S. melongena* and *V. unguiculata*. Family Tarsonemidae was represented by *Polyphagotarsonemus latus* (Banks) which attacked *Capsicum annum* L., *V. unguiculata* and *S. melongena*. The damage was extremely severe in *C. annum* with a prevalence of 24% resulting in bronzing and downward curling of leaves, deformed fruits, crumpled apical shoot and stunted growth. *Aculops lycopersici* (Masse) was the only collected eriophyid mite in this study which was recovered from *Lycopersicon esculentum* L. This mite causes silverying of under surface of leaves leading to bronzing, loss of hairs from stem and leaf desiccation causing death of plants. In a study conducted by Lokender *et al.*, (2015), *A. lycopersici* was found initially on stem portion of tomato plants, which gradually spread to the whole aerial parts.

Damages by plant mites very often catch less attention compared to insect attack, perhaps due to their small size and cryptic habits. This study urges the need for considering mites as potential threats to vegetable crops and developing proper pest management programs accordingly.

Table 1. Damage symptoms and prevalence of mite species recovered from the survey in 2016.

Sl. No.	Mites recovered		Damage symptoms	Host plant	Prevalence of mite species (%)
	Species	Family			
1	<i>Tetranychus macfarlanei</i> Baker & Pritchard	Tetranychidae	Profuse webbing, Yellowing, drying and premature falling of leaves, reduced yield and stunted growth.	<i>Solanum melongena</i> L. (Brinjal)	20
				<i>Vigna unguiculata</i> L. (Cowpea)	8
				<i>Abelmoschus esculentus</i> L. (Lady's finger)	10
				<i>Cucumis sativus</i> L. (Cucumber)	10
				<i>Lycopersicon esculentum</i> L. (Tomato)	5
				<i>Momordica charantia</i> L. (Bitter gourd)	10
2	<i>Tetranychus urticae</i> Koch	Tetranychidae	Whitish / yellowish spots on leaves, premature leaf fall, intense webbing, stunted growth	<i>Solanum melongena</i> L. (Brinjal)	18
				<i>Psophocarpus tetragonolobus</i> L. (Winged bean)	10
				<i>Moringa oleifera</i> Lam. (Muringa)	10
				<i>Ipomoea muricata</i> L. (Clove bean)	10
3	<i>Tetranychus ludeni</i> Zacher	Tetranychidae	Leaves with yellowish spots. Leaves wilt and drop early.	<i>Abelmoschus esculentus</i> L.	20
				<i>Solanum melongena</i> L.	14

Table 1. Continued.

Sl. No.	Mites recovered		Damage symptoms	Host plant	Prevalence of mite species (%)
	Species	Family			
4	<i>Tetranychus truncatus</i> Ehara	Tetranychidae	Yellowing and bronzing of leaves	<i>Solanum melongena</i> L.	5
5	<i>Tetranychus neoclaedonicus</i> Andre	Tetranychidae	Leaves with yellowish spots, premature leaf fall	<i>Solanum melongena</i> L. <i>Lycopersicon esculentum</i> L.	8 2
6	<i>Eutetranychus</i> sp.	Tetranychidae	Yellowish spots on leaves	<i>Abelmoschus esculentus</i> L. <i>Murraya koenigii</i> L. (Curry leaves)	12 6
7	<i>Schizotetranychus</i> sp.	Tetranychidae	White spots and drying up of leaves.	<i>Murraya koenigii</i> L.	3
8	<i>Brevipalpus phoenicis</i> Geijskes	Tenuipalpidae	Chlorotic spots on leaves, deformities in plants.	<i>Vigna unguiculata</i> L. <i>Solanum melongena</i> L.	15 15
9	<i>Brevipalpus obovatus</i> Donnadieu	Tenuipalpidae	Light brownish spots on leaves, stunted growth	<i>Solanum melongena</i> L.	9
10	<i>Brevipalpus californicus</i> (Banks)	Tenuipalpidae	Bronzing and premature leaf fall.	<i>Abelmoschus esculentus</i> L.	7
11	<i>Polyphagotarsonemus latus</i> (Banks)	Tarsonemidae	Bronzing and downward curling of leaves.	<i>Capsicum annum</i> L. (Green chilli) <i>Vigna unguiculata</i> L. (Cowpea) <i>Solanum melongena</i> L.	24 15 10
12	<i>Aculops lycopersici</i> (Masse)	Eriophyidae	Silvering and bronzing leaves, stem loses hairs	<i>Lycopersicon esculentum</i> L. (Tomato)	8

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