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Survey of endemic locality, host plants of mites associated with summer vegetable crops

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Abstract
Survey of phytophagous mites during 2021 and 2022 on summer vegetable crops surrounding Tilak Dhari Post Graduate Collage, Jaunpur, Uttar Pradesh. The survey of plant mites reveled that out of sixteen (16) species of mites belonging to seven (7) genera, six (6) family and two (2) orders. The order Prostigmata is represented by five (5) family, six (6) genera and twelve (12) species. Whereas, one (1) family, one (1) genera and four (4) species represent order Mesostigmata. Of the sixteen (16) species recorded nine (9) are phytophagous nature and seven (7) species belong to predatory group. Among the twelve (12) summer vegetables crops surveyed maximum number of species were recorded on brinjal (9) and sponge gourd (9) followed by bottle gourd (8) and ridge gourd (8), long melon, bitter gourd, pumpkin, okra and cucumber in each seven (7). Rest of vegetable crops recorded (2-6) species.

Keywords: Survey, phytophaous mite, vegetable

Introduction
In agriculture, the problem of phytophagous mites become intense after the introduction of large scale use of insecticides during 1950s for the control of many insect pests but at the same they also destroyed the natural enemies of phytophagous mites which result in the resistance and resurgence problem as well as toxic residues. As a result many mite species which were never seen earlier have become important pests of regular occurrence *i.e.* two spotted spider mites. Broad spectrum pesticides increase mite population as these kill their natural enemies. Selective pesticides allow the survival and viability of natural enemies such as predators and parasitoids (Villanueva-Jimenex and Hoy, 2003) [6].

Spider mites are excellent indicators of pesticides induced imbalance in agro-ecosystems. A total of 660 mite species are known to occur on various plants in India, out of which 319 species are plant feeding and predatory in nature. The plant feeding mites are represented by 169 species, whereas 148 species belongs to predatory group. In India 17 species of mites are considered as major pests and 30 species as minor posts of different crops (Gupta, 1991) [2]. The spider mite *Tetranychus urticae* Koch attacks on a wide range of crops including fruit trees, fibres crops, ornamental plants and obviously vegetables. Other species occurring on vegetable crops are predatory in nature and may enhance yield by contributing to the natural control of injurious species of mites. Vegetables are important constituents of Indian agriculture due to their short duration, high yield, nutritional richness and ability to generate on-farm and off-farm employment

Materials and Methods
A survey of plant mites associated with summer vegetable crops was carried during 2021 and 2022 surrounding the Tilak Dhari Post Graduate Collage, Jaunpur. Ten summer vegetables were selected for the routine survey for the record of mites' fauna.

Mites infesting leaves were collected in polythene bags and brought to the laboratory. As the mites are very minute, a pocket lens (10x) was used for its detection of the infested leaves in the field. In most of the cases, characteristic symptoms (blotching, Steppling, bronzing, yellowing and webbing on plant portion) produced by these mites peculiar symptoms or plant abnormalities were recorded. The bags containing plant materials were carefully protected from the sun to prevent dehydration of plant. The plant leaves brought to the laboratory and examined under a stereoscopic binocular microscope and the mites were stored in the 70 percent alcohol with the help of fine brush (all vials were kept in to bigger jar containing 70 percent alcohol nearly half filled). Later, they were mounted in Hoyer's medium and identified.

Results and Discussion

Mites host index (Table – 1and 2) and contains host mites index (Table- 3), which are recording during this study on summer vegetable crops surrounding Tilak Dhari Post Graduate Collage, Jaunpur, Uttar Pradesh in 2021 and 2022.

It is evident from (Table-1) the survey surrounding in Tilak Dhari Post Graduate College, Jaunpur region, Uttar Pradesh may yield more species of tetrenychid mites on summer vegetable crops. The present survey also reveals some new host records of some tetranychid mites, *viz*, tomato *Lycopersicum esculentum* Mill is a new host records for mites *Tetranychus urticae* Koch. Long melon (*Cucumis melo* L. var: *utilissimus*) is new host for mites *Tetranychus urticae* Koch have been found to be of economic importance in Jaunpur region in Uttar Pradesh and doing appreciable damage to their hosts. The family – Tenuipalpidae, there is good scope for working in the field of tenuipalpid mites associated with summer vegetable crops in Jaunpur region, Uttar Pradesh. In the present investigation, pumpkin (*Cucurbita moschata* Ducth) is a new host record for mites *Brevipalpus californicus* (Banks). The family – Tarsonemidae is represented by only one species *Polyphagotarsonemus latus* (Banks). Bottle gourd (*Lagenaria siceraria* Standle), and pumpkin (*Cucurbita moschata* Duth) are the new host of mites *Polyphagotarsonemus latus* (Banks) in Jaunpur, Uttar Pradesh. The (Table- 1) indicates that there is one (1) species under one (1) genera on summer vegetables in Jaunpur, Uttar Pradesh. This family is completely unexplored on the vegetable crops in Jaunpur, Uttar Pradesh as well as on other crops also. Our presented survey record, Ridge gourd {*Luffa acutangula* (Roxb.) L.} and sponge gourd (*Luffa cylendrica* Roemex) are a new host of mites *Agistemus industani* Gonzalez-Rodriguez. Prior to this investigation two (2) species under one (1) genera of stigmaeid mites were known occurring on summer vegetables crops. Not much taxonomic work has been done on this group of mites in India and through survey may yield many new and interesting species. The family- Tydedae is also revealed new host record for this species. Ridge gourd [*Luff acutangula* (Roxb.) L] and sponge gourd (*Luffa Cylendrica* Roemer) are new host records for the mites *Pronematus fleschneri* Baker in Jaunpur, Uttar Pradesh (Table -1).

The order mesostigmata, family- Phytoseiidae is the most important predatory group of mites occurring on crops all over the world. The present investigation yielded five (4) species of phytoseiidae mites, which are distributed over two (1) genera. pumpkin (*Cucurbita moschata* Ducth) is new habitat records for mites *Amblyseies indicus* Narayan & Kaur); Bottle gourd (*Lagenaria siceraria* Standle), Cucumber (*Cucumis sativas* L.), pumpkin (*Cucurbita moschata* Ducth), ridge gourd [*Luffa acutangula* (Roxb.) L.], sponge gourd (*Luffa cylendrica* Roemer) and long melon (*Cucumis melo* L. Var: *utilissimus*) are new habitat records for mites *Amblyseies largoensis* Muna; ridge gourd [*Luffa acutangula* (Roxb.) L.] and sponge gourd (*Luffa cylendrica* Roemer), cucumber (*Cucumis melo* L.) and long melon (*Cucumis melo* L. Var: u*tilissimus*) are new habitat records for mites *Amlyseies* (*Typhlodromips*) *tetanychivorus* (Gupta).

In the present investigation, the order – Prostigmata is represented by five (5) families, six (6) genera and twelve (12) species, whereas order –Mesostigmata is represented by one (1) family, one (1) genera and four (4) species (Table 1, 2 and 3). Similar tends were found in different location different worker i.e. Prasad and Singh (2009) at Varanasi, the order – Prostigmata is represented by seven (5) families, nine (7) genera and twenty-three (15) species. The order – Mesostigmata is represented by one (1) family, two (2) genera and five (5) species of mites, Singh and Raghuraman (2011) [4] was found Multi Locational Project on Agricultural Acarology, Singh and Chauhan (2014) [5] in mid-hills of Himachal Pradesh, Bala and Karmakar (2022) [1].

Table 1: Mites associated with various summer vegetables host plants in Jaunpur during 2021-2022

S. No.	Mites with taxonomic position	Name of host plants		Distribution	Occurrence	Damage	Remark
		Common	Botanical				
A.	**Phytophagous group Order:- Prostigmata**						
(a)	**Family:- Tetranychidae**						
1.	*Tetranychus urticae* Koch	Bitter gourd	*Momordica charantia* L.	Scanty	Incidental	Low	
		Bottle gourd	*Laginaria siceraria* Standle	Widespread	Consistent	Extensive	
		Pumpkin	*Cucurbita moschata* Dutch	Widespread	Consistent	Extensive	
		Cucumber	*Cucumis sativus* L.	Scanty	Incidental	Moderate	
		Long melon	*Cucumis melo* L. var: *utilissimus*	Scanty	Scarce	Low	
		Sponge gourd	*Luffa cylindrica* Roemer	Scanty	Incidental	Extensive	
		Okra	*Abelmoschus esculentus* (L.) Moench	Widespread	Consistent	Extensive	
		Tomato	*Lycopersicun esculentum* Mill	Scanty	Incidental	Low	
		Brinjal	*Solanum melongena* L.	Widespread	Consistent	Extensive	
2.	*Tetranychus macfarlanei* Baker & Pritchard	Bottle gourd	*Laginaria siceraria* Standle	Widespread	Consistent	Extensive	
		Pumpkin	*Cucurbita moschata* Dutch	Widespread	Consistent	Extensive	
		Cucumber	*Cucumis sativus* L.	Scanty	Incidental	Moderate	
		Sponge gourgd	*Luffa cylindrica* Roemer	Scanty	Incidental	Low	
		Long melon	*Cucumis melo* L. var: *utilissimus*	Scanty	Incidental	Low	

		Okra	*Abelmoschus esculentus* (L.) Moench	Widespread	Consistent	Extensive	
		Brinjal	*Solanum melongena* L.	Widespread	Consistent	Extensive	
3.	*Tetranychus ludeni* Zacher	Cucumber	*Cucumis sativus* L.	Widespread	Consistent	Extensive	
		Long melon	*Cucumis melo* L. var: *utilissimus*	Scanty	Scarce	Low	
		Pumpkin	*Cucurbita moschata* Dutch	Scanty	Scarce	Low	
		Sponge gourd	*Luffa cylindrica* Roemer	Scanty	Incidental	Low	
		Okra	*Abelmoschus esculentus* (L.) Moench	Widespread	Consistent	Extensive	
		Brinjal	*Solanum melongena* L.	Widespread	Consistent	Extensive	
		Cowpea	*Vigna unguiculata* Walp	Widespread	Consistent	Extensive	
		Pointed gourd	*Trichosanthes dioica* Roxb	Widespread	Consistent	Extensive	
4.	*Eutetranychus orientalis* (Klein)	Ridge gourd	*Luffa acutangula* (Roxb.) L.	Scanty	Scarce	Low	
		Okra	*Abelmoschus esculentus* (L.) Moench	Scanty	Scarce	Low	
		Pointed gourd	*Trichosanthes dioica* Roxb	Scanty	Scarce	Low	
		Sponge gourd	*Luffa cylindrica* Roemer	Scanty	Incidental	Low	
(b)	**Family:- Tenuipalpidae**						
1.	*Brevipalpus phoenicis* (Geij.)	Bitter gourd	*Momordica charantia* L.	Scanty	Scarce	Low	Bottle gourd & Ridge gourd is new host
		Sponge gourd	*Luffa cylindrica* Roemer	Scanty	Incidental	Moderate	
		Ridge gourd	*Luffa acutangula* (Roxb.) L.	Scanty	Scarce	Low	
		Long melon	*Cucumis melo* L. var: *utilissimus*	Widespread	Incidental	Moderate	
		Bottle gourd	*Laginaria siceraria* Standle	Scanty	Scarce	Low	
		Okra	*Abelmoschus esculentus* (L.) Moench	Scanty	Scarce	Low	
		Brinjal	*Solanum melongena* L.	Scanty	Scarce	Low	
2.	*Brevipalpus californicus* (Banks)	*Bottle gourd*	*Laginaria siceraria* Standle	Scanty	Scarce	Low	
		Pumpkin	*Cucurbita moschata* Dutch	Scanty	Scarce	Low	
		Brinjal	*Solanum melongena* L.				
3.	*Brevipalpus creber* Chaudhri	Bitter gourd	*Momordica charantia* L	Scanty	Scarce	Low	
4.	*Brevipalpus rugulosus* Chaudhri Akbar & Rasool	Ridge gourd	*Luffa acutangula* (Roxb.) L.	Scanty	Scarce	Low	
(c)	**Family:- Tarsonemidae**						
1.	*Polyphagotarsonemus latus* (Banks)	*Bottle gourd*	*Laginaria siceraria* Standle	Widespread	Consistent	Extensive	
		Pumpkin	*Cucurbita moschata* Dutch	Widespread	Consistent	Extensive	
		Sponge gourd	*Luffa cylindrica* Roemer	Widespread	Consistent	Moderate	
		Brinjal	*Solanum melongena* L.	Scanty	Scarce	Low	
		Tomato	*Lycopersicun esculentum* Mill	Scanty	Scarce	Low	
		Pointed gourd	*Trichosanthes dioica* Roxb	Scanty	Scarce	Low	
B.	**Predatory mites Order:- Mesostigmata**						
(a)	**Family:- Phytoseiidae**						
1.	*Amblyseius indicus* (Narayanan & Kaur)	Bottle gourd	*Laginaria siceraria* Standle	Scanty	Scarce	Low	Cucumber is new host
		Pumpkin	*Cucurbita moschata* Dutch	Scanty	Scarce	Low	
		Cucumber	*Cucumis sativus* L.	Scanty	Scarce	Low	
		Brinjal	*Solanum melongena* L.				
2.	*Amblyseius largoensis* (Muma)	Bottle gourd	*Laginaria siceraria* Standle	Scanty	Scarce	Low	Long melon & cucumber is new host.
		Pumpkin	*Cucurbita moschata* Dutch	Scanty	Scarce	Low	
		Cucumber	*Cucumis sativus* L.	Scanty	Scarce	Low	
		Long melon	*Cucumis melo* L. var:	Scanty	Scarce	Low	

			utilissimus				
		Bitter gourd	*Momordica charantia* L	Scanty	Scarce	Low	
		Ridge gourd	*Luffa acutangula* (Roxb.) L.	Scanty	Scarce	Low	
		Okra	*Abelmoschus esculentus* (L.) Moench	Scanty	Scarce	Low	
		Brinjal	*Solanum melongena* L.	Scanty	Scarce	Low	
		Cowpea	*Vigna unguiculata* Walp	Scanty	Scarce	Low	
4.	*Amblyseius tetranychivorus* (Gupta)	Cucumber	*Cucumis sativus* L.	Scanty	Scarce	Low	
		Long melon	*Cucumis melo* L. var: *utilissimus*	Scanty	Scarce	Low	
		Sponge gourd	*Luffa 1366ylindrical* Roemer	Scanty	Scarce	Low	
		Okra	*Abelmoschus esculentus* (L.) Moench	Scanty	Scarce	Low	
		Brinjal	*Solanum melongena* L.	Scanty	Scarce	Low	
		Pointed gourd	*Trichosanthes dioica* Roxb	Scanty	Scarce	Low	
5.	*Amblyseius multidentatus* (Swirski & Schecter)	Cowpea	*Vigna unguiculata* Walp	Scanty	Scarce	Low	
C.	**Order:- Prostigmata**						
(a)	**Family:- Stigmaeidae**						
1.	*Agistemus industani* Gonzalez – Rodriguez	Bottle gourd	*Laginaria siceraria* Standle	Scanty	Scarce	Low	
		Pumpkin	*Cucurbita moschata* Dutch	Scanty	Scarce	Low	
		Brinjal	*Solanum melongena* L.				
		Bitter gourd	*Momordica charantia* L	Scanty	Scarce	Low	
2.	*Agistemus macrommatus Gonzalez – Rodriguez*	Bitter gourd	*Momordica charantia* L	Scanty	Scarce	Low	
b.	**Family:- Tydeidae**						
1.	*Pronematus fleschneri* Baker	Bitter gourd	*Momordica charantia* L	Scanty	Scarce	Low	
		Pumpkin	*Cucurbita moschata* Dutch	Scanty	Scarce	Low	
		Sponge gourd	*Luffa cylindrica* Roemer	Scanty	Scarce	Low	
		Ridge gourd	*Luffa acutangula* (Roxb.) L.	Scanty	Scarce	Low	

Table 2: Composition of mite species recorded on various summer vegetables in India and Jaunpur, Uttar Pradesh

S. No.	Order	Family	In Jaunpur, U. P.	
			No. of Genera	No. of Species
1.	Prostigmata	Tetranychidae	2	4
		Tenuipalpidae	1	4
		Tarsonemidae	1	1
		Stigmaeidae	1	2
		Tydeidae	1	1
		Tuckerellidae	0	0
		Chydeidae	0	0
2.	Mesostigmata	Phytoseiidae	1	4
Total	2	8	7	16

Table 3: Distribution of mites on different host plant at Jaunpur during 2021 and 2022

S. No.	Common Name	Botanical Name of Host Plant	Scientific Name of Mites
1.	Bitter gourd	*Momordica charantia* L.	1. *Tetranychus urticae* Koch*
			2. *Brevipalpus phoenicis* (Geij)
			3. *Brevipalpus creber* Chaudhri
			4. *Agistemus industani* Gonzalez – Rodriguez
			5. *Agistemus macrammatus* Gonzalez – Rodriguez
			6. *Pronematus fleschneri* Baker
			7. *Amblyseius largoensis* Muna
2.	Brinjal	*Solanum melongena* L.	1. *Tetranychus urticae* Koch*
			2. *Tetranychus macfarlanei* Baker & Pritchard*
			3. *Tetranychus ludeni* Zacher*
			4. *Brevipalpus phoenicis* (Geij)
			5. *Brevipalpus californicus* (Banks)
			6. *Polyphagotarsonemus latus* (Banks)
			7. *Agistemus industani* Gonzalez – Rodriguez

			8. *Amblyseius indicus* (Narayan &Kaur) 9. *Amblyseius largoensis* Muna
3.	Cowpea	*Vigna unguiculata* Walp	1. *Tetranychus ludeni* Zacher* 2. *Tetranychus macfarlanei* Baker & Pritchard 3. *Tetranychus urticae* Koch 4. *Amblyseius multidentatus* (Swirskie and Shechgter 5. *Amblyseius largoensis* Muna
4.	Cucumber	*Cucumis sativus* L	1. *Tetranychus urticae* Koch* 2. *Tetranychus macfarlanei* Baker & Pritchard* 3. *Tetranychus ludeni* Zacher 4. *Tyrophagus putrescentiae* (Schrank) 5. *Amblyseius largoensis* Muna 6. *Amblyseius tetanychivorus* Gupta 7. *Amblyseius indicus* (Narayan &Kaur)
5.	Okra	*Abelmoschus esculentus* (L.) Moench	1. *Tetranychus urticae* Koch* 2. *Tetranychus macfarlanei* Baker & Pritchard* 3. *Tetranychus ludeni* Zacher 4. *Eutetranychus orientalis* Klein 5. *Brevipalpus phoenicis* (Geij) 6. *Amblyseius largoensis* Muna 7. *Amblyseius tetanychivorus* Gupta
6.	Pointed gourd	*Trichosanthes dioica* Roxb	1. *Tetranychus ludeni* Zacher* 2. *Eutetranychus orientalis* Klein 3. *Amblyseius tetanychivorus* Gupta 4. *Polyphagotarsonemus latus* (Banks)
7.	Pumpkin	*Cucubita moschata* Ducth	1. *Tetranychus neocaledonicus* Andre* 2. *Tetranychus urticae* Koch 3. *Tetranychus macfarlanei* Baker & Pritchard* 4. *Tetranychus ludeni* Zacher 5. *Brevipalpus californicus* (Banks) 6. *Polyphagotarsonemus latus* (Banks) 7. *Agistemus industani* Gonzalez – Rodriguez
8.	Ridge gourd	*Luffa acutangula* (Roxb.) L.	1. *Eutetranychus orintalis* (Klein)* 2. *Brevipalpus phoenicis* (Geij) 3. *Brevipalpus rugulosus* Chaudhri Akbar & Rasool 4. *Pronematus fleschneri* Baker 5. *Amblyseius largoensis* Muna 6. *Amblyseius largoensis* Muna 7. *Amblyseius indicus* (Narayan &Kaur) 8. *Pronematus fleschneri* Baker
9.	Sponge gourd	*Luffa cylendrica* Roemer	1. *Tetranychus urticae* Koch* 2. *Tetranychus macfarlanei* Baker & Pritchard 3. *Tetranychus ludeni* Zacher 4. *Eutetranychus orintalis* (Klein)* 5. *Brevipalpus phoenicis* (Geij) 6. *Polyphagotarsonemus latus* (Banks) 7. *Amblyseius largoensis* Muna 8. *Pronematus fleschneri* Baker 9. *Amblyseius tetanychivorus* Gupta
10.	Tomato	*Lycopersicun esculentum* Mill	1. *Tetranychus urticae* Koch 2. *Polyphagotarsonemus latus* (Banks)*
11.	Bottle gourd	*Laginaria siceraria* Standle	1. *Tetranychus urticae* Koch 2. *Tetranychus macfarlanei* Baker & Pritchard* 3. *Brevipalpus phoenicis* (Geij) 4. *Brevipalpus californicus* (Banks) 5. *Polyphagotarsonemus latus* (Banks)* 6. *Amblyseius largoensis* Muna 7. *Amblyseius indicus* (Narayan &Kaur) 8. *Agistemus industani* Gonzalez – Rodriguez
12	Long Melon	*Cucumis melo* L. var: *utilissimus*	1. *Tetranychus urticae* Koch 2. *Tetranychus macfarlanei* Baker & Pritchard 3. *Tetranychus ludeni* Zacher* 4. *Brevipalpus phoenicis* (Geij) 5. *Tyrophagus putrescentiae* (Schrank 6. *Amblyseius largoensis* Muna 7. *Amblyseius tetanychivorus* Gupta

* Major pest

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