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On a collection of mites and insects occurring on some vegetable crops cultivated in Nerendrapur campus Ramakrishna Mission, West Bengal, India

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Abstract
The study conducted on occurrence of mites and insects on Summer and Winter vegetables crops cultivated in Narendrapur Ramkrishna Mission in West Bengal during September 2021 to April 2022, revealed the occurrence of a total of 13 species of mites under 9 genara 6 families and 3 orders and insects are represented by 12 species belonging to 7 genera 8 families and 3 orders from both the Summer and Winter vegetable crops during the present study period. These includes 5 species of phytophagous mites and 6 of prefatory mites. Among the insects, they belong to phytophagous group excepting one which was a predator. All the Mites and insects having lifted giving their respective host plants, collection data and importance has also been provided.

Keywords: Diversity, mites, insects, vegetables crops, Narendrapur Ramkrishna Mission, West Bengal, India

Introduction
India is the second largest producer of vegetables next only to china and contributes 13.88% of world population. India occupies first producer in ginger and okra, second in production of potatoes, onion, cauliflowers brinjal, and cabbage. Among the Indian states, West Bengal is the largest producer of vegetables. In the fiscal year 2021, the annual vegetable yield in India was about 18 metric tons per hectare. These vegetables include potatoes, tomatoes, onions and cabbages among others.

Narendrapur campus of Ramakrishna Mission grows a various types of summer and winter vegetables. Previous very some mites species were recorded by Gupta (2012) [2] and Ghosh, Debnath & Gupta (2017) [1] from Vegetable crops of West Bengal, but no detailed survey has ever been conducted as to what are the insects species which infest those vegetables, what type of damages they do inflict to the crops from Narendrapur campus of Ramakrishna Mission. Therefore the present was undertaken to record not only to record the insect pest faunal diversity but also to observe these insect/mite-pests association with various winter and summer vegetable crops cultivated in the different plots of Narendrapur campus of Ramakrishna Ashrama.

Materials and methods
1. Collection site
For the studying of diversity of mites and insects on summer and winter vegetable crops of Narendrapur campus of Ramakrishna mission during September 2021 to April 2022.

2. Host plant studied during the present study
The summer vegetable were - Chilli (*Capsicum annum*), Brinjal (*Solanum melongene*), Snake gourd (*Cucurbita pepo*), Bitter gourd (*Mormodica charantia*), Ridge gourd (*Luffa acutangula*), Bottle gourd (*Lagenaria siceraria*), Bhendi (*Abelmoschus esculentus*), Onion (*Allium cepa*), Green plantain (*Musa paradisica*), Seem (*Lablab nigar*), Point gourd (*Trichosanthes dioica*), sweet gourd (*Trichosanthes cucumerina*), Arum (*Colocasia esculents*), Round gourd (*Lagenaria siceraria*), Beans (*Phaseolus vulgaris*), Cow pea (*Vigna unguiculata*), Hyacinth bean (*Lablab purpureus*), sweet and chili pepper (*Capsicum annuvm*).

The winter vegetables were - Potato (*Solanum tuberosum*), Tomato (*Solanum lycopersicum*),

Cauliflower (*Brassica oleracea*), amaranthus (*Amaranthus virdis*), Papaya (*Carica papaya*), Cabbage (*Brassica oleracea* var. *capitata*), spinach (*Spinacia oleracea* L.), Radish (Raphanus *sativus*), coriander (Coriandrum sativum), methi (*Trigonella foenum-graecum*), onion (*Allium cepa*), Arum (*Arum lilies*), pea (*Pisum sativum*), Turnip (*Brassica rapa* subsp. Rapa), carrot (*Daucus carota*) etc.

3. Collection and preservation of Insects and mites

- **In case of insects**

Collection was done by using Hand picking and Sweep net method. Small sucking pest like aphids and mealy bugs and large sized caterpillars were handpicked. For storage and preservation the killing jars with potassium cyanide were used to killed large insects. The small insects were preserved in glass vials consisting of 70-90% ethyl alcohol. In many cases, the leaves were brought to laboratory in polythene bags covering the mouth tightly and examined under a stereo binocular microscope and the insect were collected from there.

- **In case of mites**

Leaves were examined in the field under a 20x hand lens and mites that were seen were collected with a fine brush moistened with alcohol and preserved in 70% alcohol. In many cases, the leaves were brought to laboratory in polythene bags covering the mouth tightly and examined under a stereo binocular microscope and mites were collected from there. The mounting was done in Hoyer's medium.

4. To study the intensity of damage

Depending upon the availability of plants, 10-20 plants were randomly selected and data pertaining to insect pests were recorded. The sampling of insects at each location was carried out at regular intervals.

The per cent plant infestation during the present survey was recorded using the following formula:

$$\text{Per cent infestation} = \frac{\text{Number of infested plants}}{\text{Total no. of observed plants}} \times 100$$

The nature of damage by each insect was observed. The immature stages of the insects recorded on the plants were collected and reared to adult stage in the laboratory for identification. Moreover, the Intensity of damage to the vegetables crops were also recorded based on visual observations vitz. Low: up to 10 per cent leaf infestation; Medium: 11-30% leaf infestation; High: beyond 30% leaf infestation following Sharma *et al*. (2014) [3].

Results and discussion

I. Survey and documentation of different insects and mites' pests occurring on

A. Summer vegetables

During the present survey a total of 11 mite species and insects 9 insect pests were observed in case of summer vegetables. These 11 mite species belongs to 4 family under 3 order. The 9 insect species which was found during the present work belongs to 6 family under 3 orders (Table 1).

Among the phytophagous mite, in the present study T. *macfarlanei* was found attacking beans, Bitter gourd, Bottle gourd, Brinjal quite seriously, *T. urticae* infesting spong gourd, *Brevipalpus californicus* on beans are the new pest records which are being reported here the first time.

Phytophagous Insects included aphid, *Henosepilachna vigintioctopunctata* were observed at high intensity infesting on their respective host plants.

B. In winter vegetables

In case of winter vegetable crops, 8 mite species belonging 4 family under to 3 order and 5 insect species belonging to 5 family under 3order were observed (Table 2).

In phytophagous mites *Tetranychus urticae* was found to be most serious pest causing damage to Amaranthus. In case of pea *Tetranychus neocaledonicus* mites colonized under surface of leaves and damage in same manner as in case of *Tetranychus urticae*, sometimes the infestation become so serious which lead to the death of the entire plant.

In case of phytophagous insects, aphids and black fly were recorded on cabbage of which the former was found to cause serious damage on cabbage, while the latter shows no serious damage to the crop.

II. Study on damage caused by insects and mites

During the present study Intensity of infestation made by Insect and mite pests on summer and winter vegetable plants recorded during survey at NRKMA are presented in the following Tables 3 & 4. The results obtained towards the damage plants are presented in the Tables 5 & 6. The study of intensity was based on visual observations.

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Table 1: Mite and Insect pests of summer vegetables recorded during the present survey at RKMN

List of vegetables examination	Occurrence of mite	Occurrence of insect
Summer		
Beans (*Phaseolus vulgaris*)	*Tetranychus urticae* Koch, 1836	*Aphis craccivora* Koch *Cornuaspis* sp. Scale insect
	Tetranychus neocaledonicus Ardre, 1933	
	Brevipalpus californicus (Banks, 1904)	
	Brevipalpus phoenicis Geijskes, 1939	
	Agistemus fleschneri (Summers)	
	Amblyscius paraaerialis Muma, 1967	
	Paraphytoseius orientalis (Narayanan, Kaur and Ghai)	
Bhendi (*Abelmoschus esculentus*)	*Tetranychus urticae* Koch, 1836	----------
Bitter gourd (*Mormodica charantia*)	*Tetranychus macfarlanei* Baker and Pritchard, 1960	----------
Bottle gourd (*Lagenaria siceraria*)	*Tetranychus macfarlanei* Baker and Pritchard, 1960	----------
Brinjal (*Solanum melanogena*)	*Tetranychus macfarlanei* Baker and Pritchard, 1960	*Scirtothrips* sp.

	Tetranychus neocaledonicus Ardre, 1933	*Thrips tabaci Lind* *Scymnus gracilis Savoiskaya* *Myzus persicae* (*Sulzer*) *Henosepilachna vigintioctopunctata*
	Tetranychus urticae Koch, 1836	
	Brevipalpus phoenicis Geijskes, 1939	
	Brevipalpus californicus (Banks, 1904)	
	Aceria lycopersici	
	Amblyscius largoensis (Muma, 1955)	
	Euseius alstoniae (Gupta, 1975)	
	Paraphytoseius orientalis (Narayanan, Kaur and Ghai)	
	Paraphytoseius bhadrakaliensis (Gupta, 1969)	
Chilli (*Capsicum frutescens*)	*Polyphagotarsonemus latus* (Banks,1904)	*scirtothrips* sp.
	Aceria lycopersicum (Wolffenstein)1879	
Onion (*Allium cepa*)		----------
Pointed gourd (*Trichosanthusdioica*)	*Brevipalpus phoenicis* Geijskes, 1939	----------
Ridge gourd (*Luffa acutangula*)		*Aphis craccivora Koch* *Ferrisia virgata Cockerell*
Round gourd (*Lagenaria siceraria*)		----------
Snake gourd (*Trichosanthes cucumerina*)	*Tetranychus macfarlanei* Baker and Pritchard, 1960	----------
Sweet gourd (*Ipomoea leatatas*)	*Tetranychus macfarlanei* Baker and Pritchard, 1960	----------
Sponge gourd (*Luffa aegyptiaca*)	*Brevipalpus obovatus* Donnadieu, 1857	----------

Table 2: Mite and Insect pests of winter vegetables recorded during survey at RKMN

List of vegetables examination	Occurrence of mites	Occurrence of insects
Winter		
Amaranthus (*Amaranthus cruentus*)	*Tetranychus urticae* Koch, 1836	*Aphis craccivora Kach*
Arum (*Colocasia esculents*)	*Brevipalpus californicus* (Banks, 1904)	*Ferrisia virgate* Cockerell *Pseudococcidae* sp. *Thrips larva*
Cabbage (*Brassica oleracea*)	*Agistemus fleschneri* (Summers)	*Black fly*
Cauliflower (*Brassica oleraceavar. botrytis*)	----------	----------
Coriander (*Coriander sativum*)	----------	----------
Methi (*Trigonella foenum-graecum*)	----------	----------
Onion (*Allium cepa*)	----------	----------
Carrots (*Daucus carota*)	----------	----------
Pea (*Pisum sativum*)	*Tetranychus neocaledonicus* Ardre, 1933	----------
Tomato (*Solanum lycopersicum*)	*Polyphagotarsonemus latus* (Banks, 1904) *Euseius alstoniae* (Gupta, 1975) *Paraphytoseius orientalis* (Narayanan, Kaur and Ghai)	----------
Turnip (*Brassica rapasubsp.rapa*)	----------	----------

Table 3: Intensity of infestation made by Insect pests on summer and winter vegetable plants recorded during survey at NRKMA

Family/order	Species	Hosts	Intensity	Plants part damage
Order – Hemiptera *A. Family-Aphididae*	*Aphis craccivora Kach*	Amaranthus Bean Cariander Ridge gourd	High	Leaves
	Myzus persicae (Sulzer)	Brinjal Cariander	Medium	Leaves
B. Family - Cicadelld	*Ferrisia virgata*Cockerell	Arum	Medium	Leaves
C. Family - Coccidae	Scale insect	Beans Cariander	High	Leaves
D. Family - Diaspidae	Scale insect	Beans Carianden	High	Leaves
E. Family - Pseudococcidae	*Pseudococcidae sp.*	Arum	Low	Leaves
2. Order- Thysanoptera *A. Family - Thripidae*	*Scirtothrips sp.*	Chilli Brinjal	Medium	Leaves and inflorescence
	Thripstabaci Lind	Brinjal	High	Leaves and inflorescence
	Thrips larva	Arum	Medium	Leaves
Order - Coleoptera *A. Family – Coccinella*	*Scymnus gracilis* Savoiskaya	Brinjal	Medium	Leaves
	Bettle larva	Brinjal	Medium	Leaves and apical twig
Order - Diptera *A. Family -Simuliidae*	Black fly	Cabbage	Medium	Leaves and inflorescence and apical twig

Where: *Low: up to 10 per cent leaf infestation; Medium: 11-30% leaf infestation; ** based on visual observations

Table 4: Intensity of infestation made by mite pests on summer and winter vegetable plants recorded during survey at NRKMA

Order/family	Species	Host	Intensity	Damaged
Order - Prostigmata A. Family - Tetranychidae	*1.Tetranychus macfarlanei* Baker & Pritchard,1960	1.Bitter gourd 2.Bottle gourd 3.Snake gourd 4.Sweet gourd	Medium	Leaves
	2.Tetranychus neocaledonicus Ardre,1933	1.Beans 2.Brinjal	High	Leaves and inflorescence

		3.Pea		
	Tetranychus urticae Koch,1836	1.Beans 2.Bhendi 3.Brinjal 4.Amaranthus	High	Leaves and inflorescence
2.order: Prostigmata A. Family -Tenuipalpidae	*Brevipalpus californiaus* (Banks, 1904)	1.Arum 2.Beans 3.Brinjal	Medium	Leaves
	5.*Brevipalpus phoenicis* Geijskes, 1939	1.Beans 2.Beinjal 3.Pointed gourd	Medium	Leaves
B. family - Tarsonemidae	6.*Polyphagotarsonemus latus* (Banks, 1904)	1.Chilly 2.Tomato	Low	Leaves
C. Family - Eriophyidea	7.*Aceria lycopersici* (Wolff., 1879)	1.Chilly 2.Brinjal 3.Tomato	Low	Leaves and inflorescence
D. Family – Stigmaeidae	8.*Agistemus fleschneri*	1.cabbage 2.Bean	Medium	Leave and inflorescence
Order - Mesostigmata A. Family – Phytoseiidae	9.*Amblyseius largoensis* (Muma, 1955)	1.Brinjal	Medium	Leaves
	10. *Amblyscius paraaerialis Muma, 1967*	1.Beans	Medium	Apical twig
	11.*Euseius alstoniae*	1.Brinjal 2.Tomato	Low	Leaves
	12. *Paraphytoseius bhadrakaliensis* (*Gupta, 1969*)	1.Brinjal	Medium	Leaves
	13.Paraphytoseius orientalis	1.Beans 2.Brinjal 3.Tomato	Medium	Leaves

*Low: upto 10 per cent leaf infestation; Medium: 11-30% leaf infestation; ** based on visual observations

Table 5: Per cent infestation by the mite pests on the host plants:

Host	Mite pests		
	Number of infested plants	Total number of observation plants	Per cent infestation
Bitter gourd	25	80	31.25
Bottle gourd	30	85	35.29
Beans	60	250	24
Brinjal	40	190	21.05
Bhendi	29	70	41.42
Amaranthus	20	80	25
Arum	12	50	24
Chilly	25	90	27.77
Cabbage	13	70	18.57
Pea	25	90	27.77
Pointed gourd	21	50	42
Tomato	10	50	20
Snake gourd	20	80	25
Sweet gourd	20	87	22.98

Table 6: Per cent infestation by the insect pests on the host plants:

Host	Insect pests		
	Number of infested plants	Total number of observation plants	Per cent infestation
Amaranthus	25	80	31.25
Arum	7	50	14
Beans	37	250	14.8
Brinjal	45	190	23.68
Carianden	29	90	32.22
Chilly	29	90	32.22
Cabbage	10	70	14.28
Ridge gourd	23	90	25.55

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