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Some mites and insects occurring on medicinal plants from medicinal plant gardens located in and around Kalyani, West Bengal

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Abstract
The present paper reports the occurrence of 22 species of mites belonging to 16 genera, 7 families and 3 orders as well as 11 species of insects under as many genera, 7 families and 3 orders, collected from medicinal plants from different medicinal plant gardens located in and around Kalyani during September 2021 to April 2022. Altogether 10 species of mites under 6 genera, 3 families belong to phytophagous group, 10 species of mites under 7 genera and 2 families belong to predatory group and 3 species of mites under as many genera and families belong to fungal feeding group. Out of these mite species, 2 species (*Eotetranychus indicus* and *Oligonychus indicus*) were found highly injurious causing damage to their respective host plants while 2 species, *viz*. *Neoseiuslus longispinosus* on *Tetranychus neocaledonicus* and *Paraphytoseius orientalis* on *Polyphagotarsonemus latus* were found as potential predators helping in biological control. Among the 11 species of insects, *Aphis craccivora* on *Mentha arvensis*, *Aphis gossypii*, *Aphis nerii*, both on *Calotropis procera* and *Monanthia globulifera* on *Ocimum sanctum* were important pests doing noteworthy damage on their respective host plants. All the species are listed with their hosts/habitat records, collection data and importance as pests/predators, if any.

Keywords: Mites, insects, diversity, medicinal plants, Kalyani, West Bengal, India.

Introduction
The medicinal plants are important for their therapeutic values and are used for over thousands of years by the Indians in health care systems. This apart in the present days these plants are also used quite extensively for different other purposes like nutraceuticals, health drinks, cosmetics, toiletries, coloring, flavorings and dyeing agents, phytopesticides, etc. In view of these, the medicinal plants have invited attention of a large section of people not only in India but also in many other parts of the world. To meet this growing demand, large scale cultivation of medicinal plants has been started in India. With the increase in cultivation, the pest population including mites and insects has also increased. Some attempts have been made to explore mites and insects from medicinal plants from different parts of the country and some such references are Lal & Mukherjee (1977) [13] on mites; Ghosh & Gupta (2003) [2] on mites; Ghosh & Singh (2004) [1] on insects; Lahiri *et al*. (2004) [7]; Gupta *et al*. (2005) [3]; Roy, Gupta, Saha (2007, 2008) [11, 12]; Gupta and Mondal (2016) [4]; Mondal & Gupta (2016) [8] on mites; Gupta & Bose (2017) [5]; Mondal & Gupta (2019) [9]; Mondal & Gupta (2021) [10]. Gupta (2005) [3] reviewed the occurrence of insects and mites from medicinal plants in India. In his book, he reported 463 species of insects and 280 species of mites from India, known till that time. However, Kalyani, a rich area for medicinal plants in West Bengal, has not been properly explored by the earlier workers. In order to fill -in the gap, the present study was taken up, though for a very brief period, to collect and identify the mites and insects from medicinal plants which are abundantly grown in the targeted area and the results thereof is presented in this paper.

Materials and Methods
Different medicinal plant gardens located in and around Kalyani (District-Nadia, West Bengal) were, visited for collection of mites and insects during September 2021 to April 2022. All the available medicinal plant species were examined in the field itself under 20Xhand lens and mites and insects were collected with the help of a brush moistened with ethyl alcohol and preservation was done in 70% alcohol.

Sometimes, for better collection, the plant samples were collected from the field in polythene bags and brought to the laboratory for examination under stereo binocular microscope.

Result and Discussion

The identification of mites and insects collected from different medicinal plant gardens located in and around Kalyani during September 2021 to April 2022 revealed the occurrence of a total number of 22species of mites belonging to 16 genera, 7 families, 3 orders swell as 11 species of insects under as many genera, 7 families and 3 orders. These included 10 species of mites under 6 genera, 3 families which belonged to phytophagous group. 10 species of mites under 7 genera, 2 families belonged to Predatory group and 2 species were there which were fungal associated. Out of the mite species, *Eotetranychus indicus* on *Ocimum sanctum* and *Oligonychus indicus* on *Cymbopogon citratus* were found injurious to their respective host plants while *Neoseiulus longispinosus* preying upon *Tetranychus neocaledonicus* and *Paraphytoseius orientalis* preying upon *Polyphagotarsonemus latus* were important predatory species. Among the 11 species of insects, the most injurious species were *Aphis craccivora*, *Aphis gossypii* and *Aphis nerii*, all on *Calotropis procera* and *Monanthia globulifera* on *Ocimum sanctum* and these were injurious and damage causing insects on their respective host plants. All the species of mites and insects have been listed in Table-1 and Table-2, respectively.

In addition, another list (Table-3) has been given which included list of mite and insect species against each of the medicinal plants (Plant Hosts/ Habitats- Mites/ Insects list) along with the therapeutic values of the medicinal plants dealt with in this paper.

Gupta (2005) [3] in his book reported the occurrance of mites and insects known from medicinal plants in India and some of the species of mites belonging to Oribatida (*Scheloribates (Scheloribates) fimbriatus*) Phytoseiidae (*Amblyseius orientalis*, *Paraphytocius multidentalis*) Tetranychidae (*Eotetranychus indicus*) and Tarsonemidae (*Daidalotarsonemus* sp.), Teneupalpidae (*Brevipalpus essigi*) are being reported here for the first time in addition some insects like *Poophilus costalis*, *Chrysocoris stolhi*, *Caliothrips indicus* were also unknown earlier on medicinal plant. In fact some of the insects belonging to Lepidoptera, Orthoptera, Hymenoptera, which were reported earlier workers on medicinal plants could not be recorded in the present study. May be, if more intensive studies are conducted many insects from representing different orders could be recorded.

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Table-1: List of mites (phytophagous/ predators/ fungal associated) collected from medicinal plants in and around Kalyani during September 2021 to April 2022

Mite Species Recorded	Medicinal Plants	Date of Collection	Locality	Remarks
A. Phytophagous group Family-I Tetranychidae			**Kalyani Medicinal Plant Garden and adjoining areas**	
1. *Eotetranychus indicus* Gupta & Gupta	*Ocimum sanctum*	28/09/21, 31/10/21, 04/12/21, 29/03/22		Colony observed on under surface of leaves, feeding caused chlorosis.
2. *Eotetranychus syzygii* Gupta & Gupta	*Ocimum sanctum*	25/10/21, 29/11/21 04/12/21, 29/03/22		No damage symptoms, poor population.
3. *Oligonychus indicus* (Hirst)	*Cymbopogon citratus*	08/09/21, 21/12/21, 28/02/22		Serious infestation seen on under surface of leaves, feeding produced striplings arranged in linear rows.
4. *Tetranychus ludeni* Zacher	*Mentha arvensis*	08/11/21, 21/12/21, 15/03/22		Poor or stray population observed on lower leaf surface, only damage symptoms included pale yellowing of leaves.
5. *Tetranychus neocaledonicus* Andre	*Ocimum sanctum*	18/10/21, 15/12/21, 28/01/21, 23/03/22		Population was not heavy, damage, symptoms not noticed.
Family-II Tenuipalpidae				
6. *Brevipalpus essigi* Baker	*Ocimum sanctum*	18/10/21, 29/11/21, 12/02/22		Only a couple of specimens collected, no damage done.
7. *Brevipalus obovatus* Don adieu	*Murraya koenigii*	22/09/21, 25/12/21, 10/03/22		Occurred on undersurface of leaves, brownish patches were produced at points of feeding.
8. *Brevipalpus phoenicis* Geij	*Catharanthus roseus*	16/11/21, 28/02/22, 10/03/22		Occurred on undersurface of leaves, produced brownish patches at points of feeding.
Family-III Tarsonemidae				
9. *Daidalotarsonemus* sp.	*Calendula officinalis*	31/10/21, 21/12/21, 04/02/22		Found moving fast on undersurface of leaves having some garbage-like substances on dorsal body surface of mites.

10. *Polyphagotarsonemus latus* Banks	*Ocimum gratissimum*	22/09/21, 28/02/22, 10/03/22		Feeding produced curling of apical leaves.
B. Predatory group Family-IV Ascidae				
11. *Lasioseius quadrisetosus* Chant	*Piper chaba* Blume	28/12/21, 17/02/22, 15/03/22		Predatory mite, but its feeding on any prey mite was not observed.
Family-V Phytoseiidae				
12. *Ambyseius largoensis* (Muma)	*Eupatorium tripilinerve*	04/10/21, 15/12/21, 31/01/22		Regularly encountered, but its importance was unknown, as no prey mite was seen associated with it.
13. *Amblyseius orientalis* Ehara	*Ocimum sanctum*	08/01/22, 28/02/22, 15/03/22		Casual encounter, importance not known though it belongs to predatory group.
14. *Euseius ovalis* (Evans)	*Bixa orellana*	16/11/21, 21/01/22, 29/03/22		Commonly occurred in association with coccids.
15. *Neoseiulus longispinosus*(Evans)	*Ocimum sanctum*	28/12/21, 15/01/22, 17/02/22		It is well known predatory mite, found in association with *T. neocaledonicus* Observed to feed on immature stages of prey mite when, infested leaves were examined under stereo binocular microscope in lab.
16. *Paraphytocius multidentalis* (Swirskiz, Shechter)	*Cymbopogon martinii*	08/11/21, 28/12/22, 15/03/22		Predatory Mite Importance unknown.
17. *Paraphytoseius orientalis* (Narayan, Kaur & Ghai)	*Ocimum basilicum*	25/10/21, 28/12/21, 29/03/22		Occurred abundantly in association with *Polyphagotarsonemus latus.*
18. *Typhlodromips syzygii* Gupta	*Mentha arvensis* L.	08/11/21, 04/11/22, 31/01/22		Occasionally occurred.
19. *Phytoseius kapuri* Gupta	*Ocimum sanctum*	29/11/21, 31/01/22 28/02/22		It was found associated with *Polyphagotarsonemus latus.*
C. Fungal Feeding Family-VI Austrachipteriidae				
20. *Lamellobates* sp.	*Cymbopogon citratus*	08/11/21, 17/02/22, 29/03/22		Belongs to fungal feeding group.
Family-VII Galumnidae				
21. *Galumna* sp.	*Mentha arvensis* L.	04/10/21, 28/02/22, 15/03/22		Belongs to fungal feeding group.
Family-VIII Scheloribatidae				
22. *Scheloribates (Scheloribates) fimbriatus* Thor	*Elettaria cardamonum*	22/09/21, 31/01/22		Belongs to fungal feeding group.

Table 2: List of insects collected from medicinal plants at Kalyani and surrounding areas.

Insects species recorded	Medicinal Plants	Date	Locality	Remarks
A. Hemiptera Family- I Aphididae			**Kalyani Medicinal Plant Garden and adjoining areas**	
1. *Aphis craccivora* Koch	*Mentha arvensis* L.	28/12/21, 17/02/22, 10/03/22		The sucking of leaves made those yellowish discolourations on undersurface of leaves.
2. *Aphis gossypii* Glover	*Calotropis procera*	18/10/21, 04/02/22, 29/03/22		The sucking of leaves made those yellowish. It colonized on undersurface of leaves.
3. *Aphis nerii* (BDF)	*Calotropis procera*	04/10/21, 15/12/21, 10/02/22, 15/03/22		The sucking of leaves made those yellowish. It colonized on undersurface of leaves.
4. *Aphis* sp.(undetermined)	*Olax scandens* Roxb.	25/11/21, 04/12/21, 17/02/22		The sucking of leaves made those yellowish. It colonized on undersurface of leaves.
Family- II Cercopidae				
5. *Poophilus costalis* Walker	*Ocimum gratissimum*	08/09/21, 21/12/21, 15/01/22, 22/03/22		It produced froth-like secretion on leaves and young twigs within which, the nymphs could be found. It caused no damage.
Family-III Pentatomidae				
6. *Chrysocoris stolhi* (Wolff)	*Ocimum sanctum*	16/11/21, 21/12/21, 17/02/22, 29/03/22		Found on leaves, no damage symptoms produced, poor population.
Family-IV Tingidae				
7. *Monanthia globulifera* Walk.	*Ocimum sanctum*	22/09/21, 28/12/21 29/03/22		These black insects were found in plenty on undersurface of leaves especially near the petiolar attachment where they produced yellowish patches.
B. Coleoptera Family-V				
8. *Henosepilachna*	*Datura metel*	14/09/21, 15/12/21,		The feeding produced network like

vigintioctopunctata F.		17/02/22, 29/03/22		appearance on the leaves because of feeding upon chlorophyll and leaving behind only network of veins.
Family-VI Chrysomelidae				
9. *Aspidomorpha* sp.	*Ficus religosa*	18/10/21, 28/12/21, 10/03/22		Its feeding made the leaf lamina perforated and became yellowish.
C. Thysanoptera Family-VII Thripidae				
10. *Caliothrips indicus* (Bagnall)	*Ocimum sanctum*	31/10/21, 21/12/21, 17/02/22, 29/03/22		It caused production of silvery white patches on leaves.
11. *Thrips* sp.	*Mentha arvensis* L.	25/11/21, 28/12/21, 31/01/22, 10/03/22		It caused production of silvery white patches on leaves.

Table 3: Name of the medicinal plants with their therapeutic values and list of Mites and insects collected therefrom

Name of the medicinal Plants	Therapeutic values	Mite species recorded	Insect Species recorded
1. *Bixa orellana*	Antipyretic, aphrodisiac, antidiarrheal, antidiabetic, insect repellent.	Family- Phytoseiidae *Euseius ovalis* (Evans)	
2. *Calotropis procera*	Antidote for snake bite, sinus fistula, rheumatism, mumps, burn injuries, body pain.		Family- Aphididae *Aphis gossypii* Glover *Aphis nerii* (BDF)
3. *Calendula officinalis*	Muscle spasms, menstrual periods cramp, reduce fever, stomach and duodenal ulcers.	Family- Tarsonemidae *Daidalotarsonemus*sp.	
4. *Catharanthus roseus*	Muscle pain, depression, also used for applying to wasp sting, heal wounds.	Family- Tenuipalpidae *Brevipalpus phoenicis* (Geij.)	
5. *Cymbopogon citratus*	Antipasmodic, analgesic, antiseptic, gastrointestinal disorder and fever treatment.	Family- Tetranychidae *Oligonychus indicus* (Hirst) Family- Austrachipteriidae *Lamellobates* sp.	
6. *Cymbopogon martinii*	Joint pain, respiratory diseases, anorexia, intestinal worms, skin diseases.	Family- Phytoseiidae *Paraphytoseius multidentatus* (Swirskiz, Shechter)	
7. *Datura metel*	Epilepsy, hysteria, insanity, heart diseases, fever.		Family- Coccinellidae *Henosepilachna Vigintioctopuncta* F.
8. *Elettaria cardamomum*	Indigestion, nausea, vomiting and used to expel out phlegm out of body.	Fungal Feeding Family- Scheloribatidae *Scheloribates fimbriatus* Thor	
9. *Eupatorium triplinerve* Vahl.	Antibacterial, anti-fungal, antiinflammatory, antiulcer activity.	Family- Phytoseiidae *Amblyseius largoensis* (Muma)	
10. *Ficus religiosa*	Asthama, diabetes, epilepsy, gastric problems, infectious and sexual disorders.		Family- Chrysomelidae *Aspidomorpha* sp.
11. *Mentha arvensis* L.	Hypertension, heart diseases, diarrhea, dysentery and stomach problems.	Family- Tetranychidae *Tetranychus ludeni* Zacher Family- Phytoseiidae *Typhlodromips syzygii* Gupta Family- Galumnidae *Galumna* sp.	Family- Aphididae *Aphis craccivora* Koch Family- Thripidae *Thrips* sp.
12. *Murraya koenigii*	Piles, inflammation, itching, fresh cuts, edema.	Family- Tenuipalpidae *Brevipalpus obovatus* Donnadieu	
13. *Ocimum basilicum*	Headaches, cough, diarrhea, constipation, warts, worms, kidney malfunctions	Family - Phytoseiidae *Paraphytoseius orientalis* (Narayan, Kaur & Ghai)	
14. *Ocimum gratissimum*	Antidiarrhea, bronchitis, conjunctivitis, skin infections.	Family - Tarsonemidae *Polyphagotarsonemus latus* (Bank)	Family - Cercopidae *Poophilus costalis*Walker
15. *Ocimum sanctum*	Antifertility, anticancer, antidiabetic, antifungal, analgesic, cardioprotective, adaptogenic, diaphoretic actions.	Family- Tetranychidae *Eotetranychus indicus* Gupta & Gupta *Tetranychus ludeni* Zacher *Tetranychus neocaledonicus*Andre Family- Tenuipalpidae *Brevipalpus essigi* Baker Family- Phytoseiidae *Amblyseius orientalis* Ehara *Phytoseius kapuri* Gupta	Family - Tinigidae *Monanthia globulifera* Walk. Family- Pentatomidae *Chrysocoris stollii* (Wolff.) Family - Thripidae *Caliothrips indicus* (Bagnall)
16. *Olax scandens* Roxb.	Anaemia, diabetes, fever.		Family- Aphididae *Aphis* sp.
17. *Piper chaba Blume*	Chronic bronchitis, Asthama, constipation, gonorrhea, viral hepatitis, stomachache.	Family- Ascidae *Lasioseius quadrisetosus* Chant	

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