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Mites and insects occurring on some leafy ornamentals and floricultural plants in Howrah and Purba Medinipur districts of West Bengal, with their economic importance

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Abstract
The present paper deals with a total of 26 species of mites under 10 families, 17 genera and 3 orders as well as 10 species of insects under 5 families, 9 genera and 3 orders, collected from some floricultural and leafy ornamental plants in Howrah and Purba Medinipur districts of West Bengal. It may be mentioned here that these two districts are the largest producers of these plants. Among the mites, there are 14 species under 4 families and 8 genera which belong to phytophagous group, 10 species under 4 families and 7 genera belong to predatory group and remaining 2 species under as many families and genera belong to fungal feeding group. All the species of mites and insects are listed with their respective host/habitat plants, collection localities as well as their economic importance, if any. The most injurious species of mites which were observed in the field are *Tetranychus urticae* on *Dahlia variabilis*, *Oligonychus biharensis* on *Rosa centifolia*, *Eutetranychus orientalis* on *Tabernaemontana divaricata* and, *Eotetranychus suginamensis* on *Nyctanthes arbor-tristis.* Among the predatory mites, *Amblyseius largoensis* and *Amblyseius herbicolus* are important predators on phytophagous mites and the occurrence of the other predatory mites are only occasional. Among the insects, *Ferrisia virgata*, *Aphis gossypii* and *Scirothrips* sp. on *Codiaeum variegatum*, and *Ferrisia virgata* on *Hibiscus rosa-sinensis*, respectively were found abundantly.

Keywords: Phytophagous mites, predatory mites, insects, leafy ornamentals, floricultural plants, West Bengal

Introduction
West Bengal is one of the largest producers of floricultural and leafy ornamental plants in India sharing 9% of total crop production and as much as 29,000 hectares of land are dedicated to flower farming. The present data given here is as per West Bengal State Food Processing & Horticulture Development Corp Ltd. (2019). West Bengal produces around 77,246 Metric Tonnes (MT) of loose flowers and 148.09 crores of cut flowers. Among the different districts of West Bengal, Howrah (covering 1.347 ha land under floriculture cultivation and producing 3.353 MT of loose flowers and 4.760 crore sticks) and Purba Medinipur (5.849 ha under flower cultivation producing 15.015 MT of loose flowers and 261.85 crore sticks of cut flowers) are the leading producers of these plants. The flowers of these two districts largely cater the demand of the entire state. Among the flowers, both summer and winter flowers are grown and those include:-Rose (*Rosa centifolia*), Tuberose (*Polianthes tuberosa*), Hibiscus (*Hibiscus rosa-sinensis*), carnation (*Dianthus caryophyllus*), Gerbera (*Gerbera jamesonii*), sunflower (*Helianthus annuus*), Marigold (*Tagetes erecta*), Chrysanthemum (*Chrysanthemum indicum*), leafy ornamental plant like *Codiaeum variegatum* (5 varieties) were found dominant. A large number of floricultural and leafy ornamental plants are moderate to severely attacked by a number of insect and mite pests and those, in many cases, cause threats to the flower cultivation. Sometimes, the growers incur huge loss because of pest attack. Unfortunately, not much study has been undertaken earlier on the mites and insects occurring on these plants particularly in those two districts. With a view to generating some data in this aspect, surveys were undertaken in Howrah and Purba Medinipur districts of West Bengal during September 2021 to April 2022 and a good number of mites and insects were collected from 23 species of

floricultural and leafy ornamental plants. The present paper is based upon identification of those mites and insects. While making collection, observations were recorded as regards their nature of association with the host plants regarding phytophagous group and plant habitats and associated press in case of predatory group. Chadha (2010) had given detailed information about floriculture in India. Some of the works done in this area are Mohanasundaram (1987) [10], Chatterjee and Gupta (1995) [1] Jose *et al.* (1999) [6], Dhooria (1999, 1999a) [2, 3], Prasad Kumar (2007) [8], Karmakar *et al.* (2010) [7] etc. Gupta (1985, 2012), reviewed occurrence of mites on these plants from India, while Pal and Sarkar (2009) [11], Prithiv Raj *et al.* (2019) [13], Sundararaj *et al*. (2021) [15], etc. reviewed the occurrence of insects on these plants in India.

Materials and Method

The collection of insects and mites was made during September 2021 to April 2022 from various flower gardens located in two districts of West Bengal *viz.* Howrah and Purba Medinipur which are the two leading districts for cultivation of these plants. The localities which were visited for collection were Uluberia (Latitude: 22° 28' 12.00" N and Longitude: 88° 06' 36.00" E), Bagnan (Latitude: 22° 28' 12.00" N and Longitude: 87° 58' 12.00" E), Domjur (Latitude: 22° 38' 24.00" N and Longitude: 88° 13' 12.00" E) in Howrah district and Khirai (Latitude: 22° 22' 28.00"N Longitude: 87° 41′ 47.86″ E), Panskura (Latitude:22° 23' 44.0952" N and Longitude: 87° 44' 30.7752" E), Gotpota (Latitude:22.3874° N and Longitude: 87.6889° E) and adjoining areas in Purba Medinipur district. As many as 21 collection trips were conducted during the mentioned period. The mites and insects were collected in the field itself with the help of a fine brush moistened with ethyl alcohol and those were preserved in 70% ethyl alcohol. Many a times, the infested leaves/twigs were collected in the field in polythene bags and brought to the laboratory for examination under stereobinocular microscope. Mites/insects were collected and preserved in the same manner as mentioned earlier. While collecting, observations were recorded as to behaviour of the mites/insects whether those were feeding upon the concerned plants (for phytophagous insects/mites along with type of damage and whether they were feeding upon prey species, in case of predatory group). The entire identification of mites was done by the 3rd author in collaboration with the 1st author while the insect specimens were identified by the 2nd author.

Results and Discussion

The mites and insects which were identified revealed the occurrence of 26 species of mites under 10 families, 14 genera and 3 orders which included 14 species under 4 families and 8 genera as phytophagous, and 10 species under 4 families and 7 genera as predatory and 2 species under 2 families and 2 genera were fungal associated. Among mites, the species *viz*. *Amblyseius largoensis*, *Amblyseius herbicolus* were important predators. The insects belonged to 10 species under 5 families, 9 genera and 3 orders, of those, *Scolothrips sexmaculatus* was a predatory species while all others were phytophagous in nature.

All the species of mites and insects have been listed in Table-1 and Table- 2 respectively which provide their host/habitat plants, localities and importance as pests/predators and those Tables are self-explanatory.

In addition, a separate list of plant Hosts/Habitats and Mites, Insects has also been provided in Table-3.

On the basis of the preliminary studies, on occurrence of mites and insects on floriculture and ornamental plants from Howrah and Purba Medinipur districts of West Bengal, it revealed the occurrence of 26 species of mites and 10 species of insects. The result of such a short duration study revealing a good number of mites and insects give enough evidence that these two regions are indeed rich which these types of plants (examined 23 plant species) and that contributed for richness of mite and insect species also. Hence, it is quite obvious that more study if conducted in future will bring into light many more species and some of which might be very interesting also. Gupta (1985, 2012) [4, 5] while reporting mites on various types of crops including floriculture and ornamental plant in India, reported over 70 species of mites belonging to both phytophagous and predatory groups on ornamental and floricultural plants from India. Earlier workers like-Mohanasundaram (1987) [10], Chatterjee and Gupta (1995) [1], Dhooria (1999, 1999a) [2, 3], Jose *et al*. (1999) [6], Prasad kumar (2007) [8], Karmakar *et al*. (2010) [7], Patil *et al.* (2014) [12], Shah and Shukla (2014) [14], etc. contributed substantially towards exploring mites on these plant from India. Some of the recent works in this area are Pal and Sarkar (2009) [11] on pest on ornamental plants in West Bengal. Prithiv Raj *et al.* (2019) [13], Sundararaj *et al.* (2021) [15] reported insects on these plants dominated by Aphids, Thrips and some Hymenopteran, Neuropteran insects, Aleyrodids etc. According to these authors, the mite infestation on these plant was minimum. Pal and Sarkar (2020) while reviewing pest of important commercial flowers reported yellow mite, red spider mite, aphids and white fly were the major pests. The observation made by the present authors support their observations as in the present study also spider mite, yellow mite, aphids were the major pests. Through the present study, two potentially important predatory mites, *viz. Amblyseius largoensis* and *Amblyseius herbicolus* and an insect predator, *Scolothrips sexmaculatus* were reported. More intensive study will throw further light as how best those predators can be successfully utilized in suppression of mites and insects pest species.

Table 1: List of mites collected on floricultural plants and leafy ornamental plants from Howrah and Purba Medinipur districts of West Bengal during September 2021- April 2022.

A. Phytophagous mite

SI No	Name of Species	Host /Habitat Plants	Locality	Date of Collection	Remarks
Order I: Trombidiformes Suborder: Prostigmata. Family I: Tetranychidae					
1	*Eutetranychus maximae* Nassar & Ghai	*Rosa chinensis* (China rose/Bengal rose), *Hibiscus rosa-sinensis* (Hibiscus)	Khirai (Purba Medinipur), Domjur (Howrah)	03.1.2022 & 15.01.2022	Causing chlorosis.
2	*Eutetranychus orientalis* (Klein)	*Tabernaemontana divaricata*	Bagnan (Howrah)	12.03.2022	This mite occurred on under surface of leaf producing brownish patches.
3.	*Eotetranychus hirsti* Pritchard & Baker	*Bauhinia purpurea, Nyctanthes arbor-tristris*	Uluberia (Howrah) Khirai (Purba Medinipur)	17.10.2021 & 04.09.2021	Stray occurrence of this mite was found on under surface of leaf but due to poor population no damage was caused to the host. This mite is more common on fig tree, causing chlorosis.
SI No	**Name of Species**	**Host/Habitat Plants**	**Locality**	**Date of Collection**	**Remarks**
4.	*Eotetranychus suginamensis* Yokoyama	*Codiaeum variegatum* (var. Bush on fire)	Panskura (Purba Medinipur)	11.12.2021	The population of this mite was too poor to cause any damage to its host. This is an important pest of Mulberry. *Euseius ovalis* was found associated with this mite.
5.	*Eotetranychus truncatus* Estebanes & Baker	*Codiaeum variegatum* (var.Croton Mammy)	Uluberia (Howrah)	28.01.2022	This mite was found along with a predatory Phytoseiidae mite, *Amblyseius largoensis* which was found feeding when the infested leaf was examined under the stereo binocular microscope. *Euseius ovalis* was also found associated but their feeding was not observed.
6.	*Oligonychus biharensis* (Hirst)	*Rosa centifolia* (Rose)	Khirai (Purba Medinipur)	03.01.2022	Feeding caused discolouration and drying of leaves.
SI No	**Name of species**	**Host/habitat plants**	**Locality**	**Date of collection**	**Remarks**
7.	*Schizotetranychus cajani* Gupta	*Pseudophoenix sargentii* (var. Florida cherry palm)	Bagnan (Howrah)	27.09.2021	This was found on undersurface of leaf, causing no damage though it is an important pest of *Cajanus cajan* causing yellowing of leaves. One Iolinidae predatory mite was found associated with this host but whether it was a predator upon any stage of *Schizotetranychus cajani* is not known with certainty. Otherwise, this mite feeds on spider mites' egg.
8.	*Tetranychus macfarlanei* Baker & Pritchard	*Magnolia champaca*	Gotpota (Purba Medinipur)	26.03.2022	The population was poor and no damage was done.
9	*Tetranychus neocaledonicus* Ardre	*Dahlia variabilis* (Dahlia)	Khirai (Purba Medinipur)	06.02.2022	Infestation of this mite on Dahlia was seen during February 2022. It colonized on under surface of leaf producing yellowish spots at the points of feeding.
SI No	**Name of species**	**Host/habitat plants**	**Locality**	**Date of collection**	**Remarks**
10	*Tetranychus urticae* Koch	*Rosa centifolia* (Rose), *Petunia alba* (Petunia), *Dahlia variabilis* (Dahlia), *Dianthus caryophyllus* (Carnation),*Polyanthes tuberosa*(Tuber	Gotpota (Purba Medinipur), Uluberia (Howrah), Khirai (Purba Medinipur), Bagnan (Howrah), Domjur (Howrah)	23.12.2021, 28.01.2022,6.02.2022, 20.02.2022 & 03.04.2022	Tetranychus infestation was noticed on undersurface of leaf and colony was observed. An uncommon Phytoseiidae mite (*Indoseiulus eharai*) was associated with this mite and found voraciously feeding on Tetranychus mite assuming reddish colour. Infested leaf dried up due to chlorosis.

		rose).			
Family II: Tenuipalpidae					
11.	*Brevipalpus phoenicis* (Geijskes)	*Rosa chinensis* (China rose/Bengal rose)	Bagnan (Howrah)	20.02.2022	Caused leaf browning.
Family III: Eriophyidae					
12.	*Aceria jasmini* Channa Basavanna	*Jasminum auriculatum* (Jasmine)	Khirai (Purba Medinipur)	01.03.2022	This mite occurred on undersurface of leaf and feeding induced production of erineum.
13.	*Aceria nerii* Channa Basavanna	*Nerium indicum* (Indian Oleander)	Panskura (Purba Medinipur)	26.03.2022	It was found as vagrant.
Si No	**Name of species**	**Host/habitat plants**	**Locality**	**Date of collection**	**Remarks**
Family IV: Tarsonemidae					
14	*Polyphagotarsonemus latus* (Banks)	*Tagetes erecta* (Marigold)	Gotpota (Purba Medinipur)	20.11.2022	This mite infested apical leaves causing curling and drying of leaves.

B. Predatory mite

Si no	Name of species	Host/habitat plants	Locality	Date of collection	Remarks
Family V: Eupodidae					
15.	*Eupodes sigmoidensis* Strandtmann & Goff	*Ixora coccinea*	Khirai (Purba Medinipur)	04.09.2021	This is a rarely occurring mite and it has been reported only from a limited plants. It's feeding habit is not known with certainty but more likely this is a predatory mite feeding upon spider mites' egg. It is having an interesting behaviour that is, whenever attempt was made to collect it, this mite jumped and escaped.
Family VI: Iolinidae					
16.	*Parapronematus cameliae* Gupta	*Pseudophoenix sargentii* (Florida cherry palm)	Uluberia (Howrah)	17.10.2021	This is not known to occur regularly and hence its record in the present study is interesting.
Si no	**Name of species**	**Host/habitat plants**	**Locality**	**Date of collection**	**Remarks**
Family VII: Cunaxidae					
17.	*Cunaxa setirostris* (Hermann)	*Dieffenbachia seguine* (Dumb cane)	Panskura (Purba Medinipur)	29.10.2021	This mite was quite common and had been reported from a variety of plants and is known to be a good predator of phytophagous mite. However, no such behaviour was observed in the present study.
Order II: Mesostigmata Family VIII: Phytoseiidae					
18.	*Amblyseius excelsus* Chaudhri	*Codiaeum variegatum* (var. Garden croton)	Uluberia (Howrah)	18.09.2021	No information about its economic importance.
19.	*Amblyseius herbicolus* (Chant)	*Polyalthia longifolium*	Bagnan (Howrah)	07.10.2021	This was another commonly occurring predatory Phytoseiidae mite on a number of plants. It was collected from under surface of leaf having no association with any phytophagous mite.
Si no	**Name of species**	**Host/habitat plants**	**Locality**	**Date of collection**	**Remarks**
20	*Amblyseius largoensis* (Muma)	*Aspidistra elatior*, (Cast-iron Plant), *Codiaeum variegatum* (var. garden croton),*Rhapis excels* (Broadleaf lady palm)	Khirai (Purba medinipur), Domjur (Howrah), Gotpota (Purba Medinipur)	30.11.2021, 20.04.2022 & 09.11.2021	This is one of the commonly occurring Phytoseiidae mite having wide range of plants. This is a very good predator though on this host this was not having any association with prey mite.
21	*Amblyseius*	*Codiaeum variegatum* (Florida select)	Domjur	20.10.2021	The collection of this mite is interesting because this is not a very common mite. Therefore, its record is

	orientalis Ehara		(Howrah)		interesting.
22	*Euseius ovalis* (Evans)	*Codiaeum variegatum* (Garden croton)	Domjur (Howrah)	20.10.2021	This is an effective predatory mite with its occurrence on a large number of plants and is known to be associated with *Eotetranychus suginamensis.*
23	*Indoseiulus eharai* (Gupta)	*Rosa centifolia* (Rose)	Uluberia (Howrah)	28.01.2022	This is a very good predator of 'spider mites' and was found feeding upon *Tetranychus urticae* on Rose and fully consumed predator had reddish body due to pigments of the prey.
24	*Scapulaseius sukaensis* (Gupta)	*Codiaeum variegatum* (var.Croton Mammy)	Domjur (Howrah)	03.04.2022	It is widely distributed predator mite and is known to be good predator of 'spider mite'.

C. Fungal feeder

Si no	Name of species	Host/habitat plants	Locality	Date of collection	Remarks
Order III: Sarcoptiformes Family IX: Glycyphagidae					
25.	*Lepidoglyphus destructor* (Schrank)	*Codiaeum variegatum* (Garden croton)	Gotpota (Purba Medinipur)	20.11.2021	This is a common stored product mite and therefore, its occurrence on plant is accidental and might have been blown onto it through air current.
Family X: Scheloribatidae					
26.	*Scheloribates* sp.	*Polyalthia longifolium*	Domjur (Howrah)	03.04.2022	This is a soil dwelling fungal feeding mite but how it occurred on plant was uncertain.

Table 2: List of insects collected on floricultural plants and leafy ornamental plants from Howrah and Purba Medinipur districts of West Bengal during September 2021- April 2022:

A. Predatory Insect

Si no	Name of species	Host/habitat plants	Locality	Date of collection	Remarks
Order I: Thysanoptera Family I: Thripidae					
1.	*Scolothrips sexmaculatus* Pergande	*Ixora coccinea*	Khirai (Purba Medinipur)	04.09.2021	This is a predatory thrips and it is known to feed upon eggs of spider mite but in the present study this thrips was recorded on plant where no infestation of spider mites was noticed.

B. Phytophagous insects

2	*Scirothrips* sp.	*Codiaeum variegatum* (var.Garden croton)	Khirai (Purba Medinipur)	30.11.2021	This is a phytophagous thrips
3.	*Thrips tabaci* Lind	*Allamanda cathartica* (Golden trumpet/Yellow allamanda)	Bagnan (Howrah)	12.03.2022	This is a serious pest of a number of crops, due to its infestation the leaves turned pale. Infested plants became weak.
Si No	**Name of species**	**Host/Habitat Plants**	**Location**	**Date of collection**	**Remarks**
Order II: Hemiptera Family II: Aleyrodidae					
4	*Aleurobius* sp.	*Codiaeum variegatum* (Garden croton)	Bagnan (Howrah)	27.09.2021	This unidentified insects had poor population and did not cause any damage.
	Family III: Aphididae				
5.	*Aphis craccivora* Koch	*Rosa centifolia* (Rose)	Panskura (Purba Medinipur)	11.12.2021	This is also a polyphagous species and the present host Rose, appeared to be so far not reported for this insect.
6.	*Aphis gossypii* Glover	*Codiaeum variegatum* (Croton petra)	Bagnan (Howrah)	12.03.2022	This is a polyphagous species and its occurrence was noticed on *Codiaeum variegatum* but had shown no noticeable damage symptoms.
Si no	**Name of species**	**Host/habitat plants**	**Locality**	**Date of collection**	**Remarks**
Family IV: Cicadellidae					
7	*Kolla vesta*	*Hibiscus rosa-sinensis*	Uluberia (Howrah)	18.09.2021	Earlier occurrence of this insect on *Hibiscus rosa-sinensis* was not known and therefore, it

	(Distant)	(Jaba)			formed new host record.
Family V: Diaspidae					
8.	*Cornuaspis* sp.	*Chrysanthemum indicum* (Chrysanthemum)	Khirai (Purba Medinipur)	06.02.2022	This scale insect infested under surface of chrysanthemum leaf producing brownish spots at the point of feeding. Population was good.
Family VI: Pseudococcidae					
9.	*Ferrisia virgata* Cockrell	*Codiaeum varigatum* (Croton Mammy), *Hibiscus rosa-sinensis*.	Gotpota (Purba Medinipur), Domjur (Howrah)	26.03.2022 & 20.04.2022	This is one of the common mealybugs known to have a wide range of hosts. Due to the infestation, twigs and leaves dried up causing death of the plant.
Si no	**Name of species**	**Host/habitat plants**	**Locality**	**Date of collection**	**Remarks**
Order III: Diptera **Family VII: Simuliidae**					
10	Black fly	*Dahlia variabilis* (Dahlia)	Uluberia (Howrah)	28.01.2022	Some leaves of Dahlia when examined under stereobinocular microscope, some members of black fly were noticed but no damage was found. It could not be identified.

Table 3: List of plants (Hosts for phytophagous group and Habitat for predatory group) against occurrence of Mites and Insects:

Si no	Name of host/habitat plants	Name of mite species	Name of insect species
1.	*Allamanda cathartica* (Golden trumpet/Yellow allamanda)	----------	*Thrips tabaci*
2.	*Aspidistra elatior* (Cast-iron Plant)	*Amblyseius largoensis*	----------
3.	*Bauhinia purpurea*	*Eotetranychus hirsti*	-------
4.	*Chrysanthemum indicum* (Chrysanthemum)	----------	*Cornuaspis* sp.
5.	*Codiaeum variegatum* (varieties name of *Codiaeum variegatum* -Bush on fire, Croton Mammy, Garden Croton, Florida select, Croton petra)	*Eotetranychus suginamensis* (Bush on fire), *Eotetranychus truncatus*& *Scapulaseius sukaensis* (Croton Mammy), *Euseius ovalis, Amblyseius excelsus, Amblyseius largoensis* & *Lepidoglyphus destructor* (Garden Croton), *Amblyseius orientalis* (Florida select)	*Scirothrips* sp. &*Aleurobius* sp. (Garden Croton), *Aphis gossypii* (Croton petra)
6.	*Dahlia variabilis* (Dahlia)	*Tetranychus urticae*	Black fly.
7.	*Dianthus caryophyllus* (Carnation)	*Tetranychus urticae*	----------
8.	*Dieffenbachia seguine* (Dumb cane)	*Cunaxa setirostris*	----------
9.	*Hibiscus rosa- sinensis* (Hibiscus)	*Eutetranychus maximae*	*Ferrisia virgata, Kolla vesta.*
10.	*Ixora coccinea*	*Eupodes sigmoidensis*	*Scolothrips sexmaculatus*
11.	*Jasminum auriculatum* (Jasmine)	*Aceria jasmini*	----------
12.	*Magnolia champaca*	*Tetranychus macfarlanei*	---------
13.	*Nerium indicum*	*Aceria nerii*	----------
14.	*Nyctanthes arbor-tristis*	*Eotetranychus hirsti*	------
15.	*Petunia alba* (Petunia)	*Tetranychus urticae*	----------
16.	*Polyalthia longifolium*	*Amblyseius herbicolus , scheloribates* sp.	----------
17.	*Polyanthes tuberosa* (Tuberose)	*Tetranychus urticae*	----------
18.	*Pseudophoenix sargentii*	*Schizotetranychus cajani, Parapronematus cameliae*	-------
Si No	**Name of host/habitat plants**	**Name of mite species**	**Name of insect species**
19.	*Rhapis excelsa* (Bamboo palm)	*Amblyseius largoensis*	----------
20.	*Rosa centifolia* (Rose)	*Oligonychus biharensis, Tetranychus urticae, Indoseiulus eharai*	*Aphis craccivora*
21.	*Rosa chinensis* (China-rose)	*Eutetranychus maximae, Brevipalpus phoenicis.*	------
22.	*Tabernaemontana divaricata*	*Eutetranychus orientalis*	-------
23.	*Tagetes erecta* (Marigold)	*Polyphagotarsonemus latus*	----------

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