Faunal account of the predatory mites (Acari: Cunaxidae and Phytoseiidae) from the Agri-horticultural crops of south Bengal with three new records from India

Subhasree Mitra, Shelley Acharya and Sujay Ghosh

Abstract
The paper deals with the study of predatory mites which was undertaken from January, 2015 to March, 2017 to explore the predatory mite fauna from different agri-horticultural crops in 11 southern districts of West Bengal. A total number of 33 species of predatory mites were recorded with their predatory habits, prey preference, impact on prey population and the inhabiting plants among which 10 species under 2 genera are of family Cunaxidae and 23 species under 7 genera are of family Phytoseiidae. Predaceous mites were found more diverse and abundant than family Cunaxidae. One species namely Amblyseius impressus of Phytoseiidae and two species of Cunaxidae viz., Cunaxa evansi and Dactyloscius fuscus were reported first time from India. The current investigation reports the diversity of predatory mites harbouring various types of agriculturally important crops of South Bengal with their distribution, habitat specificity, prey preference and effective predatory behaviour.

Keywords: Predatory mites, Cunaxidae, Phytoseiidae, Agri-horticultural crops, Biological control, South Bengal

Introduction
Mite-plant interaction is one of the fascinating avenues of acarological research. Mites directly affect humans as pests of different crops, fruit plants, vegetable crops and field crops; as parasites of human beings, veterinary animals, poultry and pets; pets of stored grains and other products; mushrooms and cheese; and as parasites of honeybees. Mite infestations are responsible for economic losses worth billions of dollars in terms of reduced crop yields and lowered quality of produce. Mites are encountered as pests regularly or as sporadic pests under all situations. Fruits and crops are infested by different groups of mites at all growing stages and appear under favourable conditions of climatic conditions. Currently, pests such as insects, mites, bacteria, fungi, viruses, nematodes, and weeds often cause up to 40% reduction in crop yields (SP-IPM 2010). Insect pests are responsible for a major part of these losses due to direct feeding damage and/or vectoring of viral, bacterial, and fungal diseases. Predatory mites are very important and potential group of biological control agent with the ability to suppress the phytophagous mites, thrips, aphids, coccids population of various agricultural crops. Among the predatory group Phytoseiids are the most dominant. Major part of works on Phytoseiidae have been reported by Gupta [41-48] from India, Gupta & Karmakar [50] from India, Tuttle & Muma [80] from Arizona, Chant & McMurthy [11-15] from all over the world, De Moraes & McMurtry [22, 24] from Brazil and Kenya, De Moraes & Mesa [25] from Columbia, De Moraes et al. [23, 26-29] Brazil, French, Africa and Brazil, Fiaboe et al. [39] from Southeastern Brazil, Denmark et al. [35] from Central America, Dhoooria [36] from Punjab, Kreiter & Tixier [56] from Brazilian Atlantic Forest, Mallik et al. [59] from India, Karmakar & Gupta [54] from West Bengal, Matheus et al. [60] from Brazil, Prasad [60] on the genus Paraphyoseius from all over world, Chinniah & Mohansundaram [20, 21] from Kerala and Tamil Nadu in India, McMurtry, Moraes & Sourassou [64] on lifestyle and implications for biological control strategies of Phytoseiidae mites. A considerable work have been done on Cunaxidae from Greece by Sioni & Papadoullis [74], from Iran by Den Heyer, Ueckermann & Kanhani [30, 31, 32], from Brazil by Castro and Den Heyer [9, 10], from Pakistan by Muhammad & Chaudhri [66]; Bashir & Afzal [5] and Bashir et al. [4, 5] from Florida by Muma [67], from Eastern United States by Skvarla & Dowling [76] and a review of Cunaxidae in ZooKeys 2014 by Skvarla, Fisher & Dowling [75, 77].
from all over the world. In the current investigation a general survey on Phytoseiid (Acari: Phytoseiidae Berlese, 1913) [6] and Cunaxid (Acari:Cunaxidae Thor, 1902) [79] mites harbouring various types of agri-horticulturally important crops has been conducted in different districts of South Bengal during the period from January, 2015 to March, 2017 to explore the habitat specificity, predatory behaviour, occupied vegetation types with special emphasis to potentially important species.

Materials and Methods

Study area

The survey was conducted in 11 southern districts of West Bengal and samples were collected from North and South 24 Parganas, Howrah, Kolkata and Nadia districts under presidency division of Bengal; Bankura, Burdwan, Birbhum, East Midnapur, West Midnapur and Hoogly under Burdwan division of West Bengal.

Habitat

The samples were collected from different vegetation of South Bengal viz. forest vegetation of Jaipur forest, coastal plain of Digha dune, Kanthi dune, Rarh region of Burdwan, Birbhum, Bankura, Gangetic delta region of Nadia, Hoogly, Kolkata, South and North 24 Parganas. Some parts of western plateau and high lands of South Bengal were also covered for sample study.

Hosts

Mite samples were taken from medicinal plants, flower yielding plants, fruit crops, vegetables, oil yielding crops, aromatic plants, spice yielding crops, economic crops and some grass and weeds.

Collection procedure

The mites were collected seasonally during summer, pre-monsoon, post-monsoon and in winter during the period from January, 2015 to March, 2017. Mite samples were examined under hand lens with magnification of 20X and picked with the help of fine brush [size “0”] moistened with 70% alcohol.

Laboratory method

The infested leaves were brought to the laboratory within a zipper bag and then examined under stereoscopic research microscope [Motic SMZ-168 Stereo Zoom Microscope]. Mites were mounted in Hoyer’s medium and examined under compound light microscope [Motic DM-BI Digital Microscope]. The identification was done following the latest keys of Gupta [47, 48]. Identified collections are deposited in the National Zoological Collection (NZC) of Zoological Survey of India, Kolkata.

Results

The study reports a total number of 33 species of predatory mites with their predatory habits, feeding status, prey preference, impact on prey population and the inhabiting plants (Table 1, 2) of which 10 species under 2 genera belong to the family Cunaxidae and 23 species under 7 genera are from the family Phytoseiidae. One species from Phytoseiidae *Amblyseius impressus* (Denmark & Muma, 1973) [33] and two species from Family Cunaxidae *Cunaxa evansi* (Smiley, 1992) [78] and *Dactyloscirus fuscus* (Chaudhri, 1977) [18] were reported first time from India. The distribution data of each studied species are also incorporated.

Table 1: List of Collected Cunaxid (Family: Cunaxidae, Thor 1902) Mites from Agri-Horticultural Crops of South Bengal during January 2015 to March 2017.

<table>
<thead>
<tr>
<th>Species Name</th>
<th>Habitat (Inhabiting Plants)</th>
<th>Locality of collection records in South Bengal</th>
<th>Distribution</th>
<th>Feeding status</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Cunaxa setirostris</em> Herman</td>
<td><em>Artocarpus lankoecha, Ocimum tenuiflorum, Tagtes patula.</em></td>
<td>Raidighi, Laksmitkantapu, Chandannagar.</td>
<td>India- Arunachal Pradesh, Meghalaya, Sikkim, Tripura, West Bengal, Himachal Pradesh, Punjab, Andaman &amp; Nicobar Isls., Lakshadwip, Uttar Pradesh, Elsewhere- Cosmopolitan.</td>
<td>1</td>
<td>Very common and effective predator of spider mites</td>
</tr>
<tr>
<td><em>Cunaxa capreolus</em> Berlese</td>
<td><em>Justicia adhatoda, Psidium guajava.</em></td>
<td>Narendrapur, Sreerampore.</td>
<td>India-Meghalaya, Manipur, Arunachal Pradesh, West Bengal. Elsewhere- Cosmopolitan</td>
<td>3</td>
<td>Rare occurrence</td>
</tr>
<tr>
<td><em>Cunaxa myabunderensis</em> Gupta &amp; Ghosh</td>
<td><em>Saraca asoca, Aegle marmelos.</em></td>
<td>Assansol, Halisahar, Kamarapukur.</td>
<td>India- West Bengal, Andaman &amp; Nicobar Isls.</td>
<td>3</td>
<td>Rare occurrence</td>
</tr>
<tr>
<td><em>Cunaxa evansi</em> Smiley</td>
<td><em>Barleria cristata, Nyctanthes arbor-tristis.</em></td>
<td>Sonarpur, Rajpur.</td>
<td>India-New report from India. Elsewhere-Mexico.</td>
<td>3</td>
<td>Rare occurrence and new report from India</td>
</tr>
<tr>
<td><em>Dactyloscirus bengalensis</em> Gupta</td>
<td><em>Aegle marmelos, Dahlia spp. Nyctanthes arbor-tristis.</em></td>
<td>Siuri, Satragachi, Narendrapur.</td>
<td>India- West Bengal. Elsewhere- Bangladesh</td>
<td>3</td>
<td>Rare occurrence</td>
</tr>
<tr>
<td><em>Dactyloscirus fuscus</em> Chaudhri</td>
<td><em>Ficus hispida.</em></td>
<td>Rajpur (Chowhati area).</td>
<td>India- New report from India. Elsewhere-Pakistan.</td>
<td>3</td>
<td>Rare occurrence and new report from India</td>
</tr>
<tr>
<td><em>Dactyloscirus machairoides</em> Oudemans</td>
<td><em>Ixora cocinea, Cocos nucifera, Phoenix dactylifera.</em></td>
<td>Deibipur, Kulpai road, Narendrapur.</td>
<td>India- Meghalaya, Manipur, West Bengal. Elsewhere- Indonesia.</td>
<td>3</td>
<td>Rare occurrence</td>
</tr>
<tr>
<td><em>Cunaxa bambusae</em> Gupta &amp; Ghosh</td>
<td><em>Bambusa vulgaris.</em></td>
<td>Digha, Kanthi, Contai.</td>
<td>India-Andaman &amp; Nicobar Isls, Digha, Orissa, Tripura.</td>
<td>3</td>
<td>Rare occurrence</td>
</tr>
<tr>
<td><em>Cunaxa anacardae</em> Gupta</td>
<td><em>Mangifera indica, Litchi chinensis.</em></td>
<td>Tambuk, Mourigram, Krishnamohan, Daspur.</td>
<td>India- West Bengal, Tripura, Elsewhere- Bangladesh.</td>
<td>2</td>
<td>Not very common but effective predator</td>
</tr>
<tr>
<td><em>Cunaxa mangiferae</em> Gupta</td>
<td><em>Mangifera indica, Syzygium jambolanum.</em></td>
<td>South Barasat, Narendrapur, Shibpur.</td>
<td>India- West Bengal, Tripura, Elsewhere- Bangladesh.</td>
<td>1</td>
<td>Very common and good predator of spider mites</td>
</tr>
</tbody>
</table>
### Table 2: List of Collected Phytoseiid (Family: Phytoseiidae, Berlese 1913) Mites from Agri-Horticultural Crops of South Bengal during January 2015 to March 2017.

<table>
<thead>
<tr>
<th>Species Name</th>
<th>Habitat (Inhabiting Plants)</th>
<th>Locality of collection records in South Bengal</th>
<th>Distribution</th>
<th>Feeding status</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Amblyseius largoensis</strong> (Muma)</td>
<td>Bauhinia acuminata, Colocasia antiquorum, Impatients balsamina, Malvaviscus arboreus, Alagium lamarckii, Michelia champaca, Gelenium multilorum, Mangifer a indica, Hibiscus rosa-sinensis, Citrus spp., Aegle marmelos, Musa sapientum, Clitoria ternata, Solanum melongena, Artocarpus heterophyllus.</td>
<td>Canning, Gosaba, Kulpi road, Taldi, Joynagar-Majilpur, Jagaddol, Tamluk, Baruiupur, Barasat, Narendrapur, Sonarpur, Dunlop, Budge-Budge, Hind Motor, Kharagpur, Alipore, SaltLake, Jhargram.</td>
<td>West Bengal, Manipur, Tripura, Arunachal Pradesh, Assam, Orissa, Sikkim, Andhra Pradesh, Tamil Nadu, Pondicherry, Kerala, Uttar Pradesh, Punjab, Himachal Pradesh, Jammu &amp; Kashmir, Gujrat, Andaman &amp; Nicobar Islands, Lakshadweep Islands, Mizoram, Bihar, Meghalaya, Karnataka.</td>
<td>1</td>
<td>Very common and good predator on eggs of <em>Panonychus citri</em>, <em>Eutetranychus orientalis</em>, <em>Tetranychus neocaledonicus</em>. This species is very potential bio-controlling agent against phytophagous group.</td>
</tr>
<tr>
<td><strong>Amblyseius herbicola</strong> (Chant)</td>
<td>Tamarindus indica, Weed, Cynodon dactylon, Artocarpus heterophyllus, Vigna unguiculata.</td>
<td>Diamond harbour, Gobordanga, Howrah, Canning, Arambagh.</td>
<td>India- Tripura, West Bengal, Mizoram, Sikkim, Tamil Nadu. Elsewhere- USA, Burma Philippines, Thailand, Taiwan, China, Papua New Guinea, Australia, Japan, Madagascar, South Africa, Mexico, Brazil, West Indies, Portugal.</td>
<td>1</td>
<td>Good predator of eggs and nymphs of <em>Eutetranychus syngens</em> and <em>Tetranychus luden</em>.</td>
</tr>
<tr>
<td><strong>Amblyseius orientalis</strong> Ehara</td>
<td>Camellia sinensis, Rosa spp., Citrus spp.</td>
<td>Bardhaman Agricultural farm, Kalayni Agricultural farm, Newtown (Rajarhat).</td>
<td>India- Assam, Meghalaya, North Bengal. Elsewhere- Japan.</td>
<td>3</td>
<td>Rare occurrence.</td>
</tr>
<tr>
<td><strong>Amblyseius aeralsis</strong> Muma</td>
<td>Carica papaya, Boerhavia diffusa</td>
<td>Halisahar, Madhyamgram</td>
<td>India- Karnataka, Bihar, Chennai, West Bengal, Arunachal Pradesh, Bihar, Karnataka. Elsewhere- USA, Galapagos Islands, Mexico, Honduras, Jamaica, Brazil, Algeria.</td>
<td>2</td>
<td>Potential predator of <em>Eutetranychus orientalis</em>, <em>Panonychus citri</em> on papaya. Effects on eggs of <em>Brevipalpus karuanchii</em>.</td>
</tr>
<tr>
<td><strong>Amblyseius kalini</strong> Gupta</td>
<td>Murraya koenigii</td>
<td>Egra, Ramnagar</td>
<td>India- Assam, West Bengal, Meghalaya. Elsewhere- Burma, Bangladesh.</td>
<td>2</td>
<td>Effects on nymphs of <em>Schizotetranychus balucazi</em>.</td>
</tr>
<tr>
<td><strong>Amblyseius adhatodae</strong> Muma</td>
<td>Justicia adhatoda</td>
<td>Amtala, Haridebpur.</td>
<td>India- Bombay, Delhi, West Bengal. Elsewhere- Pakistan.</td>
<td>1</td>
<td>Good predator of spider mites.</td>
</tr>
<tr>
<td><strong>Amblyseius cucurbitae</strong> Rather</td>
<td>Cucurbita maxima, Cucumis sativus.</td>
<td>Hogla, Raidighi, Taratala, Namkhana.</td>
<td>India- Jammu and Kashmir, Meghalaya, Darjeeling, Sikkim.</td>
<td>1</td>
<td>They are common predator for spider mite population.</td>
</tr>
<tr>
<td><strong>Amblyseius paraealaisis</strong> Muma</td>
<td>Citrus spp., Carica papaya, Justicia adhatoda, Saraca asoca</td>
<td>Majherhat, Narendrapur, Hotor.</td>
<td>India- Arunachal Pradesh, Assam, Meghalaya, Sikkim, Kerala. Elsewhere- Thailand.</td>
<td>1</td>
<td>Good predator on eggs of <em>Brevipalpus phoenicis</em>.</td>
</tr>
<tr>
<td><strong>Amblyseius impressus</strong> Denmark &amp; Muma</td>
<td>Bambusa vulgaris</td>
<td>Sonarpur (Shimultala)</td>
<td>India- New report from India. Elsewhere- Brazil.</td>
<td>3</td>
<td>Rare occurrence and new report from India.</td>
</tr>
<tr>
<td><strong>Amblyseius neoerykei</strong> Gupta</td>
<td>Cactus, Orchid, Punica granatum.</td>
<td>Bolepur, Raichak, Kalayni Agricultural Farm</td>
<td>India- West Bengal, Arunachal Pradesh, Sikkim, Elsewhere- Burma, Bangladesh.</td>
<td>3</td>
<td>Rare occurrence.</td>
</tr>
<tr>
<td><strong>Euseius alstoniae</strong> Gupta</td>
<td>Syzygium jambolanum</td>
<td>Arambagh, Kamarupur</td>
<td>India- Arunachal Pradesh, Meghalaya, Tripura, West Bengal, Orissa, Bihar, Tamil Nadu, Karnataka.</td>
<td>1</td>
<td>Effects on eggs and nymphs of <em>Brevipalpus sp.</em></td>
</tr>
<tr>
<td>Species</td>
<td>Hosts</td>
<td>Locations</td>
<td>Rare Occurrence</td>
<td>Good Predator of Eggs and Nymphs of <em>Tetranychus urticae</em></td>
<td>Voracious Feeder and Good Predator of <em>Tetranychus urticae</em></td>
</tr>
<tr>
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<td>-----------------------------------------------------------------</td>
</tr>
<tr>
<td><em>Euseius coccocoides</em> Ghai &amp; Menon</td>
<td><em>Terminalia arjuna, Saraca asoca, Gossypium arboreum</em></td>
<td>Madhyamgram, Jhargram, Taki</td>
<td>India- Karnataka, Pondicherry, Tamil Nadu, Kerala, Andhra Pradesh, Punjab, West Bengal, Lakshadweep, Tripura, Elsewhere- Cosmopolitan.</td>
<td>2</td>
<td>Rare occurrence</td>
</tr>
<tr>
<td><em>Euseius ovialis</em> (Evans)</td>
<td><em>Tamarind, Impatines balsamina, Terminalia arjuna, Capcicum annuum,</em></td>
<td>Krishnanagar, Chinsurah, Bandel, Candannagar.</td>
<td>India- Arunachal Pradesh, Assam, Sikkim, Mizoram, Meghalaya, Tripura, West Bengal, Manipur, Bihar, Andhra Pradesh, Karnataka, Tamil Nadu, Pondicherry, Kerala, Maharashtra, Gujarat, Punjab, Andaman &amp; Nicobar Isis., Lakshadweep Isls. Elsewhere- Philippines, Taiwan, Hawaii, Mauritius, Mexico, Malaysia, Hong Kong, Japan, Indonesia, New Zealand, Australia.</td>
<td>3</td>
<td>Good predator of eggs and nymphs of <em>Tetranychus urticae</em>.</td>
</tr>
<tr>
<td><em>Indoseiulus ricipini</em> (Ghai &amp; Menon)</td>
<td><em>Solanum melongena,</em> Dolichos spp.</td>
<td>Nabadwip, Haldia</td>
<td>India- Tamil Nadu, Gujrat, Uttar Pradesh, Himachal Pradesh, Bihar, Arunachal Pradesh, West Bengal,Sikkim, Tripura,Punjab.</td>
<td>3</td>
<td>Voracious feeder and good predator of <em>Tetranychus urticae</em>.</td>
</tr>
<tr>
<td><em>Neoseiulus indicus</em> (Narayanan &amp; Kaur)</td>
<td><em>Justicia adhatoda Polyalthia longifolia</em></td>
<td>Alipur, Behala</td>
<td>India- Delhi, West Bengal, Punjab, Uttar Pradesh. Elsewhere- Bangladesh.</td>
<td>2</td>
<td>Rare occurrence</td>
</tr>
<tr>
<td><em>Neoseiulus longispinosus</em> (Evans)</td>
<td><em>Carica papaya, Averrhoa carambola</em></td>
<td>Chakdah, Raichak</td>
<td>India- West Bengal, Orissa, Bihar, Arunachal Pradesh, Sikkim, Tamil Nadu, Karnataka, Pondicherry, Uttar Pradesh, Andaman &amp; Nicobar Isls, Lakshadweep Isls. Elsewhere- Philippines, Taiwan, Indonesia, Japan, Pakistan, New Guinea, Australia, Malaysia, Hong Kong, Hawaii, New Zealand, Jamaica.</td>
<td>1</td>
<td>Voracious predator and feeds voraciously. It attacks all the developmental stages of <em>Tetranychus urticae</em>.</td>
</tr>
<tr>
<td><em>Paraphytoseius bhadragaliensis</em> Gupta</td>
<td><em>Triumfetta shombaidea, Artocarpus heterophyllus</em></td>
<td>Lilua, Kharagpur, Jhargram.</td>
<td>India- West Bengal, Tamil Nadu, Karnataka, Andhra Pradesh, Tripura, Punjab, Andalnan Isls., Jummu and Kashmir, Bihar. Elsewhere- Bangladesh.</td>
<td>2</td>
<td>Very good predator of juvenile stages of tetranychid mites but not very common.</td>
</tr>
<tr>
<td><em>Paraphytoseius multidentatus</em> Swirski &amp; Shechter</td>
<td><em>Jasminum nudiflorum, Rambusa vulgaris</em></td>
<td>Taki, Ramnagar</td>
<td>India- Tripura, Arunachal Pradesh, Mizoram, Assam, Sikkim, Meghalaya, West Bengal, Bihar, Maharashatra, Punjab, Tamil Nadu, Karnataka, Uttar Pradesh, Andhara Pradesh, Andaman &amp; Nicobar Isls. Elsewhere- Hong Kong, Thailand, Philippines, Nigeria, Madagascar, Malaysia, China.</td>
<td>1</td>
<td>Good predator</td>
</tr>
<tr>
<td><em>Paraphytoseius orientalis</em> (Narayanan, Kaur &amp; Ghai)</td>
<td><em>Cinnamomum zylanicum, Colocasia antiquorum, Cyndon dactylon, Monodora cochinchinensis, Bauhinia acuminata, Solanum melongena.</em></td>
<td>Taki, Basirhat, Habra, Naihati, Taratala, Dunkuni, Sreerampore, Jaipur Forest.</td>
<td>India- Uttar Pradesh, West Bengal, Punjab. Elsewhere- Brazil, Burundi, China, Colombia, Costa Rica, Democratic Republic of Congo, Guadeloupe, Hong Kong, Japan, Kenya, Madagascar, Malaysia.</td>
<td>1</td>
<td>Very common on eggs of tetranychids and tenuipalpids.</td>
</tr>
</tbody>
</table>
Paraphytoseius scleroticus
Gupta & Ray
Rauvolfia tetraphylla
Duttapukur
India- Uttar Pradesh, West Bengal, Tripura. Elsewhere- Asiatic countries.
3
Rare occurrence

Phytoseius kapuri
Gupta
Setaria paniculifera
Haldia
3
Good predator of Tetranychus neocaledonicus and Tetranychus cinnabarinus

Typhlodromips suknaensis
Gupta
Theobroma cacao, Cynodon dactylon
Narendrapur, Jaipur forest
India- Arunachal Pradesh, Assam, Sikkim, Mizoram, Tripura, West Bengal, Orissa, Meghalaya, Uttar Pradesh, Andaman & Nicobar Isls, Kerala.
2
Rare occurrence

Typhlodromips syzygii (Gupta)
Citrus maxima.
Narendrapur
India- West Bengal, Orissa, Tripura, Meghalaya, Bihar, Sikkim, Mizoram, Uttar Pradesh. Elsewhere- Thailand.
2
Not very common.

Discussion
In the present investigation, an initial survey of predatory mites inhabiting various group of agri-horticultural crops from different districts of West Bengal, particularly South Bengal was undertaken. This particular area of Bengal was chosen for its unique and enriched physical features which supports the diverse vegetation with enormous species diversity.

From our study it has been observed that family Phytoseiidae is the most dominant group affecting more than 50 agri-horticultural crops of different vegetation. Genus Amblyseius belonging to the subfamily Amblyseiinae represented by 10 species is the most abundant genus among the predatory mites. Amblyseius largoensis Muma, A. herbicola (Chant), A. aeriaulis Muma, Neoseiulus longispinosus (Evans), are most frequent and dominant predatory species among Phytoseiidae family, McMurthy, Moraes and Sourassou [64] proposed a new categorization of mite predators viz. Type 1 as specialized mite predators of Tetranychus species, Type II as selective predators of tetranychid mites and Type III as generalised predators is a huge and diverse group of general feeders. In our study we found that Indoseiulus ricini (Ghai & Menon) is voracious feeder and good predator on spider mites. Paraphytoseius bhadarakalensis Gupta, Phytoseius kapuri Gupta, Euseius ovalis (Evans), Amblyseius adhatodae Muma, Amblyseius cucurbiteae Rather are very potential predator of all developmental stages of spider mites specially on tetranychidae family. De Moraes, Barbosa and Castro [29] studied the Phytoseiids from natural ecosystem in the state of Sao Paulo, Brazil and reported 40 phytoseid species. Here we reported 23 species from southern part of a state only which undoubtedly specifies the rich biodiversity of the state as well as the country. The recent work of Lofego, Castro & Feres [53] reported 22 species of phytoseiids from rubber tree crops in the state of Bahia, Brazil. If we compare our result in respect of entire state also proves a greater diversity of phytoseiids in the agri horticultural crops studied only from southern part of the state West Bengal. One species Amblysieus impressus (Denmark & Muma, 1973) [34] is reported first from India on Bambooo (Bambusa vulgaris) from Sonarpur of South 24 Parganas.

Amblysieus paraerialis Muma, Euseius alstoniae Gupta, Paraphytoseius orientalis (Narayan, Kaur & Ghai) are very common and efficient predator of Tenuipalpid mites specially on Brevipalpus spp. Typhlodromips suknaensis Gupta, Typhlodromips syzygii (Gupta), Paraphytoseius scleroticus (Gupta & Ray). Amblysieus neorykei Gupta, Amblysieus orientalis Ehara, are reported as rare and occasional feeder. Amblysieus orientalis Ehara, is very unusual species and basically inhabiting on aromatic types of crop like lemon, rose, tea etc. The coastal salty region specially around Dune area is represented by a single species Amblysieus kulini Gupta.

Similarly another studied family Cunaxidae represents two species Canaxa evansi (Smiley, 1992) [78] on Barleria Cristina and Nyctanthes arbour and Dactylocirrus fuscus (Chaudhuri, 1977) [18] on Ficus hispida from Rajpur-Sonarpur Municipality area of district South 24 Parganas which are first time reported from India. A wide range survey by Sionti and Papadouilis [74] in Greece revealed 14 species of cunaxid mites which is certainly a less number in comparison with our studied species in a part of the state Bengal. Blanca, Recamier and Gabriela [7] studied the stage distribution of cunaxids in soil and litter in Mexico. Mei jia et al. [65] studied the cunaxidae diversity and population dynamics in garlic crop field which shows the agricultural practices applied to the garlic crop had an impact on cunaxid abundance. Very little recent work has been done in respect of its biological control and effect of pesticides on the population of mites in India. The cunaxids in our study comprises 10 species from 20 types of agri horticultural plants in studied location of which Canaxa setirostris Hermann, Canaxa anacardae Gupta, Canaxa mangiferae Gupta, are very effective and good predator of spider mites among Cunaxid mites. We reported Canaxa anacardcae Gupta and C. mangiferae Gupta from fruit crops
viz., Mangifera indica, Litchi chinensis, Syzygium jambolanum etc. Cunaxa bambusae Gupta & Ghai was reported from Digha dune and Kanthi dune of coastal plains of south Bengal. Cunaxa myabunderensis Gupta & Ghosh, C. capreolus Berlese, Dactylolosirus machairodus Oudemans, D. bengalensis Gupta are rarely occurring species with less abundance.

The present study reports an enriched predatory mite fauna of two families Cunaxidae and Phytoseiidae occurring in agri-horticultural crops of South Bengal. These two groups have been reported as a potential natural enemies of phytophagous mites under both natural and environmentally managed condition. The predatory species found in this survey should be conserved for natural supression of agricultural pests not only of phytophagous mites but also thrips, aphids, coccids, some insects pests also. Minimizing the commercial use of chemical pesticide may conserve the effective population of these beneficial mites. The present study is exhaustive and constitutes the most comprehensive list of predatory mites in south Bengal, including a complete bibliography of research on the subject. The publication of this work should help to stimulate further studies on this important group of acari in India.

Acknowledgement

The authors are thankful to the Director of Zoological Survey of India, Kolkata and indebted to the Department of Zoology, University of Calcutta for providing laboratory and infrastructural facilities to conduct this work. Authors are thankful to the Secretary and Assistant Secretary of Ramakrishna Mission Ashrama, Narendrapur for allowing to make the collection from the medicinal plant garden and agricultural crop fields. I would like to express my sincere gratitude to Dr. S.K Gupta, former Scientist Emeritus of MoEF and DST, Govt. of India, for helping in identification of species and literature support. Sincere thanks to Dr. Krishna Karmakar, Professor, Department of Agricultural Entomology, BCKV, West Bengal for his guidance and valuable suggestions.

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