A record of five mealybug species as minor pests of cotton in India

V. S. Nagrare, Rishi Kumar, B. Dharajothi

ABSTRACT

Five mealybug species belonging to Pseudococcidae and Monophlebidae families of Hemiptera order were recorded as minor pests of cotton in India. These mealybug species were spherical mealybug Nipaecoccus viridis (Newstead), striped mealybug Ferrisia virgata (Cockerell), Pink hibiscus mealybug Macconellicoccus hirsutus (Green), mango mealybug Rastrococcus iceryoides (Green) (Pseudococcidae) and ber mealybug Perissopneum tamarindus (Green) (Monophlebidae). N. viridis was found to infest cotton from Nagpur, Wardha and Amaravati districts of Maharashtra. F. virgata was recorded from Nagpur and Coimbatore while M. hirsutus from Coimbatore. R. iceryoides was documented from Nagpur and Salem in association with other mealybugs such as Phenacoccus solenopsis, Paracoccus marginatus and N. viridis while P. tamarindus was restricted to Sirsa of Haryana state. Among these species, N. viridis was found to be next most widely distributed mealybug species after P. solenopsis and deserves close monitoring.

Keywords: Cotton, mealybugs, minor pests.

1. Introduction

Cotton is an important cash crop in India occupies 11.6 million hectare area which is the largest acreage in the world. However, wide gaps exist in productivity due to a number of biotic and abiotic stresses that are difficult to manage due to late and improper diagnosis of the problem. Since 2002, as a result of widespread cultivation of hybrids, crop management practices have changed, and become more input-intensive. Moreover, the homogeneity of genotypes in the form of hybrids across vast areas favoured build-up of epidemics. As a result, many minor insects have emerged as major problems threatening cotton cultivation. Prior to the introduction of Bts, the cohabitant sucking pests were suppressed with the insecticides applied for the control of bollworms. Populations of regular sucking pests viz., leafhoppers (Amrasca biguttula biguttula Ishida), aphids (Aphis gossypii Glover), mirid (Campylomma livida Reuter, Creontiades biseratense Distant), thrips (Thrips tabaci Linde.) and whiteflies (Bemisia tabaci Genn.) were seen in regular occurrence despite the use of insecticides. During the last half decade, new pests like mealybug and mirids have caused significant damage to cotton crop occurring as either endemic or as well as pests widespread across India. Among the new pests of cotton, mealybugs Phenacoccus solenopsis Tinsley have been found to be predominant across India \(^1\) while Paracoccus marginatus Williams and Granara de Willink have been reported from south India \(^2,3\). With the emergence of the two mealybug species on cotton it was conceptualized to document the occurrence of other species on cotton.

2. Materials and Methods

Twenty six random surveys were carried out during 2009-10, 2010-11, 2011-12, 2012-13 and 2013-14 in three cotton growing zones of India. Nature of damage and location of occurrence with coordinates with handheld GPS (Garmin ETrax\(^R\) H) was recorded for the presence of mealybugs infesting cotton. The collected mealybug specimens were identified from Dr VV Ramamurthy, Insect Identification Service, Division of Entomology, Indian Agricultural Research Institute, New Delhi-110012

3. Results and Discussion

The results of the study revealed five mealybug species belonging to the Pseudococcidae and Monophlebidae families of Hemiptera order infesting cotton in India other than predominant mealybug species Phenacoccus solenopsis Tinsley and Paracoccus marginatus Williams and...
These mealybug species were spherical mealybug Nipaecoccus viridis (Newstead) (Plate 1), striped mealybug Ferrisia virgata (Cockerell) (Plate 2), pink hibiscus mealybug Maconellicoccus hirsutus (Green) (Plate 3), mango mealybug Rastrococcus iceryoides (Green) (Pseudococcidae) (Plate 4) and ber (Zizyphus) mealybug Perissopneumon tamarindus (Green) (Monophlebidae) (Plate 5). N. viridis was recorded from the central zone (Maharashtra state), R. iceryoides and F. virgata from central and south zone (Tamil Nadu), M. hirsutus from south zone while P. tamarindus from northern zone (Haryana State) (Fig 1). Identification records of these species were N. viridis - RRS No. 1659-1668/2009, F. virgata: RRS No. 2439-2448/2011 & 1631-1640/2013, M. hirsutus - RRS No. 628-637/2010, R. iceryoides - RRS No. 496-499/2012 & 53-54/2009 and P. tamarindus - RRS No. 2058-2062/2011. Species wise year of occurrence in crop season and location with coordinates is given in Table 1.

Both nymphs and adults of mealybugs suck sap from all above ground parts of the plant. Cotton plants infested by mealybugs exhibit symptoms of distorted and bushy shoots, crinkled and/or twisted and bunchy leaves, and stunted plants that dry completely in severe cases resulting in reduced plant vigour. Sooty mould that develops on the honey dew secretions attracts ants that carry crawlers from one plant to another. Mealybugs infest all plant parts including developing bolls that are scarred due to de-sapping. Late season infestations cause early senescence as a consequence of reduced vigour and cause significant yield loss. The five minor mealybug pests were found to infest cotton plants ranging from infestation grade I to IV [4], in patches.

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Name of mealybug</th>
<th>Crop season</th>
<th>Location</th>
<th>Coordinates (Latitude-Longitude)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Nipaecoccus viridis (Newstead)</td>
<td>2009-10</td>
<td>Savandi, Wardha</td>
<td>20°44'43.134''N, 38°36'10.5572''E</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2010-11</td>
<td>CICR farm, Nagpur</td>
<td>21°2'14.0088''N, 79°3'31.5138''E</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2011-12</td>
<td>Warud, Amravati</td>
<td>21°31'2.3911''N, 78°16'20.2764''E</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2012-13</td>
<td>Palora, Saoner, Nagpur</td>
<td>21°21'15.77''N, 79°10'10.00''E</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2013-14</td>
<td>CICR farm, Nagpur</td>
<td>21°2'20.3814''N, 79°3'34.8762''E</td>
</tr>
<tr>
<td>2</td>
<td>Ferrisia virgata (Cockerell):</td>
<td>2011-12</td>
<td>CICR farm Nagpur</td>
<td>21°2'12.3066''N, 79°3'25.1022''E</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2012-13</td>
<td>CICR farm Nagpur</td>
<td>21°2'12.3066''N, 79°3'25.1022''E</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2012-13</td>
<td>Coimbatore</td>
<td>11°0'51.52634''N, 76°55'44.8824''E</td>
</tr>
<tr>
<td>3</td>
<td>Maconellicoccus hirsutus (Green)</td>
<td>2009-10</td>
<td>Vadugathampatti, Salem</td>
<td>11°38'17''N, 78°25'53''E</td>
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<tr>
<td>4</td>
<td>Rastrococcus iceryoides (Green)</td>
<td>2011-12</td>
<td>Saoner Nagpur</td>
<td>21°21'57.77''N, 79°10'10.00''E</td>
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<tr>
<td></td>
<td></td>
<td>2008-09</td>
<td>CICR farm, Coimbatore</td>
<td>76°55'44.8824''N, 11°0'51.2634''E</td>
</tr>
<tr>
<td>5</td>
<td>Perissopneumon tamarindus (Green)</td>
<td>2009-10</td>
<td>CICR RS farm, Sirsa</td>
<td>29°32'44.3''N, 75°02'11.0''E</td>
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<tr>
<td></td>
<td></td>
<td>2010-11</td>
<td>CICR RS farm, Sirsa</td>
<td>29°32'44.3''N, 75°02'11.0''E</td>
</tr>
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<td></td>
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<td>2010-11</td>
<td>Bakieranwali, Sirsa</td>
<td>29°25'33.55''N, 75°01'18.10''E</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2010-11</td>
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</tr>
<tr>
<td></td>
<td></td>
<td>2011-12</td>
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<td>31°40'41.0298''N, 73°16'1.0308''E</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2011-12</td>
<td>Panniwala, Mota, Sirsa</td>
<td>29°42'14.74''N, 74°54'43.58''E</td>
</tr>
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<td></td>
<td></td>
<td>2011-12</td>
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</tr>
<tr>
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<td>2011-12</td>
<td>Ding Mandi, Sirsa</td>
<td>29°31'34.9824''N, 75°16'13.836''E</td>
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<tr>
<td></td>
<td></td>
<td>2011-12</td>
<td>Sahuwala, Sirsa</td>
<td>31°40'41.0298''N, 73°16'1.0308''E</td>
</tr>
</tbody>
</table>

3.1 Nipaecoccus viridis (Newstead) (Pseudococcidae: Hemiptera)

N. viridis has been consistently recorded infesting cotton in central zone all through the years, starting from 2009-10 at Nagpur and Wardha, during 2011-12, 12-13 & 13-14 at Nagpur and during 2010-11 at Amravati district. The species was also seen in combination with P. solenopsis and/or R. iceryoides. The species is well known as an agricultural pest in Asia that attacks a wide variety of plants including food, forage, ornamental crops and fibre crops especially cotton; often causing considerable damage. It is native to Asia and widespread throughout the tropics and subtropics. Potential for invasiveness of this species appears high. Adult females are about 4 mm long, pink in colour. During oviposition females’ body gets covered with white waxy threads. On squashing body contents ooze out purple in colour.

3.2 Ferrisia virgata (Cockerell): (Pseudococcidae: Hemiptera)

F. virgata was recorded from Nagpur during 2011-12 and 2012-13, in trances. Infestation ranging from 16-83 per cent was recorded on cotton during June to August 2013 at Coimbatore. The species is known by several names viz. cotton scale, grey mealybug, guava mealybug, spotted mealybug, tailed coffee mealybug, white-tailed mealybug. F. virgata is highly polyphagous infesting over 150 genera in 68 families [6] and distributed in more than 110 countries around the world [4]. The adult female is yellowish green in colour measuring about 4-4.5 mm in length with...
two dark stripes stretched down to length of body. This mealybug species bears two long wax tails while waxy threads extend in all directions. Body is covered in copious secretions, usually white or yellow. A pair of lateral wax filaments is also present.

**Mealybug species**

*Nipaecoccus viridis* (Newstead)

**Infestation on cotton**

*Cotton plant infested by N. viridis*

Plate 1

*Ferrisia virgata* (Cockerell)

*Cotton plant infested by F. virgata*

Plate 2

*Maconellicoccus hirsutus* (Green)

*Cotton branch infested by M. hirsutus*

Plate 3

*Rastrococcus iceryoides* (Green)

*Cotton branch and boll infested by R. iceryoides*

Plate 4

*Perissopneumon tamarindus* (Green)

*Cotton stem infested by P. tamarindus*

Plate 5
Fig 1: Distribution of five mealybug species as minor pests of cotton in India
Numbers in the map (in parenthesis) indicate sites Haryana: Sirsa (1), Maharashtra: Amaravati (2), Nagpur (3), Wardha (4), Tamil Nadu: Salem (5), Coimbatore (6).

Mealybug species composition: A Nipaecoccus viridis, B Ferrisia virgata, C Maconellicoccus hirsutus, D Rastrococcus iceryoides, E Perissopneumon tamarindus

3.3. Maconellicoccus hirsutus (Green) (Pseudococcidae: Hemiptera)
The species was recorded on cotton from Coimbatore district of Tamil Nadu state during crop season 2009-10. The mealybug was found to occur in Salem district and the incidence level varied from 5 to 85 per cent. It is a sporadic pest mainly found on hibiscus plant. Records are also available on incidence of M. hirsutus on cotton in other parts of India, particularly Punjab [7] and in Gujarat [8]. M. hirsutus, also known as the grape mealybug, is a pest of variety of cultivated and uncultivated plants, trees, and shrubs. The pest has its presence in most tropical areas of the world, prominently in Asia, Africa and Australia [9]. It infests crops such as hibiscus, citrus, coffee, guava, mango, soybean, cotton, maize etc. Infested plants show colonies of M. hirsutus, thereafter the colonies grow into large masses of white waxy coverings on branches, fruiting structures and even whole plants. Adult female measures about 4mm in length with the body being pink in colour with a white waxy coating. Lateral filaments are absent or rarely 1 or 2. Body is covered with sparse white wax, but with no stripes or blotches; ovisac is produced over entire body [10].

3.4. Rastrococcus iceryoides (Green) (Pseudococcidae: Hemiptera)
R. iceryoides was recorded from Nagpur and Coimbatore found in association with other mealybugs such as P. solenopsis, P. marginatus and N. viridis infesting cotton. The species has been found to damage several hosts like custard apple, mango, guava, citrus, tea, drumstick, hibiscus, etc. The species reproduce sexually as well as through oviparity and only fertilized eggs are laid by females [11]. R. iceryoides is an invasive mealybug species that
originated from South East Asia, and attained serious pest status on a wide range of host plants. The adult female body is oval to round about 3-4 mm; light yellow; mealy wax covering thick, in median area forming medial longitudinal ridge on thorax and abdomen; without longitudinal bare areas on dorsum. Lateral wax filaments are variable in number [12].

3.5 *Perissopneumon tamarindus* (Green) (Monophlebidae: Hemiptera)
The mealybug was first reported from CICR experimental farm, Sirsa, Haryana, India during crop season 2009-10 on cotton. Its presence was recorded on roadside trees and the adjoining cotton crop in Sirsa at four locations during 2010-11 and also during 2011-12. The species was observed in an experimental area of CICR, Regional station, Sirsa during 2010-11. Average maximum per cent incidence and mean population/ plant of *P. tamarindus* was 63.50 and 10.49 and lowest were 4.67 and 3.22, respectively at all the infested locations. A predatory bug *Rodolia fumida* (Mulsant) (Coleoptera: Coccinellidae) (RRS 533-568/11) associated with *P. tamarindus* was also recorded. Adult females are elliptical, size medium to fairly large (8 to 14 mm long), derm becoming quite definitely chitinized and yellow brown at maturity, with large circular to oval areoles around the pores.

Mealybugs are pests of many cultivated and uncultivated crops around the globe. In the present paper, we reported five mealybug species as pests of cotton in different parts of the cotton growing areas of India. These mealybugs have been reported [13] in the Indian agro-ecosystem infesting a variety of agricultural and forest plants. However, their infestation on cotton was recorded in the recent years for the first time. This is a matter of concern as mealybugs are difficult to control once they establish owing to their inherent high reproductive capacity and ease of transport from one plant to another through natural carriers readily make them pests of economically important plants. To avoid yield losses and minimize plant protection costs a constant watch is essential for timely management with eco-friendly measures. This study added the mealybug fauna as pests of cotton besides bollworm complex and regular sucking pests. Of these five species, *N. viridis* was found as emerging pest after *P. solenopsis* and needs close monitoring.

4. Acknowledgements
The authors thankfully acknowledge the funding by World Bank to carry out the present study as a part of National Agricultural Innovation Project. Dr VV Ramanurthy, Insect Identification Service, Division of Entomology, Indian Agricultural Research Institute, New Delhi is gratefully acknowledged for identifying mealybug species under report. Guidance and facilities provided by Dr S. Kranthi, Head Crop Protection Division and Dr K. R. Kranthi, Director, CICR is duly acknowledged.

5. References