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

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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 *Maconellicoccus hirsutus* (Green), mango mealybug *Rastrococcus iceryoides* (Green) (Pseudococcidae) and ber mealybug *Perissopneumon 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 ETrex(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

Granara de Willink. 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 north 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. atamarindus* -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 1: Species wise year of occurrence and location with coordinates

Sl. No	Name of mealybug	Crop season	Location	Coordinates (Latitude- Longitude)
1.	*Nipaecoccus viridis* (Newstead)	2009-10	Savandri, Wardha	20°44'43.134"N, 38°36"10.3572"E
			CICR farm, Nagpur	21° 2' 14.0388"N, 79° 3' 31.5138" E
		2010-11	CICR farm, Nagpur	21° 2' 14.0028"N, 79° 3' 31.5138"E
			Warud, Amravati	21° 31' 2.391"N, 78° 16'20.2764"E
		2011-12	Palora, Saoner, Nagpur	21°21'57.7"N, 79°10'10.0"E
			CICR farm, Nagpur	21° 2' 20.3814"N, 79° 3' 34.8762"E
		2012-13	CICR farm, Nagpur	21° 2' 20.3814"N, 79° 3' 34.8762"E
			Kalmeshwar, Nagpur	21° 14' 7.8498"N, 78°55'24.6282 E
		2013-14	CICR farm, Nagpur	21° 2' 20.3814"N, 79° 3' 34.8762"E
			Kalmeshwar, Nagpur	21° 14' 7.8498"N, 78°55'24.6282 E
2	*Ferrisia virgata* (Cockerell):	2011-12	CICR farm Nagpur	21° 2' 12.3066"N, 79° 3' 25.1022"E
		2012-13	CICR farm Nagpur	21° 2' 12.3066"N, 79° 3' 25.1022"E
		2012-13	Coimbatore	11° 0' 51.2634"N, 76° 55' 44.8824"E
3	*Maconellicoccus hirsutus* (Green)	2009-10	Vadugathampatti, Salem	11°38'17''N, 78°25'53''E
4	*Rastrococcus iceryoides* (Green)	2011-12	Saoner Nagpur	21°21'57.7"N 79°10'10.0"E
		2008-09	CICR farm, Coimbatore	76° 55' 44.8824"N, 11° 0'51.2634"E
5	*Perissopneumon tamarindus* (Green)	2009-10	CICR RS farm, Sirsa	29°32'44.3"N, 75°02'11.0"E
		2010-11	CICR RS farm, Sirsa	29°32'44.3"N, 75°02'11.0"E
			Bakerianwali, Sirsa	29°25'33.55"N, 75°01'18.10''E
			Ding Mandi, Sirsa	29°31'34.9824N, 75°16'13.836''E
			Sahuwala, Sirsa	31°40'41.0298"N, 73°16'1.0308"E
			Panniwala, Mota, Sirsa	29°42'14.74"N, 74°54'43.58"E
		2011-12	Bakerianwali, Sirsa	29°25'33.55"N, 75°01'18.10''E
			Ding Mandi, Sirsa	29°31'34.9824"N, 75°16'13.836''E
			Sahuwala, Sirsa	31°40'41.0298"N, 73°16'1.0308"E
			Panniwala, Mota, Sirsa	29°42'14.74"N, 74°54'43.58"E

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., purple 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 traces. 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, tailed mealybug; white-tailed mealybug. *F. virgata* is highly polyphagous infesting over 150 genera in 68 families [5] and distributed in more than 110 countries around the world [6]. 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	Infestation on cotton
	
Nipaecoccus viridis (Newstead)	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 waxy body that protects them from insecticides. The 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.

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5. References

1. Nagrare VS, Kranthi S, Biradar VK, Zade NN, Sangode V, Kakde G. Widespread infestation of the exotic mealybug species, *Phenacoccus solenopsis* Tinsley (Hemiptera: Pseudococcidae), on cotton in India. Bulletin of Entomological Research 2009; 99:537–541.
2. Dharajothi B, Surulivelu T, Gopalakrishnan N, Manjula TR. Occurrence of Papaya mealybug, *Paracoccus marginatus* Williams and Granara de Willink (Hemiptera: Pseudococcidae) on Cotton. Journal of Biological Control 2009; 23:321-23.
3. Tanwar RK, Jeyakumar P, Vennila S. Papaya mealybug and its management strategies, Technical Bulletin 22, National Centre for Integrated Pest Management, New Delhi, 2010; pp 22.
4. Nagrare VS, Kumar R, Amutha M, Dharajothi B, Kranthi S, Vennila S. A record of host plants of mealybug, *Phenacoccus solenopsis* Tinsley for devising ecofriendly management strategies. Journal of Entomological Research 2012; 36(4):327-344.
5. CABI. Crop Protection Compendium (2003 edition). Wallingford, UK: CAB International 2002.
6. DOCS. http://docs.exdat.com /docs/ index- 323096.html? page=13 2013.
7. Dhawan AK, Singh J, Sidhu AS. *Maconellicoccus* sp. attacking *Gossypium arboreum* cotton in Punjab. Science and Culture 1980; 46:258.
8. Muralidharan CM, Badaya SN. Mealybug (*Maconellicoccus hirsutus*) (Pseudococcidae: Hemiptera) outbreak on herbaceum cotton (*Gossypium herbaceum*) in Waged cotton belt of Kachchh. Indian Journal of Agricultural Sciences 2000; 70:705–706.
9. Williams DJ. A brief account of the hibiscus mealybug *Maconellicoccus hirsutus* (Hemiptera: Pseudococcidae), a pest of agriculture and horticulture, with descriptions of two related species from southern Asia. Bulletin of Entomological Research 1996; 86(05):617-628.
10. Miller DR. Identification of the Pink Hibiscus Mealybug, *Maconellicoccus hirsutus* (Green) (Hemiptera: Sternorrhyncha: Pseudococcidae). Insecta Mundi. Paper 339. http://digitalcommons.unl.edu/ insectamundi/3391999.16 July, 2014.
11. Rawat RR, Jakhmola SS. Bionomics of the mango-Coccid (*Rastrococcus iceryoides* Green; Homoptera: Coccidae). Indian Journal of Agricultural Sciences 1970; 40(2):140-144.
12. Williams DJ. The mealybug genus *Rastrococcus* Ferris (Hemiptera: Pseudococcidae). Systematic Entomology 1989; 14:333-486
13. Gautam RD, Suroshe SS, Gautam S, Saxena U, Fand BB, Gupta T. Fortuitous biological control of exotic mealybug, *Phenacoccus solenopsis*- A boon for Indian growers. Annals of Plant Protection Sciences 2009; 17(2):459-526.