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## Sucking pest complex of cotton and their management: A review

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### Abstract

Cotton is one of the most grown commercial crops of India. It grows well in almost all areas of the country with black soil. It is a member of Malvaceae family. It is mostly grown for textile industry, there by called as the King of Textiles. However, the cultivation of cotton possesses a great threat starting from the planting up to the harvest of bolls due to the attack of enormous pest and disease complex. Among all the pests, sucking pests are many and they cause a huge loss by affecting the vegetative growth of the plants, there by directly retarding the production of bolls to a large extent.

**Keywords:** Cotton, commercial crop, sucking pests, management methods

### Introduction

Cotton (*Gossypium* spp.) has more than 200 genera and about 2300 species. It belongs to family Malvaceae. There are more than 50 species of genus *Gossypium* reported till now, which are native to Africa, Australia, Central and South America and Asia (Fryxell 1992; Wendel and Grover 2015) [1, 2]. Only four species are widespread and used for commercial cultivation- two diploid ( $2n = 26$ ) species, namely *Gossypium arboreum* and *Gossypium herbaceum* belong to old world cotton and two tetraploid ( $2n = 52$ ) species, namely *Gossypium barbadense* and *Gossypium hirsutum* belong to new world cotton. *Gossypium barbadense* produces 4%, while *Gossypium hirsutum* known as upland cotton produces about 90% of the total cotton production in the world (Lu *et al.*, 1997; McCarty *et al.*, 2004) [3, 4]. In India, cotton is grown as a staple cash crop and accounts for 126.07 M hectare area with 337 MT of production during 2018-19 (CAB, 2019). During the recent periods, sucking pest complex evolved as a major headache for cotton growing farmers as the Bt cotton also affected by such pests. It is worth mentioning the recent outbreak of whitefly (*Bemisia tabaci*) in Bt cotton growing areas of Punjab in India. The whitefly attack in Punjab that damaged over 75 per cent crop across the cotton belt had led to widespread protests. About 95 per cent of Bt cotton got damaged in this outbreak resulting in a loss of around Rs.4500 crore (The Hindu, 2015) [5]. According to an estimate bollworms and sucking pest complex cause about 20-40% yield losses in Pakistan [Ahmad, 1999] [6]. Important sucking insect pests are jassid *Amarasca devastans* Dist. (Hemiptera: Cicadellidae), whitefly, *Bemisia tabaci* (Genn.) (Hemiptera: Aleyrodidae), cotton thrips, *Thrips tabaci* Lind. (Thysanoptera: Thripidae) and cotton aphid, *Aphis gossypii* Glover (Homoptera: Aphididae). No single pest control method is sufficient for good production. With effective control of cotton pests, yield of cotton can be increased by 200-300 kg ha<sup>-1</sup> [Khan *et al.*, 1987] [7].

### Major Sucking Pest Complex of Cotton

Cotton crop attracts many insect-pest which are major concerns from economic point of view. They are of two types- leaf eaters (defoliators) and sap suckers. The defoliators are majorly controlled by the cultivation of Bt cotton in recent days. But the sap suckers still possess a great threat to the Bt cotton. The present study highlights different types of sucking pest complex of cotton crop which are enlisted below.

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Sl. No	Common Name	Scientific Name	Family	Order
1	Leaf hopper	<i>Amrasca biguttula biguttula/ Amrasca devastans</i>	Cicadellidae	Hemiptera
2	White fly	<i>Bemisia tabaci</i>	Aleyrodidae	
3	Cotton aphid	<i>Aphis gossypii</i>	Aphididae	
4	Red Cotton Bug	<i>Dysdercus cingulatus</i>	Pyrrhocoridae	
5	Dusky cotton bug	<i>Oxycarenus hyalinipennis</i>	Lygaeidae	
6.	Mirid bug	<i>Ragnus spp Creontiades biseratense</i>	Miridae	
7.	Mealy bug	<i>Phenacoccus solenopsis Maconellicoccus hirsutus</i>	Pseudococcidae	
8.	Mites	<i>Tetranychus telarius, T. bioculatus</i>	Tetranychidae	Acari
		<i>Hemitarsonemus latus</i>	Tarsonemidae	
		<i>Eriophyes gossypii</i>	Eriophyiidae	
8.	Cotton Thrips	<i>Thrips tabaci, Scirtothrips dorsalis Thrips pami</i>	Thripidae	Thysanoptera

### 1. Leaf Hopper

It is a minute insect, varying from less than 1 mm to about 3 mm with body colour of reddish in winter and greenish yellow in summer. The adult is a wedge-shaped insect about 3.5 mm in length. There is a black spot on each forewing and two small black spots on the vertex. Both nymphs and adults move diagonally, when disturbed. It damages leaves by sap sucking from leaves and cause typical damage called hopper-burn where the edges of leaves curl downwards and become yellowish and then reddish before drying-out and shedding (Atakan, 2009) <sup>[8]</sup>. Severe hopperburn symptoms can cause stunting of young plants and can reduce cotton yields (Matthews, 1994) <sup>[9]</sup>.

**Management:** Integrated Pest Management approach for leaf hopper management should be followed in order to manage their population below ETL. The economic threshold level (ETL) for leaf hopper is more than 2 leaf hopper per leaf and appearance of crinkling and curling of few leaves in the lower portion of plant along with marginal yellowing (NCIPM, 2014). Cultural methods like growing of resistance varieties and seed treatments are followed to safeguard the cotton seedlings up to 30 days of sowing. Botanicals like Neem and Datura at 2 per cent are also useful for controlling various sucking pests in cotton (Khan *et al*, 2013) <sup>[11]</sup>. Biological agents like *Chrysoperla* @ 10000 per hectare are encouraged at the early fruiting stage.

### 2. White fly

This small pest of cotton is having a white or greyish body measuring upto 0.5 mm in length. A single female can lay about 70 stalked eggs or can breed parthenogenetically. Both nymphal and adult stages are responsible for the damage to the cotton leaf that results in chlorotic spots on leaves along with the development of sooty moulds. It also acts as a vector of cotton leaf curl virus.

**Management:** The economic threshold level (ETL) for white fly is more than 10 whiteflies in the middle region of the plant in more than 50 per cent of the total plants or adults produce smoky appearance when disturbed. Yellow sticky traps should be fixed at the vegetative stage of the crop in order to monitor the pest population. Border crops like sorghum or pearl millet or maize can be grown around the cotton fields. The plants affected with the leaf curl virus can be uprooted and burnt in order to avoid the spread of the virus (Kumar *et al.*, 2016) <sup>[13]</sup>.

### 3. Cotton aphid

It is a polyphagous pest with yellowish, green or greenish

brown body colour. The adults are distinguished by the presence of a pair of cornicles on the dorsal abdomen. They generally reproduce sexually or parthenogenetically. Both adult and nymphs damage cotton leaves by causing curled leaves that eventually dries up. They also secrete honeydew which result in the production of black sooty moulds.

**Management:** In cotton, the ETL of aphid is fixed at more than 10 per cent affected plants counted randomly showing symptoms of cupping or crumpling of few leaves on the upper portions of the plant. Biocontrol agents like *Aphelinus* spp., *Syrphus* spp. are applied to manage the aphid population (NCIPM, 2013).

### 4. Red cotton bug:

The nymphs and adults of red cotton bug suck sap from tender leaves and petioles in early stages. Their infestation results in the loose of vigour and premature boll opening with stained lint. It mainly feeds on the milky content of the seed kernels (Cauquil, 1988) <sup>[14]</sup>. A bacterium - *Nematospora gossypii* gains entry and spoils the lint from the spot of injury on the bolls. Stained or discoloured lint turns to typical yellow colour. Reddish nymphs are seen in aggregation around developing and open bolls (Vennila, 2007) <sup>[15]</sup>.

**Management:** Dislodging the gregarious population of the stainers on the bolls in to a vessel containing water with a thin film of kerosene is recommended as the late season insecticidal applications leave residues in the harvested produce besides being uneconomical (Vennila, 2007) <sup>[15]</sup>. Biocontrol agents like *Ectomocoris tibialis*, *Rhynocoris fuscipes* and *Harpactor costalis* are highly effective against red cotton bug.

### 5. Dusky cotton bug

The damage symptom caused by dusky cotton bug is similar to that of red cotton bug. Its egg is cigar shaped and white in colour. Both nymph and adult causes the sap from the immature seeds causing the staining of the lint. Serious damage is done to the seeds by reducing quality, germination and oil content (Sweet, 2000) <sup>[16]</sup>. Feeding by large populations of the nymphs and adults can cause a significant decrease in cotton seed weight (up to 15%). The ability of seeds to germinate is also significantly reduced, potentially as much as 88% (Henry, 1983) <sup>[17]</sup>.

**Management:** Same management methods are followed as that of management of red cotton bug. Predator *Orius tantalus* feeds on the nymphs of the dusky cotton bug.

## 6. Mirid bug

The yellowish green nymphs and adults were observed to suck the sap. The feeding on squares and bolls lead to flaring up. Due to this, the young bolls drop off the plant. The mirid bugs are observed to be the serious pest of Bt cotton.

**Management:** use Lucerne as a trap crop. As chemical control Fipronil 5SC (1 ml), Prophenophos 50EC(2ml)/Indoxacarb 15.5SC (0.5 ml) can be used.

## 7. Mealybug

It is a minor pest of cotton. Female mealy bugs are wingless, measuring up to 3-4 mm in size. Mature females are often found in the ovisacs containing eggs within. It severely attacks the Bt cotton complex. The nymphs caused serious damage to the crop through formation of crinkled leaves, distorted or bushy shoot and presence of honeydew and black sooty moulds.

**Management:** ETL of mealybug is attained if one stem of the plant get completely colonized by mealybugs. Cotton crop can be saved from mealybug attack by the cultivation of cornflower (*Centaurea cyanus*) and coriander as the border crops. Predator, *Cryptolaemus montrouzieri* is effective against mealybug (Miles *et al.*, 1992) <sup>[23]</sup>.

## 8. Mites

These are polyphagous organisms feeding on wide range of vegetables. Their adult females are with variable colours. The time of infestation and rate of development of two spotted spider mite populations causes significant reduction in the yield, fibre quality and seed viability of cotton (Wilson, 1993) <sup>[18]</sup>. The heavy infestation of mites results in the curling up of leaves which later on becomes hard and shed up. The bolls also ripen prematurely and shed up. In general, the yield depression by mites directly related to population density and duration of infestation. Spider mite injury also reduced boll size and appeared to adversely affect several characters of the seed and lint (Don *et al.*, 1964) <sup>[9]</sup>.

**Management:** Generally, the chemicals of chlorinated hydrocarbon groups should not be applied to the mites as it increases the resurgence capacity of mites and proves to be fatal to the natural enemies. So, sulphur related acaricide should be applied to manage the mite population. It had been noticed that the mite, *Tetranychus cinnabarinus* was effectively controlled by the release of predatory mite, *Neoseiulus pseudolongispinosus* at the early stage (Sarwar, 2013) <sup>[20]</sup>.

## 9. Cotton thrips

Thrips are having a wide range of host. Their eggs are kidney shaped laid in slits of the leaf tissues. Nymphs are pale tallow while the adults are straw coloured. Nymphs and adults suck the sap from upper and lower surfaces of the leaves. Margins of affected leaves get slightly curled up and the leaf blades show uneven surface. When the insect attacks in flowering stage, the affected flowers may wither away. Thrips infested fields show rusty appearance from a distance. It is a vector of yellow spot virus and spotted wilt virus (Groves *et al.*, 1998) <sup>[21]</sup>.

**Management:** The ETL for thrips is fixed at more than 10 thrips per leaf or silvery patches on underside of the leaves

above mid canopy in a sample of 10 samples per acre. French bean can be grown as an attractant crop around the field to control the thrips population. Bioagents like predatory mite, *Amblyseius swirskii* and predatory thrips, *Aeolothrips* spp. are very useful for controlling the pest population.

## Conclusion

Cotton, the major textile has been threatened by a group of sucking pests in various stages, leading to reduce the quality of lint and fibre. In this regard, there is an utmost need to adopt an eco-friendly and economic management practice, that will be helpful in managing the pest complexes and reducing their levels below ETL, thus reducing economic injury. Integrated pest management practices are helpful in managing the menace of these sucking pests. Starting from the first step in pest management i.e. proper identification of the pest to the chemical curative control measures can be followed for effective management. Apart from this, cultural control, use of resistant varieties, use of beneficial insects such as predators and parasites as emphasized in the literature can also be followed for a fruitful management of the diverse sucking pests.

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