

Species composition of the entomofauna on cotton in the Chirpan region

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Cotton (*Gossypium spp.*) is the most significant fiber crop globally. The standard fiber obtained from it is a main raw material for the textile industry due to its unique qualities – high hygroscopicity, electrical neutrality, resistance to friction and heating.

Cotton is attacked by a number of pests (around 1326) throughout the entire growing season, which damage all parts of the plant and are capable of reducing yield and deteriorating fiber quality (Leigh et al., 1996; Hanchinal et al., 2009; Kulkarni et al., 2024). Their species composition varies across different phenophases of the crop and in geographical regions worldwide (Rajendran et al., 2018).

In Australia, over forty species of insects and seven species of mites have been described on cotton, among them the most economically important are: cotton bollworm (*Helicoverpa armigera* Hub.), tobacco whitefly *Bemisia tabaci* (Grennadius), cotton aphid (*Aphis gossypii* Glover), tobacco thrips (*Thrips tabaci* L.), western flower thrips (*Frankliniella occidentalis*) (Pergande) and common spider mite (*Tetranychus urticae* Koch.) (Wilson et al., 2018).

In Pakistan, 38 species of insects from 9 orders and 25 families have been identified on cotton. Among them, those of economic importance are: *Erias insulana* Boisd., pink bollworm (*Pectinophora gossypiella* Saund.), tobacco thrips (*Thrips tabaci* L.), cotton aphid (*Aphis gossypii* Glover), tobacco whitefly (*Bemisia tabaci* Grenn.) and mites of the genus *Tetranychus* spp. (Taqi et al., 2019).

In the tropical and subtropical regions of India, several authors Puri et al. (1998), Hanchinal et al. (2009), Navi et al. (2021), report: *Bemisia tabaci* Gennadi and *Scirtothrips dorsalis* Hood as important cotton pests that transmit viruses.

In the USA, the following pests have been reported on cotton: thrips of the genus *Frankliniella* spp. (*Thysanoptera:Thripidae*), black cutworm (*Agrotis ipsilon* Hufnagel) (*Lepidoptera:Noctuidae*), cotton aphid (*Aphis gossypii* Glover) (*Hemiptera:Aphididae*), bugs from the family *Miridae* and wireworms from the family *Elateridae* (Allen et al., 2018).

Leigh and Goodell (1996) point out that wireworms cause the greatest damage to cotton in the first phenophases, destroying germinating seeds and young plants.

According to Williams, (2008, 2015, 2016, 2017) in the period 2007-2016, thrips attack between 70-95% of cotton areas in the USA.

Stoetzel et al., (1996) report eight species of aphids on cotton in the USA: *Aphis craccivora* Koch; *Aphis fabae* Scopoli; *Aphis gossypii* Glover, *Anuraphis maidiradicis* Forbes, *Macrosiphum euphorbiae* Thomas, *Myzus persicae* Sulzer, *Rhopalosiphum rufiadinale* Sasaki and *Smynthuodes betae* Westwood. Of these, the cotton aphid is constantly present in the cotton agrocenosis (Leigh et al., 1996).

Bugs from the family *Miridae*: *Lygus lineolaris* (Palisot de Beauvois), *Lygus hesperus* Knight, *Pseudatomoscelis seriatus* (Reuter) and *Neurocolpus nubilis* (Say), are cited as economically important cotton species (Leigh et al., 1996; Layton, 2000) and attack 38-61% of areas in the USA (Williams, 2008, 2015, 2016, 2017).

Before cotton sowing in Chirpan, species from the family *Elateridae* were identified: common click beetle (*Agriotes sputator* L.) and dark click beetle (*Agriotes obscurus* L.). They were recorded at a low density 0.5 - 1.5 larvae/m² (Table 1). Wireworms cause serious damage from sowing until the 1-2 true leaf stage. They gnaw at seeds, sprouts, and create tunnels in young plants. These damages are significant with early sowing and a cool spring, which prolongs the crop's vegetation. Alongside them during this period, the common darkling beetle (*Opatrum sabulosum* L.) was found, which was recorded at a density of 0.4-1 individuals/m².

Таблица 1. Неприятелни установени преди сеитбата на памука през 2023-2024 г. в района на гр. Чирпан (ср.бр./m²)

Клас/Разред	Семейство/Вид	Плътност (ср.бр./m ²)
Coleoptera	<i>Elateridae</i>	
	<i>Agriotes lineatus</i> L.	1.5
	<i>Agriotes obscurus</i> L.	0.5
	<i>Tenebrionidae</i>	
	<i>Opatrum sabulosum</i> L.	0,4-1

Immediately after cotton emergence until the 4-5th leaf stage, the following were found: turnip moth (*Agrotis segetum* Schiff.), cotton bollworm (*Helicoverpa armigera* Hb.), cotton aphid (*Aphis gossypii* Glover), tobacco thrips (*Thrips tabaci* Lind.) and common spider mite (*Tetranychus urticae* Koch.) (Table 2).

Таблица 2. Неприятелни установени в памуковите агроценози от фаза поникване до фаза цъфтеж през 2023-2024 г. в района на гр. Чирпан (ср.бр./m²)

Клас/Разред	Семейство/Вид	Плътност (ср.бр./m ²)
<i>Insecta</i> <i>Lepidoptera</i>	<i>Noctuidae</i>	
	<i>Agrotis segetum</i> Schiff.	0.5 - 1
	<i>Helicoverpa armigera</i> Hb.	15 повр. бутона/100 р-я
	<i>Aphididae</i>	
	<i>Aphis gossypii</i> Glover	Бал 2
<i>Thysanoptera</i>	<i>Thripidae</i>	
	<i>Thrips tabaci</i> Lind.	3
<i>Arachnida</i> , <i>Trombidiformes</i>	<i>Tetranychidae</i>	
	<i>Tetranychus urticae</i> Koch.	2 подвижни форми на лист

During the period from emergence to the 1-2 true leaf stage, cotton damage is caused by the caterpillars of the turnip moth, which gnaw at sprouts and young stems near the soil surface. During the reporting period, its density was low, 0.5 - 1 individuals/m²

After cotton emergence, the tobacco thrips migrates from weed vegetation. It was recorded at a low density of 3 individuals/m². Mass reproduction of the pest is observed in warm and dry weather. The species attacks the youngest leaves and the growing tip of the plants, as a result of which the leaves become deformed and the plants branch out.



Cotton aphid

The cotton aphid causes the most economically significant damage during this period. It sucks sap from the underside of leaves and plant stems, secreting honeydew. The damages are in patches and the degree of infestation was high - 2 points.



Cotton bollworm caterpillar

During the budding-early flowering period, damages from cotton bollworm caterpillars were observed. They damage the buds, which later fall off. 15 damaged buds per 100 plants were recorded.

From the beginning of flowering until ripening, cotton is damaged by the common spider mite, which develops on the underside of leaves, sucks sap, as a result of which the leaves yellow and dry out. In case of mass reproduction of the species, leaves, stems, and the growing tip are covered with silk threads. During the reporting period, mite density reached 2 mobile forms per leaf.

In May-June, among the polyphagous pests in the cotton agroecosystem, the great green bush-cricket (*Tettigonia viridisima* L.) was found. The species was recorded in low numbers, 1 individual/m². Larvae, nymphs, and adults gnawed on leaves and were found along the periphery of the crop.

In the flowering to ripening stage, the harmful activity of the cotton bollworm, cotton aphid, horned leafhopper, and common spider mite continues. All these pests were recorded at low densities. This period covers the months of July and August, which are characterized by maximum high temperatures and low relative humidity (Table 3).

Таблица 3. Неприятели в памуковата агроценоза от фаза цъфтеж до фаза узряване през 2023-2024 г. в района на гр.Чирпан (ср.бр./m²)

Клас/Разред	Семейство/Вид	Плътност (ср.бр./m²)
<i>Insecta,</i> <i>Orthoptera</i>	<i>Tettigoniidae</i>	
	<i>Tettigonia viridisima</i> L.	0.5
<i>Lepidoptera</i>	<i>Noctuidae</i>	
	<i>Helicoverpa armigera</i> Hb.	2
<i>Hemiptera</i>	<i>Aphididae</i>	
	<i>Aphis gossypii</i> Glover	Бал 1
	<i>Membracidae</i>	
	<i>Stictocephala bubalus</i> F.	0.5
<i>Arachnida,</i> <i>Trombidiformes</i>	<i>Tetranychidae</i>	
	<i>Tetranychus urticae</i> Koch	1

The cotton agroecosystem has less entomofaunal biodiversity due to the presence of gossypol in cotton plants – a compound with toxic effects on animal organisms. Additional influence is exerted by the ecological conditions under which the crop is grown – the southernmost regions of the country, characterized by extremely high temperatures during the summer season.

The agricultural practices carried out in cotton cultivation, including inter-row cultivation, limit the availability of host plants for insects inhabiting cotton fields.

The beneficial entomofauna in the cotton agroecosystem includes representatives of the order *Coleoptera*, family *Coccinellidae*: seven-spot ladybird (*Coccinella septempunctata* L.), five-spot ladybird (*Coccinella quinquepunctata* L.), variable ladybird (*Adonia variegata* Gz.), fourteen-spotted ladybird (*Propylaea quatuordecimpunctata* L.) and punctate ladybird (*Stethorus punctillum* Ws.); from the order *Heteroptera*, family *Nabidae* - *Himacerus apterus* F. and *Nabis ferus* L.; from the order *Neuroptera*, family *Chrysopidae* - common green lacewing (*Chrysopa carnea* Steph.), seven-spotted green lacewing (*Chrysopa septempunctata* Wesm.) and beautiful green lacewing (*Chrysopa formosa* Br.); from the order *Diptera*, family *Syrphidae* - *Scaeva pyrastris* L. and parasites from the order *Hymenoptera*, family *Aphidiidae* - *Diaeretiella rapae* M. Int., *Lysiphlebus fabarum* March. and *Aphidius matricariae* Hal.



Fourteen-spotted ladybird (Propylea quatuordecimpunctata)

The development of beneficial species on cotton is closely related to the presence of the main pest — **the cotton aphid**. Its appearance leads to an increase in the number of several beneficial insects acting as natural regulators. Among them, important ones are: **seven-spot ladybird** (*Coccinella septempunctata*), **five-spot ladybird** (*Coccinella quinquepunctata*), **variable ladybird** (*Hippodamia variegata*), **fourteen-spotted ladybird** (*Propylea quatuordecimpunctata*) and representatives of the family **Nabidae**: *Himacerus apterus* (F.) and *Nabis ferus* (L.).

These species limit the aphid population and contribute to the stability of the agrocenosis.

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