

Taxonomic Composition, Harmfulness, and Preventive Measures of Hemiptera: Miridae Bugs Under the Conditions of Karakalpakstan

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Abstract This article analyzes the taxonomic composition, trophic groups, patterns of damage to cotton and forage crops, and preventive management measures of bugs of the family Miridae Hahn, 1833 occurring in cotton, alfalfa, and vegetable agroecosystems and natural ecosystems of the Republic of Karakalpakstan, particularly in the Amu Darya and Khujayli districts. Although representatives of Hemiptera are sometimes called beetles in the scientific literature, taxonomically beetles belong to the order Coleoptera, whereas Miridae is a family of true bugs within Hemiptera: Heteroptera. The analysis was based on data on 19 species recorded in the Amu Darya–Khujayli area in 2015–2020, including 17 phytophagous and 2 entomophagous species. Regional data were compared with international taxonomic catalogues, GBIF, and recent Miridae/Heteroptera studies published in Uzbekistan. The results show a strong association of Miridae species with the generative organs of cotton, alfalfa, vegetables, and wild host plants. Local sources report that Miridae feeding causes 5–7% damage to the cotton yield; under other agroclimatic conditions of Uzbekistan, certain mirids, especially *Adelphocoris lineolatus*, *Lygus pratensis*, and *Creontiades pallidus*, have been associated with significant yield losses. The article proposes an integrated preventive system consisting of monitoring, management of weeds and reservoir plants, conservation of entomophages, a trap-crop approach, and decision-making based on the economic threshold of damage.

Keywords Miridae, Hemiptera, Heteroptera, Karakalpakstan, Amu Darya, Khujayli, Cotton, Alfalfa, Phytophage, Entomophage, Integrated pest management

1. Introduction

Miridae Hahn, 1833 is one of the largest and ecologically most important families within Heteroptera, comprising thousands of species worldwide. In cotton agroecosystems of Uzbekistan, certain representatives of this family damage generative organs buds, flowers, bolls, and capsules as sap-sucking phytophages, while other representatives are important as entomophages or zoophytophages feeding on eggs and larvae of small insects. [2] Therefore, generalizing Miridae species solely as pests is scientifically insufficient: the trophic status, phenology, host plants, and function of each species in the agroecosystem should be assessed separately.

The issue of Miridae in Karakalpakstan is relevant for two reasons. First, the region has an arid climate, while irrigated areas in the Amu Darya delta are located in a landscape where cotton, alfalfa, and vegetable agroecosystems intersect

with natural desert–meadow biotopes. Such a mosaic landscape creates favorable conditions for the migration of phytophagous bugs between crop fields and wild reservoir plants. Second, the Southern Aral Sea region and Lower Amu Darya area have been actively studied in recent years in terms of Heteroptera diversity: in 2025, the composition of Heteroptera in the Southern Aral Sea region was reported to comprise 258 species, 25 families, and 104 genera. [4] This indicates the need to strengthen regional inventory and practical monitoring of Miridae.

2. Results

The family Miridae belongs to the infraorder Cimicomorpha within the superfamily Miroidea. In GBIF data, for example, the complete hierarchy for *Lygus pratensis* is Animalia – Arthropoda – Insecta – Hemiptera – Miridae – *Lygus* – *Lygus pratensis*. [8] The Catalogue of Life lists the “On-line Systematic Catalog of Plant Bugs” dataset as a separate global taxonomic resource in its 2026 version. [7]

Nineteen species from the family Miridae were recorded in published materials for the Amu Darya and Khujayli districts, of which 17 were assessed as phytophagous and 2 as entomophagous. [1] The table presents taxa that can be clearly read in the source and are considered within Miridae. Because some names are given with old transliterations or spelling errors, molecular or genital-morphological re-examination is required.

Important note on taxonomic accuracy: Certain names such as *Carpocoris* also appear alongside the Miridae entries in the source, but *Carpocoris* is generally placed in the family Pentatomidae. Therefore, it was not included in Miridae in this article; instead, it was treated as part of the general Heteroptera list in the source.

According to regional data, phytophages predominate among Miridae species: 17 of the 19 species are indicated as phytophages and 2 as entomophages. This ratio demonstrates the practical importance of the Miridae family in cotton, alfalfa, and vegetable agroecosystems. At the same time, conserving zoophytophagous/entomophagous representatives such as *Campylomma verbasci* and *Deraeocoris punctulatus* may be important for naturally limiting populations of pest phytophages. The role of *Deraeocoris serenus* as an entomophage in the agroecosystems of Karakalpakstan was specifically noted by Jollibekova G.P. and Juginisov T.I.; the bioecological characteristics of Miridae bugs in the Southern Aral Sea region were described in a study involving Juginisov T.I. and Duysengaliyev E.S. [17], [19].

The spectrum of host plants is broad: a local source reports that Miridae representatives are associated with 46 plant species belonging to 18 families, and oviposition was recorded on 32 plant species. [1] This indicates that Miridae representatives move among and inhabit not only agroecosystems but also wild plants, field margins, ditch banks, alfalfa, and cotton fields.

Miridae representatives suck sap from plant tissues using piercing-sucking mouthparts. In the *Lygus* group, damage is often associated with the apical meristem, buds, flowers, seeds, and fruit organs; damage results from mechanical piercing and the action of salivary enzymes that disrupt cellular contents. [9] In cotton, this may manifest as bud shedding, blackening of flowers, black spots on bolls, deformation, slowed seed development, and a reduction in yield-forming elements.

In Amu Darya district of Karakalpakstan, black spots on bolls, flowers, and stems were recorded on cotton variety C-27-54 R-1 after feeding by field and alfalfa bugs. The regional conclusion indicates that feeding on the generative organs of cotton was associated with 5–7% yield damage. [1] Special cage experiments conducted in other regions of the republic showed that the damage range for some Miridae representatives can be considerably higher: 32.3–36.4% under the influence of *Adelphocoris lineolatus*, 8.6–13.5% under the influence of *Lygus pratensis*, and up to 61.6–88.9% yield reduction with early-season damage by *Creontiades pallidus*. [2]

Table 1. Methodological framework and key indicators for the regional agroecological assessment of Miridae in Karakalpakstan

Indicator	Approach adopted in the article	Scientific significance
Region	Amu Darya and Khujayli districts; broader context the Southern Aral Sea region and Uzbekistan's cotton agroecosystems	Makes it possible to distinguish regional and republic-level data
Object	Representatives of the family Hemiptera: Heteroptera: Miridae	Ensures use of the scientific term “bug/plant bug” instead of “beetle”
Main data	Regional observations from 2015–2020; new studies on Uzbekistan from 2023–2025	Updates the article with recent literature
Type of analysis	Taxonomic, trophic, agroecological, and preventive analysis	Combines theoretical and practical conclusions
Outcome criteria	Number of species, trophic group, spectrum of host plants, damage range, preventive measures	Provides a basis for developing an IPM system

Table 2. Taxonomic classification of the family Miridae (Hemiptera: Heteroptera)

Taxonomic rank	Accepted unit	Note
Kingdom	Animalia	Multicellular animals
Phylum	Arthropoda	Arthropods
Class	Insecta	Insects
Order	Hemiptera	Proboscis-bearing/sap-sucking insects
Suborder	Heteroptera	True bugs
Infraorder	Cimicomorpha	Includes many phytophagous and zoophagous bugs
Superfamily	Miroidea	Higher taxon associated with Miridae
Family	Miridae Hahn, 1833	Plant bugs / true mirid bugs

Table 3. Species composition, trophic groups, host associations, and agroecological significance of Miridae recorded in Karakalpakstan

№	Genus	Species	Trophic group	Main biotope/host	Scientific note
1	<i>Adelphocoris</i>	<i>Adelphocoris lineolatus</i> (Goeze, 1778)	Phytophage	Alfalfa, cotton, legumes, and weeds	Alfalfa bug; important as a polyphagous harmful species
	<i>Adelphocoris</i>	<i>Adelphocoris jakovlevi</i> Reut., 1896	Phytophage	Alfalfa, cotton, legumes, and weeds	Alfalfa bug; important as a polyphagous harmful species
2	<i>Lygus</i>	<i>Lygus pratensis</i> (Linnaeus, 1758)	Phytophage/ zoophytophage	Cotton, alfalfa, flowering weeds	Field bug; damages generative organs
3	<i>Lygus</i>	<i>Lygus gemellatus</i> Herrich-Schaeffer	Phytophage	Alfalfa and meadow plants	Given in the source with the abbreviation H.-S.
4	<i>Lygus</i>	<i>Lygus rugulipennis</i> Poppius	Phytophage	Flowering wild weeds, agrocnosis margins	Should be assessed within the Lygus complex
	<i>Lygus</i>	<i>Lygus pratensis</i> L. 1758	Phytophage	Flowering wild weeds, agrocnosis margins	Should be assessed within the Lygus complex
	<i>Lygus</i>	<i>Lygus gemellatus</i> H.-S. 1836	Phytophage	Flowering wild weeds, agrocnosis margins	Should be assessed within the Lygus complex
5	<i>Polymerus</i>	<i>Polymerus cognatus</i> Fieber	Phytophage	Meadow and agrocnosis plants	Representative of Mirinae
6	<i>Trigonotylus</i>	<i>Trigonotylus ruficornis</i> Geoffroy	Phytophage	Grasses and reed-like grasses	May serve as a reservoir on field margins
7	<i>Stenodema</i>	<i>Stenodema calcaratum</i> Fieber	Phytophage	Representatives of Poaceae	Elongate-bodied grass bug
8	<i>Poeciloscytus</i>	<i>Poeciloscytus cognatus</i> Fieber	Phytophage	Wild weeds and agrophytocnosis	Given in the source as <i>P. cognatus</i>
9	<i>Poeciloscytus</i>	<i>Poeciloscytus vulneratus</i> Panzer	Phytophage	Meadow plants	Recorded during regional monitoring
10	<i>Poeciloscytus</i>	<i>Poeciloscytus brevicornis</i> Reuter	Phytophage	Wild plants	Recorded during regional monitoring
11	<i>Campylomma</i>	<i>Campylomma verbasci</i> (Meyer-Dür, 1843)	Entomophage/ zoophytophage	Small phytophages, certain plant parts	Must be conserved as a beneficial entomophage
	<i>Campylomma</i>	<i>Campylomma diversicornis</i> Reut. 1878	Entomophage/ zoophytophage	Small phytophages, certain plant parts	Must be conserved as a beneficial entomophage
12	<i>Atomoscelis</i>	<i>Atomoscelis onustus</i> Fieber	Phytophage	Cotton and weeds	May occur in cotton agrocnoses
13	<i>Deraeocoris</i>	<i>Deraeocoris punctulatus</i> Fallén	Entomophage/ zoophytophage	Small insects, phytophages	Beneficial representative in natural control
14	<i>Dicyphus</i>	<i>Dicyphus</i> sp.	Zoophytophage	Vegetables and wild plants	Species-level identification is required
15	<i>Orthotylus</i>	<i>Orthotylus flavosparsus</i> C. R. Sahlberg	Phytophage/ zoophytophage	Wild weeds	Given in the source as <i>Orthotulus</i>
16	<i>Pichroscytus</i>	<i>Pichroscytus undulatus</i> Reuter	Phytophage	Natural plants	Requires nomenclatural verification
17	<i>Dichroscytus</i>	<i>Dichroscytus pseudosalinus</i> (as written in the source)	Phytophage	Desert–meadow biotopes	International catalogue and specimen verification are required for certainty

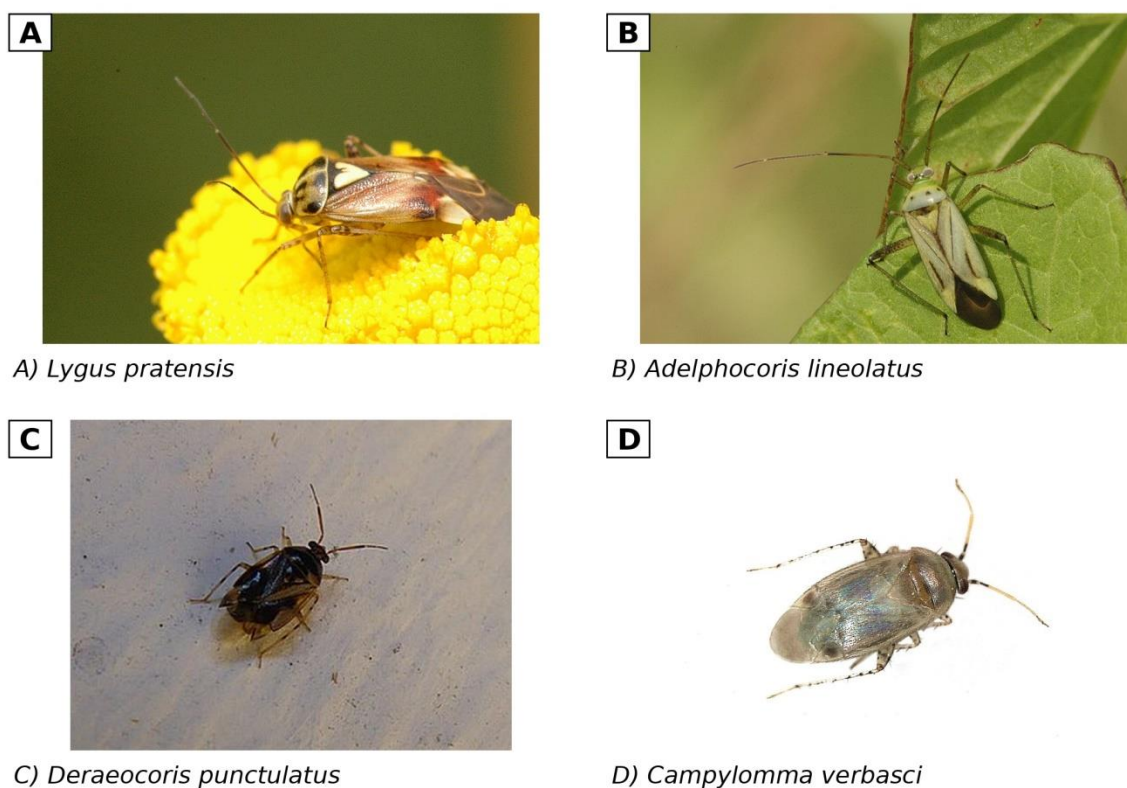


Figure 1. Real photographs of species belonging to the family Miridae obtained from the Internet: A — *Lygus pratensis*, B — *Adelphocoris lineolatus*, C — *Deraeocoris punctulatus*, D — *Campylomma verbasci*. Photo credits and licenses: Wikimedia Commons. [13]

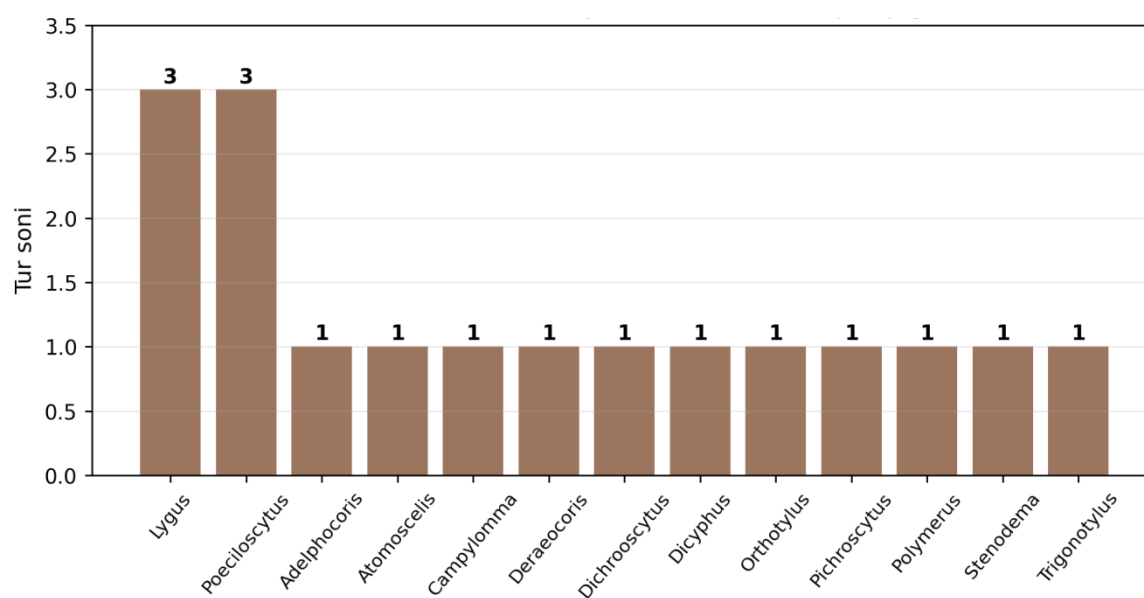


Figure 2. Number of species by clearly identified Miridae genera in the Amu Darya–Khujayli data. The graph was reconstructed based on the taxonomic table in the source

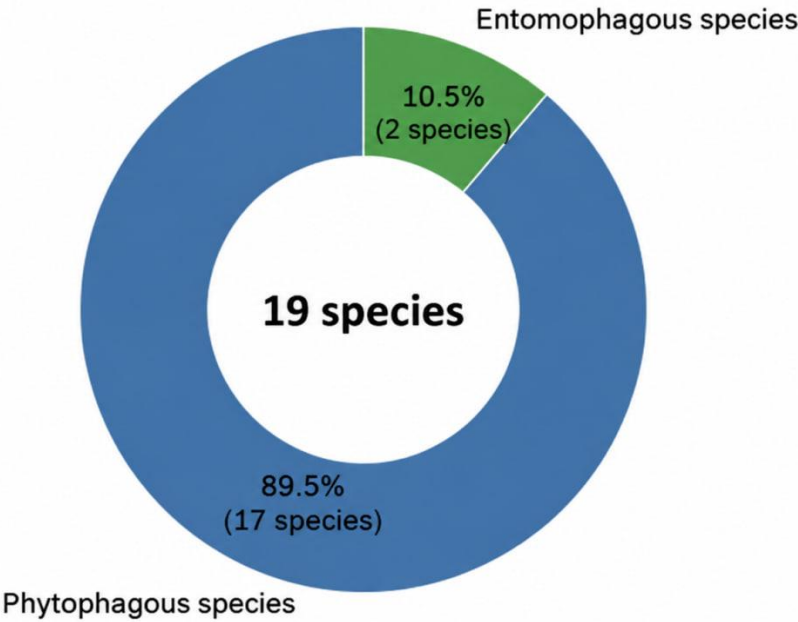


Figure 3. Ratio of trophic groups of Miridae species recorded in the Amu Darya and Khujayli districts

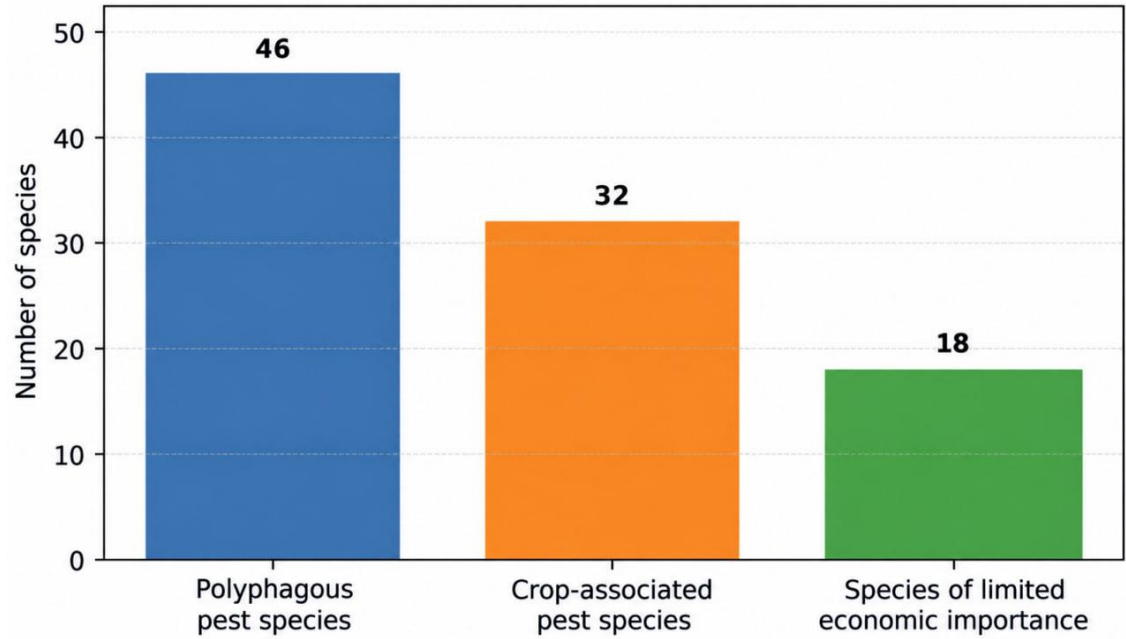


Figure 4. Spectrum of host plants associated with Miridae representatives: number of plant species, species on which oviposition was recorded, and number of plant families

Table 4. Major damage symptoms caused by Miridae, their biological causes, occurrence periods, and practical monitoring approaches

Damage symptom	Possible biological cause	Period most commonly observed	Practical assessment
Bud and flower shedding	Piercing-sucking, effect of salivary enzymes, weakening of generative organs	Budding–flowering period	Monitoring every 7–10 days; separate counts at field margins and near alfalfa
Black dots/spots on bolls	Damage and necrosis of boll tissue	Young boll formation	Record the proportion of damaged bolls
Spots on stems and flower pedicels	Local necrotic reactions at feeding sites	Throughout the growing season	Use a magnifying glass and laboratory examination to distinguish from disease spots
Migration from alfalfa and wild weeds to cotton	Movement following drying or mowing of host plants	Alfalfa mowing or drought period	Separate transect monitoring along field margins

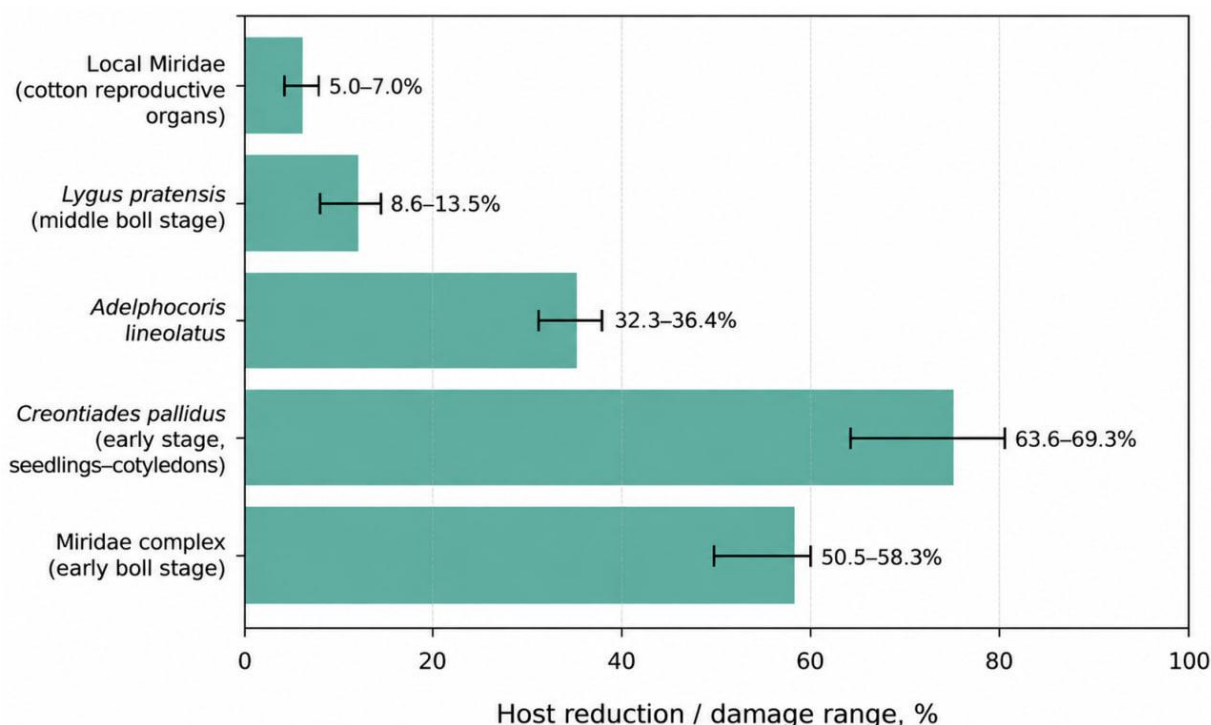


Figure 5. Ranges of cotton damage by Miridae reported in Uzbek sources. Data on *Creontiades pallidus* are provided for comparison at the republic level and do not refer to Karakalpakstan

Table 5. Integrated pest management strategies for Miridae in cotton agroecosystems

Direction	Practical measure	Scientific basis	Expected result
Monitoring	Weekly visual observations in cotton, alfalfa, and field margins; standard sweep sampling with an entomological net; separately record damage to buds, flowers, and bolls at designated points	Miridae are detected more frequently during their active period; standardized sweeping allows comparison of results	Early detection of pests and reduced unnecessary treatments
Agronomic practices	Control weeds and wild reservoir plants; however, do not eliminate all field margins at once, and preserve habitats for natural enemies	Phytophages reproduce on reservoir plants; natural enemies also inhabit these biotopes	Reduced migration risk while maintaining biological control
Alfalfa management	Coordinate alfalfa mowing with the cotton budding period; monitor the risk of migration to cotton after mowing	Alfalfa is an important feeding and breeding site for Miridae	Prevention of abrupt migration between alfalfa and cotton
Biological control	Conserve beneficial entomophages such as <i>Deraeocoris</i> , <i>Campylomma</i> , <i>Nabis</i> , and <i>Orius</i> ; limit broad-spectrum treatments	Entomophages naturally suppress phytophagous eggs and larvae	Greater ecosystem stability
Trap-crop approach	Use alfalfa or other attractive plants as diversionary fields, but manage them through monitoring	<i>Lygus</i> species may prefer certain hosts to the main crop	Potential reduction in damage to the main crop
Chemical method	Apply only when the economic threshold is exceeded, using registered products and professional phytosanitary recommendations; rotate modes of action	Resistance risk must be reduced and entomophages conserved	Reduced unnecessary costs and environmental pressure

3. Discussion

The results show that the Miridae problem under the conditions of Karakalpakstan is not limited to a single crop or a single species. Cropland, alfalfa, vegetables, wild plants, and natural biotopes form an interconnected agroecological system. Therefore, prevention should not rely solely on chemical treatment; instead, it should combine monitoring, agronomic practices, biological control, conservation of natural enemies, and, where necessary, selective chemical

measures.

Recent studies indicate that the Heteroptera fauna of Uzbekistan is being rapidly updated. For example, in 2024, *Asciodema obsoleta* was reported for the first time for the fauna of Uzbekistan, based on material from the Khorezm, Namangan, and Fergana regions. [6] This confirms the need to maintain the Miridae list not as a static inventory but as a continuously updated database.

A particular risk for Karakalpakstan is that alfalfa and wild flowering plants may serve as reservoirs for

phytophagous Miridae. International literature notes that trap crops for *Lygus* species, particularly alfalfa-based border crops, may divert pests from the main crop; however, if such an approach is improperly managed, the reservoir field itself may become a source of pests. [9] Therefore, as a preventive measure, alfalfa mowing, field margins, vegetation along ditches, and migration periods between crops should be planned together. The need to link preventive work with seasonal monitoring is also evident in the work of Juginisov T.I., Kurbaniyazov B.T., Duysengaliyev E.S., and co-authors on seasonal changes in the development of *Anacanthotermes* termites. [18]

Preventive Measures System. The following system is a recommended preventive model for the cotton–alfalfa–vegetable agrocenoses of Karakalpakstan. It is not a pesticide dosage or field-treatment instruction; chemical measures should be carried out only in accordance with labels of registered products, local phytosanitary regulations, and the instructions of qualified specialists.

4. Conclusions

Representatives of the family Miridae in the agrocenoses of the Amu Darya and Khujayli districts of Karakalpakstan form a multi-component complex associated with cotton, alfalfa, vegetable crops, and natural plants. Published regional data record 19 species of Miridae, of which 17 are indicated as phytophagous and 2 as entomophagous. For scientific accuracy, some taxon names should be re-examined using international catalogues, collection specimens, and, where necessary, DNA barcoding. Miridae damage is most pronounced in the generative organs of cotton: damage to buds, flowers, and young bolls, black spots, shedding, and reductions in yield-forming elements are observed. Local sources report damage of 5–7%, but special experiments in other regions of Uzbekistan show considerably higher yield losses for some species. The preventive system should combine monitoring, agronomic management, control of alfalfa and field-margin reservoirs, conservation of entomophages, and scientifically justified chemical intervention only when necessary.

Scientific Novelty and Practical Significance. Maqolaning ilmiy yangiligi Miridae bo'yicha mahalliy Qoraqalpog'iston ma'lumotlarini so'nggi xalqaro va respublika nashrlari bilan uyg'unlashtirish, shuningdek, turlarni fitofag-entomofag funksional guruhlari bo'yicha profilaktik boshqaruv nuqtai nazaridan qayta talqin qilishdan iborat. Amaliy ahamiyati esa paxta va beda agrotsenozlarida keraksiz kimyoviy bosimni kamaytirgan holda Miridae xavfini erta aniqlash va boshqarish algoritmini taklif etishidir.

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