

# FEEDING OF COCCINELLIDS AS ENTOMOPHAGES

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**Abstract:** This article examines the feeding characteristics of coccinellids (Coccinellidae) as entomophagous insects and their significance in biological pest control. The role of natural enemies in regulating pest populations in agroecosystems is discussed, with particular emphasis on predatory and parasitic species. The classification of coccinellids according to their feeding habits—phytophagous and predatory groups—is presented, including aphidophagous, coccidophagous, microentomophagous, and acariphagous species. Special attention is given to their effectiveness in controlling cotton aphids and other agricultural pests. Historical examples of successful biological control programs, including the introduction of beneficial species, are highlighted. The importance of conserving native entomophagous species and accurately identifying their species composition for sustainable agricultural practices is emphasized.

**Keywords:** Coccinellidae, coccinellids, entomophages, biological control, predatory insects, aphidophages, cotton aphid, agroecosystem, pest management, species composition, introduction, natural enemies.

## КОРМЛЕНИЕ КОКЦИНЕЛЛИД КАК ЭНТОМОФАГОВ

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**Аннотация:** В статье рассматриваются особенности питания кокцинеллид (Coccinellidae) как энтомофагов и их значение в биологической борьбе с вредителями. Обсуждается роль естественных врагов в регулировании популяций вредителей в агроэкосистемах, с особым вниманием к хищным и паразитическим видам. Представлена классификация кокцинеллид по типам питания —

фитоморфные и хищные группы, включая афидофагов, кокцидофагов, микроэнтомофагов и акарифагов. Особое внимание уделено их эффективности в контроле популяций тли хлопковой и других сельскохозяйственных вредителей. Приведены исторические примеры успешных программ биологической борьбы, включая интродукцию полезных видов. Подчёркивается важность сохранения местных энтомофагов и точного определения их видового состава для устойчивого ведения сельского хозяйства.

**Ключевые слова:** Coccinellidae, кокцинеллиды, энтомофаги, биологическая борьба, хищные насекомые, афидофаги, тля хлопковая, агроэкосистема, управление вредителями, видовой состав, интродукция, естественные враги.

**Introduction:** The biological method of pest control is based on the use of natural enemies of harmful organisms as well as microbiological preparations. According to their feeding characteristics, the natural enemies of arthropods are divided into entomophages (feeding on insects) and acariphages (feeding on mites).

In practice, the biological method is implemented by artificially rearing and releasing specific predatory insects and mites in areas where pest outbreaks are likely to occur. There are two main approaches to the large-scale use of entomophages: first, identifying and effectively utilizing local species; second, introducing aggressive species from other regions (introduction) and adapting them to local conditions.

**Main Part:** Natural enemies of pests may act either as parasites or predators. Parasites may be internal (endoparasites), developing inside their host (e.g., *Trichogramma*, *Apanteles*), or external (ectoparasites), whose larvae feed on the outside of the host (e.g., some braconids). Predatory entomophages (such as lacewings, coccinellids, and wasps) differ from parasites in that they kill their prey immediately rather than gradually.

As mentioned above, local species of parasites and predators can be mass-reared under laboratory conditions (in biofactories) and released into infested fields to maintain pest populations at an economically harmless level. In Uzbekistan's biological laboratories, three main biological control agents are mass-produced: *Trichogramma*,

Bracon, and lacewings. Trichogramma is used against moth eggs, while Bracon, as a generalist predator, is used against both sucking and chewing pests.

### **Effective Natural Enemies of Cotton Aphids**

Coccinellids, commonly known as ladybird beetles, are widely distributed in nature. Interest in ladybird beetles dates back to the great European biologist Carl Linnaeus, who recommended their use against aphids. Erasmus Darwin also advised using ladybird beetles to eliminate aphids in greenhouses. In England, the release of ladybird beetles in fields and greenhouses was proposed to control aphid populations.

A notable example is the introduction in 1888 of *Rodolia cardinalis* Muls. from Australia to California to control the cottony cushion scale (*Icerya purchasi*) in citrus orchards. This introduction achieved remarkable success and marked a turning point in the development of biological plant protection.

In 2011, during the mass outbreak of cotton aphids in May–June in the Navoiy region, the regional Plant Protection Center organized the collection of ladybird beetles from natural habitats with the participation of school, lyceum, and college students and released them into cotton fields. This effort resulted in the effective suppression of the pest.

Science recognizes about 5,000 species of coccinellids worldwide, of which around 2,000 species have been recorded in the CIS countries. In Central Asia, 180 species are known, and several subfamilies, species, and subspecies occur in Uzbekistan. Approximately 80 species are known as entomophages (Mansurov, Hamroyev, Babanov, 2002).

### **Classification of Coccinellids According to Feeding Habits**

Coccinellids are divided into the following groups based on their feeding habits:

**1. Phytophagous coccinellids (plant-feeding species), which are subdivided into three groups:**

- a) Phytophages – feeding on plant leaves, and partly on stems and flowers;
- b) Palinophages – feeding on flowers;
- c) Mycetophages – feeding on fungi.

**2. Predatory coccinellids, which are subdivided into four groups:**

- a) Aphidophages – feeding on aphids;
- b) Coccidophages – feeding on scale insects and mealybugs;
- c) Microentomophages – feeding on small insect larvae;
- d) Acariphages – feeding on spider mites.

Considering the beneficial activity of predatory entomophagous coccinellids, it is essential both to develop measures for their conservation and to determine their species composition to effectively utilize them in pest management.

### **Morphological Characteristics of Coccinellids**

Coccinellids are relatively small beetles, usually short and elongated, convex dorsally and flat ventrally. Their coloration is variable. Many species are bright red or yellow with black spots or markings, sometimes forming distinctive patterns. The dorsal surface may be smooth and shiny or covered with fine hairs and punctures. The ventral side and legs are almost always covered with short hairs.

**Conclusion:** The head is transverse and rounded, with a flat dorsal surface and rounded posterior margin. In some species, the anterior margin of the frons is nearly straight or slightly curved; in others, it is convex and protruding. The eyes are oval or kidney-shaped, composed of small hexagonal facets, and are located laterally on the head, partially visible from above. The antennae are club-shaped and covered with setae, positioned between the base of the mandibles and the eyes or in front of the eyes.

The number of antennal segments varies among genera: in the genus *Platynopis* there are 10 segments; in *Chilocorus*, 8 segments; in *Exochomus*, 9 segments; and in *Subcoccinella*, 11 segments. In some forms (e.g., *Hyperaspis*, *Chilocorus*), the antennae are short, while in others (e.g., *Coccidulini*) they are slightly longer than the head.

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