

HABITAT AND DISTRIBUTION OF COCCINELLIDS

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Abstract: This article discusses the habitat, geographical distribution, taxonomic composition, and biological and ecological characteristics of the family Coccinellidae. The species diversity at the global level and in Central Asia, particularly in Uzbekistan, is analyzed, along with their role in agrobiocenoses and food chains. Information is provided on the developmental stages, laboratory rearing methods, feeding characteristics, and effectiveness in biological control of *Coccinella septempunctata*. Additionally, the invasive potential of this species and its impact on native species are examined. The research findings are important for the development of environmentally safe biological control methods in agriculture.

Keywords: Coccinellids, Coccinellidae, *Coccinella septempunctata*, biological control, entomophages, agrobiocenosis, ecology, distribution, larva, invasive species, aphids, food chain.

СРЕДА ОБИТАНИЯ И РАСПРОСТРАНЕНИЕ КОКЦИНЕЛЛИД

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Аннотация: В статье рассматриваются среда обитания, географическое распространение, таксономический состав, а также биологические и экологические характеристики семейства Coccinellidae. Анализируется видовое разнообразие на глобальном уровне и в Центральной Азии, в частности в Узбекистане, а также их роль в агробиоценозах и пищевых цепях. Приводится информация о стадиях развития, методах лабораторного разведения, особенностях питания и эффективности в биологической борьбе у *Coccinella septempunctata*. Дополнительно рассматривается инвазивный потенциал данного вида и его влияние на местные виды. Полученные результаты имеют значение для разработки

экологически безопасных методов биологической защиты сельскохозяйственных растений.

Ключевые слова: Кокциnellиды, Coccinellidae, *Coccinella septempunctata*, биологическая борьба, энтомофаги, агробиоценоз, экология, распространение, личинка, инвазивные виды, тля, пищевая цепь.

Introduction: Coccinellids (family Coccinellidae) belong to the order Coleoptera (beetles), which is the largest group within the class Insecta. Worldwide, more than 250,000 species of beetles have been identified. Beetles vary greatly in their external structure and size. Representatives of the ladybird beetles (Coccinellidae) range in length from 2 to 18 mm.

The great taxonomist Carl Linnaeus, in his 1758 work “*Systema Naturae*”, first provided information about coccinellids, including morphological descriptions of 36 species belonging to the genus *Coccinella*. In Central Asia, about 180 species have been recorded, while in Uzbekistan 106 species and subspecies belonging to 2 subfamilies and 25 genera have been identified. According to N.J. Vandenberg, there are six subfamilies of Coccinellidae worldwide: Coccidulinae, Coccinellinae, Scymninae, Chilocorinae, Sticholotidinae, and Epilachninae.

Main Part: In Central Asia, the distribution of coccinellids across natural landscapes in the Republic of Tajikistan was studied by F.R. Khakimov. In Kazakhstan, the biology and ecology of coccinellid species were comprehensively described by G.I. Savoyskaya.



In Uzbekistan, ecological and taxonomic characteristics of coccinellids, their role in food chains, overwintering features, distribution across biotopes in the Bukhara region, and prospects for their use in biological control of agricultural pests were investigated by O.I. Jabborova.

The use of pesticides in agriculture often leads to a sharp decline in populations of beneficial entomophagous insects. However, coccinellids receive particular attention in

biological control due to their high ecological adaptability, unique life cycle, rapid reproduction, and ability to form broad natural complexes in agroecosystems. Expanding the use of environmentally safe biological control methods in agriculture requires scientific analysis of insect biology, ecology, trophic relationships, and evaluation of beneficial entomophagous species composition and natural resources.

According to Anorbayev, who studied predatory insects in Uzbekistan agrobiocenoses, plant nectar serves as an additional food source for entomophagous insects besides aphids. Nectar (carbohydrates) positively affects insect development and egg-laying productivity. Studies conducted in Pakistan analyzed the development and oviposition rate of *Coccinella septempunctata* under laboratory conditions when fed artificial diets (sugar solution, honey syrup) and aphids (*Brassicae brassicae*, *Macrosiphon roseae*, *Rhopalosiphum maidis*). Laboratory rearing methods were tested at +25–31°C and 40–60% relative humidity.

When fed eggs of the cotton aphid (*Aphis gossypii*), *C. septempunctata* completed its full development cycle, whereas when fed eggs of the greater wax moth (*Galleria mellonella*), development progressed only up to the third instar. In laboratory conditions, one larva of *C. septempunctata* consumed an average of 22.6 eggs of *Aphis gossypii* per day. Cannibalistic feeding behavior was also observed: larvae of *C. septempunctata* fed on larvae of *Coccinella undecimpunctata*, *Adonia variegata*, *Synharmonia conglobata*, and *Propylaea quatuordecimpunctata*.

Coccinella septempunctata, commonly known as the seven-spotted lady beetle, inhabits Europe, Asia, and North Africa. Due to its potential as a biological control agent against aphids, it was intentionally introduced into the United States multiple times between 1956 and 1971.

Since its establishment in North America, it has spread hundreds and thousands of miles from its initial release sites. In the United States, *C. septempunctata* competes with and displaces several native coccinellid species, contributing to population declines. It is widely used in greenhouses for aphid control and serves as a natural enemy of aphids in citrus, beans, sunflower, potato, sweet corn, alfalfa, wheat, sorghum, and walnut crops. It has also played a role as a pollinator of certain endemic and endangered plant species.

However, *C. septempunctata* is a highly competitive species capable of replacing native coccinellids. During its invasion in the United Kingdom, cases of crop damage and contamination during grape processing were reported.

Adult beetles are relatively large (7–8 mm) and have pale spots on both sides of the scutellum (posterior part of the mesonotum). The pronotum bears two characteristic pale spots along its anterior margin. The body is oval and dome-shaped. Pigmentation develops over time, and the red coloration deepens in the weeks or months following emergence from the pupa.

The number of spots varies from 0 to 9, though adults typically have seven black spots on a red background. The red and black pigments of the elytra are derived from melanins, while lighter areas develop from carotenoids. At 25°C, the average lifespan is 94.9 days.

Conclusion: The eggs are oval and elongated (about 1 mm long) and are attached vertically to leaves and stems. Hatching takes approximately four days, though temperature influences the duration of the egg stage. After hatching, larvae remain for one day and feed on eggshells, neighboring larvae, and infertile eggs. Four larval instars are observed, differing in size. Depending on food availability, larvae grow from 1 mm to 4–7 mm within 10–30 days. Before pupation, fourth-instar larvae stop feeding for at least 24 hours. The abdomen tip attaches to plant substrate. The pupa is partially immobile and curved, able to raise and lower its anterior region in response to perceived threats. Pupal coloration varies with temperature: at higher temperatures it appears orange, while at lower temperatures it ranges from dark brown to black.

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