BIOLOGICAL CONTROL OF ROSE APHIDS (MACROSIPHUM ROSAE) USING THE PARASITOID APHIDIUS COLEMANI IN HYDROPONIC GREENHOUSES OF UZBEKISTAN

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Abstract: Aphids are among the most common pests of ornamental plants, including roses. This study presents the results of research on the species composition of aphids and the effectiveness of biological control using the parasitoid Aphidius colemani in hydroponic greenhouses of the Tashkent region. The studies were conducted in 2022-2023 at the enterprise "Agro Light Business". It was found that the main aphid species on roses were Macrosiphum rosae and Macrosiphum euphorbiae. The biological efficiency of the parasitoid reached 93.4% on the 21st day. The obtained results confirm the prospects of using this entomophagous species in integrated pest management systems for ornamental crops.

Keywords: Aphidius colemani, rose aphids, Macrosiphum rosae, Macrosiphum euphorbiae, biological control, hydroponic greenhouse, integrated pest management.

Introduction. Aphids (Aphididae) are among the most widespread groups of phytophagous insects damaging agricultural and ornamental plants. According to Blackman and Eastop [1. p.], representatives of this family are characterized by high fecundity and a short life cycle, which contributes to rapid population growth.

The rose aphid Macrosiphum rosae is one of the most common pests of roses and is widely distributed in Europe and Asia, causing significant damage to ornamental plants [2. p.]. Several studies also report the presence of Macrosiphum euphorbiae on ornamental crops [7. p. 717].

Parasitoids of the family Aphidiidae play a crucial role in the natural regulation of aphid populations and are considered among the most effective biological agents against these pests. As noted by Pavel Starý [3. p. 643], representatives of this group exhibit high biological efficiency in suppressing aphid populations. In modern integrated pest management (IPM) systems, the importance of biological control methods is steadily increasing due to the need to ensure environmental safety and to reduce pesticide loads. In this context, van Lenteren [4. p. 3]. emphasizes that the use of natural enemies significantly

decreases the reliance on chemical insecticides. Among the entomophagous species used for aphid control, Aphidius colemani occupies a prominent position as one of the most widely applied parasitoids in greenhouse crop production [5. p. 583].

This species is a solitary endoparasitoid belonging to the family Braconidae, in which the female deposits a single egg inside the body of an aphid host. The larva develops internally, progressively disrupting the physiological processes of the host and ultimately causing its death.

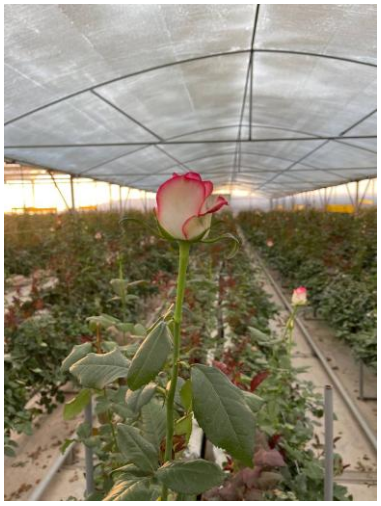
The obtained results complement previously published data on rose pests in Tashkent [9. p. 63], where information on the pest complex of ornamental roses was presented.

The ontogeny of Aphidius colemani includes the egg, larval, pupal (formed within the so-called “mummy”), and adult stages. The larval development typically lasts 4-5 days, while adult emergence occurs approximately 6-7 days after parasitism. Under optimal temperature conditions (22–25°C), the complete developmental cycle is completed within 10-12 days. A single female is capable of parasitizing up to 100-350 aphids during its lifetime. The parasitoid demonstrates highly efficient host-searching behavior, utilizing chemical cues such as kairomones emitted by plants and aphids, which enables effective detection and exploitation of aphid populations even at low density levels (3. p. 643; 4. p. 6; 5. p. 585).

Materials and Methods. The research was conducted in 2022–2023 in hydroponic greenhouses of the enterprise “Agro Light Business” located in the Tashkent region. Aphid population monitoring was carried out according to standard entomological methods described by Fasulati [7. p. 424] and Palij [8. p. 192]. For observations, 10-15 plants were randomly selected, and 3-5 leaves per plant were examined. The number of living aphids and parasitized individuals (mummies) was recorded. The parasitoid was released at the early stages of aphid infestation. The parasitoid-host ratios were 1:5, 1:10, and 1:20.

Results of the Study. The results of the study demonstrated that the dominant aphid species on roses under hydroponic greenhouse conditions was Macrosiphum rosae, which formed dense colonies on young shoots and buds, leading to noticeable deformation and suppression of plant growth. In addition, monitoring revealed the presence of Macrosiphum euphorbiae on roses, which is recorded for the first time in the fauna of Uzbekistan. This species was observed forming compact colonies primarily on tender vegetative parts of the plant, indicating its successful adaptation to greenhouse conditions.

Visual assessment of plant condition revealed clear differences between healthy and infested plants. Healthy roses grown under hydroponic conditions were characterized by well-developed shoots, uniform leaf coloration, and normal bud formation (Figure 1).



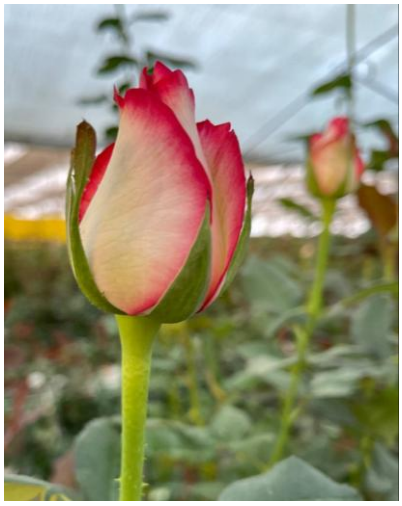


Figure 1. Healthy rose plants grown under hydroponic greenhouse conditions.

In contrast, plants infested by aphids exhibited typical damage symptoms, including leaf curling, deformation of shoots, and a reduction in ornamental value (Figures 2–3).

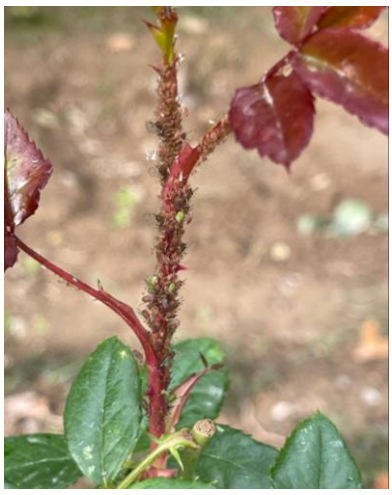


Figure 1. Colony of M. rosae on rose shoots (original photo by author).

Figure 2. Colony of M. euphorbiae on rose (photo by author).

Following the release of the parasitoid Aphidius colemani, the first signs of parasitism, expressed as the formation of characteristic aphid mummies, were observed within 6-7 days. A gradual decrease in aphid population density was recorded throughout the observation period. By the 14th day, the biological

efficiency reached a moderate level, while a significant increase was observed by the 21st day.

The biological efficiency on the 21st day reached 93.4%, which was almost twice as high as that recorded on the 14th day [10. p. 38]. This pattern can be explained by the completion of the parasitoid's developmental cycle and the emergence of a new generation, which intensified the parasitism pressure on aphid populations. As a result, a substantial reduction in aphid density was achieved, confirming the high effectiveness of Aphidius colemani under the given experimental conditions.

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