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DISTRIBUTION, DEVELOPMENTAL PHENOLOGY, AND DAMAGE CAUSED BY THE PURPLE SCALE – PARLATORIA OLEAE (COLVÉE) — IN SWEET CHERRY ORCHARDS OF THE KASHKADARYA REGION

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Annotation: The study investigated the distribution, developmental phenology, and impact on the vegetative growth and yield of cherry trees – as well as the natural enemies – associated with the olive scale Parlatoria oleae (Colvée) in cherry orchards across the Yakkabag, Shahrisabz, and Karshi districts of the Kashkadarya region during 2023 – 2025. Conducted on the Kordia and 'Regina' cultivars, the research revealed that the pest produces two generations annually: the first generation of larvae emerges during the first ten days of May, while the second appears between late July and early August. The population density of the second generation is high, and the primary damage occurs during this period. Aphytis proclia Wlk. and Chilocorus bipustulatus L. were identified as natural enemies. The findings highlight the importance of timing pest control measures to coincide with the periods of mass larval emergence.

Keywords: Experiment, study, pest, cherry fruit fly, adult, fungus gnat, standard yellow sticky traps, ammonium acetate, ammonium carbonate, integrated, larva, monitoring

Introduction. One of the factors hindering the production of high yields and quality fruit is the spread and development of harmful insects. The olive scale insect (Parlatoria oleae [Colvée]), found in cherry orchards, damages the twigs, branches, leaves, and fruit of the trees, potentially negatively affecting both vegetative growth and fruit quality. The pest's developmental characteristics and the extent of the damage vary depending on the region's natural and climatic conditions. To develop cherry cultivation and improve the phytosanitary status of orchards in the Kashkadarya region, it is important to study the distribution, seasonal developmental stages, and the role of natural enemies of the olive scale insect. In particular, determining the timing of mass larval emergence enables the timely implementation of protective measures against the pest.

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Therefore, the aim of this study – conducted between 2023 and 2025 in cherry orchards across the Yakkabag, Shahrisabz, and Karshi districts of the Kashkadarya region – is to determine the distribution and developmental phenology of the olive scale insect, its impact on the vegetative growth and yield of cherry trees, and the level of parasitism by natural entomophages.

Literature Review. The cherry is an economically important crop in the fruit-growing sector, and regular monitoring of pest populations is crucial for ensuring high yields and quality produce. Among the pests found in cherry agrobiocenoses, scale insects stand out due to their prolonged feeding on the tree's vegetative and reproductive organs, their concealed mode of life, and their ability to rapidly reach high population densities [2, 3].

The olive scale (Parlatoria oleae [Colvée]), a member of the Diaspididae family, is a polyphagous pest that infests not only cherry trees but also apple, pear, sour cherry, plum, apricot, and various other fruit and ornamental trees. The pest primarily colonizes the bark, one- and two-year-old shoots, bud axils, leaf stalks, and fruit stems, feeding on plant sap. High-density infestations result in the bark becoming covered with the pests' protective scales, disrupting photosynthetic and nutritional processes, slowing shoot growth, and reducing fruit quality. Prolonged, severe infestation can lead to premature leaf desiccation, a decline in the tree's overall physiological health, and a reduction in the formation of fruit buds for the following year.

When developing an effective pest control strategy for orchards, it is crucial to accurately determine the pest's seasonal development patterns, generation turnover, and economically critical stages [3, 6, 7]. The efficacy of control measures against members of the Diaspididae family, in particular, depends directly on the timely detection of the mobile first-instar larval stage—the phase before the protective scale is formed. Although some studies have been conducted on the primary pests of cherry trees and their entomophages under local conditions [3-5], the phenological development, extent of damage, sex ratio, and regulatory role of natural enemies of P. oleae in the Kashkadarya region have not been sufficiently investigated.

To determine the level of parasitism by natural entomophages, samples of shoots infested with scale insects were collected from orchards. The samples were kept in the laboratory in glass containers with a capacity of 2–3 liters. Moistened cotton was wrapped around the base of the shoots to maintain stable moisture levels. Emergence holes left by parasites on the scale insect shields were regularly recorded. The level of parasitism was calculated as a percentage of the total number of scale insects observed. Standard methods accepted in agricultural entomology and experimental research were employed for organizing the study, conducting field observations, and performing calculations [6–8].

In this regard, the aim of this study was to determine the distribution and seasonal development of the purple scale insect in the cherry orchards of the Kashkadarya region, to assess the impact of the infestation level on the vegetative growth and yield of the cherry trees, and to identify the pest's natural entomophages.

Materials and Methods. The research was conducted using methods and techniques widely employed in general and agricultural entomology. Species identification of the pest and entomophages was based on the works of G.Ya. Bey-Bienko (Key to the Insects of the European Part of the USSR, Vols. II–V) and B.V. Dobrovolskiy (Key to Insects); agro-toxicological studies followed the methodology of Sh.T. Khodjaev (Methodological Guidelines for Testing Insecticides, Acaricides, Biologically Active Substances, and Fungicides); and the biological efficacy of chemical and microbiological agents was assessed using the methods of Sh.T. Khodjaev and W.S. Abbott.

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Results and Discussion. The research was carried out between 2023 and 2025 in commercial orchards and experimental research plots located in the Yakkabag, Shahrisabz, and Karshi districts of the Kashkadarya region – areas specializing in cherry cultivation.

Phenological observations recorded the seasonal appearance of overwintering females, eggs, first- and second-instar larvae, and adult males and females of the purple scale insect. Monitoring continued from the pest's emergence from winter diapause through the end of the growing season. To assess pest density and the degree of tree damage, the number of individuals on a 10 cm² area of the bark on the shoots was counted. Damage was evaluated based on the following 0–4 point scale:

0 points — no pests detected;
1 point — 1–5 individuals per 10 cm² area;
2 points — 6–10 individuals;
3 points — 11–15 individuals**;**
4 points — more than 15 scale insects.

To determine the impact of infestation on cherry tree growth, the length of one-year-old shoots was measured on "Cordia" variety trees exhibiting varying levels of damage and compared with data from uninfested control trees. The effect on yield was assessed by comparing the harvest of infested trees against that of the control group.

A study on the sex ratio of the purple scale insect was conducted on July 28, 2025, using the "Regina" variety in the Yakkabog district. For this purpose, 25 sample trees were selected. From each tree, 15 cm-long shoots and leaf samples infested with the scale insect were collected from four sides. In laboratory conditions, male and female individuals were counted separately to determine the sex ratio.

Observations indicate that the purple scale insect overwinters as a fertilized female beneath its scale on tree bark, on one- and two-year-old shoots, and in bud axils. In the conditions of the Kashkadarya region, the overwintering females became active during the third ten-day period of March. As sap flow began in the plants, the females resumed feeding. Following the end of winter diapause, a period of supplementary feeding was observed, after which egg-laying began.

Egg-laying by first-generation females coincided primarily with the final phase of cherry blossom – specifically, the third ten-day period of April. In early May, mobile first-instar larvae – known as "crawler" larvae – emerged from the eggs and began to disperse across the tree. These larvae settled on sections of twigs with relatively smooth bark, as well as on leaf and fruit stalks, and commenced feeding. Once feeding began, they gradually lost their mobility and formed a protective scale.

Male larvae subsequently passed through pronymph and nymph stages to become winged adult males, whereas females reached the adult stage following their second molt.

Three years of observations revealed that P. oleae develops two generations during the growing season in the conditions of the Kashkadarya region. The mass emergence of first-generation "crawler" larvae was primarily observed during the first ten days of May. Second-generation larvae actively dispersed between late July and the first ten days of August. In most observation plots, the pest density of the second generation was higher than that of the first. This period coincided with relatively stable summer temperatures and dry weather conditions.

The average fecundity of first-generation females was 52 – 58 eggs. Embryonic development lasted 8 – 10 days. The larval feeding and development period averaged 52 – 56 days. The emergence of "crawler" larvae was observed slightly earlier in plain areas compared to foothill regions; this phenomenon may be attributed to differences in the accumulated spring temperatures between the areas.

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Table 1

Phenological development dynamics of the purple scale insect (Kashkadarya region, 2023–2025)

Stages of development	March	April	May	June	July	August	September	October
Female in winter diapause	+++	++	-	-	-	-	++	+++
Egg	-	++	++ +	-	+	++	-	-
1st-instar larva	-	+	++ +	++	-	++	+	-
2nd-instar larva	-	-	++	++ +	+	++	++	-
Adult male and females	-	-	-	++	++ +	+	+++	++

Note: +++ — period of active development; ++ — period of moderate duration; + — beginning or end of the stage; - — not recorded.

Phenological data indicate that the pest's developmental stages partially overlap throughout the year. Consequently, during the second half of summer, individuals of various ages and developmental stages can be found in the population simultaneously. From a practical standpoint, the mobile first-instar larvae observed during the first ten days of May and the late July–early August period serve as the most critical indicator stages for planning pest control measures.

The impact of the purple scale insect on cherry tree development was studied using the "Cordia" cultivar. While no damage at the level of 4 points was recorded during observations, damage within the 1–3 point range negatively affected the trees' vegetative growth.

In the control group, the average length of one-year-old shoots was 89.2 cm, whereas in the infested groups, this figure ranged from 22.5 to 51.7 cm.

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Table 2

Negative impact of the purple scale insect on the development and yield of sweet cherry ('Cordia' variety, Kashkadarya region, 2023–2025)

№	Location of study	Orchard area, ha	Damage level, score	Length of 1-year-old shoot, cm	Reduction in shoot length compared to control, cm	Reduction in yield compared to control, g
1	Yakkabog District, "Tolmas Tog'ayevich" farm	2,0	2	34,8	54,4	71,2
2	Yakkabog District, "Turdiyev Doston" farm	5,0	3	22,9	66,3	103,7
3	Qarshi District, "Polvon Xoji fayz baraka" farm	3,0	1	44,7	44,5	51,2
4	Qarshi District, "Polvon Xoji fayz baraka" farm	5,0	3	22,5	66,7	91,3
5	M. Mirzayev Scientific Center, Qarshi District	0,55	2	36,8	52,4	31,9
6	M. Mirzayev Scientific Center, Qarshi District	0,55	1	51,7	37,5	56,3

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7	**Control**	2,0	0	89,2	-	-

The data in the table indicate a trend of reduced growth in one-year-old shoots as the level of infestation increased. Notably, in variants with an infestation level of 3 points, shoot length ranged from 22.5 to 22.9 cm, which was 66.3–66.7 cm less than that of the control group.

A reduction in shoot growth was also observed in areas with an infestation level of 1 point. This demonstrates that even a relatively low density of scale insects exerts a certain negative impact on the tree's vegetative development. Field observations of more heavily infested trees revealed premature leaf drying starting in the second ten-day period of July, suppressed shoot growth, and a decrease in the number of fruit buds for the following year. Yield losses compared to the control group ranged from 31.9 to 103.7 g. The greatest reduction was observed at the "Turdiyev Doston" farm in the Yakkabog district, where the infestation level reached 3 points.

The results indicate that the pest's impact is not limited to the yield of the current growing season but can also affect the tree's reproductive potential for the following year. To assess the composition of the purple-colored shield bug population, the sex ratio of the "Regina" variety in the Yakkabag district was studied on July 28, 2025.

Table 3

Sex ratio of the purple scale insect on the cherry tree ('Regina' cultivar, Yakkabog' district, July 28, 2025)

	Organ sampled	**Number of samples (units)**	**Total number of scale insects (units)**	**Males (units)**	**Females (units)**	**Sex ratio, ♂:♀**
	Twigs	100	997	478	519	1,0:1,09
	Leaves	300	258	103	155	1,0:1,50

In the shoot samples, the numbers of male and female individuals were similar, though the proportion of females was slightly higher; the sex ratio was 1.0:1.09. On the leaves, however, the predominance of females was much more pronounced, with a sex ratio of 1.0:1.50.

This pattern may be attributed to female individuals remaining longer on leaf stalks and adjacent vegetative organs to feed and undergo further reproductive development. However, to fully substantiate this trend, it is advisable to continue repeated observations across various phenological stages.

To identify organisms that naturally suppress P. oleae populations in cherry orchards, infested shoot samples were monitored under laboratory conditions.

The study recorded Aphytis proclia Wlk., a parasite of the scale insects, and Chilocorus bipustulatus L., a predator that feeds on them. In 2024, emergence holes left by parasitic entomophages were observed in 65 out of 380 scale insects, resulting in an overall parasitism rate of 17.1%. In 2025, parasitism was recorded in 34 out of 338 scale insects, a rate of 10.1%. The year-to-year variations observed may be attributed to pest population density, meteorological conditions, agrotechnical and protective measures applied in the orchards, and the seasonal activity of entomophages.

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The presence of natural entomophages indicates the potential for biologically suppressing a portion of the P. oleae population. Therefore, preserving beneficial entomofauna requires special attention when establishing protection systems in cherry orchards. The indiscriminate or ill-timed use of broad-spectrum insecticides can reduce the number of natural enemies, potentially creating conditions for the subsequent resurgence of scale insect populations. In this context, an integrated approach that simultaneously considers the pest's phenology and the status of beneficial entomofauna is crucial [3, 7].

Table 4

Infestation of the purple scale insect by parasitic entomophages ('Cordia' variety, Kashkadarya region, 2024–2025)

Year	Study site	Number of scale insects observed	Number of parasite emergence holes	Parasitism rate, %
2024	**Yakkabog' district**	296	52	17,6
2024	**Karshi district**	84	13	15,5
2024	**Total**	**380**	**65**	**17,1**
2025	**Shahrisabz district**	175	21	12,0
2025	**Karshi district**	163	13	8,0
2025	**Total**	**338**	**34**	**10,1**

Conclusion. Research conducted in the cherry orchards of the Kashkadarya region between 2023 and 2025 investigated the distribution, developmental phenology, damage characteristics, and natural entomophages of the olive scale insect, Parlatoria oleae (Colvée). It was determined that the pest produces two generations annually in the region and causes the most significant damage during the second half of summer due to the high density of the second generation. Severe infestation significantly inhibits the growth of one-year-old shoots on cherry trees. Additionally, Aphytis proclia and Chilocorus bipustulatus were identified as natural enemies. The obtained results demonstrate the importance of organizing pest control measures in cherry orchards by taking into account the pest's developmental stages and the activity of natural entomophages.

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