Nature & Science
April 2026, Vol. 8, Issue 2, pp. 45–49
DOI: https://doi.org/10.36719/2707-1146/65/45-49

Species Composition and Bioecological Characteristics of Major Entomophages Against Ornamental Plant Pests in Absheron

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Abstract. *Extended research on both native and introduced ornamental plants in parks, boulevards, sports complexes, and residential zones of the Absheron Peninsula has documented 72 species of entomophages that play an important role in the biological control of pest populations. These species are classified within 4 orders and 12 families, consisting of 46 parasitoid species and 26 predatory species. Among the recorded taxa, 14 species belong to the family Braconidae, 8 to Ichneumonidae, 18 to Chalcidoidea, 1 to Bethylidae, 1 to Scoliidae, 4 to Tachinidae, 5 to Carabidae, 1 to Histeridae, 2 to Staphylinidae, 4 to Dermestidae, 10 to Coccinellidae, and 3 to Chrysopidae. In addition, 15 of these species have been identified as new records for the fauna of Azerbaijan, while 25 species have been documented for the first time in the Absheron region. Altogether, 14 parasitoid and predatory species were evaluated as economically important, and 9 of them were recognized as potentially suitable for application in biological control and integrated pest management programs.*

Keywords: *Absheron, pest, entomophage, bioecological, ornamental plants, species*

Introduction

In recent years, research has focused on integrated and biological methods for controlling plant pests. This shift is driven by the ecological risks of chemical pesticides and their negative impacts on human health, highlighting the need for safer alternative approaches. In this context, developing scientifically grounded biological control strategies for insect pests of both native and introduced ornamental plants is especially important. Observations in the Absheron Peninsula show that parasitoid and predatory entomophages play a key role in controlling pests, making it important to study their composition and bioecological traits for integrated pest management. Research in the Absheron region has thus focused on documenting entomophage diversity, understanding their pest-control mechanisms, and assessing their potential in biological control programs (Safarova, 2013, pp. 75–108; Valiyeva & Hasanova, 2022).

Methods

The study was conducted on the Absheron Peninsula during the vegetation season from April to October. Field surveys were carried out to identify parasitoid and predatory entomophages associated with major ornamental plant pests.

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Received: 4 January 2026; Accepted: 28 March 2026; Published online: 25 April 2026

Insects were collected using standard entomological methods such as direct observation, hand sampling, and sweep netting. Host infestation levels were assessed by recording the presence and activity of entomophages on infested plants, and infestation degrees were classified on a scale from I to III. Species identification was performed using morphological keys, focusing on Hymenoptera (Braconidae, Ichneumonidae, Chalcidoidea, Aphelinidae, Encyrtidae), Diptera (Tachinidae, Sarcophagidae), Coleoptera (Carabidae, Staphylinidae, Dermestidae, Cleridae, Coccinellidae), and Neuroptera (Chrysopidae). The seasonal activity periods of each species were determined by repeated observations throughout the growing season (Agasyeva et al., 2023).

Results

Infection periods and degrees of major ornamental plant pests by entomophages in the Absheron Peninsula.

Parasitoid Hymenoptera (*Braconidae, Ichneumonidae, Chalcidoidea*, etc.)

Bracon hebetor, Br. Variegator, Br. Intercessor → active IV–X; infestation degree I–III. *Agathis malvacearum*, *Microdus dimidiator, Macrocentrus linearis* → active IV–IX; degree III. *Ascogaster 46ariegate46ate, Apanteles solitarius, A. fulvipes, A. spurius* → active IV–X; degree I–III. *Meteorus 46ariegat, M. versicolor, Theronia atalantae*, *Pimpla turionella, P. examinator, P. instigator* → active V–X; degree II–III. *Itoplectis europeator, I. alternans, Agrypon stenostiqma, Scambus calobata* → active IV–IX; degree I–III. *Eulophus chrysomella, Brachymeria intermedia, Tetrastichus evonymellae*, *Monodontomerus obsoletus, Elasmus albipennis* → active IV–VIII; degree I–III. *Trichogramma cacoeciae, Tr. Evanescens* → active V–VIII; degree I.

Parasitoid Hymenoptera (*Aphelinidae, Encyrtidae*, etc.)

Aphytis mutilaspidus, Aph. Proclia, Archenomus caucasicus, Ar. Bicolor, Cocophagus lycimnia, Anagyrus psedococci → active IV–X; degree I–III. *Pseydophycus malinus*, *Encyrtus lacaniorum*, *Encarsia perniciosis, E. partenopea* → active VI–VIII; degree I–III.

Diptera Parasitoids (*Tachinidae, Sarcophagidae*, etc.)

Perisierola qalicolla, Scolia quadripunctata, Eurythaea scutellaris, Tachina praeceps, Phorosera silvestris, Parasarcophaga portchinskiy → active IV–X; degree I–III. Predatory Coleoptera (Carabidae, Staphylinidae, Dermestidae, Cleridae, Coccinellidae). *Carabus granulatus, C. bessiz, C. scabris, Calosoma sycophanta, C. inguisitor* → active V–X; degree I–III. *Cylister lineare, Placusa depressa, Nudobius lentus* → active IV–VIII; degree I–III. *Dermestes 46ariegate, D. bicolor, D. ater, D. undulatus* → active V–IX; degree I–III. *Thanasimus formicarius* → active IV–VII; degree I. *Chilocorus bipustulatus, Ch. Renipustulatus, Adalia bipunctata, A. decimpunctata, Coccinella septempunctata, Semiadalia undecimnotata, Holysia sedecimpunctata, Adonia 46ariegate, Scymnus frontalis, Radolia cardinalis* → active IV–X; degree I–III. Predatory Neuroptera (Chrysopidae). *Chrysopa carnea, Ch. Septempunctata, Ch. Perla* → active IV–IX; degree I–II. Research carried out in the Absheron Peninsula identified 72 species of entomophages. Their activity periods predominantly spanned from April to October, with host infestation levels ranging from I to III. Both parasitoid and predatory species were shown to contribute significantly to the natural control of pest populations (Safarova, 2013, pp. 75–108).

Discussion

Entomophages—both parasitoid and predatory insects are key to the biological control of plant pests (Landis et al., 2000; Symondson et al., 2002), and collecting data on their diversity, life cycles, host interactions, and distribution is essential for developing scientifically grounded integrated pest management strategies (Apazhev et al., 2020; Almeida et al., 2022; Bale et al., 2019; Letourneau et al., 2021). Long-term research carried out in the Absheron Peninsula has recorded numerous entomophage species and analyzed their bioecological traits. Examining these traits helps understand

the natural pest control role of entomophages, and this study presents the bioecological characteristics of key species affecting ornamental plants in the Absheron region (EFSA Panel on Plant Health, 2021).

Bioecological characteristics of the parasite Ascogaster in Absheron

Among the main parasites of ornamental plant pests in the Absheron region are *Archips rosana* (rose leafroller), *Spilonota ocellana* (bud moth), and *Recurvaria nanella* (leaf moth). The ascogaster parasite plays an important role in the biological control of *Archips rosana*. Field observations in household gardens of Absheron (Mashtaga, Novkhani, and Nardaran) showed that ascogaster overwinters within the body of first-instar host larvae. In spring (late April to early May), the overwintered parasite larva feeds internally on the host's tissues. After completing three larval stages, pupation takes place either on the remains of the last host larva or occasionally near the host pupa (Miller & Davidson, 2005). The pupae are white with a noticeable transverse band, and pupal development lasts 15–16 days at 20–22 °C. The full development from egg to adult requires 35–40 days, with the species producing two generations per year. Adults live 15–25 days under natural conditions, feeding on nectar before reproduction. Adults of the second generation lay eggs on rose leafroller larvae during August–September (Bennett et al., 2019**)**. The larval stage of the parasite coincides with the appearance of host larvae. Infected host larvae reach the second and third instars but, along with the parasite, enter diapause beneath tree bark for overwintering. In spring, parasitized larvae do not complete development, and the parasite pupates inside the host. Adults emerge in May, flying until September. Ascogaster lowers leafroller populations by 20–25%, showing promise for integrated pest management, particularly if mass-rearing in the lab is developed (Mirzoeva, 2001, pp. 41–52).

Bioecological characteristics of *Apanteles solitarius*

Apanteles solitarius is a key parasitoid involved in the biological control of ornamental plant pests, especially Lepidoptera larvae such as the bud moth (Spilonota ocellana), rose leafroller (Archips rosana), and hawthorn moth (Hyponomeuta spp.). Field observations in the botanical gardens and dendraria of Absheron have indicated that females can lay up to 2000 eggs over their lifetime, depositing them individually inside host larvae. The development of the parasitoid is closely synchronized with host growth, occurring within the fourth and fifth larval instars. Mature larvae leave the host, form yellowish cocoons, and pupate internally or externally, overwintering as pupae or late-instar larvae (Nadein & Perkovsky, 2018, pp. 97–106). The species has three generations per year, with adults appearing from late April onward. Nectar plants like alfalfa, milkweed, and dill boost reproduction and parasitism, while chemical controls reduce activity. The first generation of A. solitarius parasitizes 60–80% of hawthorn moth larvae, while later generations affect 8–10% of bud moths and 6–8% of rose leafrollers. These characteristics make the species a valuable candidate for integrated pest management programs. It is widely distributed across the Palearctic region, the Caucasus, and several regions of Azerbaijan, including Quba, Khachmaz, Shusha, Ordubad, and Nakhchivan.

Bioecological characteristics of *Scambus calobota*

Scambus calobota is common across the Absheron Peninsula, especially on flowering plants like alfalfa, and parasitizes larvae of silk moth, golden moth, "beautiful moth," and hawthorn moth. Females generally lay a single egg on second or third instar host larvae. Larval development within the host lasts approximately 5–6 days, followed by pupation for 10–12 days. The entire life cycle is completed within 20–25 days, with adults overwintering beneath tree bark (Mammadov, 2004). Activity occurs from early May to late July. Field observations indicate significant parasitism rates: silk moth larvae 32–37%, golden moth larvae 20–23%, and "beautiful moth" larvae 26–30%. These results underscore the species' important role in controlling pest populations in ornamental plantings. In the Absheron region, *Scambus calobota* helps control pests in rose gardens and orchards, especially in household plots where chemical control is not used. It produces two generations per year: the first

attacks young silk moth larvae, and the second targets golden moth and "beautiful moth" larvae. Under laboratory conditions at 22–24 °C, adults survive 12–16 days when provided with a sugar solution, but only 3–4 days without food. This parasitoid is considered highly valuable for biological control, with significant practical potential for use in integrated pest management programs (Zhang, 2025).

Bioecological Characteristics of *Aphytis proclia*

Aphytis proclia is an oligophagous ectoparasitoid, primarily associated with the California red scale (Aonidiella aurantii), although it can also parasitize other hosts. Females lay eggs externally by piercing the host's scale and attaching eggs to its surface; the larvae feed on the host's internal tissues and complete development beneath the scale. Pupation and adult emergence occur within this protective covering. The species produces up to five generations per season, with flight activity observed from mid-May to September. Its population dynamics are strongly affected by host availability, as early generations often coincide with low numbers of female scales, leading to reduced parasitism rates. Supplemental feeding on nectar-producing plants, such as Phacelia, significantly improves adult longevity (exceeding one month) and fecundity (40–75 eggs), thereby enhancing parasitism levels (De Curtis et al., 2019**)**. Field observations have demonstrated that in orchards with flowering Phacelia, infestation of California red scale by Aphytis increased from 1% prior to flowering to over 70% afterward, resulting in a 2.5-fold decrease in pest density by the end of the growing season. In the Absheron Peninsula, parasitism rates of California red scale reach 15–20% in May–June and 30–35% in September, underscoring the species' practical value for biological control (Safarova, 2013, pp. 75–108).

Conclusion

In conclusion, research on the Absheron Peninsula shows that 72 entomophage species provide effective natural control of ornamental plant pests. Active mainly from April to October, they include parasitoid Hymenoptera, Diptera, predatory beetles, and neuropterans, all contributing at infestation levels between I and III. Their overlapping activity periods ensure continuous regulation, keeping pest populations below economic thresholds. This ecological balance reduces dependence on chemical treatments and offers a strong foundation for integrated pest management in the region. In conclusion, recent research highlights the growing importance of integrated and biological methods for pest control as safer alternatives to chemical pesticides. Studies in the Absheron Peninsula demonstrate that parasitoid and predatory entomophages are central to regulating ornamental plant pests, underscoring the need to document their diversity and bioecological traits. By understanding their mechanisms and seasonal activity, these natural enemies can be effectively incorporated into biological control programs, providing a sustainable foundation for integrated pest management while reducing ecological and health risks. Surveys in the Absheron Peninsula revealed 72 entomophage species across 4 orders and 12 families, reflecting high biodiversity in ornamental plant ecosystems. Fifteen species were new for Azerbaijan's fauna and 25 were first records for Absheron. Fourteen parasitoid and predatory species were considered economically important, with nine identified as promising candidates for biological control and integrated pest management, offering strong potential for sustainable pest regulation.

Declaration of Competing Interests

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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