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Absheron Region Garden and Forest Plant Pests and Their Integrated Entomophage Complexes

Abstract

Various pest species cause extensive damage to garden plants, trees, and shrubs in the Absheron region, resulting in annual yield reductions of 30–50%, which can escalate to 80–90% during periods of intensive plant growth. Scientific foundations have been developed in Azerbaijan aiming at the biological control of major pest species through the use of effective entomophages. These foundations focus on the species composition and bioecological characteristics of six insect species that damage garden and forest vegetation, as well as their natural enemies, including parasites and predators that regulate their populations. The investigation of pest and entomophage species diversity, their bioecological traits, and distribution patterns across green spaces in the Absheron natural zone was carried out using classical entomological techniques, specialized methodological tools, and authoritative identification references. These include works by N. F. Meyer (1933–1936), N. A. Telenga (1936), and I. A. Rubchov (1948).

Keywords: *Absheron region, garden, entomophages, insect, plant, forest, integrated*

Introduction

Like all areas of socio-economic and cultural life of Azerbaijan, the ecological situation of our republic is also in the focus of attention of the President of the country, and a consistent plan of targeted measures is being implemented in this area. The *Comprehensive Action Plan for Improving the Ecological Situation in the Republic of Azerbaijan*, approved by the 2006 decree of the President of the Republic of Azerbaijan, is aimed at improving the environment in the country, including Baku and the Absheron Peninsula.

Research

The study of pest and entomophage species composition, their bioecological features, and distribution patterns in the green areas of the Absheron natural region was conducted using standard entomological methods, tools, and reference materials (Meyer, 1933–1936; Telenga, 1936; Rubchov, 1948). In addition, to determine the species composition and morphological features of pests and entomophages, MBS-1 and MBS-9 microscope magnifiers, a *Biolom* microscope, a *Canon* digital camera, and a luxometer were used to determine the degree of light irradiation. As a result, complex entomophages of several insects that cause serious harm were discovered (Mirzoeva, 2001).

1. Complex entomophages of the willow moth (*Pandemis heperani* Den. et Schiff.)

The entomophages of the willow moth are represented by polyphagous parasites and predatory insects (four-spotted carrion beetle, ladybird). In this context, the entomophage complex of the willow moth warrants thorough study, as information on it remains very limited (Muradova, 2015).

According to studies, it would be more interesting to examine the entomophages of the willow moth in places where it is most abundant — in cities, streams, and various geographical areas. We found that the infection of young caterpillars with entomophages by arthropods is 20%, and of older

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caterpillars by dipterans — 37%. Among the entomophages, *Apanteles solitarius* Ratz., *A. inclusus* Ratz., tachin flies — *Complisura concinnata* Mg., *Zenilla libathrix* Panz., *Exorista larvarium* L., and sarcophagus — *Pseudosarcophaga affinis* Flln. are widespread (Aslan & Warchalowski, 2001).

2. Complex entomophages of the silver butterfly (*Cacoecia lecheana* L.)

The entomophage complex of the silver butterfly was examined between 2010 and 2015 during periods of mass oak tree growth in open fields. Infection of the caterpillar stage of the butterfly by entomophages takes the second place. They consist of six hymenopteran and three dipteran species in a complex.

Among them, the parasite that infects eggs, *Telenomus brevis* Thoms., is of greater importance. It destroys 24.2–32.3% of eggs in different years. A number of authors have named the species *Telenomus laeviusculus* Ratz., *Telenomus mayri* Kieff., *Anastatus bifasciatus* Fons., and *Teleas punctatissimus* Ratz. as egg parasites. Such a large number of egg-eaters is due to the correct location of eggs in the bark of oak trees. In some cases, even 84–94% infection was noted.

In 2012–2014, the mass reproduction of the silver butterfly in the egg stage in oak forests in the Sheki–Zagatala region was completely suppressed by the parasite *Trichogramma evanescens* Westw. In 2013–2014, during the repeated mass reproduction, infection of the caterpillar and pupal stages with the parasite *Barylypa longicornus* Brauns. was noted. In some foci of infection, the rate of infection reached 35–40%. In 2015, the role of this parasite was more significant during mass reproduction (Toth, Schmera, & Imrei, 2004).

Dusona falcator F., *Coclichneumon cingulars* Bert., and *Enicospilus rossicus* Kok. parasites were less frequently recorded. In recent years, no silver butterfly caterpillars were found on the parasite. The decrease in the number of the pest was due to the presence of tachinids — *Drino inconspicua* Mg., *Exorista fallax* Mg., *Exorista unicolor* Stein., *Tachina magna* Giglio Tos., *Compsilura concinnata* Meig., and *Zenillia libatrix* Panz.

The species *Meteorus fragilis* Wesm., recorded in St. Petersburg by I. A. Porchinsky (1911), has not been found in Azerbaijan. According to the conducted studies, 10.6% of silver butterfly pupae were infected by the parasite *Cyclogastrella deplanata* Nees in 2014 and 27.4% in 2015. These species are highly developed and effective among the complex parasites of the silver butterfly, and their complex use in biological control was also proposed by I. A. Porchinsky (1911) (Balakhanova, 2024).

3. Complex Entomophages of the Ringed Beetle (*Malacosoma neustria* L.)

The complex entomophages of this pest consist of 93 species, mostly polyphagous. The use of the parasite *Telenomus laeviusculus* Ratz. has been proposed for the biological control of the ringed beetle in forests and orchards. It was found that the ringed beetle is infected with six species of parasites in the egg phase — *Telenomus* spp., mainly *Ooencyrtus tardus* Ratz., and *Anastatus bifasciatus* Fons. Oviparous insects form a common complex and are found at all developmental stages of the pest.

Other parasites are associated with caterpillars — 32 species in total, including 19 species of horseflies and 13 species of tachinids. The composition of the parasite complex also changes depending on the beetle's reproduction conditions in different geographical regions (Valiyeva & Hasanova, 2022).

In all complexes associated with various populations, braconids such as *Apanteles spurius* Wesm. and *Meteorus versicolor*, ichneumonids such as *Pimpla turionella*, *Teronia atalanta*, and representatives of the genera *Casinaria*, *Campoplex*, and *Barylypa* are more common. Among polyphagous taxa, species such as *Carcelia exisa* Fall., *C. gnava* Meig., *Zenillia libatrix* Panz., *Blondelia nigripes* Fll., *Compsilura concinnata* Mg., and *Phryxe vulgaris* Fall. are frequently found.

In the list compiled by V. A. Shapiro (1960), sarcophagid flies were rarely observed, while in our studies, 2–3 species were recorded. Predatory insects that feed on the ringed beetle include mainly carabid beetles and brown ants (Mamedov, 2004). During periods of mass pest reproduction, the population infection rate with complex entomophagous insects reached 70%. In general, the complex entomophagous agents of the ringed beetle are not sufficiently effective, and only specifically

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designated ovipositors can be used for active biological control (Ben-Yehuda, Assael, & Mendel, 2000).

4. Complex Entomophages of the Green Oak Leaf Beetle (*Tortrix viridana* L.)

Entomophages of the green oak leaf beetle have been studied by many researchers both in Azerbaijan and abroad. The entomophage complex in a single mass breeding site of the host typically includes 12–30 parasite species. According to conducted studies, the impact of complex entomophages on different populations of the green oak leaf beetle is generally limited and not sufficiently effective to significantly reduce the pest's damage.

Among parasites in Absheron, 93% of those collected from caterpillars of the green oak leaf beetle belong to *Phaeogenes invisor* Thunb. In oak groves across other regions of Azerbaijan, this parasite also predominated (Mammadov, 2004). In 2015, infection of leaf beetle pupae with this parasite reached 25%. During mass breeding of the host, *Apechthis resinator* Thunb. and *Apechthis rufata* Gm. were dominant, while *Pimpla turionellae* L., *Pimpla instigator* F., and *Itoplectis alternans* Grav. were also frequently encountered.

In the Lankaran–Astara zone, the main parasite of leaf beetle pupae was *Phaeogenes invisor* Thunb., followed by the tachinid fly *Elodia tragica* and the chalcid *Brachymeria rugulosa* (Safarova, 2024b). The number of *Apechthis* and *Itoplectis* species was relatively small. In 2014–2015, infection of pupae with parasites ranged from 7.2–7.4%, increasing to 28.5–39% in subsequent years.

Parasites of caterpillars were almost insignificant. Although their numbers were approximately double those of pupal parasites, infection rates were only 3%. The main caterpillar and caterpillar–pupal parasites were *Microgaster meridiana* Hal., *Apanteles xanthostigma* Hal., and *Angitia fenestralis* Holmgr (Beibutov, 1965). In Azerbaijan, the leading species in the pupal stage was *Phaeogenes invisor*. Among all parasites found, *Phaeogenes invisor* accounted for 81.5% in the Sheki–Zagatala region and 44.7% in Ganja–Gazakh. Polyphagous parasites also play a significant role in reducing pest infestation levels (Kondo & Watson, 2022).

According to studies, the parasite complex of the green oak leaf beetle in Azerbaijan includes 35 species: 10 ichneumonids, 8 braconids, 11 chalcids, and 6 tachinids (Meyer, 1933–1936).

5. Complex Entomophagous Species of Wood Pests

Extensive research has been conducted on the complex entomophagous species of horntails and long-horned beetles. Entomophagous species of other xylophagous pests have been studied to a lesser extent (Moiseeva & Polyakova, 1970). In our research, the entomophagous species of the pine fiber beetle, tip beetle, large black pine beetle, and typographer beetle were studied in the Absheron region. In all complexes, the main role is played by predatory insects that feed on the root parts of trees (Rubtsov, 1948).

Conclusion

The study focused on identifying major pest species affecting garden and forest plants in the Absheron region of Azerbaijan and analyzing their associated entomophage complexes. Classical entomological methods and diagnostic tools were employed to determine the species composition, bioecological features, and distribution patterns of both pests and their natural enemies.

The willow leafroller (*Pandemis heperana*) was found to be parasitized by hymenopteran and dipteran species, with infection rates reaching 20% in younger larvae and 37% in older ones (Shapiro, 1960). Key parasitoids included *Apanteles solitarius*, *Complisura concinnata*, *Zenillia libatrix*, and *Pseudosarcophaga affinis*. Despite high parasitism rates during outbreaks, only specific egg parasitoids were considered effective for biological control.

These findings highlight the ecological role of entomophages in regulating pest populations and their potential application in integrated pest management strategies. Further research and targeted use of these natural enemies could enhance sustainable pest control in Absheron's forest and garden ecosystems (Safarova, 2024a).

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