

Research Article

**Species composition and significance of entomophages of apple moth in the south of Uzbekistan**

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**Abstract**

As a result of the research, 14 species of coin-winged entomophagous insects, 6 species of Ichneumonoidea, 5 species of Braconidae, 3 species of Thrichogrammatidae, 6 species of Chrysopidae and 8 species of Coccinellidae were found in the ecosystem of southern Uzbekistan. These species were experimentally tested.

To study the species composition of the entomophages of the apple moth, various observation methods and accountings were used. To collect caterpillars and pupae of the pest, trapping belts, that are fixed at a height of 35-60 cm from the ground made of corrugated paper or burlap, were widely used. The collected objects were brought up in large test tubes and in 0.5 liter jars. The species belonging of the isolated parasites and the collected predators was established according to the identification keys and from the leading specialists of Uzbekistan and Kazakhstan.

**Key words:** parasites, caterpillars, pupae, entomophages, trapping belts, burlap, corrugated papers, predators, ontogeny, beetles.

**Introduction**

The study of natural regulators of the apple moth population is an important point in the preparation of scientifically based programs for an integrated system for protecting the orchard.

Since the number of individual phases of development of the pest is regulated not only by insects, we can talk about arthropods and some vertebrates / birds, lizards, etc. /. Useful organisms for a long time can restrain the growing beginning of the number of harmful objects, but this requires, first

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of all, a quantitatively reasonable ratio of harmful and useful species and, if necessary, their enrichment with entomofauna under the influence of the anthropogenic factor [8].

### Objects and methodology

During all the years / 2018-2019 / and beyond / we constantly conducted observations and records of useful insects and other animals that negatively affect the number of the apple moth.

Insects were collected at stationary sites throughout the season. First of all, the physiological state and parasite infestation of the apple moth population in the autumn-winter period were studied. So, it was found that a significant part of the caterpillars that have gone for the winter are infected with various types of parasitic insects / table 1.1/ [4].

The percentage of infestation of caterpillars and pupae of daughter generations of the apple moth in the spring-summer season has its own patterns and, having low rates in the first generation, gradually increases to the third one / table 1.2/ [8].

Table 1.1

#### The percentage of infestation of caterpillars and pupae of the apple moth in the autumn-winter period 2018-2019.

№	Terms of insect gatherings	Number of collected caterpillars and pupae		Out of this	
		Num.	%	Parasitized	%
I.	November 2018	550	100	128	23,2
II.	February 2019	220	100	107	46,5

Table 1.2

#### Changes in the infection of caterpillars and pupae of the apple moth by parasites during the growing season in 2019. Horticulture «Yakkabag»

Insect counting and collection days	Number of collected insects, number	Out of this	
		Parasitized number	% departure of parasites
4.06	202	7	3,46
14.06	594	22	3,70
23.06	879	36	4,09
2.07	257	25	9,72
12.07	636	79	12,4
22.07	210	24	11,4
2.08	754	96	12,2
12.08	859	122	14,2
20.08	395	42	10,6
31.08	126	126	23,9
<b>TOTAL:</b>	<b>5260</b>	<b>579</b>	
Average	-	-	11,0

## Results and Discussion

To study the species composition of the entomophages of the apple moth, various observation methods and accountings were used. To collect caterpillars and pupae of the pest, trapping belts, that are fixed at a height of 35-60 cm from the ground made of corrugated paper or burlap, were widely used. The collected objects were brought up in large test tubes and in 0.5 liter jars. The species belonging of the isolated parasites and the collected predators was established according to the identification keys and from the leading specialists of Uzbekistan and Kazakhstan [7].

In another case, the collected caterpillars of the apple moth were placed in specially designed cassettes according to the method of V.G. Kovalenkov and T. Tyurina/1988/. Caterpillars and pupae, hung in cassettes on trees, were kept for 4-5 days, and then returned to the laboratories for further observations [6].

To establish the species composition of the egg eaters, parasitizing on the eggs of the apple moth, pest eggs, obtained under laboratory conditions were fixed on a cardboard surface using a thin layer of gluten and hung on trees. After 5-6 days, the pads were collected and transferred to the laboratory.

Table 1.3. provides a general list of parasites and predators of the apple moth that feed on insects in various phases of its development in ontogenesis. As can be seen from the materials presented, the eggs are mainly parasitized by species of Thrichogrammatidae family. Large quantities of them can be destroyed by the larvae of lacewings / Chrysopidae / larvae and beetles of various species of ladybirds / Coccinellidae / and predatory bugs [5].

Table 1.3.

### Useful arthropods destroying the apple moth in the Kashkadarya region in 2018-2019.

№ п/п	Arthropods destroying the apple moth	Occurrence
A. Parasitic insects		
Superfamily Ichneumonoidea		
I. Ichneumonidae family		
1.	<i>Liotryphon punctulatus</i> (Ratzeburg, 1848)	+++
2.	<i>Gelisinstabilis</i> Forst	+++
3.	<i>Pimpla turionellae</i> (Linnaeus, 1758)	+++
4.	<i>Pimpla instigator</i> F.	++
5.	<i>Ephialtes extensor</i> Tasch.	+
6.	<i>Mastrus</i> sp.	++
II. Braconidae family		
1	<i>Apanteles</i> sp.	+++

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2	<i>Ascogaster quadridentatus</i> Wesm.	++
3	<i>Bracon hebetor</i> Say	+++
4.	<i>Microdus rufipes</i> Nees.	+++
5	<i>Eurytoma</i> sp.	+
II. Thrichogrammatidae family		
1	<i>Trichogramma evanescens</i> Westw.	+
2	<i>Trichogramma principium</i> Sug. et Sor	++
3	<i>Trichogramma pintoii</i> Voeg.	++
B. Predators		
1	I. Chrysopidae /6 species/, Coccinellidae / 8 species/, predator spiders / subclass of Aranea / birds / класс – Aves / and etc.	
1	<i>Coccinella undecimpunctata</i> (Linnaeus, 1758)	++
2	<i>Coccinella septempunctata</i> (Linnaeus, 1758)	+++
3	<i>Harmonia axyridis</i> (Pallas, 1773)	+++
4	<i>Chilocorus kuwanae</i> (Silvestri, 1909)	+
5	<i>Adalia bipunctata</i> (Linnaeus, 1758)	+++
6	<i>Calvia decemguttata</i> (Linnaeus, 1767)	++
7	<i>Calvia quindecimguttata</i> (Fabricius, 1777)	++
8	<i>Stethorus pusillus</i> (Herbst, 1797)	+

Involving entomophages by planting flowering alfalfa plants between garden rows to attract members of the coccinellidae family to apple orchards gives high results. Because alfalfa is rich in nectar and attracts coccinellides. This is because entomophagous coccinellides have also been observed to feed on plant nectar. This was especially evident during the egg-laying period, when the larvae that hatched from the eggs were also fed with plant nectar along with the prey, as well as with the eggs and larvae of the *Cydia pomonella*. The most common species found in apple orchards are the two-pointed ladybird (*Adalia bipunctata*), seven-pointed ladybird (*Coccinella septempunctata*) and eleven-pointed ladybird (*Coccinella undecimpunctata*). When we observed our experiments according to the seasons, *Adalia bipunctata* and *Coccinella septempunctata* were the most productive among those fed on *Cydia pomonella* and young worms. More involvement of these species will lead to a decrease in the number of *Cydia pomonella*.

Involvement of entomophages by planting flowering alfalfa plants between rows of orchards to attract members of the coccinellid family to apple orchards shows good results. Because alfalfa is rich in nectar and attracts coccinellides. This is due to the fact that coccinellidae entomophages also feed on plant nectar. This was especially evident during the period of egg-laying, when the larvae hatched from the eggs fed together with the extraction of plant nectar, as well as the eggs and larvae of the apple orchard. The larvae and pupae of the pest are infected with a wide variety of insect species from the

superfamily Ichneumonoidea - Ichneumonids, Braconids, etc. Of the Ichneumonids, the species *Liotryphon punctulatus*, an ectoparasite that infects older caterpillars and prepupae. The female parasite paralyzes the victim and lays eggs on its surface. The hatched larvae stick to the victim. Ichneumonids are also common: *Gelisinstabilis* Forst and *Pimpla turionellae*. Species from the genus *Apanteles* and the species *Microdus rufipes* are of practical importance. The *Bracon hebetor* species willingly infected caterpillars inside our proposed cardboards, and in natural conditions - mainly in places where the pest is left for pupation or diapause [1]. Caterpillars and pupae are eagerly eaten by lacewings, Coccinellids, as well as a wide variety of birds / including the imago of the pest.

On a stationary site - a garden on the territory of the horticulture "Yakkabag" we carried out accompanying researches to study the effect of various types of inter-row treatments in an old-age garden with several apple sorts and the effect of pesticide treatments on the spread and effectiveness of parasitic insects. The infestation of the preimaginal phases of development of the moth with parasites was counted ten days per table. 1.4./. From the results presented in the table, we can conclude the following: [2]

1. Entomophages - parasites of the apple moth develop better and destroy the pest in the case when alfalfa is sown in the aisles of the garden, and no chemical treatment of trees is carried out.

2. At approximately the same level, indicators in the garden, where intermediate agro-technical treatments are not carried out, that is, a neglected garden, and where pesticide treatments are also not carried out.

3. The worst results in terms of target indicators were obtained where plowed and nothing was sown between the trees, but no chemical treatments were carried out. And even worse, where they are held - "black steam", with three pesticide treatments. The number of paralyzed pests in this case decreased by 10 times [3].

Based on the results obtained, in 2019, then a special experiment was carried out under the same conditions in order to study the potential influence of abundantly flowering catch crops on the abundance of entomophages as bait crops for additional nutrition. As such crops, we selected representatives of the umbellate-seed plants of dill, carrots, parsley and alfalfa. The timing of their sowing was chosen so that plants bloomed consistently on the plot with the experimental variant, which ensured the constant presence of the insects of interest to us. Table 4.7. the results of this experiment are given, from which it follows that sowing nectar plants on the aisles of plantings of an apple orchard provides a significant increase in arthropods, including beneficial insects – entomophages. In this case, the infestation of moth eggs and other types of leaf rollers with trichogram increased by more than two times; caterpillars and pupae of the pest by parasites - about 2 times. The number of lacewings and coccinellids increased by 60-70%. Thus, our studies allow us to conclude that in the conditions of the Kashkadarya region with high air temperatures in summer, it is possible to achieve an increase in the density of entomophages due to their attraction by sowing bait crops and additional agricultural technology in the biotope / loosening, irrigation, fertilization, etc [8].

Table 1.4

**Influence of inter-row and pesticide treatments on the infectivity of the preimaginal phases of the apple moth development horticulture «Yakkabag», 2019**

№	Options / state of inter-row and chemical garden treatment	% of infestation of the preimaginal phases of the moth by parasites according to dates of registration									
		2.06.	12.06.	21.06.	1.07.	10.07.	20.07.	1.08	10.06.	22.08.	30.08.
1.	Without inter-row treatment and without chemical treatment	5,4	6,2	4,9	12,4	13,7	11,6	12,4	15,7	14,3	25,4
2.	«Black steam», without chemical treatment	1,8	2,4	3,5	4,8	5,6	6,5	7,2	8,1	6,3	10,1
3.	«Black steam», with chemical treatment	0,5	0	0	0,2	0,2	0,7	0,8	0,8	1,4	2,5
4.	Control / alfalfa in inter-rows and without chemical treatment /	6,7	8,4	9,2	15,4	18,7	12,5	14,3	21,3	22,7	26,2

I treatment: 12.05. - Nurelle-D /0,15%/,  
 II treatment: 11.06. - Danitol /0,2%/ + Topaz /0,02%/,  
 III treatment: 8.07. - Cymbush /0,02%/

Table 1.5

**Change in the number of beneficial insects infecting the apple moth,  
depending on the presence of inter-row nectar plants**

Horticulture «Yakkabag» 2019

Intermediate processing options	The timing of the accounting	% of infestation by parasites		Total number of entomophages per 10 branches, eggs of an adult larva, number		
		eggs	Caterpillars and pupae	Lacewing	Coccinellidae	Other types
<b>Experience:</b> in between the seed plants of carrots, dill, parsley, alfalfa were sown - 3-fold chemical treatment	9.05.	38,9	18,3	3,8	16,4	3,0
	19.05.	54,2	4,3	11,4	35,6	2,6
	30.05.	17,5	14,5	36,3	24,2	14,5
	8.06.	-	22,5	17,5	6,7	17,3
	19.06.	-	18,3	25,4	16,3	6,3
	27.06.	16,5	26,7	6,5	37,5	12,4
	8.07.	36,6	28,9	24,5	46,6	25,4
	25.07.	30,5	23,2	46,4	15,4	15,8
	6.08.	-	36,5	64,5	24,8	3,2
	20.08.	44,5	32,7	84,4	41,4	48,9
3.09.	-	47,9	176,7	45,4	61,1	
Amount		238,7	273,8	497,4	310,3	210,5
%		225,2	196,8	169,1	158,9	107,3
<b>Control:</b> Black steam - 2-fold inter-row plowing, -3-fold chemical treatment	9.05.	17,4	3,5	0,9	3,7	2,1
	19.05.	31,2	4,9	12,1	29,7	6,6
	30.05.	6,1	11,2	3,5	11,4	0,9
	8.06.	0,7	6,3	6,5	26,6	25,2
	19.06.	-	8,8	13,2	7,7	16,2
	27.06.	6,6	13,2	35,2	16,5	35,2
	8.07.	12,2	18,2	6,5	3,8	11,2
	25.07.	20,2	15,2	16,7	10,7	25,2
	6.08.	0,9	13,0	37,2	11,2	16,2
	20.08.	10,7	20,6	125,6	28,7	33,2
3.09.	-	24,2	36,8	45,2	24,2	
Amount	-	106,0	139,1	294,2	195,2	196,2
%	-	100	100	100	100	100

Among the predators of the apple moth, entomophages - polyphages are of particular importance:

Coccinellids, Chrysopids, spiders and especially birds. According to V. I. Degtyareva, (1964) in the stomach of the white-winged woodpecker, about 50 adult caterpillars of the apple moth were found. This apparently applies to many other species of birds visiting the gardens. Spiders, subclass of Aranea, are important entomophages that kill a large number of insects, including the apple moth. It has been established that spiders destroy about 2 quintals of insects per hectare of forest during the season (Directory, 1989).

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