

ORIGINAL PAPERS

BIOLOGICAL AND MORPHOLOGICAL PARTICULARITIES OF THE MAIN SPECIES OF *TRICHOGRAMMA*, COLLECTED IN THE AGROCENOSIS OF THE REPUBLIC OF MOLDOVA

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Key words: biological indices, prolificacy, moths, *Trichogramma*, biological efficacy

INTRODUCTION

Incorrect choice of *Trichogramma* species may become the cause of the low efficacy of the parasite, because the ecological requirements of different species are different: in the Western European countries *T. armigera* species and *T. chilonis* are used, and in Austria for combating the same pest, *T. pretiosum* species are used. In Uzbekistan, Tajikistan, Azerbaijan, Georgia and Russia - *T. pintoi* is used instead. Taking in consideration the publications of Dr. Gavrilita (2002), it can be remarked the substitution of *T. pintoi* species by *T. evanescens* and its predominance in the pile of Lepidoptera pests' eggs in the agrocenoses in cabbage fields (Grinberg, Przyszwyr, 1989) in natural conditions, Republic of Moldova.

Over several years, researches have been carried out to determine the specific composition of *Trichogramma* on annual agrocenoses (tomatoes, corn, cabbage, peas, sugar beet, soybean) and multiannual (apple, plum) with the scope of identifying the dominant species. This reason for, there have been collected different piles of pests' eggs naturally parasitized, and exposed to fresh eggs of *Sitotroga cerealella* Ol in laboratory conditions, following their parasitization by *Trichogramma* collected.

Within the Institute of Genetics, Plant Physiology and Plant Protection, researches were carried out in laboratory and experimental fields. The applications with *Trichogramma evanescens* were carried out in different farms at annual crops like cabbage, maize, peas, soybeans, tomatoes, beets and *T. embryophagum*, *T. dendrolimi*, *T. evanescens* collected at apple and plum cultures. The entomophage was multiplied on eggs of cereal moth (*Sitotroga cerealella* Ol.), preliminarily irradiated with gamma rays and on non-irradiated eggs. The presence of these species in various censuses in the Republic of Moldova and predominance of the *T. evanescens* species is confirmed the following works; Дюрич (1979, 1984, 1987); Гринберг, Зильберг (1985); Боубэтрын (1988); Гринберг, Пынзарь

(1989); Gavrilita (2002). A number of authors point to the fact that in nature, *Trichogramma* is divided into narrow breeds and specialized ecotypes in the host group and its place of life. The *Trichogramma* entomophage has very small dimensions (0.3-0.9 mm). The number of segments on their antennas are 4-6. The legs are made up of three segments. The *Trichogramma* has two pairs of wings. The first pair is wider, where the length is 2 times larger than the width. The edge of the wings is round and endowed with beads. The second pair of wings is narrow and sharp at the top. The antennas are short. At females they end with accumulation of sensilla, and the male antennae are longer, with longer sensilla. There can be specimens with short and thick sensilla, the length of which are equal to the widest width or exceed by 1,5 times (Дюрич, 2008; Fabritius, 2005).

Accumulation and maintenance of different *Trichogramma* species in pure lines under laboratory conditions is done strictly separated in different rooms, so as not to mixt the species. One of the mandatory conditions for obtaining high biological efficacy in field is the thorough selection of the species, even the intraspecific forms, which are better suited to the given pest and region. The reason of which is that not all species are equally effective in their use in pest control. Rearing of the entomophage collected from nature requires taxonomic control, because in joint multiplication, happens usually mixing and substitution of one species by another, which leads to negative results in plant protection with the *Trichogramma* entomophage.

MATERIAL AND METHODS

The species collected from different regions of the Republic from different cultures, were obtained from exposal of them to the cereal host eggs of cereal moth (*Sitotroga Cerealella* O.) and by collecting the parasitized natural host eggs, being separately set in different containers and reared, then identified. The identification of the *Trichogramma* species was performed on the basis of morphological and

biological distinctive characters, the main key being the male genital organs. For this, temporary and permanent specimens were prepared. After determining the species under laboratory conditions, the entomophagus accumulated was induced into diapause for 5-6 months for subsequent investigations.

The collection, identification, conservation and accumulation of *Trichogramma* spp. species were performed according to the methods of author Дюрич (1978, 2008). The multiplication of the laboratory host - the cereal moth, for the production of the *Trichogramma* entomophage, the identification of the biological indices, the effectiveness of the entomophage and the degree of attack of the pest were carried out according to the methods of the authors Абашкин, Гринберг, and others (1979).

RESULTS AND DISCUSSIONS

As a result of the analysis, the *Trichogramma* which hatched from the parasitized eggs of the pests collected from nature and eggs exposed to *Sitotroga cerealella* O., proved to have the following species identified: *T. evanescens* Westw., *T. pintoi* Vog, *T. semblidis* A., *T. leucaniae* P. & Ch., *T. sibiricum* Sor., *T. dendrolimus* Mat, *T. aurozum* Sug., *T. piceum* Dj., *T. embryophagum* Hb., *T. sorokina* Kost, *T. telengaie* Sor.

The biological features of the *Trichogramma* species collected in the agrocenoses in the Republic of Moldova.

Trichogramma evanescens Westv is being found in different climatic areas: agrocenoses of the annual crops (vegetables, legumes, grasses, technical) collected from eggs of the complex of moth, cabbage moth and multiannual crops (apple, plum) were collected from eggs from moth and buch.

Trichogramma evanescens Westv. is being found in different climatic areas. In the agrocenoses of the annual crops (vegetables, legumes, grasses, technical ones) along with multiannual crops (apple, plum), *Trichogramma* was collected from eggs of different species of moths. *Trichogramma* is a specie that prefers high humidity (60-80%). Optimal development conditions are: relative air humidity 75-80%, temperature of 23-25°C. The prolificity of females that develop in natural host eggs is up to 50 eggs with a median of 20-24 eggs. At a higher temperature of 30°C and below 15°C, the prolificacy of the females decreases twice.

Trichogramma evanescens (corn) can be used to combat corn borer and moth complex at corn, where 100.000-200.000 females / ha are released if the pests' density is 6-10 pints per 100 plants.

Trichogramma evanescens (cabbage) is used in combating the complex of cabbage moth, cabbage butterflies on different plants (cabbage, tomatoes, beet, sunflower, soy, peas, vine, orchards, etc.). We

launch 100.000-200.000 females/ha when the pest density is 1-5 eggs /m² and 200.000-250.000 females/ha, when the pest density is 10-15 eggs per m².

Trichogramma pintoi Voeg. is used to combat the buckwheat complex in various plants (cabbage, beet, sunflower, tomatoes, peas, etc.). We launch 150.000-200.000 females/ha when the pest density is 1-5 eggs/m² and 200.000-250.000 females/ha when the pest density is 10-15 eggs per m². *T. pintoi* is easily reared on grain moth eggs (*Sitotroga cerealella*). Under laboratory conditions this specie has a higher competition capacity than the other species of *Trichogramma*, but in the field this capacity is not high.

Trichogramma denrolimi Mats. (*T. cacaoeciae* March) Species, which are found in the vast majority of multi-annual crops in moth eggs. It is a dendrophilous species, parasites the pests of apple worms, plum worms, and annual crops. We launch 150.000-200.000 females/ha when the pest density is 1-5 eggs/m² and 200.000-250.000 females/ha when the pest density is 10-15 eggs per m². Prefers the eggs of the bud complex.

Trichogramma embryophagum Hartig, predominates in orchards, its prolificity under optimal conditions constitutes 16-23 eggs. *T. embryophagum* prefers low humidity (50-60%) and high temperature (25-27°C), it is found mostly on the top of the crown of trees, so it is launched at the bottom of the crown so that it moves from the bottom to the top to parasitize the pests it encounters on the way. It is being launched at the amount of 200.000-400.000 individuals per hectare.

Trichogramma semblidis Auriv.- is used to combat the buckwheat complex in various plants (cabbage, beet, sunflower, peas, etc.). It is launched 150.000-200.000 females/ha when the pests' density is 1-5 eggs/m² and 200.000-250.000 females/ha when the pest density is 10-15 eggs per m². *T. semblidis* prefers humid places. It is easily reared on grain moth eggs (*Sitotroga cerealella*).

Trichogramma leucaniae Pang și Chen. – This specie can be found in eggs of different pests with preference for annual crops. Most males of this species are without wings, or with short wings therefore its spread and long distance flight is limited. It is launched 150.000-200.000 females/ha when the pests' density is 1-5 eggs/m² and 200.000-250.000 females/ha when the pest density is 10-15 eggs per m².

Trichogramma sibiricum Sor. Specie which is mostly found in multi-annual cultures. It is a dendrophil specie, which parasites the eggs of the pests layed on the leaves of the willow, poplar, white acacia. It prefers eggs to the bucket complex. It is launched 150.000-200.000 females/ha when the pests' density is 1-5 eggs/m² and 200.000-250.000 females/ha when the pest density is 10-15 eggs per m².

***Trichogramma aurozom* Sug and Sor.** Species, which are mostly found in multi-annual crops, tortricides, in European apple sawfly eggs. Very rarely encountered in eggs of the moth complex. Under laboratory conditions, this specie is not reared on the eggs of grain moth (*Sitotroga cerealella*), but it parasitizes with ease the eggs of the moth complex. It is launched 150.000-200.000 females/ha when the pests' density is 1-5 eggs/m² and 200.000-250.000 females/ha when the pest density is 10-15 eggs per m².

***Trichogramma piceum* Djuritsch** is used in combating the moth complex in different plants (cabbage, beet, sunflower, tomatoes, peas, etc.). Launch norm is as followed: 100.000-200.000 females/ha when the pest density is 1-5 eggs/m² and 200.000-250.000 females/ha when the pest density is 10-15 eggs per m². *T. piceum* is easily reared on moth eggs (*Sitotroga cerealella*). Under laboratory conditions this species has a higher competition capacity than other species, but in the field the capacity is endowed. The species of *Trichogramma* spp. collected and identified from different areas of the Republic of Moldova in the years 2000-2018 are presented in Table 1.

The morphological characteristics of the species of *Trichogramma* spp. collected in the Republic of Moldova.

Trichogramma sp. is a small insect that has the size of 0.3-0.5 mm which lays its eggs in the pests' eggs - being a oophag parasit. It's legs are composed of three segments. The *Trichogramma* has two pairs of wings. The front wings are twice as long as their width, rounded at the top. Female antennae are shorter and end with a slightly rounded segments with short senses. In males the wings are smaller, the antennas are covered with longer sensors.

In order to determine the species of *Trichogramma*, the morphological and biological characteristics are fundamental, the main key being the genital organs on males. For this reason, temporary glycerin preparations are prepared.

Individuals are preventively taken in lactic acid until discoloration (for about 3-4 days) to have a better transparency of the genital apparatus construction. Preparations have been made accordingly following the author's methods Дюрич Г. Ф., (1978, 2008), Fabritius, (2005).

Trichogramma spp. is one of the most important biological agents for plant protection, which is easily multiplied in the laboratory and accumulates quickly due to the short development time. The *Trichogramma* entomophagus is used in the egg stage to combat various pests: the buch, moth, and albila complex.

CONCLUSIONS

In order to determine the species of *Trichogramma*, the morphological and biological characteristics are fundamental, the main key being the genital organs on males. For this reason, temporary glycerin preparations are prepared.

Accumulation and maintenance of different *Trichogramma* species in pure lines under laboratory conditions is done strictly separated in different rooms, so as not to mixt the species. One of the mandatory conditions for obtaining high biological efficacy in field is the thorough selection of the species, even the intraspecific forms, which are better suited to the given pest and region.

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Table 1. Species of *Trichogramma* spp. collected and identified from various areas of the Republic of Moldova in 2000-2018

ultures	Farma/Households	Species of <i>Trichogramma</i> identified	Number of parasitized eggs, %
Cabbage, Maize, Tomatoes, Green peas, Beet for sugar, soy	Pohoarna, Cotul-Morii, Cauşeni, Chişinău, Balţi, Chetrosu, Sângera, Coşniţa, Gura Bacului, Bacioi, Sarata Galbenă, Balţi, Puhoi, Marandeni	<i>T. evanescens</i> Westwood (varză)	16.7 – 86.0
		<i>T. evanescens</i> Westwood (porumb)	6.0 – 58.0
		<i>T. pintoi</i> Voegele	3.7 – 30.0
		<i>T. dendrolimi</i> Matsumura (=cacoeciae Martsh.)	5.9 – 22.2
		<i>T. mirabile</i> Djuritsch	1.0 – 4.4
		<i>T. leucaniea</i> Pang & Chen	2.0 – 7.0
		<i>T. semblidis</i> Aurivillius	3.0 – 10.0
Apple, plum trees	Chisinau, Puhoi, Mereni, Bacioi	<i>T. telengai</i> Sor.(= <i>T.embryopha-gum</i> Hartig)	60.0 – 88.9
		<i>T. evanescens</i> Westwood	5.1 – 20.0
		<i>T. dendrolimi</i> Matsumura (=cacoeciae Martsh.)	6.0 – 30.0
		<i>T. pintoi</i> Voegele	4.0 – 7.0%

ABSTRACT

As a result of the analysis, the *Trichogramma* which hatched from the parasitized eggs of the pests collected from nature and eggs exposed to *Sitotroga cerealella* O., proved to have the following species identified: *T. evanescens* Westw., *T. pintoii* Vog, *T. semblidis* A., *T. leucaniae* P. & Ch., *T. sibiricum* Sor., *T. dendrolimus* Mat, *T. aurozum* Sug., *T. piceum* Dj., *T. embryophagum* Hb., *T. sorokina* Kost., *T. telengaie* Sor. The *Trichogramma* spp. entomophagus is used in the egg stage to combat various pests: the buch, moth, and albila complex.

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