

# REVIEW

## STATE, PROBLEMS AND PERSPECTIVES FOR DEVELOPMENT OF THE INDUSTRIAL ENTOMOPHAGES REARING AND THEIR APPLICATION

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**Key words:** *entomophages, phytophages, beneficial organisms, plant protection, Trichogramma, Bracon hebetor*

### Table of Contents

Introduction .....	84
Producing of commercial insects .....	84
Programmers for the biological control .....	85
The commercial biological methods as a business .....	86
Conclusions .....	86
Abstract .....	86
References .....	86

### INTRODUCTION

The biological methods for plant protection against harmful organisms, in conformity with the international generally accepted classification, are divided in classical (introduction of natural enemies – NE), inundating (augmentation of – NE), and methods both preservation, and augmenting the entomophage efficacy in agroecosystems (NE conservation) of different agricultural crops [1, 2].

Introduction and acclimatization of beneficial organisms remain the main method of combating the pest species [3].

Such measures are financed, first of all, from the budget of states or divert social foundations [4, 5].

Preservation and efficacy augmentation of natural entomophages population and phytophage development suppression, in general, take into consideration a circle of problems, which harder will be attributed to the agrotechnical methods of plant protection against pests [6, 7].

To take knowledge more in detail with the modern views concerning the ensuring of rational management of the agroecosystems is possible from a whole number of articles and monographs during the last year [8, 9, 10].

The natural guarding measures need not so much financing, as instructive work. The inundating method is more dynamic way of biological control. Inundation allows the possibility for the short periods of time at local site attain the pest destruction. These peculiarities of this method, maybe, have become the main condition of its commercialization. These interests, especially of last direction, at the international level are presented by International

Organization of Biological Control (IOBS), which was founded in 1950, particularly by west Pale arctic and Non arctic regional sections.

### PRODUCING OF COMMERCIAL INSECTS

At present time more than 150 species of predator and parasitic arthropods are being reared in the world. Production of the majority species is sustained by state programs is financed from other sources, and only 35 of them constitute 90% of total sum realized in market. The main mass of the beneficial insects and mites produced on the commerce base are being utilized in greenhouses. If whole quantity of the reared acarientomophages to express in money, then the portion of covered ground will constitute 80% of whole sum. The first place in the money sum of the realized is occupied encarsia with the portion - 25%, *Phytoseiulus* and *Amblyseius* occupy by realization the second place, approximately each by 12% of total dimension of the market [11].

Annually the production quantity of parasites and predator in the 80-90 years increased by 20-25%. To the beginning of new millennium entomophage realization diminished by 15-20% per year [12, 13].

The microbiological and accompanying methods for plant protection have come to the first place. By diverse estimations in 2004 acarientomophages were produced at a sum of 100-150 mln. Euros, and annually growth of their production of the biological means for plant protection in the world for inundation release is estimated at a range of 424 mln. Dollars, the entomophages constitute approximately 47% of total sum. For 2008 growth of

indices was forecasted by 523 mln Dollars, 53% of which constitutes microbiological preparations [14].

In comparison with the pesticides the selling promotion which constitutes 35-40 mln dollars, the portion of the biological means in this volume is equal to only 1% [15].

Being consider at a whole the sphere of combating the noxious organisms, it is to remark that besides annually the seeds of genetically modified plants are sale at a sum of 5,6 bln. dollars.

### PROGRAMMERS FOR THE BIOLOGICAL CONTROL

At present the market of the genetically modified plans shows the greatest dynamics of the growth among the agricultural technologies, even in the historical aspect.

It is generally known that the most widely the programmers for the biological control of pest number on the territory of the former USSR have been carried out. To the end of 80-ties the *Trichogramma* was released on a area of more than 18 mln ha, in addition 3 mln ha were treated by microbiological preparations. At that period of time the surfaces of covered ground to be utilized the biological method on them attained 88%. Only in Ukraine 260 biological laboratories were being functioned. On the territory of the former USSR they numbered more than 1400. The main object produced at these laboratories was eggbeater *Trichogramma*.

It is necessary to note that in spite of significant success of the biological control, application of chemical preparations during this time continued to grow. The maximal induces for pesticide application were attained in 1985 and constituted in average in Ukraine 5,5 kg/ha (by active substance), the fact that almost did not different (by positive stance) from other country in the world. The social crisis of 90-tis years brought to the failure of the biological control. At present in countries which have been formed apart from the USSR, utilization of the biological methods does not exceed 3-4% of total scale of methods for plant protection [16, 17, and 18].

Presently in Ukraine near 90 biological laboratories remained, among them only a few are really working. Even under such strict conditions the biological control is living and the volume of its application begin to grow and now it possesses comparatively not fad induces – 0.9 -1.0 mln ha of application [19, 20, 21].

Not long ago the second place by size of application the biological method was occupied by China. The first industrial biological laboratories to produce *Trichogramma* there were organized in 1950 years. The maximal area for utilization of biological method constituted 70000 ha of field crops and 1 mln ha in forestry (1986).

At present time China made his choice and rearranged the accents in the direction of widening the application of the genetic technologies (China is the leader in the Genetic Modified Organisms in the Euroasiatic region) [22, 23].

The only country in the World which has preserved and actively continues the development program me for inundation in open ground is Cuba. In this country function 222 (280) biological laboratories, the main object of rearing and application is *Trichogramma* (the area of its utilization constitutes 685 thousand hectares). Along with entomophages in Cuba exist a the production of a whole number of biological preparations, the production of which constitutes more than 2000 tons with application on area of 700 thousand hectares. There is a supposition that in Cuba it is absent the financial possibility to acquire modern pesticides. It is an interesting idea [24, 25].

In Europe approximately 30 companies are occupied with the rearing of entomophages, of with 3 big firms “Kopert”, “Biobest”, “Singenta” have up to 100 workers, others less than 10. In general, on the biological method for plant protection in Europe near 750 coworkers is working [26].

Implementation of acari-entomophages by more quick rates takes place into greenhouse farms. In England 74% farmers were utilizing encarsia and 46% - phytoseiulus in 1982. Presently this index attained 90%, while in the world it is equal to not more than 5% [27].

On ornamental plants de dimension of implementation is significantly lower and constitutes from 30 to 35%, it being linked with export orientation of production and quarantine requirements for production purity [28].

On open ground *Trichogramma* dominates in France, Slovakia and Hungary – it is colonized on an area of 100000 hectares against European corn borer on sugar corn plantations. An insignificant quantity of the predator phytoseids is utilized in orchards for control the red spider mites [29].

In USA 130 (86 commerce) companies are rearing 110 species of beneficial arthropods.

The whole dimension of realization the biological methods exceed 100 million dollars or 30% of world market. At the same time the entomophage portion constitutes nearly 10% or 9-10 millions dollars. Biological method is utilized on 10% of covered ground, 8% when ornamental cultures are grooved. On open ground the predator acarions are colonized on 50-70% plantations of strawberries. Lacewing, *Bracon* and *Trichogramma* are used on cotton, the last without somewhat success.

A well developed network of biological is in Latin America. In Brazil there are 44. Entomophages are colonized on 300 thousand hectares of sugar-care and 1 million hectares of soybean.

In Columbia there are 30 biological laboratories which produce entomophages for protection cotton, cassava, tomatoes, sorg and sugar-cane that succeeds as resultants 200 thousand hectares.

Mexican possesses 30 biological laboratories as well, which are reared on the whole *Trichogramma* for lancing on area of 2 million hectares, additionally on 100 thousand hectares is used *Lacewing* and *Bracon* on 6 thousand hectares.

In Panama there are 82 instars and 27 microbiological laboratories [30].

In Asia, besides China, the entomophages are reared in Australia, New Zealand, India and Philippines, but in am all quantities.

In Japan the entomophages are reared from 1955. Presently 14 species of entomophages are allowed to utilize which are produced at 3 biological laboratories. The quantity of the entomophages produced allows ensuring biological control on 1000 hectares of greenhouse, from which the strawberry constitutes 70 ha [31].

#### THE COMMERCIAL BIOLOGICAL METHOD AS A BUSINESS

The main problem of the commercial biological method providing a suitable level of pest number control and reaching competitiveness with the chemical means for plant protection.

So at this phase a question appeared about quality of biological preparations (international requirements to the goods quality and services are expressed in ISO 9000). The produce should suit the aim, for which it is manufactured. Just in such a manner has determined also the quality of the entomophages one of the classics of mass rearing Chambers [32].

The final target of entomophage application is pest struggle, i.e. its efficacy, but how determines it at the level of production? Here there is different approach in dependence on production objects [33].

However the international standards exist and they must be respected [34].

The beneficial arthropods for the programmers of biological method acquired the goods properties. The international market has a constant demand which continues annually to grow. The big firms propose a wide assortment of products, and the small firms are rearing 2-3 species. For satisfaction – insurance of the local consumers with assortment the small firms are organizing, whole-sale delivery from the big firms. The intensify for exchange by biological materials between diverse regions of the world is being grown.

The species which has past through border becomes adventives and potentially dangerous. A question appears about import regulation even for useful organisms [35].

## CONCLUSIONS

Information is resulted on a mass production and use of natural enemies in the different countries of the world. Control of quality is one of main problems of commercial method. In spite of the known cases of no target action of several exotic species of predatory and parasitic arthropods, biological control remains the most perspective, ecologically safe method of plants protection.

## ABSTRACT

The paper is a review on the biological methods for plant protection against harmful organisms. Natural parasites limited attack in the field and can accompany pests and in protected spaces. Introduction and acclimatization of beneficial organisms remain the main method of combating the pest species. Currently, many countries have developed programmes for the biological control with very good results. Production of the majority species is sustained by state programs. At present time more than 150 species of predator and parasitic arthropods are being reared in the world. The main problem of commercial biological method remains ensuring adequate and quality pest control.

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