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ECONOMIC EFFICIENCY OF IN VITRO CULTIVATION TECHNOLOGY OF BRACON HEBETOR

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Abstract

The article is aimed at determining the economic efficiency of the technology of in vitro propagation of the *Bracon hebetor* Say species. The propagation of entomophages in biolaboratories around the world requires large expenses. This requires barley, wheat, corn, margarine, milk and a lot of time. All this leads to an increase in economic costs. In vitro propagation of entomophages leads to savings in these costs. The article analyzes the reduction of economic costs using the technology of in vitro propagation of the *Bracon hebetor* Say species. This is the first part of the scientific research, the information will be supplemented in subsequent articles.

Keywords: *Economic efficiency, bracon, entomophag, in vitro, artificial medium, hemolymph, inhabitation, result*

JEL: *Q16*

Introduction

Nowadays the safety of foodstuff is considered as one of the world global problems. More than 60 countries are suffering from this problem in the world. Increasing population of our country and exceeding demand for quality food, cultivating agricultural products and searching new sources of rearing is becoming problem. That's why our motherland is paying attention widely to provide people with the safety of foodstuff in order to cultivate ecological healthy food and protect environment (Khabiba Khidoyatova and Rasul Jumaev 2024; Jumaev R. A. 2016; Jumaev R. A., Kimsanboev X. X., Adilov M. M., Rustamov A. A., 2017).

It is required much financial expenses to rear entomophags in laboratories in order to cultivate agricultural products and protect pests. In our Republic exist biolaboratories separate more than 140–150 thousand tons barley, maize, wheat to culture entomophags. It means that it causes great loss for food

industry (Khabiba Khidoyatova and Rasul Jumaev 2024; Jumaev R. A. 2016; Jumaev R. A., Kimsanboev X. X., Adilov M. M., Rustamov A. A., 2017).

To carry artificial mediums in rear entomophags is considered as the best way and it notes the duties of directions such as produce them, save and select effective sorts (Khabiba Khidoyatova and Rasul Jumaev 2024; Jumaev R. A. 2016). In rear parasite entomophags, using artificial mediums widely and automatizing them gives much opportunity to solve above mentioned problems (Jumaev R. A., Kimsanboev X. X., Adilov M. M., Rustamov A. A., 2017; Jumaev R., 2023; Li Li-ying, Liu Wenhui. 1997).

It was investigated scientifically by learning inhabitation of bracon parasite entomophag. In this article creating artificial diets medium for growing bracon parasite entomophag in biolaboratories, choosing productive diet medium and learning inhabitation of bracon parasite entomophag, which reared in artificial way, was investigated scientifically (Khabiba Khidoyatova and Rasul Jumaev. 2024; Jumaev R., 2023; Jumaev R., Sobirov T. R., Azimova M. B. 2021; Li Li-ying, Liu Wenhui. 1997).

Bracon is reared widely in biolaboratories as an effective parasite which is against for rodent pests of agricultural plants. It was widely spread in Uzbekistan and other countries of the world. By developing biological methods of learning insects for struggling against pests in the field of researching by these organisms is being payed attention much more. However, in spite of this few researches were done in the field of developing these organisms artificially. That's why we chose this branch (Khabiba Khidoyatova and Rasul Jumaev. 2024; Jumaev R. A., Kimsanboev X. X., Adilov M. M., Rustamov A. A., 2017; Jumaev R., 2023; Jumaev R., Sobirov T. R., Azimova M. B., 2021).

Methods of research

Preparing of artificial mediums. The basic ingredient of medium is prepared insect hemolymph and in addition it is added chicken yolk, solution of cow milk (10 gr /100 ml water). In each 100 ml mixture, 40–60 thousand i.u of gentamisin is added. The mixture of diets are shown at the 6th table.

It is defined there is albumen, oil, water when it is checked ingredients of master caterpillar's type that belong to bracon in nature. Ingredients of caterpillar resemble each other. That's why it is taken as a base hemolymph of wax moths' caterpillar to rear properly in laboratory. Besides, *Heliothis armigera* Hb, *Agrotis segetum* Sciss and cabbage white moths' pupal liquid is used for research.

When it dries, by cutting a small part of the tail or pressing to disjoin liquid, it is pulled with special syringe.

Natural milk mixture is added to hemolymph. In this case 1 gr of dry milk is dissolved at 10 ml distilled water and chicken yolk is added diet medium and put at ultraviolet lamp. It is rotated for 5 minutes at 2000 second speed in centrifuge.

Picture 1. *Researcher Khabiba Khidoyatova is conducting in vitro technology and its economic analysis (Experiments of the laboratory, 2024 year)*

As a result, above separated additional oil and foam is distinguished. Diet medium should be kept in the clean, without microbe room and at 20 °C cool (Khabiba Khidoyatova and Rasul Jumaev. 2024; Jumaev R.A., Kimsanboev X.X., Adilov M.M., Rustamov A.A., 2017; Jumaev R., Sobirov T. R., Azimova M. B., 2021). After medium has been ready, it is placed in special artificial caterpillars which are cleaned with 75% ethyl spirit made of politilen.

Particular thermostat, test-tube 50-PX, politilen material 4mm, spirit 75%, ultraviolet lamp, petri plate, antiseptic pipette, centrifuge 2500, medical syringe 5 ml are necessity (Khabiba Khidoyatova and Rasul Jumaev. 2024; Jumaev R. A., Kimsanboev X. X., Adilov M. M., Rustamov A. A. 2017; Jumaev R. 2023; Li Li-ying, Liu Wenhui. 1997).

A small part (1 x 1) of parafilm is extended 2x4 cm, absorbed in 75% alcohol for 15 minutes. Then it is dried with sterile printed paper, folded as a sack and fixed in order to stick both sides.0,5 ml of mediums is placed by pipette into each parafilm box. When parafilm box is fulled with mediums, it yields such depicted maggot.15–20 small holes are opened with sterile entomologic needle for properly prepared artificial caterpillars. All the processes of the preparation are required to carry out in sterile room (Khabiba Khidoyatova and Rasul Jumaev. 2024; Jumaev R. A., Kimsanboev X. X., Adilov M. M., Rustamov A. A. 2017; Jumaev R. 2023; Jumaev R., Sobirov T. R., Azimova M. B., 2021).

Diet mediums which are ready are put in test-tube (50-PX), a day ago flown and nourished bracon's (*Bracon hebetor* Say) female genders are flown in 1:5 proportion.

In order to separate 100 mostly effective diet mediums,3 kinds of diet mediums are prepared, they are investigated repeatedly 100 times. Their ingredients are following; (Khabiba Khidoyatova and Rasul Jumaev. 2024; Jumaev R. A., Kimsanboev X. X., Adilov M. M., Rustamov A. A. 2017; Jumaev R. 2023; Li Li-ying, Liu Wenhui. 1997).

Results of the research

In each experiment 200 artificial caterpillar are formed from diet mediums of above structure and each of them is experienced 100 times.(1-picture).

We chose a type of bracon to be harmed with bracons. *Bracon hebetor* Say, this type is tolerant, durable in extreme condition. It is practiced by means of choosing convenient state in developing each type to be harmed diet mediums with bracon and in this condition it is put in thermostat.

Damaging the type of bracon with diet mediums at +28±1 °C temperature, at 68±3% moisture.

Picture 2. *Bracon hebetor Say artificial propagation technology (Experiments of the laboratory)*

To compare bracon generation of all diet mediums with tunla caterpillars, cotton-plant caterpillars are also damaged with bracon (1-table).

Table 1. *In vitro propagation of Bracon hebetor to determine the cost-effectiveness of artificial nutrient media compared to natural methods in in vitro technology. (Experiments of the laboratory), (+31±1 °C, RH 65±2%)*

Types of diet mediums and their ingredients' expenditure limit %			The amount of damage % with parasite for artificial caterpillar	Development degree of Bracon in diet mediums by days				All the numbers of generation days	Genders proportion ♂: ♀
				Egg	Larva	Pupa	Undone developing	Imago	
	A								
A1	A2	A3	86,5	1,8±0,2	5,4±0,3	4,6±0,4	—	1,5±0,9	13,3±0,8	1:6
40,04	30,03	29,03								
	B									
B1	B2	B3	61,3	1,3±0,5	3.3±0,9	4,8±0,9	1,8±0,2	—	12,2±0,5	1:1
45,01	28,02	26,07								
	C									
C1	C2	C3	73,4	1,7±0,5	4,8±0,2	4.5±0,3	—	2,3±0,2	12±0,3	1:4
50,04	25,03	24,03								

The indexes of specifying bracon generation's developing artificially made caterpillars in different expenditure limit.

According to it, the first diet medium (A) organizes damaging degree with bracon 86,6% of all prepared diet medium, It takes about 13,3 days from eggs to imago (mature) period. Imagos live 5,8 days.It takes 1,8 days to birth larvae from eggs,5,4 days for larva period,4,6 days for pupa period.

Picture 3. *Young scientist Khabiba Khidoyatova and Economist Islambek Asomutdinov are conducting scientific research to determine the economic efficiency of the in vitro propagation technology of the Bracon hebetor Say species. (Experiments of the laboratory, 2024 year)*

Genders of bracons which went out from medium are male: female proportion will be 1:6. In next diet medium (B) damaging degree of bracon mediums will be 61,3%. It takes 1,3 days to go out larvae from eggs, in diet medium caterpillars inhabit 3,3 days and transform to pupa. Pupa period continues 4,8 days, imagos develop a little and in pupa period they die in spite of observing their flying. In next mediums (C) bracon damage diet mediums till 73,4%. It takes 1,7 days to appear larvae from layed eggs and they begin to consume nutrition.

Larvae develop for 4,8 days in this diet mediums and pupa period includes 4,6 days. Genders of bracons flown from medium are male: females proportion is 1:4.

It is defined during research that prepared all diet mediums are detrimented with bracon generation, they layed their eggs there. But some of diet mediums die because of inconvenience for developing parasite generation.

Picture 4. *Young scientist Khabiba Khidoyatova and Economist Islambek Asomutdinov Young scientist Khabiba Hidoyatova are conducting scientific analyses to determine the economic efficiency of in vitro technology*

According to mediums' structure the portion of only wax moths hemolymph (A) is 40,4 and in this diet medium bracon parasites progress continuingly. The reason of it, there is average albumen and oil in the ingredient of hemolymph. They are convenient for developing parasite larva.

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