



## Using Zoohumus of the Insect *Hermetia Illucens* as a Substrate for Elaboration of Antagonist Fungi

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December 16, 2021

## **Using zoohumus of the insect *Hermetia illucens* as a substrate for elaboration of antagonist fungi**

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Abstract.

We developed the substrates for cultivation of antagonist fungi *Paecilomyces lilacinus* and *Trichoderma viride* based on the *Hermetia illucens* insect zoohumus, for controlling the root rot, traheomycosis vascular wilt and gall eelworms. Best fungi development was observed on zoohumus obtained after processing by the black soldier fly larvae the brewery waste (with the spores titer 5 billion/gram).

Keywords: zoohumus, black soldier fly, *Hermetia illucens*, antagonist fungi, *Paecilomyces lilacinus*, *Trichoderma viride*.

Biological methods of controlling phytopathogens provide application of various antagonists or their metabolites, for suppressing phytopathogen populations. One of the modern approaches for plant protection from pests and pathogens is realization of biological control for phytopathogenic organism population dynamics. This concept implies ecologically justified usage of antagonistic relationships in agroecosystems. The species like *Trichoderma viride* and *Paecilomyces lilacinus* capable to interact with infectious agents, the phytopathogenic nematodes, and decrease their population density at different developmental stages [1]. Using the biological control agents for adjusting the population dynamics of developing pathogens must consider their biotic relationships and natural regulatory mechanisms taking place in the agroecosystems.

The larvae of *Hermetia illucens* (black soldier fly) are used for utilization of various organic wastes and obtaining the nutrient protein and fat, and produce in result zoohumus known as a good organic fertilizer [2-4]. This direction in biotechnology is currently very popular due to its multi-application and multi-purpose nature. Besides activation of the plant growth and development, zoohumus may serve as a cheap and reliable substrate for development of multiple groups of microorganisms, including phytopathogen antagonists.

Control of the population dynamics of pest and infectious agents implies limitation of their damage at economically insignificant level, keeping negative environmental impacts minimal. Application of biological agents is particularly perspective for indoors conditions, where utilization of chemicals is very limited technically and juridically, with the Federal Law 280, On organic products and corrections into selected legislative acts of the Russian Federation.

Purpose of the study

To develop nutrient substrates for *Trichoderma viride* and *Paecilomyces lilacinus* antagonist fungi, based on zoohumus of the insect *Hermetia illucens* (black soldier fly).

Materials and Methods

In the study we used zoohumus obtained in result of utilization by the *Hermetia illucens* (black soldier fly) larvae substrates based on chicken compound fodder, vegetable and fruit mix, and

brewery waste products. The control was represented by wheat grain. In the experiment we used *Trichoderma viride* Pers., the antagonistic fungus to soil pathogens, and the species *Paecilomyces lilacinus* (Thom) Samson, an endoparasite of gall nematodes, suppressing these root rot causative agents. All these fungi are the soil saprophytes, capable for fast multiplication and colonisation of the substrate. Part of the experiments were done with the use of the equipment of the State Collection of Plant Pathogenic Microorganisms, Indicator Plants and Differential Cultivars at All-Russian Research Institute of Phytopathology (SCPPM ARRP).

Pure fungal cultures were seeded into Petri dishes on humus sterilized by autoclaving at 1.2 atm for 45 min) and cultivated in the incubator at 24°C. On the seventh day, we recorded the radial growth of colonies and the spore titre (Table 1).

#### Research results

Table 1. Radial growth and spore production on the nutrient substrates on the basis of *Hermetia illucens* insect

№	Fungal species	Fungal colony diameter (mm), on				Avg. Spore titre/g
		Grain (Control)	Zoohumus produced from			
			Compound fodder	Vegetables	Brewery waste	
1	<i>T. viride</i>	78,6±6,09	85,1±6,87	83,4±6,65	86,2±7,48	4·10 <sup>9</sup>
2	<i>P. lilacinus</i>	75,1±6,29	79,9±7,02	76,5±7,88	80,3±6,84	5·10 <sup>9</sup>

Analysis of the radial growth of the fungi *T. viride* and *P. lilacinus* has shown that the best substrate for growth, development and spore production was zoohumus produced of the brewery waste products. The spore production indexes were close to each other in both species, ~4-5X10<sup>9</sup> spores/g, which is perspective for further developments.

#### Conclusions

In result of the studies conducted we designed the substrates for multiplying the antagonist fungi *T. viride* and *P. lilacinus* based on zoohumus after processing various organic wastes (compound fodder, vegetable and fruit mass, brewery spent products). All substrates were characterized by pretty high level of spore production. Substrates based on zoohumus are products of organic waste processing, and cost much cheaper than grain. Thus, this technology may be assessed as perspective one for further application.

The study was performed in the framework of the grant by the government of Tula Region in the field of science and technology in the year 2021, Biotechnology utilization of organic waste with the use of the larvae of the insect *Hermetia illucens* (black soldier fly) and designing new products, according to the contract No ДС/263 from 25.10.2021.

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