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FUNGICIDAL ACTIVITY OF COLLOIDAL COPPER PARTICLES OBTAINED ON THE BASIS OF THE EXTRACT OF THE ALCHEMILLA VULGARIS

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The effect of colloidal particles on the growth of phytopathagen fungi of various taxonomic classes was studied.

Keywords: *colloidal copper particles; fungicides; fungi-phytopathogens.*

ФУНГИЦИДНАЯ АКТИВНОСТЬ КОЛЛОИДНЫХ ЧАСТИЦ МЕДИ, ПОЛУЧЕННЫХ НА ОСНОВЕ ЭКСТРАКТА МАНЖЕТКИ ОБЫКНОВЕННОЙ

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Изучено влияние коллоидных частиц меди на рост грибов-фитопатагенов различных таксономических классов.

Ключевые слова: *коллоидные частицы меди; фунгициды; грибы-фитопатогены.*

The problem of environmentally friendly agriculture is currently becoming increasingly relevant. One way to solve this problem is to use metal colloids obtained from plant extracts as biologically active preparations. It is known that copper nanoparticles exhibit pronounced biological activity [1]. In the present work, the fungicidal activity of a colloidal solution, including copper and extract of Alchemilla vulgaris, was investigated.

The starting aqueous plant extract was prepared in a Soxhlet extractor. The weight of a sample of plant material was 50 g, the volume of water was 250 ml. To obtain a colloidal solution, 8.5 ml of the filtered extract was added dropwise to 50 ml of a solution of copper nitrate (C = 0.001 mol / L) at room temperature, with constant stirring. The color of the solution became darker after 10 minutes of reaction, which indicated the development of copper nanoparticles. To study the effect of concentration on the biological activity of colloidal copper, three solutions were prepared by dilution: the initial solution ***(1)***, dilution 10 times ***(2)***, dilution 100 times ***(3)***, and dilution 1000 times.

The fungicidal activity of the test substance was studied in vitro on seven phytopathogen fungi of various taxonomic classes, which are the causative agents of the most common diseases for the main types of agricultural plants in the central zone of Russia. Fungi were used: V. inaequalis – the causative agent of scab apple trees, *R. solani* – the causative agent of rhizoctonia, *F. oxysporum, F. moniliforme* – causative agents of fusarium cereal crops, *B. sorokiniana* – the causative agent of root rot, S. sclerotiorum – the causative agent of white rot, *P. ostreatus* – the causative agent of yellow mixed rot of tree trunks.

Fungicidal activity was determined by the method [2]. Fungal mycelium was measured on the 3rd day after sowing. The effect of the drug on the radial growth of mycelium was studied in three dilutions. The percentage of inhibition of mycelial growth was calculated by Abbott from the time of sowing. The experiment was repeated three times. The analysis data are presented in table 1.

Table 1.

Fungicidal activity of Alchemilla vulgaris extract and colloidal solutions of copper based on it

Phyto-pathogenic fungi	Mycelium growth inhibition rate, %				
	Alchemilla vulgaris extract	Solutions of $Cu(NO_3)_2$, C= 10^{-3} mol / l	Colloidal solution № 1	Colloidal solution № 2	Colloidal solution № 3
F. moniliforme	-33	17	0	17	0
F. oxysporum	25	25	25	38	25
V. inaequalis	-67	0	-33	0	0

End of the table 1.

R. solani	-300	0	-67	0	-67
B. sorokiniana	-140	20	-20	20	0
P. ostreatus	86	86	86	86	86
A. alternata	-75	-25	-300	-50	-100

Thus, the fungicidal activity analysis data presented in Table 1 illustrate the high fungistaticity of all test samples with respect to *P. ostreatus*. The percentage of inhibition of mycelial growth in all experiments with this phytopathogen fungus is 86%. To a lesser extent, growth inhibition of *F. oxysporum* mycelium occurs. The decrease in the growth rate of this fungus when treated with all the studied solutions varies from 25 to 38%. In all other cases, both the plant extract and the synthesized colloidal solutions of copper do not significantly affect the growth of fungi – phytopathogens, and in some cases even stimulate the growth of mycelium.

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