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BIOLOGIZATION OF THE CULTIVATION OF THE MEDICINAL PLANT *CAPPARIS SPINOSA L.* IN THE ARID ZONES OF THE REPUBLIC OF UZBEKISTAN USING BIOSTIMULANTS OF MICROBIAL ORIGIN

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ABSTRACT. This paper presents biological methods for the development of arid lands by developing a resource-saving cultivation technology *Capparis spinosa L* using biological products of microbial origin (enzyme organic fertilizer, enzymes of filamentous fungi, biostimulants) in order to obtain fruit elements with improved qualities and increased amounts of fruit elements for the needs of the pharmaceutical industry.

Methods for cultivating capers in arid zones of the Republic from seedlings and from seeds using biological products have been developed, a comparative assessment of the state of the soil microbial landscape and their number, biological activity and soil fertility under the rhizosphere of capers has been carried out. To evaluate the biological methods of capers cultivation, tests were carried out in comparison with chemical (sulfuric acid) and reference preparations (Vitofax-200 F).

For the first time, biotechnology has been created for the development of arid territories of the Republic by cultivating a caper plant using pre-sowing seed treatment with cellulose of the xylotrophic fungus *Aspergillus terreus*, which ensures seed germination by 92-93%. The efficiency of the use of the environmentally safe biological product *"Microzyme-2"* for the cultivation of caper plants from seeds and seedlings is shown, which contributes to an increase in germination and further plant growth, as well as an increase in the biological activity of the soil by enriching the soil composition with microorganisms, an increase in the enzymatic activity of arid territories of the Republic.

In general, the paper provides data on the use of biological methods of cultivation of the medicinal plant capers in the extreme soil and climatic conditions of the arid territories of the Jizzakh and Namangan regions of the Republic of Uzbekistan. It is noted that this technology can be applied in other regions with similar soil and climatic conditions.

Keywords: Medicinal plants; *Capparis spinosa L, seeds, soil, "Microzyme-2"*, treatment, cultivation, microorganisms, soil fertility, biological activity, soil enzymes ,

Central Asia is an integral part of the world space, where 70% of the territory is occupied by arid zones, pastures, etc. The flora of Uzbekistan has 3,700 plant species, among them there are more than 220 species of steppe plants, which are mainly xerophytes and these are camel thorns, capers, black saxaul, shuvak, carrack, white smut, which are mainly fodder. Unlike other plants, capers (*Capparis spinosa L*) are very promising because all vegetative parts of capers (roots, stems, leaves, buds, flowers, fruits) are very valuable for medicine, pharmaceuticals and food industry [Pfundel E E, et.all, 2006. Eshankulova N.T., * Akhmedova Z.R. 2018]. In this regard, the use of thermoxerophytes for the assimilation of arid territories and bioremediation of soils, taking into account their utilitarian properties in harsh xerothermal conditions, where soil moisture is zero, and the air temperature reaches 65-70° C , sometimes penetrating into the soil depth of 5-10 cm [Eshankulova N.T., Akhmedova Z.R. 2013]..

Therefore, recently, according to the Resolutions of the Government of the Republic of Uzbekistan, with the support of the international community, the republic has begun to implement a program for the development of desert territories by introducing and/or cultivating endemic unique medicinal plants that form natural biologically valuable, healing substances to eliminate the deficiency of micronutrients: macro and microelements , iodine and iron deficiency, vitamins, etc. in the food industry and pharmaceuticals [Eshonkulova N.T., Merganov A., 2014, Eshonkulova N.T., Merganov A 2016].

The gradual decrease in the number and productivity of xerophytic desert plants, first of all, is due to the disappearance of the soil microbial community, which increases soil fertility and provides plants with nutrients. Recently, consumer demand for *Capparis spinosa L.* fruits has increased significantly in Europe, America, CIS and Central Asia [Orphanos, P. I. 1983]. Capers is a promising wild plant, resistant to stressful conditions (high solar insolation, salinity, aridity, etc.). Its advantages have long been known to the peoples of Asia and Europe. In the famous "The Canon of Medicine" Abu Ali ibn Sina reports on the medicinal properties of all parts of capers, which have a preventive, curative effect [Pfundel E E, et.all, 2006].

The soil is the main poverty of nature, in which all the vital processes of nature take place for both the plant and animal world, humanity. The biological processes occurring in the soil depend on many factors, which primarily include the composition and structure of the soil, soil microorganisms, as well as root exudates of cultivated crops. Light and heavy soil fractions and their acidity play an important role in the development of soil microorganisms, which determines their fertility [Eshonkulova N., 2013]_

The basis of the soil is soil minerals, which make up 80-90% of the total weight of the soil. They, as a rule, contain almost all the elements of the periodic table, but, unfortunately, in a form inaccessible to plants, animals, etc., most of all in a complex indigestible state. The smallest particles or flakes of minerals form clay soils, larger ones - loams, even larger ones - sandy loams and sands. The smallest particles that form clay minerals are in the form of flakes, therefore, their total surface is enormous and they are able to hold on their surface the ions of elements in a form available for plant nutrition. Some soil microorganisms with sufficient moisture and heat are able to dissolve mineral particles, making the associated chemical elements available to plants. [Zvyagintsev D.G. 1991, Z.R. Akhmedova, 2019,].

Despite the importance of soil elements, soil microorganisms play a major role in the formation of soil fertility. Most of the microorganisms are bacteria, then fungi and actinomycetes. The soil rich in microorganisms is glued together with mineral and organic colloidal particles into small lumps that do not adhere tightly to each other, which allows air to penetrate deep into the soil, and water does not linger on the surface and moisten the soil. Clay rich in humus falls into small lumps [Khusanov T.S., Akhmedova Z.R., 2019].

On the other hand, soil structure is the most important condition for the synthesis of humus, increasing soil fertility, and its health. Moves of microscopic and earthworms, cavities of dead plant roots also improve aeration and soil permeability. Some soil microorganisms decompose organic matter introduced into the soil, contribute to the formation of humus, make nutrients available to plants, others bind atmospheric nitrogen, synthesize organic compounds, the next transform these compounds into forms available to plants. Soil microorganisms transform phosphorus into a soluble state, even decompose minerals, and first of all, practically inexhaustible clay minerals, delivering all the "elements of the periodic table" to plants [Morgun V.V. et all, 2009].

Mineral fertilizers are not evil, but only with their balanced use can you get healthy and wholesome vegetables and increase soil fertility. After all, mineral fertilizers, such as nitrogen, are directly consumed by soil microorganisms, which decompose organic matter and, therefore, contribute to the accumulation of humus. But adding complex fertilizers to the compost heap speeds up the maturation of the compost and turns it into an extremely effective fertilizer. Therefore, it is necessary to recognize that mineral fertilizers still play a starting role in the formation of soil fertility [Compant S., et.all, 2005].

In general, the above arguments give us a clear understanding of the biological, chemical, physical, microbiological processes occurring in soils of various types, the mechanisms of action that directly affect the structure, composition and biological properties of the soil, without which it is impossible to create drugs and substances of biological nature for restoration, increased fertility and soil condition, leading to enormous values in agriculture [Akhmedova Z.R, et.all, 2020] .

Modern intensive plant growing is unthinkable without the use of fertilizers, regulators of plant growth and ontogenesis, control of the number of pests and beneficial micro- and mesoorganisms. In some cases, the synthesis of the substances necessary for this is more profitable (easier, cheaper and more efficient) to produce not chemically, but biologically, using animals, plants (or a culture of cells and tissues) and microorganisms for this. The advantages of organic substances, metabolites of living things over artificially synthesized pesticides and industrial chemical fertilizers are their complex positive effect and high efficiency, which allows the introduction of biological products in minimal doses [Jeon J, et.all, 2003].

Being natural substances, they do not accumulate in the environment and are easily utilized in it. Some of the necessary substances can not be introduced ready-made, but produced directly at the place of consumption, using living beings. One of the main principles of modern biotechnology is the use by man of the three billion "experience" of living nature in his evolution on Earth. Microorganisms are most suitable for this purpose [Unterman R.*1996*].

Microorganisms use substrates of the nutrient medium, synthesize substances (metabolites), grow and multiply. Depending on the goals of cultivation, the end product may be cell biomass or some extracellular metabolite [Upadhyay SK et.all. 2011]. Then in the first case, the waste will be the liquid part of the culture medium, and in the second - the cells. Depending on the target product, the most acceptable method for its isolation is used:

Cells (microbial mass)	Soluble metabolite
Sedimentation and decantation Filtration Centrifugation Deposition Flotation Rectification	Extraction Sorption Sedimentation . Chromatography Isolation with membranes

After separation from the culture liquid, the microbial mass is usually dried (usually lyophilized), mixed with a carrier: sterile soil, peat, lignin, activated carbon, ceramic granules and packed. Microorganisms are better preserved on the carrier, but you can do without it. Sometimes the microbial mass is produced in the form of a suspension of microorganisms. Before use, the dry microbial mass or suspension is diluted with water, the microorganisms restore their native properties and can carry out the processes necessary for a person and synthesize biologically active substances [Zh.Mathatov et/all, 2019, Akhmedova Z.R., et.all,2017].

New forms of microbiological products on the basis of effective strains of beneficial microorganisms and their products are increasingly used in agricultural practice. For example, the following drugs of microbial origin are currently known: *Bio-fungicides, Bactofit, Binoram, Vermiculen, Integral, Planriz, Pseudobacterin, Pseudobacterin-2, Fitolavin-300, Fitosporin*-M, etc., which are revealed even more and more [Z.R. Akhmedova, Z.T.Khamraeva 2018].

The study of the distribution of capers in the wild in two geographically different regions of the Jizzakh and Namangan regions showed that they are found in all fogs on arid, saline soils, but chaotically and in small quantities. Therefore, for the development of abandoned lands, seedlings and seeds of caper plants were chosen [7; 13-p]. For sowing with seedlings, the roots of wild caper species were soaked in *Microzyme-2*, then planted to a depth of 30-50 cm and watered 2 times with *Microzyme-2* for 10 days. For sowing capers with seeds, we used: “Microzyme-2, purified cellulase of the fungus Aspergillus terreus H9, Vitovax-200 F (standard), 2n H2SO4 and vermicompost. The seeds treated for 2 hours and then washed with sterile water were kept in a thermostat for 7 days at 50-55 ° C. Then they sowed into the soil to a depth of 3-5 cm. The maximum rates of seed germination, depending on the type of preparations and sowing time, were different. High germination was observed in variants treated with cellulase in the amount of 275 pieces (91.6%), “***Microzyme-2”*** -253 pieces (84.3%), biohumus-242 pieces (80.6%), 2.0 N sulfuric acid - 207 pieces (69.0%), then Vitovax 200 F -165 pieces (55.0%) on the 45th day of cultivation (Table 1).

For sowing capers in the field, the same treatment scheme was used, seeds were used in the traditional way at the rate of 1.0 kg / ha of area, cellulase consumption was 40 units / g of seeds, taking into account that the mass of 1000 pieces of caper seeds is 7.6- 7.8 gr. Due to the improved content of enzymes and phytohormones, the best results of germination in the field were shown by variants with cellulase and "Microzyme-2" within 30-40 days, where the germination of seeds was 91% and 76.2%, respectively.

Table 1.

Germination energy of caper seeds, depending on processing

№	Treatment of caper seeds	Number of seeds (pcs) germination, %	Time (days), quantity (pcs) and germination rate (%)								
			5	10	15	20	25	30	35	40	45
1	Biohumus	300	-	48	92	98	107	118	146	214	242
		Germination, %	-	16	31,6	33,2	36,7	39,3	48,7	71,3	80,6
2	***Microzyme-2***	300	-	103	121	150	185	208	214	228	253
		Germination, %	-	34,3	40,3	50	61,6	69,3	71,3	76,2	84,3
3	Cellulase ***Aspergillus terreus H9***	300	5	120	224	262	268	272	273	273	275
		Germination, %	1,6	40	74,6	87,3	89,3	90,6	91	91	91,6
4	Vitovax 200-F (control)	300	-	38	104	123	151	155	157	161	165
		Germination, %	-	12,6	34,6	41	50,3	51,6	52,3	53,6	55
5	2н H_2SO_4	300	-	44	172	154	175	181	197	203	207
		Germination, %	-	14,6	47,3	51,3	58,3	60,3	65,6	67,6	69

The study of the number of soil microorganisms under capers after the 30th day of sowing showed that their number depends on the preparations used and the soil horizon (Table 2).

Table 2

The number of the main groups of soil microorganisms under capers (30 days)

Experience options	Soil horizons, cm	Total number of microorganisms, thousand / 1 g of soil			
		Putrefactive bacteria	Bacteria assimilating mineral nitrogen	Bacteria growing on a nitrogen-free environment	Microscopic fungi
Original soil	0-15 15-30	1280 1147	1394 1288	1245 1140	3,1 2,2
Biohumus	0-15 15-30	2756 2372	3675 4758	5389 3987	19,7 15,8
Seed treatment: Vitovax-200 F	0-15 15-30	2295 2344	3549 2347	6531 4022	5,8 6,6
2,0 н H_2SO_4	0-15 15-30	2139 2190	2995 2647	1447 2029	3,3 4,5

Cellulase *Aspergillus terreus* H9	0-15 15-30	4558 3147	4459 2131	7532 5028	5,3 7,5
Microzyme-2	0-15 15-30	13114 6061	7165 4151	5389 3883	12,8 8,6

Putrefactive bacteria were found in greater numbers in the variants with "Microzyme-2" in the soil layer of 0-15 cm, then with cellulase, in the variants with Vitovax-200 F and H_2SO_4 in almost equal amounts in the soil section 15-30 cm. In the original soil, under capers, their number was 5-6 orders of magnitude smaller. There were more bacteria assimilating mineral nitrogen and fungi in the variant with "Microzyme-2", and there were more bacteria growing in a nitrogen-free environment in the variant with cellulase in the upper soil layers (Table 3).

From the data in Table 3, it can be seen that almost all soil microorganisms are more common in variants with "*Microzyme-2"* and cellulase in soil horizons of 0-15 cm, fungi -15-30 cm, which proves the positive effect of the drug on the soil microflora, soil respiration, in which the release of CO_2,% / 24 hours was more than in other variants (Fig. 1).

Table 3.

The number of the main groups of soil microorganisms under capers (flowering phase)

Experience options	Soil horizons, cm	Total number of microorganisms, thousand / 1 g of soil			
		Putrefactive bacteria	Bacteria assimilating mineral nitrogen	Bacteria growing on a nitrogen-free environment	Microscopic fungi
Seed treatment: ***Vitovax-200*** (standart)	0-15 15-30	5961 3848	3841 3475	831 577	5,3 2,9
2,0 н H_2SO_4	0-15 15-30	2747 1441	3445 2233	516 421	3,7 2,8
Cellulase *Aspergillus terreus* H9	0-15 15-30	8170 5755	7258 5451	1831 1229	8,55 5,73
Microzyme-2	0-15 15-30	8975 8772	8272 6464	2844 1832	9,8 15,3

Similar results were obtained when studying the content of humus and nitrogen in soil horizons 0-10.10-15.15-30 cm. It was found that the amount of humus was large in variants with Microzyme-2 (10-15 cm) - 1.78%, nitrogen-0.273% (15-30cm) and cellulase Aspergillus terreus H9 (humus 1.98% (0-10cm), nitrogen -0.149% (15-30cm), Vitovax-200 F (humus-0.935%) in soil horizons 10 - 15 cm.

Depending on the number and height of the bushes, the number of leaves in them (St.) varies from 25 to 30 pieces, not less than 2500 cm2 in size, on small branches - 4500 cm2, which is of great importance in the process of photosynthesis, phytomass growth and yield [34; 35]

Fig-3. Spring view of sprouts and plants of capers grown from seeds treated with cellulase *Aspergillus terreus H9*

Cultivation of capers by seedling methods in the amount of 300 bushes according to the scheme (90x30 cm2) also showed good results. On each bush, up to 10-15 fruits were found with an average weight of 12-15 g and a yield of 1.0-1.5 quintals per bush, which increases by time (2-6 years). The average yield of capers (fresh fruits) is 18-20 t / ha from 4 harvests.

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