

Microbiology

Influence of Ultraviolet Irradiation on the Microflora of Soybean Rhizosphere

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ABSTRACT. The effect of ultraviolet irradiation and temperature on the qualitative and quantitative composition of some physiological groups of microorganisms from soybean (*Glycine hispida* Max.) rhizosphere has been studied. It was established that the total amount of the plant's microflora significantly changed under the influence of these factors. This effect was reflected on quantitative variations of particular taxonomic groups of microorganisms.
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Key words: ultraviolet irradiation, rhizosphere, soybean.

Light intensity and its spectral composition have a significant influence on plant metabolism and regulation of its rhizosphere's microfloral structure.

From literary data it is known that the reaction of plants to ultraviolet radiation (UV) is diverse and depends on plant species, developmental phase, habitat and irradiation regimen [1]. Accordingly, the effect of irradiation varies in a wide range – from inhibitory to stimulating.

An unambiguous interpretation of the existing opinions on this question is complicated by the presence of a big amount of radiation metabolites, actively absorbing the UV and responsible for diverse biological effects [2].

According to experimental data UV irradiation changes also the microfloral composition of the plant's rhizosphere. This effect, in turn, influences the plant's development [3-5].

The purpose of our investigation was to study the influence of UV irradiation on the qualitative and quantitative composition of some physiological groups of microorganisms from soybean (*Glycine hispida* Max.) rhizosphere.

The effect of UV irradiation on the (initial) suspension of microorganisms' culture has been studied. The

suspension was irradiated from an artificial UV-source, using suitable transparency filters (УФС-1). Intensity of irradiation was 10w/m^2 in two different ranges: 254 nm (A) and 313 nm (B), exposures to irradiation were: 35, 70 and 140sec.

Experimental data are given in Table 1. Sample 1 corresponds to control variant, 2, 3, 4 are expositions to UV-A radiation respectively for 35, 70 and 140 sec, and variants with 5, 6, 7 are samples irradiated with UV-B for 35, 70 and 140 sec.

Analysis of the data has shown that oligonitrophiles prevail in illuminated variants, while cellulose destruction bacteria are in minimal amount. In variants N6 and 7 fungi are represented in minimal amount, in N4 exposure fungi and cellulose destructing bacteria are in equal amount ($5 \times 10^{-4}\%$).

While comparing particular taxonomical groups, the following becomes clear: In all experimental variants the amount of oligonitrophiles is much higher compared with control, while the amount of fungi, cellulose destructing bacteria, actinomycetes and saprophytes decreased. Nitrificators and denitrificators have revealed medium intensity of development.

According to the obtained data it may be concluded

Table 1

Influence of ultraviolet irradiation on the microflora of soybean's rhizosphere

Group of microorganisms Sample N	Oligonitrophiles (%)	Fungi (%)	Cellulose destructing bacteria (%)	Actinomycetes (%)	Saprophytes (%)	Nitrifiers	Denitrifiers	Total amount of microorganisms (mln)
1(Contr.)	12.6	200·10 ⁻⁶	170·10 ⁻⁶	350·10 ⁶	87.3	3+	4+	28636
2	63.15	110·10 ⁻⁶	20·10 ⁻⁶	110·10 ⁶	36.4	3+	2+	43181
3	72.72	80·10 ⁻⁶	30·10 ⁻⁶	160·10 ⁶	27.27	2+	5+	24999
4	60.0	50·10 ⁻⁶	50·10 ⁻⁶	300·10 ⁶	39.93	2+	2+	11363
5	82.75	120·10 ⁻⁶	30·10 ⁻⁶	90·10 ⁻⁶	17.24	3+	+	32954
6	80.0	30·10 ⁻⁶	80·10 ⁻⁶	80·10 ⁻⁶	19.99	2+	+	11362
7	99.99	20·10 ⁻⁶	70·10 ⁻⁶	90·10 ⁻⁶	0	2+	+	9090

Table 2

Influence of ultraviolet irradiation and Temperature on the microflora of soybean's rhizosphere

Group of microorganisms Sample N	Oligonitrophiles (%)	Fungi (%)	Cellulose destructing bacteria (%)	Actinomycetes (%)	Saprophytes (%)	Nitrifiers	Denitrifiers	Total amount of microorganisms (mln)
1(Contr.)	31.91	3·10 ⁻⁶	8·10 ⁻⁶	2·10 ⁻⁶	68.08	3+	4+	1 175000
2	28.57	3·10 ⁻⁶	11·10 ⁻⁶	12·10 ⁻⁶	71.42	3+	2+	560000
3	21.34	2·10 ⁻⁶	9·10 ⁻⁶	11·10 ⁻⁶	78.65	2+	5+	445000
4	12.41	10 ⁻⁶	3.5·10 ⁻⁶	9·10 ⁻⁶	87.59	2+	2+	342000
5	33.87	3·10 ⁻⁶	10 ⁻⁶	8·10 ⁻⁶	66.12	3+	+	767500
6	52.02	2·10 ⁻⁶	10 ⁻⁶	8·10 ⁻⁶	47.97	2+	+	432500
7	68.57	3·10 ⁻⁶	0.7·10 ⁻⁶	4·10 ⁻⁶	31.42	2+	+	262500

that UV irradiation has a stimulating effect on oligonitrophiles, while for fungi, cellulose destructing bacteria, actinomycetes and saprophytes it appears to be inhibiting.

At the next stage of experimental work the complex effect of UV irradiation and temperature on the microflora of soybean rhizosphere was investigated.

In one series of experiments irradiated samples were placed in a thermostat at high temperature and some time later – were moved to comparatively low temperature.

Experimental results are demonstrated in Table 2. From the data it is clear that while affecting with UV-A, the amount of oligonitrophiles and fungi decreased, and saprophytes and actinomycetes prevailed. Irradiation with UV-B caused an increase of the amount of oligonitrophiles and actinomycetes, while cellulose destructing

bacteria and saprophytes diminished in number.

The experimental results show that the complex influence of UV irradiation and temperature was stimulating for saprophytes in UV-A irradiated variants and of the same effect for oligonitrophiles in UV-B irradiated variants. In the case of actinomycetes both UV-A and UV-B irradiations were stimulating. UV-A irradiation has inhibiting effect on oligonitrophiles, and UV-D revealed the same kind of influence on cellulose destructing bacteria and saprophytes.

Summarizing the experimental results, it may be concluded that different doses of UV irradiation significantly change particular taxonomic groups of microorganisms, which is expressed through quantitative changes of the total microflora.

მიკრობიოლოგია

ულტრაიისფერი სხივების გავლენა სოიას რიზოსფეროს მიკროფლორაზე

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ნაშრომში შესწავლილია ულტრაიისფერი სხივებისა და ტემპერატურის გავლენა სოიის (*Glycine hispida* Max.) რიზოსფეროს მიკროორგანიზმების ზოგიერთი ფიზიოლოგიური ფუნქციის თვისებებზე და რაოდენობრივ შემადგენლობაზე.

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