ANNEX E.

EPIC DATABASE

“RADIATION EFFECTS ON MICROORGANISMS”

(RUSSIAN/FSU DATA)

EFFECTS OF RADIATION ON MICROORGANISMS (RUSSIAN/FSU DATA), CHRONIC AND ACUTE EXPOSURE. Effect codes: NE-no effect; CG- cytogenetic effect; REPR-effect on reproduction; MT-effect on mortality; MB-effect on morbidity; AD-adaptation to radiation; STIM-stimulation; IMIT-imitation of radiation effect by chemical agent.

Record identification number	Type of organism	Latin name, common name	Impact	Nuclide	Activity in water, Bq/L or soil, Bq/kg	Dose rate, Gy/d	Dose, Gy	Effect	Effect Code	Reference
M1-1	Microorganisms	Bacteria: *Bacillus cereus, Methylobacterium extorguens, M.mesophilicum*	Territory contaminated from the Chernobyl accident (10-km zone around ChNPP).Field studies 1993-1995.	Cs-137				Bacteria *Bacillus cereus, Methylobacterium extorguens, M.mesophilicum* were found in all samples of contaminated soil. No difference with the control. Bacteria:	NE	Romanovskaya et al., 1986
M1-2	Microorganisms	Specialised bacteria: nitrifying, sulphate-reducing, nitrogen-fixing, cellulose-destroying, heterotrophic iron bacteria	Territory contaminated from the Chernobyl accident (10-km zone around ChNPP). Field studies 1993-1995.	Cs-137	1,11E+04 Bq/kg soil			Concentrations of specialized bacteria (nitrifying, sulphate-reducing, nitrogen-fixing, cellulose-destroying, heterotrophic iron bacteria) were 10-100 times lower than in the control.	MT	Romanovskaya et al., 1986
M1-2	Microorganisms	Bacteria from different specialised groups	Experiment, imitation of radiation by keeping bacteria in solutions of hydrogen peroxide (0,1 - 1 Mole). Time of exposure 5-45 minutes.	H_2O_2	0,1 - 1 Mole of hydrogen peroxide in solution			Species of bacteria, which are resistant to H_2O_2 well survive in the Chernobyl near zone, bacteria sensitive to H2O2 were depressed in contaminated soils.	IMIT	Romanovskaya et al., 1986
M2-1	Microorganisms	Saprophytic flora	Experiment, single addition of radionuclide in aquatic system	Ru-106	3,7E+02 - 3,7E+05			No effect on saprophytic flora and biological oxygen depletion.	NE	Guskova et al., 1973

Record identification number	Type of organism	Latin name, common name	Impact	Nuclide	Activity in water, Bq/L or soil, Bq/kg	Dose rate, Gy/d	Dose, Gy	Effect	Effect Code	Reference
M2-2	Microorganisms	Saprophytic flora	Experiment, single addition of radionuclide in aquatic system	Ru-106	3,7E+06 - 3,7E+07			Depression of saprophytic microflora (48,8% of control).	MT	Guskova et al., 1973
M2-3	Microorganisms	*Infusoria*	Experiment, single addition of radionuclide in aquatic system	Ru-106	1,85E+07			Decrease in survival of infuzoria by 15-20%	MT	Guskova et al., 1973
M3	Microorganisms	*Protoccocue algae*	Experiment, single addition of radionuclide in aquatic system	I-131	3,70E+05			Growth rate of protoccocous algae slightly decreased	REPR	Guskova et al., 1973
M4	Microorganisms	*Flagellata*	Experimental plot contaminated with Sr-90.Upper horizon of chernozem-meadow soil under a cereal motley grass.	Sr-90	74E+06 Bq/m2			Species diversity in Flagellata group did not differ from the control (n=8 species in the experimental plot; n=9 species – in the control plot).	NE	Korganova,1973; Krivolutskiy,1983, p.46.
M5	Microorganisms	*Flagellata*	Experimental plot contaminated with Sr-90.Upper horizon of chernozem-meadow soil under a cereal motley grass.	Sr-90	7.4E+07 Bq/m2			Numbers of flagellata cells per 1 g of air-dry soil were lower than those in the control (17 000 in the experimental plot; 166 000 – in the control) .	MT	Korganova,1973; Krivolutskiy,1983, p.46.
M6	Microorganisms	*Amoebida*	Experimental plot contaminated with Sr-90.Upper horizon of chernozem-meadow soil under a cereal motley	Sr-90	7.4E+07 Bq/m2			Species diversity in Ameboida group decreased in the contaminated area (n=8 species in the experimental plot; n=15 – in the control plot).	ECOL	Korganova,1973; Krivolutskiy,1983, p.46.

Record identification number	Type of organism	Latin name, common name	Impact	Nuclide	Activity in water, Bq/L or soil, Bq/kg	Dose rate, Gy/d	Dose, Gy	Effect	Effect Code	Reference
			grass.							
M7	Microorganisms	*Amoebida*	Experimental plot contaminated with Sr-90.Upper horizon of chernozem-meadow soil under a cereal motley grass.	Sr-90	74E+06 Bq/m2			Numbers of ameboid cells per 1 g of air-dry soil were lower (7 000) on the experimental plot than those in the control (183 000).	MT	Korganova,1973; Krivolutskiy,1983, p.46.
M8	Microorganisms	*Infusoria*	Experimental plot contaminated with Sr-90.Upper horizon of chernozem-meadow soil under a cereal motley grass.	Sr-90	7.4E+07 Bq/m2			Species diversity in Infuzoria group did not differ from the control.	NE	Korganova,1973; Krivolutskiy,1983, p.46.
M9	Microorganisms	*Infusoria*	Experimental plot contaminated with Sr-90.Upper horizon of chernozem-meadow soil under a cereal motley grass.	Sr-90	7.4E+07 Bq/m2			Numbers of Infusoria cells per 1 g of air-dry soil were lower (n=25) on the experimental plot comparing with the control (n=45).	MT	Korganova,1973; Krivolutskiy,1983, p.46.
M10-1	Microorganisms	*Chlorella vulgaris, uni-cell microalgae*	Culture of Chlorella	Sr-90 - Y-90	3.7E+08	2,85		Increase of mutations in Chlorella cells. Maximum amount of mutant cells in population was 1%. Irradiation did not influenced on viability of cells. Natural level of mutation in Chlorella - (0,3-0,6)%	NE	Shevchenko, 1979.
M10-2	Microorganisms	*Chlorella vulgaris, uni-*	Culture of Chlorella	Sr-90 - Y-90	7.4E+08	5,7		Increase of mutations in Chlorella cells. Maximum	NE	Shevchenko, 1979.

Record identification number	Type of organism	Latin name, common name	Impact	Nuclide	Activity in water, Bq/L or soil, Bq/kg	Dose rate, Gy/d	Dose, Gy	Effect	Effect Code	Reference
		cell microalgae						amount of mutant cells in population was 2%. Irradiation did not influenced the viability of cells. Natural level of mutation in Chlorella - (0,3-0,6)%		
M10-3	Microorganisms	*Chlorella vulgaris, uni-cell microalgae*	Culture of Chlorella	Sr-90 - Y-90	1,85E+09	14,25		Increase of mutations in Chlorella cells. Maximum amount of mutant cells in population was 5%. Irradiation did not influenced the viability of cells. Natural level of mutation in Chlorella - (0,3-0,6)%	NE	Shevchenko, 1979.
M11-1	Microorganisms	*Chlorella vulgaris, uni-cell microalgae*	Culture of Chlorella. Radionuclide was added at the beginning of experiment (1st series of experiment).	Pm-147	1,85E+08	0,155		Numbers of viable cells decreased; minimal amount of viable cells in population was about 80%, at stabilization - about 98%. Numbers of mutant cells increased: at maximum, share of mutant cells was 8%, at stabilization about 4-5%. Natural level of mutation in Chlorella - (0,3-0,6)%.	CG	Shevchenko, 1979.
M11-2	Microorganisms	*Chlorella vulgaris, uni-cell microalgae*	Culture of Chlorella. Radionuclide was added at the beginning of experiment (1st series of experiment).	Pm-147	7,40E+08	0,62		Numbers of viable cells decreased; minimal amount of viable cells in population was about 35%, at stabilization - about 90%. Numbers of mutant cells increased: at maximum, the numbers of mutant cells were 18%, at stabilization about 11%. Natural level of mutation in	CG	Shevchenko, 1979.

Record identification number	Type of organism	Latin name, common name	Impact	Nuclide	Activity in water, Bq/L or soil, Bq/kg	Dose rate, Gy/d	Dose, Gy	Effect	Effect Code	Reference
								Chlorella - (0,3-0,6)%.		
M11-3	Microorganisms	*Chlorella vulgaris, uni-cell microalgae*	Culture of Chlorella. Radionuclide was added at the beginning of experiment (1st series of experiment).	Pm-147	1,85E+09	1,55		Numbers of viable cells decreased; minimal amount of viable cells in population was about 8-10%, at stabilization - about 80%. Numbers of mutant cells increased: at maximum, the share of mutant cells was 32%, at stabilization about 24%. Natural level of mutation in Chlorella - (0,3-0,6)%.	CG	Shevchenko, 1979.
M11-4	Microorganisms	*Chlorella vulgaris, uni-cell microalgae*	Culture of Chlorella. Radionuclide was added after latency time (2nd series of experiments).	Pm-147	1,90E+08	0,155		At stabilization phase, share of mutant cells in population was 2%. Numbers of viable cells were about 90%. Natural level of mutation in Chlorella - (0,3-0,6)%.	CG	Shevchenko, 1979.
M11-5	Microorganisms	*Chlorella vulgaris, uni-cell microalgae*	Culture of Chlorella. Radionuclide was added after latency time (2nd set).	Pm-147	7,40E+08	0,62		At stabilization phase, share of mutant cells in population was 12%. Numbers of viable cells varied with time; at stabilization, viable cells amounted to about 70%. Natural level of mutation in Chlorella - (0,3-0,6)%.	CG	Shevchenko, 1979.
M11-6	Microorganisms	*Chlorella vulgaris, uni-cell microalgae*	Culture of Chlorella. Radionuclide was added after latency time (2nd set).	Pm-147	1,85E+09	1,55		Numbers of mutant cells varied with time from 10 to 40%, at stabilization - 15%. Numbers of viable cells decreased; at minimum, share of viable cells in population was about 8-10%, at stabilization - about 60%. Natural level of mutation in	CG	Shevchenko, 1979.

Record identification number	Type of organism	Latin name, common name	Impact	Nuclide	Activity in water, Bq/L or soil, Bq/kg	Dose rate, Gy/d	Dose, Gy	Effect	Effect Code	Reference
								Chlorella - (0,3-0,6)%.		
M12-1	Microorganisms	*Chlorella vulgaris, uni-cell microalgae*	Culture of Chlorella.	Fission products of U-235 (age of FP at the start of experiment was 10 hours).	1,85E+10 Bq/l			During the first 10 cycles of density reduplication, considerable increase of mutant cells was observed. Maximal share of mutant cells was 2,8%. Natural level of mutation in Chlorella - (0,3-0,6)%.	CG	Shevchenko, 1979.
M12-2	Microorganisms	*Chlorella vulgaris, uni-cell microalgae*	Culture of Chlorella.	Fission products of U-235 (age of FP at the start of experiment was 10 hours).	3,7E+9 Bq/l			Increase in the number of mutant cells in Chlorella population. Maximum share of mutant cells was 1%. After 20 cycles of density reduplication, share of mutant cells stabilized at a level 0,5%. Natural level of mutation in Chlorella - (0,3-0,6)%.	CG	Shevchenko, 1979.
M12-3	Microorganisms	*Chlorella vulgaris, uni-cell microalgae*	Culture of Chlorella.	Fission products of U-235 (age of FP was 14 hours at the start of experiment).	4,2E+9 Bq/l	Dose rate decreased exponentially from approximately 15 to 2.5 Gy/day in the first 8-10 days		Maximum number of mutant cells was 3,5%. Increasing period of maximal mutation numbers indicated the delay in cell replication during the initial phase of experiment. In the course of the experiment, there were 21,6 cycles of density reduplication of cells in irradiated cultures compared with 23 cycles in the control. Natural level of mutation in Chlorella - (0,3-0,6)%.	CG	Shevchenko, 1979.
M12-4	Microorganisms	*Chlorella vulgaris, uni-cell*	Culture of Chlorella.	Fission products of U-235 (	4,2E+9 Bq/l	Dose per one cycle of reduplicatio		Numbers of viable cells decreased to 80,0±2,3% in first phase of the experiment, but	CG	Shevchenko, 1979.

Record identification number	Type of organism	Latin name, common name	Impact	Nuclide	Activity in water, Bq/L or soil, Bq/kg	Dose rate, Gy/d	Dose, Gy	Effect	Effect Code	Reference
		microalgae		age of FP was 14 hours at the start of experiment).		n decreased exponentially from 30 to 5 Gy in the first 8-10 days		by 8-10th cycles of density reduplication it was the same as in the control.		
M12-5	Microorganisms	*Chlorella vulgaris, unicell microalgae*	Culture of Chlorella. Cultivation in volumetric flacks. 22-24 cycles of duplication during 44 days of the experiment.	Fission products (age of FP was 14 hours).	8,5E+8 Bq/l	Dose per one cycle of reduplication decreased exponentially from 2.5 to <1 Gy in the first 8-10 days		Maximum number of mutant cells was 2%. After 5 cycles of density reduplication numbers of mutant cells decreased to a stabilization level (0,7%). Natural level of mutation in Chlorella - (0,3-0,6)%.	CG	Shevchenko, 1979.
M12-6	Microorganisms	*Chlorella vulgaris, unicell microalgae*	Culture of Chlorella. Cultivation in volumetric flacks. 22-24 cycles of duplication during 44 days of the experiment.	Fission products (age of FP was 2 days).	3,7E+9 Bq/l	Dose per one cycle of reduplication decreased exponentially from 18 to 4 Gy during the first 8-10 days		Maximal numbers of mutants (6%) were observed at 8-10th cycles of duplication; at stabilization phase, the percentage of mutants was about2.5%. Natural level of mutation in Chlorella - (0,3-0,6)%.	CG	Shevchenko, 1979.
M12-7	Microorganisms	*Chlorella vulgaris, unicell microalgae*	Culture of Chlorella. Cultivation in volumetric flacks. 22-24 cycles of duplication during 44 days of the experiment.	Fission products (age of FP was 2 days).	1,85E+9 Bq/l	Dose per one cycle of reduplication decreased exponentially from 9 to 2 Gy during the first 8-10 days		Maximal numbers of mutants (3%) were observed at 8-10th cycles of duplication; at stabilization, the share of mutants was about 1-1.5%. Natural level of mutation in Chlorella - (0,3-0,6)%.	CG	Shevchenko, 1979.
M12-8	Microorga	*Chlorella*	Culture of	Fission	3,7E+9	Dose per		The highest numbers of	CG	Shevchenko,

Record identification number	Type of organism	Latin name, common name	Impact	Nuclide	Activity in water, Bq/L or soil, Bq/kg	Dose rate, Gy/d	Dose, Gy	Effect	Effect Code	Reference
	nisms	*vulgaris, uni-cell microalgae*	Chlorella. Cultivation in volumetric flacks. 22-24 cycles of duplication during 44 days of the experiment.	products (age of FP was 20 days).	Bq/l	one cycle of reduplication decreased from 16 Gy to 4 Gy during the first 10 cycles, later on remained at a level about 4 Gy per cycle		mutants (4.5-5%) were observed at 8-15th cycles of duptlication, at stabilization the percentage of mutants was about 3%. Natural level of mutation in Chlorella - (0,3-0,6)%.		1979.
M12-9	Microorganisms	*Chlorella vulgaris, uni-cell microalgae*	Culture of Chlorella. Cultivation in volumetric flacks. 22-24 cycles of duplication during 44 days of the experiment.	Fission products (age of FP was 20 days).	1,85E+9 Bq/l	Dose per one cycle of reduplication decreased from 8 Gy to 2 Gy during the first 10 cycles, later on remained at a level about 2 Gy per cycle		The highest numbers of mutants (2-2.2%) were observed at 10-20th cycles of duplication; at stabilization, the percentage of mutants was about 1.5%. Natural level of mutation in Chlorella - (0,3-0,6)%.	CG	Shevchenko, 1979.
M12-10	Microorganisms	*Chlorella vulgaris, uni-cell microalgae*	Culture of Chlorella. Cultivation in volumetric flacks. 22-24 cycles of duplication during 44 days of the experiment.	Fission products (age of FP was 20 days).	9,25E+8 Bq/l	Dose per one cycle of reduplication decreased from 4 Gy to 1 Gy during the first 10 cycles, later on remained at a level		The highest numbers of mutants (2-2.2%) were observed at 10-20th cycles of duptlication, at stabilization the percentage of mutants was about 1.5%. Natural level of mutation in Chlorella - (0,3-0,6)%.	CG	Shevchenko, 1979.

Record identification number	Type of organism	Latin name, common name	Impact	Nuclide	Activity in water, Bq/L or soil, Bq/kg	Dose rate, Gy/d	Dose, Gy	Effect	Effect Code	Reference
						about 1 Gy per cycle				
M12-11	Microorganisms	*Chlorella vulgaris, uni-cell microalgae*	Culture of Chlorella. Cultivation in volumetric flacks. 22-24 cycles of duplication during 44 days of the experiment.	Fission products (age of FP was 20 days).	4,44E+8 Bq/l	Dose per one cycle of reduplication decreased from 2 Gy to 0.5 Gy during the first 10 cycles, later on remained at a level about 0.5 Gy per cycle		The highest numbers of mutants (1-1.2%) were observed at 5-20th cycles of duptlication, at stabilization the percentage of mutants was about 0.7%. Natural level of mutation in Chlorella - (0,3-0,6)%.	CG	Shevchenko, 1979.
M13-1	Microorganisms	*Chlorella vulgaris, uni-cell microalgae*	Culture of Chlorella. Cultivation in volumetric flacks.Time of exposure was 17 days.	Y-90	3,7E+9 Bq/l	Dose per one cycle of reduplication decreased from 25 Gy to 1.4 Gy during the experiment	total absorbed dose was 160 Gy	Maximum numbers of mutant cells (3,7±0,3)% were observed at the first cycle of density reduplication, and later decreased. Since 19th cycle level of mutant cells was the same as on the control. Natural level of mutation in Chlorella - (0,3-0,6)%.	CG	Shevchenko, 1979.
M13-2	Microorganisms	*Chlorella vulgaris, uni-cell microalgae*	Culture of Chlorella. Cultivation in volumetric flacks. Time of exposure was 17 days.	Y-90	2,22E+10 Bq/l	Dose per one cycle of reduplication decreased from 290 Gy to 5 Gy during the experiment	Total dose - 980 Gy	Maximum number of mutant cells was (7,0±0,3)% on the 4,1th cycle of density reduplication. At stabilization, numbers of mutant cells were (2,2±0,2)% . Natural level of mutation in Chlorella - (0,3-0,6)%.	CG	Shevchenko, 1979.
M13-3	Microorganisms	*Chlorella vulgaris, uni-cell*	Culture of Chlorella. Time of exposure was 17	Y-90	2,22E+10 Bq/l	Dose per one cycle of reduplicatio	Total dose 980	Number of viable cells decreased. Lowest numbers of viable cells (79,0±2,3)% were	MB	Shevchenko, 1979.

Record identification number	Type of organism	Latin name, common name	Impact	Nuclide	Activity in water, Bq/L or soil, Bq/kg	Dose rate, Gy/d	Dose, Gy	Effect	Effect Code	Reference
		microalgae	days.			n decreased from 290 Gy to 5 Gy during the experiment	Gy	observed between the 1st and 2nd cycles of reduplication.		
M14-1	Microorganisms	*Chlorella vulgaris, uni-cell microalgae*	Cultures of Chlorella from the Kyshtym contaminated area, 5 years after the accident. Forms of Chlorella vulgaris from natural populations were subjected to additional exposure by x-rays (30E+3 R). 23 strains of Chlorella were tested	Sr-90 - Y-90	(1,7E+6 - 8,3E+6) Bq/kg soil soil	0,011 -0,06 Gy/d (chronic)	Additional acute exposure 300 Gy	Increase of radioresistance was observed in natural Chlorella populations from the Kyshtym contaminated soils. Average survival of Chlorella cells after probing exposure was (33,5±1,5)%. Average survival of Chlorella cells in the control was (19,6±1,5)%.	MB	Shevchenko, 1979.
M14-2	Microorganisms	*Chlorella vulgaris, uni-cell microalgae*	Cultures of Chlorella from the Kyshtym contaminated area, 6 years after the accident.Forms of Chlorella vulgaris from natural population were subjected to additional exposure by x-rays (30E+3 R). Tested were 17 strains of Chlorella.	Sr-90 - Y-90	(1,7E+5 - 8,3E+5) Bq/kg soil	0,0013-0,0063 Gy/day chronic exposure	Additional acute exposure 300 Gy	Increase of radioresistance was observed in natural Chlorella populations from the Kyshtym contaminated soils. Average survival of Chlorella cells was (36,0±1,7)%. Average survival of Chlorella cells in the control was (19,6±1,5)%.	MB	Shevchenko, 1979.
M14-3	Microorga	*Chlorella*	Cultures of	Sr-90 - Y-	(1,7E+6 -	0,013-0,063	Addit	Increase of radioresistance	AD	Shevchenko,

Record identification number	Type of organism	Latin name, common name	Impact	Nuclide	Activity in water, Bq/L or soil, Bq/kg	Dose rate, Gy/d	Dose, Gy	Effect	Effect Code	Reference
	nisms	*vulgaris, unicell microalgae*	Chlorella from the Kyshtym contaminated area, 11 years after the accident.Forms of Chlorella vulgaris from natural population were subjected to additional exposure by gamma-rays from Cs-137 (30E+3 R).Tested were 17 strains of Chlorella.	90	8,3E+6) Bq/kg soil	Gy/day chronic exposure	ional acute exposure 300 Gy	was observed in natural Chlorella populations from the Kyshtym contaminated soils. Maximum average survival of Chlorella cells after probing exposure was (23,0±3,0)%. Average survival of Chlorella cells in the control was (12,2±2,2)%.		1979; Alexeenok, 1970.
M15-1	Microorganisms	*Chlorella vulgaris, uni-cell microalgae*	Culture of Chlorella from the Kyshtym contaminated area, 5 years after the accident.Forms of Chlorella vulgaris from natural population were subjected to additional exposure from beta-emission of Y-90- Sr-90 (activity 5,6E+8Bq/l, dose rate 420 rad/day, time of exposure - 1 day).	Sr-90 - Y-90	(1,7E+5 - 1,7E+6) Bq/kg soil	0,0013-0,0126 Gy/day chronic exposure	Additional exposure in radioactive solution 4.2 Gy	Radioresistance in chronically exposed Chlorella populations increased in the range of the levels of soil contamination (1,7E+4 - 1,7E+7) Bq/kg, and gradually decreased at higher contamination. Average radioresistance for cultures with normal phenotype was (80,8±4,1)% (in the control (34,6±7,9)%).	AD	Shevchenko, 1979.
M15-2	Microorganisms	*Chlorella elipsoidea,*	Cultures of Chlorella from the	Sr-90 - Y-90	(1,7E+7 - 1,7E+8)	0,13-1,26 Gy/day	Additional	Increase of radioresistance in chronically exposed Chlorella	AD	Shevchenko, 1979.

Record identification number	Type of organism	Latin name, common name	Impact	Nuclide	Activity in water, Bq/L or soil, Bq/kg	Dose rate, Gy/d	Dose, Gy	Effect	Effect Code	Reference
		uni-cell microalgae	Kyshtym contaminated area, 5 years after the accident.Forms of Chlorella elipsoidea from natural populations were subjected to additional exposure by beta-emission of Y-90- Sr-90 (activity of solution was 3,7E+8 Bq/l; dose rate 280 rad/day, time of exposure -1 day).		Bq/kg soil	chronic exposure	exposure in radioactive solution 2.8 Gy	population. Average survival of Chlorella elipsoidea cells was (47,4±16,5)%. Average survival of Chlorella cells on the control was (0,6±0,3)%.		
M15-3	Microorganisms	*Chlorella terricola, uni-cell microalgae*	Culture of Chlorella. Kyshtym contaminated area, 5 years after the accident.Forms of Chlorella terricola from natural population were subjected to additional exposure by beta-emission of Y-90- Sr-90 (activity of solution was 1,5E+8 Bq/l; dose rate 112 rad/day, time of exposure -1 day).	Sr-90 - Y-90	(1,7E+5 - 1,7E+6) Bq/kg soil	0,0013-0,0126 Gy/day chronic exposure	Additional exposure in radioactive solution 1.12 Gy	Increase of radioresistance in chronically exposed Chlorella population. Average survival of Chlorella terricola cells subjected to probing exposure was (35,7±9,9)%. Average survival of Chlorella cells in the control was (7,9±2,8)%.	AD	Shevchenko, 1979.