

ELECTRONIC SUPPLEMENTARY MATERIAL

Can potato plants be colonized with the fungi *Metarhizium* and *Beauveria* under their natural load in agrosystems?

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Figure S1. Location of plots in the Novosibirsk region.

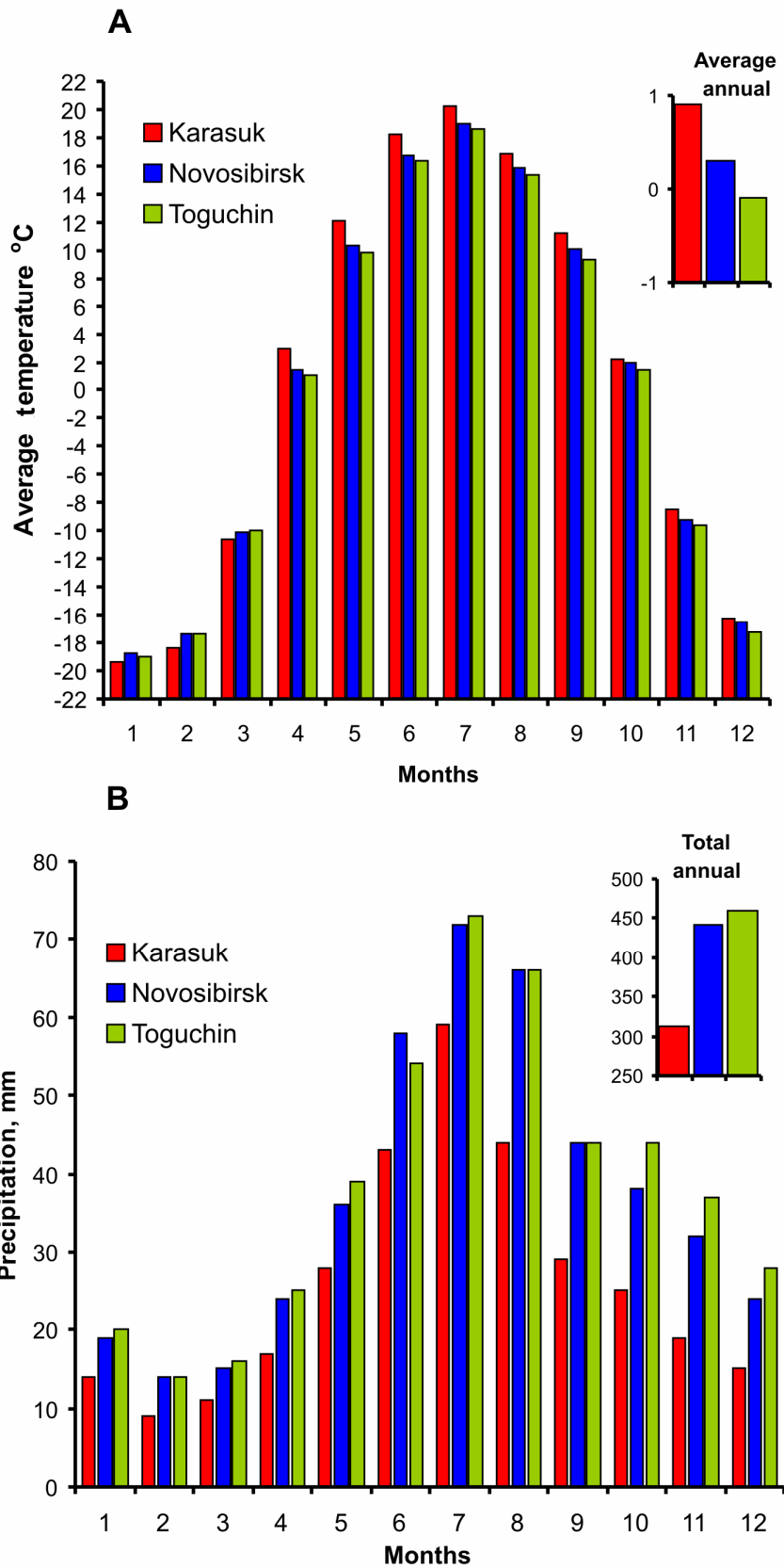


Figure S2. Average long-term temperatures and precipitation in the surveyed locations. Plots generated based on data from Kravtsov and Donukalova [1].

Table S1. Granulometric composition of soil samples from experimental plots, as determined by laser diffraction using a Fritsch Analysette-22 MicroTec device.

Location of plots	Sludge weight - particles diameter more than 250 μm , g	Percent of particles with different diameter						Physical clay < 10 μm	Physical sand > 10 μm
		1000-250 μm	250-50 μm	50-10 μm	10-5 μm	5-1 μm	1-0,1 μm		
Karasuk	2.1 $\pm$ 0.1	15.8 $\pm$ 1.0	11.7 $\pm$ 1.6	24.7 $\pm$ 2.4	15.0 $\pm$ 4.7	25.3 $\pm$ 2.4	7.6 $\pm$ 0.9	47.8 $\pm$ 4.7	52.2 $\pm$ 4.7
Novosibirsk	0.06 $\pm$ 0.01	0.6 $\pm$ 0.1	27.1 $\pm$ 1.9	39.8 $\pm$ 1.4	11.1 $\pm$ 2.8	16.8 $\pm$ 1.4	4.6 $\pm$ 0.5	32.6 $\pm$ 2.8	67.4 $\pm$ 2.8
Toguchin	0.06 $\pm$ 0.03	0.4 $\pm$ 0.2	2.0 $\pm$ 0.2	36.4 $\pm$ 5.5	22.6 $\pm$ 9.2	33.6 $\pm$ 5.5	5.7 $\pm$ 0.7	61.9 $\pm$ 9.2	38.1 $\pm$ 9.2

Table S2. Agrochemical properties of soils in the location of experimental plots.

Soil properties*	Content in 5-20 cm layer		
	Karasuk	Toguchin	Novosibirsk
pH _(H2O)	5.2 ± 0.5	6.7 ± 0.5	7.5 ± 0.1
C _{org} , %	1.35 ± 0.3	5.2 ± 0.2	0.8 ± 0.04
N _{tot} , %	0.15 ± 0.04	0.5 ± 0.03	0.09 ± 0.01
N-NO ₃ , mg kg ⁻¹	18.2 ± 5.5	34.3 ± 7.6	17.3 ± 8.1
N-NH ₄ , mg kg ⁻¹	0.94 ± 0.5	1.7 ± 1.3	0.7 ± 0.2
Phosphorus _{mobile} , mg P ₂ O ₅ g ⁻¹	14.9 ± 3.9	6.7 ± 0.5	7.5 ± 0.1
Content of mobile forms of macroelements in acetate-ammonium buffer			
Calcium, (mg Ca/100 g ⁻¹)	130.5 ± 6.7	443.9 ± 23.9	297 ± 8.9
Magnesium, (mg Mg/100 g ⁻¹)	27.1 ± 1.3	67.1 ± 5.7	16.1 ± 1.3
Potassium, (mg K/100 g ⁻¹)	93.1 ± 22.0	227.3 ± 15.6	12.4 ± 2.1
Sodium, (mg Na/100 g ⁻¹)	3.4 ± 0.9	4.8 ± 0.3	2.5 ± 0.3

* - pH of the aqueous soil suspension (1 : 2.5) was analyzed by potentiometry. The carbon (C_{org}) content was analyzed after wet burning in a mixture of 0.4 N K₂Cr₂O₇ with H₂SO₄[2]. The total nitrogen content (N_{tot}) was determined by the Kjeldahl technique after wet ignition of the samples with the Kuderyarov catalyzing reducing agent [3]. Exchangeable ammonium (N-NH₄) was detected by Kuderyarov method after extraction with 0.1 N KCl [4]. Nitrate nitrogen (N-NO₃) and phosphorus (P₂O₅), were detected on the basis of extraction with 0.003 M K₂SO₄. Exchangeable K⁺, Na⁺, Ca²⁺ and Mg²⁺ were determined by atomic adsorption method after extraction with 1M CH₃COONH₄ [5-6]. All analyses were performed in three replicates.

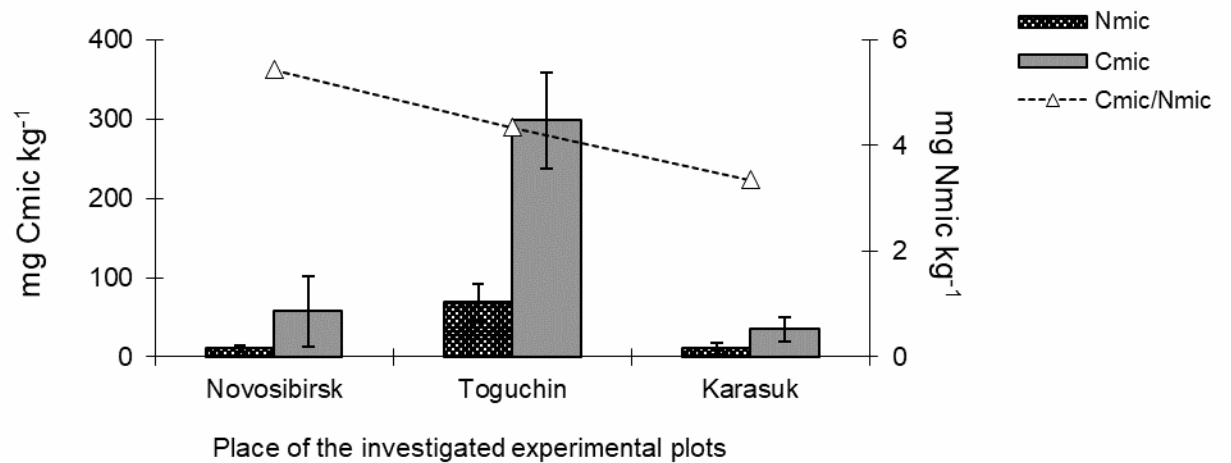


Figure S3. Content of carbon (Cmic) and nitrogen (Nmic) of the microbial biomass in the investigated soils as analyzed by fumigation-extraction method [7-8]. Analyses were performed in three replicates.

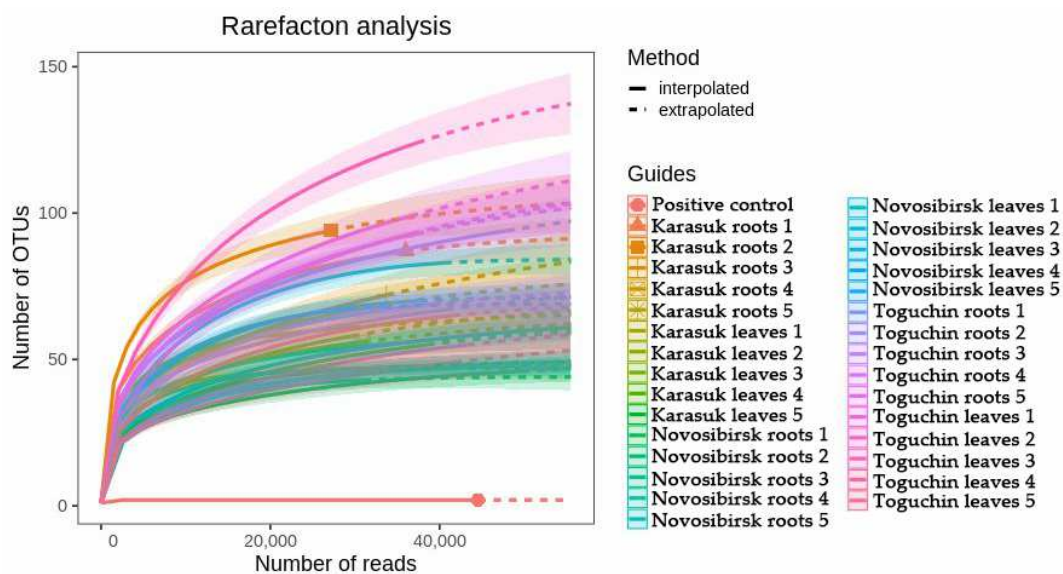


Figure S4. Rarefaction analysis of the investigated samples. Plastid and mitochondrial reads were not excluded.

References

1. Kravtsov, V.M.; Donukalova, R.P. Geography of Novosibirsk region. INFOLIO, Novosibirsk. **1999**, 208 pp. (in Russian).
2. Sokolov, A.V. Agrochemical Methods of Soil Studies. Nauka, Moscow. 1975; pp. 656. (in Russian).
3. Ma, T.S.; Zuazaga, G. Micro - Kjeldahl determination of nitrogen. A new indicator and an improved rapid method. *Ind. Eng. Chem. Anal. Ed.*, 1942, *14*, 280–282.
4. Maslova, A.L. Potassium as an element of soil fertility, in: Potassium fertilizers. LOVIUAA, Leningrad, 1938. pp. 82-171 (in Russian).
5. Kudayarov, V.N. Colorimetric determination of ammonium nitrogen in soils and plants phenolic methods. *Agrochemistry*, 1965, *6*, 146-150 (in Russian).
6. Blackmore, L.C.; Searle, P.L.; Daly, B.K. Methods for chemical analysis of soils. *New Zealand Soil Bureau scientific report*; 10A. 1981. 102 pp. doi: [10.7931/DL1-SBSR-10A](https://doi.org/10.7931/DL1-SBSR-10A)
7. Brookes, P.C.; Landman, A.; Pruden, G.; Jenkinson, D.S.; Chloroform fumigation and the release of soil nitrogen a rapid direct extraction method to measure microbial biomass nitrogen in the soil. *Soil Boiol. Biochem.*, 1985. *17*. 837-842.
8. Vance, E.D.; Brookes, P.C.; Jenkinson, D.S.; An extraction method for measuring soil microbial biomass-C. *Soil Biol. Biochem.*, 1987. *19*. 703-707.