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# FORMATION OF MICROBESCENOSIS IN THE CENTERS OF COMPACTION SOD-LAYERED SOILS

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*The influence of anthropogenic compaction on species composition and population of microorganisms in sod-layered soils was researched. It's established that in upper half-meter depth sod-layered soils under the influence of recreational impacts is to reduce the number of pedotrophic microorganisms (on 10,5-74,6 %) and micromycetes (on 64,3-99,2 %) and the increasing of oligotrophic microorganisms (for 4,9-553,3 %) and actinomycetes (on 15,5-150,0 %).*

**Microbescenosis, sod-layered soils, recreation, pedotrophic microorganisms oligotrophic microorganisms, micromycetes, actinomycetes.**

If you are using forests for recreational purposes it is a compaction of the upper soil layers [3, 7], which negatively affects their biological and enzymatic activity [6], which leads to a decrease y humus content, total nitrogen, total and mobile forms of nitrogen and phosphorus [5] and as a result cause violations of mineral nutrition of woody plants and significantly reduces the biological stability, performance and durability of plant communities that grow under these conditions [8]. Given that in these and other literature dealing with the effects of anthropogenic compaction mainly on physical and chemical properties of sod-podzolic soils and outside the attention of scientists remain quantitative information about the impact of recreational pressures on other soil types, we also conducted the study.

**The purpose of research** is to identify the impact of anthropogenic compaction on species composition and population of microorganisms of sod-layered soils.

**Materials and methods research.** The study was conducted in mature oak stands growing on sod-layered soils and exposed to intense recreational activity. The pure oak stand with density 0.6 incorporates a undergrowth of black elderberry, which is located at the site of clumps. The stand is located in the southern part of the park "Alexandria" that in Belaya Tserkov. The planting area with no visible signs of

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degradation of cover grass was served as a control, as well as research plantation was presented the plot with lost ground cover due to trampling of soil. The number of colony of forming units (CFU) pedotrophic and oligotrophic microorganisms and micromycetae and actinomycetes were determined according to the method of allocation and accounting of soil microorganisms [4]. The test samples were taken from the upper half-meter layer of soil every 10 cm. Repeated determinations – 5X. Mean values of the number of colonies was calculated in one gram of soil using software developed for PCs [1] and the evaluation of significance of the data by 5%-th level of accuracy Student's test [2].

**Results.** In sod-layered soils under the influence of anthropogenic trampling otherwise modified water-physical properties of the upper 50-cm column. As a result of consolidation, it held growth density (at 10-54 %), reducing duty cycle (by 8-52 %), and reduction of productive moisture (on 49 %) [7] and changes in biological activity [6], and the changes that undergoes a number microbescenosis are in our study.

The results of determining the number of colonies of pedotrophic organisms showed (table 1) that their maximum number was observed at 30-40 centimeter depth. In centers where sod-layered soils not subjected to compression and served as controls, there were 158,4 ± 10,56 thousand colonies per 1 g of soil, and the focus of compaction their number was lower by 10,5% and amounted to 141,8 ± 5,85 thousand colonies per 1 g of soil. The minimum value of the number of microorganisms observed in upper 10-cm soil layer and were 42,6 ± 6,39 thousand colonies under control and 10,8 ± 0,01 thousand colonies in the compacted soil. It should be noted that a significant difference (criterion $t_f$ – 3,50-4,98) in the number of microorganisms was observed only pedotrophic in top 20-cm soil strata studied where the size difference in studied microbescenosis reached 58,6-74,6%.

In centers of compaction sod-layered soils we observed decrease in micromycetes (table 2) on 64,3-99,2 %. Such differences in number of microorganisms at 5 % probability level are identified as significant ($t_f$ = 5,68-15,40).

**1. Impact of anthropogenic compaction on number of pedotrophic microorganisms in half-meter thickness of sod-layered soils**

| Depth of samplings, cm | Number of pedotrophic microorganisms, thousand CFU (g soil)$^{-1}$ | | With respect to "control" | |
|---|---|---|---|---|
| | unconsolidated "control" | consolidated | % | t |
| 0–10 | 42,6±6,39 | 10,8±0,01 | 25,4 | 4,98 |
| 10–20 | 98,5±15,33 | 40,7±6,11 | 41,3 | 3,50 |
| 20–30 | 148,8±16,24 | 108,5±14,78 | 72,9 | 1,84 |
| 30–40 | 158,4±10,56 | 141,8±5,85 | 89,5 | 1,38 |
| 40–50 | 94,9±16,10 | 75,9±5,06 | 80,0 | 1,12 |

*Note.* Tabular values of quintiles Student's t test (t) at probability level of 0.05 - 2.45.

**2. Impact of anthropogenic compaction on number of micromycetes in half-meter thickness of sod-layered soils**

| Depth of samplings, cm | Number of micromycetes, thousand CFU (g soil)$^{-1}$ | | With respect to "control" | |
|---|---|---|---|---|
| | unconsolidated "control" | consolidated | % | t |
| 0–10 | 11,2±0,53 | 4,0±0,36 | 35,7 | 11,23 |
| 10–20 | 16,9±2,79 | 1,0±0,20 | 5,9 | 5,68 |
| 20–30 | 34,7±2,48 | 1,4±0,27 | 4,0 | 13,37 |
| 30–40 | 44,7±2,88 | 0,3±0,07 | 0,8 | 15,40 |
| 40–50 | 20,4±2,53 | 1,0±0,19 | 4,9 | 7,64 |

*Note.* Tabular values of quintiles Student's t test (t) at probability level of 0.05 - 2.45.

It should also be noted that the maximum values for these microbescenosis observed in unconsolidated soils 30-40-cm depth (44,7 ± 2,88 colonies in 1 gram of soil), and compacted – in upper 10-cm layer (4,0 ± 0,36 colonies in 1 gram of soil). Minimum values were characteristic of the upper 10-cm layer of unconsolidated soil (11,2 ± 0,53 colonies in 1 gram of soil) and 30-40 centimeter layer of compacted soil (0,3 ± 0,07 colonies in 1 gram of soil).

Data of the table 3 show that the maximum number of oligotrophic micro-organisms (97,3 ± 6,27 colonies in 1 gram of soil) is typical for the 30-40 centimeter layer of compacted soil, and a significant difference ($t_f$ = 4,42 and 11,03) was observed in their top 20-cm thickness, which in relative units reached 28,3-553,3 %.

**3. Impact of anthropogenic compaction on number of oligotrophic microorganisms in half-meter thickness of sod-layered soils**

| Depth of samplings, cm | Number of oligotrophic microorganisms, thousand CFU (g soil)$^{-1}$ | | With respect to "control" | |
|---|---|---|---|---|
| | unconsolidated "control" | consolidated | % | t |
| 0–10 | 18,0±3,60 | 88,0±13,20 | 653,3 | 4,42 |
| 10–20 | 10,6±0,01 | 13,6±2,72 | 128,3 | 11,03 |
| 20–30 | 20,3±4,06 | 21,3±0,43 | 104,9 | 0,24 |
| 30–40 | 15,7±2,12 | 97,3±6,27 | 237,6 | 3,26 |
| 40–50 | 6,3±0,01 | 6,7±1,34 | 106,3 | 0,30 |

*Note.* Tabular values of quintiles Student's t test (t) at probability level of 0.05 - 2.45.

The maximum value of the number of colonies of actinomycetes (table 4) observed in the upper 10-cm soil layer was studied. It should also be noted that in centers where the soil layer did not undergo consolidation, the number of actinomycetes reached 28,8 ± 5,19 thousand colonies per 1 g of soil, and in the case of compactions, their numbers increased by 150 %.

**4. Impact of anthropogenic compaction on number of actinomycetes in half-meter thickness of sod-layered soils**

| Depth of samplings, cm | Number of actinomycetaes, thousand CFU (g soil)$^{-1}$ | | With respect to "control" | |
|---|---|---|---|---|
| | unconsolidated "control" | consolidated | % | unconsolidated "control" |
| 0–10 | 28,8±5,19 | 72,0±5,60 | 250,0 | 5,66 |
| 10–20 | 23,9±2,75 | 27,6±4,60 | 115,5 | 0,69 |
| 20–30 | 30,1±5,36 | 37,6±4,71 | 124,9 | 1,06 |
| 30–40 | 24,6±1,27 | 53,4±3,57 | 217,1 | 7,60 |
| 40–50 | 21,3±1,55 | 31,6±4,26 | 148,4 | 2,27 |

*Note.* Tabular values of quintiles Student's t test (t) at probability level of 0.05 - 2.45.

In the places of anthropogenic compaction the number of microorganisms in the half-meter thickness of sod-layered soils increased by 15,5-150,0 %, but the coefficients of variation of the available experimental data significantly significant difference ($t_f$ = 5,66-7,60) were observed only in the 0-10 and 30-40 centimeter layers, where the difference between the findings reached 117,1-150,0%.

## Conclusion

Compaction of sod-layered soils, which is due to anthropogenic stresses, leads to a decrease in their half-meter thickness of pedotrophyc number of microorganisms (in 10,5-74,6 %) and micromycetes (on 64,3-99,2 %) and increase in the number of oligotrophic microorganisms (on 4,9-553,3 %) and actinomycetes (on 24,9-150,0 %). The most significant change is the number of colonies of studied microorganisms in upper 10-cm soil layer ($t_f$ = 4,4-11,2).

## References

1. Боровиков В. STATISTICA: Искусство анализа данных на компьютере. Для профессионалов / В. Боровиков. – СПб. : Питер, 2001. – 658 с.

2. Корн Г. Справочник по математике для научных работников и инженеров. Определения, теоремы, формулы / Г. Корн, Т. Корн. – М. : Наука, 1984. – 831 с.

3. Кротова Н. Г. Влияние подлеска на физико-химические свойства почвы лесной опытной дачи ТСХА // Н. Г. Кротова / Доклады Тимирязевской с.-х. академии, 1969. – Вып. 149. – С. 265–269.

4. Методы почвенной микробиологии и биохимии. Под ред. Д. Г. Звягинцева – М. : МГУ, 1991. – 304 с.

5. Ремезов Н. П. Лесное почвоведение / Н. П. Ремезов, П. С. Погребняк. – М. : Лесн. пром., 1965. – 324 с.

6. Рижов О. М. Вплив антропогенного ущільнення дерново-шаруватих ґрунтів на їх біологічну активність / О. М. Рижов // Науковий вісник НУБіП України. Серія «Лісівництво та декоративне садівництво». 2013. – № 187, – ч. 1. – С. 294–298.

7. Рижов О. М. Вплив антропогенного ущільнення ґрунтів на їх фізичні та водні властивості / О. М. Рижов, Ф. М. Бровко // Науковий вісник НУБіП України. Серія «Лісівництво та декоративне садівництво». 2012. – № 171, ч. 3. – С. 207–212.

8. Таран И. В. Устойчивость рекреационных лесов / И. В. Таран, В. Н. Спиридонов. – Новосибирск : Наука, 1977. – 179 с.