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Features of mountain-meadow soils of Crimean mountain pastures

Goal. To conduct a comparative analysis of the main properties of mountain meadow soils of the Crimean Yale. Methods. In samples, pH was determined by salt, hydrolytic acidity, content of total organic carbon, group composition of humus, optical density of humic acid solution. The granulometric composition of the soil was determined by the pipette method, the composition of exchange cations - by displacement of 0.2 n NH4Cl solution, the content of amorphous iron - by Tamm. Results It has been established that under the grassy cover of meadow steppes on suspended products the weathering of limestone is dominated by typical mountain-meadow chernozem-like soils, which are similar in structure to the extracted chernozems of plains. Where, at one time, forest vegetation was replaced by meadow, common mountain-meadow secondary soils, which by their basic properties occupy an intermediate position between typical mountain-like soils and forest brown soils. Conclusions The proximity of soils to the main properties in the western and eastern Yayles may indicate a lack of significant differentiation of these areas in climatic conditions.

Key words: mountain Crimea, plateau, soils, humus, acidity, iron amorphous.

The study of the Crimean Yale soils, which are hilly plateau of the main strata of the Crimean mountains, covered with alpine meadows with a large variety of herbaceous vegetation, was initiated at the end of the XIX century. Professor of Kharkiv University MA Theological [2]. The scientist first described the mountain-meadow soil on the Ai-Petri plateau, which was formed under a powerful layer of turf. It was characterized by a dark brown upper, loose horizon with a well-defined, similar to black soil, a structure with a thickness of about 35 cm, a denser, more coarse structure with a reddish transition horizon and a red base. At the same time MA Theological stressed that, despite the similarity of the described soil to black soil, it was significantly different from the latter with the complete absence of carbonates in the profile. He reasonably saw the reason for this in the differences in the climatic conditions of the formation of chernozems of plains and mountain-meadow soils, although in 1897, when the author conducted his The research, meteorological observations on the Ai-Petrinsky Yayl only began, so he did not have an idea of the real degree of gravity of this territory. MA. The Theological presented results only during the first year of the weather station "Ai-Petri" (1896), when in the area, according to V. Dmitrieva [4], only 608 mm of precipitation fell. At the same time, for many years of observation, the average rainfall here is 1049 mm. However, the researcher rightly noted the significant difference between the wetland climate of the Yile and the dry climate of the steppe, which is characterized by less rainfall and more favorable conditions for their evaporation.

Subsequently, the study of mountain-meadow soils was carried out by many well-known scientists-soil scientists, among them O.M. Mikhailovskaya [11], I.M. Antipov-Karatayev and LI Prasolov [1], MM Klepinin [7], MA Kochkin [10] et al. These researchers drew attention to a considerable diversity of the Crimean Yale soils, linking it with the diversity of soil conditions and above all forms of relief. It is the relief that determines the nature of the redistribution of heat and moisture - the main factors affecting the power and degree of leakage of a crumbling crust of weathering on the surface of the yail. Therefore, sufficiently developed, full-profile soils lie on the eluvium of slopes and eluvodeluvia of various lowering. It was these soils that were the object of our research, since they most fully correspond to the bioclimatic conditions of soil formation.

The purpose of the research is to conduct a comparative analysis of the main properties of the mountain soils of the Crimean Yale.

Research methods. The research was conducted within the limits of the two western yayles - Ai-Petri and Chatyr-Dag, and the two eastern ones - Karabi and Dolgorukovskaya. For the laying of soil cuts, the areas of the surface with a slight slope were selected, on which well-developed soils were formed with a total capacity of not less than 50 cm. The samples were taken in a solid column every 10 cm.

The climatic conditions of the western yayles are characterized by a large amount of precipitation - 1000 - 1200 mm per year and an average annual temperature of about 6 ° C, which testifies to their belonging to over-humidified areas from the SCC during the growing season more than 1,5. Unfortunately, no detailed meteorological observations were carried out on the eastern Yayles, since only 1 meteorological station on the Karabi plateau (985 m above the rm) operated there, according to which the average rainfall here was 595 mm per year [15]. Because of this, the climate of the eastern yayles is considered to be more arid than the western ones, and the soils formed on them are usually considered not mountain-ray, but mountain-steppe [5, 10]. However, the analysis of observations on the amount of precipitation in the Mountain Crimea during the years 1978-2000 conducted by the employees of the Yalta Hydrogeological and Engineering-Geological Parties shows that the observations of the Karabi-yayla meteorological station are not consistent with the data given by the meteorological stations on the southwest slope - the array, where at an altitude of 585 m above the rm the average period fell by 637 mm, and at an altitude of 665 m above the rm - 930 mm. This means that on the Karabi plateau the amount of precipitation that grows naturally is not less than the slope, and therefore the moisture content of all Crimean yayles should be about the same level - about 1000 mm per year. Consequently, the properties of the soils formed on Karabi should correspond to such a level of moisture.

The yile vegetation in the research sites was represented by well-developed communities of meadow steppes that form a very powerful turf, whose plant remains contribute to the accumulation of a large amount of humus in the mountain-meadow soils.

The specimens were determined by the pH of the salt, hydrolytic acidity (GC) according to Kappen in the modification of the TSI NAO [14], the total organic carbon content (SZAG), the group composition of humus [8], the optical density of the humic acid solution (ESGC) [13]. The granulometric composition of the soil was determined by the pipette method with the preparation of samples by the pyrophosphate method. Composition of exchange cations - displacement of 0.2 n NH4Cl solution with further determination of calcium and magnesium by the complexometric method, potassium and sodium on atomic absorption spectrophotometry, content of amorphous iron - by Tamm.

The optical properties of soils were studied using an office scanner [9]. For this, the samples were moistened to a paste-like state, applied to a transparent film, covered with filtration paper and placed on the scanner's working surface. The scanning was carried out in color mode at a resolution of 300 dpi. The quantitative values of the RGB optical model were calculated using the LDE program [3]. To compare soil samples, the intensity of the image used the values of the red (R) channel, which are most closely related to the content of humus. The connection between these indicators is inverse, therefore, the darker the samples of the soil, the smaller the values of R-RGB.

Research results. There were 2 incisions on Ai-Petri, the first of which (1251) was laid in the central part of the plateau under meadow vegetation, which grows on separate plots of artificial forests built in the middle of the last century. The absence of natural forests may indicate that the central part of the egyla was always bare. Therefore, the soils formed here should be predominantly of the sod type of soil formation. This is evidenced by the typical structure of the chernozem profile, consisting of dark gray, loose, well-absorbed by the roots of the humus-turf horizon Hd (0-12 cm), dark gray, well-structured horizon H (12 - 45 cm) , upper Hpk (45-56 cm) and lower Phk (59-80 cm) of transitional strongly carbonate horizons and soil rock formation (Pk) on dense limestones. The soil did not contain the humus horizon skeleton and was completely removed from the carbo- nates. At the same time, in the lower part of the profile there was a significant amount of limestone debris, and the content of carbonates in fine earth in contact with limestones was 50%. Despite the high carbonateness of the transition horizons and soil-forming soil, the soil within the horizon H on the level of pH was slightly acidic, indicating that there was no seasonal migration of carbonates under the conditions of the flushing water regime inherent in the Crimean Yayla.

The second incision (1332) was laid in the northern part of the Ai-Petrina Yayli at the point of transition to the northern macrosphere, where the meadow vegetation areas occur among the natural beech massifs and artificial plantations of pine and birch. The presence here is very high-bonite, as for the Crimean mountains, beech forests, proves the favorable conditions for the growth of woody vegetation, which may have been partially destroyed by man in his time, which led to the appearance of loose areas. This presupposition is confirmed by considerable differences in the structure of the profile and in the properties of 2 sections. Thus,

unlike section 1251, the horizons Hd (0 - 7 cm) and H (7 - 30 cm) were characterized by a much lighter color, less power and the presence of a crusty structure in the lower part of the humus horizon and in the transient grayish- brown horizon Hp (30 - 50 cm). Below lay a dense layer of clay-depleted limestone clay. And in this case, the soil within the profile did not contain a skeleton and was removed from carbonates, but unlike the section 1251, it was characterized by a much lower pH value, with a larger GC and, accordingly, less saturated with the bases (the table), which is characteristic of the soils, formed It is under forest vegetation. In addition, the soil of the section 1332 was characterized by a much greater degree of texture differentiation of the fiber, since in it the ratio of the content of sludge in the layer 40 - 50 cm and the content in the horizon Hd was 1.96, and in the soil of the cut 1251 - 1.37. The average profile of amorphous iron in the section 1251 more than doubled this figure in 1332 and was the highest among the meadow soils represented here. It is believed that the accumulation of Feam is characteristic of brown soil [6], but our research suggests that in the soils of the Mountain Crimea, its amount increases with the increase in the degree of humidity of the terrain, regardless of the type of soil formation.

Less intense coloration of the soil the cut 1332 compared with the cut 1251, which is confirmed by the corresponding values of R-RGB, is due to lower content of rubber, the specific weight in its composition of darkened-colored humic acids (a narrower ratio of Cr / Cr) and a lower optical density of the latter (see table), which is also characteristic of soils formed under woody vegetation.

The cuttings 1306, formed under a very well-developed herbaceous cover on the lower plate of Chatyr-Dag, were characterized by the highest content of humus, a fairly wide ratio of Cr / Cr and high optical density of humic acid solution. This, as can be seen from the corresponding values of R-RGB (see table), has the most intense, almost black coloring within the horizons Hd (0 - 10 cm) and H (12 - 20 cm). Horizons Hp (20-31) and PH (31-60), although containing significantly less organic matter than humus, were R-RGB values close to the upper part of the 1332.

The soil profile was completely eliminated from carbonates, had a strongly acid reaction up to contact with the substrate solid plate of dense limestone, was characterized by several times higher hydrolytic acidity, in line with previous cuts and correspondingly lower bases saturation. The degree of differentiation of the profile on the content of the silt was close to the previous cut, which confirms the possibility of intensive logging in sod soils, which are formed in conditions of excessive moisture.

The largest amount of amorphous iron has accumulated in the horizon H and is rather sharply decreasing with the approach to the bedrock.

Both sections on the Dolgorukovskaya Yayli were laid under well-developed cover of arched vegetation, the first of them - on the edge of beech forest, the second - about 5 km north and 150 m below the slope. These sections formed on limestone weathering products due to the significant participation of sandstones and, therefore, were distinguished by a reduced granulometric composition and a rather significant degree of profile differentiation in the content of sludge. The latter could have been conditioned not only by the forging of the silt, but also by the initial layering of the soil-forming rocks. At the same time, these soils differed considerably in terms of the capacity of the humus part of the profile and the content of humus. The cut-off soil 1342 had a total capacity of the Hd + H horizons of 24 cm and Ph - 10 cm; 1343 - respectively Hd + H - 35 cm, HP - 13 cm and Ph - 12 cm. Because of this, the average content of humus in the second case was 2.5 times higher. In addition to the total content of organic matter, the soils differed significantly in the quality of humus: the ratio of Sgk / Sfk and the optical density of the solution of humic acids. That is why the sectional area 1343 was characterized by a much darker coloration of the entire profile, as evidenced by the corresponding values of R-RGB (see table).

By the level of pH, these soils are very close and belong to the strong and the average acid, and higher values of the GC in the section 1343 are due to the higher content of organic matter, which holds a significant amount of exchange protons and aluminum in the form of organo-mineral complexes [12].

The higher content of amorphous iron was observed in section 1343, which may be due to the increased sludge content in the latter compared with the cut 1342, although the character of the profile distribution of Feam indicates that it is accumulated precisely in the surface layers of the soil with the least amount of sludge.

Mountain-meadow soils in Karabii-Yayli were also characterized by a significant differentiation of the profile of the sludge content due to the woodland and the initial layering of the soil-forming rock. The latter is confirmed by a sharp change in the content of silt at a depth of 20 cm (see table).

The peculiarity of the humus state of this soil is a sharp decrease in the content of organic matter with a depth similar to those of 1332 and 1342 due to the insignificant thickness of the humus horizon (Hd + H = 22 cm), which is not characteristic of mountain-ray chernozem-like soils of the Crimea. This also applies to qualitative indices of organic matter: the ratio of Cr / Cr and the optical density of the humic acid solution, the low values of which result in a much lighter coloration of these soils than the rest of the cuts (see table).

The main properties of the mountain-meadow soils of the Crimean Yale

Despite the fact that the Karabi-Yayli area is considered to be the least moisturized among the Crimean Yail, the 1340's cuttings appeared to be the most acidified among all the mountain-meadow soils we studied in Crimea. According to the pH values in the upper part of the profile, it was strongly acidic, and the lower - very strongly acid. The hydrolytic acidity of the soil at times exceeded the magnitudes of this indicator of other mountain-meadow soils, with the exception of the section 1306. The average content of 1340 amorphous iron in the soil was also close to the latter, which confirms the intimacy of the yard of Chatyr-Dag and Karabi for level of moisture.

Consequently, the results of comparative studies of mountain-meadow soils of the Crimean Yale indicate the existence of two varieties of such soils. The first one may include the typical mountain-black chernozem-like soil (cuts 1251, 1306, 1343), an analogue of the plain black soil, which differs from the last acidic reaction, certain unsaturated bases, the absence of secondary carbonates, the lower optical density of the solution of humic acids and a shorter correlation of Chk / Sfk. The second is an intermediate type between the mountain-ray chernozem-like soil and the forest boreozem (sections 1332, 1342, 1340) and, compared with the first, is characterized by a lower capacity of the humus horizon and the intensity of its color, humus content, optical density of the solution of humic acids , the shorter the ratio of SGK / CFC, higher acidity and less saturated bases. Such soils were formed under forest vegetation or for the joint influence of forest and lucerne. This is evidenced by their confinement on Ai-Petrina and Dolgorukovskaya Yayla to the edges of beech forests, and after disappearing for some reasons of the latter - they continued their evolution under the meadow. This is consistent with the opinion of N.O. Dragan [5], who considered such soils to be mountain-ray secondary, formed under post-forest vegetation, and have a relict horizon in their profile.

Conclusions

The full range mountain meadows of the Crimean Yale are divided into 2 main groups: typical mountain-meadow chernozem and mountain-meadow secondary, the main difference between which is the values of humus and acidity indices. A comparative analysis of the mountain-meadow soils of the eastern and western Yile indicates that there is no significant difference between them according to the main characteristics, which, in our opinion, is a sign of the proximity of these areas to climatic indicators.

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