

# THE CHALK FLORA NEAR OHIRTSEVE VILLAGE (CHUHUIV DISTRICT, KHARKIV REGION, UKRAINE): SYSTEMATIC, ECOMORPHIC AND COENOTIC ANALYSES

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Flora of the cretaceous outcrops is specific due to the physical and chemical traits of the chalk. Many cretophilic plants are rare and protected because the distribution of the chalk outcrops limits the range of the plants adapted to this type of substrate. That is why most cretophilic plants are endemics and sub-endemics of the Don and Volga rivers' basins. There are chalk outcrops in the eastern part of Ukraine: in Kharkiv, Donetsk, and Luhansk regions. Mostly, they are presented in the Siverkyi Donets valley and its inflows. The main threats to cretophilic flora are chalk mining, cattle grazing, fires, and afforestation. The War against Ukraine became another threat to the chalk flora.

We study the chalk outcrops near Ohirtseve Village in the north-eastern part of Kharkiv region (50°18'21.4"N 36°50'14.1"E). In contrast to the main typical chalk outcrops in the Pontic province, the slopes under consideration are in the Forest-Steppe province (Didukh & Shelyag-Sosonko, 2003). It was the reason why we selected that area for the investigations.

The time coverage of the exploration occupies the vegetation season of 2020 (June 20th, July 05th, and September 20th). The route method is used to research the flora diversity. We collected the species needed to identify and we made the herbarium samples, by using morphological features of plants to determine the species (Prokudin et al., 1987). Systematic structure of the flora research is based on the methods created by A. Tolmachov (1970), also we studied the ecological flora structure using ecological scales (Didukh, 2011). We referred (Tarasov, 2012; Gorelova & Alyokhin, 2002) to determine the coenomorphes of each species, we based on the monographs. While using the official lists of protected plant species (IUCN, CITES, CITES II, The Red Data Book of Ukraine (2009), The Official List of Regional Rare Plants of Kharkiv Region (The Official..., 2012), we considered a rare fraction of the flora.

The flora analysis shows that at least 137 species of vascular plants grow on the chalk outcrops near Ohirtseve village. They represent 3 divisions, 4 classes, and 46 families. The leading families of that territory are Asteraceae (25 species; 18.2 %), Fabaceae (15 species; 10.9 %), Rosaceae (8 species; 5.8 %), Poaceae (7 species; 5.1 %), Apiaceae (7 species; 5.1 %), Scrophulariaceae (7 species; 5.1 %), Lamiaceae (6 species; 4.4 %), Caryophyllaceae (6 species; 4.4 %), and Ranunculaceae (5 species; 3.6 %). Other families presented by less than 5 species,

and they count 51 species (37.4 %). This distribution of families are typical for Holarctic Flora Kingdom (Takhtajan, 1978).

We research the ecological structure by considering 6 factors (humidity, acidity, carbonate and nitrate content in soils, climate continentality and luminosity). The biggest group of hygromorphes is sub-mesophytes (51 species; 37.2 %), but less species represent the mesophytes group (49 species; 35.8 %). So the humidity of the soil of the territory is in diapason  $W_{np} = 75-180$  mm. The acidomorph analysis proves that the soil is neutral, because most species are neutrophiles (92 species; 67.6 %). The result of the analysis of carbonatomorphes is that 42.6 % or 58 species are acarbonatophiles. These plants are adapted to soils with carbonate content 0.5-1.5 %. The specific group of carbonatomorphes (hyper-carbonatophiles) contains 4 species (2.9 %) only (*Polygala cretacea* Schkuhr, *Thymus calcareus* Klok. et Schost., *Inula ensifolia* L. та *Linum ucrainicum* Czern.). The nitromorphes analysis detected that more than half species are represent the group of hemi-nitrophiles, characterized by adaptation to soils with mineralized nitrogen content within 0.2-0.3 %. In addition to the edaphotopic factors we take into consideration climatic factors such as continentality and luminosity. The analysis of the first factor shows that 64 species (47.1 %) belong to hemi-continental group. This ecological group of plants is usual for Kharkiv region. Almost quarter (33 species; 24.3 %) of the flora belongs to the group of hemi-oceanic plants. The species indicate the influence of the Mediterranean and Pontic flora on the formation of the chalk outcrops vegetation cover. On the basis of the heliomorphic analysis, it is proved that most species are represented the sub-heliophytes group (104 species; 76.5 %). There is the group of the grasslands where the lower herbs layers are shadowed by higher one.

On the basis of the coenomorph analysis we state that most species are meadow plants (44 species; 33.8 %). The second largest habitat group covers forest species (26 species; 19.1 %). The steppic group includes 24 species (17.6 %). Such pattern is not typical for the chalk flora of the Pontic geobotanical province. Other groups of the coenomorphes are smaller (totally 11.9 %). The ruderal fraction of the flora consists of 24 species (17.6 %) by a moderate anthropic impact.

The rare fraction analysis reveals the presence of at least 10 preserving species (8.0 % of total flora list). Ten of them are included in the Official List of Regional Rare Plants of the Kharkiv Region: *Anthyllis macrocephala* Wend., *Campanula persicifolia* L., *Carex humilis* Leys., *Dianthus stenocalyx* Juz., *Inula ensifolia* L., *Linum ucrainicum* Czern., *Polygala cretacea* Klok., *Thymus calcareous* Klok. et Shost., and *Viburnum opulus* L.. The only one species is listed in Appendix II of Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES II) and The Red Data Book of Ukraine (2009) – *Epipactis helleborine* (L.) Crantz.

The presence of the rare species is the reason for including that territory to the Nature Reserve Fund of Ukraine. Considering the placement of the territory (near the State Border) and the current military situation, it needs to be protected.

The protection status of the area is the best decision to restore the plant cover after the war actions.

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## BIOBETON IM BAUWESEN

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Das Ziel der Arbeit sind die Untersuchungen von Eigenschaften der Baustoffe und zwar des Biobetons. Der Beton ist ein sehr verbreiteter Baustoff, der sehr festig ist, aber oft ist er der Riesengefahr ausgesetzt. Die Riesen führen zum Festigkeitsverlust. In die Riesen kann das Wasser durchdringen und bei dem Frieren innere Zerstörungen verursachen.

Die Instandsetzung von Bauelementen aus Beton ist eine teure und komplizierte Aufgabe. Die Forscher der TU Delft in Holland arbeiten schon 20 Jahre an das Problem der Riesenreduzieren im Beton und Renovierung deren Oberfläche. Als Problemlösung schlugen sie eine biologische Methode vor. Die