

**HISTORY OF FORMATION OF THE PLANT COVER
OF THE FOREST ZONE OF UKRAINE IN THE LATE GLACIAL AND HOLOCENE
(BASED ON PALYNOLOGICAL EVIDENCE)**

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Reconstructions of changes in the plant cover and climate within the forest zone of Ukraine in the Late Glacial and Holocene are based primarily on results of spore-pollen studies of lake and mire deposits, usually supported by radiocarbon data (Chernavskaya, Fogel', 1991; Bezusko et al., 2007; et al.). It is known that, on the background of the main trend toward warming, at least three stadial cooling episodes (DR-1, DR-2, DR-3) and two interstadial warming episodes (BL, AL) occurred during the Late Glacial. Deposits formed during DR-1, BL and DR-2 in Ukrainian sections were investigated fragmentarily. Most detailed palynological characteristics were obtained for lake-mire and mire deposits formed during the latest climatic rhythm of the Late Glacial (AL and DR-3). Thus, the palynological data available allow reconstructing to the best possible degree the pattern of changes in vegetation of the forest zone of Ukraine in AL (AL-1, AL-2, AL-3) and DR-3 (Bezusko, 1999; Bezusko, Bezusko, 2002 et al.). We provide data of thorough palynological studies of the Late Glacial and Holocene deposits in sections of Doroshev (DR-3 – SA-3), Starniki (AL-3 – SA-3), Ikva-I (AL-1 - SA-3), Komarovskoye (BO-2 – SA-3), Bolotnoye (AT-3 – SA-3) in the Right-Bank (western) forest zone; Roman'kovo (AL-1 – SA-3) and Kukarinskoye (DR-3 - SA-3) in the Left-Bank (eastern) forest zone. The data obtained allow concluding that climatic conditions in AL-1 within the forest zone of Ukraine were favorable for forest vegetation. During that time, broadleaf tree species (*Quercus* sp., *Ulmus* sp., *Tilia* sp., *Acer* sp., *Fraxinus* sp. etc.) participated in pine, birch-pine, and pine-birch forests. Decreasing continentality of the climate and degradation of seasonally frozen subsoil promoted formation of forests with participation of *Picea* sp. Formation of forests as a zonal type of vegetation in Ukraine started in AL-1. It should be noted that these processes were best manifested within the Right-Bank (western) part of the forest zone, and the western part of the forest-steppe zone. Short-term worsening of climatic conditions during AL-2 resulted in shrinking of forest areas and some decline of the role of broadleaf trees. At the same time, somewhat higher participation of microtherm species is registered in the plant cover. Expanding areas of plant communities typical for disturbed habitats probably indicate some strengthening of erosion processes. During AL-3 the areas of forest vegetation expanded again, but these processes were less evident than those in AL-1. It should be emphasized that in AL (AL-1, AL-2, AL-3) the participation of broadleaf species in forest vegetation was more pronounced in the Right-Bank part of the modern forest zone. Within the Middle Dniester (Dnestr) area, forests with participation of *Ulmus* sp. expanded; such forests were mainly confined to river valleys and ravines (Bolikhovskaya, 1995). Complex and evident rearrangements in the plant cover occurred during DR-3 in the area presently occupied by the forest zone, as well as in the plain part of Ukraine in general. These events resulted in retreats (and, in some areas, in complete degradation) of forests. Periglacial plant communities with participation of steppe and tundra floral components dominated. Microtherm species (*Betula nana* L., *B. humilis* Schrank., *Dryas octopetalla* L., *Botrychium boreale* Milde, *Selaginella selaginoides* (L.) Link, *Diphasiastrum alpinum* (L.) Holub etc.) increased their participation in vegetation. As compared to AL, during DR-3 the areas of disturbed and saline plant communities increased considerably. The role of steppe species (*Ephedra distachya* L., *Krascheninnikovia ceratoides* (L.) Gueldenst., *Kochia prostrata* (L.) Schrad., *Artemisia* sect. *Seriphidium* etc.) in the modern forest zone range also considerably increased. Small areas were occupied by pine and birch rarefied forests ("park forests"). Broadleaf species decreased their participation in forest communities to the minimum. Most probably they survived and persisted in

refugia in the Cis-Carpathian and Carpathian areas, and probably also locally in ravines and valleys within some areas of the modern forest-steppe and steppe zones of Ukraine. These secondary refugia promoted postglacial migrations of thermophilic broadleaf species in Ukraine and adjacent areas (Mosyakin et al., 2005). At present the total palynoflora from AL and DR-3 deposits contains more than 200 identified taxa of various ranks. results of palynological studies allow tracing some spatial differences in composition of the Late Glacial floras within the present-day forest zone of Ukraine. *Pinus cembra* L., *Euonymus* sp., *Alnus viridis* Chaix (*Duschekia viridis* (Chaix) Opiz), *Diphasiastrum alpinum* played considerable roles in the plant cover of the western regions, while *Alnus fruticosa* Rupr., *Lonicera* sp., *Ophioglossum vulgatum* L occurred only in the eastern regions. It should be noted that modern parts of ranges of *Selaginella selaginoides*, *Dryas octopetalla* and *Pinus cembra* in Ukraine are restricted to the Carpathians. In the Late Glacial (AL and DR-3) these species widely occurred within the plain portion of Ukraine. *Pinus cembra* participated in formation of forest vegetation in the western regions, while *Selaginella selaginoides* and *Dryas octopetalla* occurred at those times in the plant cover of the modern forest and forest-steppe zones of Ukraine both west and east of the Dnieper (Dnepr). We consider results of palynological studies of the Last Glacial Maximum (LGM) deposits, testifying to the absence of primary refugia of thermophilic trees of at least the plain part of Ukraine. Secondary refugia of these species most probably existed вероятно in postglacial times. Based on available paleopalynological data, in most cases these refugia were located in the western regions of Ukraine. We analyzed and generalized results of palynological studies of the Holocene deposits of the forest zone of Ukraine at the level of conventional and absolute chronology. Based on palynological data, supported for some sections by radiocarbon dating, the pattern of main changes in the vegetation cover of the forest zone in the Holocene (PB-1, PB-2, BO-1, BO-2, BO-3, AT-1, AT-2, AT-3, SB-1, SB-2, SB-3, SA-1, SA-2, SA-3) was reconstructed. The maximum of distribution of broadleaf species in forest vegetation was registered during the Atlantic times (4500 – 6200 BP). At the same time we registered the maximum of distribution of oak and linden (*Tilia*) forests, as well as forest with participation of these species. Usually the maximum of distribution of *Tilia* preceded the maximum of *Quercus*. By the end of the Atlantic times (AT – 3) we observe some expansion of areas of hornbeam and beech forests. Our palynological results indicate that the main Holocene migration of the "fagetal" (associated with *Fagus*) flora from the Carpathians to the plains (Kleopov, 1990) occurred within 4600 – 6000 BP (AT-3). Using case studies (Volhynian Polessie – sections Komarovskoye and Bolotnoye, and Novgorod-Siversky Polessie – sections Roman'kovo and Kukarinskoye), we consider both natural and anthropic changes in the plant cover of the forest zone of Ukraine in the Holocene.

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