

INVASIVE SPECIES OF THE FLORA OF THE CENTRAL PART OF THE BELARUSIAN POLESYE

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The article presents an overview of invasive plant species of the flora of the central part of the Belarusian Polesye. A total of 50 species with a high invasive potential (*Echinocystis lobata* (Michx.) Torr et A. Gray, *Solidago canadensis* L.), whose distribution threatens native biodiversity, were found within this territory. A number of other species (*Gaillardia ×grandiflora* Van Houtte, *Phytolacca acinosa* Roxb.) also possess invasive properties and in the near future can supplement the list of aggressive alien representatives of the flora.

Keywords: invasive species, Belarusian Polesye, natural flora, anthropogenic transformation of flora.

Anthropogenic transformation of the flora is associated with a phenomenon such as biological pollution, which refers to the introduction of alien plant species into natural communities. This process is the result of saturation of the flora with adventive species and leads not only to a change in its composition and structure, but also to destabilization of the vegetation cover. According to our research, the modern natural flora of the central part of the Belarusian Polesye has 1450 species of vascular plants. Of these, 584 species are adventitious, that is, they were brought here from other natural regions. All these plant species, due to their ecological and biological properties, have a different degree of naturalization in the southern part of Belarus. This factor is decisive in assessing their invasive potential. The lowest threat to native biodiversity is represented by ephemerophytes – plant species retained in the natural flora for a short time (up to 2–3 years). Among them are *Callistephus chinensis* (L.) Nees, *Panicum miliaceum* L. and others. Colonophytes (*Digitalis purpurea* L., *Phlox paniculata* L., etc.) are able to be retained in the composition of plant communities for a fairly long time, but they have no tendency to further spread. The peculiarity of epekophytes lies in the fact that these species (*Bellis perennis* L., *Lathyrus tuberosus* L., etc.) can penetrate into semi-natural plant communities and spread quite actively there. The highest degree of naturalization has a group of agriophytes, representatives of which are part of the natural plant communities: *Arc-tium lappa* L., *Carex brizoides* L. and others. Some epekofity and agriophytes are able to displace native species from natural habitats and form mono-species thickets, which determines their ecological damage. The dissemination of these taxa can pose a threat to the health of the population, and the fight against them requires significant financial costs in agriculture and forestry. The criteria listed above are decisive when classifying adventitious species as invasive species.

According to our research, 50 invasive species were noted in the flora of the central part of the Belarusian Polesye: *Acer negundo* L., *Acorus calamus* L., *Ambrosia artemisiifolia* L., *Amelanchier spicata* (Lam.) K. Koch, *Angelica archangelica* L., *Asclepias syriaca* L., *Aster ×salignus* Willd., *Aster novi-belgii* L., *Bidens connata* Muhl. ex Willd., *Bidens frondosa* L., *Conyza canadensis* (L.) Cronquist, *Cyclachaena xanthiifolia* (Nutt.) Fresen., *Echinocystis lobata* (Michx.) Torr et A. Gray, *Elodea canadensis* (Michx.) Planch., *Elodea nuttallii* (Planch.) H. St. John, *Epilobium adenocaulon* Hausskn., *Erechtites hieracifolius* Raf., *Festuca trachyphylla* (Hack.) Krajina, *Galinsoga parviflora* Cav., *Galinsoga quadriradiata* Ruiz et Pav., *Helianthus tuberosus* L., *Heracleum sosnowskyi* Manden., *Hippophae rhamnoides* L., *Impatiens glandulifera* Royle, *Impatiens parviflora* DC., *Lupinus polyphyllus* Lindl., *Oenothera biennis* L., *Oenothera rubricaulis* Kleb., *Padus serotina* (Ehrh.) Borkh., *Parthenocissus quinquefolia* (L.) Planch., *Petasites hybridus* (L.) G. Gaertn., *Phalacrolooma annuum* Dumort., *Phalacrolooma septentrionale* (Fernald et Wiegand) Tzvelev, *Phragmites altissimus* (Benth.) Mabile, *Populus alba* L., *Quercus rubra* L., *Reynoutria japonica* Houtt., *Reynoutria sachalinensis* (F. Schmidt) Nakai, *Robinia pseudoacacia* L., *Rumex confertus* Willd., *Sambucus nigra* L., *Sambucus racemosa* L., *Sarothamnus scoparius* (L.) W.D.J. Koch, *Schedonorus arundinaceus* (Schreb.) Dumort., *Solidago canadensis* L., *Solidago gigantea* Aiton, *Sorbaria sorbifolia* (L.) A. Braun, *×Sorbaronia mitschurinii* (A.K.Skvortsov et Maitul.) Sennikov, *Xanthium albinum* H. Scholz и *Zizania latifolia* (Griseb.) Turcz. et Stapf. These species have different numbers and distribution within the territory under consideration, but together they determine the significant anthropogenic transformation of flora and vegetation. In addition, some other adventitious species possess invasive properties: *Gaillardia ×grandiflora* Van Houtte, *Lunaria annua* L., *Miscanthus sacchariflorus* (Maxim.) Hack., *Phytolacca acinosa* Roxb., *Pinus banksiana* Lamb., *Rudbeckia laciniata* L., etc. These circumstances allow us to consider the territory of the Belarusian Polesye as an acceptor region of alien species and indicate an intensification of the invasive process.

Thus, the presence of invasive species in the composition of the natural flora can be considered the final stage of its anthropogenic transformation, since the latter are able to radically change the floristic composition of natural phytocenoses, as well as the structure of the vegetation cover.

EXPERIMENTAL STUDY OF THE PROCESSES OF SOLUBILITY OF BORIC ACID IN STEAM

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The processes of droplet entrainment of soluble substances with steam during the operation of nuclear power plants have a significant impact on the ecological situation. This effect can be expressed in increasing the humidity of the ambient air by using evaporative cooling towers or influencing the possibility of cooling the core of the reactor in the event of an accident. To study these processes in the IPPE, the experimental study of solubility of boric acid in a saturated steam at boiling was carried out, the main results of which are presented in this paper.

Keywords: boric acid, solubility, steam, reactor, accident, environment.

Ensuring the safety of modern NPP projects in order to prevent accidents that can have a negative ecological impact on the environment is one of the most urgent tasks facing modern nuclear energy. In Russian Federation the advanced project of nuclear power plant WWER-TOI (Water-Water Energetic Reactor Typical Optimized Informatized) has been developed. This project of NPP with WWER-1200 water pressurized reactors was constructed according to the international nuclear and radiation safety requirements. WWER-TOI project is developed on the basis of the design documents worked-out for AES-2006 project, considering in maximum experience gained by industry organizations while development of the recent NPP projects based on WWER technology (Novovoronezh NPP-2). WWER-TOI project takes into account experience in construction and operation of NPP with WWER both in Russia and abroad. Design solutions have been optimized to minimize the failures having a negative effect on power unit economic indicators.

Within the framework of the WWER-TOI project, special attention is paid to ensuring reactor safety in case of beyond-design accidents with a rupture in the main circulation line and loss of all AC sources within 72 hours. This task is solved by the functioning of passive safety systems that provide core cooling for a consecutive feed to the reactor solution of boric acid with a concentration of 16 g / kg from the system of hydraulic capacities. As is known, the core is at this time in a boiling state, correspondingly, taking into account the low acid concentration in the vapor phase, it is possible to increase the amount of boric acid in the core coolant and to achieve the conditions for its crystallization on the outer surface of the fuel rods, which can lead to deterioration of the heat sink. Removal of boric acid from the reactor with steam or as a result of drip entrainment can significantly reduce the risk of its crystallization. Consequently, the study of the processes of entrainment of boric acid from the core is of great practical importance for the calculation of emergency regimes at nuclear power plants with water-cooled reactors of a new generation.

In this regard, in the IPPE, experimental studies of the processes of entrainment of boric acid due to solubility in steam were carried out. The experiments were performed in an experimental setup at a vapor pressure of 0.2 MPa, which corresponds to the pressure in the WWER-TOI reactor in the event of an accident with a break in the main circulation circuit. The concentration of boric acid in the experiments varied in the range 16–380 g / kg H₂O.

The data obtained as a result of the experiments can be used for the computational modeling of the emergency processes in the WWER reactor facility with the operation of a complex of passive safety systems including the system of hydraulic accumulators of the third stage. The results obtained will help to justify the safety of new NPP projects to guarantee that the minor accident does not transform to a serious stage, with the possible release of radioactive fission products into the environment and causing great ecological damage.

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