IMPACT OF INVASIVE SPECIES ON FOREST ECOSYSTEMS

IMPACTUL SPECIILOR INVAZIVE ASUPRA ECOSISTEMELOR FORESTIERE

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Abstract*. The introduction of species beyond their natural range is rising sharply lately, due to increased trade between different regions on Earth, transport, travel and tourism and the unprecedented accessibility of goods resulting from globalization. Climate changes recorded during the last years resulted in changes of some species spread area. Invasive species may cause extinction of a native species, change the structure or functions of biocenoses, or alter the genetic structure of a local population. Because invasive species are a serious threat on biodiversity and stability of the receiving ecosystem, in Europe and in USA as well, organizations were established to deal with development and implementation of strategies meant to minimize the negative effects.*

Key words: Alien invasive species, natural biodiversity, globalization.

Rezumat*. Extinderea arealului unor specii în afara limitelor naturale este un fenomen care se manifestă tot mai puternic în ultima perioadă, datorită intensificării schimburilor comerciale între diferite regiuni ale Globului, a transporturilor, a turismului, a accesibilizării fără precedent a bunurilor ca urmare a globalizării. Schimbările climatice globale, tot mai pregnante în ultimii ani, au determinat, de asemenea, modificări ale arealului unor specii. Speciile invazive pot conduce la dispariţia unor specii autohtone, modificarea structurii şi funcţiilor biocenozelor receptoare sau a structurii genetice a populaţiilor locale. Întrucât speciile invazive constituie un factor perturbator al biodiversităţii şi stabilităţii ecosistemelor colonizate,atât în Europa cât şi în SUA, au fost înfiinţate organizaţii menite să elaboreze şi implementeze strategii de minimizare a efectelor negative.*

Cuvinte cheie: Specii invazive, biodiversitate naturală, globalizare.

INTRODUCTION

Tourism development, increased trade between different regions on Earth, transport resulted in accidental or intentional transfer of many species which became able to overpass the natural barriers and enlarge the spreading area in new territories. Alien invasive species were recorded in every taxonomic group: viruses, fungi, algae, bryophytes, ferns, superior plants, invertebrates, fishes, amphibians, reptiles, birds, and mammals. Reaching new territories, some of the alien species don't adapt to the new conditions and disappear and others, on the contrary, manage to develop very well and, not in few cases, in disadvantage of the local species, influencing the ecosystems' biological diversity.

MATERIAL AND METHODS

The aim of the present paper is systematization and evaluation of the existent data regarding the occurrence of the invasive species in forest ecosystems, the spreading ways,

the impact on forest ecosystems. The study is focused mainly on the phytophagous insects and phytopathogenic fungus species in forests, but other examples will not be avoided.

RESULTS AND DISCUSSIONS

Invasive species are considered the second important cause of decreasing biodiversity, following after direct destruction of habitats, with subsequent environmental, economical and social impacts (CBD, 2006). The impact of non-indigenous species on biodiversity acts at different levels of organization: ecosystem, community, population, individual, genetic (Kenis & Péré, 2008). This includes reducing biodiversity or even extinction of some indigenous species as a result of competition, predation or diseases, which resulted in disturbances of local ecosystems' functions. Exotic species dispersal beyond the natural range affected the biodiversity of the majority of ecosystems on Earth. Almost 40% of the extinctions recorded starting the 17th century, when the causes are known, are attributed to invasive species (CBD, 2006). Negative effects of non-native species introduction are emphasized by climate changes, pollution, habitat destruction and human disturbances.

Not any newly introduced species become invasive. If only the new territory provides conditions resembling to natural distribution area, the new species can survive and reproduce. Climate conditions are considered a major influence in species distribution, especially for poikilotherm species. Seasonal climate variation, mainly temperature and humidity, can be determinant for the newly introduced pathogens. In order to infect the host plant, develop the disease and spread, the pathogens, especially fungi, reclaim special temperature and humidity conditions during particular time period of the year, determinant for the pathogen installation. To become invasive, a phytophagous species has to successfully compete for food supplies and habitat, to increase the population density so that negative effects to be recorded on spread area. Phytophagous species may alter the level of food resources by intense consuming of leaves or other plant parts, change the relation predator – parasite – phytophagous species, change the competition among species, become drivers for new pathogens, hybridize with related species, disturb or even destroy habitats. All these effects can be recorded from ecosystem to genetic level.

Invasive species may cause extinction of a native species, change the structure or functions of biocenoses, or alter the genetic structure of a local population. The pathogenic fungus *Cryphonectria parasitica* Murril, causing chestnut blight, was accidentally introduced from Asia to North America, than spread and caused die of an important rate of chestnut trees in North America, where this species was predominant before the introduction of the mentioned pathogen. This resulted in almost full extinction of chestnut trees in North America with repercussion in biocenoses structure, chestnut being replaced by oak trees (*Quecus* spp.). Changes caused by *C. parasitica* in forests were beneficial to other non – indigenous species, a defoliating insect, *Lymantria dispar* L., which prefers as host oak trees (*Quercus* spp.). The changes induced by these two invasive species may have been led to changes of the community and individuals' genetic structure by

modifying the selection direction, but this repercussion is difficult to detect and highlight.

Data on invasive species, including forest species, in Europe are provided by the program Delivering Alien Invasive Species Inventories in Europe (DAISIE). It's estimated that today, in Europe, there are about 1200 exotic insect species, of which 313 live in forests, parks, shelterbelts, road sides. Most of exotic insect species belong to Homoptera and Coleoptera orders. The number of newly introduced species increased during the second half of the twentieth century, and 42,2% is estimated to be introduced since 1950. The most important source of invasive species is Asia, which provided more than 20% of the introduced species in Europe. Less than 2% of the forest species come from deliberate releases (e.g. species of Saturnidae, biocontrol agents). The majority of the introduced insect species is phytophagous (77%).

Among the main drivers of the new forest insect species were identified: bonsai import from Asian countries (about 35,3% of invasive species), wood package from Asia (37,7%), timber trade from Russia (24,1%). The diversity of the species introduced with bonsai imports was assessed to be higher than of the species introduced with wood packages or timber (Roques, 2007).

There are only 109 exotic insect species feeding on plants introduced in Europe and successfully installed in wooden plant ecosystems. These belong to North America and Asia as well and most of them feed on broadleaves. Statistics (Vanhanen, 2008) show that there are three times more phytophagous invasive insect species coming from Europe in USA than vice versa, although the number of invasive species increased in Europe by 40% and in USA by only 13% comparing with the mid of the last decade. Many phytophagous species in North America succeeded in establishing permanent populations in Europe, either because the host plant preceded their arrival in Europe or joined them, or because they reproduce asexual.

In 1985 – 2000, APHIS (United States Animal and Plant Health Inspection Service) intercepted during the quarantine inspections about 500 000 transports containing exotic insects (Haack, 2006). Yearly are recorded about 53 000 interceptions of exotic species in USA (Pimentel *et al.,* 2004) and the records for one species may vary from 1 to several hundreds in one year. But only 2% of the goods introduced in USA are properly inspected because of the limited resources of the agencies in charge considering the burgeoning volume of the imported goods (McMannus, 2006), consequently the major importance is given to detection of the species harmful to living plants (Vanhanen, 2008).

Many countries deal with complex and expansive issues caused by invasive species. For example, the economic losses caused yearly by exotic species in USA, Great Britain, Australia, South Africa, India and Brazil were estimated at over 100 billion US $ (CBD, 2006).

Because invasive species are a serious threat on biodiversity and stability of the receiving ecosystem, in Europe and in USA as well, organizations were established to deal with development and implementation of strategies meant to minimize the negative effects. EPPO (European and Mediterranean Plant Protection

Organization) is an intergovernmental organization which coordinates actions for providing a proper phytosanitary state on the European continent. Its role is to elaborate international strategies for preventing the introduction of new bark and wood insect pest species. EPPO promoted in 2000 a project oriented to potential risk assessment associated to regional timber trade and to development of detection protocols for common pests in EPPO region. The risk associated to timber importation from Russia and former USSR countries is highlighted. A list of forest pest species QPF (Quarantine Pest for Forestry) was produced, encompassing 1365 species.

APHIS is a governmental agency, established in USA. The goal of this agency is to protect natural and agricultural resources in USA. APHIS works to prevent the introduction of non-native invasive species, animals, plants and pathogens, and surveys and coordinates the control of already installed invasive species. In the same time, it's responsible with developing and application of preventing strategies against introduction of new species.

CONCLUSIONS

The major part of exotic invasive species in European forests belongs to Homoptera and Coleoptera orders.

The main sources of new insect species in forest ecosystems in Europe are: bonsai import from Asian countries, wood packages from Asia, timber trade from Russia.

There are three times more phytophagous invasive insect species coming from Europe in USA than vice versa**.**

Yearly are recorded about 53 000 interceptions of exotic species in USA during phytosanitary quarantine inspections.

Although difficult to assess, environmental damages caused every year by exotic species in USA, Great Britain, South Africa, India and Brazil were estimated at over 100 billion US $.

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