

## **Importance of researching invasive species against the threat of future pandemics: the study of invasive plants in Azerbaijan**

**R.T. Abdiyeva**

*Institute of Botany, Azerbaijan National Academy of Sciences, 40 Badamdar Highway, Baku AZ1004, Azerbaijan*

*For correspondence: abdiyeva.rena@mail.ru*

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**The world is concerned about the COVID-19 pandemic. An active search is underway for ways to combat this threat. Invasions of plants and animals can be carriers of pathogens, themselves cause diseases and allergic reactions in humans. In recent decades, there has been an increase in their activity. The main reasons are intensive trade, population displacement and climate impacts. Once in a new environment, invasive species can multiply in large numbers. The researchers note that data on the early phases of invasions are extremely useful for understanding and predicting their distribution around the world. The identification of new alien species and the subsequent study of their influence on humans is one of the ways to combat their negative influences. Alien insects, birds, mammals, fungi and plants can become one of the reasons for the transfer of the pandemic, and their spread leads to its globalization. In Azerbaijan, in the study of invasions, as in the world, attention is paid to the problem of identification and registration of invasive species. This article presents some data on invasive plant species: the species that negatively affect human life are indicated, a comparative analysis of the content of the invasive fraction is carried out in the botanical- geographical regions of Azerbaijan.**

*Keywords: Invasions and COVID-19, invasive flora of Azerbaijan, methods of investigating invasions, the impact of invasions on humans*

### **INTRODUCTION**

Currently, we are living in a completely unusual regime associated with the worldwide spread of the COVID-19 disease, which has received the status of a pandemic. The problem of assessing and predicting the consequences of global invasions of alien species of flora and fauna in recent years and especially in 2020 comes to the fore (Palmer and Nursey-Bray, 2007; CBD Strategic Plan for Biodiversity 2011-2020, 2011). The decrease in the species diversity of ecosystems is due to the high competitiveness of invasions in comparison with local species (Van Kleunen et al., 2015). By occupying ecological niches and actively using soil minerals, changing light and water regimes they leave less resources for aboriginal species (Kunte, 2008; Hulme and Bremner, 2006). The growing activity of alien species is recognized not only as one of the

factors of biodiversity loss, transformation of natural ecosystems, but also a threat to human health (Dyer et al., 2017; Pimental et al., 2001).

According to scientists, invasive insects, birds, mammals, fungi and plants are considered to be a special risk group in the transfer of diseases that threaten humans (Bertelsmeier and Olliver, 2020). It is expected that in the future arbovirus infections can be activated – carriers of which are arthropods, transmitting agents from host animals (e.g., birds), directly to humans (Weaver and Reisen, 2009). The animal world does not exist in isolation from the plant world. Therefore, in this chain, most likely, plants will be involved or possibly already involved - as vectors or as intermediate hosts. The scientific community has made progress in developing large checklists and databases on invasive species, for example, Delivering Alien Invasive Species Inventories for Europe (DAISIE),

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European Commission 2010, Global Invasive Species Database (GISD), IUCN, 2020, Global Register of Introduced and Invasive Species (GRIIS) IUCN, 2006], which allow researchers to map large-scale patterns of their intercontinental, inter-regional distribution (Turbelin et al., 2017).

The reduction of species diversity in the ecosystem leads to a high degree of competitiveness of the invasion by comparison with local species (Callaway and Aschchoug, 2000). According to the degree of exposure, alien species are classified into a number of groups, among which the most aggressive species are considered - transformes, which are able to change ecosystems in a significant area (Réjmánek et al., 2005). By occupying ecological niches and actively using soil minerals, changing light and water regimes, affecting allelopathically (Hierro and Callaway, 2003), etc., they leave less resources for aboriginal species. As a result, communities dominated by alien plants may include fewer native species. Among the invasive plants, there are species that have a negative effect on the human body (Fig. 1, a, b). In particular, in some regions of Azerbaijan there are *Ambrosia artemisiifolia* L., *Ailanthus altissima* (Mill.) Swingle, *Euphorbia humifusa* Schlecht., *Euphorbia maculata* L. causing allergic reactions in humans.

Invasive and expansive species *Ailanthus altissima* is observed in all regions of Azerbaijan, in-

cluding coastal areas. There are also invasive species *Xanthium strumarium* L., *X. spinosum* L., *Amaranthus retroflexus* L., *Chenopodium album* L., *Coniza canadensis* L. and etc. which play a dominant role in vegetation. Species- *Acalypha australis* L., *Erigeron annuus* (L.) Pers. which are rapidly spreading in certain localities have been also determined. New alien species *Oenothera odorata* Jacq. has been also identified for the flora of Azerbaijan (Abdiyeva et al., 2020).

Currently, there are a number of approaches and directions in the study of invasive species - identification of the mechanisms of their introduction and distribution, the study of biological, phytocenotic features, allelopathic influences; genetic and genomic approaches, as well as the ecological approach to studying the activity of invasions in connection with climatic changes, the search for natural enemies - phytophagan and vice versa, various microorganisms and fungi that are in symbiosis with alien plants, etc. are also developing .

The main methods of studying invasions include an effective strategy for controlling invasive species, including the creation of various databases (DAISIE), ecological and geographical modeling of invasion niches, allowing for high-precision determination of their distribution, predicting the state and further spread of invasions by computer modeling methods using involvement of GIS technologies.

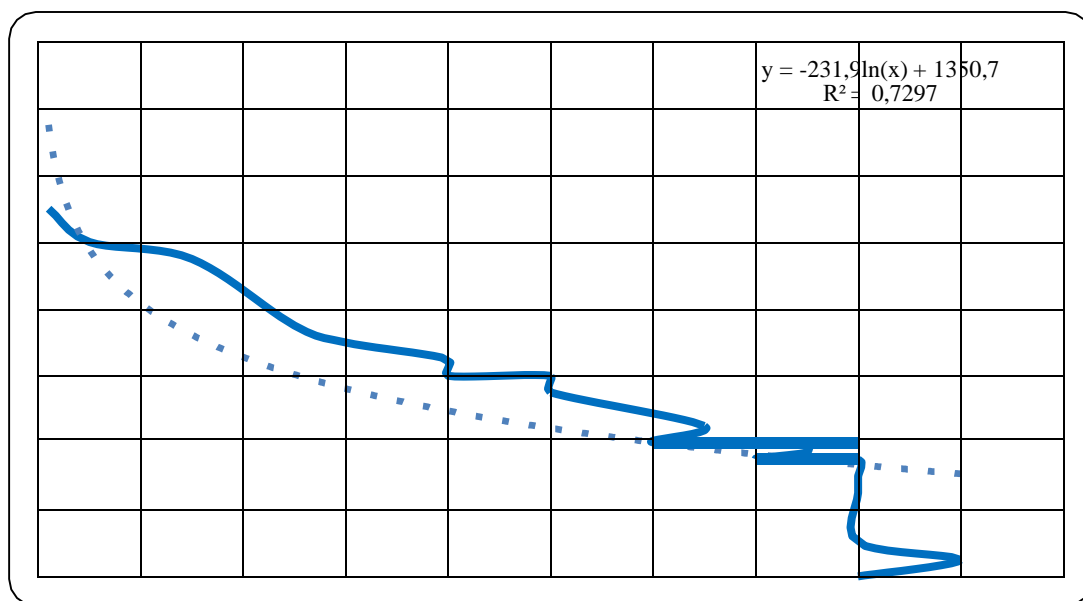


(a)

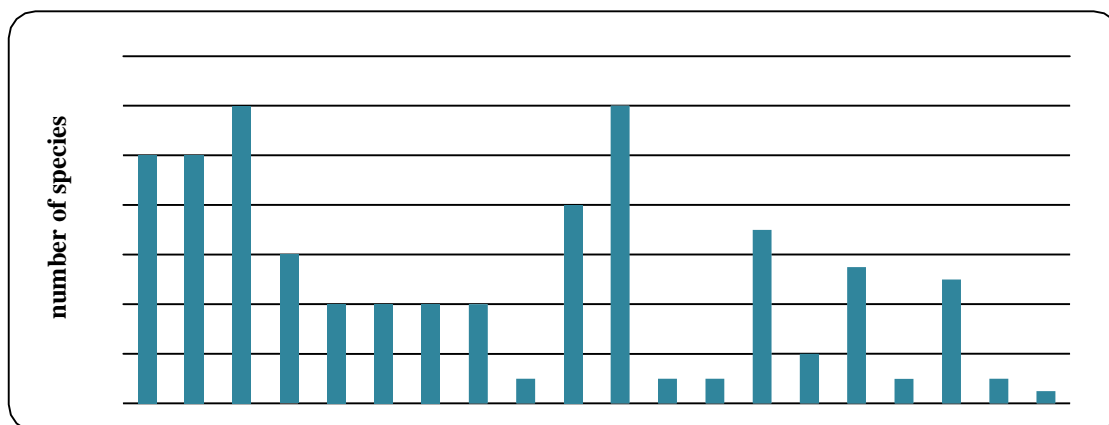


(b)

Fig. 1. (a) *Ailanthus altissima*; (b) *Ambrosia artemisiifolia*.



**Fig. 2.** Distribution of alien species depending on the height above sea level (y-axis - height above sea level (m), x-axis - occurrence of species (%)).



**Fig. 3.** The ratio of the fractions of the alien flora in the botanical-geographical regions of Azerbaijan.

At present, the Institute of Botany of ANAS, taking into account the above-mentioned approaches and methods, is conducting special studies of invasive plant species in Azerbaijan - a preliminary “black list” of these species has been drawn up, numbering 64 species belonging to 22 families and 46 genera (Abdiyeva, 2018), which will most likely be replenished as our research expands. Established the distribution of alien flora is subject to vertical zoning. The optimal height for the growth of invasions is in the range of 100-600 (700) m a.s.l. (Fig.2). Studies show that the species

diversity of plants and the territories of their natural habitats are increasingly subject to global climate change and anthropogenic impact. As a result, there is a change in the structure of the vegetation cover and its fragmentation, as well as a decrease in the number of populations of most characteristic species and a progressive activity of alien plants entering into interspecific competition with native plants.

At the same time, the key places of localization of invasive plants are areas with the cultivation of cotton, tea, rice and tobacco. This is the central part of the Kura - Araz lowland, the Lankaran

group of districts, as well as the northern regions of the country (Fig. 3). The Institute has begun modeling the geographical limits of the spread of invasive plant species on the territory of Azerbaijan due to climate change.

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## Gələcək pandemiyanın təhlükəsindən invaziv növlərinin araşdırılmasının əhəmiyyəti: Azərbaycanda invaziv bitki növlərinin öyrənilməsi

R.T. Abdiyeva

AMEA-nın Botanika İnstitutu, Bakı, Azərbaycan

Dünya COVID-19 nəticəsində yaranan pandemiya olduqca narahatdır. Bu təhlükə ilə mübarizə yolları üçün fəal çıxış yolları axtarılır. Bitki və heyvanların invaziyası xəstəliklərin yaranmasının daşıyıcıları ola bilər və ya özləri insanlarda xəstəliklərə və allergik reaksiyalara səbəb olur. Son onilliklərdə onların sürətli artımı müşahidə edilir. Buna əsas səbəblər - intensiv ticarət, əhalinin yerdəyişməsi və iqlimə olan təsir

hesab oluna bilər. Yeni bir yaşama mühitində invaziv növlər çoxlu sayda arta bilərlər. Alimlər tərəfindən qeyd olunur ki, invaziyanın ilkin mərhələlərində toplanılan məlumatlar, onların dünyada yayılmasının tədqiqində və proqnozlaşdırılmasında olduqca zəruridir. Yeni yad növlərin müəyyənləşdirilməsi və onların insanlara təsirinin tədqiqi onların mənfi təsirləri ilə mübarizə yollarından biridir. Yad həşəratlar, quşlar, məməlilər, göbələklər və bitkilər qloballaşmanın bir nəticəsidir və COVID-19 pandemiyası kimi global bir həll tələb edir. Dünyada olduğu kimi, Azərbaycanda da invaziyaların tədqiqi baxımından invaziv növlərin probleminə olduqca diqqət yetirilir.

***Açar sözlər:** Invaziyalar və COVID-19, Azərbaycanın invaziv florası, invaziv növlərinin öyrənilməsi metodları, invaziv növlərin insanlara təsiri*

**Важность исследования инвазивных видов от угрозы пандемий в будущем: изучение инвазивных видов растений в Азербайджане**

**Р.Т. Абдыева**

*Институт ботаники НАН Азербайджана, Баку, Азербайджан*

Мир обеспокоен пандемией, вызванной COVID-19. В настоящее время проводится активный поиск путей борьбы с этой угрозой. Инвазивные растения и животные могут являться переносчиками возбудителей заболеваний, а также сами вызывать заболевания и аллергические реакции у человека. В последние десятилетия наблюдается рост их активности. Основные причины - интенсивная торговля, перемещение населения и воздействие на климат. Оказавшись в новой среде инвазивные виды, могут размножаться в больших количествах. Исследователи отмечают, что данные о ранних фазах вторжения инвазий чрезвычайно полезны для понимания и прогнозирования их распространения по всему миру. Выявление новых заносных видов и последующее изучение их влияния на человека является одним из путей борьбы с их негативными влияниями. Заносные насекомые, птицы, млекопитающие, грибы и растения являются результатом глобализации и требуют глобальных ответных мер, как и пандемия COVID-19. В Азербайджане, как и во всем мире, большое внимание уделяется проблеме заносных видов с точки зрения изучения инвазий.

***Ключевые слова:** Инвазии и COVID-19, инвазивная флора Азербайджана, методы исследования инвазий, влияние инвазий на человека*