Modeling of the potential distribution ranges of the invasive alien species Heracleum sosnowskyi and Heracleum mantegazzianum in Eastern Europe

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Modeling of the potential distribution ranges of the invasive alien species *Heracleum sosnowskyi* and *Heracleum mantegazzianum* in Eastern Europe

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***Heracleum sosnovskyi* Manden.**
Western Rhodopi Mts

***Heracleum mantegazzianum* Sommier & Levier**
Sofia city

Programme for bilateral cooperation: Bulgaria – Russia

The leading institution in the programme on the Russian side is the Russian Foundation for Basic Research, and on the Bulgarian side is the Ministry of Education and Science through the National Science Fund. The programme is based on the Memorandum of Cooperation signed between the two funds.

The purpose of the agreement is to support activities related to international scientific and technical cooperation for direct contacts between scientists and research teams from universities and research institutions of Bulgaria and Russia.

The current project, entitled **Modeling of potential ranges of the invasive species *Heracleum sosnowskyi* and *Heracleum mantegazzianum* in Eastern Europe**, was submitted and approved in the 2019-2020 call for project proposals.

Research goal and hypothesis

The **goal** of the study is to model and predict the potential spread of the invasive alien species *Heracleum sosnowskyi* and *H. mantegazzianum* in Eastern Europe.

The working **hypothesis** suggests that, compared to the currently known localities of *H. mantegazzianum* and *H. sosnowskyi*, there are significantly larger areas on the territory of Bulgaria and the Komi Republic, which provide suitable conditions and are vulnerable to invasion by both species in the absence of measures for control.

Project background

Invasive alien species are among the main factors that cause loss of biodiversity and have a significant negative impact on the economy and human health. Therefore, the development of the theory of predicting and controlling biological invasions is one of the priority areas of contemporary biological and environmental research.

The objects of the present project - *Heracleum mantegazzianum* and *H. sosnowskyi* are monocarpic plants. Their natural range covers the Caucasus. In the 19th and 20th centuries, the species were introduced to a number of European countries, mainly as ornamentals and less often as fodder plants, after which they became naturalized in most places. Today, both species are considered one of the most problematic invasive species, with a number of negative impacts on local biodiversity, the economy, and human and animal health.

Both species have been included in the List of invasive alien species of EU concern related to EU Regulation 1143/2014.

Expected results

The following **major results** are expected:

1) DNA barcodes for reliable identification of *H. mantegazzianum* and *H. sosnowskyi*.
2) New data on the two invasive species (chromosome numbers, genome size, reproductive potential and mechanisms of seed dispersal, impact on native plant diversity).
3) Verified distribution models of the two species along the southern and northern boundaries of their potential habitats.
4) Estimation of the invasion of the two species in Europe within the limits of simulated potential habitats for the period up to 2070 in the conditions of lack of control of their invasion.

The results will contribute to the control of the invasion and the reduction of the negative impact from the spread of the two invasive alien species.

Mid-term results related to Bulgaria

Dense stands of *H. sosnowskyi* near Borino village, Western Rhodopi Mts.

Plants of *H. sosnowskyi* grazed by domestic stock near Borino village

Nikolay Tashev counting the number of flowers per plant of *H. sosnowskyi* near Borino village

- ✓ The currently known distribution of the two species in Bulgaria is: *H. mantegazzianum* – Sofia floristic region; *H. sosnowskyi* – Sofia and Rhodopi Mts (Western) floristic regions
- ✓ A map of the potential distribution of both species in Bulgaria has been drawn up
- ✓ Plant material (silica-gel dried leaves) for DNA-barcoding studies has been collected
- ✓ Live plants for karyological and genome size studies have been collected and cultivated in the vegetation house of IBER-BAS
- ✓ Soil seed-bank samples from Rhodopi Mts have been collected
- ✓ Impact of *H. sosnowskyi* on the local plant diversity in Western Rhodopi Mts has been assessed
- ✓ Data for assessing the reproductive potential has been collected (number of umbels and seeds per plant; ripe seeds for assessing seed viability and dispersal potential, etc.)

Plants of *H. sosnowskyi* in the village of Mirkovo, Sofia District

Plant of *H. sosnowskyi* by the local river in Mirkovo village

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