Interreg NEXT Black Sea Basin

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Assessing invasion potential: seed viability, germination and drought tolerance

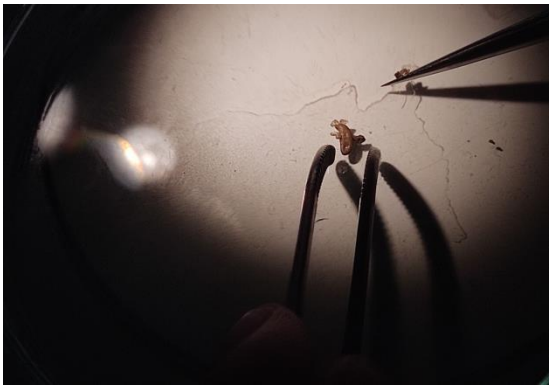
As part of the IASON+ project, the Greek project partner, Democritus University of Thrace (DUTH), is carrying out experimental research to improve knowledge of the reproductive potential, establishment capacity and possible future spread of selected invasive alien plant species. The study currently focuses on four species: *Amorpha fruticosa*, *Phytolacca americana*, *Solanum elaeagnifolium* and *Datura stramonium*.

Seed material was collected from invasive plant populations in the Nestos Delta and the Lake Vistonida area in northern Greece. Additional seeds of *Amorpha fruticosa* were collected from the Danube Delta, providing material from a second major European deltaic ecosystem. This material will also allow the responses of geographically distinct populations to be compared.

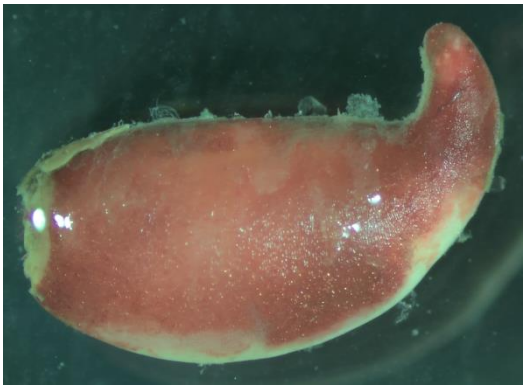
Seed viability and germination capacity are two fundamental components of invasion potential. High seed production alone does not necessarily lead to population expansion if the seeds are not viable or cannot germinate successfully. Examining both parameters therefore provides a more reliable indication of the capacity of a species to reproduce, establish new populations and potentially expand into additional areas. Viability indicates the proportion of produced seeds that remain biologically capable of developing, while germination tests show how readily those seeds can establish under favourable or experimentally defined conditions. This information can support invasion-risk assessment, monitoring priorities and the development of appropriate management measures.

The first stage of the work focused on determining the quality and viability of the collected seeds. Embryos were carefully extracted and examined to establish whether

the seeds contained living, normally developed embryos capable of germination. Reliable information on the proportion of viable seeds is required to estimate the actual reproductive capacity of each species.

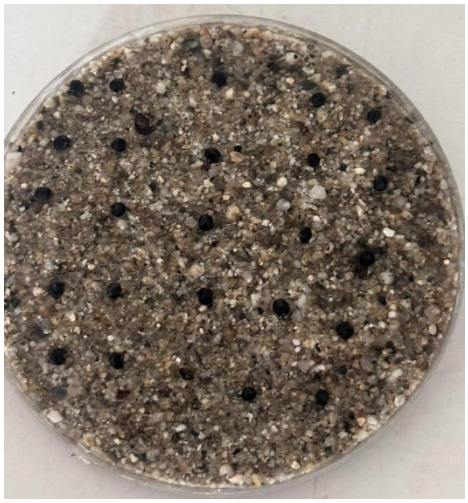


Embryo extraction of *Amorpha fruticosa*



Viable embryo of *Amorpha fruticosa*

Seed germination is another key factor affecting the establishment and future spread of invasive alien plants. Even when seeds are viable, their ability to germinate may depend on dormancy mechanisms, environmental conditions and specific stimuli. For this reason, different pre-germination treatments were tested for each species to identify the conditions that promote germination and to investigate possible physical, thermal or physiological barriers.



Treated seeds of *Phytolacca americana* ready to germinate

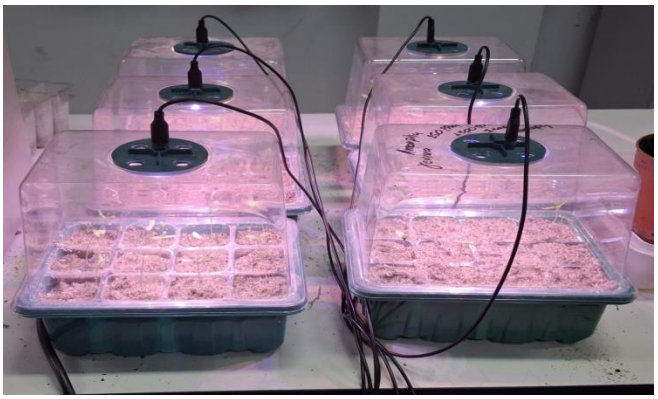
Germinated seeds of *Amorpha fruticosa*

Germination was systematically monitored, and the percentage of successfully germinated seeds was calculated for each treatment. Based on the results, species-

specific germination protocols were successfully established for all four invasive alien plant species. The selected protocols were subsequently applied to a larger number of seeds in order to produce sufficient plant material for the next stages of the experiment.

Following germination, the emerging seedlings were transferred to controlled growth chambers, where temperature, light and moisture conditions were maintained within suitable ranges. The seedlings remained under controlled conditions until they had developed sufficiently to withstand transplantation. They were then carefully transferred into individual pots.

As the plants continued to grow, they were monitored for successful establishment and early development. When they reached approximately 5 cm in height, they were transplanted for a second time into larger containers, providing sufficient space for further root and shoot growth.



Seedlings of *Amorpha fruticosa* grown in the growth chambers

Transplanted seedlings of *Amorpha fruticosa*

The next stage of the research will consist of a controlled water-stress experiment. The established young plants will be exposed to different levels of reduced water availability in order to assess their survival and response to increasingly dry conditions. Plant survival, growth and visible stress responses will be monitored, allowing the drought tolerance of the four species to be compared.

This experiment is directly related to the assessment of possible future spread trends under climate change. Increasing temperatures, more frequent drought events and changes in seasonal water availability may alter the suitability of habitats for invasive alien plants. Some species may be negatively affected by drier conditions,

while others may possess sufficient drought tolerance to survive, establish and expand into areas that are expected to become increasingly water-limited.

Young plants of *Phytolacca americana*

Young plants of *Amorpha fruticosa*

The results of the water-stress experiment will therefore provide indications of the capacity of the studied species to persist and potentially spread under future climatic conditions. Combined with the information on seed viability and germination capacity, the findings will support a more comprehensive assessment of their reproductive success, establishment potential and possible expansion in the context of climate change.