

Understanding the Synergistic Effect of Priming with Silver Nanoparticles and Antioxidants on the Protection of Pedunculate Oak (*Quercus robur* L.) Seeds Against Pathogenic Infections and DNA Damage During Storage

Climate changes, such as more frequent droughts, heatwaves, floods, and increased salinity in water bodies, are causing biodiversity loss. The main approach to preserve the biodiversity of plant species consists in *ex situ* storage of seeds, pollen, and other plant organs in gene banks. Unfortunately, not all seeds can be stored in seed banks. *Recalcitrant* seeds are sensitive to the desiccation process, so they cannot be frozen and stored for long periods, due to their high water content. The *recalcitrant* category of seeds includes acorns of pedunculate oak (*Quercus robur* L.), which is a key species in many ecosystems and its presence affects species diversity at many trophic levels. Over the last centuries and decades, there has been a decline in the population of the *Q. robur* in Europe. *Q. robur* trees produce seeds that do not tolerate desiccation below the MC of 40% and could be stored only for 2-3 winters when they are stored at -3°C before they start to lose viability. High seed moisture is associated with exposure to fungi that reduce seed viability. One method that shows promise in supporting seed viability and longevity is seed priming, which aims to improve the quality of stored seeds and speed up the growth of plants. The use of silver nanoparticles (AgNPs) in seed priming may have positive and negative effects, which is influenced by the concentration and size of AgNPs, incubation time and the type of seed. On the positive side, silver nanoparticles can have antimicrobial effects. Unfortunately, they can also cause negative effects such as inhibition of germination, root growth, reduction of biomass, inhibition of photosynthesis, respiration processes, damage to the genetic material. Despite the constantly developing methods, there is a need to understand the changes occurring in seeds at the molecular level caused by these processes. Another aspect is the search for methods that will alleviate the adverse effects associated with the use of AgNPs. Therefore, in proposed research I will apply mixed treatment composed of the priming with antioxidants before priming with nanoparticles. The priming method uses redox-active compounds to protect the plant against biotic or abiotic stress. Importantly, the effect of the priming methods is far less recognized in *recalcitrant* than in *orthodox* seeds. Moreover, there is a lack of reports showing the efficiency and safety of mixed priming approaches in supporting seed viability and longevity. The significance of this research lies in the urgent need to preserve biodiversity amidst the growing threats posed by climate change. As the global environment changes rapidly, it is crucial to understand the effectiveness and safety of new methods for protecting and storing the genetic material of key plant species.