

Conference of Young Botanists 2025

BOOK OF ABSTRACTS



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- TALK [Giulia Raffaele](#): Nitric Oxide role in rice root formation and development exposed to viable and autoclaved mycorrhizal spores
- POSTER [Marcello Bigoni](#): *Asparagus officinalis* L.: a food plant model for monitoring heavy metal contamination in fields bordering roadways in the Ferrara province (Italy)?
- TALK [Marco Dainelli](#): Deciphering plant-microplastic interactions in freshwaters through *Spirodela polyrhiza*: towards phytoremediation applications
- TALK [Mariel Isidra Arellano](#): Unrevealing the Role of Epidermal Patterning Factor-Like Peptides in the Root Nodule Symbiosis.
- POSTER [Marta Beccaluva](#): Urban stress and plant adaptation: exploring the morphological, genetic and physiological changes in *Populus alba*"
- POSTER [Nayara Machado](#): Evolution of fleshy fruits in Myrtaceae: initial impressions in the subgenera of *Syzygium*
- TALK [Pablo Carril](#): Biostimulants in action: enhancing nickel phytoextraction in *Odontarrhena decipiens* (Nyár.) grown in serpentine soil
- TALK [Pierluigi Giacò](#): Urban wastewater phytoremediation by autochthonous microalgae in winter season: indoor and outdoor trials
- TALK [Saverio Savio](#): Enhancing plant resistance to *Botrytis cinerea* using *Cylindrotheca closterium* extract
- TALK [Silvia Piccinelli](#): Disentangling Intra-annual Tree Growth Responses to Hydro-Climatic Conditions: Insights from Quantitative Wood Anatomy in Peatlands

5. Genetics, genomics, and bioinformatics

- TALK [Anna Pasinato](#): Unveiling the biosynthetic potential of lichens: a comparative genomic analysis of secondary metabolite diversity in ascomycetes
- POSTER [Chiara Dassow](#): The Mystery of Blue Flowers: Sequencing and Analysis of the Cornflower Genome
- TALK [Chiara Paleni](#): First steps towards conservation of endemic *Salvia* in Italy with population genomics
- TALK [Dario Galanti](#): Adaptation to ash dieback disease in natural populations of European ash
- TALK [Giulia Ghirardello](#): Exploring rhizobacteria-induced molecular pathways in *Solanum lycopersicum*
- TALK [Jacopo Vujovic](#): Genomic and phylogenomic analyses of *Bradyrhizobia* associated with *Tuber magnatum*
- POSTER [Paloma Perez-Bello Gil](#): The LIFE Seedforce project: a comprehensive genotyping initiative to assist the conservation of endangered Habitat Directive plant species
- TALK [Simone Graziosi](#): FISH technique to detect *T. magnatum* colonization in plant roots

6. Plants, Fungi and Society

- TALK [Alberto Massimi](#): Antifungal activity of components from essential oils against microfungi isolated from industrial resins.
- TALK [Alex Alberto](#): Landraces for valorising mountain areas: the case study of 'Articiok di Malegno' (*Cynara cardunculus* subsp. *scolymus* L. Hayek)
- TALK [Dario Nicola Tangredi](#): Epiphytic lichen biodiversity and species distribution in the area of the University Campus of Salerno (Italy).
- TALK [Fabrizia Milani](#): Urban Ethnobotany: selection process of a foreign community inte-

POSTER – Urban stress and plant adaptation: exploring the morphological, genetic and physiological changes in *Populus alba*

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Cities are the greatest visible sign of human impact on the Earth's ecosystem. Due to their dense population, transport networks, energy use and increased impermeable surface cover, they radically affect the carbon cycle, as well as the state of the atmosphere and climate. While comprising merely 3% of the Earth's surface area, urban areas are accountable for a substantial 70% of global CO₂ emissions. CO₂ is the most worrying greenhouse gas (GHG) due to its rapid increase in concentration in the atmosphere (from the 280 ppm about 150 years ago to the current 420 ppm). Cities are also characterised by other stress conditions such as higher temperatures, increased surface water and rainwater runoff and pollution. The environmental parameters variation mentioned above ensure that urbanisation has great impact on the environment, ecosystem processes and the ecology of all organisms. Despite numerous studies on the subject, we still know little about how urbanisation affects the organisms' evolution in general and plants in particular. Plant life is highly dependent on the environmental conditions in which they grow, so any prolonged stress generates an adaptive and subsequently evolutionary response on their part. In this context, our research aims to exploit plant adaption in urban areas where CO₂ concentration has been reported to be higher than the extra-urban area. To evaluate the evolutionary rates of plants in Florence city, where high CO₂ levels could accelerate the effects of positive selection on key adaptive strategies, we carried-out biochemical, microscopy and genetic analyses on *Populus alba* grown in urban and non-urban areas. Through more physiological approaches, we wish to determine how higher CO₂ concentrations influence the photosynthetic processes. As the activity of the RuBisCO enzyme is sensitive to changes in CO₂ concentrations, rubisco's activity is measured by a high-throughput enzyme assay applied to our model species sampled inside and outside the city. Moreover, to compare chloroplast genomes, given their key role in photosynthesis, we use molecular and genetic techniques to analyse genome size, structure, gene content and sequence mutations at protein level. Using confocal microscopy, we determine how urban environment models the morphological structure of photosynthetic tissues and leaf cuticle. In the end, to assess the impact of the urban environment and the adaptation strategies adopted at the cellular level we use Transmission Electron Microscopy. The proposed approach will deepen our understanding of the physiological responses of plants to urban climatic and environmental conditions. Furthermore, this research will introduce innovative methodologies for assessing the health of urban vegetation and implementing effective conservation strategies.