From first reports to hidden reservoirs: emerging forest pathogens dynamics under climate pressure in Central Italy

I. Giubilei[1], S. Turco[1], M.I. Drais[1], F. Brugneti[1], A. Cardacino[1], D. Cos[1], L. Mahawar[2], B.R. Albrectsen[2], A. Mazzaglia[1]*

*[1]Department of Agriculture and Forest Sciences, University of Tuscia, Viterbo, Via San Camillo de Lellis snc, Viterbo 01100, Italy, *irene.giubilei@unitus.it*
[2]Department of Plant Physiology, Umeå Plant Science Centre (UPSC), Umeå University, 90736 Umeå, Sweden

Keywords: forest pathology, metabarcoding, climate change, microbiome

Climate warming is progressively reshaping forest ecosystems across Europe, with Mediterranean regions particularly exposed to rising temperatures and recurrent droughts. In Central Italy, growing evidence points to a consistent pattern of emerging plant pathogens affecting forest species, suggesting that local host–microbe interactions are undergoing measurable shifts. Indeed, an increasing number of pathogens are being identified for the first time on forest hosts previously considered unaffected. Within this context, we documented the first report of *Colletotrichum fioriniae* on *Fagus sylvatica*, an emerging generalist spreading across various woody hosts in Italy, and the first report of *Neofusicoccum parvum* on *Ailanthus altissima*, a highly invasive species acting as a potential pathogen reservoir. Field observations further reinforce this trend, revealing not only the arrival of new species but also the increased virulence of well-known pathogens, whose impact is exacerbated by ongoing climatic stress. At the Monte Raschio beech forest, a high incidence of foliar lesions in autumn 2023 highlighted a diverse and active disease scenario, where several pathogenic genera co-occurred within the same stand. Crucially, this threat is not limited to visible symptoms. Potentially harmful microorganisms can persist within apparently healthy tissues as latent reservoirs, remaining asymptomatic until environmental triggers, such as extreme heat or drought, induce pathogenic outbreaks. This is supported by our seasonal metabarcoding analyses of bacterial and fungal endophytic communities in asymptomatic beech tissues, which revealed dynamic shifts in microbiome composition throughout the growing season. Taken together, the convergence of novel host–pathogen associations, heightened virulence of established taxa, and the persistence of endophytic reservoirs highlights a coherent emerging threat to Italian forest ecosystems. These findings emphasize the urgent need for proactive, molecular-based surveillance to anticipate disease dynamics in European forests under a rapidly changing environment.

This research was funded by the AGRITECH PNRR SPOKE 7 project and supported within the framework of the Ministry for University and Research (MUR) initiative “Department of Excellence” (Law 232/2016) – DAFNE Project 2023-27 “Digital, Intelligent, Green and Sustainable” (acronym: DIVerSo).