GIORNATA DEL DIPARTIMENTO DI BIOTECNOLOGIE E BIOSCIENZE

Developing innovative approaches and strategies to "DNA barcode" Mediterranean Biodiversity

Verduci Valentina[1,2,3], Frigerio J.[1,2], Galimberti A.[1,2], Maggioni D.[1], Sarà G.[2,3], Labra M.[1,2]

E-mail: valentina.verduci@community.unipa.it

[1] University of Milano-Bicocca, Department of Biotechnologies and Biosciences, Italy

[2] National Biodiversity Future Center, Palermo, Italy

[3] University of Palermo, Department of Earth and Sea Sciences, Italy

Abstract:

Biodiversity is rapidly declining worldwide due to human interference. To properly monitor and offer solutions to mitigate this situation, advanced taxonomic knowledge and innovative identification methods are required. In this scenario, Italy is one of the most important biodiversity hotspots in the Northern hemisphere as it hosts many unexplored regions, making effective conservation efforts crucial. Traditional taxonomic evaluations are time-consuming and prone to errors, particularly when dealing with cryptic species; therefore, DNA barcoding, which uses standardized genetic markers for species identification, offers a solution to cope with these challenges but is sometimes impaired in terms of sample availability, wet-lab processing, and database quality and completeness.

This project aims to enhance DNA barcoding approaches to address identification efforts in some valuable Mediterranean taxonomic groups: Italian vascular plants, wild bees, and Mediterranean fish.

The study will address the critical challenges of the DNA barcoding approach by generating and publishing DNA barcode sequences in existing databases (e.g., BOLD, GenBank) and creating thematic datasets that will support the development of a national biodiversity reference library, consolidating reliable data to enhance species identification and monitoring efforts.

The portable third-generation sequencer Oxford Nanopore Technologies' MinION™ will also be adopted and validated for its efficiency and versatility in sequencing small DNA fragments useful for species recognition in difficult conditions (e.g., museum specimens, highly processed products).

It enables sample analysis directly in the field, in protected areas, within companies or along production chains, providing a valuable tool for a wide range of stakeholders, offering practical applications in biodiversity monitoring, sustainable resource management, and product traceability. Finally, bioinformatic tools will be adopted to implement reliable species delimitation models to resolve taxonomic warnings and explore genetic variability at the geographical scale.

The outcomes of this project will have a significant impact on biodiversity conservation, monitoring, management, and valorization, for example supporting national parks and regulatory authorities. Furthermore, the project will contribute to combating illegal trade while supporting the authentication of commercial products, benefiting producers, customs authorities, and other stakeholders along the production chain, while strengthening collaboration between science, industry, and regulatory entities for biodiversity preservation.