

Master Project 1

FUNCTIONAL ANALYSIS OF CANDIDATE GENES OF CORK DEVELOPMENT, THROUGH A REVERSE GENETIC APPROACH

Supervisor: Liliana Marum

Proponent Institution: Cebal, Grupo de Genómica Agronómica, Beja

Email: liliana.marum@cebal.pt

Abstract:

Cork is one of the most valuable non-wood forest products for the industrial sectors in our country, playing an important economic, social and ecological role. Portugal is the world leader on cork production and it is therefore understandable that cork quality and development is a very important aspect of the industrial processing. In this context, the study of factors contributing for the determination of cork development and quality are essential.

Cork is obtained from the outer bark of the cork oak, a natural material composed of hollow cells formed by the phellogen layer, a secondary meristem of *Quercus suber*. The phellogen is part of the boundary tissue, the periderm, that provides an efficient plant protection. The periderm is regularly found in the bark of woody plants, but herbaceous plants may also form a well-developed periderm in roots, tubers, and the oldest portions of stems. The periderm has been widely studied in potato (*Solanum tuberosum*) tubers.

This Master's project aims at the functional characterization of candidate genes involved in cork development by using a reverse genetic approach in potato, a model plant for periderm studies. The project intends also to contribute for the dissection of the molecular mechanisms underlying cork quality.

Studies involve the overexpression and promoter analysis of candidate genes (CGs) previously identified by transcriptomic profiles of phellogen and lenticular channels of *Q. suber*. The work involves the (1) *in vitro* propagation of potato plants, (2) tubers induction, (3) plasmid construction, (4) plant transformation, (5) RNA isolation and (6) Northern blot analysis.

Master Project 2

EXPRESSION ANALYSIS OF GENES INVOLVED IN CORK QUALITY

Supervisor: Liliana Marum

Proponent Institution: Cebal, Grupo de Genómica Agronómica, Beja

Email: liliana.marum@cebal.pt

Abstract:

Cork is a natural product obtained from the outer bark of the cork oak (*Quercus suber*). Cork quality is an important aspect of the industrial processing of cork, reaching high values in top quality cork. The main factor of the industrial quality of cork is the porosity trait of this tissue.

The relation between the quality grading and the porosity quantified by image analysis revealed that the porosity and the dimension of the pores increased from the best to the worst quality classes. These pores identified in cork tissue represent the lenticular channels that cross the cork layers and are usually associated with gas exchange processes.

Some studies pointed out those molecular mechanisms are involved in cork development and quality. However, no information is available concerning the lenticels molecular regulation.

The project intends to contribute for the dissection of the molecular mechanisms behind cork quality.

The aims of the Master's project are the histological analysis for space-temporal identification of lenticular channels and phellogen development and the expression analysis of genes involved in cork quality, mainly in cork porosity.

The student will be involved in histological analysis, RNA extraction, RNA seq data analysis, validation by real-time (RT-qPCR).

Master Project 3

MOLECULAR STUDIES OF CYNAROPICRIN BIOSYNTHESIS IN *CYNARA CARDUNCULUS*

Supervisors: Liliana Marum, Fátima Duarte

Proponent Institution: Cebal, Beja

Email: liliana.marum@cebal.pt

Abstract:

Cardoon is a perennial plant that belongs to the Asteraceae family, originated from the Mediterranean region, and it's able to adapt to a wide range of environments. In the typical semi-arid climate conditions of Baixo Alentejo region, several cardoon populations have already been identified and thereafter some studies are being conducted by Cebal.

C. cardunculus leaf extracts have been associated to some medicinal properties, derived by the rich contents of phenylpropanoids and sesquiterpene lactones (STLs). Cynaropicrin is one of the main STLs which contribute to the bitter taste of *C. cardunculus*, and it has been characterized with biological activity. Cynaropicrin was described to be a useful agent for inflammatory diseases, and to have antioxidant, antigastritis, and antitumoral activities, among others.

The variations of bioactive compounds observed in cardoon can be associated to genetic and to environmental factors. Previous studies have been conducted in order to characterize the Portuguese populations from the South of Portugal and several individuals were identified with a higher chemical profile. However, little is known about the biosynthesis and tissue localization of this compound by *C. cardunculus*.

The aims of the Master's project are to study the production and localization of cynaropicrin in *C. cardunculus* and the expression analysis of genes involved in biosynthetic pathway of cynaropicrin. The student will be involved in histological analysis, trichomes identification and isolation, RNA extraction, validation by real-time (RT-qPCR).