



A methodology for conservation and sustainable use of the neglected/under-utilized tree species: *Q. rotundifolia* Lam.

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INTRODUCTION

Holm oak (*Q. rotundifolia* Lam) and cork oak (*Q. suber* L.) are keystone species of traditional Mediterranean silvi-agro-pastoral systems known as *dehesas* in Spain and *montados* in Portugal. These cover an area of about 3.5 million ha in the Iberian Peninsula, occupying critical areas in terms of soil and water resources.

These traditional systems are managed by interlocking land-uses that produce inter-related products such as wood, acorn and grass for livestock rearing and cork in the case of *Q. suber*. In addition, they prevent desertification and erosion of the soil and provide shelter for wildlife.

Montados as a differentiated stage of Mediterranean ecological succession is totally dependent on human management, without which it degenerates into other ecological succession stages such as Maquis, Matorral and finally the mature stage: the Mediterranean forest (when the ecological conditions are favourable). Dramatic changes in landscape structure and function have occurred in their native ranges in the past century. The reasons include: deforestation, unfavourable climatic factors, pests and diseases, and overgrazing.

However, these traditional ecosystems have become valued at national and international policy-making levels for their agronomic and ecological importance, biodiversity, and potential for tourism. Nevertheless, an effective link between conservation and sustainable land use of montados is still lacking.

AIMS:

Sustainable long-term conservation of Southern Portugal montados of *Q. rotundifolia* L. through use of selected plant material for the target agronomic trait: "Total oil Content".

GENERAL OBJECTIVES:

1. To formulate an integrated conservation and utilization strategy based upon:

- 1.1 Ecogeographic survey of the target taxum: *Q. rotundifolia* Lam.
- 1.2 Genetic Diversity and population structure study
- 1.3 Morphological study for the agronomic trait of interest: "Total oil content of the acorns"
- 1.4 Maternal molecular marker association with oil content
- 1.5 Maternal metabolomic spectra association with oil content

2. The conservation plan will include guidelines about:

- 2.1 Location of *in-situ* and *on-farm* reserves for *Q. rotundifolia* Lam.
- 2.2 Design *ex-situ* conservation strategy including location of collecting sites

3. The utilization plan will provide models for:

- 3.1 1st cycle of Selection among maternal trees
- 3.2 2nd cycle of selection among offspring of each maternal tree

METHODOLOGY

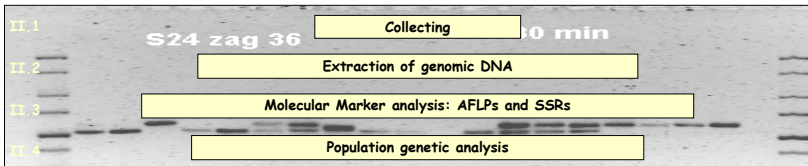
I. Ecogeographic survey (Maxted *et al.*, 1997)

Objective: To collate and synthesize ecological, geographical and taxonomic data about the target taxon *Q. rotundifolia* Lam.



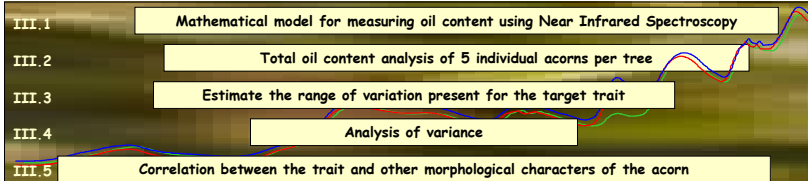
II. Genetic diversity and population structure study

Objective: To obtain basic data on: 1. Available genetic variation within the target taxon
2. Distribution of variation
3. Assess the risk of Inbreeding (mating between relatives)



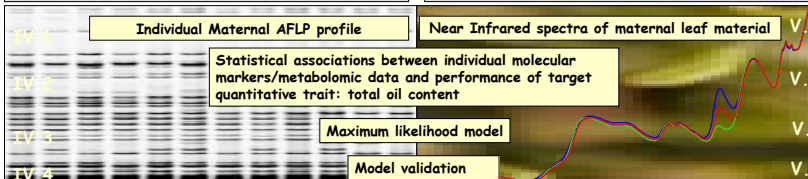
III. Phenotypic study

Objectives: Morphological characterization of target agronomic trait: "total oil content of acorns"



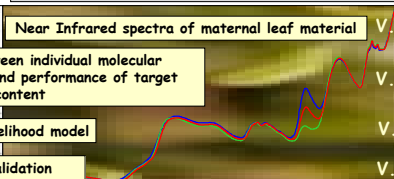
IV. Molecular marker evaluation

Objectives: Marker profile association with agronomic trait (Ford-Lloyd *et al.*, 2001)



V. Metabolomic Evaluation

Objectives: Spectra profile association with agronomic trait



CONSERVATION AND UTILIZATION PLAN

OUTPUTS

I Distribution area of target taxon: *Q. rotundifolia* Lam.
Identification of collecting sites for genetic diversity study representative of the ecogeographic range

II Identification of source populations for multiplication
Identification of sites for *ex situ*, *in situ* and *on farm* conservation

III Cost efficient method for characterisation of *ex situ* and *in situ* collections of oil seed crops
Guidelines for selection of source maternal trees (1st cycle of selection)

IV Cost efficient evaluation of *ex situ* and *on farm* collections

V Selection of best trees in early stages of development (2nd cycle of selection)

DISCUSSION

Long term conservation might be effectively enhanced by sustainable and economically viable production systems.

The present work combines different methodologies reported in the literature, currently used in conservation of plant genetic resources.

The innovative side of it relates to the use of cost efficient characterisation and evaluation techniques for oil seeds, such as Near Infrared Spectroscopy combined with Molecular marker analysis.

Statistical associations between molecular markers/ Metabolomic data and the target agronomic trait: "Total oil content" of the acorns will be used to construct mathematical models to predict the performance of different accessions of *Q. rotundifolia* Lam. for this trait.

The genetic basis of the statistical associations between a quantitative trait and its molecular marker profile have been related to both genetic linkage and linkage disequilibrium due to the evolutionary forces occurring in natural populations.

Metabolomic analysis is highly affected by environmental factors. However, if the variation due to environmental factors can be individually quantified and removed, statistical associations between spectra profiles and the trait could also be attributed to the genetic make up.