2. Seed characterization

ANALYSIS OF SEEDS DIVERSITY IN ASTRAGALUS AQUILANUS, AN ENDEMIC SPECIES WITH PHYSICAL DORMANCY

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Introduction

Astragalus aequilanus Anzal. (Fabaceae) is an endemic species of central Italy. It can be found in ecotonal habitat near natural pinewoods or near degraded oak woods in arid grasslands sites from 750 to 1050 m asl (1). This species is included in the IUCN Red List as Data deficient (DD) (2) and it is a priority species in Annex II of the Habitat Directive 92/43/ECC, is in the Bern Convention, and it is also a target species of Flaranet LIFE project (LIFE15 NAT/IT/000946). A. aequilanus have a physical dormancy that is a strategy to regulate the timing of germination (3). Most plant species produce seeds that are dormant at maturity, where germination is prevented by water-impermeable seed coats (4). Furthermore, the seeds of this species have a large morpho-colorimetric variation. In this work, we investigate the high intraspecific diversity of this seeds through morpho-colorimetric and chemistry analysis. Especially we focused our analysis on morphologic, colorimetric and infrared spectroscopy characterization of four different populations in Abruzzo region.

The main goals:

I. Investigate the intraspecific diversity in seeds traits (morpho-colorimetric and chemistry composition) among population and seed color.

II. Understand the correlation among morpho-colorimetric traits and the infrared spectrum of seeds.

Materials and methods

Morpho-colorimetric traits analysis: 100 seeds each population (Monteluco di Roio, Piano La Roma, San Colombo, M. Scuncle).

10 Morphometric variables: Area, Perimeter, Width, Height, Major and Minor (are the primary and secondary axis of the best fitting ellipse), Circularity, Ferets Diameter, Aspect Ratio of the particular fitted ellipse, Roundness; 5 Colorimetric variables:

Mean Grey Value (average grey value within the seeds; Standard Deviation of mean grey value, Modal Grey Value, Min and Max grey level (5,6).

Chemistry content: Infrared Spectrum, 40 seeds of each population, 20 black (mean grey value < 40) and 20 white (mean grey value > 80). All the statistics analysis was conducted using Linear Discriminant Analysis (LDA), and for IR Variable selection we use Step Wise algorithm (SW). 50% of data collected using for training of Step Wise variable selection and other 50% for LDA analysis. Each LDA was followed by Wilks’s Lambda test.

Results and Discussion

Morpho-colorimetric traits: LDA analysis shows a clear differentiation among population Fig.5, confirmed from Wilk's lambda test (p<0.001). The top 3 variables for discrimination are: Mean grey value, Perimeter and Heigth. This results confirm a clear differentiation in both colorimetric and morphometric traits.

Chemistry content: SW algorithm have selected 10 discriminant variables for population and 6 for colors Fig.4. These variables are slight different and confirm that the variability among population is strong different from the variability among seeds white and black. The LDA results on chemistry composition Fig.6 confirm the differentiation observed in morpho colorimetric analysis. Surely this results suggest that this species have a great seed variability probably conditioned by environment. However, among seeds white and black we obtain a differentiation less pronounced Fig 7, but Wilks’s lambda test confirm the significant difference among two type of color. This results confirm that each population have also a great variability in type of seeds produced.

Conclusion

This study was been possible to obtain the first results of A. aequilanus seeds characterization. The results have shown a clear intraspecific seeds diversity among population, especially in infrared spectrum. This large variability inside each population is probably associated to change in environmental condition of each site. This study is relevant to better understand the ecology of this species that it is crucial for any future restocking interventions.

Bibliography