Determination of the Ideal Conditions for Germination, Desiccation Tolerance, and Storage of Gabiroba Seeds

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Abstract

Campomanesiapubescens (DC.) O Berg, commonly known as gabiroba, is a shrub native to Brazil that is distributed throughout the Cerrado region of the above-mentioned country. The species has medicinal properties: anti-inflammatory and antioxidants. It holds significant commercial potential for cultivation. The objective of this work was to evaluate the storage of seeds of this species at different temperatures and humidity levels. Fruits were collected at the beginning of November 2014 from plants in a rural area of the municipality of Jatai. The fruits were processed, and the seeds were extracted in the Laboratorio de Sementes at the Instituto Federal Goiano, Campus Rio Verde. The research was divided into three distinct trials. In the first trial, the ideal temperature for germination was tested for seeds with a natural water content of 44%. Meanwhile, the second tested the desiccation tolerance of the seeds. Finally, the third trial determined their ideal storage conditions. The experimental design that was adopted for each trial was completely randomized in a factorial scheme, with four repetitions for each condition; each experimental plot consisted of 25 seeds. The germination was most effective at 30°C, while the presence or absence of light could, in certain cases, have a physiological effect. Meanwhile, seeds with water content between 28 and 37% could be stored for up to 20 days at 20°C and still remain viable. Finally, a temperature of 10°C was best suited for the storage of seeds with a water content of 44%.

INTRODUCTION

Many economically vital perennial species bear recalcitrant seeds, inclusive of tea, coffee, cocoa, mango, citrus, rubber, oil palm and coconut. Orthodox seeds may be dried almost absolutely without dropping viability, however so-called recalcitrant seeds have a totally restrained storage existence and die upon drying below a higher important moisture content than orthodox seeds. As a result, the development of long-time period garage methods for recalcitrant seeds is compromised. Lowering this important moisture content could be very valuable seeing that dry seed storage is the safest, most handy and most inexpensive approach for retaining plant genetic resources.

Although seeds of many citrus cultivars can be dehydrated competently to 10%–12% moisture content material, similarly dehydration impairs seed viability. The phytohormonesabscisic acid (ABA) and gibberellins (GAs) are associated with many physiological processes and often paintings antagonistically. During seed maturation, ABA is responsible for the acquisition of DT in orthodox seeds. Low ranges of ABA or disruption of its signaling pathway may bring about desiccation sensitivity.

MATERIALS AND METHODS

A preliminary experiment was done that used the identical protocol as described above however using abscisic acid (ABA) (Sigma Aldrich) as opposed to PAC. We used exclusive concentrations of ABA (5 μM, 50 μM and 500 μM) however they didn't arrest germination and set off DT in C. Limon seeds. Also, clean seed germination couldn't be inhibited by using ABA. All the subsequent experiments finished in this examine were primarily based on 10 mmol/L PAC treatments.

RESULTS

To investigate the molecular adjustments associated with PAC triggered DT, we done a transcriptome analysis on non-desiccated seeds incubated for 7 d in PAC and in water (control). We used RNA-seq analysis to discover the genes of which the expression had modified in desiccation tolerant PAC-treated seeds in evaluation to non-treated desiccation sensitive fresh seeds, the use of 3 organic replicates consistent with condition (Figures S1, S2). Since there is no genome sequence to be had for C. Limon, we done a de novo assembly of the RNA-seq reads the use of the Trinity software.

Seed samples treated with PAC showed great upregulation of 613 genes and downregulation of 950 genes in assessment to the water control. Based on a GO enrichment analysis of the upregulated set, we located eight organic process (BP) categories considerably enriched, in addition to 31 molecular function (MF) and 35 cellular factor (CC) categories. The downregulated set showed 98 BP, 20 MF and 17

CC categories.

The downregulated set contained more genes and become greater diverse than the upregulated set, as evidenced by using the plenty larger variety of GO categories. This in all likelihood represents the general growth inhibitory movement of the PAC treatment. Apparently, the suppression of GA-biosynthesis has multiple consequences across various pathways.

Furthermore, a cellular compartmentalization switch became observed in the mobile element GO enrichment analysis. The mitochondrial transcriptome appeared largely suppressed, while plastid genes have been induced.

The discount of mitochondrial gene expression probable reflects the suppression of power metabolism and preparation for quiescence. The upregulation of genes located in the plastids isn't always photosynthesis associated as these seeds aren't green. Thus, this feature may as an alternative be associated with reserve remobilization, especially that of lipids.

PAC inhibits the monooxygenases involved within the oxidation of ent-kaurene to ent-kaurenoic acid and therefore reduces the plant's capability to synthesize energetic GAs.

We finished a KEGG enrichment analysis of the downregulated gene set and determined a massive enrichment of the category plant hormone sign transduction (Table S4). Among them have been genes involved within the signaling of auxin, gibberellin, ethylene, brassinosteroids, jasmonic and salicylic acid.

Seed desiccation sensitivity has been associated with the lack of developmental arrest. Thus, we took a closer take a look at the differentially regulated genes involved in the merchandising or inhibition of germination and, possibly, with acquisition of DT in C. Limon seeds upon PAC treatment.

DISCUSSION

The storage of desiccated seeds is critical to make sure long-term conservation of a large genetic diversity. In the prevailing study, C. Limon seeds confirmed a DS phenotype and, hence, can not be stored for extended periods. Current consensus shows that seed desiccation sensitivity takes place while seeds fail to undergo the final degrees of maturation all through seed improvement. During the development of orthodox seeds the reduction of metabolism, in particular the reduction of respiratory rate, coincides with their survival after desiccation.

The inverse relation between the regulation of biotic versus abiotic stresses and related hormone pathways, as observed in the present work, has additionally been discovered in other studies where, for example, ABA contents are correlated with susceptibility to pathogens in numerous plant species.