Molecular mechanisms of seed dormancy in plants: an overview and implications for Traditional Leafy Vegetables

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INTRODUCTION

Loss of seed viability, poor and delayed germination and inaccessibility of high-quality seeds are key bottlenecks limiting an all year-round production of Traditional Leafy Vegetables (TLVs). While harvest time, storage and conservation conditions can be easily controlled, breaking seed dormancy requires a thorough knowledge of the seed intrinsic nature and physiology. Through this review, we (1)synthetized the scattered knowledge on seed dormancy constraints in TLVs, (2)highlighted the main seed dormancy regulation factors, and (1)developed a conceptual approach for molecular genetic analysis of seed dormancy in TLVs.

Seed dormancy in Traditional Leafy Vegetables

Farmers are confronted to improper seed extraction, storage and conservation. So far, physical and physiological dormancy are occurring among TLVs species from mature freshly harvested seeds to the dry seeds. Studies reported physical and physiological dormancy for *Talinum triangulare*, a deeper level of primary dormancy for *Solanum nigrum*, a physical dormancy for *Corchorus olitorius*, and a physiological dormancy for *Gynandropsis gynandra.*

Seed dormancy regulation in plants

Several hormones, proteins, changes in chromatin structures, ribosomes, quantitative trait loci (QTL), and genes are involved in seed dormancy regulation. The homone-level regulation involves the abscisic–gibberellin acids (ABA-GA) crosstalk, and other plant hormones such as Auxin, salicylic acid, jasmonic acid, brassinosteroïds, ethylene, and cytokinin. The gene-level regulation involves Delay of Germination (DOG), DNA BINDING ZINC FINGER affecting germination (DAG) and reduced dormancy (RDO) genes.

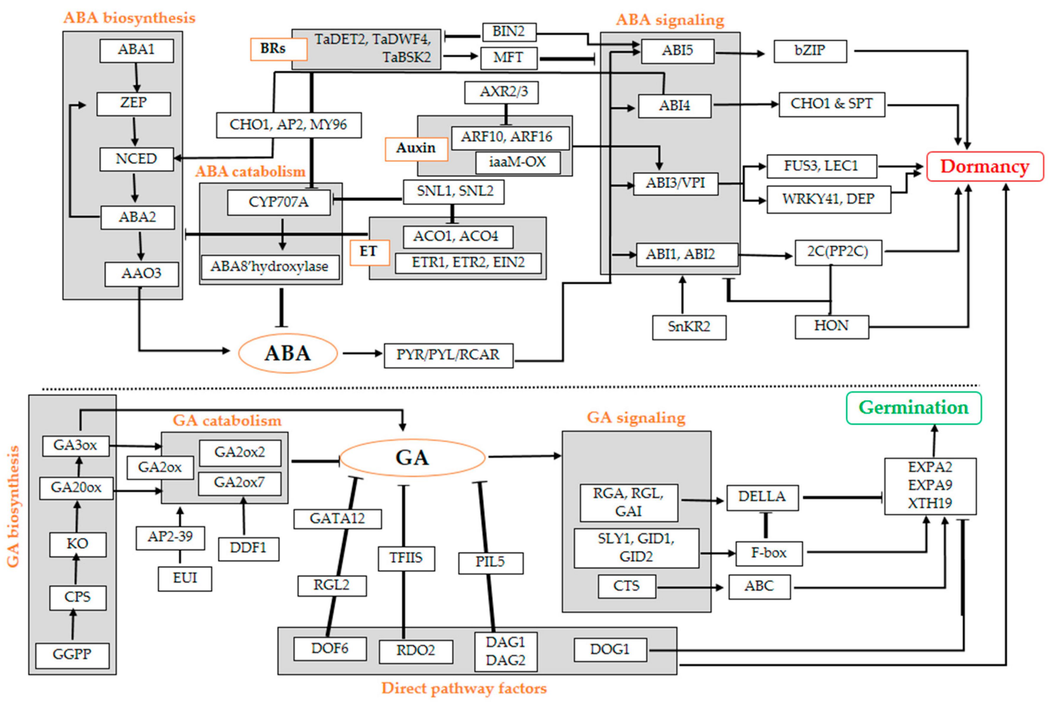
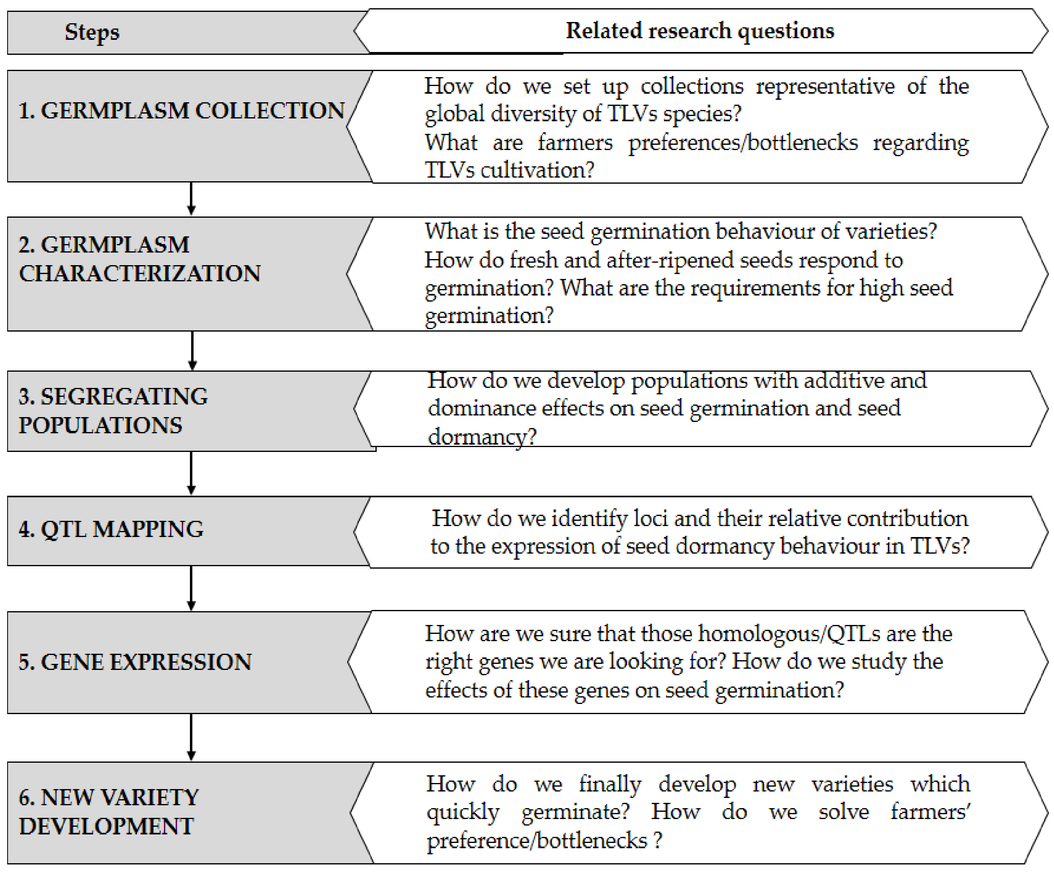


Figure 1. Mechanisms underlining dormancy & germination control in plants



Future prospects for dormancy studies in traditional leafy vegetables

Gynandropsis gynandra appears as a model plant for seed dormancy analysis in TLVs. The proposed research avenue involves a large germplasm collection, characterization of factors influencing seed physiology, seed dormancy and dormancy breaking, development of mapping populations like biparental population, QTL mapping with molecular markers, gene expression analysis through comparison analysis, and the development of improved varieties combining many interest traits.

Figure 2. A conceptual approach for seed dormancy study in TLVs species

Sogbohossou, E.D., Achigan-Dako, E.G., Maundu, P., Solberg, S., Deguenon, E.M., Mumm, R.H., Hale, I., Van Deynze, A., and Schranz, M.E., *A roadmap for breeding orphan leafy vegetable species: a case study of Gynandropsis gynandra (Cleomaceae).* Hortic Res, 2018. **5**(1): p. 2.