AGRIALLIS
Science for Agriculture and Allied Sector: A Monthly Magazine
Volume 5, Issue 10
www.agriallis.com

Article Id
AL04263

ACQUISITION OF DESICCATION TOLERANCE IN SEEDS

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Maturation drying is the normal terminal event in the development of many seeds, after which they pass into a metabolically quiescent state. Seeds remain viable in this dry state from several days to many years, and they germinate upon hydration if they are not dormant (Matilla, 2022).

Acquisition of Desiccation Tolerance in Crop Plants

Desiccation is the process of becoming completely dry. Seeds are not capable of withstanding desiccation at all stages during their development, but their acquisition of desiccation tolerance is usually considerably earlier than maturation drying itself. In the developing castor bean (*Ricinus communis*), seeds show germination 50-55 days after pollination (DAP), when maturation drying has commenced. But excised seeds do not germinate until they reach maturation drying. If excised seeds are first desiccated and placed on water, germination is achieved as early as 25-30 DAP. Seeds desiccated at 20 DAP will not germinate, nor will they survive, they have yet to reach the desiccation tolerant stage of their development. In some species desiccation-tolerance is achieved within 5 days during development (20-25 DAP) and similar rapid acquisition of tolerance occurs in developing seeds. Eg:- *Phaseolus vulgaris*, Mustard and Rape seed.In case of castor been survival upon desiccation occurs only if the seed is dried slowly over several days, later times of development tolerance of rapid desiccation is acquired. Thus the ability of seeds to tolerate desiccation improves progressively during development. This is consequence of physiological and morphological changes which take place gradually as development proceeds and synthesis of specific protective substances at later stages.In castor bean and soybean as seeds mature not only they become more tolerant of desiccation but also upon rehydration they increase capacity to form normal seedling. Drying leads to improved seedling quality following subsequent germination. Seeds of some graminae species may

withstand rapid desiccation relatively early during their development. Eg:- *Avena fatua* (wild oat). The onset of desiccation tolerance in developing seeds may or may not coincide with their, or their embryos, ability to germinate, depending on the species. Eg:-barley.

Changes in Metabolism Associated with Drying

Several metabolic changes occur in seeds either just prior or during drying. These changes involve the appearance of oligosaccharides and sugars or specific types of proteins that have significant role in the protection of seed tissues against the rigors of dessication.

Sugars: In maturing seeds of several species, the concentration of several sugars and oligosaccharides increases in association with the onset of desiccation tolerance and in the early phase of water loss, they are the source of carbon and inducer of dessication tolerance (Mondal *et al*., 2002). .eg :- white mustard-sinapsis alba, soybean , brassica compestris, maize. In some cases disaccharise sucrose, oligosaccharides raffinose, and stachyose are relatively abundant. But these compounds generally occur at much lower concentrations when glucose, mannose, fructose and galactose predominant. In developing embryos like soybean, there is an increase in some sugars and oligosaccharides within embryos induced to become desiccation tolerant by slow drying. For example, the involvement of sucrose and oligosaccharides plays a role in desiccation tolerance in case of Arabidopsis thaliana.

***Proteins*:** Proteins such as the dehydrins play an important key role in protection especially at very low moisture contents, they replace water and thus stabilize the cellular membranes and other sensitive systems (Savage, 2003). During seed development and maturation different groups of transcripts and their protein tranclation products arise at discrete times.In castor embryos one group of proteins accumulated relatively in high concentration at late embryogenesis, so these are named as LEA proteins (late embryogenesis abundant proteins) encoded by the lea genes.

LEA proteins: Their amino acid sequence has been deduced from the base composition of their respective cDNAs.These also found in other plant species and considered to have a highly homologous group. These are strongly hydrophilic proteins, highly stable in nature, not denaturated by boiling. Their ability to attract water water molecules maintain a water-enriched local environment. Even sometimes they act as substitutes for water. So at subcellular level they play an important role in protection against desiccation.

Conclusion

The process of desiccation tolerance is established during the later stages of seed development and is lost during the process of germination. Desiccation tolerance is a complex trait involves cellular protection and repair. Attaining levels of desiccation tolerance varies and is mainly dependent on progressive acquisition of specific tolerance mechanisms or accumulation of desiccation protectants. Proteins and sugars play a protective role by stabilizing the cellular membranes.

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