Plant seeds protect their genetic material against dehydration

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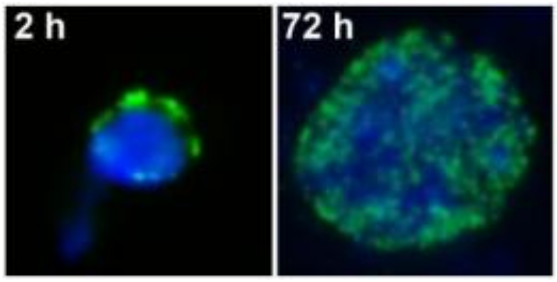

Cell nucleus of a plant seed in a dormant state (left) and after germination (right). The DNA in the smaller nucleus (blue) is more tightly compacted than in the larger one (green: methylated DNA). Credit: MPI for Plant Breeding Research

Plant seeds represent a special biological system: They remain in a dormant state with a significantly reduced metabolism and are thus able to withstand harsh environmental conditions for extended periods. The water content of maturing seeds is lower than ten percent.

Researchers from the Max Planck Institute for Plant Breeding Research in Cologne have now discovered that the genetic material in seeds becomes more compact and the nuclei of the seed cells contract when the seeds begin to mature. The seeds probably protect their genetic material against dehydration in this way.

Plants prepare for changing environmental conditions in the best

possible way by developing dormant seeds. Seeds that mature in autumn, for example, have no problem surviving the harsh conditions of winter. And when the seeds encounter more pleasant external conditions in spring, they germinate and reboot their metabolism, which has been running at a low speed. In archaeological excavations, seeds have even been found that had survived for several thousand years and were still able to germinate.

Dry seeds represent a transitional stage between embryonic and seedling stages. During developmental transitions, the genes that control the new state must be activated while the genes for the "old" stage are silenced. The genes in the cell nucleus are surrounded by proteins. This complex – the chromatin – can be tightly or loosely packed. The degree of compactness of the chromatin regulates the activity of the genes: the more "open" the chromatin, the better the genes can be read.

It was not known up to now whether the reduced metabolic activity or low water content of seeds was linked with changes in the chromatin. The research team working with Wim Soppe from the Max Planck Institute for Plant Breeding Research has now shown in studies on the thale cress that the cell nuclei clearly contract during seed maturation and the chromatin compacts as part of this process. Both processes are reversed during germination. "The size of the nucleus is independent of the state of dormancy of *Arabidopsis thaliana* seeds," says Soppe. Instead, the reduction of the nucleus is an active process, the function of which is to increase resistance to dehydration. Again, the condensation of the chromatin arises independently of the changes in the nucleus.

Thanks to the discoveries of the Cologne-based researchers it may be possible to protect other organisms against dehydration, as the mechanisms that regulate the organisation of the chromatin have undergone little or no change over the course of evolution.

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