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Meeting abstract

Changes in a pattern of HMW-DNA fragmentation accompany differentiation and ageing of plant cells

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Nuclear DNA is arranged into loop domains by periodical attachment of chromatin fibers to nuclear matrix at highest level of chromatin compactisation. Chromatin loops represent the basic structural components of higher order chromatin folding, which are maintained during cell cycle and in differentiated cells. An increasing number of evidences suggests strong relationship between chromatin structure compactisation and functional activity of cell nucleus.

We showed previously that regular DNA cleavage into high molecular weight (HMW) DNA fragments can be induced in intact nuclei, resulting in formation of ~300 kb and 50–100 kb fragments. The patterns of induced cleavage were essentially similar both in intact and high-salt-extracted nuclei suggesting that HMW-DNA fragments represent DNA loop domains (or their associates). Biochemical properties of induced HMW-DNA cleavage suggest involvement of matrix-associated topoisomerase II in excision of DNA loop domains.

We demonstrated further that patterns of HMW-DNA cleavage are distinct in plant tissues differed on proliferative activity and differentiation status. The least fragmentation was found in the embryos of dry quiescent seeds, whereas the induction of growth and development was accompanied by increase in HMW-DNA fragmentation. The study of cell nuclei during natural and accelerated ageing of rye seeds demonstrated that loss of germination capacity was associated with decreased excision of chromatin loop domains.

Taken together, our data demonstrate that changes in physiological status of plant tissues are accompanied with the changes in patterns of HMW-DNA fragmentation. The HMW-DNA fragments are generated by the scaffold-associated topo II-like endonuclease activity that cleaves nuclear DNA probably at the positions of its attachment to nuclear scaffold. We hypothesize that HMW-DNA cleavage activity is related to some DNA metabolic processes in cell nuclei and is necessary for maintaining active physiological status of plant tissues.