Summary

Cytokinins (CKs) are plant hormones that affect a wide range of developmental processes. The most important group of isoprenoid CKs represent zeatin and its derivatives occurring in two, *cis* and *trans,* positional isomers. Whereas *trans*-zeatin (*trans*Z) was found to be a highly bioactive substance, *cis*-zeatin (*cis*Z) has been viewed for years as inactive or weakly active adjunct to its corresponding *trans* counterpart playing only an insignificant physiological role in plants.

The occurrence of *cis*Z-type CKs was found in a great number of plant species with especially high levels identified in species of family *Poaceae.* All tested derivatives of *cis*Z, surprisingly including also zeatin-N9-glucoside, delayed dark-induced chlorophyll degradation in oat and wheat leaf segments. Additionally, *cis*Zs effectively induced cell division in CK-dependent tobacco callus. The most pronounced activity was exhibited by *cis*Z riboside (*cis*ZR) in the two types of CK bioassays. Metabolism of both zeatin isomers differed in short-term as well as in long-term experiments, which was supported also by various affinity of CK degrading enzyme, CK oxidase/dehydrogenase (CKX), to individual *cis* and *trans* isomers. Primary root enlargement of *Arabidopsis* seedlings was inhibited by *cis*ZR in the same or similar way as by *trans*ZR, presumably via restriction of auxin (NAA) response. On the other hand, *cis*ZR might have impaired chlorophyll accumulation in *Arabidopsis* in the presence of auxin by an ethylene-dependent route different from *trans*ZR. Phenotypic analysis of mutants in *cis*Z biosynthesis, lacking tRNA-isopentenyltransferases (AtIPT2 and AtIPT9) showed chlorotic changes, growth retardation and alterations in leaf and seed shape in *atipt2 9* double mutant. However, according to the obtained data these defects might be caused predominantly by defective protein translation because of lacking tRNA prenylation and significant decrease of isopentenyladenine derivatives rather than by *cis*Z deficiency.

With respect to the latest knowledge of *cis*Z accumulation in tissues exhibiting restricted growth and under stress conditions as well as considering the data presented here it is hypothesized that *cis*Z may function in plants under growth limiting conditions to preserve a minimal CK response necessary for their survival.