

In silico analysis of cis-acting regulatory elements in 5' regulatory regions of Ca²⁺/cation antiporters gene family in *Zea mays* L.

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Abstract: Systemic and cellular homeostasis is very important for proper functioning of living organisms, including plants. The role of Ca²⁺ as a secondary messenger in signal transduction in response to external and internal stimuli like plant growth nutrients, light, fungal elicitors and various abiotic stresses is well known. The modulation in Ca²⁺ concentration across the cell membrane is basically mediated by three classes of transporters-Ca²⁺-ATPases (PCAs), Ca²⁺ permeable channels, and Ca²⁺/cation antiporters (CaCAs), which function in combination with each other. CaCA proteins basically form a composite superfamily, which consists of five different families of exchanger proteins-YRBG, Na⁺/Ca²⁺ exchanger (NCX), Na⁺/Ca²⁺, K⁺ exchanger (NCKX), cation/ Ca²⁺ exchanger (CCX), and H⁺/cation exchanger (CAX), which are classified on the basis of their function and evolutionary relationship. Identifying this gene family and examining the promoter region to determine the *cis-regulatory* elements of the response to hormones and stresses could be the first step to understand the function of this gene family in maize (*Zea mays*). In the present study by using HMM profile and blastP search 14 *ZmCaCA* genes identified in maize genome database which were classified into seven *ZmCAX*, six *ZmCCX* and one *ZmMHX* genes families based on their evolutionary relation with earlier reported *CaCA* genes in Arabidopsis and rice. Unlike rice and Arabidopsis, which have two and one genes of *NCL* subgroup respectively, Promoter analysis of these genes using PlantCare database showed the presence of several *cis-regulatory* elements related to stress and hormone response within the 1.5' kbp of 5' regulatory region. Overall, 19 different types stresses and hormones responsive cis element with varying abundance were identified in the promoter region of these genes. The most abundance regulatory elements are MBS, CGTCA-motif and TGACG-motif which form 10/24%, 15/12% and 15/12% of regulatory elements and act in response to drought, methyl jasmonate and methyl jasmonate respectively. Of the other important cis-element could be mentioned to ERA, GC-motif, ABRE and TCA-element. This result revealed that *cis-acting* regulatory elements that possibly are involved in the expression and regulation of CaCA gene families in maize during environmental stress conditions.

Keywords: Gene Family; Promoter; Signaling; Calcium

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