Table 1. *In vitro* substrates of protein kinase CK2 in plants

Name	Type	Source	Role	Reference
Light-signal transduction pathway				
GBF-1	bZIP transcription factor	Arabidopsis	binds to G-box promoter	6
AT-1	transacting factor	Pea	binds to AT-rich promoter	40
ATBP-1	transacting factor	Pea	binds to AT-rich promoter	41
CCA-1	Myb-related transcription factor	Arabidopsis	potential clock gene	43
LHY	Myb-related transcription factor	Arabidopsis	potential clock gene	43
HY5	bZIP transcription factor	Arabidopsis	promotes photomorphogenesis	44
Seed storage				
Opaque2	bZIP transcription factor	Maize	binds to zein promoter	45
β-conglycinin	storage protein	Soybean	storage protein	46
calreticulin	Ca^{2+} binding protein	Spinach	Ca^{2+} metabolism	47
RNA translation				
P-proteins	Ribosomal proteins	Maize	complex with 60S ribosomal subunits	49
p34	ribonucleoprotein	Spinach cloroplasts	mRNA 3′ end processing	51
p36	eIF-2 subunit	Wheat germ	guanine nucleotide exchange	52
DNA transcription				
PDH65	Dna helycase	Pea	opens the duplex DNA during nucleic acid transactions	54
ABA/stress-induced pathway				
Rab 17	LEA protein	Maize	Stress-induced protein	55
TAS-14	LEA protein	Tomato	Stress-induced protein	58
ATP synthesis				
CFOCF1-ATPase	ATPase synthase b subunit	Spinach cloroplasts	ATP synthesis	59
apyrase	Pea	ATP hydrolysis	60	
Lipid synthesis				
gp96	lipoxygenase	Soybean	oxygenation of unsaturated fatty acids	61
Proteasome machinery				
C2	proteasome protein	Rice	protein degradation	62
Nuclear matrix proteins				
lamina-like	lamina matrix protein	Pea	lamina matrix protein	7

have a diminished DNA binding activity compared to the hypophosphorylated forms [45]. In maize endosperm, O2 regulates the expression of the zein genes, which are the primary storage product. In fact, multiple storage protein are *in vitro* substrates of CK2, such as β-conglicin [46] or calreticulin [47]. The plant calreticulin is an abundant ER involved in many different functions in cells, and is specifically phosphorylated by CK2 *in vitro*. On the contrary, animal calreticulin is not a CK2 substrate, even though all the major Era/Ca^{2+}-binding proteins such as calmodulin [25] or calnexin [48] are.

As in the case of animals, proteins involved in the RNA translation are also phosphorylated in plants. In maize, the complex of the 60S ribosomal subunit contains acidic phosphoproteins (P-proteins) involved in the regulation of the protein synthesis which are *in vitro* phosphorylated by CK2 [49] as in the case of the P-proteins from animals and yeast [50]. In spinach chloroplasts, the physiological activity of the ribonucleoprotein p34 which is required for plastid mRNA 3' processing, is regulated by CK2 phosphorylation [51]. Another *in vitro* substrate of CK2 is p36, the small subunit of the wheat germ eukariotic initiation factor, eIF-2α [52]. The functional significance of plant eIF-2α phosphorylation is not clear, whereas in mammals, the eIF-2α phosphorylation by eIF-2 kinases inhibits the protein synthesis [53]. Recently, it has been reported that PDH65, a DNA helicase that may be involved both in rDNA transcription and in early stages of pre-RNA processing, is upregulated by CK2 phosphorylation [54].

The maize Rab17 is a phosphoprotein responsive to abscisic acid and induced under water stress conditions and it has been reported that is strongly phosphorylated by CK2 *in vitro* [55]. It is located both in cytoplasm and nucleus of the maize cells and it is able to interact with synthetic NLS peptides but only in the phosphorylated form, it seems therefore that Rab 17 protein might act regulating transport of proteins from cytoplasm to the nucleus during stress conditions and this nuclear transport may be dependent of CK2 phosphorylation [56, 57]. Recently in animals CK2 re-localization has been described under stress conditions [58]. A homologue of Rab17 in tomato, the TAS-14 protein is also phosphorylated by CK2 [59].