

Additional File 3. Triticeae MPK and MKK accessions and nomenclature. Six tables are presented below one for each species: *Triticeae aestivum* (pages 2-5), *Hordeum vulgare* (pages 6-7), *Secale cereale* (page 8), *xTritosecale* (page 9), *Aegilops tauschii* (page 10), *Triticum urartum* (page 11). Nucleotide accessions were collected from various databases as indicated in the footnote for each table. Translated sequences from nucleotides marked in bold were used for phylogenetic analysis (Figs 1, 2 and 3, and Additional File 11).

References

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Wheat (*Triticum aestivum*)

Gene Name	Nucleotide	Loc	Protein	Reported Names	Comments
Wheat MPKs					
TaMPK3	AF079318 ^{GB}	-	AAC28850	<i>WCK-1</i> ^{GB,1} <i>TaMAPK1</i> ² <i>TaMPK3</i> ³	Genbank Gene ID 542829
	TA63689_4565 ^{GB}	-	-	<i>TaMPK4</i> ⁴	Genbank accession provided by [4] could not be retrieved from the database; however, primer sequences show homology to TaMPK3 and its 3'-UTR
	306486_AA1008960.2 ^{EP}	4AS	A7L5U5	<i>MPK3</i> ^{EP} <i>TaMAPK30</i> ⁵	
	320270_AA1033300.1 ^{EP}	4BL	A7L5U5	<i>MPK3</i> ^{EP} <i>TaMAPK9</i> ⁵ <i>TaMAPK15</i> ⁵	
	344691_AA1148960.1 ^{EP}	4DL	W5EFF0	<i>MPK3</i> ^{EP} <i>TaMAPK25</i> ⁵	
TaMPK4	AK330924 ^{GB}	-	-	<i>TaMPK6</i> ⁶⁻⁸ <i>TaMAPK4</i> ²	
	000118_AA0003960.1 ^{EP}	1AL	W4ZQS8	<i>TaMAPK14</i> ⁵	
	030274_AA0084790.2 ^{EP}	1BL	W5A5U1	<i>TaMAPK28</i> ⁵	
	061983_AA0206840.1 ^{EP}	1DL	-	<i>TaMAPK32</i> ⁵	
TaMPK6	AY173962 ^{GB}	-	AAO16560	<i>FLRS</i> ^{GB,9,10} <i>TaMAPK2</i> ³ <i>TaMPK6</i> ²	Genbank Gene ID 543088; insertion encoding a ten residue stretch (277-VFPCGISSLQ-287) within the PK domain of AA061959.1 (see Additional File 6)
	JX646783	-	AG061959	<i>MAPKflrs</i> ^{GB,11}	Partial sequence; 100% sequence ID with AAO16560
	AK333212 ^{GB}	-	-	<i>TaMPK1</i> ⁶⁻⁸	Single nucleotide and amino acid difference between RFL_contig3769 and AK333212
	RFL_contig3769 ^{TRI}	-	-	-	
	570369_AA1834630.1 ^{EP}	7AS	-	<i>TaMAPK48</i> ⁵	
	593766_AA1954300.1 ^{EP}	7BS	-	<i>TaMAPK51</i> ⁵	
	622461_AA2040040.1 ^{EP}	7DS	-	<i>TaMAPK19</i> ⁵	
TaMPK7	HQ650112 ^{GB}	-	AET10457	<i>MAPK5</i> ^{GB}	
	HQ650111 ^{GB}	-	AET10456	<i>MAPK4/TaMPK4</i> ^{GB,12}	
	Ta.7205 ^{GB}	-	-	<i>TaMAPK5</i> ²	
	tplb0018e09 ^{TRI}	-	-	<i>TaMPK4</i> ⁶⁻⁸	
	558385_AA1792950.1.X ^{EP}	7AL	-	<i>TaMAPK12</i> ⁵	
	576902_AA1859240.1 ^{EP}	7BL	A0A088AX68	<i>TaMAPK54</i> ⁵	
	603254_AA1979200.2 ^{EP}	7DL	-	<i>TaMAPK21</i> ⁵	
TaMPK11	603035_AA1974260.1 ^{EP}	7DL	-	-	
	HAAB01041577 ^{GB}	-	-	-	Proteins share 100% sequence identity
	555982_AA1751700.1 ^{EP}	7AL	W5H9L7	-	
	JV870088 ^{GB}	-	-	<i>TaMAPK3</i> ²	Proteins share 100% sequence identity
TaMPK14	580661_AA1914980.1 ^{EP}	7BL	-	-	
	603600_AA1986180.1 ^{EP}	7DL	-	-	
	AK332648 ^{GB}	-	-	<i>TaMPK3</i> ⁶⁻⁸ <i>TaMAPK6</i> ²	
TaMPK14	487866_AA1573320.1.X ^{EP}	6AS	-	<i>TaMAPK36</i> ⁵	
	514340_AA1658600.1.X ^{EP}	6BS	-	-	

Gene Name	Nucleotide	Loc	Protein	Reported Names	Comments
TaMPK16	544171_AA1747030.1 ^{EP}	6DS	-	TaMAPK45 ⁵	
	DQ322665 ^{GB}	-	ABC54584	MAPK2A ^{GB,11}	Genbank Gene ID 100136975
	DQ322666 ^{GB}	-	ABC54585	MAPK2B ^{GB,11}	Genbank Gene ID 100137006
	DQ322667 ^{GB}	-	ABC54586	TaMAPK11 ²	
	020601_AA0078640.1 ^{EP}	1AS	W4ZYA7	MAPK2C ^{GB}	
				TaMAPK11 ⁵	
				MPK16 ^{EP}	
049733_AA0160590.2 ^{EP}	1BS	A9RAB0	TaMAPK27 ⁵		
			MPK16 ^{EP}		
642759_AA2122920.1 ^{EP}	U	A9RAB1	TaMAPK4 ⁵		
			MPK16 ^{EP}		
TaMPK17	AK333198 ^{GB}	-	-	TaMPK12 ⁶⁻⁸	Stop codon in PK domain
	RFL_contig3756 ^{GB}	-	-		
	AY881102 ^{GB}	-	AAX20165	MAPK1a ^{GB,11}	
				TaMAPK14 ²	
	AY881103 ^{GB}	-	AAX20166	MAPK1b ^{GB}	
	DQ322668 ^{GB}	-	ABC54587	MAPK1C ^{GB}	
	DQ334402 ^{GB}	-	ABC65848	MAPK1d ^{GB,13}	Genbank Gene ID 100125895; premature stop?
	DQ444321 ^{GB}	-	ABD97883	MAPK1f ^{GB,11}	
	556562_AA1765430.2 ^{EP}	7AL	A9RAB3	TaMAPK49 ⁵	
	641980_AA2108810.2 ^{EP}	U	-	TaMAPK53 ⁵	
604680_AA2000630.1 ^{EP}	7DL	Q5BU11	TaMAPK20 ⁵		
TaMPK20-1	KT187392 ^{GB}	-	AKS50324	-	
	Ta.13373 ^{GB}	-	-	TaMAPK10 ²	
	194002_AA0624350.1 ^{EP}	3AL	AOA0K0YGT2	TaMAPK38 ⁵	
	224428_AA0796670.1.X ^{EP}	3B	-	-	Unidentified nucleotides (presumably 27 residue stretch) in C-terminal extension
	253300_AA0894090.1 ^{EP}	3DL	-	TaMAPK8 ⁵	
TaMPK20-2	AK331818 ^{GB}	-	-	TaMAPK9 ⁶⁻⁸	
				TaMAPK9 ²	
	tplb0059e09 ^{TRI}	-	-	-	Predicted protein in database is translated in the wrong frame
	002534_AA0042880.5.X ^{EP}	1AL	-	TaMAPK43 ⁵	
	030959_AA0104540.1 ^{EP}	1BL	-	TaMAPK6 ⁵	
063491_AA0227870.2 ^{EP}	1DL	-	TaMAPK34 ⁵		
TaMPK20-3	KR422425 ^{GB}	-	AKL80627	-	
	557823_AA1786610.1 ^{EP}	7AL	W5HC04	TaMAPK3 ⁵	
	577050_AA1864020.2 ^{EP}	7BL	-	TaMAPK52 ⁵	
	604962_AA2003380.1 ^{EP}	7DL	-	TaMAPK7 ⁵	
TaMPK20-4	AK333309 ^{GB}	-	see comment	TaMAPK7 ²	NCBI Genomic Scaffold Match: HG670306; RFL predicted protein is translated in the wrong frame
	RFL_contig3856 ^{TRI}	-		TaMAPK8 ²	
	195023_AA0643580.5 ^{EP}	3AL	-	TaMAPK39 ⁵	
	225288_AA0806810.1 ^{EP}	3B	AOA077RTL3	TaMAPK16 ⁵	
	250331_AA0866300.5 ^{EP}	3DL	-	TaMAPK24 ⁵	
TaMPK20-5	KR422426 ^{GB}	-	AKL80628	-	
	tplb0009i20 ^{TRI}	-	-	TaMPK7 ⁶⁻⁸	
	001596_AA0032670.1 ^{EP}	1AL	-	TaMAPK41 ⁵	

Gene Name	Nucleotide	Loc	Protein	Reported Names	Comments
	032512_AA0130820.2 ^{EP}	1BL	-	<i>TaMAPK29</i> ⁵	
	643598_AA2133390.1 ^{EP}	U	-	<i>TaMAPK33</i> ⁵	
<i>TaMPK21-1</i>	KR422427 ^{GB}	-	AKL80629	-	
	Ta.18660 ^{GB}	-	-	<i>TaMAPK12</i> ²	
	tplb0009k03 ^{TRI}	-	-	<i>TaMPK17</i> ⁶⁻⁸	
	002281_AA0040420.1.X ^{EP}	1AL	-	<i>TaMAPK42</i> ⁵	
	032784_AA0134120.1 ^{EP}	1BL	-	-	
	061695_AA0201870.1 ^{EP}	1DL	-	<i>TaMAPK5</i> ⁵	
<i>TaMPK21-2</i>	AK330685 ^{GB}	-	-	<i>TaMAPK13</i> ²	
	RFL_contig1494 ^{TRI}	-	-	<i>TaMPK16</i> ⁶⁻⁸	
	196288_AA0659130.2 ^{EP}	3AL	-	<i>TaMAPK40</i> ⁵	
	221708_AA0748020.2 ^{EP}	3B	-	-	
	249051_AA0836180.1 ^{EP}	3DL	-	<i>TaMAPK23</i> ⁵	
<i>TaMPK24</i>	AK334728 ^{GB}	-	-	<i>TaMPK12;1</i> ⁶⁻⁸	
	Ta.68224 ^{GB}	-	-	<i>TaMAPK15</i> ²	
	RFL_contig5132 ^{TRI}	-	-	-	
	640751_AA2072490.1.X + AA2072480.1.X ^{EP}	U	-	<i>TaMAPK35</i> ⁵	Fusion of 2 accessions; Unidentified nucleotides (presumably 28 residue stretch) in PK domain
	513631_AA1646180.1 ^{EP}	6BS	-	<i>TaMAPK17</i> ⁵	
	543835_AA1744530.1 ^{EP}	6DS	-	<i>TaMAPK44</i> ⁵	
<i>TaMPK25</i>	375843_AA1227850.X ^{EP}	5AL	-	-	
	405765_AA1334990.1 ^{EP}	5BL	-	-	
	*TGACv1_Scaffold_433177_5DL:99000-100916 ^{EP}	5DL	-	-	
	290148_AA0982230.1 ^{EP}	4AL	-	-	
<i>TaMKK1-1</i>	570427_AA1835590.1.X ^{EP}	7AS	-	-	
	HP624471 ^{GB}	-	-	-	Coding sequences share 100% identity
	622118_AA2033130.2 ^{EP}	7DS	-	-	
<i>TaMKK1-2</i>	HP621269 ^{GB}	-	-	-	
	485693_AA1550190.1.X ^{EP}	6AS	-	-	
Wheat MKKs					
<i>TaMKK1-1</i>	290148_AA0982230.1 ^{EP}	4AL	-	-	
	570427_AA1835590.1.X ^{EP}	7AS	-	-	
	HP624471 ^{GB}	-	-	-	Coding sequences share 100% identity
	622118_AA2033130.2 ^{EP}	7DS	-	-	
<i>TaMKK1-2</i>	HP621269 ^{GB}	-	-	-	
	485693_AA1550190.1.X ^{EP}	6AS	-	-	
	513382_AA1639520.1.X ^{EP}	6BS	-	-	
<i>TaMKK1-3</i>	644387_AA2139180.1.X ^{EP}	U	-	-	
	623511_AA2053970.1.X ^{EP}	7DS	-	-	
	228257_AA0826360.1.X ^{EP}	3B	-	-	Partial sequence
<i>TaMKK3</i>	KT187393 ^{GB}	-	AKS50325	-	
	405566_AA1330480.6.X ^{EP}	5BL	-	<i>TaMAPKK2</i> ⁵	
	432926_AA1394740.1 ^{EP}	5DL	-	<i>TaMAPKK13</i> ⁵	
	<i>TaMKK3-3</i>	373997_AA1187200.3.X ^{EP}	5AL	-	<i>TaMAPKK4</i> ⁵
405070_AA1319320.2.X ^{EP}		5BL	-	<i>TaMAPKK18</i> ⁵	

Gene Name	Nucleotide	Loc	Protein	Reported Names	Comments
	435057_AA1445420.4 ^{EP}	5DL	-	TaMAPKK3 ⁵	
TaMKK4	472053_AA1517260.1.X ^{EP}	6AL	-	-	Described in Ensembl as ncRNA
	502626_AA1625820.1 ^{EP}	6BL	-	-	
	528809_AA1716310.1.X ^{EP}	6DL	-	TaMAPKK1 ⁵	
TaMKK5	572257_AA1851770.1 ^{EP}	7AS	-	-	
	592906_AA1946090.1 ^{EP}	7BS	-	-	
	623332_AA2052160.1.X ^{EP}	7DS	-	-	
TaMKK6	AK330201 ^{GB}	-	-	TaMPKK1 ⁶⁻⁸	
	290485_AA0985860.1 ^{EP}	4AL	-	MKK6 ^{EP}	
	320624_AA1044950.2 ^{EP}	4BL	-	MKK6 ^{EP}	
	342786_AA1122060.5 ^{EP}	4DL	W5EJ68	MKK6 ^{EP}	
TaMKK10-2	307146_AA1017600.1 ^{EP}	4AS	-	-	
	323005_AA1073590.1 ^{EP}	4BL	-	-	
	344093_AA1143600.1 ^{EP}	4DL	-	-	
TaMKK10-1/3	288275_AA0943400.1.1 ^{EP}	4AL	-	TaMAPKK17 ⁵	
	327917_AA1078630.1.1.X ^{EP}	4BS	-	-	
	328797_AA1093760.1.1 ^{EP}	4BS	-	TaMAPKK7 ⁵	
	328797_AA1093770.1.1.X ^{EP}	4BS	-	TaMAPKK7 ⁵	
	329516_AA1102150.1.1 ^{EP}	4BS	-	TaMAPKK6 ⁵	
	329775_AA1103890.1.1 ^{EP}	4BS	-	-	
	362002_AA1175570.1.1 ^{EP}	4DS	-	TaMAPKK12 ⁵	
	362154_AA1177260.1.1 ^{EP}	4DS	-	-	
TaMKK10-4	220919_AA0723740.1.1 ^{EP}	3B	-	TaMAPKK9 ⁵ TaMAPKK10 ⁵	
	289532_AA0972640.1.1 ^{EP}	4AL	-	TaMAPKK14 ⁵	
	291020_AA0991400.1 ^{EP}	4AL	-	TaMAPKK15 ⁵	
	329491_AA1101870.1.1 ^{EP}	4BS	-	TaMAPKK5 ⁵	
	361832_AA1173360.1 ^{EP}	4DS	-	-	
TaMKK10-5	292438_AA0998860.1 ^{EP}	4AL	-	TaMAPKK16 ⁵	
	331242_AA1109740.1 ^{EP}	4BS	-	-	
	362002_AA1175550.1.1 ^{EP}	4DS	-	TaMAPKK11 ⁵	

Notes:

- **Nucleotide** - Accessions were collected from EP (Ensembl Plants, <http://plants.ensembl.org/index.html>), GB (GenBank, <https://www.ncbi.nlm.nih.gov/genbank/>), or TRI (Triticeae Full-length CDS database, <http://trifldb.psc.riken.jp/v3/index.pl>). Abbreviated nucleotide identifiers were used for EP accessions (for full gene identifiers refer to Additional File 2) which should be preceded with 'TRIAE_CS42_CN_TGACv1_', where CN refers to the chromosome number as defined under location. In some cases where nucleotide sequences were identified in EP, accessions were not available—in these instance, genomic locations are provided under Nucleotide instead. Sequences for which alternative splicing is proposed are include the suffix 'X' at the end of the nucleotide identifier.
- **Loc** (location) - Gene sequence were located on chromosomes 1-7 of the A, B and D genomes of *Triticum aestivum*. U refers to unknown location, where U is followed by a number if more than one orthologue was identified with unknown location. Location is not available (-) for sequences obtained from GB or TRI.
- **Protein** - GB or UniProt (Ensembl) protein accessions.
- **Reported Names** - Other names that have been assigned in GB, EP or according to references (marked with superscript numbers). EP names were assigned to the genes where MPKs and MKKs are spelled out ('mitogen activated protein kinase' and 'mitogen activated protein kinase kinase', respectively; note that in some cases UniProt sequence was assigned a different MPK/MKK number than that assigned to the gene.

Barley (*Hordeum vulgare*)

Gene Name	Nucleotide	Loc	Protein	Reported Names	Comments
Barley MPKs					
<i>HvMPK3</i>	MLOC_17814.3 ^{EP}	4	M0V3Q0	<i>MPK3</i> ^{EP}	Coding sequences share 100% identity
	Locus_5782_Transcript_3/3_Confidence_0.864 ^{HW}	-	-	<i>HvMPK5</i> ¹⁴	
<i>HvMPK4</i>	AK366765 ^{GB}	-	BAJ97968	<i>HvMPK6</i> ¹⁴	Coding sequences share 100% identity
	MLOC_5653.1 ^{EP}	1	F2DS97	-	
<i>HvMPK6</i>	AK355058 ^{GB}	-	BAJ86277	<i>HvMPK1</i> ¹⁴	Proteins share 100% sequence identity
	AK376245 ^{GB}	-	BAK07440	-	
	AK359140 ^{GB}	-	BAJ90351	-	
	*7:33935418-33937780(-) ^{EP}	7	-	-	
<i>HvMPK7</i>	AK252980 ^{GB}	-	-	<i>HvMPK4</i> ^{14,15}	Coding sequences share 100% identity
	MLOC_74277.1 ^{EP}	7	M0YY17	-	
<i>HvMPK11</i>	AK364586 ^{GB}	-	BAJ95789	<i>HvMPK2</i> ¹⁴	Coding sequences share 100% identity
	MLOC_71588.1 ^{EP}	7	M0YQ06	-	
<i>HvMPK14</i>	AK353742 ^{GB}	-	BAJ84961	<i>HvMPK3</i> ¹⁴	Coding sequences share 100% identity
	AK354217 ^{GB}	-	BAJ85436	-	
	MLOC_44271.1 ^{EP}	6	F2CQ40	-	
<i>HvMPK16</i>	AK356908 ^{GB}	-	BAJ88123	-	Coding sequences share 100% identity
	AK354221 ^{GB}	-	-	-	
	AK251500 ^{GB}	-	-	<i>HvMPK14</i> ¹⁴	
	MLOC_60926.2 ^{EP}	1	M0XKT1	<i>MPK16</i> ^{EP}	
<i>HvMPK17</i>	AK252439 ^{GB}	-	-	-	Proteins share 100% sequence identity
	AK376500 ^{GB}	-	BAK07695	-	
	MLOC_31474.2 ^{EP}	7	F2EK23	-	
<i>HvMPK20-1</i>	AK252802 ^{GB}	U	-	-	Partial or chimeric sequence?
<i>HvMPK20-2</i>	AK361158 ^{GB}	-	BAJ92365	<i>HvMPK9</i> ¹⁴	Coding sequences share 100% identity
	AK361419 ^{GB}	-	-	-	
	MLOC_64743.1 ^{EP}	1	F2DB94	-	
<i>HvMPK20-3</i>	Locus_4929_Transcript_3/3_Confidence_0.714 ^{HW}	-	-	<i>HvMPK11</i> ¹⁴	
<i>HvMPK20-4</i>	AK365649 ^{GB}	-	BAJ96852	-	Coding sequences share 100% identity
	AK365810 ^{GB}	-	BAJ97013	-	
	MLOC_4609.1 ^{EP}	3	F2DP31	-	
<i>HvMPK20-5</i>	AK357581 ^{GB}	-	BAJ88795	<i>HvMPK7</i> ¹⁴	Coding sequences share 100% identity
	MLOC_36752.2 ^{EP}	1	F2D124	-	
<i>HvMPK21-1</i>	AK377157 ^{GB}	-	BAK08351	<i>HvMPK17</i> ¹⁴	Chimeric sequence?
	MLOC_11730.2.X ^{EP}	1	M0UKB5	-	
<i>HvMPK21-2</i>	AK373134 ^{GB}	-	BAK04331	<i>HvMPK16</i> ¹⁴	
<i>HvMPK24</i>	*6:62507485-62509104(1) + 6:47704546-47706434(-) ^{EP}	6	-	-	Fusion of 2 chromosomal regions
<i>HvMPK25</i>	*5:449484666-449486231(-) ^{EP}	5	-	-	
Barley MKKs					
<i>HvMKK1-1</i>	MLOC_5024.1 ^{EP}	7	M0WE95	-	

Gene Name	Nucleotide	Loc	Protein	Reported Names	Comments
<i>HvMKK1-2</i>	*6:24836464-24837555(-) ^{EP}	6	-	-	Partial sequence; N-terminal region found in GenBank accession AC264970.1
<i>HvMKK3-2</i>	AK364882 ^{GB}	-	BAJ96085	-	Partial PK domain
	AB598128 ^{GB}		BAU62004	<i>HvMKK3</i> ^{GB,16}	
	MLOC_51567.4.X + *5:556255205-556260000(-) ^{EP}	5	M0WHK8	<i>MKK3</i> ^{EP}	Fusion of accession with downstream sequence shows homology with other Triticeae MKK3-2 sequences. Protein accession (M0WHK8) represents translated sequence from MLOC_51567.4
<i>HvMKK3-3</i>	*5:282831404-282831930(-) + 5:85174242-85175936(+) + 5:111354822-111355452(-) ^{EP}	5	-	-	Fusion of 3 chromosomal regions
<i>HvMKK4</i>	AK374401 ^{GB}	-	see comment	-	Predicted protein (BAK05597) is in frame with translated sequence but is missing the N-terminal region reported herein
	*6:510407310-510408104(+) ^{EP}	6	-	-	Partial (N-term truncation)
<i>HvMKK5</i>	AK370268 ^{GB}	-	see comment	-	Predicted protein (BAK04169) is translated in the wrong frame
	*7:71862432-71862578(+) + MLOC_21954.1.X ^{EP}	7	-	-	Fusion of accession with upstream sequence; missing sequence between accession and upstream sequence provided, but the sequences have homologies to AK370268.
<i>HvMKK6</i>	AK250233 ^{GB}	-	-	-	
	MLOC_4417.1.X + *4:519072245-519072491(-) ^{EP}	4	-	<i>MKK6</i> ^{EP}	Fusion of accession with downstream sequence
<i>HvMKK10</i>	MLOC_58682.1.X ^{EP}	1	-	-	Partial sequence
<i>HvMKK10-2</i>	AK363295 ^{GB}	-	BAJ94499	-	
	MLOC_77796.1.X ^{EP}	4	-	-	Partial sequence
<i>HvMKK10-1/3</i>	*morex_contig_1636696:1-1144(+) ^{EP}	U	-	-	Partial sequence
<i>HvMKK10-4</i>	*4:23822500-23823800(-) ^{EP}	4	-	-	
<i>HvMKK10-5</i>	*4:23881977-23883581(-) ^{EP}	4	-	-	

Notes:

- **Nucleotide** - Accessions were collected from EP (Ensembl Plants, <http://plants.ensembl.org/index.html>), GB (GenBank, <https://www.ncbi.nlm.nih.gov/genbank/>), or HW (HarvEST:Web, <http://harvest-web.org/hweb/utimenu.wc>). For nucleotide sequences identified in EP, but accessions were not available, genomic locations are provided instead, and marked with an asterisk. Sequences for which alternative splicing is proposed include the suffix 'X' at the end of the nucleotide identifier.
- **Loc** (location) - Gene sequence were located on chromosomes 1-7 of H genome (*Hordeum vulgare*). Location is not available (-) for sequences obtained from GB or HW.
- **Protein** - GB or UniProt (Ensembl) protein accessions.
- **Reported Names** - Other names that have been assigned in GB, EP or according to references (marked with superscript numbers). EP names were assigned to the genes where MPKs and MKKs are spelled out ('mitogen activated protein kinase' and 'mitogen activated protein kinase kinase', respectively; note that in some cases UniProt sequence was assigned a different MPK/MKK number than that assigned to the gene.

Rye (*Secale cereale*)

Gene Name	Nucleotide	Comments
Rye MPKs		
<i>ScMPK3</i>	GCJW01013649	
<i>ScMPK4</i>	GCJW01021504	
<i>ScMPK6</i>	GCJW01029298	
<i>ScMPK7</i>	GCJW01012233	
<i>ScMPK11</i>	GCJW01021982	
<i>ScMPK14</i>	GCJW01021899	
<i>ScMPK17</i>	GCJW01009290	
<i>ScMPK20-1</i>	GCJW01023871	
<i>ScMPK20-2</i>	GCJW01009928	
<i>ScMPK20-3</i>	GCJW01009952	
<i>ScMPK20-4</i>	GCJW01023593	
<i>ScMPK20-5</i>	GCJW01010817	
<i>ScMPK21</i>	GCJW01028630	
<i>ScMPK24</i>	GCJW01027829	Re-amplified sequence does not have stop codon as reported in GenBank
<i>ScMPK25</i>	GCJW01029388	
Rye MKKs		
<i>ScMKK1</i>	GCJW01014171	
<i>ScMKK3-2</i>	GCJW01010230	
<i>ScMKK3-3</i>	GCJW01028545	
<i>ScMKK4</i>	GCJW01029276	
<i>ScMKK5</i>	GCJW01029147	Partial sequence
<i>ScMKK6</i>	GCJW01013226	
<i>ScMKK10</i>	GCJW01031072	Partial sequence

Note: Nucleotide accessions were collected from GeneBank's Transcript Assembly (TSA) database. Bioproject PRJDB2278 [16].

Triticale (*xTritosecale*)

Gene Name	Nucleotide	Loc	Comments
Triticale MPKs			
<i>TsMPK3</i>	Contig10429	R/A/B	
<i>TsMPK4</i>	Contig67966	R/A	Re-amplified sequence does not have stop codon reported in contig file
<i>TsMPK6</i>	Contig251617	R	
<i>TsMPK7</i>	Contig199810	B	
<i>TsMPK11</i>	Contig120398	U	
	Contig88156	A	
<i>TsMPK14</i>	Contig220413	R/B	
<i>TsMPK16</i>	Contig209684	U1	
	Contig244429	U2	
<i>TsMPK17</i>	Contig26009	R	
	Contig75139	A	
	Contig38651	U	
<i>TsMPK20-1</i>	Contig53750	U1	
	Contig64364	U2	Multiple stop codons
	Contig185846	U3	
<i>TsMPK20-2</i>	Contig111052	U1	Deletion or sequencing error; single nucleotide (T) missing in sequence leads to disruption of full length MAPK sequence (see Additional File 5)
	Contig113411	U2	
<i>TsMPK20-3</i>	Contig68811	U	
	Contig19795	B	
<i>TsMPK20-4</i>	Contig251629	U	
<i>TsMPK20-5</i>	Contig67306	U1	
	Contig67307	U2	
<i>TsMPK21-1</i>	Contig53625	U	Partial sequence
<i>TsMPK21-2</i>	Contig68757	U1	
	Contig201182	U2	
	Contig221182	U3	
<i>TsMPK24</i>	Contig116794	U	
<i>TsMPK25</i>	Contig146788	U	
Triticale MPKs			
<i>TsMKK3-2</i>	Contig143511	B	
	Contig224242	U1	
	Contig229009	U2	
<i>TsMKK3-3</i>	Contig90697	U	
<i>TsMKK4</i>	Contig104479	U1	
<i>TsMKK5</i>	Contig141775	U2	
	Contig154845	U3	
<i>TsMKK6</i>	Contig212597	R	
<i>TsMKK10</i>	Contig129481	-	Partial sequence

Note: Nucleotide accessions were collected from a TSA project not yet available in GenBank [17]; Locations predicted based on homologies with wheat and rye sequences, where U = unknown.

Goat Grass (*Aegilops tauschii*)

Gene Name	Nucleotide	Protein	Reported Names	Comments
Goat Grass MPKs				
<i>AetMPK3</i>	EMT08915.X	-	<i>MPK3</i>	
<i>AetMPK4</i>	EMT33725.X	-	<i>MPK6</i>	
<i>AetMPK6</i>	EMT30535.X	-	<i>MPK1</i>	
<i>AetMPK7</i>	EMT18927	R7W9L5	-	
<i>AetMPK11</i>	EMT18008.X	-	-	
<i>AetMPK14</i>	EMT33478.X	-	<i>MPK3</i>	
<i>AetMPK16</i>	EMT19997.X	-	<i>MPK16</i>	
<i>AetMPK17</i>	EMT12771.X	-	-	
<i>AetMPK20-1</i>	EMT32532.X	-	<i>MPK10</i>	
<i>AetMPK20-2</i>	EMT15153.X	-	-	
<i>AetMPK20-3</i>	EMT10986.X	-	<i>MPK11</i>	
<i>AetMPK20-4</i>	EMT09350.X	-	<i>MPK8</i>	
<i>AetMPK20-5</i>	EMT10806.X	-	<i>MPK7</i>	
<i>AetMPK21-1</i>	EMT25710.X	-	<i>MPK17</i>	
<i>AetMPK21-2</i>	EMT27546.X	-	<i>MPK16</i>	
<i>AetMPK24</i>	EMT28412.X	-	-	
<i>AetMPK25</i>	EMT00145.X	-	-	
Goat Grass MPKs				
<i>AetMKK1-1</i>	*Scaffold59969:73755-76762(-)	-	-	
<i>AetMKK1-2</i>	EMT27166.X	-	<i>MKK1</i>	
<i>AetMKK3</i>	EMT30937.X + EMT30938.X	-	<i>MKK1</i>	
<i>AetMKK3-2</i>	EMT25805.X	-	<i>MKK6</i>	
<i>AetMKK4</i>	EMT05580.X	-	<i>MKK4</i>	
<i>AetMKK5</i>	EMT03871.X	-	<i>MKK4</i>	
<i>AetMKK6</i>	EMT19002.X	-	<i>MKK6</i>	
<i>AetMKK10-5</i>	EMT23048.X	-	<i>MKK4</i>	Partial Sequence
<i>AetMKK10</i>	EMT19304.X	-	-	Partial Sequence

Note: Nucleotide and protein accessions and reported names from Ensembl Plants.

Red Wild Eincorn (*Triticum urartu*)

Gene Name	Nucleotide	Protein	Reported Names	Comments
Red Wild Einkorn MPKs				
<i>TuMPK3</i>	TRIUR3_20327-T1.X	-	<i>MPK5</i>	
<i>TuMPK7</i>	TRIUR3_17440-T1	M8A8M9	<i>MPK4</i>	
<i>TuMPK11</i>	TRIUR3_30143-T1	M7ZEQ4	<i>MPK2</i>	
<i>TuMPK14</i>	TRIUR3_09881-T1	M7ZYV1	<i>MPK3</i>	
<i>TuMPK16</i>	TRIUR3_00870-T1.X	-	<i>MPK14</i>	
<i>TuMPK17</i>	TRIUR3_13756-T1.X	-	<i>MPK12</i>	Partial sequence
<i>TuMPK20-1</i>	TRIUR3_21548-T1.X	-	<i>MPK10</i>	
<i>TuMPK20-2</i>	TRIUR3_19922-T1.X	-	<i>MPK9</i>	
<i>TuMPK20-3</i>	TRIUR3_18187-T1.X	-	<i>MPK11</i>	
<i>TuMPK20-4</i>	TRIUR3_32310-T1.X	-	<i>MPK8</i>	
<i>TuMPK21</i>	TRIUR3_01866-T1	M8A5Z4	<i>MPK17</i>	
<i>TuMPK24</i>	TRIUR3_08179-T1.X	-	<i>MPK13</i>	
Red Wild Einkorn MKKs				
<i>TuMKK1-1</i>	TRIUR3_03040-T1.X	-	<i>MKK1</i>	
<i>TuMKK1-2</i>	TRIUR3_10169-T1.X	-		Described in Ensembl as nontranslating CDS
<i>TuMKK3</i>	TRIUR3_00549-T1.X	-	<i>MKK6</i>	Partial sequence
<i>TuMKK3-2</i>	TRIUR3_07377-T1.X	-	<i>MKK6</i>	
<i>TuMKK3-3</i>	TRIUR3_10006 + 10007	-	<i>MKK1</i>	Fusion of 2 accessions; 'Other name' associated with TRIUR_10006
<i>TuMKK4</i>	TRIUR3_14235-T1.X	-	<i>MKK4</i>	
<i>TuMKK5</i>	TRIUR3_05471-T1.X	-	<i>MKK5</i>	
<i>TuMKK6</i>	TRIUR3_04435-T1	M7YY42	<i>MKK1</i>	Stop codon not reported in Ensembl, but is found in 1 st three nucleotides downstream of proposed coding sequence
<i>TuMKK10-1/3</i>	TRIUR3_19643-T1.X	-	<i>MKK4</i>	Partial sequence
<i>TuMKK10-4</i>	TRIUR3_30060-T1.X	-	-	
<i>TuMKK10</i>	TRIUR3_19642-T1.X	-	-	Partial sequence

Note: Nucleotide and protein accessions and reported names from Ensembl Plants.