

HvMAPK2 .....  
HvMAPK7 .....  
HvMAPK4 .QSRQEKIYLP PPPPLPSGIHPLSGAPPDRARRGGRAP TLP LSSPAAACARSPRRVRLA  
HvMAPK5 .....  
HvMAPK17 .....  
HvMAPK18 .MGGNGIVDG.....FRRLFHRRTPSGSVLGSSNQSSAGEDSSE  
HvMAPK3 PPPNAPAHPRNRQR CMGGRARSLIRWLRHHR SRRVSSAS SSSSSSHLTHINTSSATTATSD  
HvMAPK6 PIARLPLHPR.....RVHAP.....LPHPRPSVPAEARHT  
HvMAPK12 .....  
HvMAPK9 .....  
HvMAPK16 .....  
HvMAPK1 .....  
HvMAPK10 .....  
HvMAPK19 .....  
HvMAPK8 .....  
HvMAPK13 .....  
HvMAPK11 .....  
HvMAPK15 .....  
HvMAPK20 .....  
HvMAPK14 .....

1

HvMAPK2 .....MPEANA  
HvMAPK7 .....MQPDQQ  
HvMAPK4 VRESGGPAP.....RAGGQGSVRSPEPSWRADR  
HvMAPK5 .....  
HvMAPK17 .....  
HvMAPK18 L.....EAVEDLDLVGLRP IRVPKR  
HvMAPK3 LRARS LPLQQEDDDV EAGWEEEQDEF AEGPESDPEGYIVL EREGDAGSLRVVVP RAPAR  
HvMAPK6 ARTRAP.....EPVEG..VDPGG...SETARGSTSLRSTGRLAR  
HvMAPK12 .....  
HvMAPK9 .....MDGAPVA  
HvMAPK16 .....APGGAME  
HvMAPK1 .....MDTSGGGGGAAGGAA  
HvMAPK10 .....  
HvMAPK19 .....MAMMVD  
HvMAPK8 .....MAMLVD  
HvMAPK13 .....PSSPRPSCPPSPSHLKMAMMLVD  
HvMAPK11 .....  
HvMAPK15 .....  
HvMAPK20 .....  
HvMAPK14 .....

10 20 30 40 50 60  
HvMAPK2 GARGGGEQRSKSSDVMS F F S E Y G D A S R Y K I . E E I I G K G S Y G V V C S A I D R Q T G E K V A I K K I  
HvMAPK7 .....QHQQRRKSSDMD F F S E Y G D A N R Y K I . Q E V I G K G S Y G V V C S A I D Q H N G D K V A I K K I  
HvMAPK4 PVRQPVMQRSKSSAEVD F F T E Y G D A N R Y K I . Q E V I G K G S Y G V V C S A I D L Q T R Q K V A I K K I  
HvMAPK5 .....MQQDQRKSSAEAE F F T E Y G D A S R Y K I . Q E I V G K G S Y G V V C S A I D V H T G E K V A I K K I  
HvMAPK17 . . M Q N I D L R K K S A A E I D F F T E Y G D T N R Y K V . L E V I G K G S Y G L V C S A N D T Q T G E K V A I K K I  
HvMAPK18 K M P L P V E S H K K N I M E K E F F T E Y G E A S Q Y Q I . Q E V V G K G S Y G V V A A A I D T R T G E R V A I K K I  
HvMAPK3 T K P P R M D P G K K T S E S E F F T E Y G E L N R Y Q V . S E V I G K G S Y G V V A A A I D T Q T G E R V A I K K I  
HvMAPK6 R A P C L K R R G G . . S D K A G F F T E Y G E A T R Y E V . G E V V G K G S Y G V V A A A V D T H T G E R V A I K K I  
HvMAPK12 .....M E F F T E Y G E A S Q Y Q I . K E I I G K G S F G V V A A A V D T Q T G E W V A I K K I  
HvMAPK9 E F R P T M T H G G R F L L Y N I F G N Q F E I T A K Y Q P P I M P I G R G A Y G I V C S V M N F E T R E M V A I K K I  
HvMAPK16 N I Q A T L S H G G R F I Q Y N I F G N V F E V T A K Y K P P I L P I G K G A Y G I V C S A L N S E T G E Q V A I K K I  
HvMAPK1 Q I O G M A T H G G R Y V L Y N V Y G N L F E V A S K Y A P P I R P I G R G A Y G I V C A A V S S D T G E E V A I K K I  
HvMAPK10 .....  
HvMAPK19 P P N G I G N H G K . . H Y Y T M W Q T M F E I D T K Y V P . I K P I G R G A Y G I V C S S I N Q E T N E K V A I K K I  
HvMAPK8 P P N G M G N Q G K . . H Y Y S M W Q T L F E I D T K Y V P . I K P I G R G A Y G I V C S S I N R E T N E K V A I K K I  
HvMAPK13 P P N G M G N Q G K . . H Y Y S M W Q T L F E I D T K Y V P . I K P I G R G A Y G I V C S S I N R E T N E K V A I K K I  
HvMAPK11 .....M E R Y K V . I R E I G D G T C G N V F R A Y N I E T N E I V A V K K M  
HvMAPK15 .....M E R Y N I . I T E V G D G T F G S V W R A I N K S E G E V V A I K K M  
HvMAPK20 .....M D R F K L . I K E V G D G T F G S V W R A I N K Q N G E V V A V K K M  
HvMAPK14 .....M D R F K L . I K E V G D G T F G S V W R A I N K Q N G E V V A V K K M

70 80 90 100 110 120  
HvMAPK2 S N I F E H I T D A A R I L R E I K L L R L L R H P D I V Q I K H I M L P P S R R D F K D I Y V V F E L M D T D L H Q V  
HvMAPK7 H N I F E H L S D A A R I L R E I K L L R L L R H P D I V E I R H I M L P P S R R D F K D I Y V V F E L M D T D L H Q V  
HvMAPK4 H N I F E H T S D A A R I L R E I K L L R L L R H P D V V E I K H I M L P P S R R D F K D I Y V V F E L M E S D L H Q V  
HvMAPK5 H D I F E H I S D A A R I L R E I K L L R L L R H P D I V E I K H I M L P P S R R D F K D I Y V V F E L M E S D L H Q V  
HvMAPK17 H N I F E H I S D A A R I L R E I K L L R L L R H P D V V E I K H I L L P P S K K D F K D I Y V V F E L M E S D L H Q V  
HvMAPK18 N D V F E H V S D A T R I L R E V K L L R L L R H P D V V E I K H I M L P P S R R E F Q D I Y V V F E L M E S D L H Q V  
HvMAPK3 N D V F D H V S D A T R I L R E I K L L R L L R H P D I V Q I K H I M L P P S R R E F R D I Y V V F E L M E S D L H Q V  
HvMAPK6 D D V F E H V S D A T R I L R E V K L L R L L R H P D I V Q I K H I M L P P S R R E F R D I Y I V F E L M E S D L H Q V  
HvMAPK12 H D M F E H A S D G T R I L R E I K L L R L L R H P N I V E I K H I L L P P A R R E F R D I Y V V F E L M E S D L Q V  
HvMAPK9 A N A F D N N M D A K R T L R E I K L L R H L D H E N I V L R D V I P P A I P Q S F N D V Y I A E L M D T D L H Q I  
HvMAPK16 A N A F D N K I D A K R T L R E I K L L R H M D H E N I V A I R D I I P P A Q R T A F N D V Y I A E L M D T D L H Q I  
HvMAPK1 G N A F D N H I D A K R T L R E I K L L R H M D H E N I L A M K D L I R P P R R D F K D V Y I V T E L M D T D L H Q I  
HvMAPK10 .....  
HvMAPK19 N N V F D N R V D A L R T L R E L K L L R H L R H E N V I A L K D I M P V Q R R S F K D V Y L V S E L M D T D L H Q I  
HvMAPK8 H N V F D N R V D A L R T L R E L K L L R H L R H E N V I S L K D I M P V Q R R S F K D V Y L V Y E L M D T D L H Q I  
HvMAPK13 H N V F D N R V D A L R T L R E L K L L R H L R H E N V I S L K D I M P V Q R R S F K D V Y L V Y E L M D T D L H Q I  
HvMAPK11 K R K F Y H W E E C I S . L R E V K A L Q K I N H P N I V Q L K E V T M . . . . E N H E L F F I F E H M D C N L Y D V  
HvMAPK15 K K K Y S F E E C M S . L R E V K S L R R M H P N I V K L K E V I R . . . . E N D M L F F V F Y E M C N L Y Q L  
HvMAPK20 K R K Y S F E E C M S . L R E V K S L R R M H P N I V K L K E V I R . . . . E N D I L Y F I M E Y M C N L Y Q L  
HvMAPK14 K R K Y S F E E C M S . L R E V K S L R R M H P N I V K L K E V I R . . . . E N D I L Y F I M E Y M C N L Y Q L

130 140 150 160 170 180
HvMAPK2 IKAN.DD LTK EHF QFFFLYQMLRA MKYIHTAN VYHRDLKPKNILANAN CKLKICDFGLARV
HvMAPK7 IKAN.DD LTK EHF QFFFLYQMLRA MKYIHTAN VYHRDLKPKNILANAN CKLKICDFGLARV
HvMAPK4 IKAN.DD LTK EHF QFFFLYQMLRA MKYIHTAN VYHRDLKPKNILANAN CKLKICDFGLARV
HvMAPK5 IKAN.DD LTK EHF QFFFLYQMLRA MKYIHTAN VYHRDLKPKNILANAN CKLKICDFGLARV
HvMAPK17 IRAN.DD LTA EHY QFFFLYQMLRA LKYIHGAN VFHRDLKPKNILANAD CKLKICDFGLARV
HvMAPK18 IRAN.DD LTA EHY QFFFLYQMLRA LKYIHGAN VFHRDLKPKNILANAD CKLKICDFGLARV
HvMAPK3 IKAN.DD LTP EHF QFFFLYQMLRA MKYIHTAN VYHRDLKPKNILANAN CKLKICDFGLARV
HvMAPK6 IKAN.DD LSP EHF QFFFLYQMLRA MKYIHTAN VYHRDLKPKNILANAN CKLKICDFGLARV
HvMAPK12 IQVN.DN LTK GHHRFFFLYQMLRA LKYIHTAN VFHRDLKPKNILANAN CKLKICDFGLARV
HvMAPK9 IRSN.QE LSE EHC QYFFLYQMLRA LKYIHTAN VIHRDLKPKNILANAN CDLKICDFGLARV
HvMAPK16 IRSN.QA LSE EHC QYFFLYQMLRA LKYIHTAN VIHRDLKPKNILANAN CDLKICDFGLARV
HvMAPK10 IRSN.QS LTD DHC QYFFLYQMLRA LKYIHTAN VIHRDLKPKNILANAN CDLKICDFGLARV
HvMAPK19 VKSS.QP LSN DH CQYFFLYQMLRA LKYIHTAN VIHRDLKPKNILANAN CDLKICDFGLARV
HvMAPK8 IKSP.QG LSN DH CQYFFLYQMLRA LKYIHTAN VIHRDLKPKNILANAN CDLKICDFGLARV
HvMAPK13 IKSP.QG LSN DH CQYFFLYQMLRA LKYIHTAN VIHRDLKPKNILANAN CDLKICDFGLARV
HvMAPK15 IRERSAP FSE EE IRK FMLQLIQGLVYMHNGYF HRDLKPKNILANAN GIKVADDFGLARE
HvMAPK11 MKSKGKPFSE ETE IRN WCFQVFA LSHMHQRGYF HRDLKPKNILANAN ELIKVADDFGLARE
HvMAPK20 MKDRVKPFAESDVRN WCFQIFQALAYMHORGYF HRDLKPKNILANAN DVLKADDFGLARE
HvMAPK14 MKDRVKPFAESDVRN WCFQIFQALAYMHORGYF HRDLKPKNILANAN DVLKADDFGLARE

190 200 210 220 230 240
HvMAPK2 AFND.TPTTVFWDYVATRWRAPPELLCGSFFTKYSP AIDTWSIGCIFAEILTCKPLFPFGK
HvMAPK7 AFND.TPTTVFWDYVATRWRAPPELLCGSFFTKYSP AIDIWSIGCIFAEILTCKPLFPFGK
HvMAPK4 AFND.TPTTVFWDYVATRWRAPPELLCGSFFTKYTP AIDIWSIGCIFAEILTCKPLFPFGK
HvMAPK5 AFND.TPTTVFWDYVATRWRAPPELLCGSFFSKYTP AIDVWSIGCIFAEILTCKPLFPFGK
HvMAPK17 AFND.APTTVFWDYVATRWRAPPELLCGSFFSKYTP AIDIWSIGCIFAEILTCKPLFPFGK
HvMAPK18 SFND.APSAIFWTDYVATRWRAPPELLCGSFFSKYTP AIDIWSIGCIFAEILTCKPLFPFGK
HvMAPK3 SFNDGAPSAIFWTDYVATRWRAPPELLCGSFFSKYTP AIDIWSIGCIFAEILTCKPLFPFGK
HvMAPK6 SFND.TPSAIFWTDYVATRWRAPPELLCGSFFSKYTP AIDIWSIGCIFAEILTCKPLFPFGK
HvMAPK12 SRDD.VPSAIFWTDYVATRWRAPPELLCGSFFSKVHP CD.....
HvMAPK19 .SE....SDMMTEYVATRWRAPPELLLSNS.DYSA AIDVWSVGCIFMELINRAPLFPFGK
HvMAPK16 .TSE....TDFMTEYVATRWRAPPELLLSNS.SEYTA AIDVWSVGCIFMELMDRKLFPFGR
HvMAPK1 .TSE....TDLMTEYVATRWRAPPELLLSNS.SQYTA AIDVWSVGCIFMELITRQPLFPFGR
HvMAPK10 .SE....MTEYVATRWRAPPELLLSNS.DKYGT SVDVWSVGCIFAEILGRKSIFFPGT
HvMAPK19 NNTK....GQFMTEYVATRWRAPPELLLSNS.DNYGT SIDVWSVGCIFAEILGRKPIFFGT
HvMAPK8 NSK....GQFMTEYVATRWRAPPELLLSNS.DNYGT SIDVWSVGCIFAEILGRKPIFFGT
HvMAPK13 NSK....GQFMTEYVATRWRAPPELLLSNS.DNYGT SIDVWSVGCIFAEILGRKPIFFGT
HvMAPK11 VCS....PPYTDYVATRWRAPPELLLSNS.SAYTP SIDMWAIGAILAEILTLSPFPFGE
HvMAPK15 IISE....PPYTDYVATRWRAPPELLLSNS.SYSS AVDMWAMGAI IAEILSHRPLFPFGS
HvMAPK20 VSA....PPYTDYVATRWRAPPELLLSNS.SAYDS AVDMWAMGAI MAEILT HPLFPFGT
HvMAPK14 VSA....PPYTDYVATRWRAPPELLLSNS.SAYDS AVDMWAMGAI MAEILT HPLFPFGT

250 260 270 280 290 300
HvMAPK2 NVVHQLDLMTDFLGTPSPDIISRIRNEKARRYLSTMRKKLPVPFSEKFPNADPAVKKLLQ
HvMAPK7 NVVHQLDLMTDFLGTPSLDITVSRIRNEKARRYLSTMRKKQTPVCFSEKFPKADPAALVKLLQ
HvMAPK4 NVVHQLDLMTDFLGTPSPMDTISRIRNEKARRYLSTMRKKDPVPFSEKFPNADPLGKLLQ
HvMAPK5 NVVHQLDLMTDFLGTPSPMDTISRIRNEKARRYLSTMRKKKEPISFSEKFPNADPLALDLLQ
HvMAPK17 NVVHQLDLITDFLGTPSLDASIQVWIFGG.....FAVKVIV
HvMAPK18 NVVHQLDLITDFLGTPSPSETLSRIRNEKARRYLSTMRKKKHPVPLTQKFPNADPLAVRLLQ
HvMAPK3 NVVHQLDLMTDFLGTPSAESLAKIRNEKARRYLSTMRKKKVPVLTQKFPNADPLALDLLQ
HvMAPK6 NVVHQLDLMTDFLGTPSAESLSRIRNEKARRYLSTMRKKKHPVPLTQKFPNADPLALDLLQ
HvMAPK12 .SE....SDMMTEYVATRWRAPPELLLSNS.DYSA AIDVWSVGCIFMELINRAPLFPFGK
HvMAPK9 DHMHQMLRITVIGTPTDDD LGFIRNEDARRYMRHLPQFPRRPFQGF PKVQPAALDLIE
HvMAPK16 DHVHQMLRLLMELISTPSPVQYSLFR.DSTTDYIQM.....IDIL
DYIQQLKILITELIGSPDSS LGFLRSNARRYMKOLPQYPRQDFRLRFRNMSDGAVDLLE
HvMAPK10 ECLNQLKLIVDVLGTMSDANLEF IGNTKARKYVKSLSYTVGVPLTRMY PQAHP LAIDLLE
HvMAPK19 DCLNQLKLIVNVLGTMSDANLEF IDNSKARKYIKSLPYTPGIPLSMSY PQAHP LAIDLLE
HvMAPK8 ECLNQLKLIVNVLGTMSDANLEF IDNPKARKYIKSLPYTPGVPVLSMSY PQAHP LAIDLLE
HvMAPK11 ECLNQLKLIVNVLGTMSDANLEF IDNPKARKYIKSLPYTPGVPVLSMSY PQAHP LAIDLLE
HvMAPK13 TETDQLFKICAVLGTDP.HSLWPEGMNLPSSSFQFPQIPPRNLWELI PNASLEALDLTK
HvMAPK15 SEADEIYKICNVLGTSP.QHTWAGGLQLAASIHFPFQSGSINLSEVVP TASEDALNLLIS
HvMAPK20 SEADEILKICNVLGTSP.EQWTPQGLSLAEAMKYQFPQIRGNQLSEVMKSSASEAVDLIS
HvMAPK14 SEADEILKICNVLGTSP.EQWTPQGLSLAEAMKYQFPQIRGNQLSEVMKSSASEAVDLIS

310 320 330 340 350
HvMAPK2 KLLAFDPPKDRPTAEAEALADPYFKG...LAKVEREPSCQPI SKMEFEFERRKFTKEE VKE
HvMAPK7 RLLAFDPPKDRPTAEAEALADPYFKG...LGKVEREPSCQPI SKFEFEFERRKFTKED VKE
HvMAPK4 KLLAFDPPKDRPTAEAEALADPYFKG...LSKVEREPSCQPI SKMEFEFERRKFTKED VKE
HvMAPK5 RLLAFDPPKDRPTAEAEALADPYFKG...LAKVEREPSCQPI SKMEFEFERRRVTKED VKE
HvMAPK17 RVCL.....LANVEREPSCQPI SKMEFEFERRRVTKED VKE
HvMAPK18 RLLAFDPPKDRPTAEAEALADPYFKG...LANVEREPSCQPI SKMEFEFERRRVTKED VKE
HvMAPK3 RLLAFDPPKDRPTAEAEALADPYFKG...LANVEREPSCQPI SKMEFEFERRRVTKED VKE
HvMAPK6 RLLAFDPPKDRPTAEAEALADPYFKG...LANVEREPSCQPI SKMEFEFERRRVTKED VKE
HvMAPK12 .SE....SDMMTEYVATRWRAPPELLLSNS.DYSA AIDVWSVGCIFMELINRAPLFPFGK
HvMAPK9 RMLTFNPLQRI TVEEALEHPYLER...LHDVADEPICT..DPFSDFEQHPLETEDQMKO
HvMAPK16 RMLVFDPPSRRI TVDEALHHPYLAS...LHDINEEPTCP..APFSDFEQHPLETEDQMKO
HvMAPK1 RMLVFDPPSRRI TVDEALHHPYLAS...LHDINEEPTCP..APFSDFEQHPLETEDQMKO
HvMAPK10 KMLVFDPPSKRISVTEALEHPYMS...LYDPSANHPAQ..APIDLIDIDE.LGVDMIRE
HvMAPK19 KMLVFDPPSKRISVTEALEHPYMS...LYDPSANHPAQ..APIDLIDIDE.LGVDMIRE
HvMAPK8 KMLIFDPPTKRISVTEALEHPYMS...LYDPSANHPAQ..APIDLIDIDE.LGVDMIRE
HvMAPK13 KMLIFDPPTKRISVTEALEHPYMS...LYDPSANHPAQ..APIDLIDIDE.LGVDMIRE
HvMAPK11 QLCSWDPKRRPTAEALQHPFFNV.RKWWQRP LHDASYSKMNEPRATPPRELD...L
HvMAPK15 WLCSWDPKRRPTAEALQHPFFNV.RKWWQRP LHDASYSKMNEPRATPPRELD...L
HvMAPK20 SLCSWDPCKRPAAEVLQHPFFNV.RKWWQRP LHDASYSKMNEPRATPPRELD...L
HvMAPK14 SLCSWDPCKRPAAEVLQHPFFNV.RKWWQRP LHDASYSKMNEPRATPPRELD...L

360 370 380 390 400 410  
HvMAPK2 LIFREI LEYHPQLLKDYTNNGSEKTNFLYPSAVDNFRRQFANLEEDGGKGGAPE...RKHV  
HvMAPK7 LIFREI LEYHPQLLKDYMNNGTEKTNFLYPSAVDNFRRQFANLEENGKGGKGGAVVPSDRKHV  
HvMAPK4 LIFREI LEYHPQLLKSYIDGTERTTFLYPSAVDHFRRQFANLEESDGGSG.PVVPADRKHA  
HvMAPK5 LIFREI LEYHPQLLKDYTNNGTERTTFLYPSAVDQFRKQFAHLEENTENG.PVVPMDRKHT  
HvMAPK17 .....  
HvMAPK18 LIYREI LEYHPQMLEEYMKGGDQISFLYPSGVDRFKRQFAHLEEHYKSKGERGSP LQRKHA  
HvMAPK3 LIYREI LEYHPHMLQEYLRGGDQMSFMYPSGVDRFKRQFAHLEKGGAKGDKSSPQLRQNA  
HvMAPK6 .....  
HvMAPK12 .....  
HvMAPK9 LIFNEA LELNPNFRY.....  
HvMAPK16 .....  
HvMAPK1 LIWREI LAFNPDPY.....  
HvMAPK10 MLWQEM LQYF.....  
HvMAPK19 MLWQEM LQYHP EAARMVNM.....  
HvMAPK8 MMWQEM LHYHP EAAAAVNM.....  
HvMAPK13 MMWQEM LHYHP EAAAAVNM.....  
HvMAPK11 WGFGEI SDD.LDLTLSLKPS..SVSDLGKR.....VPE.....RREEQNLLYPGYG  
HvMAPK15 YPVGTL SNGRP AVNNSYLSTNAPARAAGVQRKLELDHQVKPEGNHKLTTKENAMNQPSWR  
HvMAPK20 YSTGAL STSKPAGNISIKPN..SLSKIGVQRKLQLDRQA.PE.KKSTRPAESNTKQTTSR  
HvMAPK14 YSTGAL STSKPAGNISIKPN..SLSKIGVQRKLQLDRQA.PE.KKSTRPAESNTKQTTSR

420 430 440  
HvMAPK2 SLPRTTTVHSTPIPTTSGP.....ASQAPQRIPTA  
HvMAPK7 SLPRTTTVHSTPIPPKDK.....PSQVPQRIPTG  
HvMAPK4 SLPRSTIVHSTPIPAKDTR..PLFGKPCS...KTSSETGRYAGNGHGASQASHAAQAV  
HvMAPK5 SLPRSTIVHSAPIHAKEQPRIGPSRDKPSFDES YKNPRDSEKYSGNVQRTSLAPQRVPTA  
HvMAPK17 .....  
HvMAPK18 SLPRQRV GASNDSNNEQHI.....SDQEMS  
HvMAPK3 SLPRERAIGNKHGDSEYQV.....KLN..T  
HvMAPK6 .....  
HvMAPK12 .....  
HvMAPK9 .....  
HvMAPK16 .....  
HvMAPK1 .....  
HvMAPK10 .....  
HvMAPK19 .....  
HvMAPK8 .....  
HvMAPK13 .....  
HvMAPK11 NPP..VQPGLWPLMSSSHRP.....  
HvMAPK15 LPPAPVRNNMNYLAAKEQIPR.....GGAPDIA  
HvMAPK20 VPARNSPVNANPMLRHSRS.....  
HvMAPK14 VPARNSPVNANPMLRHSRS.....

450 460 470 480 490 500  
HvMAPK2 RPRGVVASATPIENAAFADROTGRMS..RDPAAAPAAAAAGYTLRFPDPCPDROQQQQQQE  
HvMAPK7 RPRGVVGPVIPPENSCAMPDYSQRRVA..RNPVLPAAATNLSAYAYHRKSDNTERELQVE  
HvMAPK4 VSRRAAGSALPYEGSGKHPYD.VASRPAMSTGCPPQQQIPQMYGQYQHAPAGAGAGAG  
HvMAPK5 RPRGVVGPVLPYENGGMKDTPRRVAAAMNSGYAPQQQIPQIYGYQTPAKSACSEPSQ  
HvMAPK17 .....  
HvMAPK18 AEPDAHGAVSPQKPDAPGVGQNGLSPTSLSSRTYLSASISASKCVVVPNKQPEYDDA  
HvMAPK3 GEKPVHASVT.....DGISKPLMSARSLKSETMSASKCIGEIKNKDDEL...  
HvMAPK6 .....  
HvMAPK12 .....  
HvMAPK9 .....  
HvMAPK16 .....  
HvMAPK1 .....  
HvMAPK10 .....  
HvMAPK19 .....  
HvMAPK8 .....  
HvMAPK13 .....  
HvMAPK11 ..LGEAPVMP SWQQAYMLDSHATTLPAAGGGGFP GSSPFGFLFP LQ.....PNLMENRSL  
HvMAPK15 EKLSQLSMSTTTTRAPIMPSDRFVDL KATTRAHGEPVRRPVPLGPRDTWHARNDPFRRTYE  
HvMAPK20 ..LPETGRATVHKVSSIT.ERLAHMSVTSRTR.TTVKPPVPLLKAG..HLKSDFLGKSDE  
HvMAPK14 ..LPETGRATVHKVSSIT.ERLAHMSVTSRTR.TTVKPPVPLLKAG..HLKSDFLGKSDE

510 520 530  
HvMAPK2 LEKDRTRYR PALHFRDARVAPEA.EARPSAYYIP.....  
HvMAPK7 LEKDRMQYQPMQRFMDAKMVSP..DLRSSSYMPKGVPKADVAERTALQPNMMQG.....  
HvMAPK4 AGIP.QAMGGYACGGYAKGTAPAPAMRAPTYRHVPAGQKNGRLDLAVETTDIYTRSLNG  
HvMAPK5 AEMYTLHQAYACANSSTVPDVALDMRAPPFHQS.AVPKRGSSDRLSAES.NLYSRSLNG  
HvMAPK17 .....  
HvMAPK18 ISEETEGAVDGLSEKVKSMHA.....  
HvMAPK3 ..ESVDAADGV SQKIAQLKT.....  
HvMAPK6 .....  
HvMAPK12 .....  
HvMAPK9 .....  
HvMAPK16 .....  
HvMAPK1 .....  
HvMAPK10 .....  
HvMAPK19 .....  
HvMAPK8 .....  
HvMAPK13 .....  
HvMAPK11 AP..APIRQVNF.....MP  
HvMAPK15 MPGERALLQRKLV.....IP.PAKRLTRKLV.....  
HvMAPK20 IP.PAKRLTRKLV.....  
HvMAPK14 IP.PAKRLTRKLV.....

540

550

HvMAPK2 . . . PFNGIAAVAGGYSKVGAA . . . ARMY  
HvMAPK7 . IAPFNGIAAVGGSYNKASAVQYGVSRMY  
HvMAPK4 IVAAAAASAGTASAHRKVGTVPFGMPPTY  
HvMAPK5 . . MAPTTSGVAASGHRKVGVPYGVSQMY  
HvMAPK17 . . . . .  
HvMAPK18 . . . . .  
HvMAPK3 . . . . .  
HvMAPK6 . . . . .  
HvMAPK12 . . . . .  
HvMAPK9 . . . . .  
HvMAPK16 . . . . .  
HvMAPK1 . . . . .  
HvMAPK10 . . . . .  
HvMAPK19 . . . . .  
HvMAPK8 . . . . .  
HvMAPK13 . . . . .  
HvMAPK11 . . . . .  
HvMAPK15 . . . . .  
HvMAPK20 . . . . .  
HvMAPK14 . . . . .