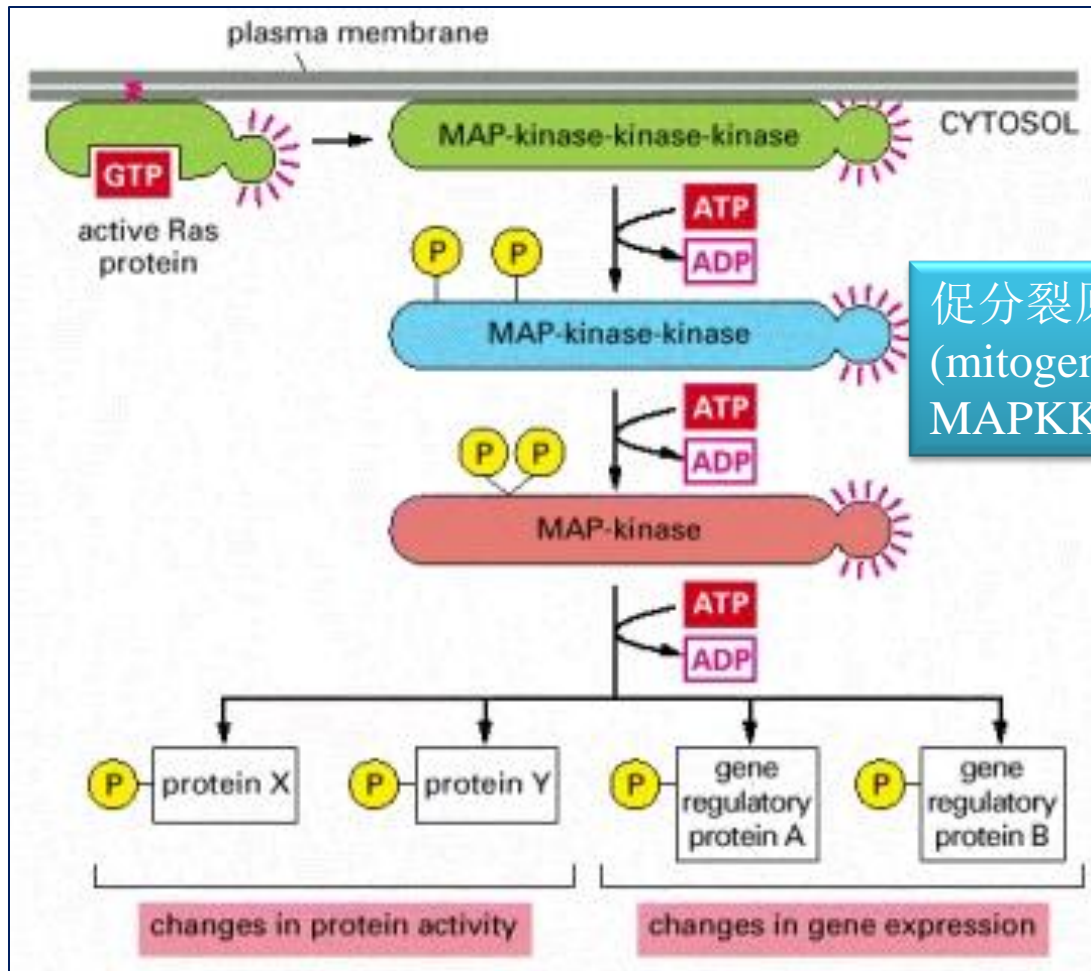


马铃薯促分裂原活化蛋白激酶激酶基因 的电子克隆与生物信息学分析

G1: 陶永宏 魏琦超 尚慧捷
韩海明 张 凡

MAPKK与细胞信号转导



促分裂原活化蛋白激酶激酶
(mitogen-activated protein kinase kinase,
MAPKK)

图1 MAPK的Ser/Thr磷酸化途径

(Molecular Biology of the Cell. 4th edition. Alberts B, Johnson A, Lewis J, *et al.*
New York: Garland Science; 2002.)

马铃薯MAPKK相关EST序列的获得

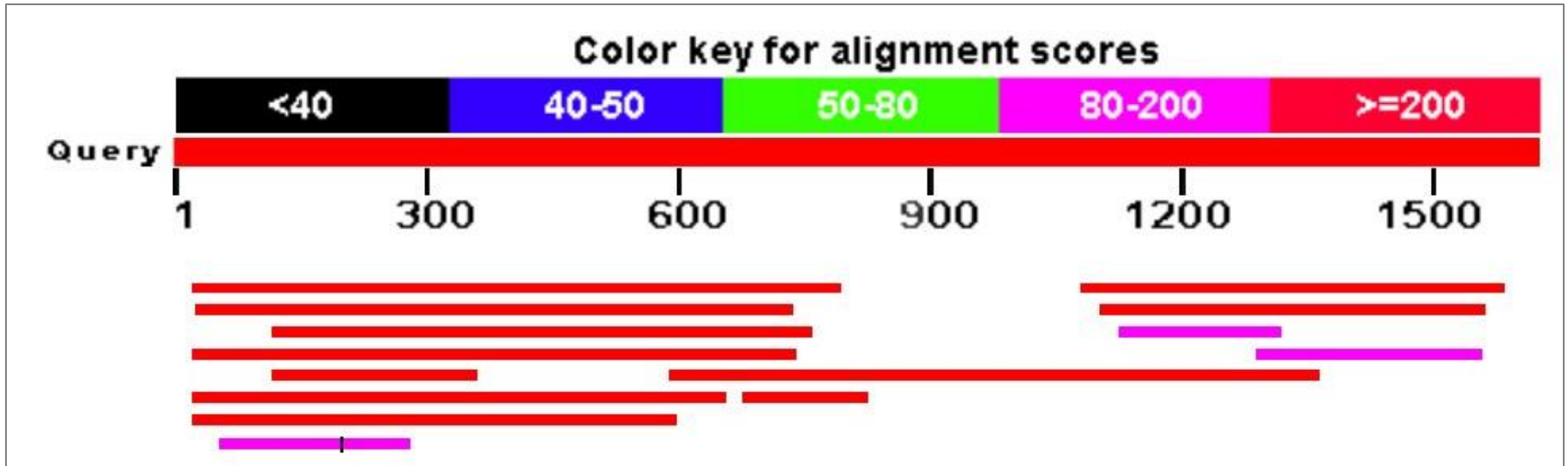


图2 烟草MAPKK基因(AF165186)搜索马铃薯EST数据库

马铃薯MAPKK相关EST序列的拼接

Name	Length	Original length	5' Trimmed bases	3' Trimmed bases
Contig 1	1694			
↓ BQ046541	721	721	0	0
↓ CK717209	643	645	0	0
↓ DR034420	805	805	0	0
↓ CK718148	739	739	0	0
↓ BM111756	789	789	0	0
↓ BG594745	641	642	0	0
↓ CV475714	767	767	0	0
↓ CV499729	496	496	0	0
↓ CK565470	205	205	0	0
↓ BQ513535	347	347	0	0

图3 马铃薯MAPKK相关EST序列的拼接结果

马铃薯MAPKK相关EST重叠群的ORF分析

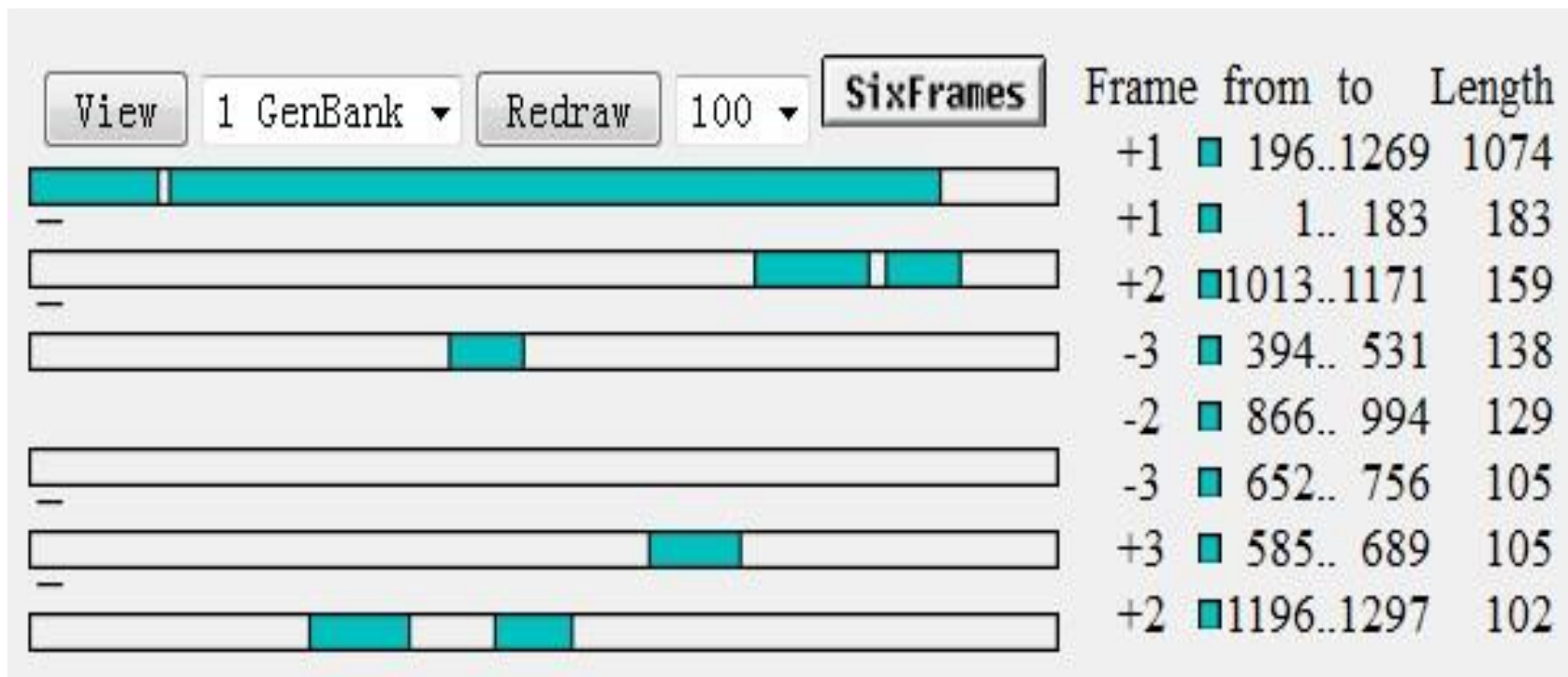


图4 马铃薯MAPKK相关EST重叠群的ORF分析

利用plotorf(v6.0.1)软件分析马铃薯MAPKK ORF

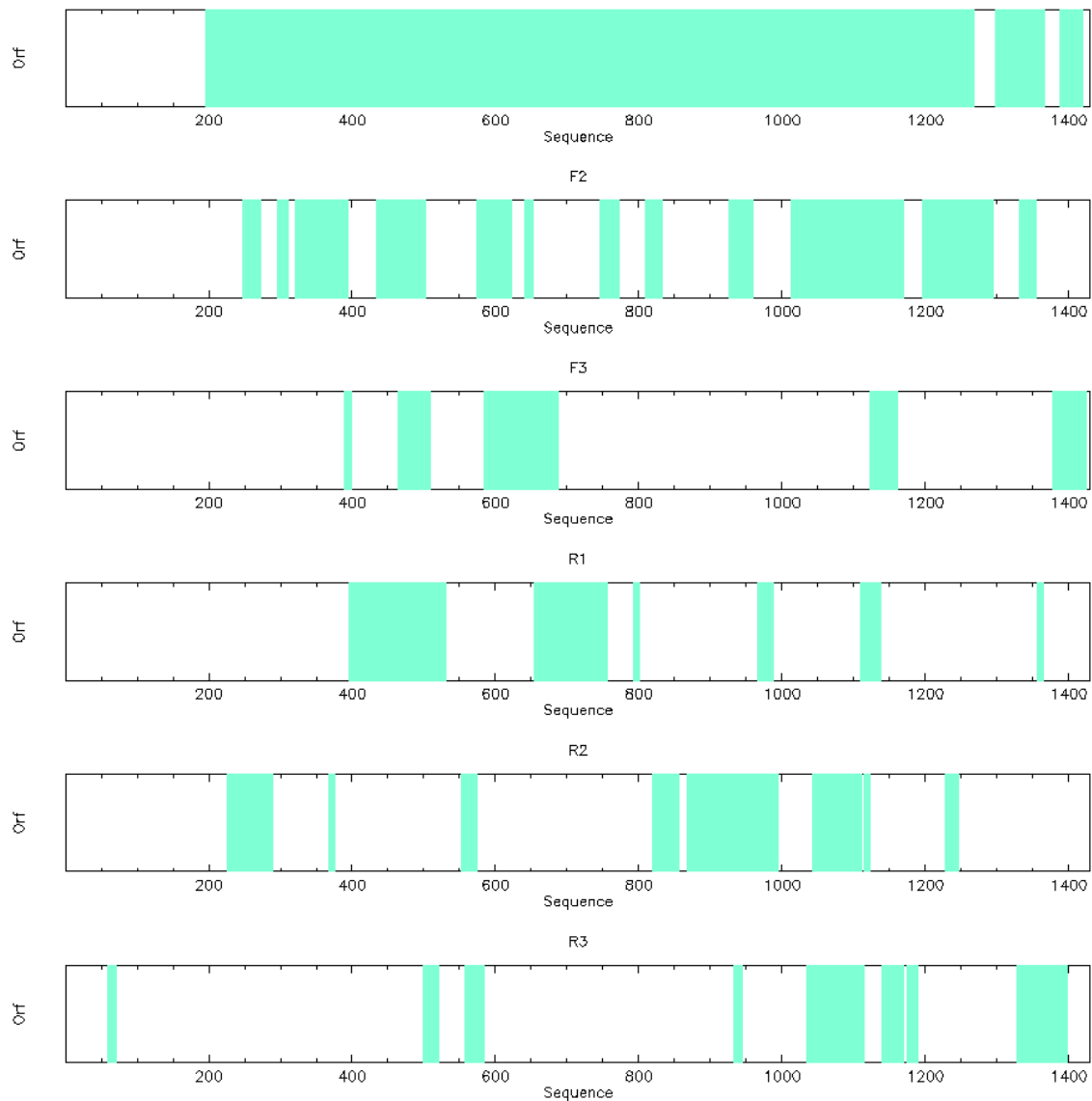


图5 利用plotorf (v6.0.1) showorf (v6.0.1) getorf (v6.0.1) 软件分析DNA序列

马铃薯MAPKK相关ORF的序列信息

```
1      GGTTCCTGG AAGCAATTTT ACAAGATTTT TATATAAGAG TGAACTTTAA GAAGAATTAC
61     CAAAACCCCA TTTGCCTGAA AGCAACTTTT ACTTTGGGTG TTCAAGATTT CAATAAAAAA
121    GTGATTTTTA AGAAGAATTC AAGAACCCCA GTTGCCCAAG AAGCAATTTT TACTGTGATT
181    TAACAAAATT TAGCTATGAA GAAAGGATCT TTTGCTCCTA ATCTTAAACT TTCTCTCCT
241    CCTCCTGATG AAGTTGCTCT CTCCAAATTC CTGACTGAAT CAGGAACATT TAAGGATGGA
301    GATCTTCTGG TGAATAGAGA TGGAGTTCGA ATTGTTTCGC AGAGTGAAGT TGCAGCTCCT
361    TCAGTTATAC AGCCATCAGA CAACCAGTTA TGCTTAGCTG ATTTTGAAGC AGTTAAAGTT
421    ATTGGAAAGG GAAATGGTGG TATTGTGCGG CTGGTTCAGC ATAAATGGAC AGGGCAATTT
481    TTCGCTCTCA AGGTTATTCA GATGAATATT GACGAGTCCA TGCGCAAACA TATTGCTCAA
541    GAACTGAGAA TTAATCAGTC ATCCAGTGT CCATATGTTG TCATATGCTA TCAGTCGTTC
601    TTCGACAATG GTGCTATATC CTTAATTTTG GAGTATATGG ATGGTGGTTC CTTAGCAGAT
661    TTTCTGAAAA AGGTCAAAC AATACCTGAA CGATATCTTG CTGTTATCTG CAAGCAGGTT
721    CTCAAAGGCT TGTGGTATCT TCATCATGAG AAGCATATTA TTCACAGGGA TTTGAAACCT
781    TCGAATTTGC TAATCAATCA TAGAGGTGAT GTCAAATCA CAGACTTTGG TGTGAGTGCA
841    GTACTGGCAA GCACATCTGG ACTGGCTAAT ACCCTTGTCG GAACATACAA CTATATGTCT
901    CCAGAGAGAA TTTCAGGAGG TGCCTATGAT TACAAAAGCG ACATTTGGAG CTTGGGTTTA
961    GTCTTACTCG AGTGTGCAAC AGGTCATTTT CCATATACAC CACCCGAGGG AGATGATGGC
1021   TGGGTCAACG TCTATGAACT TATGGAAACC ATTGTTGACC AACCAGAACC TTGTGCACCT
1081   CCTGACCAAT TTTCTCCACA ATTCTGCTCA TTCATATCTG CATGTGTCCA GAAGCATCAG
1141   AAGGACAGAC TGTCAGCAA TGAACCTATG AGTCACCCTT TCATCACCAT GTACGATGAC
1201   CAGGATATCG ATCTTGGATT TTACTTCACT TCCGCAGGAC CTCCATTGGC AACACTCACT
1261   GAGCTATAAT TGGTTTTCTA CAATGTCTTG CAACTGATGG AATTTTGGTC AATTAGCTTT
1321   TCCAGTCGCA ACGTTCCAAA AATTAGAAGC CTTTTAAGAA GGCATTGAGA ATCAAAATGA
1381   AGCAGATGGA GCCATTGTTG TACTTTTCAA GCCTCCGGTA GGTAGCGTTG GGAGTGTAAC
1441   TGTGACATTT TCTACTATGT ATGTGATTCA AATGGGAACA ACTCCAGATA TCCTTTTGAT
1501   ATGACTTATT TTTGACATTA ATCCTTGGTG GTGCAAGTGT TTTTGGTTTA CAATTTGACT
1561   TCTACCTTTT AGCACATGAA GTTGTTTATT GTCAGTGTTG AACTGAATGT AAAATTATTA
1621   AGCTCCCAT TCTCCTAAAA AAAAAAAAAA AAAAAAAAAA AAAAAAAAAA
```

图6 马铃薯MAPKK相关ORF的序列信息

马铃薯MAPKK相关ORF的翻译

1	MKKG	SFAPNL	KL	SLPPPDEV	AL	SKFLT	ESG	TF	KDGD	LLVN	RD	GV	RIV	SQS	EVA	AP	S	VI	IQP					
61	SD	NQLCL	ADF	EAV	KVIG	KGN	GG	IV	RLV	QHK	WT	GQ	FF	ALKV	IQ	MN	IDE	SMR	KH	IA	QEL	RIN		
121	QSS	QCP	YVVI	CY	QS	FF	DNGA	IS	LILE	YMDG	GS	LAD	FL	KKV	KT	IP	ERY	LAV	IC	KQ	VL	KGLW		
181	YL	HHE	KHIIH	RDL	KPS	NLLI	NH	RG	DVK	ITD	FG	VSA	V	LAST	SG	LANT	LV	GT	YN	YM	S	PERIS		
241	GG	AY	DYK	SDI	WS	LGL	VLL	EC	AT	GH	FP	YTPP	EG	DD	GW	VNVY	EL	MET	I	V	DQP	EPC	APP	DQFS
301	PQ	FC	SFISAC	VQ	KH	QK	DRLS	AN	EL	MS	HP	FI	TM	YDD	Q	DIDL	GS	YFT	S	AG	PP	LAT	L	TEL

图7 马铃薯MAPKK相关ORF的翻译

马铃薯StMAPKK氨基酸残基的统计分析

StMAPKK氨基酸残基分布及与SwissProt的比较

Residue	SwissProt*	StMAPKK	
	Number	Number	Mole%
A = Ala	8.26	21	5.882
C = Cys	1.36	8	2.241
D = Asp	5.46	24	6.723
E = Glu	6.75	17	4.762
F = Phe	3.86	16	4.482
G = Gly	7.08	25	7.003
H = His	2.27	10	2.801
I = Ile	5.97	23	6.443
K = Lys	5.85	21	5.882
L = Leu	9.66	37	10.364
M = Met	2.42	8	2.241
N = Asn	4.06	13	3.641
P = Pro	4.7	21	5.882
Q = Gln	3.93	17	4.762
R = Arg	5.53	10	2.801
S = Ser	6.55	29	8.123
T = Thr	5.34	15	4.202
V = Val	6.87	25	7.003
W = Trp	1.08	4	1.12
Y = Tyr	2.92	13	3.641

马铃薯StMAPKK的柔性分析

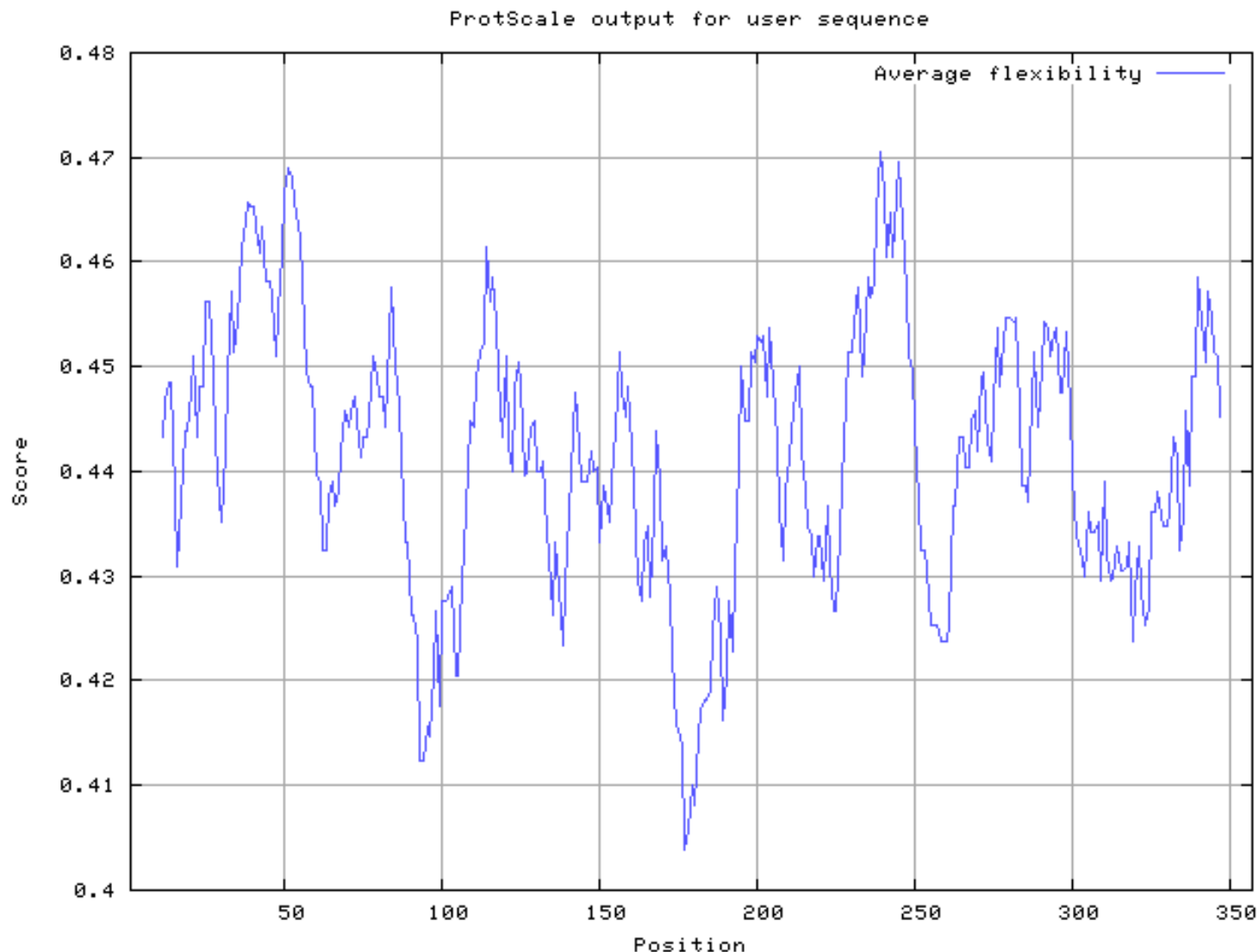


图9 StMAPKK的柔性图谱

(<http://web.expasy.org/protscale/>, Window size=21)

马铃薯StMAPKK的溶剂可及性分析

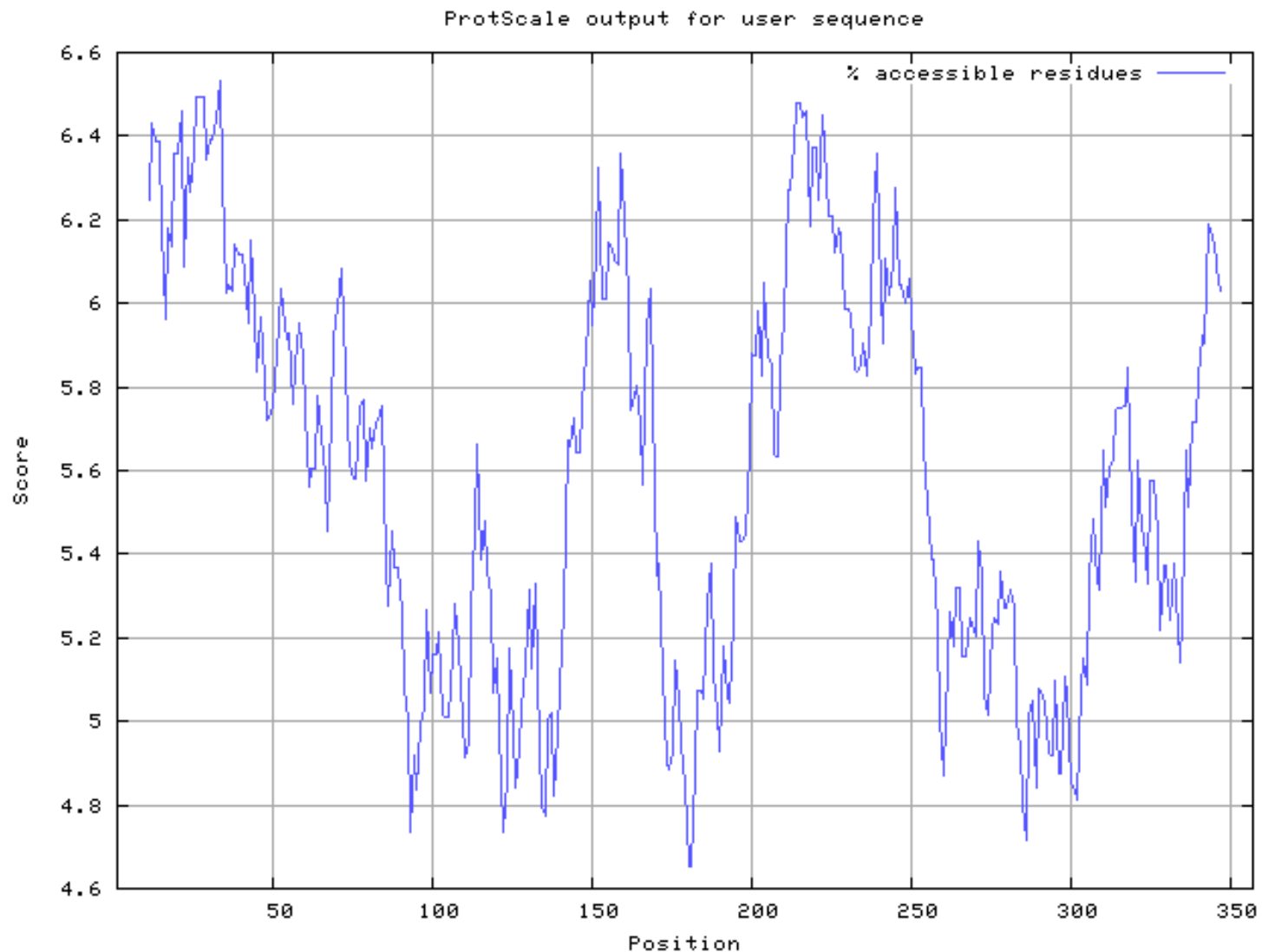


图10 StMAPKK的溶剂可及性图谱
(<http://web.expasy.org/protscale/>, Window size=21)

马铃薯StMAPKK的同源建模

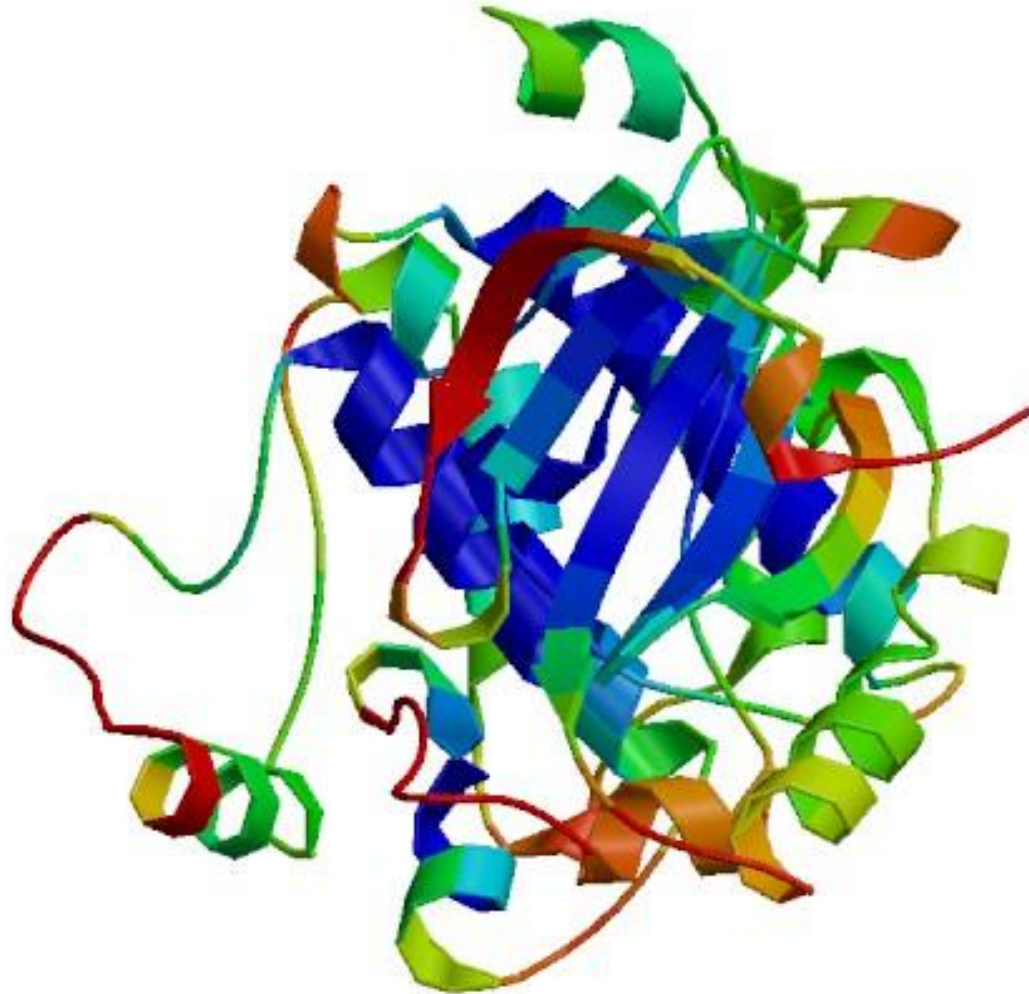


图11 马铃薯MAPKK的同源建模可靠性分析

马铃薯StMAPKK的同源建模



图12 马铃薯MAPKK的同源建模

蛋白质互作分析

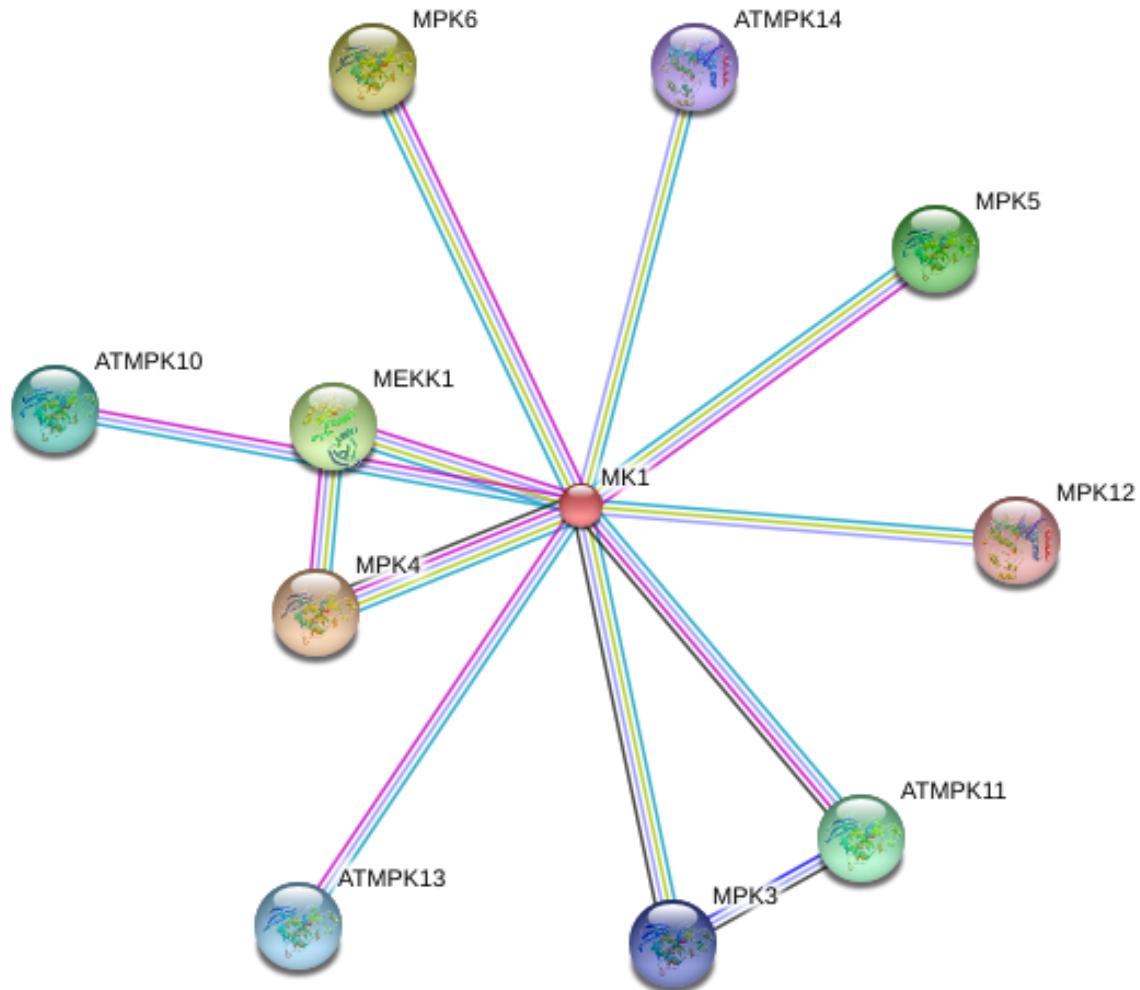


图13 蛋白质互作分析

马铃薯MAPKK蛋白质序列保守结构域分析

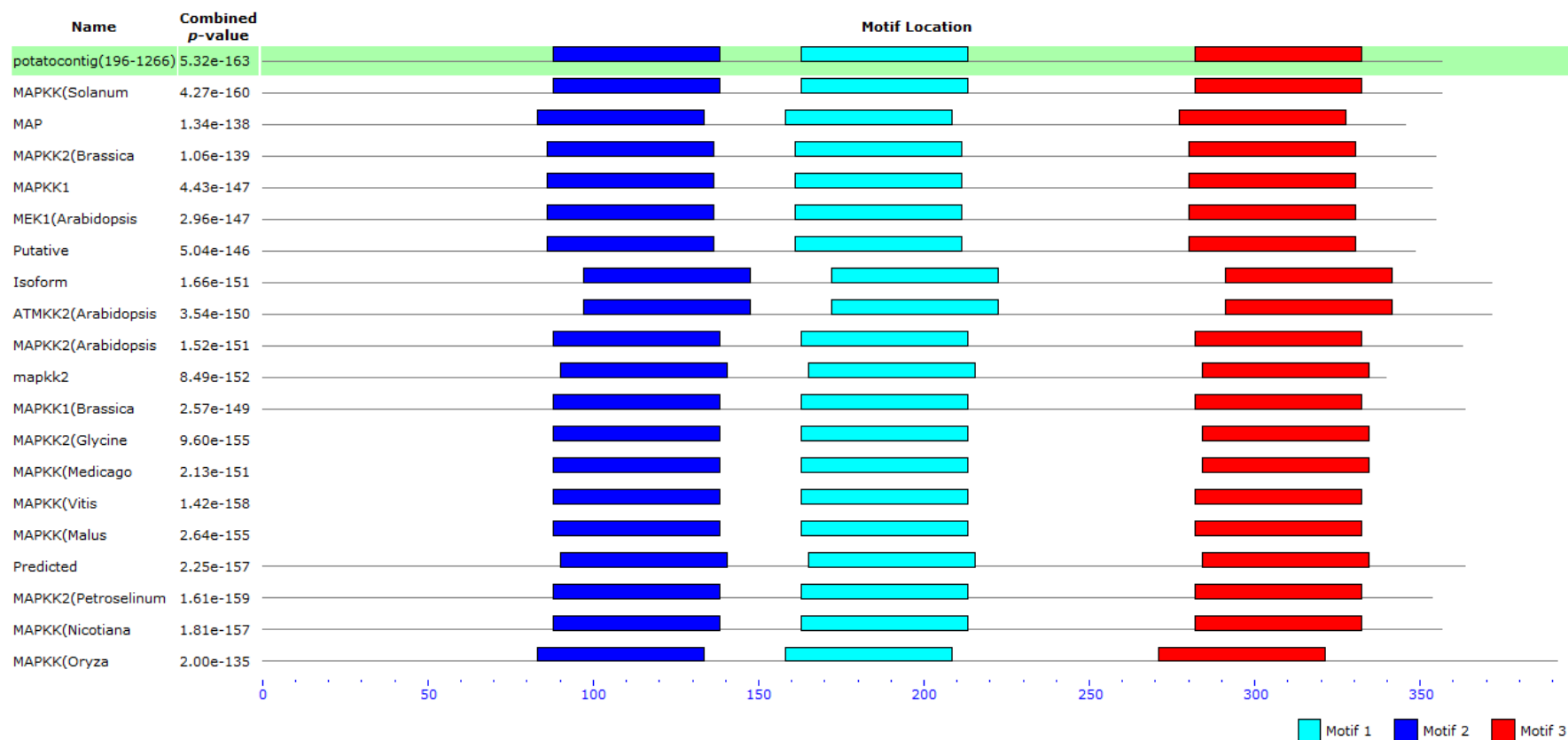


图14 利用在线软件MEME分析

(<http://meme.sdsc.edu/meme/cgi-bin/meme.cgi>)

马铃薯MAPKK蛋白质序列保守结构域 分析研究 Motif 1

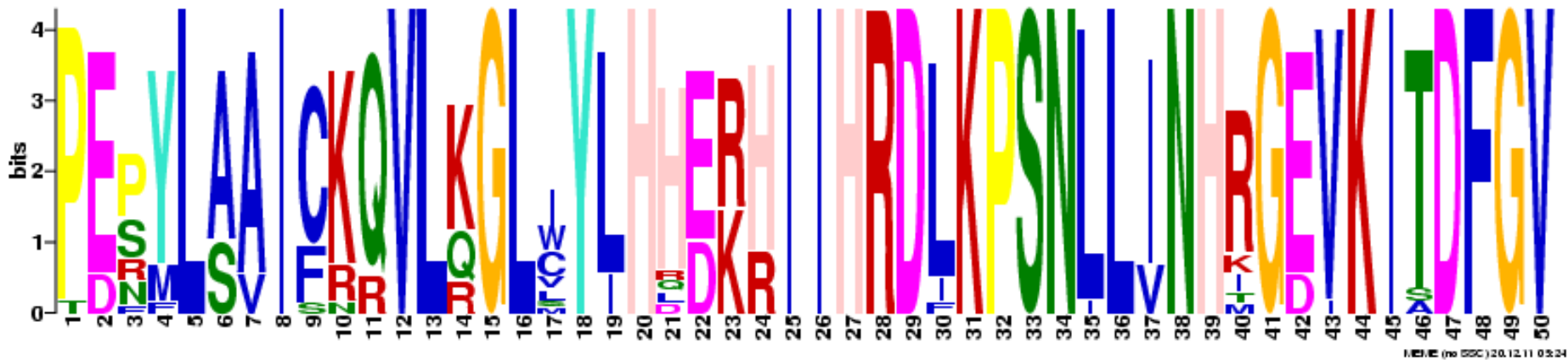


图15 利用在线软件MEME分析
(<http://meme.sdsc.edu/meme/cgi-bin/meme.cgi>)

马铃薯MAPKK蛋白质序列保守结构域 分析 Motif 2



图16 利用在线软件MEME分析
(<http://meme.sdsc.edu/meme/cgi-bin/meme.cgi>)

马铃薯MAPKK蛋白质序列保守结构域 分析Motif 3

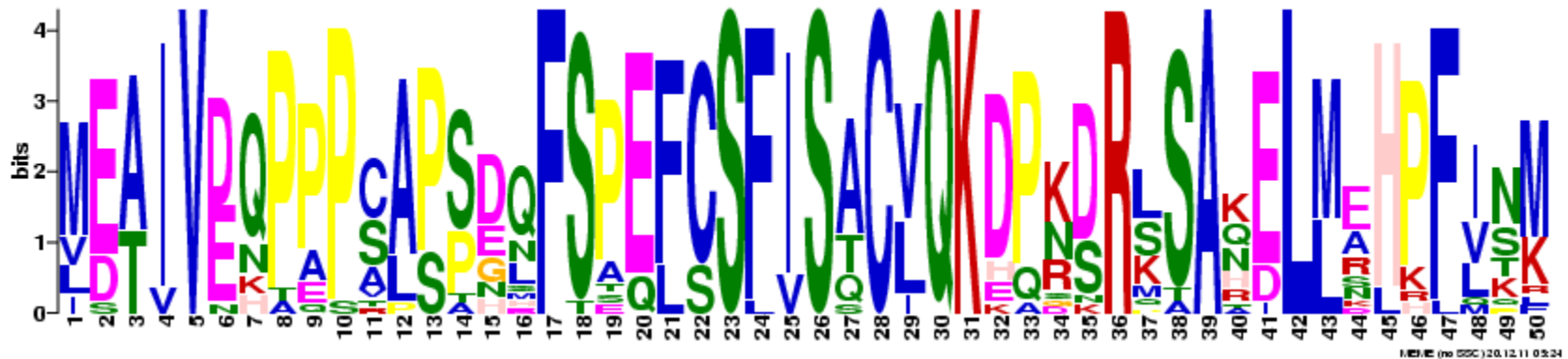
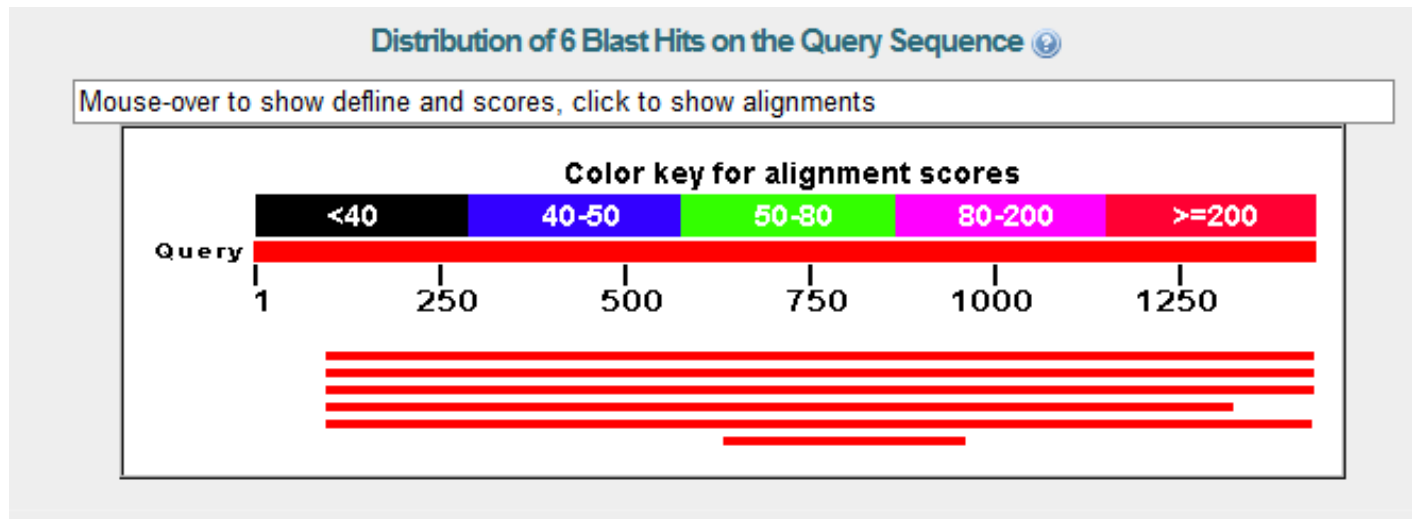


图17 利用在线软件MEME分析
(<http://meme.sdsc.edu/meme/cgi-bin/meme.cgi>)

马铃薯StMAPKK DNA在NCBI中Blast的结果



Legend for links to other resources: [U](#) UniGene [E](#) GEO [G](#) Gene [S](#) Structure [M](#) Map Viewer [B](#) PubChem BioAssay

Sequences producing significant alignments:

Accession	Description	Max score	Total score	Query coverage	E value	Max ident	Links
AK319798.1	Solanum lycopersicum cDNA, clone: LEFL1002BB05, HTC in leaf	2215	2215	93%	0.0	97%	U
AK247428.1	Solanum lycopersicum cDNA, clone: LEFL1019DB08, HTC in leaf	2215	2215	93%	0.0	97%	U E
NM_001247815.1	Solanum lycopersicum MAP kinase kinase (mek1), mRNA >emb AJ000728	2207	2207	93%	0.0	97%	U G
AY691330.1	Lycopersicon esculentum MAPKK (LeMKK1) mRNA, complete cds	2076	2076	85%	0.0	97%	U E G
AF165186.1	Nicotiana tabacum MAP kinase kinase mRNA, complete cds	1712	1712	92%	0.0	90%	U E G
AF443176.1	Nicotiana tabacum MAP kinase kinase (MAPKK) mRNA, partial cds	468	468	22%	6e-128	93%	U E G

图18 StMAPKK DNA在NCBI中的比对结果

<http://blast.ncbi.nlm.nih.gov/Blast.cgi>

进化树分析（氨基酸）

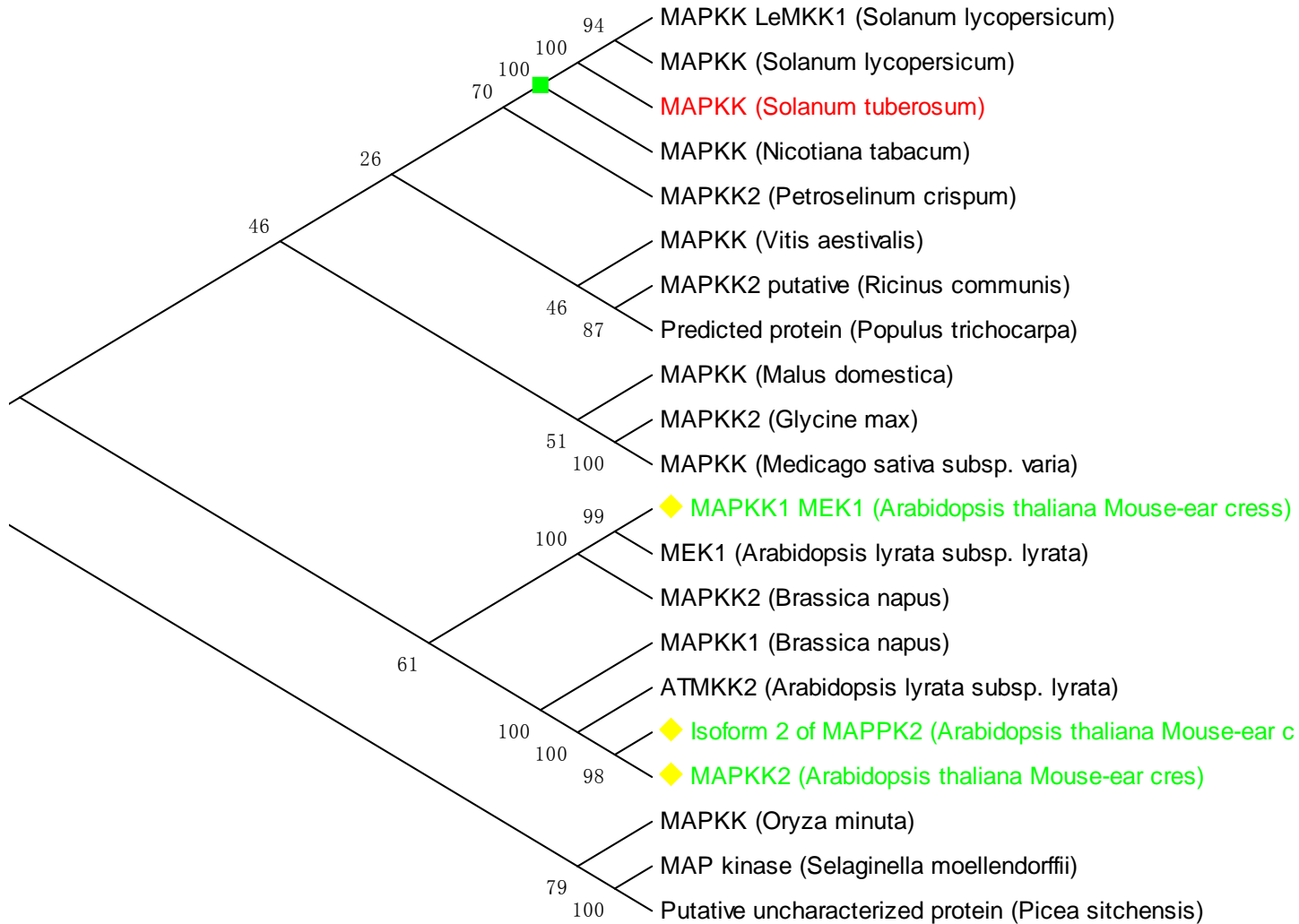


图19 利用MEGA5.05软件分析

进化树分析 (DNA)

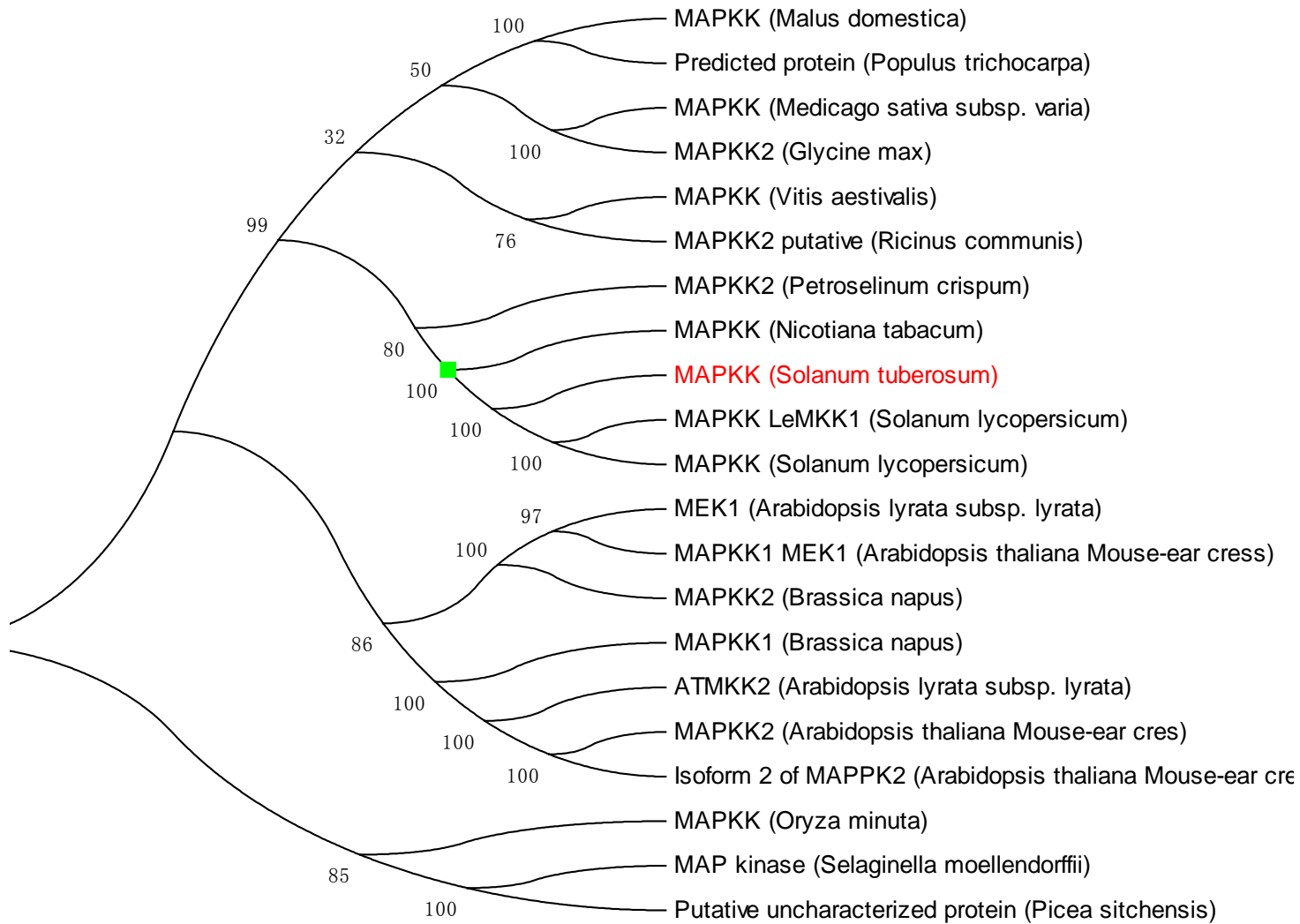


图20 利用MEGA5.05软件分析

Santa & Friend



谢谢大家!

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