

Supplementary Materials

Additional file 1

Primers used for qRT-PCR

Gene	Forward primer	Reverse primer
<i>PmWRKY03</i>	5'-ACCCTACTCCCATCACTCACT-3'	5'-TCTCCCATGCCAGAGATT-3'
<i>PmWRKY04</i>	5'-ATCGGAGCTGGAGGTTATGG-3'	5'-TTGCACCCTCCACTTGAACA-3'
<i>PmWRKY06</i>	5'-CCCAAGGTGCAGTGCTAAGA-3'	5'-GGCCTGATTGTTGAGTGGGA-3'
<i>PmWRKY08</i>	5'-GACACTCCGGCTTTGACTGA-3'	5'-CCTAAAGTAGTTCCTTGGGTGCT-3'
<i>PmWRKY13</i>	5'-ACGGATCAAGAGCTATGCGT-3'	5'-GGTTGCTTTGGTGAAGAGCC-3'
<i>PmWRKY14</i>	5'-CTCACCTACCCAAGGGGATA-3'	5'-GATCAGCATCGCCGGATCAT-3'
<i>PmWRKY18</i>	5'-CCCAAGAGAACATCGCCAGT-3'	5'-ACTGTTGAAAAGCCGGTGGGA-3'
<i>PmWRKY23</i>	5'-ACAACATACGAAGGCCAGCA-3'	5'-GATGAGGGGAAGGCACAAGG-3'
<i>PmWRKY27</i>	5'-CATCAAGCGAAGGAAGAGCC-3'	5'-TGCCACAGATCAGATGGAAC-3'
<i>PmWRKY28</i>	5'-CCACAACCATCCACTCCCTC-3'	5'-GCACTAGGCATTGAGCCTGA-3'
<i>PmWRKY32</i>	5'-GAAGCGAGTGGAGCGATCTT-3'	5'-CGAGGTATGAGTGGGCTTGG-3'
<i>PmWRKY37</i>	5'-AAGGCAATCACACCACCCA-3'	5'-GACCCCGAGAGTAGCATTTCG-3'
<i>PmWRKY42</i>	5'-ATGAAGAAAGTGGGGACAGGG-3'	5'-TGTAGGCCAGGTTGTGCATT-3'
<i>PmWRKY44</i>	5'-TTGATGATGGCTACCGCTGG-3'	5'-AACGACGATGCTTGTGTCCT-3'
<i>PmWRKY52</i>	5'-GCCCTGCAAGAAAGCATGTC-3'	5'-TCTTGGGGTGTGATGGTCG-3'
<i>PmWRKY55</i>	5'-TGATGATGGGTACCGATGGC-3'	5'-GCTTTTTGACAACGCACCCT-3'
<i>PmWRKY56</i>	5'-GGCTGGTGGTGGTGACAATA-3'	5'-CCCTATCTGCGTTTGGAGGT-3'
<i>PmCBF1</i>	5'-CAACAAGAAGACCAGGATT-3'	5'-AAGTTCAAGCAAGCAGAC-3'
<i>PmCBF5</i>	5'-CTCCATTGCCTCTTATCCA-3'	5'-TTCTCTTGCTTCTTCTGACT-3'
<i>PmCBF6</i>	5'-GTGGAAGAGAAGAAGAAGAAG-3'	5'-GTCAATCAACCTGGCATAT-3'
<i>PmLEA10</i>	5'-TACAAGTCCACCACCACACCTTA-3'	5'-AGTGTTGTCCGGGAAGTTTCTCCT-3'
<i>PmLEA29</i>	5'-ATGCTGAGCCTGCAGTAGTAGGTT-3'	5'-TCCTTCTCCTTGATGGCCTCCTTT-3'
<i>PmACTIN</i>	5'-CCCTAAGGCTAACAGAGAAAAGA-3'	5'-CAGCAAGGTCCAGACGAAGAAT-3'

Additional file 2

Conserved motifs predicted by MEME program in *P. mume* WRKY proteins

Motif	Width	Best possible match
1	26	DDGYRWRKYGQKVVKGSPYPRSYRC
2	29	GCPVRKQVZRSEDPSILITTYEGEHNHP
3	29	HPNCPVKKKVERSLDGQITEIYKGEHNH
4	63	MLTEDGHAWRKYGQKEILNAKHPRNYYRCTHKFDQSCQATKQVQQIZDDPPJFRTTTYGNHTC
5	15	EPRVAVQTRSEVDIL
6	37	ELAVLQAELGRVNEENQRLKEMLSQVTKNYQALQMQL
7	27	VEAATAAITADPNFTAALAAAITSIIG
8	21	YSWRKYGQKPIKGSYPRSY
9	29	LPPMATAMASTTSAASMLLSGSSTSADG
10	30	GRCHCSKKRKL RVKRSIRVPMISNKLADIP
11	113	TPEQHKMNNNGSVVVEEKQMMNGFNHIVPRQFMDMGRAEKDERSQCPLGCRSQDCSGSPPRNDIVESMECCCKSTSHVLHRDLSGRISTTNGGEDSPDQE
12	37	RSPYLTI PPGLSPTTELLDSPVLLSSSNALPSPTTGSF
13	7	HHQQHQ
14	21	LATLSASAPFPTITLDLTRSP
15	18	DKDRRGSYKKRKTSHSWT
16	55	TAVDHDDHHGKRIVDELDFADNKGRLMEMRDQTVEVKEEGAHDHHGVGQEQQLPD
17	20	EELVDKAVSSFKKVLSLLNG
18	29	RDYLKASELILDCTSPRESSNFIRFGDTK
19	41	PNQLPPSFPGNMPLPQIFGQALYNQSKFSGLZSFQGLDGA
20	17	EEGDEDEPESKRRKIEV

Additional file 3

The RPKM values of *PmWRKY* genes in different tissues

Gene	Root_RPKM	Stem_RPKM	Leaf_RPKM	Flower_RPKM	Fruit_RPKM
<i>PmWRKY01</i>	571.3452853	16.21669951	712.7492726	63.01261693	362.7986276
<i>PmWRKY02</i>	40.85797138	36.33093366	65.78550055	27.83845093	42.02976848
<i>PmWRKY03</i>	5.072884776	34.0938205	0	4.256376479	0.353619091
<i>PmWRKY04</i>	30.71470125	0	82.14500298	4.456217575	1.608550141
<i>PmWRKY05</i>	230.6023513	65.35487562	485.298879	106.627799	206.6934226
<i>PmWRKY06</i>	2.148184687	14.78460072	2.290604061	0.612588114	1.908514668
<i>PmWRKY07</i>	32.16485355	37.72833294	23.34178196	37.20749596	26.77805123
<i>PmWRKY08</i>	131.6293397	23.58552974	9.877524779	10.95669752	3.791582475
<i>PmWRKY09</i>	11.19665562	0	0	0	0
<i>PmWRKY10</i>	3.257666307	0	0	0	0
<i>PmWRKY11</i>	4.879422648	7.978329802	0.596736289	5.827927482	6.728723828
<i>PmWRKY12</i>	3.899029234	11.14743931	4.810203962	3.440452862	5.547901332
<i>PmWRKY13</i>	13.31017117	0.508155638	5.100581935	0	0.121222886
<i>PmWRKY14</i>	356.0891503	37.11684338	171.7651378	36.72313934	86.48787546
<i>PmWRKY15</i>	197.7219651	32.4498445	277.7475904	37.59388918	128.7683736
<i>PmWRKY16</i>	6.353075968	1.579647005	34.80148138	13.99932959	16.46895946
<i>PmWRKY17</i>	164.6480616	0.100032036	10.5344588	1.489345927	0.159087377
<i>PmWRKY18</i>	1039.619205	6.357591649	400.1448336	89.96095939	192.5983468
<i>PmWRKY19</i>	50.79634083	2.333677902	2.204458831	5.607062805	7.079147944
<i>PmWRKY20</i>	17.26524769	11.26692883	7.952003847	2.936796298	9.047096407
<i>PmWRKY21</i>	2.309671351	0	1.315784984	0	0.070650605
<i>PmWRKY22</i>	89.75163685	6.845137021	111.0470505	12.13275231	157.0133847
<i>PmWRKY23</i>	56.19569698	4.682829655	45.26988339	22.95508145	11.28747315
<i>PmWRKY24</i>	363.2698985	2.223009242	206.0761797	64.34520689	145.9887347
<i>PmWRKY25</i>	127.8441953	1.832615387	60.98083292	8.553706627	19.26825542
<i>PmWRKY26</i>	25.73004235	3.691504829	35.75556733	29.88986872	11.20796227
<i>PmWRKY27</i>	17.44163358	4.768193737	0.912322922	4.717086767	0.52905802
<i>PmWRKY28</i>	30.71608945	0.417652006	20.23059431	1.054888656	18.93023659
<i>PmWRKY29</i>	0.483660362	0	0.777399569	0.111652145	0
<i>PmWRKY30</i>	21.35990936	21.33564655	36.30426706	10.10735778	18.35382974
<i>PmWRKY31</i>	15.0137404	0.18547269	3.242664778	0.049311523	4.055825662
<i>PmWRKY32</i>	88.35223824	4.264719864	378.5805797	42.42521469	68.31913515
<i>PmWRKY33</i>	1503.14785	6.238758161	484.3974291	39.14520743	325.79261
<i>PmWRKY34</i>	61.24416762	3.296966673	9.362671593	2.37520224	1.099417967
<i>PmWRKY35</i>	3.22330717	1.088392049	6.779947628	22.81890724	10.07654256
<i>PmWRKY36</i>	46.5872472	55.39720773	82.11693107	24.05278381	62.03558349
<i>PmWRKY37</i>	231.0945156	1.936620226	203.5487882	7.255242301	40.73909539
<i>PmWRKY38</i>	31.89498259	0	1.883034511	0	0.272993938
<i>PmWRKY39</i>	14.8087021	23.57309263	21.28992671	8.717335348	22.11046409
<i>PmWRKY40</i>	1.306447014	27.5582136	0.288219568	1.986952467	0

<i>PmWRKY41</i>	4.579834125	0	0.212053436	2.055757409	0
<i>PmWRKY42</i>	64.41228696	6.981183175	20.72238936	8.297784449	6.258832315
<i>PmWRKY43</i>	641.5264483	122.0284665	357.0796239	47.59250671	343.2758971
<i>PmWRKY44</i>	2.600085723	0	0.112085388	2.318111211	0
<i>PmWRKY45</i>	2.947023698	0	0.750484769	0.529134081	1.120989601
<i>PmWRKY46</i>	510.8603931	42.29564445	341.2273572	55.12221624	16.92169216
<i>PmWRKY47</i>	72.37268741	0.945047407	39.86604596	4.202881813	76.4465007
<i>PmWRKY48</i>	14.47058701	1.998893444	18.39864506	0.53144471	0
<i>PmWRKY49</i>	32.6975446	83.70829005	43.49189792	23.9144652	93.15122376
<i>PmWRKY50</i>	50.45536359	77.14830316	125.6237911	47.34709591	73.16902135
<i>PmWRKY51</i>	59.59606186	3.636757935	43.98401586	4.898974435	32.48550747
<i>PmWRKY52</i>	20.81910498	9.161846576	5.831149166	40.62822557	25.01757137
<i>PmWRKY53</i>	80.40676054	0.195953167	290.1130653	2.083918469	7.635104435
<i>PmWRKY54</i>	1384.532462	18.91249953	184.9408895	49.25986324	833.829524
<i>PmWRKY55</i>	9.57926319	3.513405912	385.5540691	117.6085589	435.3002757
<i>PmWRKY56</i>	106.4454332	0	61.70103944	0.133443902	3.059873576
<i>PmWRKY57</i>	14.55861356	19.09050058	8.618907962	18.32298871	20.80437075
<i>PmWRKY58</i>	744.7134373	17.74087726	515.029225	50.08544754	352.5536241

Additional file 4

The RPKM values of *PmWRKY* genes in leaf buds of ‘Zhusha’ before and after freezing effect in winter

Name	‘Zhusha’		
	ZS_bef_RPKM	ZS_aft_RPKM	log2(aft/bef)
<i>PmWRKY01</i>	35.08319782	68.06779948	0.956192216
<i>PmWRKY02</i>	50.65246531	84.19881327	0.733167411
<i>PmWRKY03</i>	4.292187655	1.832817527	-1.227649992
<i>PmWRKY04</i>	0.492211656	0.06160463	-2.998168146
<i>PmWRKY05</i>	64.18959303	44.24003651	-0.536986838
<i>PmWRKY06</i>	0.613199924	0.08186387	-2.905058742
<i>PmWRKY07</i>	116.010442	156.410304	0.431080892
<i>PmWRKY08</i>	4.749622745	0.326724553	-3.861666146
<i>PmWRKY09</i>	0	0	-
<i>PmWRKY10</i>	0	0	-
<i>PmWRKY11</i>	4.152255936	3.332897224	-0.317118541
<i>PmWRKY12</i>	12.99549419	9.007033271	-0.528887602
<i>PmWRKY13</i>	0.259656948	0.108327857	-1.261202552
<i>PmWRKY14</i>	35.58776376	17.63868063	-1.012638629
<i>PmWRKY15</i>	5.807423281	7.38546679	0.346790917
<i>PmWRKY16</i>	1.42001553	0.823158792	-0.786664041
<i>PmWRKY17</i>	0.255571437	0.213246794	-0.261202552
<i>PmWRKY18</i>	12.520634	43.06848099	1.782324824
<i>PmWRKY19</i>	11.44615157	9.876096859	-0.212849726
<i>PmWRKY20</i>	12.95832704	12.38609837	-0.065157665
<i>PmWRKY21</i>	0	0	-
<i>PmWRKY22</i>	5.082160843	4.040961342	-0.330743485
<i>PmWRKY23</i>	6.480576998	21.18222404	1.7086599
<i>PmWRKY24</i>	40.3330869	64.12042938	0.66882026
<i>PmWRKY25</i>	14.30654342	14.19449588	-0.011343535
<i>PmWRKY26</i>	9.574310603	5.615957516	-0.769636588
<i>PmWRKY27</i>	5.453676534	2.151147703	-1.342122547
<i>PmWRKY28</i>	0.755832315	0.311620498	-1.278276065
<i>PmWRKY29</i>	0.044705462	0	-
<i>PmWRKY30</i>	36.39529782	39.91478802	0.133171279
<i>PmWRKY31</i>	4.580679627	3.341027735	-0.455269705
<i>PmWRKY32</i>	22.51065808	54.28362717	1.26990889
<i>PmWRKY33</i>	2.504759316	2.127950567	-0.235207344
<i>PmWRKY34</i>	3.622970555	1.859131533	-0.962544236
<i>PmWRKY35</i>	6.951820878	6.993799489	0.008685525
<i>PmWRKY36</i>	37.72241405	29.75541555	-0.342269739
<i>PmWRKY37</i>	2.380221982	6.098858322	1.357443075
<i>PmWRKY38</i>	0	0	-

<i>PmWRKY39</i>	38.69115446	54.04456475	0.482145758
<i>PmWRKY40</i>	1.44197925	0.746798978	-0.949258546
<i>PmWRKY41</i>	3.29249689	1.868118765	-0.817595901
<i>PmWRKY42</i>	4.313328461	1.92595526	-1.163227392
<i>PmWRKY43</i>	5.989033448	5.928499151	-0.014656269
<i>PmWRKY44</i>	1.10220253	2.381458964	1.111456345
<i>PmWRKY45</i>	0	0.141422802	-
<i>PmWRKY46</i>	12.25743749	7.416512897	-0.724844481
<i>PmWRKY47</i>	0	0.073259559	-
<i>PmWRKY48</i>	0.106395096	0	-
<i>PmWRKY49</i>	41.91091102	26.30289515	-0.672104277
<i>PmWRKY50</i>	62.75906009	72.60382463	0.210221803
<i>PmWRKY51</i>	15.74399466	9.199972723	-0.775100148
<i>PmWRKY52</i>	1.030521685	0.331659969	-1.635598067
<i>PmWRKY53</i>	0.500639938	0.960779051	0.940431309
<i>PmWRKY54</i>	5.39157894	3.655898266	-0.560481908
<i>PmWRKY55</i>	24.1507535	11.34173653	-1.090426654
<i>PmWRKY56</i>	0.04062058	0.071331676	1.001831854
<i>PmWRKY57</i>	28.05537824	26.57197752	-0.078371764
<i>PmWRKY58</i>	3.176002586	4.906344125	0.627436339

Additional file 5

Supplementary Data 1. The CDS sequences of 58 *P.mume* *WRKY* genes

>PmWRKY01

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Supplementary Data 2. The genomic sequences of 58 *P.mume* *WRKY* genes

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Supplementary Data 3. The protein sequences of 58 *P.mume* *WRKY* genes and 12 *Arabidopsis thaliana* *WRKY* genes

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>PmWRKY29

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>PmWRKY36

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DGYRWRKYGQKLVKGNPNRPSYYRCSNPGCPVKKHVERASHDSKVVIATYEGQHDHMPTRTVTHNA
AASNVITTARNGESGTTSEGNVCHDTSPEHEDKPNKQLNVEPRTKSSDVAGCDMVVDSDLGPERKLENEQ
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>PmWRKY37

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DLHGPTDMEFNVTGLNLLLTNTSSDQSVVDDGISSNIEDKRAKSELAVLQAELERMNAENQRLRGMLN
QVTTNYNALQVHLLTLMQSQAQEQNSSAAEGHGVFDGNKMMVVEEKKLINGNGSPVVPRQFMDLGL
AANNADADEPSQSSEERSRERSGSLGENVKVAGHSDDQEKKEFGRGIGREESPDQPSQSWAPNKVPRLN
SPKEVDQTEATMRKARVSVRARSEAPMITDGCQWRKYGQKMAKGNPCPRAYYRCTMAAGCPVRKQVQ
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SAPFPTVTLDLTQSPNPLQLQRPPGQFNIPFPNPSQNFTNGPVSLLPQIFGQALYNQSKFSGLQMSQDMEGA
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GNGNGNATSNNKLSNSSFPmN

>PmWRKY38

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K

>PmWRKY39

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QAAAPQLPGASDSEELRDEIREEGDADEPNPKRRNIDVGASEVALSHKTVTEPKIIVQTRSEVDLLDDGY
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>PmWRKY40

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>PmWRKY41

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QMQLSRF

>PmWRKY42

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SHSVSSTTPRSKRRKNQLKVCQVPmESLSADIWAWRKYGQKPIKGSYPYRGRYRCSKGCMARKQV
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>PmWRKY43

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DILGATYPRGYRCTHRGTQGLATKQVQKADADPSTMVVTYRGEHTCSQVLQLARSSVLSLAKQASTG
NQNATREVEKPKASEMSFSGAGLRVKTEDLDTREDDIFPSFSPSTPIEPENVDHIFCATLMENDLMDG
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YES

>PmWRKY44

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>PmWRKY45

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>PmWRKY46

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TVSSESETPNKQNHDFLGSSAIPVVKQEEYKEGTPTPSDLTDNLSSLETNHLWSDFKDDFALCDPmAMCVS
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>PmWRKY47

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KYGQKDILGAKYPRGYRCTHRNAQCCSATKQVQRSEDEPTVFEITYRGRHTCTQASTSITSAAPPPPPPP
QNSMDIVDPQNEQQPDLLAIPQGLTVVTEGLDAGDFSPFMGPmTSGTQYFSAEQFGGGSQGFQG
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>PmWRKY48

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DKENEELDEEERDENEIEDEDVEEDDVLIPNTAMPDEIFLGLKQLGCTSSSGGSLAAGASGDTFSDQEP
SSLGSSWAAGATVGGGC

>PmWRKY49

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>PmWRKY50

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YHFLQQQQQQQVQQQQQQQQLFLQQQQQMKHQAEMMYRRSNGINLNFSSCTPTMSSTRSFISL
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>PmWRKY51

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NSNEPPVVVDLQRIMQEEIESKQGAPRLKKNFCQVYSSTKMTGAAESKLVPISEDGYSWRKYGQKGEK
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SSPSKPHYALFGMLLAFGALLTCICELLHKGIGEVVLRWGMWLFYPPRYTVFGTLPDIYGLAGGIS
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>PmWRKY52

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KCGVKSEEATPRCLVSAGGCHCSKRRKLRIRRRVLPALSNKLADIPPDDYTWRKYGQKPIKGSYPYRYY
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>PmWRKY53

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RSCSNPETFIITYTAEHNHVHPTRRNSLAGSTRSKFPSSKNKGCKSSLNSPmMTNLAASIEEDPDVQSAST
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VTGAC

>PmWRKY54

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KDILGTHKPRSYYRCTYRNTQSCYATKQVQRSDPTIFEITYK GKHTCSHGNSVLPSPPEQEQKRNK
QNNTSHQQSQGNQMSFPTNLRVDTKFLEDRENMTSPFSFTSTSFSGMMADDAFLSSMLDDNNTFFDNF
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FS

>PmWRKY55

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>PmWRKY56

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DIQEKANKSKDVTIASTNNIYNHQYEESEMVSLSLGSFSSRAKKDEKNKNRSTSSQGKENESDRESLSLGL
DCKYEAPKSSAATTEVPLSNSSPmSSLEEVPKKEAGETWPPKKVLKTARSVEDEVAQNPVKARVSVRA
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ALSSIIGSNSVGTAGTTGMLGNNNNQAGGGDNNMAQKFNWGDQFAGSTTTSSPYLQTQIGNNSTIGC
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>PmWRKY57

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SIQTQTQSPLQLTVYPTPLSELSPSTVTSISSAPILLEQKLPPEKVNTLCTPEVDKQNSSDHKFISSVPLVK
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ESKLALSAEVRNSVTEHPCRTFNDSEVSTSSKERIQETPSIPERKRQSPSDSDGNGDVKIKEEHGDGDEPE
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>PmWRKY58

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NIQASSIMASVEESLKMEQKPWDFNRISRQADSSTEKTGVKSEFEPLQIILPEIGTNQTNMQTNGPSGAPRP
DSIHCTQSSQFVREQSDDGFNWRKYGQKQVKGSENPRSYKCTYPNCPTKKKVERSLEDGHITQIVYKGS
HNHPKPQSTRRSTSQSIQGSSYGISDQSVPTISNPKMESVTMQEDSSASIGEDFEQNSPLSNSGGAEDENEP
EAKRWKGENANDQPFAAGSRIVKEPRIVVQTTSEIDILDDGYRWRKYGQKVVKGPNPRSYKCTSVG
CPVRKHVERASHDTRAVITTYEGKHNHDVPmARGSGSYSNGNRPmSDNGSNNSNVSM AVRPLALPNHS
NLSYLSSLQNTTRQPTTERQSPYTLKMLQSEGSYGFPEF