

# *HrβVPE1* 通过调控胚乳外层细胞降解影响沙棘种子萌发

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## *HrβVPE1* Regulates Seed Germination in *Hippophae rhamnoides* by Controlling Degradation in Outer Endosperm Cells

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附表 1 qPCR 引物序列

Table 1 qPCR primer sequences

引物名称 Primer name	引物序列 Primer sequence (5'-3')	大小 Size (bp)
<i>HrVPE1</i> -F	5'-AACAAAGACACAAGATGGGC-3'	19
<i>HrVPE1</i> -R	5'-TCAATCCTCCTTCCTCAAC-3'	20
<i>HrActin2</i> -F	5'-GGTCCTCTCCAACCATCTCTC-3'	22
<i>HrActin2</i> -R	5'-CTGTGATCTCTTTGCTCATCCTGT-3'	24
<i>AtActin2</i> -F	5'-CTAAGCTCTCAAGATCAAAGGCTTA-3'	25
<i>AtActin2</i> -R	5'-ACTAAAACGCAAAACGAAAGCGGTT-3'	25
<i>AtCEP1</i> -F	5'-TATACGAACGGTGGAGGAGTCACC-3'	24
<i>AtCEP1</i> -R	5'-TCCGCATCTCCCGGTAAACACTCC-3'	24
<i>AtXCP2</i> -F	5'-GACACGACCTACAACAATG-3'	19
<i>AtXCP2</i> -R	5'-GGATAATCTTCTTCCTTGCG-3'	20
<i>AtMYB30</i> -F	5'-TCTGAGGCTTTATCTCCTGC-3'	20
<i>AtMYB30</i> -R	5'-TTGCGTCCTAAGAAACCC-3'	18
<i>AtMC9</i> -F	5'-TCTTGCCATAGTGGTGGTC-3'	19
<i>AtMC9</i> -R	5'-TGTTTCGTTGTCTCAATAGCC-3'	20
<i>AtMOD1</i> -F	5'-CAATCCTGGAAACGCTTC-3'	18
<i>AtMOD1</i> -R	5'-AGGGTCTCTTACAAGTTGG-3'	19
<i>AtDAD2</i> -F	5'-GCTTTGATTCAGCAGGTG-3'	19
<i>AtDAD2</i> -R	5'-ACACGAGAGAACTCCAGAG-3'	19
<i>VPE</i> -TRVII-GFP-F	5'-CTGTGAGTAAGGTTACCGTGATGATGTTTATGCTGGTGTACC-3'	42
<i>VPE</i> -TRVII-GFP-R	5'-TCGGGACATGCCGGGCCCCACTCTCACATGCTTCTACAT-3'	40
pTRV2-seq-F	5'-GAGTCCCACATATTCGCACG-3'	

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ATGTTAATTAGAGGGCAATTTACCAAGTGGGTTTTGATGATGGTGTTCCTATTGATATTC 60
M L I R G Q F T K W V L M M V F L L I F 20
CATATTGTTATGGAAAAGGGTGAAGCCACTCGATCAACGAACCATGGGCCGACTCTATC 120
H I V M E K G E A T R S T N H W A D S I 40
ATTCGCCAGCCCACTTACAAGATTGATGAAGACTCCGATCAACAAGACACAAGATGGGCT 180
I R Q P T Y K I D E D S D Q Q D T R W A 60
GTTCTTGGGCTGGTTCCAATGGCTATGGCAATTACAGGCATCAGGCAGATGTTTGTCTAT 240
V L V A G S N G Y G N Y R H Q A D V C H 80
GCATATCAATTGTTGAGGAAAGGAGGATTGAAGAGGAGAACATAGTGGTGTATTATGTAT 300
A Y Q L L R K G G L K E E N I V V F M Y 100
GATGATATTGCCATGCATGAATTGAATCCAAGGCCCTGGCATCATCATCAATCATCCTCAT 360
D D I A M H E L N P R P G I I I N H P H 120
GGTGATGATGTTTATGCTGGTGTACCTAAGGATTACACAGGAAAGAATGTAACAGCGGAA 420
G D D V Y A G V P K D Y T G K N V T A E 140
AATCTATATGCAGTCTTCTTGGGAACAAAAAGGAGTAAAAGGTGGAAGTGGGAAGGTC 480
N L Y A V L L G N K K G V K G G S G K V 160
ATAGATAGCAACCAATGACAGGATCTTCTTATACTACTCAGATCATGGTGGCCCTGGT 540
I D S K P N D R I F L Y Y S D H G G P G 180
GTTCTTGGGATGCCAAATTTACCCCTTCTCTATGCCATGGATTTTCATAGAAGTTTTAAAG 600
V L G M P N L P F L Y A M D F I E V L K 200
AAAAAATACGCATCTGGAACCTTACAAGGAAATGGTAATATATGTAGAAGCATGTGAGAGT 660
K K Y A S G T Y K E M V I Y V E A C E S 220
GGAAGCATTTTTACAGGCATAATGCCCAAGGATCTAAACATTTATGTAACACAGCATCA 720
G S I F T G I M P K D L N I Y V T T A S 240
AACGCACAAGAGAACAGCTGGGGCACTTATTGCCCGGAATGGAACCTTCTCCGCCGTCG 780
N A Q E N S W G T Y C P G M E P S P P S 260
GATTACACCACITGTTAGGAGATCTTACAGTGTGGTGGTGGTGGTGGTGGTGGTGGTGGT 840
D Y T T C L G D L Y S V A W M E D S E T 280
CATAATTTAAATAGAGAACAATCAAAACAACATACGAGACGGTAAAGAAAAGGACCGCT 900
H N L N R E T I K Q Q Y E T V K K R T A 300
AATTCACAACATTACAATCTGGATCGCATGTGATGGAATATGGGAATACCAACATCACA 960
N S N N Y S G S H V M E Y G N T N I T 320
GGAGAAAGCTTAACTTGTACCAAGGTTTTGATCCTGCCACTATTAACCTCCCTCCAAAC 1020
G E K L N L Y Q G F D P A T I N F P P N 340
AATAAACAATTGGGCATGCCATGGATGTTGTTAACCCAGAGAGATGCAGAGATTTTCTTC 1080
N K Q L G M P M D V V N Q R D A E I F F 360
ATGTGGCAAAATGTATAAGAAGACAGAAGATTGGACAGAAAAGAAGAAAAGAAATACTGAAG 1140
M W Q M Y K K T E D W T E K K K E I L K 380
CAAAATCAAGGACACAATGAGATATAGAGCTCACTTGGATACAAGCATGGACTTCATTGGA 1200
Q I K D T M R Y R A H L D T S M D F I G 400
TCATTTCTCTTTGGACAAAACAAGGATCCTCGATCTTGAATTTAGTGAGAGTAACTGGT 1260
S F L F G P K Q G S S I L N L V R V T G 420
CTTCTCTTGGATGATTGGGATGCTTGAATCAATGGTGGATTTATTGAAACACAT 1320
L P L V D D W G C L K S M V R L F E T H 440
TGTGGTTCAGTCAATATGGCATGAAGCACATGCGTGTCTTTTGGCAACATATGCAAT 1380
C G S L T Q Y G M K H M R A F A N I C N 460
AAAGGTATTTCTCAGGACTCCATGGAAGAAGCTTGTGGTGTCTTGCATTTGGCCATGAG 1440
K G I S Q D S M E E A C L A A C I G H E 480
CAAGGACTCTTGCATCCTTCAATCAAAGGCTACAGTGTGTA 1482
Q G L L H P S I K G Y S A * 493

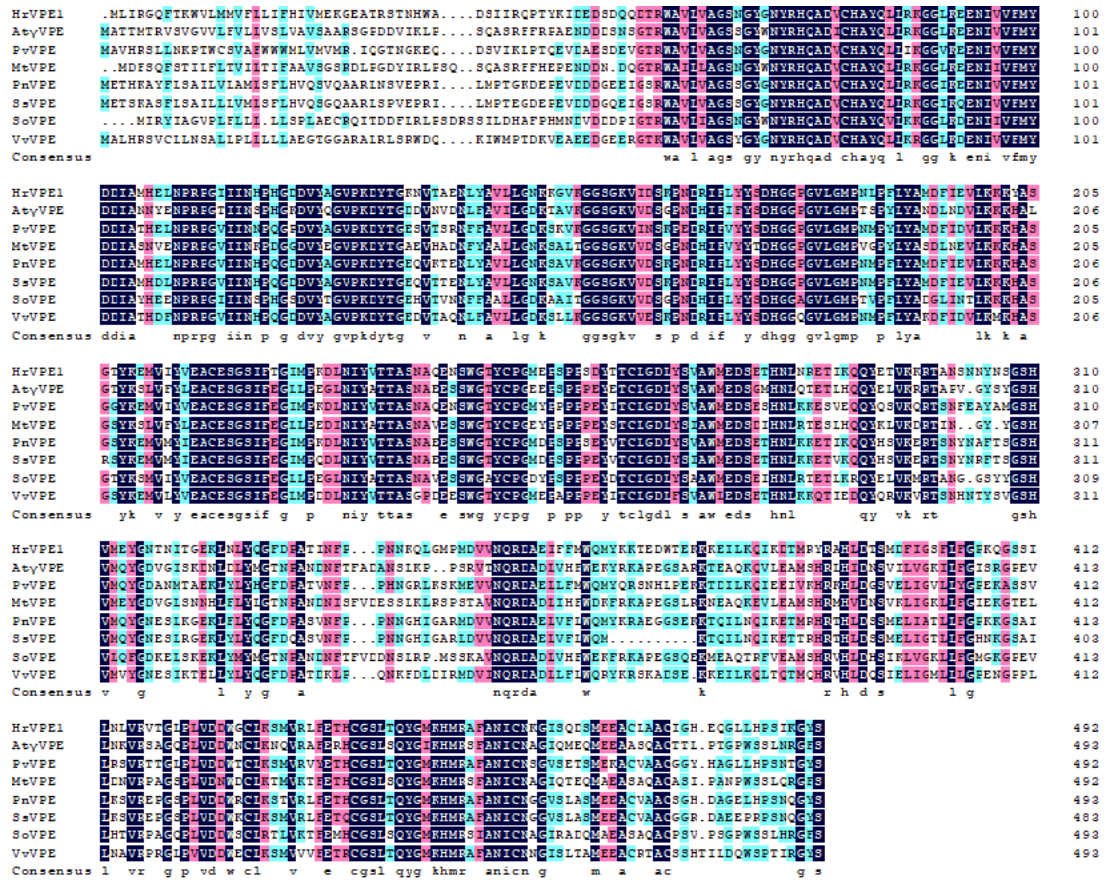
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上方序列为核苷酸序列，下方为对应的氨基酸序列；起始密码子为 ATG，终止密码子为 TGA；该编码区序列全长 1482 bp，编码 493 个氨基酸

The nucleotide sequence (upper row) and the corresponding amino acid sequence in single-letter code (lower row) are shown. The initiation (ATG) and termination (TGA) codons are indicated. The coding sequence is 1,482 bp in length and encodes a protein of 493 amino acids.

附图 1 *HrβVPE1* CDS 的核苷酸和氨基酸序列

Fig. 1 Nucleotide and amino acid sequences of the *HrβVPE1* coding sequence.



HrβVPE1 与 AtγVPE、PvVPE、MtVPE、PnVPE、SsVPE、SoVPE、VvVPE 序列多重比对；深蓝色部分代表相同的氨基酸残基  
 Multiple sequence alignment of HrβVPE1 with AtγVPE、PvVPE、MtVPE、PnVPE、SsVPE、SoVPE and VvVPE sequences. The dark blue regions indicate identical amino acid residues.

附图 2 不同物种 VPE 序列多重比对

Fig. 2 Multiple Alignment of VPE Sequences from Different Species.