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1 M E N G T H V N H Q G G G G G L V D T T 20
61 GCTGCAACAATCAACATTAAGGCATTTGAGCTTGTCTATGCAAAATGTTGATGAAGGT 121
21 A A T I T I K G I L S L L L Q N V D E G 40
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181 CACACAACCATATGCTCAAGAAGCTGTGGTGTGCTGCAATGCGACAAAGTTCAAT 241
61 H T T H I A Q E A V V G A V Q S D K F N 80
241 GGCTATGCTCCCATGCTGGGTCTTCTCTCAAAACGAGCAATGCTGAATATTTGCTC 100
81 G Y A P T V G L P Q T R R A I A E Y L S 120
301 OGGGATCTTCCATACATTAACACAGATGATGTTTTTGTACATCTGGTTGCACACAA 140
101 R D L P Y N L T T D D V F V T S G C T Q 160
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481 GATCTCTTGAAGACAGTGGCTGGGAGGTTAATCTGATGCTGTGGAAGCTCTTGGCGAT 260
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601 TACCAACATTTGGAAAGATGTCAGAACTGCAAGAACTGAGAACTCTTGTATTTGCT 340
201 Y Q H L E K I A E T A K K L R I L V I A 360
661 GATGAAGTTTATGGACCTGCGCTTTGGGGATAAACCGTTTGTGCCAATGGGAGTTT 380
221 D E V Y G H L A F G D K P F V P M G V F 400
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241 G S T V P V L T L G S L S K R W I V P G 440
781 TGGCGGCTTGGTTGGTTTGTGCAACATGATCCTGTGGCATGTTTGAAGAAACCAAGGTT 460
261 W R L G W F V T T D P C G M F R K P K V 480
841 ATTGAGCGCATTAAGAAATATTTTGTATTTTGGGCGGCTGCAACCTTCTTCAATCAGGCA 500
281 I E R I K K Y F D I L G G P A T F I Q A 520
901 GCAGTTCGAGCATCTCTGAGAAACTGAGAGGCTCTTCTTCAAGAAACTATCTATTTA 540
301 A V P S I L E K T E E V F F K K T I Y L 560
961 TTGAAGCATCATCAGATATTTTGTCTGATAGGATAAAGGACATCCTTGTCTTACCTGT 580
321 L K Q S S D I C S D R I K D I P C L I C 600
1021 CCAAAACAAAGAGAGGATCTATGGCTGTAAATGTTAACTAGAGCACTTCTTCACTGGA 620
341 P N K P E G S M A V M V K L D L S L L E 640
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361 D I S D D I D F C F K L A K E E S V I F 680
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1201 CCTTCTCTTGAAGAGCTTTTGAAGGACAAATCTTTTATCAAAAGCATGCCAGAAA 740
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421 L * 800
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181 D Y G C L F N S A S C T V Q N S V P S T 60
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301 T F N T A D A T L G R H L A R R L V Q I 100
361 GAGTCAACGAGCTCTCTCGCTCCCGGCGACTTTAATCTGACCTCTGACACACCTCA 120
421 G V T D V F S V P G D F N L T L L D H L 140
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541 I A E P G L T N I G C C N E L N A G Y A 180
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661 A D G Y A R S R G V G A C A V T F T V G 220
721 GACTGAGTGTGTTGAACGCGATCGCTGCGGCGTACAGTGAGAACTTGGCGGTATTTGTA 240
781 TGTGAGGCGGCACTTCAATGATTTACGGAATTAACAGGATTTTCCACATATTTG 260
841 I V G G P N S N D Y G C T N R I L H H T I 280
901 GGGTGGCGGCTTTAGCAAGAGCTCGCTTCTTCAAGAGCTGACCTGCTTCTTCAAGCTG 300
961 G V P D P F Q E L R C F Q T V T C F Q A 320
1021 TGTGAAATACTTGGAGGATGCACATGATGTTGATGATACGCAATTTTGCAGCTGTTGA 340
1081 V V N N L E D A H E L I D T A T S T A L 360
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1261 CTTTTCGCGTACCGCTGTTCCATTTTCAATTTCTCCAAATTTGACAAATGAATGGGAC 420
1321 T F S R D P V P F S L S P K L S N K M G 440
1381 TAGAGGCTGACGTTGAGCGAGGCGAGAGTTCTTGAACACAGGAGTGAAGCGGTTAGT 460
1441 L E A A V E A A A E F L N K A V K P V M 480
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1681 A S G F A L A V M P S A K G Q V P E H H 560
1741 CCCATTTACAGAACATCTGCGGCTGCTGAGCAGCTGCTTTGCTGCTGAGTTGTTG 580
1801 F H F T G T Y V G A V S T A F C A E I V 600
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K L K H N N T A H E N Y K R I F V P D G 760
A C C C T C T A A G G C G C A C C C A G A A C C T T T A G G G T T A A T G T T C T G T T C C A G C A C T I 780
H P L K A A P R E P L R V N V L F Q H I 800
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Q N M L S A E T A V I A E T G D S W F N 840
G C C A G A A G C T A A A T T G C C A C T G C T G C G G G T A T G A T T C C A A A T G C A A T G A T G A C A A 860
C Q K L E L P P G C G Y E F Q W Q Y G S 880
T A G G T G G T C A G T T G G C A A C T C T G G G T A T G T C T G A G A C A G G G A C T A C T G T T A A C T 900
I G W S V G A T L G Y A Q A V P E K R V 920
T T C T T T C A T G T G T G G A G C T C T C A G T G A C T G A C T A A G T G T G C C A A T G A T T C 940
L S F I G G G S F Q V T A Q D V S T M I 960
G A A T G G A C A G A G A C C A T C T T T C T G A T A A A C A A T G C G G G A T A C A C T A T T A A G T G G 980
R N G Q R T I F L I N N G G Y T I E V 1000
A A A T C A T A T G A C G T A C A A T G A T C A A G A C T G A C T A C A C T G A C T G C T T G A T G 1020
E I H D G P Y N V I K N W N Y T G L V D 1040
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A N S R P F N F Q * 1080
C C C A T T G C T C T C A C A A A T T A A G A T A A G C T A A G C T C T T A T T G T G A G A T T T T C C T A A T 1100
G C T T T T C A T T T A C T G A G A C A G T T C C T G G T T G T T G T A T A T T C C C T T T G A A T A T T 1120
A A T A T C T A C G G A T T T T C A A T T A T C A A A A A A A A A 1140

Figure S1. Nucleotide sequence and amino acid sequence of *RrAAAT* and *RrPPDC1*. (A) *RrAAAT*, GenBank accession No.MG820126; (B) *RrPPDC1*, GenBank accession No. KY622034.

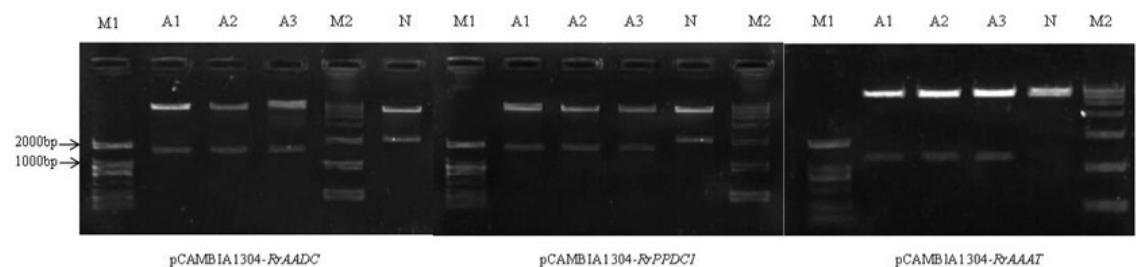


Figure S2. Enzyme digestion verification of the recombinant plasmid of the overexpression vectors. (M1) Marker DL 2000; (M2) Marker DL 15000; (A1-A3) the result of digestion. (N) negative control.

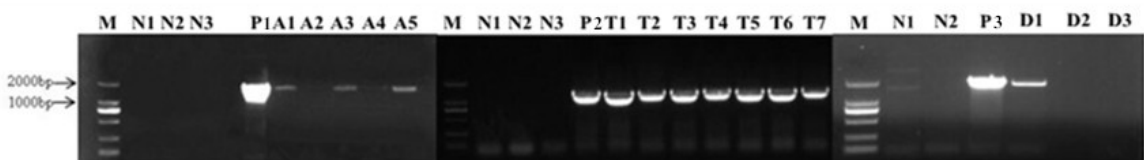


Figure S3. Colony PCR verification of *Agrobacterium transformants*. (M) Marker DL 2000; (N1) ddH₂O as template; (N2) *Agrobacterium EHA* liquid as template; (N3) *YEB* liquid medium as template; (P1) *pCAMBIA1304-RrAADC* as template; (A1-A5) *Agrobacterium EHA* of *pCAMBIA1304-RrAADC* as template; (P2) *pCAMBIA1304-RrAAAT* as template; (T1-T7) *Agrobacterium EHA* of *pCAMBIA1304-RrAAAT* as template; (P3) *pCAMBIA1304-RrPPDC1* as template; (D1-D3) *Agrobacterium EHA* of *pCAMBIA1304-RrPPDC1* as template.

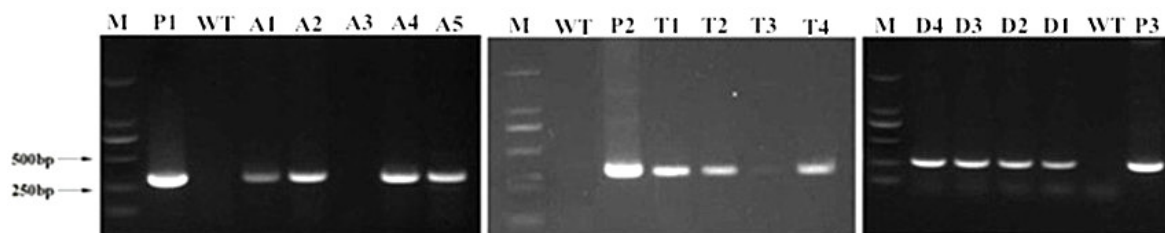


Figure S4. DNA detection of transgenic *Petunia* plants. (M) Marker DL2000; (WT) wild type; (P1) pCAMBIA1304-*RrAADC* plasmid; (P2) pCAMBIA1304-*RrAAAT* plasmid; (P3) pCAMBIA1304-*RrPPDC1* plasmid; (A1-A5) *RrAADC* overexpressing resistant plants; (T1-T4) *RrAAAT* overexpressing resistant plants; (D1-D4) *RrPPDC1* overexpressing resistant plants.

Table S1. Primers used for isolation of *RrAAAT* and *RrPPDCs* genes from *R. rugosa*

Gene	Oligonucleotide sequence (5'-3')	Application	Annealing Temperature (Ta, °C)	Time (s)
<i>RrAAAT</i>	AAATCCTTGTGGAATGTG	1st of 3' RACE	50	60
<i>RrAAAT</i>	ACCCAAGGTTATTGAGCG	2nd of 3' RACE	52	60
<i>RrAAAT</i>	GAGCATAGCCATTGAACTTGTCGGATTG	5' RACE	65	120
<i>RrPPDC1</i>	GACTTATTGGGGTGCTGTG	1st of 3' RACE	54	60
<i>RrPPDC1</i>	GTCAGTCGGTGCTACTCTCG	2nd of 3' RACE	57	60
<i>RrPPDC1</i>	CGGCGATTATGGCAGTGTGTTGGGGT	5' RACE	63	120

Table S2. Gene-specific primers sequence for detection by real-time quantitative RT-PCR

Gene	Oligonucleotide sequence (5'-3')	Melting Temperature (Tm, °C)	Time (s)
<i>Actin-F</i>	TGAGGCCATTTACGACAT	53	30
<i>Actin-R</i>	AGATCACAGGAGCATAGGAG	53	30
<i>RrAAAT-F</i>	TGATCCCTGTGGCATGTTTA	53	30
<i>RrAAAT-R</i>	TCTCAAGGATGCTCGGAACT	53	30
<i>RrPPDC1-F</i>	GCTTTCAGGCTGTGGTGAAT	53	30
<i>RrPPDC1-R</i>	GGAATCCCAGCCAAGTTACA	53	30

Table S3. The primers used for amplifying the open reading frames of *RrAADC*, *RrAAAT* and *RrPPDC1* gene

Primer	Oligonucleotide sequence (5'-3')	Annealing temperature (Ta, °C)	Time (s)
<i>RrAADC-F</i>	TCACCTAGCTGTGTTCAACT	55	120
<i>RrAADC-R</i>	TGGTACGTACAAGTAGTTT	55	120
<i>RrAAAT-F</i>	ATGGAGAATGGAACCCATGTG	53	120
<i>RrAAAT-R</i>	CTATAATTTTCTGGCATGCCTT	53	120
<i>RrPPDC1-F</i>	TACATGGAACCCTCTACACTCA	57	120
<i>RrPPDC1-R</i>	CAACTTTGATTCTTTCAGCTCCG	57	120

Table S4. The primers used for enzyme digestion

Primer	Oligonucleotide sequence (5'-3')	The sites of restriction endonuclease
<i>RrAADC-F</i>	GGACTCTTGACCATGGTTTCACCTAGCTGTGTTCAACT	<i>Nco</i> I
<i>RrAADC-R</i>	ATTCGAGCTGGTCACCTGGTACGTAGTACAAGTAGTTT	<i>BstE</i> II
<i>RrAAAT-F</i>	GGACTCTTGACCATGGTTATGGAGAATGGAACCCATGTG	<i>Nco</i> I
<i>RrAAAT-R</i>	TCAGATCTACCATGGCTATAATTTTCTGGCATGCCTT	<i>Nco</i> I
<i>RrPPDC1-F</i>	GGACTCTTGACCATGGTTTACATGGAACCCTCTACACTCA	<i>Nco</i> I
<i>RrPPDC1-R</i>	ATTCGAGCTGGTCACCCAACCTTTGATTCTTTCAGCTCCG	<i>BstE</i> II