## ผลการวิเคราะห์ลำดับนิวคลีโอไทด์ของยีน phyA170 กลาย

### 1. ยีน phyA170 กลาย Q50A

GTCCCCGCCTCGAGAAATCAATCCACTTGCGATACGGTCGATCAGGGGTA
TCAATGCTTCTCCGAGACTTC**GCATCTTTGGGGTGCTTACGTGCCGTTC**
**TT**TTCTCTGGCAAACGAATCGGCCATCTCTCCTGATGTGCCCGCCGGATGC
CGAGTCACTTTCGCTCAGGTCCTCTCCCGTCATGGAGCACGGTATCCGACC
GACTCCAAAGGCAAGAAATACTCCGCTCTCATTGAGGAGATCCAGCAGAA
TGCGACCACCTTTGATGGGAAATATGCCTTCCTGAAGACATACAACTACA
GCCTGGGTGCAGATGACCTGACTCCTTTCGGAGAACAGGAGCTAGTCAAC
TCCGGCATCAAGTTCTATCAGCGATACGAATCGCTCACAAGAAACATTAT
TCCATTCATCCGATCCTCTGGCTCCAGCCGCGTGATCGCCTCCGGCAAGAA
ATTCATCGAGGGCTTCCAGAGCACCAAGCTGAAGGATCCTCGTGCCCAGC
CCGGCCAATCGTCGCCCAAGATCGACGTGGTCATTTCCGAGGCCAGCTCA
TCCAACAACACTCTCGACCCAGGCACCTGCACCGTCTTCGAAGACAGCGA
ATTGGCCGATGCCGTCGAAGCCAATTTCACCGCCACGTTCGTCCCCACCAT
TCGTCAACGTCTGGAGAACGACCTGTCTGGCGTGTCTCTCACAGACACAG
AGGTGACCTACCT

### 2. ยีน phyA170 กลาย Q50G

GTCCCCGCCTCGAGAAATCAATCCACTTGCGATACGGTCGATCAGGGGTA
TCAATGCTTCTCCGAGACTTC**GCATCTTTGGGGTGGTTACGTGCCGTTC**
**TT**TTCTCTGGCAAACGAATCGGCCATCTCTCCTGATGTGCCCGCCGGATGC
CGAGTCACTTTCGCTCAGGTCCTCTCCCGTCATGGAGCACGGTATCCGACC
GACTCCAAAGGCAAGAAATACTCCGCTCTCATTGAGGAGATCCAGCAGAA
TGCGACCACCTTTGATGGGAAATATGCCTTCCTGAAGACATACAACTACA
GCCTGGGTGCAGATGACCTGACTCCTTTCGGAGAACAGGAGCTAGTCAAC
TCCGGCATCAAGTTCTATCAGCGATACGAATCGCTCACAAGAAACATCAT
TCCATTCATCCGATCCTCTGGCTCCAGCCGCGTGATCGCCTCCGGCAAGAA
ATTCATCGAGGGCTTCCAGAGCACCAAGCTGAAGGATCCTCGTGCCCAGC
CCGGCCAATCGTCGCCCAAGATCGACGTGGTCATTTCCGAGGCCAGCTCA
TCCAACAACACTCTCGACCCAGGCACCTGCACCGTCTTCGAAGACAGCGA
ATTGGCCGATGCCGTCGAAGCCAATTTCACCGCCACGTTCGTCCCCACCAT
TCGTCAACGTCTGGAGAACGACCTGTCTGGCGTGTCTCTCACAGACACAG
AGGTGACCTACCT

3. ยีน phyA170 กลาย Q50I


GTCCCCGCCTCGAGAAATCAATCCACTTGCGATACGGTCGATCAGGGGTA
TCAATGCTTCTCCGAGACTTC**GCATCTTTGGGGTATTTACGTGCCGTTC**
**TTT**TCTCTGGCAAACGAATCGGCCATCTCTCCTGATGTGCCCGCCGGATGC
CGAGTCACTTTCGCTCAGGTCCTCTCCCGTCATGGAGCACGGTATCCGACC
GACTCCAAAGGCAAGAAATACTCCGCTCTCATTGAGGAGATCCAGCAGAA
TGCGACCACCTTTGATGGGAAATATGCCTTCCTGAAGACATACAACTACA
GCCTGGGTGCAGATGACCTGACTCCTTTCGGAGAACAGGAGCTAGTCAAC
TCCGGCATCAAGTTCTATCAGCGATACGAATCGCTCACAAGAAACATCAT
TCCATTCATCCGATCCTCTGGCTCCAGCCGCGTGATCGCCTCCGGCAAGAA
ATTCATCGAGGGCTTCCAGAGCACCAAGCTGAAGGATCCTCGTGCCCAGC
CCGGCCAATCGTCGCCCAAGATCGACGTGGTCATTTCCGAGGCCAGCTCA
TCCAACAACACTCTCGACCCAGGCACCTGCACCGTCTTCGAAGACAGCGA
ATTGGCCGATGCCGTCGAAGCCAATTTCACCGCCACGTTCGTCCCCACCAT
TCGTCAACGTCTGGAGAACGACCTGTCTGGCGTGTCTCTCACAGACACAG
AGGTGACCTACCT


4. ยีน phyA170 กลาย Q50L


GTCCCCGCCTCGAGAAATCAATCCACTTGCGATACGGTCGATCAGGGGTA
TCAATGCTTCTCCGAGACT**TCGCATCTTTGGGGTTTGTACGTGCCGTTC**
TTTTCTCTGGCAAACGAATCGGCCATCTCTCCTGATGTGCCCGCCGGATGC
CGAGTCACTTTCGCTCAGGTCCTCTCCCGTCATGGAGCACGGTATCCGACC
GACTCCAAAGGCAAGAAATACTCCGCTCTCATTGAGGAGATCCAGCAGAA
TGCGACCACCTTTGATGGGAAATATGCCTTCCTGAAGACATACAACTACA
GCCTGGGTGCAGATGACCTGACTCCTTTCGGAGAACAGGAGCTAGTCAAC
TCCGGCATCAAGTTCTATCAGCGATACGAATCGCTCACAAGAAACATCAT
TCCATTCATCCGATCCTCTGGCTCCAGCCGCGTGATCGCCTCCGGCAAGAA
ATTCATCGAGGGCTTCCAGAGCACCAAGCTGAAGGATCCTCGTGCCCAGC
CCGGCCAATCGTCGCCCAAGATCGACGTGGTCATTTCCGAGGCCAGCTCA
TCCAACAACACTCTCGACCCAGGCACCTGCACCGTCTTCGAAGACAGCGA
ATTGGCCGATGCCGTCGAAGCCAATTTCACCGCCACGTTCGTCCCCACCAT
TCGTCAACGTCTGGAGAACGACCTGTCTGGCGTGTCTCTCACAGACACAG
AGGTGACCTACCT

5. ยีน phyA170 กลาย Q50N


GTCCCCGCCTCGAGAAATCAATCCACTTGCGATACGGTCGATCAGGGGTA
TCAATGCTTCTCCGAGACTTC**GCATCTTTGGGGT<u>AAC</u>TACGTGCCGTTC
TT**TTCTCTGGCAAACGAATCGGCCATCTCTCCTGATGTGCCCGCCGGATGC
CGAGTCACTTTCGCTCAGGTCCTCTCCCGTCATGGAGCACGGTATCCGACC
GACTCCAAAGGCAAGAAATACTCCGCTCTCATTGAGGAGATCCAGCAGAA
TGCGACCACCTTTGATGGGAAATATGCCTTCCTGAAGACATACAACTACA
GCCTGGGTGCAGATGACCTGACTCCTTTCGGAGAACAGGAGCTAGTCAAC
TCCGGCATCAAGTTCTATCAGCGATACGAATCGCTCACAAGAAACATCAT
TCCATTCATCCGATCCTCTGGCTCCAGCCGCGTGATCGCCTCCGGCAAGAA
ATTCATCGAGGGCTTCCAGAGCACCAAGCTGAAGGATCCTCGTGCCCAGC
CCGGCCAATCGTCGCCCAAGATCGACGTGGTCATTTCCGAGGCCAGCTCA
TCCAACAACACTCTCGACCCAGGCACCTGCACCGTCTTCGAAGACAGCGA
ATTGGCCGATGCCGTCGAAGCCAATTTCACCGCCACGTTCGTCCCCACCAT
TCGTCAACGTCTGGAGAACGACCTGTCTGGCGTGTCTCTCACAGACACAG
AGGTGACCTACCT



6. ยีน phyA170 กลาย Q50P


GTCCCCGCCTCGAGAAATCAATCCACTTGCGATACGGTCGATCAGGGGTA
TCAATGCTTCTCCGAGACTTC**GCATCTTTGGGGT<u>CCA</u>TACGTGCCGTTC
TT**TTCTCTGGCAAACGAATCGGCCATCTCTCCTGATGTGCCCGCCGGATGC
CGAGTCACTTTCGCTCAGGTCCTCTCCCGTCATGGAGCACGGTATCCGACC
GACTCCAAAGGCAAGAAATACTCCGCTCTCATTGAGGAGATCCAGCAGAA
TGCGACCACCTTTGATGGGAAATATGCCTTCCTGAAGACATACAACTACA
GCCTGGGTGCAGATGACCTGACTCCTTTCGGAGAACAGGAGCTAGTCAAC
TCCGGCATCAAGTTCTATCAGCGATACGAATCGCTCACAAGAAACATCAT
TCCATTCATCCGATCCTCTGGCTCCAGCCGCGTGATCGCCTCCGGCAAGAA
ATTCATCGAGGGCTTCCAGAGCACCAAGCTGAAGGATCCTCGTGCCCAGC
CCGGCCAATCGTCGCCCAAGATCGACGTGGTCATTTCCGAGGCCAGCTCA
TCCAACAACACTCTCGACCCAGGCACCTGCACCGTCTTCGAAGACAGCGA
ATTGGCCGATGCCGTCGAAGCCAATTTCACCGCCACGTTCGTCCCCACCAT
TCGTCAACGTCTGGAGAACGACCTGTCTGGCGTGTCTCTCACAGACACAG
AGGTGACCTACCT

7. ยีน  phyA170 กลาย Q50S

GTCCCCGCCTCGAGAAATCAATCCACTTGCGATACGGTCGATCAGGGGTA
TCAATGCTTCTCCGAGACTTC**GCATCTTTGGGGTTCT**TACGTGCCGTTC
**TT**TTCTCTGGCAAACGAATCGGCCATCTCTCCTGATGTGCCCGCCGGATGC
CGAGTCACTTTCGCTCAGGTCCTCTCCCGTCATGGAGCACGGTATCCGACC
GACTCCAAAGGCAAGAAATACTCCGCTCTCATTGAGGAGATCCAGCAGAA
TGCGACCACCTTTGATGGGAAATATGCCTTCCTGAAGACATACAACTACA
GCCTGGGTGCAGATGACCTGACTCCTTTCGGAGAACAGGAGCTAGTCAAC
TCCGGCATCAAGTTCTATCAGCGATACGAATCGCTCACAAGAAACATCAT
TCCATTCATCCGATCCTCTGGCTCCAGCCGCGTGATCGCCTCCGGCAAGAA
ATTCATCGAGGGCTTCCAGAGCACCAAGCTGAAGGATCCTCGTGCCCAGC
CCGGCCAATCGTCGCCCAAGATCGACGTGGTCATTTCCGAGGCCAGCTCA
TCCAACAACACTCTCGACCCAGGCACCTGCACCGTCTTCGAAGACAGCGA
ATTGGCCGATGCCGTCGAAGCCAATTTCACCGCCACGTTCGTCCCCACCAT
TCGTCAACGTCTGGAGAACGACCTGTCTGGCGTGTCTCTCACAGACACAG
AGGTGACCTACCT

8. ยีน  phyA170 กลาย Q50T

GTCCCCGCCTCGAGAAATCAATCCACTTGCGATACGGTCGATCAGGGGTA
TCAATGCTTCTCCGAGACTTC**GCATCTTTGGGGTACT**TACGTGCCGTTC
**TT**TTCTCTGGCAAACGAATCGGCCATCTCTCCTGATGTGCCCGCCGGATGC
CGAGTCACTTTCGCTCAGGTCCTCTCCCGTCATGGAGCACGGTATCCGACC
GACTCCAAAGGCAAGAAATACTCCGCTCTCATTGAGGAGATCCAGCAGAA
TGCGACCACCTTTGATGGGAAATATGCCTTCCTGAAGACATACAACTACA
GCCTGGGTGCAGATGACCTGACTCCTTTCGGAGAACAGGAGCTAGTCAAC
TCCGGCATCAAGTTCTATCAGCGATACGAATCGCTCACAAGAAACATCAT
TCCATTCATCCGATCCTCTGGCTCCAGCCGCGTGATCGCCTCCGGCAAGAA
ATTCATCGAGGGCTTCCAGAGCACCAAGCTGAAGGATCCTCGTGCCCAGC
CCGGCCAATCGTCGCCCAAGATCGACGTGGTCATTTCCGAGGCCAGCTCA
TCCAACAACACTCTCGACCCAGGCACCTGCACCGTCTTCGAAGACAGCGA
ATTGGCCGATGCCGTCGAAGCCAATTTCACCGCCACGTTCGTCCCCACCAT
TCGTCAACGTCTGGAGAACGACCTGTCTGGCGTGTCTCTCACAGACACAG
AGGTGACCTACCT

9. **ยีน** phyA170 **กลาย** Q50V


GTCCCCGCCTCGAGAAATCAATCCACTTGCGATACGGTCGATCAGGGGTA
TCAATGCTTCTCCGAGACTT**CGCATCTTTGGGGTGTTT**ACGTGCCGTTC
**T**TTTCTCTGGCAAACGAATCGGCCATCTCTCCTGATGTGCCCGCCGGATGC
CGAGTCACTTTCGCTCAGGTCCTCTCCCGTCATGGAGCACGGTATCCGACC
GACTCCAAAGGCAAGAAATACTCCGCTCTCATTGAGGAGATCCAGCAGAA
TGCGACCACCTTTGATGGGAAATATGCCTTCCTGAAGACATACAACTACA
GCCTGGGTGCAGATGACCTGACTCCTTTCGGAGAACAGGAGCTAGTCAAC
TCCGGCATCAAGTTCTATCAGCGATACGAATCGCTCACAAGAAACATCAT
TCCATTCATCCGATCCTCTGGCTCCAGCCGCGTGATCGCCTCCGGCAAGAA
ATTCATCGAGGGCTTCCAGAGCACCAAGCTGAAGGATCCTCGTGCCCAGC
CCGGCCAATCGTCGCCCAAGATCGACGTGGTCATTTCCGAGGCCAGCTCA
TCCAACAACACTCTCGACCCAGGCACCTGCACCGTCTTCGAAGACAGCGA
ATTGGCCGATGCCGTCGAAGCCAATTTCACCGCCACGTTCGTCCCCACCAT
TCGTCAACGTCTGGAGAACGACCTGTCTGGCGTGTCTCTCACAGACACAG
AGGTGACCTACCT


<u>หมายเหตุ</u> ลำดับนิวคลีโอไทด์ของไพร์เมอร์ของ ยีน phyA170 กลายพันธุ์ชนิดต่างๆ แสดงด้วย
อักษรตัวหนา และตำแหน่งที่มีการเปลี่ยนแปลงชนิดกรดอะมิโนแสดงด้วยการขีดเส้นใต้