Supplemental Data

Supplemental Figure 1. Physical interaction between SHW1 and COP1 as shown by in vitro binding assay. A, GST-HY5, GST-SHW1 and GST were individually incubated with Ni-NTA bound COP1-His protein (2 μg) in equimolar ratio. Supernatant and pellets were fractioned by 10% SDS-PAGE, blotted and probed with anti-GST antibodies. Lane 1 shows the interaction of COP1-His with GST-HY5 (positive control). Signal in supernatant serves as loading control. An autoradiograph of a typical in vitro binding experiment has been shown. **B**, Quantification of proteins retained by COP1-His, as described in A. The experiment was repeated for three times with similar results. Error bars indicate standard error of the mean of three independent experiments.

Supplemental Figure 2. ABA mediated responsiveness of *shw1 hy5* double mutants. **A**, Germination of the wild type, *shw1*, *hy5*, and *shw1 hy5* at 1 μM concentration of ABA **B**, Quantification of seed germination after 3 day in WL. Results presented are obtained from three biological replicates. Error bars indicate SD. The *t* tests show the significant differences (*$P < 0.05$).

Supplemental Figure 3. Physical interaction between SHW1 and HY5 as shown by in vitro binding assay. A, GST-HYH, GST-SHW1 and GST were individually incubated with Ni-NTA bound HY5-His protein (2 μg) in equimolar ratio. Supernatant and pellets were fractioned by 10% SDS-PAGE, blotted and probed with anti-GST antibodies. Lane 1 shows the interaction of HY5-His with GST-HYH (positive control). Signal in supernatant serves as loading control. An autoradiograph of a typical in vitro binding experiment has been shown. **B**, Quantification of proteins retained by HY5-His, as describe in A. The experiment was repeated for three times with similar results. Error bars indicate standard error of the mean of three independent experiments.

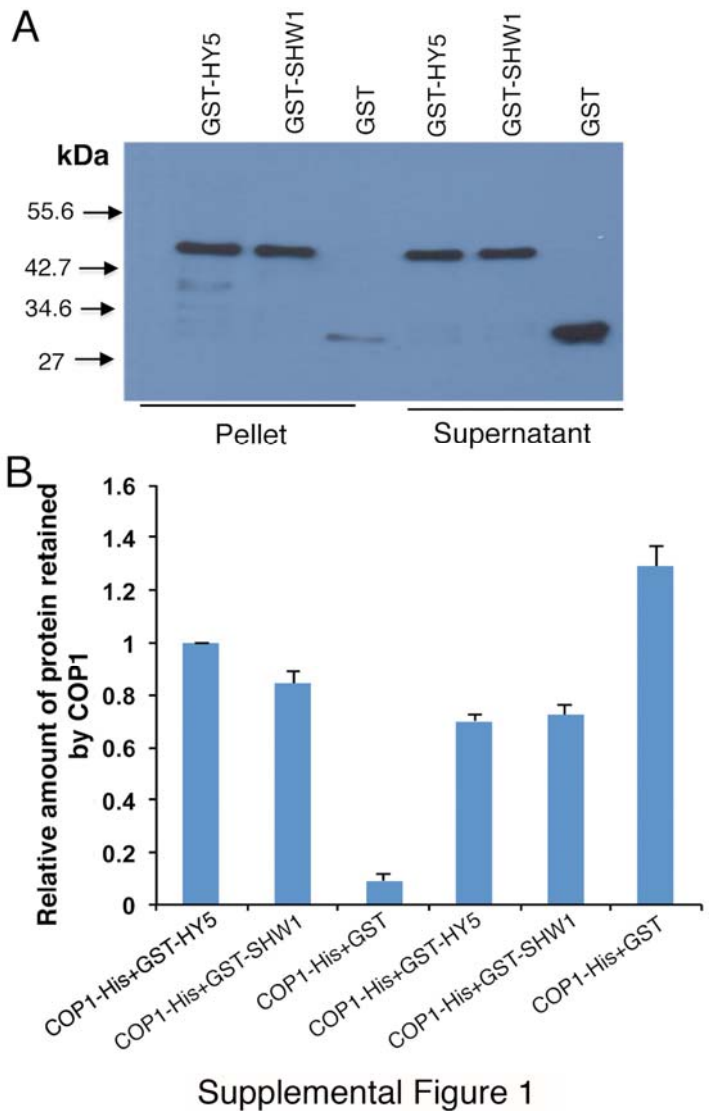
Supplemental Figure 4. Transcript levels of *HY5*. A, The transcript levels of *HY5* in wild type (Col), *shw1, cop1-6, shw1 cop1-6* mutants in 5-day-old dark grown seedlings. A representative result is shown. M indicates the DNA molecular size marker. **B**, Quantification of the data in A. The experiment was repeated for three times. The error

bars indicate standard deviations of three technical repeats (one of the three biological replicates).

Supplemental Figure 5. SHW1 Enhances the Ubiquitylation Activity of COP1 but not it Self ubiquitinated by COP1. Recombinant COP1-His, GST-SHW1, and GST-HY5 fusion proteins were purified from E.coli (BL21DE3) and used for in vitro Ubiquitination assays. Ubiquitination assays were performed using UBE1 (E1), UbcH5b (E2), and His-tagged ubiquitin (His6-Ub). Recombinant COP1-His was pre incubated with 20 mM $ZnCl_2$. Immunoblot against ubiquitin antibodies shows that HY5, however not SHW1, is a substrate of COP1 for ubiqutination. Lower panel shows the equal loading of GST-HY5 and GST-SHW1 probed with anti–GST antibodies.

Supplemental Figure 6. The Expressed proteins in Yeast Cells. The expressed proteins used in two-hybrid assays are shown.

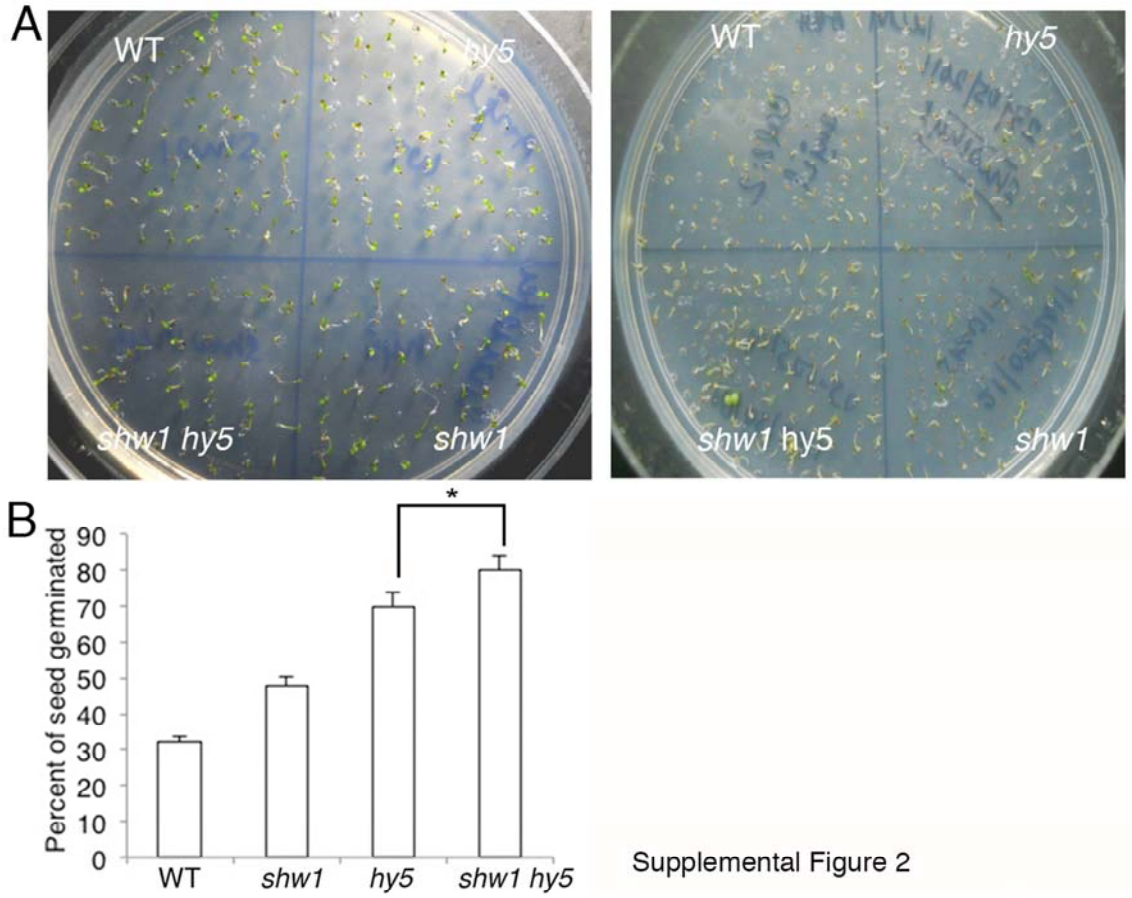
Supplemental Table 1. Primers used in this study. The primers used in this study are summarized.



Supplemental Figure 1

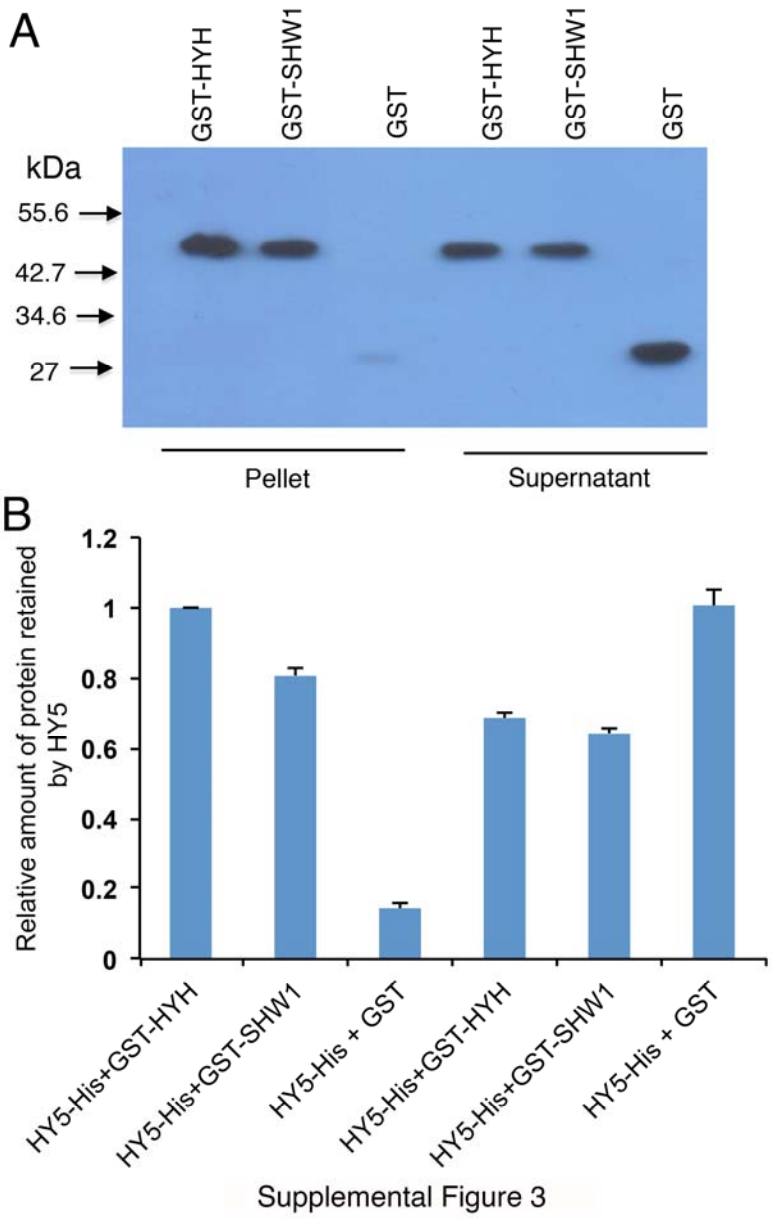
Supplemental Figure 1. Physical interaction between SHW1 and COP1 as shown by in vitro binding assay. A, GST-HY5, GST-SHW1 and GST were individually incubated with Ni-NTA bound COP1-His protein (2 µg) in equimolar ratio. Supernatant and pellets were fractioned by 10% SDS-PAGE, blotted and probed with anti-GST antibodies. Lane 1 shows the interaction of COP1-His with GST-HY5 (positive control). Signal in supernatant serves as loading control. An autoradiograph of a typical in vitro binding experiment has been shown. **B**, Quantification of proteins retained by COP1-His, as described in A. The experiment was repeated for three times with similar results. Error bars indicate standard error of the mean of three independent experiments.

54



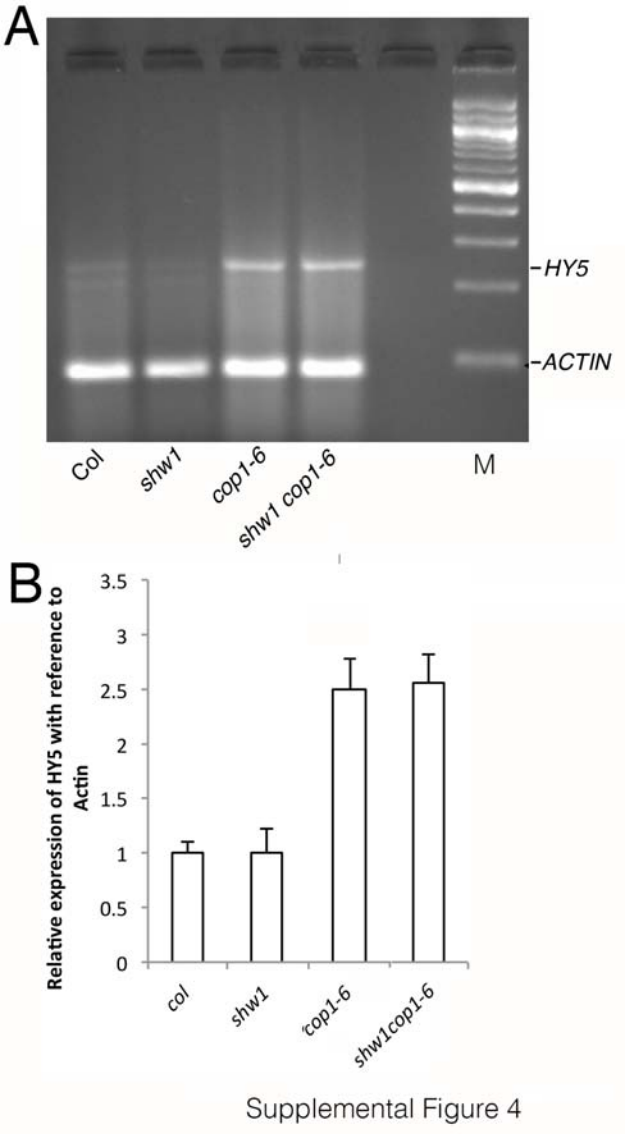
Supplemental Figure 2. ABA mediated responsiveness of *shw1 hy5* double mutants. **A**, Germination of the wild type, *shw1*, *hy5*, and *shw1 hy5* at 1 μM concentration of ABA **B**, Quantification of seed germination after 3 day in WL. Results presented are obtained from three biological replicates. Error bars indicate SD. The *t* tests show the significant differences (*P < 0.05).

55
56



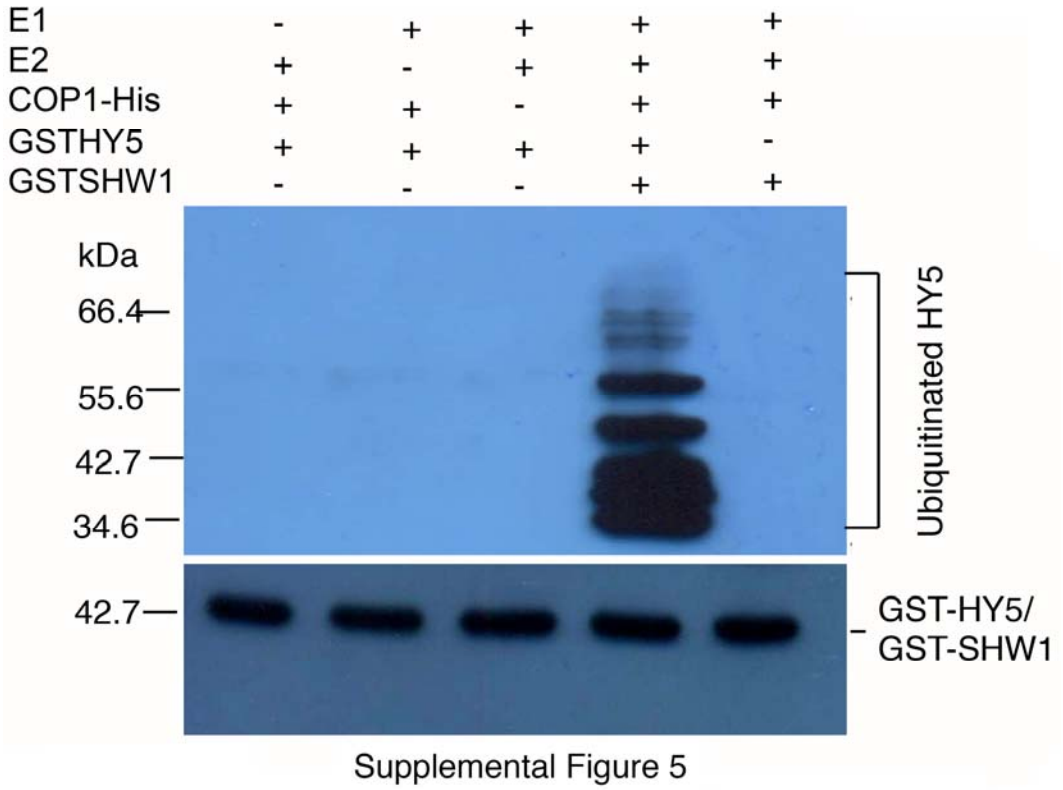
Supplemental Figure 3. Physical interaction between SHW1 and HY5 as shown by in vitro binding assay. A, GST-HYH, GST-SHW1 and GST were individually incubated with Ni-NTA bound HY5-His protein (2 µg) in equimolar ratio. Supernatant and pellets were fractioned by 10% SDS-PAGE, blotted and probed with anti-GST antibodies. Lane 1 shows the interaction of HY5-His with GST-HYH (positive control). Signal in supernatant serves as loading control. An autoradiograph of a typical in vitro binding experiment has been shown. **B**, Quantification of proteins retained by HY5-His, as describe in A. The experiment was repeated for three times with similar results. Error bars indicate standard error of the mean of three independent experiments.

57
58



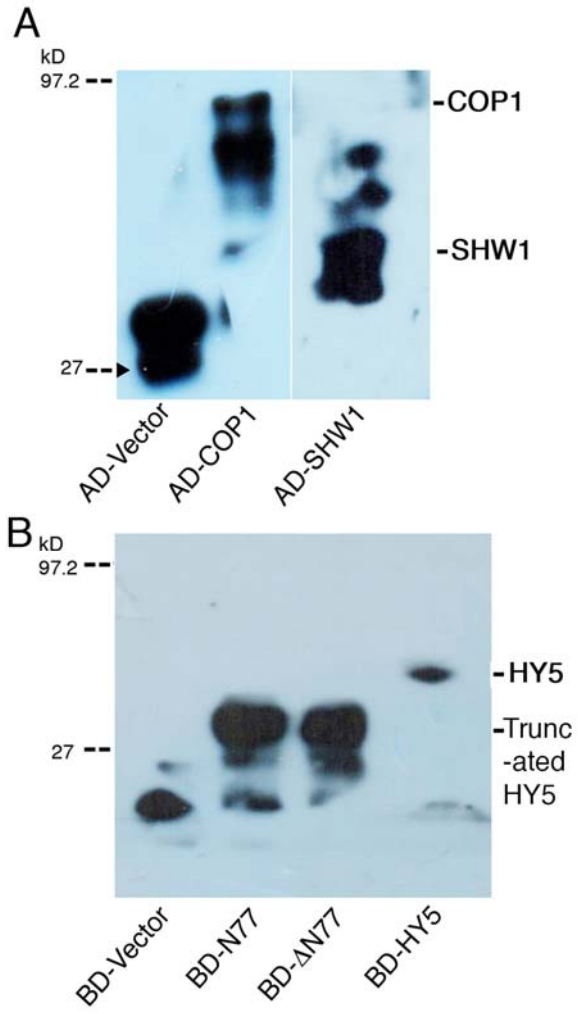
Supplemental Figure 4. Transcript levels of *HY5*. A, The transcript levels of *HY5* in wild type (Col), *shw1*, *cop1-6*, *shw1 cop1-6* mutants in 5-day-old dark grown seedlings. A representative result is shown. **B**, Quantification of the data in A. The experiment was repeated for three times. The error bars indicate standard deviations of three technical repeats (one of the three biological replicates).

59
60



Supplemental Figure 5. SHW1 enhances the ubiquitylation Activity of COP1 but not it self ubiquitinated by COP1. Recombinant COP1-His, GST-SHW1, and GST-HY5 fusion proteins were purified from E.coli (BL21DE3) and used for in vitro Ubiquitination assays. Ubiquitination assays were performed using UBE1 (E1), UbcH5b (E2), and His-tagged ubiquitin (His6-Ub). Recombinant COP1-His was pre incubated with 20 mM $ZnCl_2$. Immunoblot against ubiquitin antibodies shows that HY5, however not SHW1, is a substrate of COP1 for ubiqutination. Lower panel shows the equal loading of GST-HY5 and GST-SHW1 probed with anti–GST antibodies.

61
62



Supplemental Figure 6

Supplemental Figure 6. The Expressed proteins in Yeast Cells. The expressed proteins used in two-hybrid assays are shown.

Supplementary Table 1. Primers used in this study.

List of primers used in in-vitro pull down assays

SHW1-FL: FP (BamHI): CGGGATCCATGGCCGCAGCTACAACAAC

SHW1-FL: RP (EcoRI):GGAATTCTTAATTTACCGGGTTTGGTC

HY5-FL: FP (NdeI): GGAATTCCATATGCAGGAACAAGCGACTAG CTCTTT
HY5-FL: RP (ClaI): CCATCGATTCAAAGGCTTGCATCAGCATTAG

COP1-FL: FP (EcoRI):GCGAATTCATGGAAGAGATTTCGACGGATC
COP1-FL: RP (PstI): CGGGATCCTCACGCAGCGAGTACCAGAAC

List of primers used in yeast two hybrid assays

SHW1-FL FP (EcoRI):	GGAATTCATGGCCCGCAGCTACAACAAC
SHW1-FL RP (BamHI):	CGGGATCCTTAATTTACCGGGTTTGGTC
HY5-FL FP (EcoRI):	GGAATTCATGCAGGAACAAGCGACTAGC
HY5-FL RP (BamHI):	CGGGATCCTCAAAGGCTTGCATCAGC
HY5-ΔN77 FP (EcoRI):	GGAATTCAGGAAGCGAGGGAGGACACCG
HY5- ΔN77 RP (BamHI):	CGGGATCCTCAAAGGCTTGCATCAGC
HY5- N77 FP (EcoRI):	GGAATTCATGCAGGAACAAGCGACTAGC
HY5 N77 RP (BamHI):	CGGGATCCTTGACTTTCTCCGACAGTCGC
COP1-FL FP (EcoRI):	GGAATTCATGGAAGAGATTTCGACGG
COP1-FL RP (PstI):	AACTGCAGAGCTCGGTATAAATCTATTC
COP1-Zn+CC FP (EcoRI):	GGAATTCATGGAAGAGATTTCGACGG
COP1-Zn+CC RP (PstI):	AACTGCAGAGCTCGGTATAAATCTATTC
COP1-WD-40 FP (EcoRI):	GGAATTCGCCACTGCTGGTGTTTCTAG
COP1-WD-40 RP (BamHI):	CGGGATCCCGCAGCGAGTACCAGAAC

List of primers used in BiFC assays

SHW1-FL: FP (BamHI) CGGGATCCATGGCCGCAGCTACAACAACC

SHW1-FL: RP (XhO1) CCGCTCGAGTTAATTTACCGGGTTTGGTCC

COP1- FL: FP (Asc1) GGCGCGCCATGGAAGAGATTTCGACGGATC

COP1-FL: RP (Xho1) CCGCTCGAGCGCAGCGAGTACCAGAACTTTG

List of primers used in RT-PCR

HY5-FP: CTGAAGAGGTTGTTGAGGAACAG

HY5-RP: AGAAGAAGAAGGAGATCAAAGGC

ACTIN2-FP: AAAGGCTTAAAAAGCTGGGG

ACTIN2-RP: GGGACTAAAACGCAAAACGA

List of primers used in Genomic PCR

LBP : GCGTGGACCGCTTGCTGCACCT

SHW1 specific primers LP11: TGCAAAAGACACCTGCAAATCA and

RP11: ATGCAAAGAAC CGAGAGGTCG