The cAMP-PKA pathway-mediated fat mobilization is required for cold tolerance in *C. elegans*

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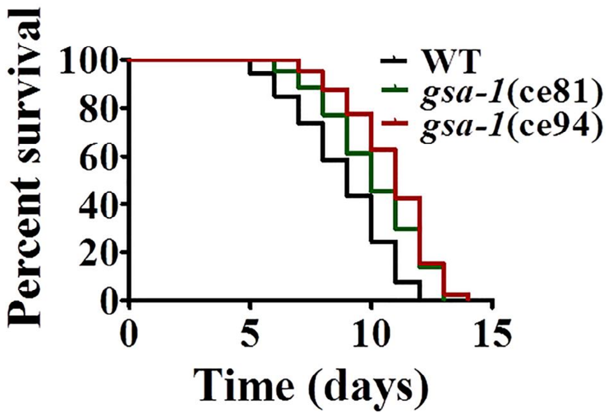
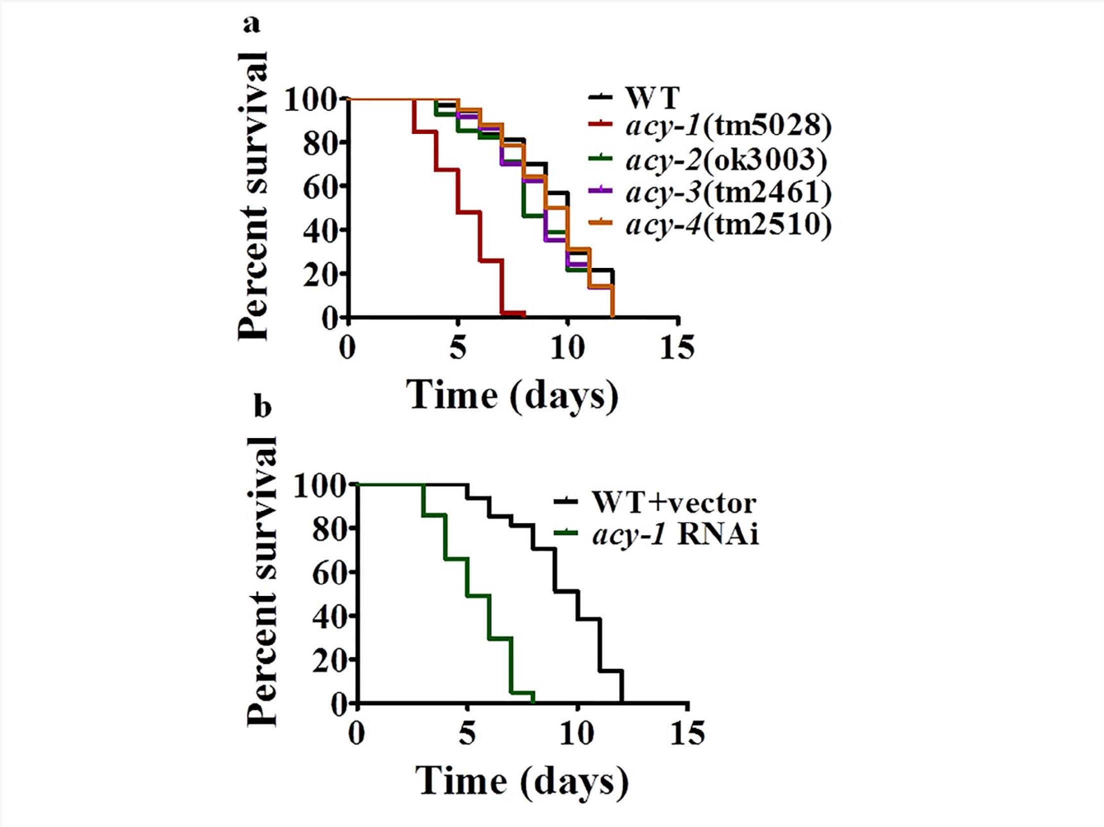
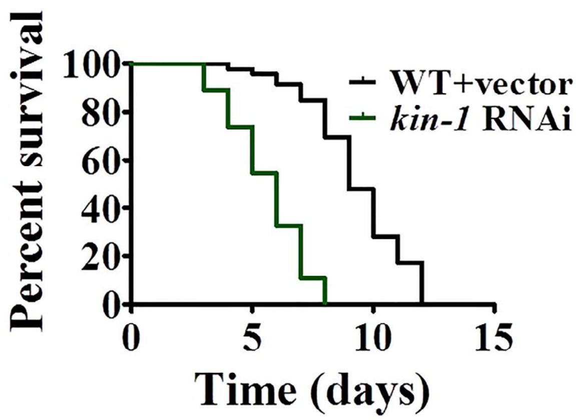


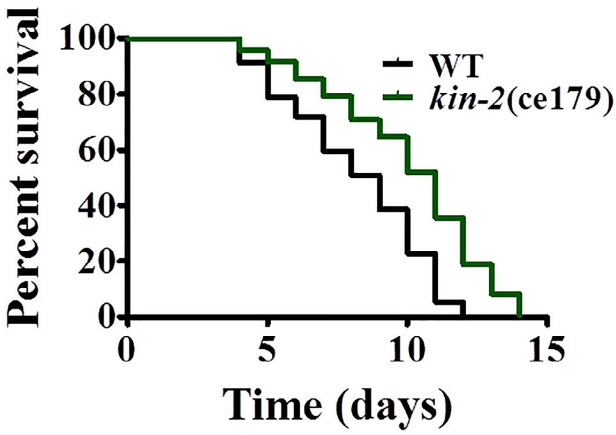
Supplementary Figure 1. Mutations in *gsa-1(ce94)* and *gsa-1(ce81)* promote survival of worms under cold conditions. $P < 0.01$ relative to wild type (WT) worms.



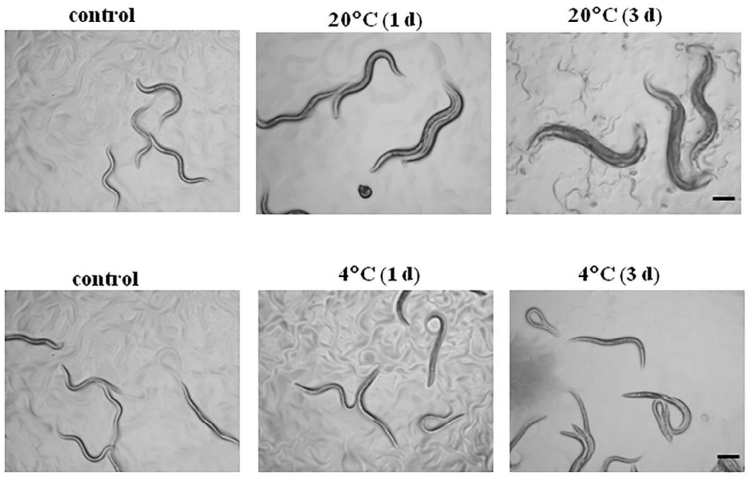
Supplementary Figure 2. Mutation or knockdown of *acy-1* reduces survival of worms under cold conditions. (a) $P < 0.001$ relative to wild type (WT) animals. (b) $P < 0.01$ relative to WT with empty vector.



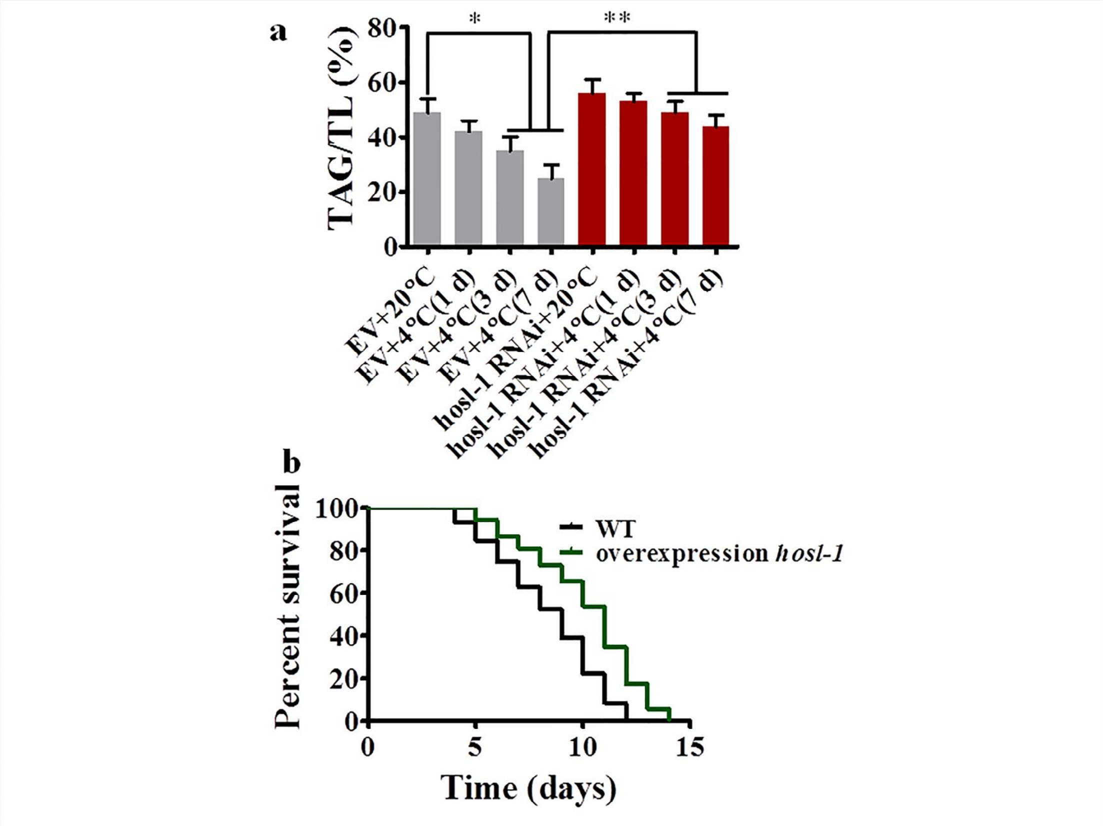
Supplementary Figure 3. Knockdown of *kin-1* by RNAi reduces survival of worms under cold conditions. $P < 0.01$ relative to wild type (WT) animals with empty vector.



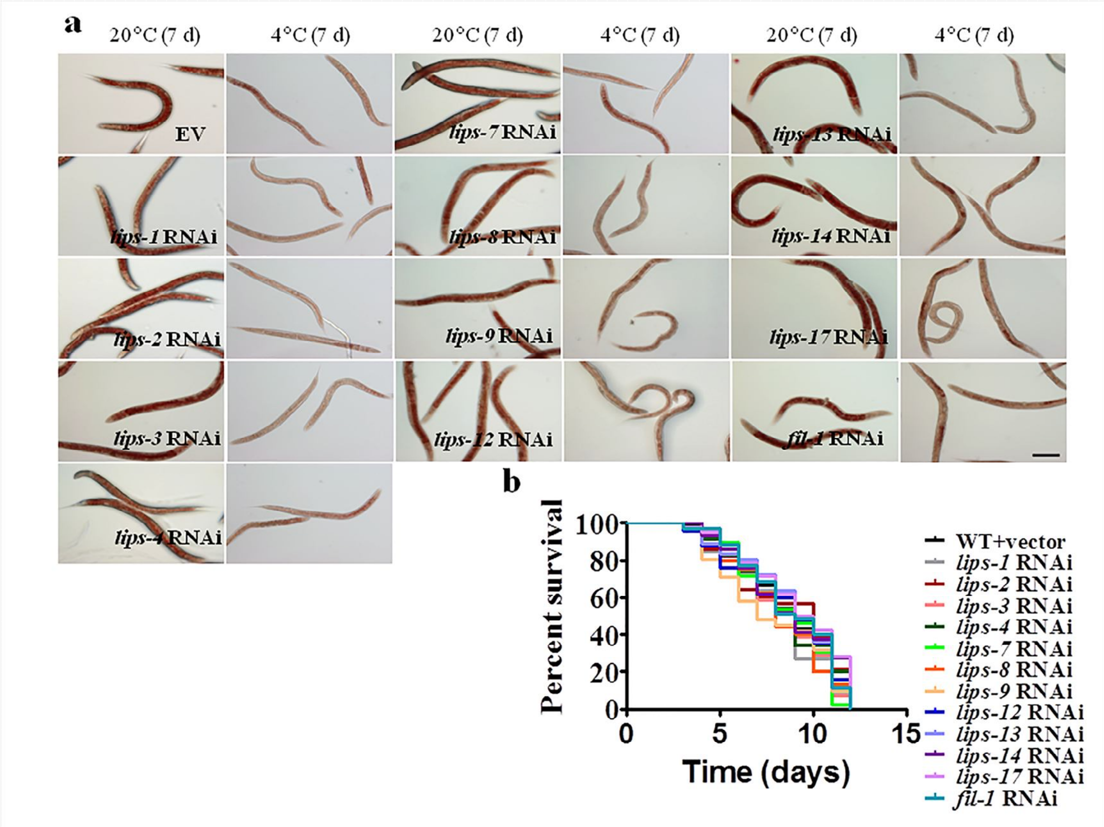
Supplementary Figure 4. Mutation in *kin-2(ce179)* promotes survival of worms under cold conditions. *P* < 0.01 relative to wild type (WT) worms.



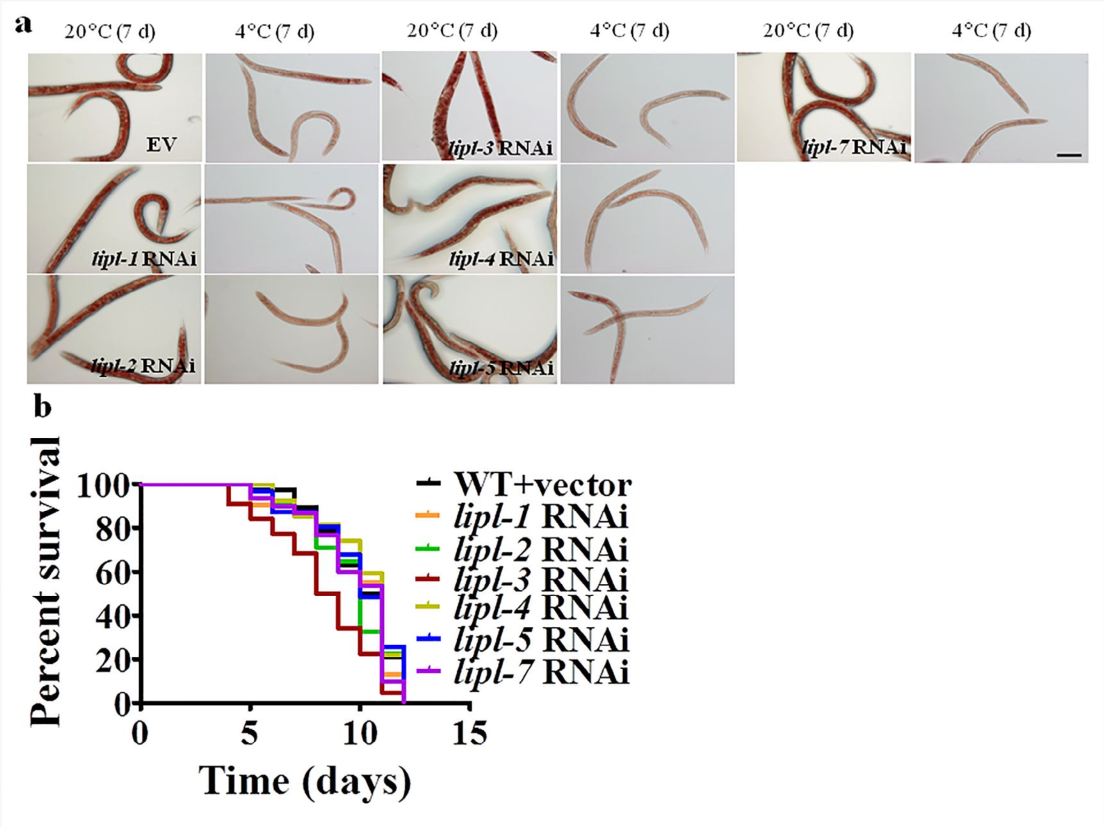
Supplementary Figure 5. Exposure to chill (4 °C) resulted the defects in egg production. Scale bar, 100 μm.



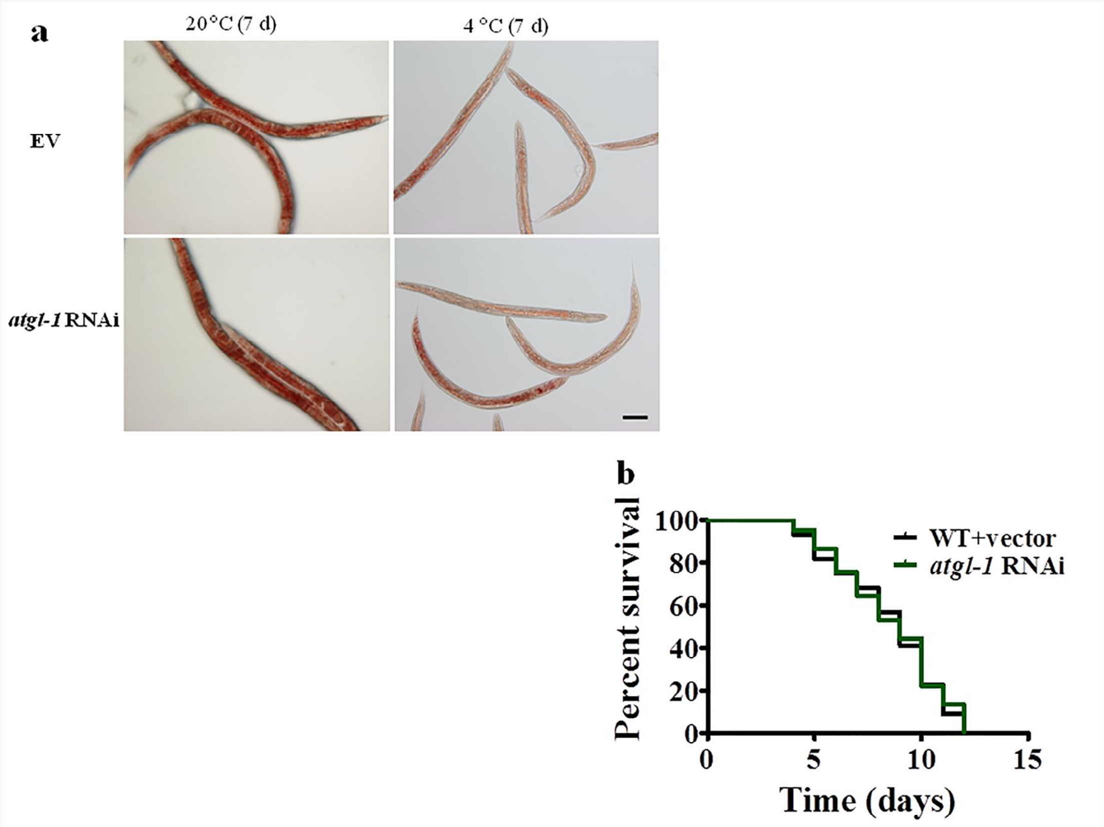
Supplementary Figure 6. Knockdown of *hosl-1* by RNAi inhibits cold-induced lipid hydrolysis. (a)The relative triacylglycerol contents were determined by GC-MS. *$P< 0.05$; **$P< 0.01$. **Overexpression *hosl-1* in worms exhibited enhanced resistance to cold stress.** (b) $P < 0.01$ relative to wild type (WT) worms.



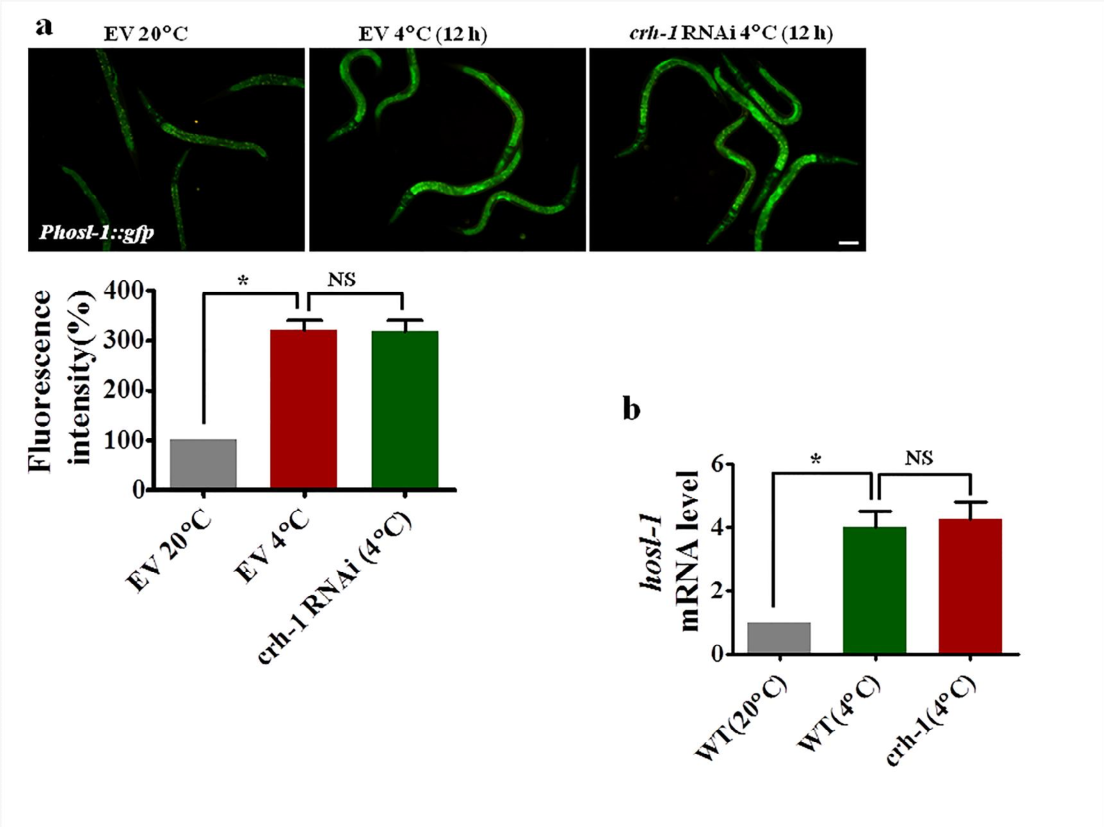
Supplementary Figure 7. Twelve class II lipase genes are not involved in lipid hydrolysis and cold tolerance. (a) Lipid content was determined by staining with Oil Red O. Scale bar, 150 μm. (b) Knockdown of these genes by RNAi did not influence survival of worms at 4°C.



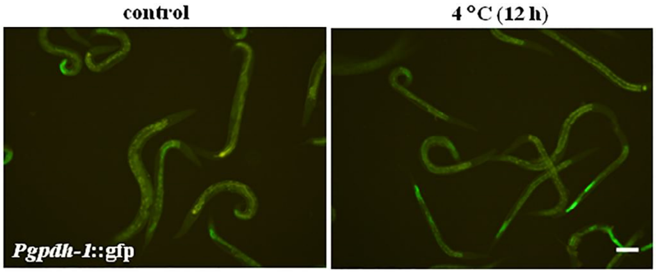
Supplementary Figure 8. Six lipase-related genes are not involved in lipid hydrolysis and cold tolerance. (a) Lipid content was determined by staining with Oil Red O. Scale bar, 150 μm. (b) Knockdown of these genes by RNAi did not influence survival of worms at 4°C.



Supplementary Figure 9. *atgl-1* is not involved in lipid hydrolysis and cold tolerance. (a) Lipid content was determined by staining with Oil Red O. Scale bar, 100 μm. (b) Knockdown of *atgl-1* by RNAi did not influence survival of worms at 4°C.



Supplementary Figure 10. CRH-1 is not involved in up-regulation of *hosl-1* expression mediated by KIN-1. (a) Knockdown of *crh-1* by RNAi did not influence the expression of *Phosl-1::gfp* at 4°C. Scale bar, 100 μm. (b) The mutation in *crh-1(tz2)* did not influence the mRNA levels of *hosl-1* at 4°C. **P*< 0.05; NS, not significant.



Supplementary Figure 11. Cold stress does not influence the expression of *gpdh-1*.

The expression of *Pgpdh-1::gfp* was not altered in worms exposed to cold (4 °C). Scale bar, 100 µm.

Supplementary Table 2. The efficiency of RNAi is detected by quantitative RT-PC.

Gene	The efficiency of RNAi
gsa-1	85%
acy-1	80%
kin-1	88%
hosl-1	81.5%
atgl-1	90%
lipl-1	75%
lipl-2	78%
lipl-3	90%
lipl-4	82%
lipl-5	78%
lipl-7	70%
lips-1	85%
lips-2	80%
lips-3	90%
lips-4	89%
lips-7	77%
lips-8	87%
lips-9	92%
lips-12	72%
lips-13	79%
lips-14	84%
lips-17	91%
fil-1	80%
crh-1	75%

Supplementary Table 3. Primer sequences used for quantitative RT-PC.

Gene	Sequences (5'→3')	Product length (bp)
gsa-1-F *gsa-1*-R	TGCTGGAAAGACAAGGGAGT ATCGTAGTTGTTCTGTCGCAC	117
acy-1-F *acy-1*-R	GCCGCTCAATACCAAAGGTT GCAACTGGAGTCATAAACGC	119
kin-1-F *kin-1*-R	GAAGGACAACAAGAACTCGGC GAATGATCCGGTTCCAAGG	145
hosl-1-F *hosl-1*-R	GGCTCGCTCATCAACACTGG CACCATTTCTCCACTCTTCC	231
atgl-1-F *atgl-1*-R	CGGGTTGTGGATTCCTTTGTG TGAGACCACAGGCAACGAT	126
lipl-1-F *lipl-1*-R	TCCTGGAGCACGGTTATGTT TTTGTGGCGTGGTCATCTTC	94
lipl-2-F *lipl-2*-R	ACGGACAAGATACACCACCA TCTCCAAGCCAATCATCGTCA	91
lipl-3-F *lipl-3*-R	CTGTGACAATGTGTGCTTCCT TCCGTGCCGAACCATCTGAA	142
lipl-4-F *lipl-4*-R	GATGTGAATAATTCCCGTCC GCCCAACCACACATCAAACC	135
lipl-5-F *lipl-5*-R	GAGTGCTGGTTTCCTGTTCG TCCCAACTCCAGTCCCAGAA	129
lipl-7-F *lipl-7*-R	CAAATAGCCGTGGAACTCCTG CCAAATCCACACTCGCTGTC	123
lips-1-F *lips-1*-R	TCGGACCCAACCTATCGCAT AGTCATTTCTGGGCAGGTGC	146
lips-2-F *lips-2*-R	TCCCAGGCAGCAACATTTG TTGGTCCGCTGCTGTTTCA	77
lips-3-F *lips-3*-R	AAACTGTTCCCGCTTGGTGC AGCGACCGTTCATTCCTGGA	258
lips-4-F *lips-4*-R	GTGGCAAAGTTGATGTGTTCG ATAGCCTCCACACGAATCTCC	137
lips-7-F *lips-7*-R	CCTTCCTGTCAGTTGCTGGT CCATCACGCTTCACAAATCCA	253
lips-8-F *lips-8*-R	TTTGTTGGTGTTGCTGGGC CAATCCGATAACCCTGCTGC	120
lips-9-F *lips-9*-R	TCGGTTTCTCGCTTGGTGT TGTCAGCGGTTCTCCAAGGT	92
lips-12-F *lips-12*-R	GAAACCGTCTACGCAACATCA CCCTTCTCCATACGCCACAAT	156
lips-13-F *lips-13*-R	GGGCAATACAACCGACACTTC GTGCCACAATATCAACCTGA	122
lips-14-F *lips-14*-R	CATACAGCACAACTCACACCT TGAACTTCGTCGGTAGGCAA	109

lips-17-F *lips-17*-R	TGTATCTGTTGCTGGAGCC CTTTATCGTCTCCTGGTCCGT	176
fil-1-F *fil-1*-R	GGAGTTACCCTTGCCAGAAAG AGACCCAAATCACAGGAACC	74
crh-1-F *crh-1*-R	CGCCGTTGATGATGCTCTTG TCACCTTATCCGCCGTTTCT	141