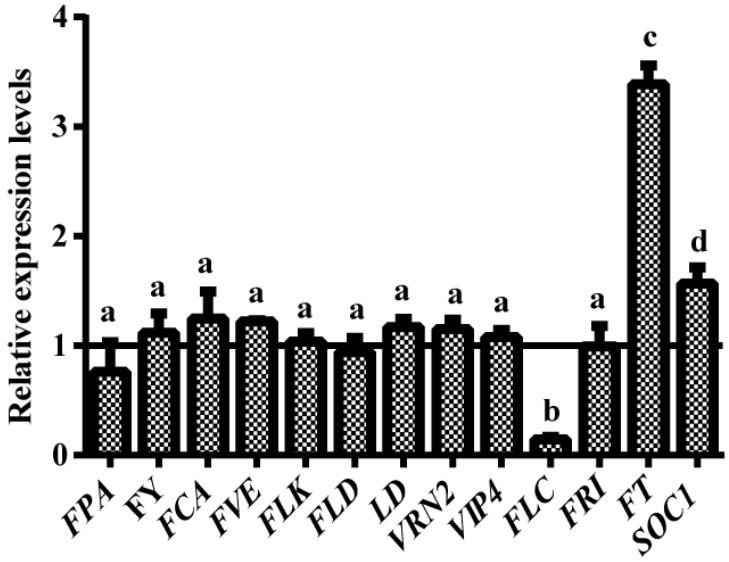

Fig. S1. *FLC* is down regulated in the *top1α* mutant. The qRT-PCRs were used to measure the relative expression levels of *FPA*, *FY*, *FCA*, *FVE*, *FLK*, *FLD*, *LD*, *VRN2*, *VIP4*, *FLC*, *FRI*, *FT* and *SOC1* in *top1α* mutants. The expression levels of these genes in the wild-type Col-0 were normalized to 1 and marked with the black line. Mean ± SD with three independent biological replicates. Bars marked with different letters are statistically different to each other ($P < 0.05$ by Student's t test). Total RNA was isolated from 8-day-old seedlings grown in 1/2 MS media under long-day conditions. *TUBULIN* was used to normalize the mRNA levels. The primer sequences used are listed in Table S1.

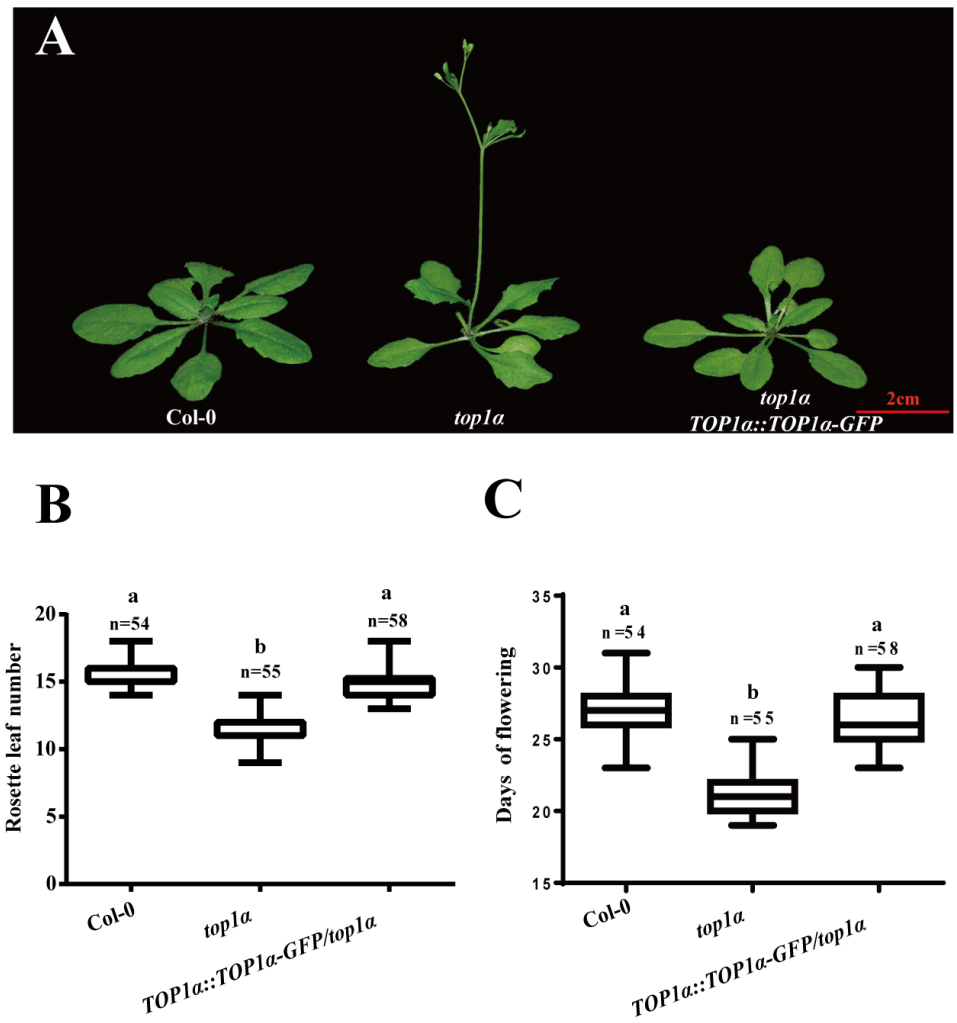

Fig. S2. The *pTOP1α::TOP1α-GFP* transgenic plants rescue early flowering phenotypes of *top1α* mutants. (A) The early flowering phenotypes of *top1α* mutants were rescued by the *pTOP1α::TOP1α-GFP* transgene. Bar, 2 cm. **(B-C)** The rosette leaf numbers and days of flowering were measured in Col-0, *top1α* and *pTOP1α::TOP1α-GFP/top1α* transgenic plants. Mean ± SD. Bars marked with different letters are statistically different to each other ($P < 0.05$ by Student's t test). Plants were grown in the soil under long-day conditions. n, the number of plants.

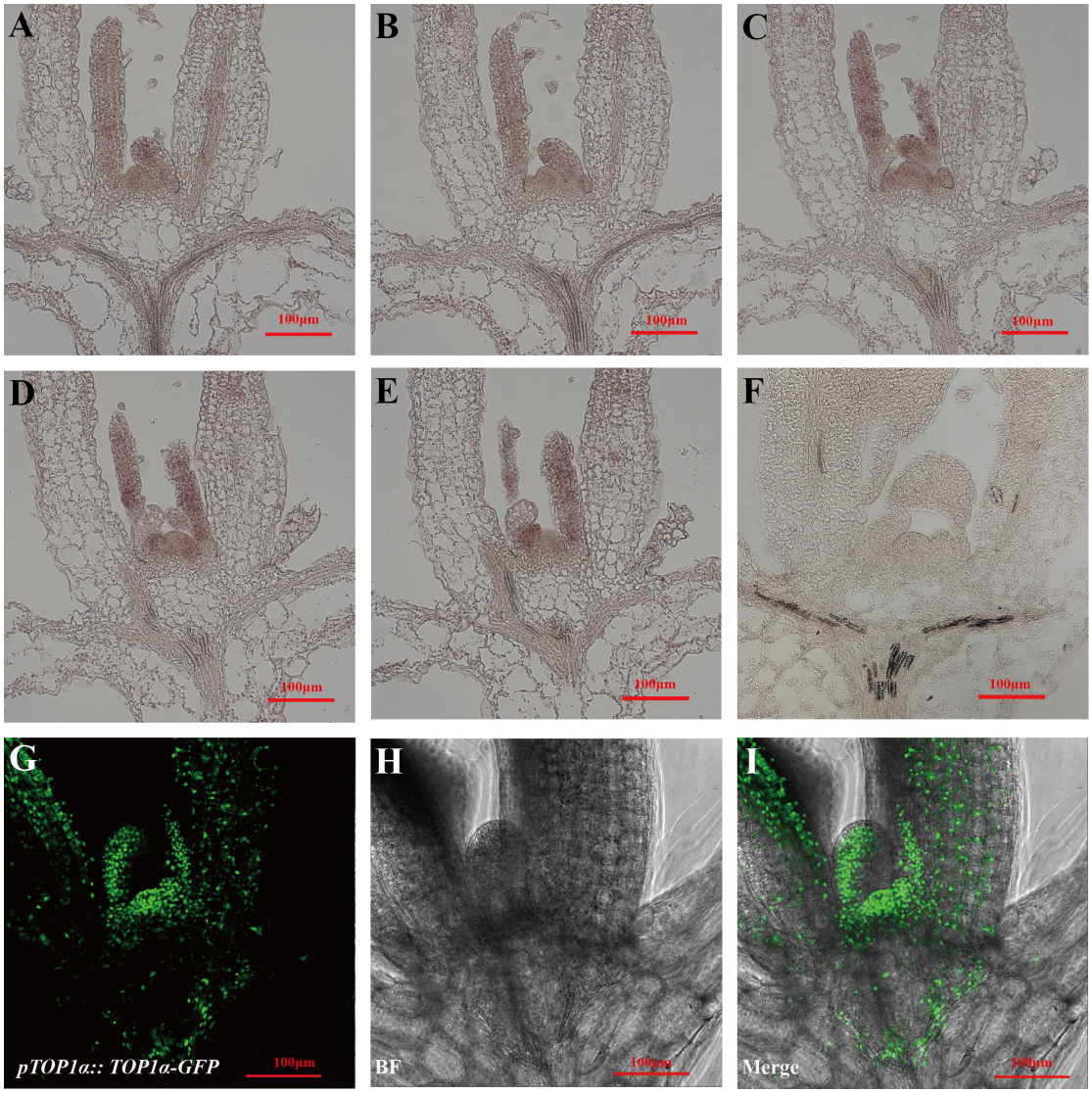

Fig. S3. *TOP1α* expression patterns in the shoot apex. (A-E) *TOP1α* expression patterns in the Col-0 seedlings using *in situ* hybridization. Serial sections were shown. Bar, 100 μm. **(F)** The sense control of *TOP1α* in the *in situ* hybridization. **(G-I)** The protein localization of TOP1α in the *pTOP1α:: TOP1α-GFP/ top1α* rescued plant. Bar, 100 μm.

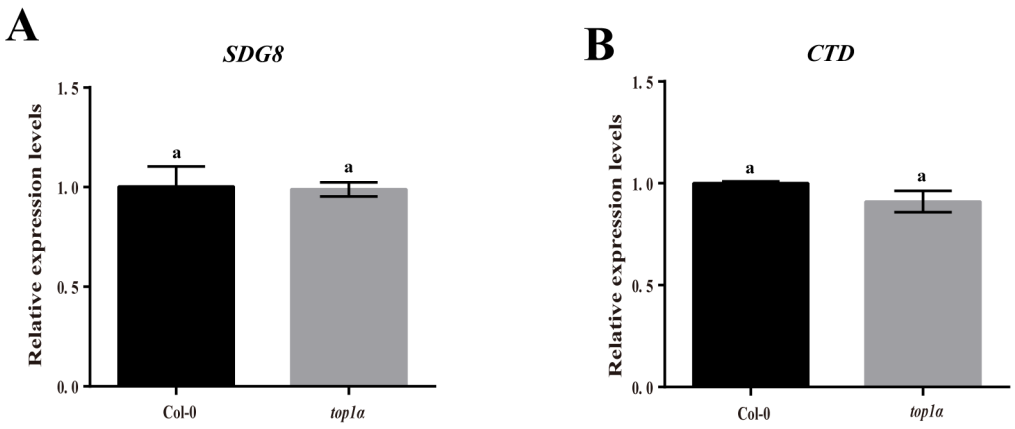

Fig. S4. TOP1α does not regulate *SDG8* and *CTD* at the transcription level. The relative expression levels of *SDG8* **(A)** and *CTD* **(B)** in *top1α* mutants were detected by qRT-PCR. Mean ± SD with three independent biological replicates. Bars marked with same letters are not statistically different to each other ($P > 0.05$ by Student's t test). Total RNA was isolated from 8-day-old seedlings grown in 1/2 MS media under long-day conditions. *TUBULIN* was used to normalize the mRNA levels. The primer sequences used are listed in Table S1.

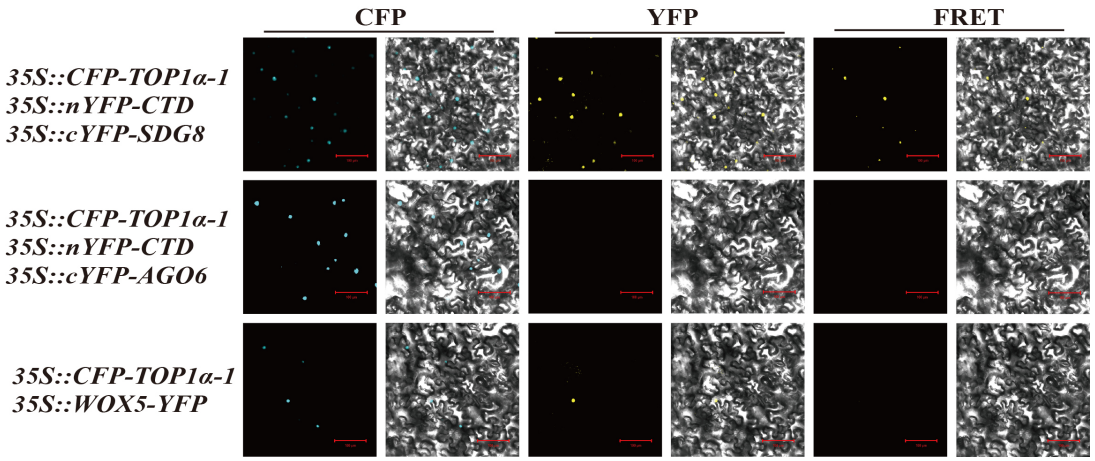

Fig. S5. TOP1α, CTD and SDG8 are in the same complex. BiFC-based FRET was performed to examine the interaction of TOP1α, CTD and SDG8 proteins in the same complex. The *35S::CFP-TOP1α-1*, *35S::nYFP-CTD* and *35S::cYFP-SDG8* were co-transformed into the abaxial leaves of *N. benthamiana*. The *35S::cYFP-AGO6* and *35S::WOX5-YFP* were used as negative controls. The excitation wavelength of 448 nm (CFP) and the emission wavelength of 514 nm (YFP) were used in the FRET channel. Bar, 100 μm.

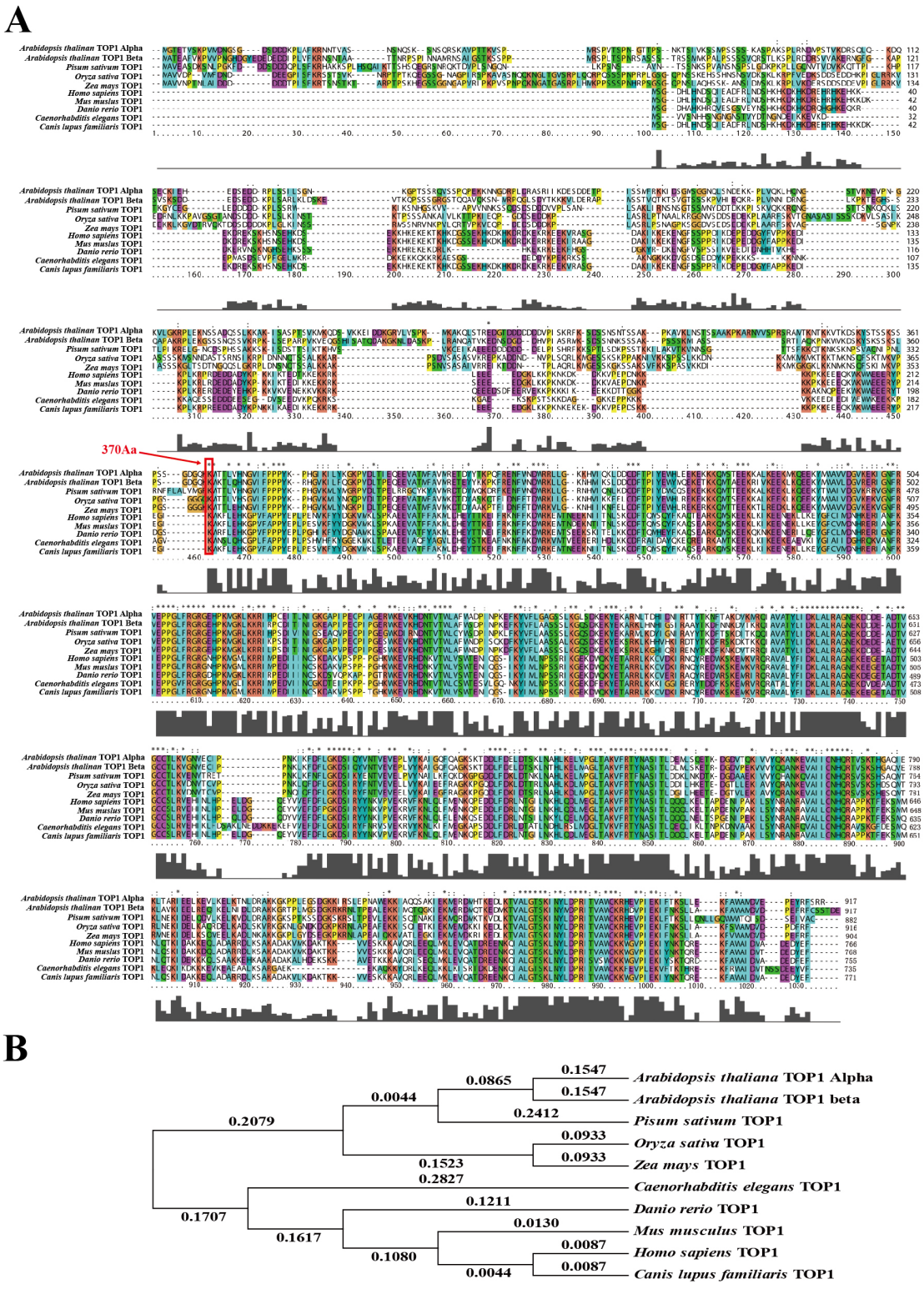

Fig. S6. The alignment of Topoisomerase 1 in different species. (A) All protein sequences were obtained from NCBI (https://www.ncbi.nlm.nih.gov/) and aligned using the software ClustalX2 (http://www.clustal.org/clustal2/). The numbers of amino acids are marked on the right. The column below shows the conservation

among different species. The dot ('.'), conservative; ':', obviously conservative; '*', absolutely conservative. The red frame shows the 370th amino acid of TOP1α in *Arabidopsis thaliana* and conserved amino acids among different species. **(B)** Phylogenetic tree and genetic distance of Topoisomerase 1 protein sequences among different species. The numbers above indicate the genetic distance.

Table S1. Oligonucleotides used in this study

Primers for ChIP and qRT-PCR

Number	Name	Forward (F) and reverse (R) primers
H3111	*FLC* 1 (-662 to -412)	F: 5'-AGGCGAGTGGTTCTTTGTTTT-3'
H3112		R: 5'-CCTCCCCTACGATACGGATT-3'
H6342	*FLC* 2 (-269 to -201)	F: 5'-CTCGTCATGCGGTACACGTGGC-3'
H6461		R: 5'-AAAAACCAAATATGTGAATAAAAAC-3'
H5744	*FLC* 3 (-200 to -1)	F: 5'-TTGCATCACTCTCGTTTACCC-3'
H5745		R: 5'-GGCTTCTCTCCGAGAGGGC-3'
H1248	*FLC* 4 (+71 to +150)	F: 5'-TCGCAACGGTCTCATCGA-3'
H1249		R: 5'-GGCGGAGACGACGAGAAG-3'
H3115	*FLC* 5 (+201 to +388)	F: 5'-ACCTGGGTTTTCATTTGTTCC-3'
H3116		R: 5'-TTTGGTTATCTCATGTATCTATC-3'
H3117	*FLC* 6 (+688 to +865)	F: 5'-TCATTGGATCTCTCGGATTTG-3'
H3118		R: 5'-ACTAATTTGGATAATCACCAAG-3'
H3119	*FLC* 7 (+1306 to +1524)	F: 5'-TTCCCACTCTTGCAGTTACACACA-3'
H3120		R: 5'-AAGACACAAGATACAAAGGTTGT-3'
H3121	*FLC* 8 (+2562 to +1746)	F: 5'-TGAACTCATGAAAGAGGCGTT-3'
H3122		R: 5'-TACAAAGCGTGTTATCAAAACC-3'
H6339	*FLC* 9 (+5506 to +5616)	F: 5'-ATGGAGAATAATCATCATGTG-3'
H6340		R: 5'-CTAATTAAGTAGTGGGAGAG-3'
H3123	*FLC* 10 (+5733 to +5869)	F:5'-GTTTGTATATCTTAATACTCTCTCTTTGGC-3'
H3124		R: 5'-ATGCAATTCTCACACGAATAAG-3'
H2660	*FPA*	F: 5'-ACCAAGCACTACGATTGCAGC-3'
H2661		R: 5'-ACCTGAAGACTGTTGCTGCTG-3'
H2662	*FY*	F: 5'-TCAAGGACAACCAAACAGTG-3'
H2663		R: 5'-TGCCTACTGATGTTGCTGATTG-3'
H2664	*FCA*	F: 5'-AGCAGCAACCGCTACAAAAGATG-3'

H2665		R: 5'-TGCGAGAACTGGCACAAAC-3'
H2821	*FVE*	F: 5'-TGCGAGAACTGGCACAAAC-3'
H2822		R: 5'-AGGCGAACCAACTCCATTAG-3'
H2823	*FLK*	F: 5'-ACGTCGGGTTCAAACATAAG-3'
H2824		R: 5'-TTGCTGCTCTGGTGCTAC-3'
H2825	*FLD*	F: 5'-ACGCAGTGACTCGTGTTC-3'
H2826		R: 5'-AGGGTATCGCCTTGTTG-3'
H2827	*LD*	F: 5'-TCGTCACAGGGTCCAAAAC-3'
H2828		R: 5'-TATAAAGGGCACGCATC-3
H2670	*VRN2*	F: 5'-ATGGACTTGTCGACTCAGCCAC-3'
H2671		R: 5'-TGTCATTCGGATGATCCACAATG-3'
H2672	*VIP4*	F: 5'-TGAAGAAGAGGAAGAGGTTGC-3'
H2673		R: 5'-TCGTCACTGTCATCAATCACG-3'
H2656	*FRI*	F: 5'-TGACTGAAGGAGGATTAGCTG-3'
H2657		R: 5'-TCTCATTCGAACCACTCATC-3'
H1248	*FLC*	F: 5'-TCGCAACGGTCTCATCGA-3'
H1249		R: 5'-GGCGGAGACGACGAGAAG-3'
H0999	*FT*	F: 5'-TACGAAAATCCAAGTCCCACTG-3'
H1000		R: 5'-AAACTCGCGAGTGTTGAAGTTC-3'
H0504	*SOC1*	F: 5'-AGGAACATGCTCAATCGAGG-3'
H0505		R: 5'-CTTATACACTCTCAGTACTGC-3'
H5028	*SDG8*	F: 5'-ACCTGACTTACTCCAATGAGATC-3'
H0723		R: 5'-TTAACTGTTGAGCTTCTTCTCTAAA-3'
H6529	*CTD*	F: 5'-AGCAAGCCCAGACTACAGC-3'
H6530		R: 5'-CAGGGTTGCCTTTATCATCC-3'
H0069	*Tublin*	F: 5'-GAGCCTTACAAGCTACTCTGTCTGTC-3'
H0070		R: 5'-ACACCAGACATAGTAGCAGAAATCAAG-3'

Primers for *in situ* hybridization

Number	Name	Forward (F) and reverse (R) primers
H0079	*TOP1α*	T7: 5'-TAATACGACTCACTATAGGG-3'
H0080		Sp6: 5'-ATTTAGGTGACACTATAGAATACT-3'

Primers for cloning

Number	Name	Forward (F) and reverse (R) primers
H5603	*SDG8*	F: 5'-GCGTCGACCTAAAAAACCATGTTGGGGATTCA-3'
H5604		R: 5'-TTTTCCTTTTGCGGCCGCAAATTTAACTTTCAAACGAAGGC-3'
H5308	*TOP1α-1*	F:
H4036		5'-ATAAGAATGCGGCCGCCATGGGCACTGAAACAGTTTCAAAACC-3'
		R: 5'-CCGCTCGAGTTATTTCTTTTGCCCATCTCCAGAGGAAG-3'
H5309	*TOP1α-2*	F:
H4038		5'-ATAAGAATGCGGCCGCcAAATGGACTACTTTGGTGCACAACGG-3'
		R: 5'-CCGCTCGAGTTATCCCAAAAATACATACTTGAATTC-3'
H5310	*TOP1α-3*	F:
H4041		5'-ATAAGAATGCGGCCGCCCTTTTCAGAGGCCGTGGAGAACATCC-3'
		R: 5'-ACGCGTCGACACACACATGGTGCGCAAATTGAAAAATTG-3'
H5579	*CTD*	F: 5'-ACGCGTCGACaGTTTATCCCCAATGTCAGATGCAC-3'
H5580		R: 5'-ATAGTTTAGCGGCCGCCAGGGTTGCCTTTATCATCCTTAC-3'
H3109	*FLC*	F: 5'-ACGCGTCGACATGGGAAGAAAAAAACTAGAAATC-3'
H3110		R: 5'-TTTTCCTTTTGCGGCCGCCTAATTAAGTAGTGGGAGAG-3'