

Supplementary Materials Experimental Evidence and In Silico Identification of Tryptophan Decarboxylase in *Citrus* Genus

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Table S1. The 12 deduced protein sequences of clementine (*C. clementina*), retrieved from Phytozome v10 database for producing significant alignments vs. *C. roseus* TDC protein of 500 aa residues, are reported with source parameters.

Sequence Code	Score (Bits)	E Value	Identity	Length	Phytozome Annotation
Ciclev10014992m	702.6	0	68.0%	499	Tyrosine decarboxylase
Ciclev10018100m	601.3	0	55.4%	506	Tyrosine decarboxylase
Ciclev10000723m	595.9	0	56.2%	567	Tyrosine decarboxylase
Ciclev10033968m	590.5	0	56.6%	501	Tyrosine decarboxylase
Ciclev10031252m	578.9	0	55.1%	517	Tyrosine decarboxylase
Ciclev10018301m	567.0	0	53.2%	519	Aromatic amino acid decarboxylase (PANTHER)
Ciclev10025359m	548.1	0	53.3%	523	Aromatic amino acid decarboxylase (PANTHER)
Ciclev10025447m	508.4	8.8×10^{-176}	50.8%	498	Aromatic amino acid decarboxylase (PANTHER)
Ciclev10020518m	439.1	3.5×10^{-150}	53.2%	391	Tyrosine decarboxylase
Ciclev10025789m	424.1	2.3×10^{-144}	51.0%	395	Aromatic amino acid decarboxylase (PANTHER)
Ciclev10027405m	395.2	1.9×10^{-132}	48.7%	432	Aromatic amino acid decarboxylase (PANTHER)
Ciclev10031566m ¹	35.4	8.8×10^{-2}	25.3%	438	Sphingosine phosphate lyase (PANTHER)

¹ The BLAST parameters for this sequence suggest to consider it not significant.

Table S2. The 11 deduced protein sequences of sweet orange (*C. sinensis*), retrieved from Phytozome v10 database and producing significant alignments vs. *C. roseus* TDC protein of 500 aa residues, are reported with source parameters.

Sequence Code	Score (Bits)	E Value	Identity	Length	Phytozome Annotation
orange1.1g010842m	703.4	0	68.0%	499	Aromatic amino acid decarboxylase (PANTHER)
orange1.1g038818m	595.1	0	56.7%	486	Aromatic amino acid decarboxylase (PANTHER)
orange1.1g010125m	578.9	0	55.1%	517	Aromatic amino acid decarboxylase (PANTHER)
orange1.1g048643m	570.1	0	55.4%	506	Aromatic amino acid decarboxylase (PANTHER)
orange1.1g037144m	562.8	0	54.7%	502	Aromatic amino acid decarboxylase (PANTHER)
orange1.1g041829m	545.0	0	53.5%	486	Tyrosine decarboxylase
orange1.1g048019m	397.1	3.9×10^{-134}	56.3%	355	Aromatic amino acid decarboxylase (PANTHER)
orange1.1g046506m	329.7	1.4×10^{-108}	51.1%	310	Aromatic amino acid decarboxylase (PANTHER)

orange1.1g048438m	258.8	3.6×10^{-82}	50.0%	239	Aromatic amino acid decarboxylase (PANTHER)
orange1.1g036996m	231.5	6×10^{-72}	58.5%	214	Aromatic amino acid decarboxylase (PANTHER)
orange1.1g041549m	194.9	6.0×10^{-58}	44.1%	218	Aromatic amino acid decarboxylase (PANTHER)

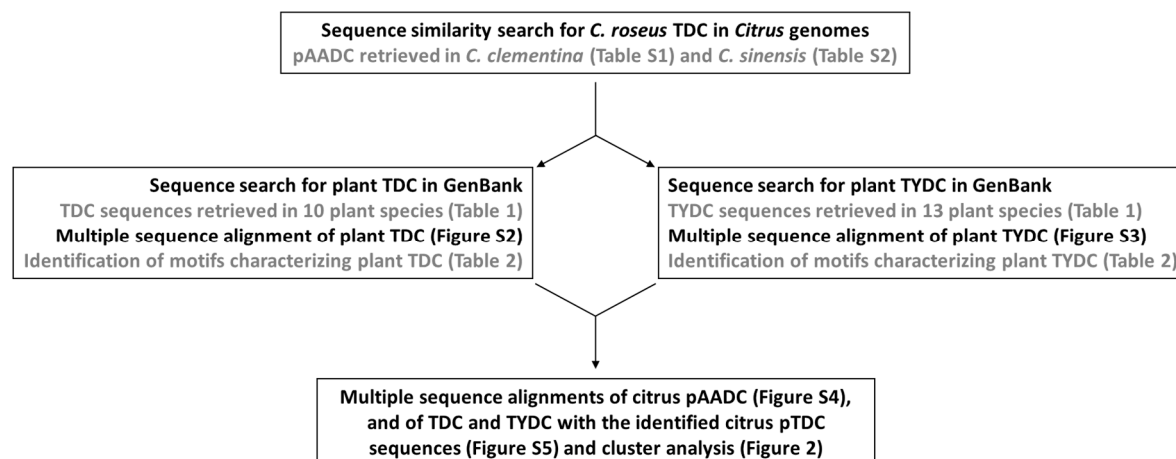


Figure S1. Workflow for TDC annotation in *Citrus* based on genomic screening and bioinformatics approach. In grey it is reported what is the result of the previous action and the input for the following one. pADC (putative Aromatic L-Amino Acid Decarboxylases).

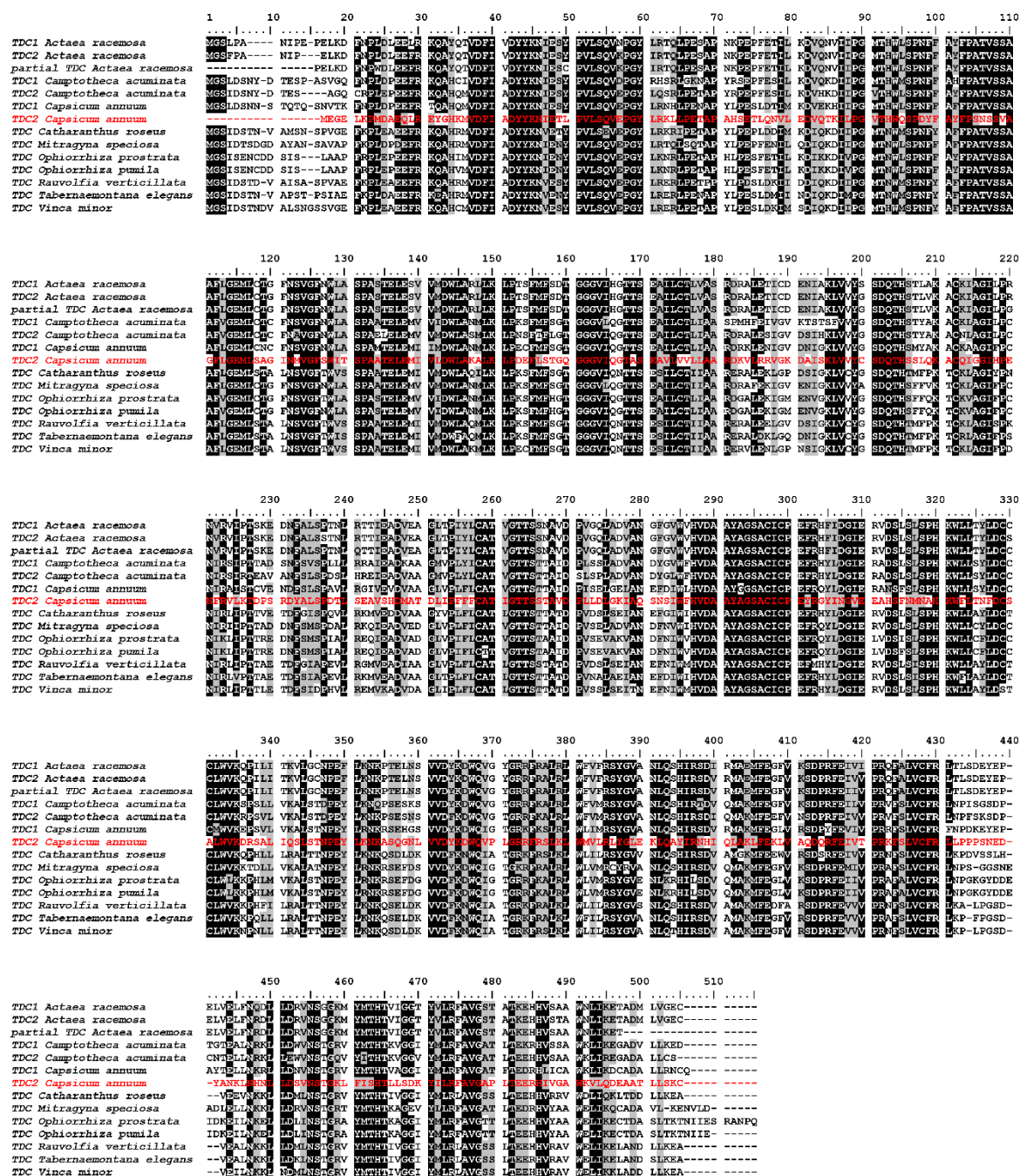


Figure S2. Multiple sequence alignment for representative plant TDC enzymes. Residues identical or similar in at least 80% of the aligned sequences are shaded in black or grey, respectively; gaps introduced are represented by dashes. *C. annuum* TDC2 sequence is indicated in red color to evidence its divergence respect to remaining TDC.

[illegible]

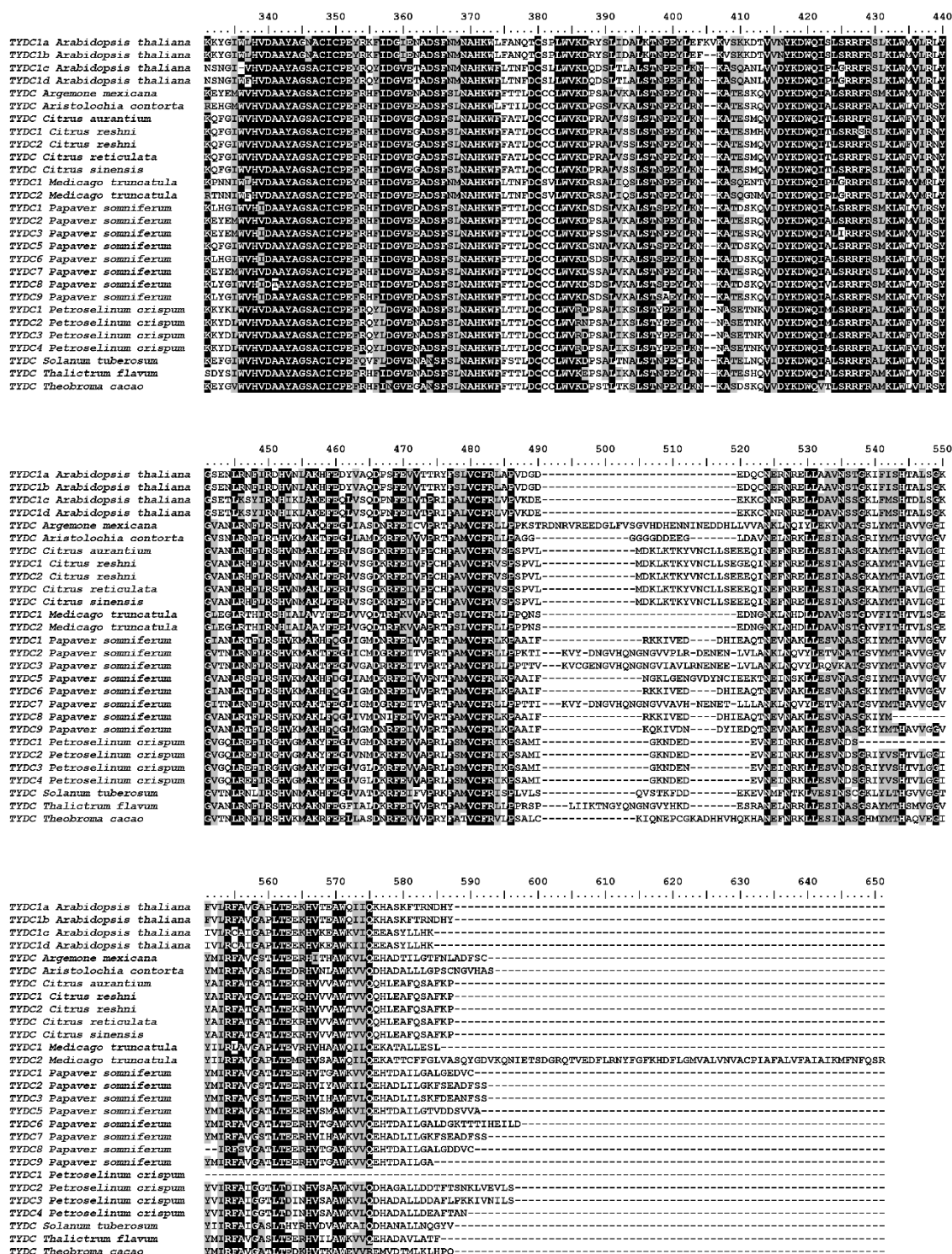


Figure S3. Multiple sequence alignment for representative plant TYDC enzymes. Residues identical or similar in at least 80% of the aligned sequences are shaded in black or grey, respectively; gaps introduced are represented by dashes.

1 10 20 30 40 50 60 70 80 90 100 110

Clemlentina|Ciclev10014992m|-----MGSLSGN-----MARSVQFKELDAQEERKQAHQVDFIADYQNIESYPTLVQVPGFGLRALPD
 Clemlentina|Ciclev10018100m|-----MGSLSDBELKHTASFNMDSEFRPQSGHMLDFIADYQNVKRYVLSQVPGGLAKRLPE
 Clemlentina|Ciclev100002723m|MEKLSSTIYTPSRGTEVITNKPFTLPIPTFLASIFFPNNFLPSAQMSGLTSDQLDG-NSGLVNLNLDPEFRPQAHMVIDFIADYQNVKRYVLSQVPGGLAKRLPE
 Clemlentina|Ciclev100033968m|-----STFNIDPDSERFRQSGHMLDFIADYQNVKRYVLSQVPGGLAKRLPE
 Clemlentina|Ciclev10031252m|-----MGSLSLDPLEYKNSGFTNLDSEFRPQSGHMLDFIADYQNVKRYVLSQVPGGLAKRLPE
 Clemlentina|Ciclev10018301m|-----MGSLSLDPLEYKNSGFTNLDSEFRPQSGHMLDFIADYQNVKRYVLSQVPGGLAKRLPE
 Clemlentina|Ciclev10025359m|-----MRAGEASLTKMGSFGLSANNITGHSSFSADLEPKSFSDESKAVIDFIADYQNVKRYVLSQVPGGLAKRLPE
 Clemlentina|Ciclev10025447m|-----MGSFGLSANNITGHSSFSADLEPKSFSDESKAVIDFIADYQNVKRYVLSQVPGGLAKRLPE
 Clemlentina|Ciclev10020518m|-----MGSFGLSANNITGHSSFSADLEPKSFSDESKAVIDFIADYQNVKRYVLSQVPGGLAKRLPE
 Clemlentina|Ciclev10025789m|-----LEPKSFPDESKAVIDFIAGYNNKIEKYPVQSKVPEPYLSVKRLPD
 Clemlentina|Ciclev10027405m|-----MGSLSGN-----MARSVQFKELDAQEERKQAHQVDFIADYQNIESYPTLVQVPGFGLRALPD
 Csinensis|orange1.1g010842m|-----MGSLSGN-----MARSVQFKELDAQEERKQAHQVDFIADYQNIESYPTLVQVPGFGLRALPD
 Csinensis|orange1.1g038818m|-----MGSLSGN-----MARSVQFKELDAQEERKQAHQVDFIADYQNIESYPTLVQVPGFGLRALPD
 Csinensis|orange1.1g010125m|-----MGSLSLDPLEYKNSGFTNLDSEFRPQSGHMLDFIADYQNVKRYVLSQVPGGLAKRLPE
 Csinensis|orange1.1g048643m|-----MGSLSLDPLEYKNSGFTNLDSEFRPQSGHMLDFIADYQNVKRYVLSQVPGGLAKRLPE
 Csinensis|orange1.1g037144m|-----MDQYAQEFRQSGHMLDFIADYQNVKRYVLSQVPGGLAKRLPE
 Csinensis|orange1.1g041829m|-----MDASQLRENAHVMDFIADYQNVKRYVLSQVPGGLAKRLPE
 Csinensis|orange1.1g048019m|-----MGSFGLSANNITGHSSFSADLEPKSFSDESKAVIDFIADYQNVKRYVLSQVPGGLAKRLPE
 Csinensis|orange1.1g048438m|-----MGSFGLSANNITGHSSFSADLEPKSFSDESKAVIDFIADYQNVKRYVLSQVPGGLAKRLPE
 Csinensis|orange1.1g036966m|-----MGSFGLSANNITGHSSFSADLEPKSFSDESKAVIDFIADYQNVKRYVLSQVPGGLAKRLPE
 Csinensis|orange1.1g041549m|-----MGSFGLSANNITGHSSFSADLEPKSFSDESKAVIDFIADYQNVKRYVLSQVPGGLAKRLPE

120 130 140 150 160 170 180 190 200 210 220

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 Clemlentina|Ciclev10018100m|SAPYNPETIETILQ---DVQSHIIPGITHWLSFNFFAPPATVSTAGTGLGSCACNSVGVNGLASAAATLEISVMDLHATMLKRNENFSGGGVCGGTCITSDSIL
 Clemlentina|Ciclev100002723m|CAPYNPESMETILQ---DVQSHIIPGITHWLSFNFFAPPATVSTAGTGLGSCACNSVGVNGLASAAATLEISVMDLHATMLKRNENFSGGGVCGGTCITSDSIL
 Clemlentina|Ciclev100033968m|CAPYNPESMETILQ---DVQSHIIPGITHWLSFNFFAPPATVSTAGTGLGSCACNSVGVNGLASAAATLEISVMDLHATMLKRNENFSGGGVCGGTCITSDSIL
 Clemlentina|Ciclev10031252m|SAPYNPESMETILQ---DVQSHIIPGITHWLSFNFFAPPATVSTAGTGLGSCACNSVGVNGLASAAATLEISVMDLHATMLKRNENFSGGGVCGGTCITSDSIL
 Clemlentina|Ciclev10018301m|SAPYNPETIETILQ---DVQSHIIPGITHWLSFNFFAPPATVSTAGTGLGSCACNSVGVNGLASAAATLEISVMDLHATMLKRNENFSGGGVCGGTCITSDSIL
 Clemlentina|Ciclev10025359m|TAPHSPESLEDILK---DVTDCILPGLTHWLSFNFFAPPATVSTAGTGLGSCACNSVGVNGLASAAATLEISVMDLHATMLKRNENFSGGGVCGGTCITSDSIL
 Clemlentina|Ciclev10025447m|TAPHSPESLEDILK---DVTDCILPGLTHWLSFNFFAPPATVSTAGTGLGSCACNSVGVNGLASAAATLEISVMDLHATMLKRNENFSGGGVCGGTCITSDSIL
 Clemlentina|Ciclev10020518m|TAPHSPESLEDILK---DVTDCILPGLTHWLSFNFFAPPATVSTAGTGLGSCACNSVGVNGLASAAATLEISVMDLHATMLKRNENFSGGGVCGGTCITSDSIL
 Clemlentina|Ciclev10025789m|TAPHSPESLEDILK---DVTDCILPGLTHWLSFNFFAPPATVSTAGTGLGSCACNSVGVNGLASAAATLEISVMDLHATMLKRNENFSGGGVCGGTCITSDSIL
 Clemlentina|Ciclev10027405m|TAPHSPESLEDILK---DVTDCILPGLTHWLSFNFFAPPATVSTAGTGLGSCACNSVGVNGLASAAATLEISVMDLHATMLKRNENFSGGGVCGGTCITSDSIL
 Csinensis|orange1.1g010842m|TAPHSPESLEDILK---DVTDCILPGLTHWLSFNFFAPPATVSTAGTGLGSCACNSVGVNGLASAAATLEISVMDLHATMLKRNENFSGGGVCGGTCITSDSIL
 Csinensis|orange1.1g038818m|SAPYNPETIETILQ---DVQSHIIPGITHWLSFNFFAPPATVSTAGTGLGSCACNSVGVNGLASAAATLEISVMDLHATMLKRNENFSGGGVCGGTCITSDSIL
 Csinensis|orange1.1g010125m|SAPYNPETIETILQ---DVQSHIIPGITHWLSFNFFAPPATVSTAGTGLGSCACNSVGVNGLASAAATLEISVMDLHATMLKRNENFSGGGVCGGTCITSDSIL
 Csinensis|orange1.1g048643m|CAPYNPESMETILQ---DVQSHIIPGITHWLSFNFFAPPATVSTAGTGLGSCACNSVGVNGLASAAATLEISVMDLHATMLKRNENFSGGGVCGGTCITSDSIL
 Csinensis|orange1.1g037144m|SAPYNPESMETILQ---DVQSHIIPGITHWLSFNFFAPPATVSTAGTGLGSCACNSVGVNGLASAAATLEISVMDLHATMLKRNENFSGGGVCGGTCITSDSIL
 Csinensis|orange1.1g041829m|SAPYNPESMETILQ---DVQSHIIPGITHWLSFNFFAPPATVSTAGTGLGSCACNSVGVNGLASAAATLEISVMDLHATMLKRNENFSGGGVCGGTCITSDSIL
 Csinensis|orange1.1g048019m|SAPYNPESMETILQ---DVQSHIIPGITHWLSFNFFAPPATVSTAGTGLGSCACNSVGVNGLASAAATLEISVMDLHATMLKRNENFSGGGVCGGTCITSDSIL
 Csinensis|orange1.1g048438m|SAPYNPESMETILQ---DVQSHIIPGITHWLSFNFFAPPATVSTAGTGLGSCACNSVGVNGLASAAATLEISVMDLHATMLKRNENFSGGGVCGGTCITSDSIL
 Csinensis|orange1.1g036966m|SAPYNPESMETILQ---DVQSHIIPGITHWLSFNFFAPPATVSTAGTGLGSCACNSVGVNGLASAAATLEISVMDLHATMLKRNENFSGGGVCGGTCITSDSIL
 Csinensis|orange1.1g041549m|SAPYNPESMETILQ---DVQSHIIPGITHWLSFNFFAPPATVSTAGTGLGSCACNSVGVNGLASAAATLEISVMDLHATMLKRNENFSGGGVCGGTCITSDSIL

230 240 250 260 270 280 290 300 310 320 330

Clemlentina|Ciclev10014992m|VLAARARADAVCA--ENNHHKLVVSDTHTSTFALCAQAOVIGDVRKFAAKTKSSSYGLSPISIAQAKNSVVEAGHELCLCATGTTATTA
 Clemlentina|Ciclev10018100m|CCLAPARDNEIGR--ENISKLVVSDTHTSTFALCAQAOVIGDVRKFAAKTKSSSYGLSPISIAQAKNSVVEAGHELCLCATGTTATTA
 Clemlentina|Ciclev100002723m|CCLAPARDNEIGR--ENISKLVVSDTHTSTFALCAQAOVIGDVRKFAAKTKSSSYGLSPISIAQAKNSVVEAGHELCLCATGTTATTA
 Clemlentina|Ciclev100033968m|CCLAPARDNEIGR--ENISKLVVSDTHTSTFALCAQAOVIGDVRKFAAKTKSSSYGLSPISIAQAKNSVVEAGHELCLCATGTTATTA
 Clemlentina|Ciclev10031252m|CCLAPARDNEIGR--ENISKLVVSDTHTSTFALCAQAOVIGDVRKFAAKTKSSSYGLSPISIAQAKNSVVEAGHELCLCATGTTATTA
 Clemlentina|Ciclev10018301m|CCLAPARDNEIGR--ENISKLVVSDTHTSTFALCAQAOVIGDVRKFAAKTKSSSYGLSPISIAQAKNSVVEAGHELCLCATGTTATTA
 Clemlentina|Ciclev10025359m|CCLAPARDNEIGR--ENISKLVVSDTHTSTFALCAQAOVIGDVRKFAAKTKSSSYGLSPISIAQAKNSVVEAGHELCLCATGTTATTA
 Clemlentina|Ciclev10025447m|CCLAPARDNEIGR--ENISKLVVSDTHTSTFALCAQAOVIGDVRKFAAKTKSSSYGLSPISIAQAKNSVVEAGHELCLCATGTTATTA
 Clemlentina|Ciclev10020518m|CCLAPARDNEIGR--ENISKLVVSDTHTSTFALCAQAOVIGDVRKFAAKTKSSSYGLSPISIAQAKNSVVEAGHELCLCATGTTATTA
 Clemlentina|Ciclev10025789m|CCLAPARDNEIGR--ENISKLVVSDTHTSTFALCAQAOVIGDVRKFAAKTKSSSYGLSPISIAQAKNSVVEAGHELCLCATGTTATTA
 Clemlentina|Ciclev10027405m|CCLAPARDNEIGR--ENISKLVVSDTHTSTFALCAQAOVIGDVRKFAAKTKSSSYGLSPISIAQAKNSVVEAGHELCLCATGTTATTA
 Csinensis|orange1.1g010842m|CCLAPARDNEIGR--ENISKLVVSDTHTSTFALCAQAOVIGDVRKFAAKTKSSSYGLSPISIAQAKNSVVEAGHELCLCATGTTATTA
 Csinensis|orange1.1g038818m|CCLAPARDNEIGR--ENISKLVVSDTHTSTFALCAQAOVIGDVRKFAAKTKSSSYGLSPISIAQAKNSVVEAGHELCLCATGTTATTA
 Csinensis|orange1.1g010125m|CCLAPARDNEIGR--ENISKLVVSDTHTSTFALCAQAOVIGDVRKFAAKTKSSSYGLSPISIAQAKNSVVEAGHELCLCATGTTATTA
 Csinensis|orange1.1g048643m|CCLAPARDNEIGR--ENISKLVVSDTHTSTFALCAQAOVIGDVRKFAAKTKSSSYGLSPIS

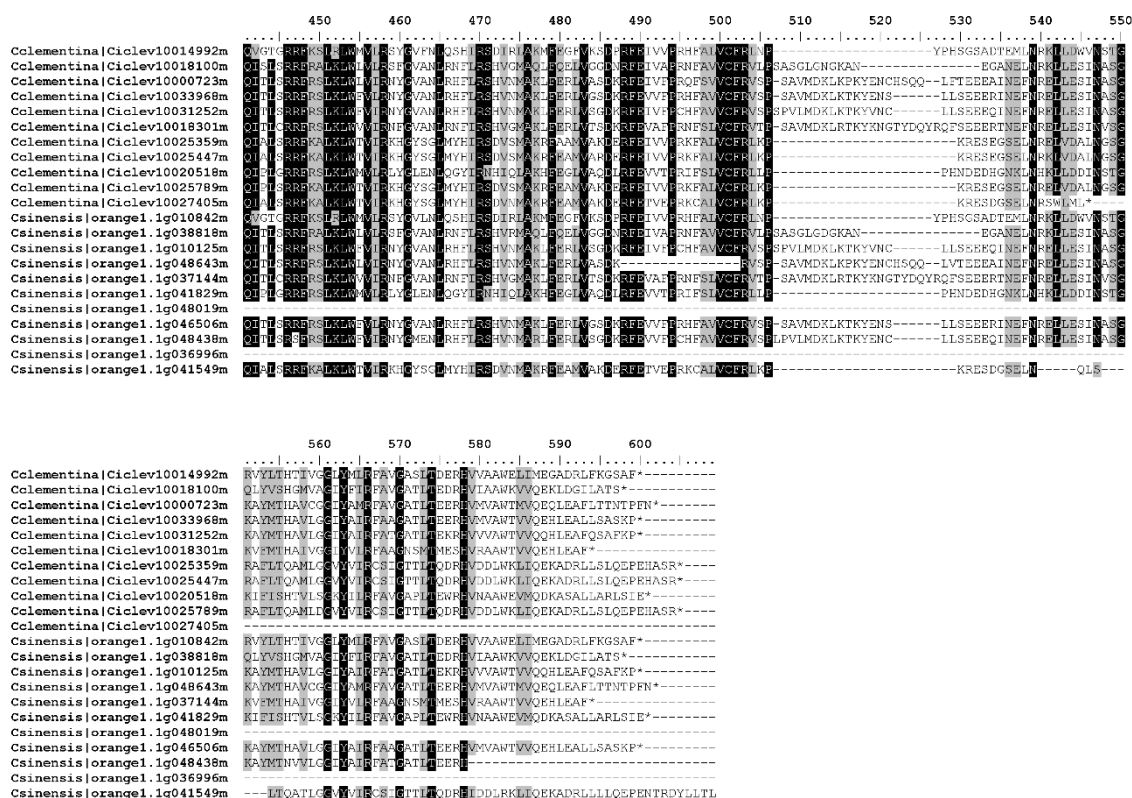


Figure S4. Multiple sequence alignment for *Citrus* sequences retrieved in this work. Residues identical or similar in at least 80% of the aligned sequences are shaded in black or grey, respectively; gaps introduced are represented by dashes.

	1	10	20	30	40	50	60	70	80	90	100
TDC1 <i>Actaea racemosa</i>											
TDC2 <i>Actaea racemosa</i>											
partial TDC <i>Actaea racemosa</i>											
TDC1 <i>Camptotheca acuminata</i>											
TDC2 <i>Camptotheca acuminata</i>											
TDC1 <i>Capsicum annuum</i>											
TDC2 <i>Capsicum annuum</i>											
TDC <i>Catharanthus roseus</i>											
TDC <i>Mitragyna speciosa</i>											
TDC <i>Ophiorrhiza prostrata</i>											
TDC <i>Ophiorrhiza pumila</i>											
TDC <i>Rauvolfia verticillata</i>											
TDC <i>Tabernaemontana elegans</i>											
TDC <i>Vinca minor</i>											
TYDC1a <i>Arabidopsis thaliana</i>											
TYDC1b <i>Arabidopsis thaliana</i>											
TYDC1c <i>Arabidopsis thaliana</i>											
TYDC1d <i>Arabidopsis thaliana</i>											
TYDC <i>Argemone mexicana</i>											
TYDC <i>Aristolochia contorta</i>											
TYDC <i>Citrus aurantium</i>											
TYDC1 <i>Citrus reshni</i>											
TYDC2 <i>Citrus reshni</i>											
TYDC <i>Citrus reticulata</i>											
TYDC <i>Citrus sinensis</i>											
TYDC1 <i>Medicago truncatula</i>											
TYDC2 <i>Medicago truncatula</i>											
TYDC1 <i>Papaver somniferum</i>											
TYDC2 <i>Papaver somniferum</i>											
TYDC3 <i>Papaver somniferum</i>											
TYDC5 <i>Papaver somniferum</i>											
TYDC6 <i>Papaver somniferum</i>											
TYDC7 <i>Papaver somniferum</i>											
TYDC8 <i>Papaver somniferum</i>											
TYDC9 <i>Papaver somniferum</i>											
TYDC1 <i>Petroselinum crispum</i>											
TYDC2 <i>Petroselinum crispum</i>											
TYDC3 <i>Petroselinum crispum</i>											
TYDC4 <i>Petroselinum crispum</i>											
TYDC <i>Solanum tuberosum</i>											
TYDC <i>Thalictrum flavum</i>											
TYDC <i>Thecroma cacao</i>											
Ciclev10014992m											
orange1.1q010842m											

	110	120	130	140	150	160	170	180	190	200
TDC1 <i>Actaea racemosa</i>										
TDC2 <i>Actaea racemosa</i>										
partial TDC <i>Actaea racemosa</i>										
TDC1 <i>Camptotheca acuminata</i>										
TDC2 <i>Camptotheca acuminata</i>										
TDC1 <i>Capsicum annuum</i>										
TDC2 <i>Capsicum annuum</i>										
TDC <i>Catharanthus roseus</i>										
TDC <i>Mitragyna speciosa</i>										
TDC <i>Ophiorrhiza prostrata</i>										
TDC <i>Ophiorrhiza pumila</i>										
TDC <i>Rauvolfia verticillata</i>										
TDC <i>Tabernaemontana elegans</i>										
TDC <i>Vinca minor</i>										
TYDC1a <i>Arabidopsis thaliana</i>										
TYDC1b <i>Arabidopsis thaliana</i>										
TYDC1c <i>Arabidopsis thaliana</i>										
TYDC1d <i>Arabidopsis thaliana</i>										
TYDC <i>Argemone mexicana</i>										
TYDC <i>Aristolochia contorta</i>										
TYDC <i>Citrus aurantium</i>										
TYDC1 <i>Citrus reshni</i>										
TYDC2 <i>Citrus reshni</i>										
TYDC <i>Citrus reticulata</i>										
TYDC <i>Citrus sinensis</i>										
TYDC1 <i>Medicago truncatula</i>										
TYDC2 <i>Medicago truncatula</i>										
TYDC1 <i>Papaver somniferum</i>										
TYDC2 <i>Papaver somniferum</i>										
TYDC3 <i>Papaver somniferum</i>										
TYDC5 <i>Papaver somniferum</i>										
TYDC6 <i>Papaver somniferum</i>										
TYDC7 <i>Papaver somniferum</i>										
TYDC8 <i>Papaver somniferum</i>										
TYDC9 <i>Papaver somniferum</i>										
TYDC1 <i>Petroselinum crispum</i>										
TYDC2 <i>Petroselinum crispum</i>										
TYDC3 <i>Petroselinum crispum</i>										
TYDC4 <i>Petroselinum crispum</i>										
TYDC <i>Solanum tuberosum</i>										
TYDC <i>Thalictrum flavum</i>										
TYDC <i>Thecroma cacao</i>										
Ciclev10014992m										
orange1.1q010842m										

[illegible]

	410	420	430	440	450	460	470	480	490	500
TDC1 Actaea racemosa	PEELAN--RP	TEINLSVDNR	DMQVGYGRFF	RALKRLVYVR	SYGVANQOSH	ISSDIRLARM	FEFGVKSDRR	FEHIVPRCPA	IVCFRNLTL	DE-----
TDC2 Actaea racemosa	PEELAN--RP	TEINLSVDNR	DMQVGYGRFF	RALKRLVYVR	SYGVANQOSH	ISSDIRLARM	FEFGVKSDRR	FEHIVPRCPA	IVCFRNLTL	DE-----
partial TDC Actaea racemosa	PEELAN--RP	TEINLSVDNR	DMQVGYGRFF	RALKRLVYVR	SYGVANQOSH	ISSDIRLARM	FEFGVKSDRR	FEHIVPRCPA	IVCFRNLTL	DE-----
TDC1 Camptotheca acuminata	PEELAN--OP	SESKSVVDNR	DMQVGTGRFF	KALKRLVYVR	SYGVANQOSH	ISDIDVQARM	FEFGVKSDRR	FEHIVPRCPA	IVCFRNLTL	G-----
TDC2 Camptotheca acuminata	PEELAN--RP	SESKSVVDNR	DMQVGTGRFF	KALKRLVYVR	SYGVANQOSH	ISDIDVQARM	FEFGVNSDPR	FEHIVPRCPA	IVCFRNLTL	K-----
TDC1 Capsicum annuum	PEELAN--NR	SEHGSDVDNR	DMQVGTGRFF	KALKRLVYVR	SYGVANQOSH	ISDIDVQARM	FEFGVNSDPR	FEHIVPRCPA	IVCFRNLTL	KE-----
TDC2 Capsicum annuum	PEELAN--NR	SEHGSDVDNR	DMQVGTGRFF	KALKRLVYVR	SYGVANQOSH	ISDIDVQARM	FEFGVNSDPR	FEHIVPRCPA	IVCFRNLTL	SM-----
TDC Catharanthus roseus	PEELAN--RP	SELDKVDNR	DMQVGTGRFF	RALKRLVYVR	SYGVANQOSH	ISDIDVQARM	FEFGVNSDPR	FEHIVPRCPA	IVCFRNLTL	SM-----
TDC Mitragyna speciosa	PEELAN--NR	SEFDSDVDNR	DMQVGTGRFF	RALKRLVYVR	SYGVANQOSH	ISDIDVQARM	FEFGVNSDPR	FEHIVPRCPA	IVCFRNLTL	GG-----
TDC Ophiorrhiza prostrata	PEELAN--NR	SEFDSDVDNR	DMQVGTGRFF	RALKRLVYVR	SYGVANQOSH	ISDIDVQARM	FEFGVNSDPR	FEHIVPRCPA	IVCFRNLTL	GY-----
TDC Ophiorrhiza pumila	PEELAN--NR	SEFDSDVDNR	DMQVGTGRFF	RALKRLVYVR	SYGVANQOSH	ISDIDVQARM	FEFGVNSDPR	FEHIVPRCPA	IVCFRNLTL	HY-----
TDC Rauvolfia verticillata	PEELAN--RP	SELDKVDNR	DMQVGTGRFF	RALKRLVYVR	SYGVANQOSH	ISDIDVQARM	FEFGVNSDPR	FEHIVPRCPA	IVCFRNLTL	-----
TDC Tabernaemontana elegans	PEELAN--RP	SELDKVDNR	DMQVGTGRFF	RALKRLVYVR	SYGVANQOSH	ISDIDVQARM	FEFGVNSDPR	FEHIVPRCPA	IVCFRNLTL	-----
TDC Vinca minor	PEELAN--RP	SELDKVDNR	DMQVGTGRFF	RALKRLVYVR	SYGVANQOSH	ISDIDVQARM	FEFGVNSDPR	FEHIVPRCPA	IVCFRNLTL	-----
TYDC1a Arabidopsis thaliana	PEELAN--RP	SELDKVDNR	DMQVGTGRFF	RALKRLVYVR	SYGVANQOSH	ISDIDVQARM	FEFGVNSDPR	FEHIVPRCPA	IVCFRNLTL	GD-----
TYDC1b Arabidopsis thaliana	PEELAN--RP	SELDKVDNR	DMQVGTGRFF	RALKRLVYVR	SYGVANQOSH	ISDIDVQARM	FEFGVNSDPR	FEHIVPRCPA	IVCFRNLTL	GD-----
TYDC1c Arabidopsis thaliana	PEELAN--RP	SELDKVDNR	DMQVGTGRFF	RALKRLVYVR	SYGVANQOSH	ISDIDVQARM	FEFGVNSDPR	FEHIVPRCPA	IVCFRNLTL	DE-----
TYDC1d Arabidopsis thaliana	PEELAN--RP	SELDKVDNR	DMQVGTGRFF	RALKRLVYVR	SYGVANQOSH	ISDIDVQARM	FEFGVNSDPR	FEHIVPRCPA	IVCFRNLTL	DE-----
TYDC Argemone mexicana	PEELAN--NA	TESKQVDNR	DMQVGTGRFF	RALKRLVYVR	SYGVANQOSH	ISDIDVQARM	FEFGVNSDPR	FEHIVPRCPA	IVCFRNLTL	STDRNRVREE
TYDC Aristolochia contorta	PEELAN--NA	TESKQVDNR	DMQVGTGRFF	RALKRLVYVR	SYGVANQOSH	ISDIDVQARM	FEFGVNSDPR	FEHIVPRCPA	IVCFRNLTL	G-----
TYDC Citrus aurantium	PEELAN--NA	TESKQVDNR	DMQVGTGRFF	RALKRLVYVR	SYGVANQOSH	ISDIDVQARM	FEFGVNSDPR	FEHIVPRCPA	IVCFRNLTL	VI-----
TYDC1 Citrus reshni	PEELAN--NA	TESKQVDNR	DMQVGTGRFF	RALKRLVYVR	SYGVANQOSH	ISDIDVQARM	FEFGVNSDPR	FEHIVPRCPA	IVCFRNLTL	VI-----
TYDC2 Citrus reshni	PEELAN--NA	TESKQVDNR	DMQVGTGRFF	RALKRLVYVR	SYGVANQOSH	ISDIDVQARM	FEFGVNSDPR	FEHIVPRCPA	IVCFRNLTL	VI-----
TYDC Citrus reticulata	PEELAN--NA	TESKQVDNR	DMQVGTGRFF	RALKRLVYVR	SYGVANQOSH	ISDIDVQARM	FEFGVNSDPR	FEHIVPRCPA	IVCFRNLTL	VI-----
TYDC Citrus sinensis	PEELAN--NA	TESKQVDNR	DMQVGTGRFF	RALKRLVYVR	SYGVANQOSH	ISDIDVQARM	FEFGVNSDPR	FEHIVPRCPA	IVCFRNLTL	VI-----
TYDC1 Medicago truncatula	PEELAN--NA	TESKQVDNR	DMQVGTGRFF	RALKRLVYVR	SYGVANQOSH	ISDIDVQARM	FEFGVNSDPR	FEHIVPRCPA	IVCFRNLTL	NS-----
TYDC2 Medicago truncatula	PEELAN--NA	TESKQVDNR	DMQVGTGRFF	RALKRLVYVR	SYGVANQOSH	ISDIDVQARM	FEFGVNSDPR	FEHIVPRCPA	IVCFRNLTL	NS-----
TYDC1 Papaver somniferum	PEELAN--NA	TESKQVDNR	DMQVGTGRFF	RALKRLVYVR	SYGVANQOSH	ISDIDVQARM	FEFGVNSDPR	FEHIVPRCPA	IVCFRNLTL	IF-----
TYDC2 Papaver somniferum	PEELAN--NA	TESKQVDNR	DMQVGTGRFF	RALKRLVYVR	SYGVANQOSH	ISDIDVQARM	FEFGVNSDPR	FEHIVPRCPA	IVCFRNLTL	IF-----
TYDC3 Papaver somniferum	PEELAN--NA	TESKQVDNR	DMQVGTGRFF	RALKRLVYVR	SYGVANQOSH	ISDIDVQARM	FEFGVNSDPR	FEHIVPRCPA	IVCFRNLTL	TI---KVY-D
TYDC5 Papaver somniferum	PEELAN--NA	TESKQVDNR	DMQVGTGRFF	RALKRLVYVR	SYGVANQOSH	ISDIDVQARM	FEFGVNSDPR	FEHIVPRCPA	IVCFRNLTL	TI---KVGE
TYDC6 Papaver somniferum	PEELAN--NA	TESKQVDNR	DMQVGTGRFF	RALKRLVYVR	SYGVANQOSH	ISDIDVQARM	FEFGVNSDPR	FEHIVPRCPA	IVCFRNLTL	IF-----
TYDC7 Papaver somniferum	PEELAN--NA	TESKQVDNR	DMQVGTGRFF	RALKRLVYVR	SYGVANQOSH	ISDIDVQARM	FEFGVNSDPR	FEHIVPRCPA	IVCFRNLTL	IF-----
TYDC8 Papaver somniferum	PEELAN--NA	TESKQVDNR	DMQVGTGRFF	RALKRLVYVR	SYGVANQOSH	ISDIDVQARM	FEFGVNSDPR	FEHIVPRCPA	IVCFRNLTL	IF-----
TYDC9 Papaver somniferum	PEELAN--NA	TESKQVDNR	DMQVGTGRFF	RALKRLVYVR	SYGVANQOSH	ISDIDVQARM	FEFGVNSDPR	FEHIVPRCPA	IVCFRNLTL	IF-----
TYDC1 Petroselinum crispum	PEELAN--NA	SETNRVDNR	DMQVGTGRFF	RALKRLVYVR	SYGVANQOSH	ISDIDVQARM	FEFGVNSDPR	FEHIVPRCPA	IVCFRNLTL	MIG-----
TYDC2 Petroselinum crispum	PEELAN--NA	SETNRVDNR	DMQVGTGRFF	RALKRLVYVR	SYGVANQOSH	ISDIDVQARM	FEFGVNSDPR	FEHIVPRCPA	IVCFRNLTL	MIG-----
TYDC3 Petroselinum crispum	PEELAN--NA	SETNRVDNR	DMQVGTGRFF	RALKRLVYVR	SYGVANQOSH	ISDIDVQARM	FEFGVNSDPR	FEHIVPRCPA	IVCFRNLTL	MIG-----
TYDC4 Petroselinum crispum	PEELAN--NA	SETNRVDNR	DMQVGTGRFF	RALKRLVYVR	SYGVANQOSH	ISDIDVQARM	FEFGVNSDPR	FEHIVPRCPA	IVCFRNLTL	MIG-----
TYDC Solanum tuberosum	PEELAN--NA	TESKQVDNR	DMQVGTGRFF	RALKRLVYVR	SYGVANQOSH	ISDIDVQARM	FEFGVNSDPR	FEHIVPRCPA	IVCFRNLTL	LS-----
TYDC Thalictrum flavum	PEELAN--NA	TESKQVDNR	DMQVGTGRFF	RALKRLVYVR	SYGVANQOSH	ISDIDVQARM	FEFGVNSDPR	FEHIVPRCPA	IVCFRNLTL	LIIK-----
TYDC Theobroma cacao	PEELAN--NA	TESKQVDNR	DMQVGTGRFF	RALKRLVYVR	SYGVANQOSH	ISDIDVQARM	FEFGVNSDPR	FEHIVPRCPA	IVCFRNLTL	LC-----
Ciclev10014992m	PEELAN--RP	SESKSVVDNR	DMQVGTGRFF	RALKRLVYVR	SYGVANQOSH	ISDIDVQARM	FEFGVNSDPR	FEHIVPRCPA	IVCFRNLTL	YP-----
orange1.1g010842m	PEELAN--RP	SESKSVVDNR	DMQVGTGRFF	RALKRLVYVR	SYGVANQOSH	ISDIDVQARM	FEFGVNSDPR	FEHIVPRCPA	IVCFRNLTL	YP-----

	510	520	530	540	550	560	570	580	590	600
TDC1 Actaea racemosa	-----	Y	EPFELVELNQ	DELDVNSG	KAMTHFVIG	GVNLRFAVG	STLDEERHVV	AAWELIKETA	DMVLGEC	-----
TDC2 Actaea racemosa	-----	Y	EPFELVELNQ	DELDVNSG	KAMTHFVIG	GVNLRFAVG	STLDEERHVV	AAWELIKETA	DMVLGEC	-----
partial TDC Actaea racemosa	-----	Y	EPFELVELNQ	DELDVNSG	KAMTHFVIG	GVNLRFAVG	STLDEERHVV	AAWELIKETA	DMVLGEC	-----
TDC1 Camptotheca acuminata	-----	S	DPFGTEALNR	DELDVNSG	RVMTHFTVIG	GVNLRFAVG	STLDEERHVV	AAWELIKETA	DMVLGEC	-----
TDC2 Camptotheca acuminata	-----	S	DPFGTEALNR	DELDVNSG	RVMTHFTVIG	GVNLRFAVG	STLDEERHVV	AAWELIKETA	DMVLGEC	-----
TDC1 Capsicum annuum	-----	Y	EPFELVELNQ	DELDVNSG	KAMTHFVIG	GVNLRFAVG	STLDEERHVV	AAWELIKETA	DMVLGEC	-----
TDC2 Capsicum annuum	-----	Y	EPFELVELNQ	DELDVNSG	KAMTHFVIG	GVNLRFAVG	STLDEERHVV	AAWELIKETA	DMVLGEC	-----
TDC Catharanthus roseus	-----	V	SSILHVEVVK	DELDVNSG	RVMTHFTVIG	GVNLRFAVG	STLDEERHVV	AAWELIKETA	DMVLGEC	-----
TDC Mitragyna speciosa	-----	S	NEADLEILNK	DELDVNSG	RVMTHFTVIG	GVNLRFAVG	STLDEERHVV	AAWELIKETA	DMVLGEC	-----
TDC Ophiorrhiza prostrata	-----	D	DEIDKEILNK	DELDVNSG	RVMTHFTVIG	GVNLRFAVG	STLDEERHVV	AAWELIKETA	DMVLGEC	-----
TDC Ophiorrhiza pumila	-----	D	DEIDKEILNK	DELDVNSG	RVMTHFTVIG	GVNLRFAVG	STLDEERHVV	AAWELIKETA	DMVLGEC	-----
TDC Rauvolfia verticillata	-----	L	PGSDVEALNK	DELDVNSG	RVMTHFTVIG	GVNLRFAVG	STLDEERHVV	AAWELIKETA	DMVLGEC	-----
TDC Tabernaemontana elegans	-----	L	PGSDVEALNK	DELDVNSG	RVMTHFTVIG	GVNLRFAVG	STLDEERHVV	AAWELIKETA	DMVLGEC	-----
TDC Vinca minor	-----	L	PGSDVEALNK	DELDVNSG	RVMTHFTVIG	GVNLRFAVG	STLDEERHVV	AAWELIKETA	DMVLGEC	-----
TYDC1a Arabidopsis thaliana	-----	EDQCNERNR	EDIAAANSTG	KIFISHTALS	SKFVLRFAVG	APLDEERHVV	AAWELIKETA	DMVLGEC	-----	-----
TYDC1b Arabidopsis thaliana	-----	EDQCNERNR	EDIAAANSTG	KIFISHTALS	SKFVLRFAVG	APLDEERHVV	AAWELIKETA	DMVLGEC	-----	-----
TYDC1c Arabidopsis thaliana	-----	EDQCNERNR	EDIAAANSTG	KIFISHTALS	SKFVLRFAVG	APLDEERHVV	AAWELIKETA	DMVLGEC	-----	-----
TYDC1d Arabidopsis thaliana	-----	EDQCNERNR	EDIAAANSTG	KIFISHTALS	SKFVLRFAVG	APLDEERHVV	AAWELIKETA	DMVLGEC	-----	-----
TYDC Argemone mexicana	DGLFVSGVHD	HENNINEDDR	LIVLANKINQ	VVETVYATG	SVMTTHAVVG	GVNLRFAVG	STLDEERHVV	AAWELIKETA	DMVLGEC	-----
TYDC Aristolochia contorta	-----	GOGGD	DEEG	-----	-----	-----	-----	-----	-----	-----
TYDC Citrus aurantium	-----	MDKL	KTKYVNCILS	EEQEINEFNR	ELLESINAGS	KAMTHFVIG	GVNLRFAVG	STLDEERHVV	AAWELIKETA	-----
TYDC1 Citrus reshni	-----	MDKL	KTKYVNCILS	EEQEINEFNR	ELLESINAGS	KAMTHFVIG	GVNLRFAVG	STLDEERHVV	AAWELIKETA	-----
TYDC2 Citrus reshni	-----	MDKL	KTKYVNCILS	EEQEINEFNR	ELLESINAGS	KAMTHFVIG	GVNLRFAVG	STLDEERHVV	AAWELIKETA	-----
TYDC Citrus reticulata	-----	MDKL	KTKYVNCILS	EEQEINEFNR	ELLESINAGS	KAMTHFVIG	GVNLRFAVG	STLDEERHVV	AAWELIKETA	-----
TYDC Citrus sinensis	-----	MDKL	KTKYVNCILS	EEQEINEFNR	ELLESINAGS	KAMTHFVIG	GVNLRFAVG	STLDEERHVV	AAWELIKETA	-----
TYDC1 Medicago truncatula	-----	EDNGKILNK	DELDVNSG	RVFTHFTVIG	GVNLRFAVG	STLDEERHVV	AAWELIKETA	DMVLGEC	-----	-----
TYDC2 Medicago truncatula	-----	EDNGKILNK	DELDVNSG	RVFTHFTVIG	GVNLRFAVG	STLDEERHVV	AAWELIKETA	DMVLGEC	-----	-----
TYDC1 Papaver somniferum	-----	RRK	IYED	-----	-----	-----	-----	-----	-----	-----
TYDC2 Papaver somniferum	NGVHQNGNGV	VELR-DENEN	LVLANKINQ	VVETVYATG	SVMTTHAVVG	GVNLRFAVG	STLDEERHVV	AAWELIKETA	DMVLGEC	-----
TYDC3 Papaver somniferum	NGVHQNGNGV	IYAVLRNENEE	LVLANKINQ	VVETVYATG	SVMTTHAVVG	GVNLRFAVG	STLDEERHVV	AAWELIKETA	DMVLGEC	-----
TYDC5 Papaver somniferum	-----	NGK	LGENGVDYNC	IEEKTEINIS	RILLESINAGS	SVMTTHAVVG	GVNLRFAVG	STLDEERHVV	AAWELIKETA	-----
TYDC6 Papaver somniferum	-----	RRK	IYED	-----	-----	-----	-----	-----	-----	-----
TYDC7 Papaver somniferum	NGVHQNGNGV	VAVH-NENET	LVLANKINQ	VVETVYATG	SVMTTHAVVG	GVNLRFAVG	STLDEERHVV	AAWELIKETA	DMVLGEC	-----
TYDC8 Papaver somniferum	-----	RRK	IYED	-----	-----	-----	-----	-----	-----	-----
TYDC9 Papaver somniferum	-----	KQK	IYED	-----	-----	-----	-----	-----	-----	-----
TYDC1 Petroselinum crispum	-----	KND	-----	-----	-----	-----	-----	-----	-----	-----
TYDC2 Petroselinum crispum	-----	KND	-----	-----	-----	-----	-----	-----	-----	-----
TYDC3 Petroselinum crispum	-----	KND	-----	-----	-----	-----	-----	-----	-----	-----
TYDC4 Petroselinum crispum	-----	KND	-----	-----	-----	-----	-----	-----	-----	-----
TYDC Solanum tuberosum	-----	QVST	KFDD	-----	-----	-----	-----	-----	-----	-----
TYDC Thalictrum flavum	-----	QVST	KFDD	-----	-----	-----	-----	-----	-----	-----
TYDC Theobroma cacao	-----	KIQN	EPGCKADHVV	HQKHANEFNR	RILLESINAGS	SVMTTHAVVG	GVNLRFAVG	STLDEERHVV	AAWELIKETA	-----
Ciclev10014992m	-----	S	GSADTEMLNR	DELDVNSG	RVMTHFTVIG	GVNLRFAVG	STLDEERHVV	AAWELIKETA	DMVLGEC	-----
orange1.1g010842m	-----	S	GSADTEMLNR	DELDVNSG	RVMTHFTVIG	GVNLRFAVG	STLDEERHVV	AAWELIKETA	DMVLGEC	-----

	610	620	630	640	650
TDC1 <i>Actaea racemosa</i>					
TDC2 <i>Actaea racemosa</i>					
partial_TDC <i>Actaea racemosa</i>					
TDC1 <i>Camptotheca acuminata</i>					
TDC2 <i>Camptotheca acuminata</i>					
TDC1 <i>Capsicum annuum</i>					
TDC2 <i>Capsicum annuum</i>					
TDC <i>Catharanthus roseus</i>					
TDC <i>Mitragyna speciosa</i>					
TDC <i>Ophiorrhiza prostrata</i>					
TDC <i>Ophiorrhiza pumila</i>					
TDC <i>Rauvolfia verticillata</i>					
TDC <i>Tabernaemontana elegans</i>					
TDC <i>Vinca minor</i>					
TYDC1a <i>Arabidopsis thaliana</i>					
TYDC1b <i>Arabidopsis thaliana</i>					
TYDC1c <i>Arabidopsis thaliana</i>					
TYDC1d <i>Arabidopsis thaliana</i>					
TYDC <i>Argemone mexicana</i>					
TYDC <i>Aristolochia contorta</i>					
TYDC <i>Citrus aurantium</i>					
TYDC1 <i>Citrus reshni</i>					
TYDC2 <i>Citrus reshni</i>					
TYDC <i>Citrus reticulata</i>					
TYDC <i>Citrus sinensis</i>					
TYDC1 <i>Medicago truncatula</i>					
TYDC2 <i>Medicago truncatula</i>	TSDGRQTVED	FLRNYFGFKH	DFLGMVALVN	VACPFAFALV	FAIAIKMFNF QSR
TYDC1 <i>Papaver somniferum</i>					
TYDC2 <i>Papaver somniferum</i>					
TYDC3 <i>Papaver somniferum</i>					
TYDC5 <i>Papaver somniferum</i>					
TYDC6 <i>Papaver somniferum</i>					
TYDC7 <i>Papaver somniferum</i>					
TYDC8 <i>Papaver somniferum</i>					
TYDC9 <i>Papaver somniferum</i>					
TYDC1 <i>Petroselinum crispum</i>					
TYDC2 <i>Petroselinum crispum</i>					
TYDC3 <i>Petroselinum crispum</i>					
TYDC4 <i>Petroselinum crispum</i>					
TYDC <i>Solanum tuberosum</i>					
TYDC <i>Thalictrum flavum</i>					
TYDC <i>Theobroma cacao</i>					
Ciclev10014992m					
orange1.1g010842m					

Figure S5. Multiple sequence alignment for representative plant TDC and TYDC enzymes with the two *Citrus* sequences retrieved in this work. Residues identical or similar in at least 80% of the aligned sequences are shaded in black or grey, respectively; gaps introduced are represented by dashes.