

## Supplementary Data

**Supplementary Figure 1** Sequence consistency analysis of 30 DQD/SDH proteins from plants.

**Supplementary Figure 2** Comparison of the partial DQD/SDH sequences from the tea plant and other species (*Arabidopsis* and *Vitis vinifera*) using DNAMAN 6.0. A. DQD unit; B. SDH unit. Amino acid numeration is based on the protein sequence of *A. thaliana*. The key amino acids are marked with red dots; the G-motif with a green box; and the NRT motif with a blue box. Conserved amino acids are marked with black (similarity = 100%), dark gray (similarity  $\geq$  75%), and light gray (similarity  $\geq$  50%) colors.

**Supplementary Figure 3** HPLC analysis of recombinant *Cs*DQD/SDHa enzyme reaction products. (A) HPLC chromatograms from top to bottom are for the standard of SA (top), boiled enzyme reaction with 3-DHS and NADPH (middle), and enzyme production of SA (bottom); (B) HPLC chromatograms from top to bottom are for the standard of 3-DHS (top), boiled enzyme reaction with SA and NADP<sup>+</sup> (middle), and enzyme production of 3-DHS (bottom); (C) MS/MS molecular ion characteristics of the enzyme products of 3-DHS (171.0) and SA (173.0).

**Supplementary Figure 4** Selection of the optimum pH value for the *Cs*DQD/SDHs reaction. A, B, and C showed the production accumulation profile at various pH values from *Cs*DQD/SDHa, *Cs*DQD/SDHc, and *Cs*DQD/SDHd, respectively. The top line shows the 3-DHS reduction reaction, the bottom line shows the SA oxidation reaction. ▲: represents the citric acid buffer; ●: represents the BTP-HCl buffer; ■: represents the sodium carbonate buffer.

**Supplementary Table S1** The primer sequences used in this study.

**Supplementary Table S2** ID of multiple plant DQD/SDH proteins used in this study.

Purpose	Name	5'-3' sequence	Restriction site
Protein expression	<i>Cs</i> DQD/SDHa-pMAL-F	<u>GGATCC</u> ATGGAGTTGGTTGCACCT	BamHI
	<i>Cs</i> DQD/SDHa-pMAL-R	<u>CTGCAGT</u> CAATATTTTGCCATGAT	PstI
	<i>Cs</i> DQD/SDHb-pMAL-F	<u>GGATCC</u> ATGGGTAGTGTGGGGTG	BamHI
	<i>Cs</i> DQD/SDHb-pMAL-R	<u>CTGCAGT</u> CAGAAGTTTGCGAAAAT	PstI
	<i>Cs</i> DQD/SDHc-pMAL-F	<u>GGATCC</u> ATGGCCTCTGGAAGCTTTTCG	BamHI
	<i>Cs</i> DQD/SDHc-pMAL-R	<u>CTGCAGT</u> TATGCGTGTCTTGACATG	PstI

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	CsDQD/SDHd-pMAL-F	<u>GGATCC</u> ATGACTCTCAGCAGCAT	BamHI
	CsDQD/SDHd-pMAL-R	<u>CTGCAGT</u> TATGTGTTCTTTGCTA	PstI
qPCR	CsDQD/SDHa-F	ACAACCGCCTTGGACATCAC	
	CsDQD/SDHa-R	CCATCAAACCCCTTTCACCC	
	CsDQD/SDHb-F	ATCACTCCCATCTCCGCTCAC	
	CsDQD/SDHb-R	GACAACCCTCGCTCCTCTG	
	CsDQD/SDHc-F	GTAGTAGCGGAGTTAGGAGCG	
	CsDQD/SDHc-R	GAAGATCAGGGCGTGGATTG	
	CsDQD/SDHd-F	GACAGGCTGCATTGCGTCAG	
	CsDQD/SDHd-R	GGCCCCTTTCACCCATAACA	
	GAPDH-F	TTGGCATCGTTGAGGGTCT	
	GAPDH-R	CAGTGGGAACACGGAAAGC	
MTCsDQ D/SDHb	CsDQD/SDHb-338G→S -F	GTGGGCCACAGCAAAAGTCCCCTTCTC CATAAT	
	CsDQD/SDHb-338G→S -R	ATTATGGAGAAGGGGACTTTTGCTGTG GCCCCAC	
	CsDQD/SDHb-381G→T- F	GCAGGTTTCAGTGTAACATTTCCATACA AGGAA	
	CsDQD/SDHb-381G→T- R	TTCCTTGATGGAAATGTTACTGAAA CCTGC	
	CsDQD/SDHb-483D→N -F	AGGGTTGTCATTTTTAACATTGATTTTG ACAGA	
	CsDQD/SDHb-483D→N -R	TCTGTCAAATCAATGTAAAAATGACA ACCCT	
	CsDQD/SDHb-484I→R- F	GTTGTCATTTTGACCGTGATTTTGACA GAGCA	
	CsDQD/SDHb-484I→R- R	TGCTCTGTCAAATCACGGTCAAAT	

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	R	GACAAC
	CsDQD/SDHb-485D→T- F	GTCATTTTTGACATTACTTTTGACAGAG CAAAG
	CsDQD/SDHb-485D→T- R	CTTTGCTCTGTCAAAAGTAATGTCAAA AATGAC
CsDQDa	CsDQDa-F	<u>GGATCCAAGAACTCAACCCTAATTTGT</u>
	CsDQDa-R	<u>CTGCAGGATATTGTACAAGTTCACCAA</u>
CsSDHa	CsSDHa-F	<u>GGATCCATTATCGGGAAGCCTGTTGGCC</u>
	CsSDHa-R	<u>CTGCAGTCCAGTGAACCTCTCGAATTG</u>

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Species	Designation	Accession number
<i>Arabidopsis thaliana</i>	AtSDH	AAF08579
<i>Vitis vinifera</i>	VvSDH1	KU163040
	VvSDH2	KU163041
	VvSDH3	KU163042
	VvSDH4	KU163043
<i>Nicotiana tabacum</i>	NtSDH1	AAS90325
	NtSDH2	AAS90324
<i>Solanum lycopersicum</i>	SISDH1	AAC17991
	SISDH2	XP_010327280
	SISDH3	XP_004242317
<i>Diospyros kaki</i>	DkSDH	BAI40147
<i>Eucalyptus grandis</i>	EgSDH1	HO1214.1
	EgSDH2	HO4428.1

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	EgSDH3	HO4427.1
	EgSDH4	BO1770.2
	EgSDH5	J00263.6
<i>Fragaria vesca</i> subsp. vesca	FvSDH1	XP_004302480
	FvSDH2	XP_004302479
	FvSDH3	XP_004289250
	FvSDH4	XP_004288087
<i>Populus trichocarpa</i>	PoptrSDH1	010G019000
	PoptrSDH2	013G029900
	PoptrSDH3	005G043400
	PoptrSDH4	014G135500
	PoptrSDH5	013G029800
<i>Juglans regia</i>	JrSDH	AAW65140

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