

Supplementary Material

Plant Specialised Glycosides (PSGs): their biosynthetic enzymatic machinery, physiological functions and commercial potential

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Table 1 glycan moieties and specific enzymes (CYPs, GTs, BGLs) involve in glycosylation/ deglycosylation of important PSGs

Source plant	Plant glycoside	Active sugar	Glyco-sylation position	CYPs	UGTs	BGLs	References
<i>M. truncatula</i>	Triterpene saponins	-	3-OH	-	73K1, 71G1	-	Sandrock et al., 1998
<i>Citrus unshiu Marc.</i>	Limonin glucosides (Monoterpene)	UDP-Glc	C17	-	-	-	Kitaa et al., 2000
<i>A. thaliana</i>	Indole-3-acetic acid (Auxin)	-	-	-	84B1	-	Jackson et al., 2001; Bock, 2016
<i>Dorotheanthus bellidiformis</i>	Betanidin (Red betacyanins)	UDP-Glc	C5	-	5-GT	-	Jones and Vogt, 2001
<i>A. thaliana</i>	Favonol glycoside	-	-	-	73C6, 78D1	-	Jones and Vogt, 2001
<i>S. bicolor</i>	Dhurrin (Cyanogenic glucoside)	UDP-Glc	-	79A1, 71E1	85B1	Dhurrinase	Jones and Vogt, 2001; Kristensen et al., 2005; Ganjewala et al., 2010; Tokpohozin et al., 2016
<i>A. thaliana</i>	Hydroxy-cinnamic acids (Phenylpropanoids)	UDP-Glc	1-O	-	84A1, 84A2, 84A3	-	Lim et al., 2001
<i>Z. maize</i>	2,4-dihydroxy-7-methoxy-1,4-benzoxazin-3-one (Cyclic hydroxamic acids)	UDP-Glc	-	BX2, BX3, BX4, BX5	BX8, BX9	-	Ober, 2005
<i>A. thaliana</i>	Salicylic acid, 4-hydroxybenzoic acid (Phytohormone)	UDP-Glc	C2	-	74F1, 74F	-	Lim et al., 2002
<i>A. thaliana</i>	Cytokinins (Phytohormone)	UDP-Glc	-	-	76C1, 76C2	-	Hou et al., 2004
<i>P. hybrid</i>	Flavonol 3-O-diglycoside	UDP-Gal, UDP-Glc	3-OH	-	F3'GT, F2'GT	-	Bowles et al., 2005

<i>C. sativus</i>	Crocin (Apocarotenoids)	-	-	-	Cs2	-	Bowles et al., 2005
<i>A. thaliana</i>	Cyanidin 3-O-xylosyl (1→2) glucoside (Anthocyanins)	UDP-Xyl, UDP-Glc	3-OH, 5-OH	F3H, DFR	79B1, 79B3, 75C1, 78D2	-	Bowles et al., 2005; Li et al., 2017
<i>A. thaliana</i>	Flavonol-7-O-glycoside	UDP-Rha	C7	-	89C1	-	Gachon et al., 2005
<i>A. thaliana</i>	Castasterone, brassinolide (Phytohormone)	-	23-O	-	73C5	-	Poppenberger et al., 2005
<i>A. thaliana</i>	Isorhamnetin (Flavonoids)	UDP-Ara	C3	-	78D3	-	Yonekura-Sakakibara et al., 2008
<i>A. thaliana</i>	Kaempferol (Flavonoids)	UDP-Rha	C3	-	78D1	-	Yonekura-Sakakibara et al., 2008
<i>A. thaliana</i>	Abscisic acid (Phytohormone)	UDP-Glc	-	-	71B6	-	Bowles and Lim, 2010; Bock, 2016
<i>A. thaliana</i>	Cyanidin 3/5-O-glucoside (Anthocyanins)	UDP-Glc	C3, C5	-	78D2, 75C1, 79B1, 91A1	-	Ozeki et al., 2011
<i>V. vinifera</i>	Anthocyanin	-	C3	-	88A12, GT3	-	Ozeki et al., 2011; Bock, 2016
<i>A. thaliana</i>	2,4,5-Trichlorophenol (Xenobiotics)	-	-	-	72B1, 72E1, 75D1, 84A1, 84A2, 84B1, 75B1, 80A2	-	Su et al., 2012; Bock, 2016
<i>A. thaliana</i>	Quercetin (Flavonoids)	UDP-Glc	C3	-	78D2, 89B1	-	Yin et al., 2012
<i>C. roseus</i>	Iridoids (Alkaloids)	-	-	-	UGT6, UGT7, UGT8	-	Asada et al., 2013
<i>Populus</i>	Rutin, kaempferol-3-O-rutinoside (Flavonoids)	UDP-Glc	-	-	84A17	-	Babst et al., 2014
<i>A. thaliana</i>	Coniferyl-4-O-β-D-	UDP-Glc	C4	-	72E2	-	Konig et al., 2014

	glucosides (Monolignolas)						
<i>A. thaliana</i>	Sinapyl-4-O- β -D-glucosides (Monolignolas)	UDP-Glc	C4	-	72E3	-	Konig et al., 2014
<i>A. thaliana</i>	Sinapoyl malate (Phenylpropanoids)	UDP-Glc	-	-	84A2	-	Babst et al., 2014; Konig et al., 2014
<i>A. thaliana</i>	Thiohydroximates (Glucosinolate)	UDP-Glc	-	79A2	74B1, 74C1	β - thioglucosidase	Bock, 2016
<i>S. rebaudiana</i>	Steviol glycosides (Diterpenoids)	UDP-Glc	-	701A3, 701A6, 88A3, KA13H	74G1, 76G1, 85C2	-	Bock, 2016
<i>V. vinifera</i>	Quercetin (Flavonoids)	-	-	-	89B1	-	Bock, 2016
Buckwheat	Cyanidin 3-O-glucoside (Anthocyanins)	UDP-Glc	C3	-	UFGT1, UFGT2, UFGT3	-	Zhou et al., 2016
<i>S. lycopersicum</i>	Steroidal glycol-alkaloids	-	-	GAME7, GAME8a, GAME8b	GAME17, GAME18	-	Cardenas et al., 2016
<i>M. spicata</i>	Menthol (Monoterpene)	-	C-OH	71D15, 71D13	-	-	Cui et al., 2016
<i>S. grosvenorii</i> (monk fruit)	Mogroside V (Triterpenoid)	UDP-Glc	C-3, C-11, C-24, C-25	102801	720, 94	-	Itkin et al., 2016
<i>A. thaliana</i>	Quercetin, Kaempferol (Flavonoids)	-	-	90A1	UFGT, 72B1, 73B3, 89C1, 73B4, 73B5, 76E2, 78D1, 73C6, 71C5, 71C3	-	Rai et al., 2016
<i>F. \times ananassa</i>	HDMF (4-hydroxy-2,5-dimethyl-3(2H)-furanone, 2(or 5)-ethyl-4-hydroxy-5(or	UDP-Glc	-	-	71K3a, 71K3b, 73B24, 71W2, 73B23	-	Song et al., 2016

	2)-methyl-3(2H)-furanone) (Terpenoids)						
<i>A. thaliana</i>	Brassinosteroid (Phytohormone)	-	C-26	734A1, 72C1, 90A1, 90B1, 90C1, 90D1, 85A2	-	-	Thornton et al., 2010; Rai et al., 2016
Cucumber	Cucurbitacins (Triterpenoids)	UDP-Glc	3-OH	81Q58, 89A14, 81Q59, 87D19, 87D20, 712D8, 88A60, 88L3, 88L4	73AM3, 71V2, 73AT1, 74AL1, 75V1	-	Zhou et al., 2016; Zhong et al., 2017
<i>C. sinensis</i>	Catechins, Flavonol glycosides (Flavonoids)	UDP-Glc, UDP-Gal	3-OH, 7- OH	-	75L12, 8A14, 78A15, 84A22	-	Dai et al., 2017
Flax	Secoisolarici-resinol diglucoside (Lignans)	-	-	-	74S1	-	Fofana et al., 2017
<i>P. glauca</i>	Acetophenones (Polyphenoles)	-	-	-	UGT5, UGT5b	PgbGLU- 1	Mageroy et al., 2017
<i>A. thaliana</i>	Flavonol 3-O- β -glucoside- 7-O- α -rhamnosides, Flavonol 3-O- β -glucosides	UDP-Glc	3-OH, 7- OH	-	78D1, 78D2, 89C1	BGLU15, BGLU12, BGLU16	Roepke et al., 2017
<i>Platycodon grandiflorus</i>	Platycodin D (Triterpenoid saponins)	UDP-Glc	C-2, C-16, C-23, C-24	716A140v2, 6A141, 716D, 72A	-	-	Tamura et al., 2017
Cucumber	Cucurbitacin C (Triterpenoids)	UDP-Glc	3-OH,	7 CYPs	74AC2, 74AJ2, 94T2, 71V2, 73AT1, 74AL1, 75V1	-	Zhong et al., 2017
<i>B. vulgaris</i>	Oleanolic acid 3-O- β -cellobioside,	UDP-Glc	C-3, C-28	-	73C11, 73C13	-	Erthmann et al., 2018

	Hederagenin 3-O- β -cellobioside (Triterpenoid saponins)						
<i>G. uralensis</i>	Licorice saponin A3 (Triterpenoids)	UDP-Glc	C-30	-	73F17	-	He et al., 2018
<i>G. uralensis</i>	Glycyrrhizin (Triterpenoid saponins)	-	C-22, C-11, C-30	88D6, 93E3, 72A566, 72A154	UGAT	-	He et al., 2018
<i>C. roseus</i>	Strictosidine (Monoterpenoid indole alkaloid)	UDP-Glc	7-OH	76B6, 76A26, 72A224, 72A1	7DLGT	SGD	Kellner et al., 2015

UDP-Rha: UDP-Rhamnose; UDP-Glc:UDP-Glucose; UDP-Ara:UDP-Arabinose; UDP-Xyl:UDP-Xylulose, UDP-Gal:UDP-Galactose.

Well classified CYPs and UGTs are represented only by family names. Notably, comprehensive information about CYPs, UGTs and GHs for PSGs is not available for majority of PSGs

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