

**Table S8.** Putative function of DEGs specific to each of the tetraploid wheats with central roles in either of emmer-specific and durum wheat-specific networks.

DEGs	up/down	metabolites	group	Putative function description	Orthologues	Central role emmer	Central role durum wheat
Traes_1AL_5F0F4FAFB	down	aspartic acid, citric acid glutamic acid, maltitol valine	kinases	Non-specific serine/threonine protein kinase (EC 2.7.11.1)		x	
Traes_3AL_883A4805C	down	aconitic acid, aspartic acid, citric acid, fumaric acid, glutamic acid, maltitol, valine	other C metabolisms	Cytokinin riboside 5'-monophosphate phosphoribohydrolase (EC 3.2.2.n1)	AT2G37210	x	
Traes_4BL_4D370C9FA	down	Alanine, fumaric acid glutamic acid, maltitol, threonine	stress	Probable mediator of RNA polymerase II transcription subunit 37c	AT3G12580	x	
Traes_4BL_4D370C9FA1		Alanine, fumaric acid glutamic acid, isomaltose, maltitol serine, valine					
Traes_4BL_96C906D61	down	citric acid, glutamic acid maltitol, valine	stress	Non-specific lipid-transfer protein	AT3G08770	x	
Traes_5AL_6FB526190	down	citric acid, glutamic acid maltitol, valine	N metabolism	Carbonic anhydrase (EC 4.2.1.1)	AT5G14740	x	
Traes_5BL_A0ED5623C	down	Maltitol, valine	stress	Phospholipase D delta (PLDDELTA) (EC3.1.4.4)	AT4G35790	x	
Traes_7AS_9A01E6B17	down	aconitic acid, aspartic acid, citric acid, glutamic acid, maltitol valine	transporter	Potassium transporter	AT2G30070	x	
Traes_7BL_8930CD1E5	down	aspartic acid, citric acid glutamic acid, palatinose -maltitol, valine	Stress	Peptide methionine sulfoxide reductase B1, chloroplastic (EC 1.8.4.12)	AT1G53670	x	
Traes_1AL_4B7636BC9	up	Valine, maltitol	Stress	Protein LOL1	AT1G32540	x	
Traes_1AL_090571678	up	Alanine, aspartic acid fumaric acid, glutamic	transporter	Secretory carrier-associated membrane protein (SCAMP)	AT1G61250	x	

		acid, isomaltose, malic acid, maltose- turanose, maltitol quinic acid, ribose, serine, shikimic acid, valine				
Traes_1BL_5F74C58ED		alanine, glutamic acid, maltose-turanose, maltitol				
Traes_1AL_1538AC680	up	alanine, citric acid, glutamic acid, maltose-turanose, maltitol, valine	Kinases	Nucleoside diphosphate kinase (EC 2.7.4.6)	AT4G23895	x
Traes_1BL_ACC9DDA86		citric acid, glutamic acid maltitol, valine				
Traes_1AL_8E8E7401B	up	alanine, maltose- turanose, maltitol, serine, valine	other C metabolisms	Beta-hexosaminidase (EC 3.2.1.52)	AT3G49850	x
Traes_1BL_7F9006C51	up	glutamic acid, maltitol, valine	Stress	Hyperosmolality-gated Ca <sup>2+</sup> permeable channel		x
Traes_1BL_C706FAA2B	up	glutamic acid maltitol, valine	Others	Ribosomal protein L17	AT3G54210	x
Traes_2AL_5BAB26827	up	citric acid, maltitol, valine	Stress	Lipoxygenase (EC 1.13.11-)	AT3G45140	x
Traes_2AS_34272605C	up	alanine, aspartic acid, fumaric acid, glutamic acid, isocitric acid isomaltose, maltitol, quinic acid, ribose, saccharic acid, serine shikimic acid, succinic acid, threonine, valine	Stress	Tubulin alpha chain	AT4G14960	x
Traes_2AS_7D3EC9FC2	up	citric acid, glutamic acid maltitol, valine	Others	E3 ubiquitin-protein ligase		x
Traes_3AS_CD8EF3E96	up	citric acid, glutamic acid maltitol, valine	Others	FRIGIDA-like protein	AT5G16320	x
Traes_4AL_17C4B47B3	up	aconitic acid, aspartic acid, glutamic acid,	Others	Pentatricopeptide repeat- containing protein At4g31850,	AT4G31850	x

		maltitol		chloroplastic		
Traes_4AS_4C25DF6F4	<i>up</i>	aspartic acid, citric acid, glutamic acid, maltitol valine	others C metabolism	Beta-galactosidase (EC 3.2.1.23)	AT2G32810	<b>x</b>
Traes_5AL_CEEDF43FC	<i>up</i>	alanine, aspartic acid, isomaltose, maltose-turanose, maltitol, ribose, serine, valine	Fatty acid metabolism	Acyl-[acyl-carrier-protein] hydrolase (EC 3.1.2.-)	AXX17-AT1G08340	<b>x</b>
Traes_6AL_006779D22	<i>up</i>	aconitic acid, alanine, aspartic acid, citric acid, fumaric acid, glutamic acid, malic acid, maltitol, quinic acid, serine, valine	other C metabolisms	Xyloglucan endotransglucosylase/hydrolase (EC 2.4.1.207)	AT2G06850	<b>x</b>
Traes_6BS_C9B216D97	<i>up</i>	alanine, aspartic acid, citric acid, glutamic acid, malic acid, maltitol, quinic acid, valine	C metabolism (glycolysis)	Acetyltransferase component of pyruvate dehydrogenase complex (EC 2.3.1.12)	AXX17-AT1G48680	<b>x</b>
Traes_7AS_378A12AA9	<i>up</i>	aconitic acid, aspartic acid, citric acid, fumaric acid, glutamic acid, maltitol, quinic acid, shikimic acid, valine	Others	TGW-7A		<b>x</b>
Traes_7AS_A80BE362A	<i>up</i>	aconitic acid, aspartic acid, citric acid, glutamic acid, maltitol valine	others C metabolism	Sucrose synthase (EC 2.4.1.13)	AT5G49190	<b>x</b>
Traes_7BL_E2E7AA383	<i>up</i>	alanine, aspartic acid, fumaric acid, isocitric acid, isomaltose, myo-inositol, maltitol, quinic acid, ribose, serine, shikimic acid, succinic acid, threonine	Stress	Protein Overexpressor of Cationic Peroxidase 3	AT5G11270	<b>x</b>
Traes_1AL_A970EBB27	<i>down</i>	aconitic acid, alanine,	Stress	Protein Detoxification 42	AT1G51340	<b>x</b>

		b-alanine, fumaric acid, GABA, malic acid, maltose-turanose, myo-inositol, maltitol, quinic acid, ribose, valine					
Traes_1AS_AEEC8D740	down	alanine, b-alanine, GABA, maltose-turanose, myo-inositol, maltitol, quinic acid, valine	Others	E3 ubiquitin-protein ligase UPL6 (EC 2.3.2.26)	AT3G17205		x
Traes_1BL_9772C6F45	down	alanine, aspartic acid beta-alanine, fumaric acid, GABA, malic acid, myo-inositol, maltitol, quinic acid, ribose, shikimic acid, valine	transporter	Calcium-transporting ATPase (EC 3.6.3.8)	AT1G27770		x
Traes_1BL_A9AC1340E	down	aconitic acid, alanine, GABA, malic acid, maltose-turanose, myo-inositol, maltitol, quinic acid, ribose, valine	Transcription factors	Auxin response factor (ARF family)	AT5G20730		x
Traes_1BS_4A63D1DBC	down	GABA, quinic acid, ribose, shikimic acid, valine	other C metabolisms	Phosphatidate cytidyltransferase (EC 2.7.7.41)	AT4G22340		x
Traes_2AL_BDC8DD6C7	down	aconitic acid, alanine, aspartic acid, beta-alanine, fumaric acid, GABA, malic acid, maltose-turanose, myo-inositol, maltitol, quinic acid, ribose, valine	kinases	Serine/threonine-protein kinase (EC 2.7.11.1)			x
Traes_2AL_E80950527	down	alanine, GABA, maltose-turanose, myo-inositol, maltitol, quinic acid, valine	transporter	Chloride channel protein	AT5G40890		x
Traes_2AL_EC2CE85AC	down	GABA, myo-inositol,	others	RING-type E3 ubiquitin	ATG23140		x

		quinic acid, ribose		transferase (EC 2.3.2.27)		
Traes_2AL_F4F6F518D	down	alanine, GABA, myo- inositol, quinic acid, ribose, maltitol	stress	Amine oxidase (EC 1.4.3.-)	AT4G12290	x
Traes_2BL_19B3E60AA	down	aconitic acid, alanine, citric acid, GABA, malic acid, maltose- turanose, myo- inositol, maltitol, quinic acid, ribose, shikimic acid, valine	transporter	Probable copper-transporting ATPase HMA5 (EC 3.6.3.54)	AT1G63440	x
Traes_2BL_BB2C0F695	down	aconitic acid, alanine, beta-alanine, GABA myo-inositol, maltitol, quinic acid, ribose	others	Histone H3	AT5G65350	x
Traes_3AL_FFE4C92D8	down	aconitic acid, alanine, citric acid, GABA, malic acid, maltose- turanose, myo- inositol, maltitol, quinic acid, shikimic acid, valine	others C metabolism	Cellulose synthase A catalytic subunit 8 [UDP-forming] (EC 2.4.1.12)	AT4G18780	x
Traes_4AL_D7702A458	down	aconitic acid, beta- alanine, fumaric acid, GABA, myo-inositol, maltitol, quinic acid, ribose, shikimic acid, valine	transporter	Plasma membrane ATPase (EC 3.6.3.6)	AT2G18960	x
Traes_5AL_07C125B1C	down	alanine, beta-alanine, GABA, quinic acid, maltose-turanose, valine myo-inositol, shikimic acid, maltitol	stress	Hypersensitive induced reaction protein 2	AT1G69840	x
Traes_5AL_13E2DEC48	down	aconitic acid, GABA myo-inositol, valine, maltitol, quinic acid, ribose	Transcription factors	MIKC-type MADS-box transcription factor WM6		x
Traes_5AL_23B24917C	down	aconitic acid, alanine, beta-alanine, citric acid GABA, malic acid,	C metabolism (photosynthes is)	Ferrochelatase (EC 4.99.1.1)	AT2G30390	x

		maltose-turanose, valine myo-inositol, shikimic acid, maltitol, quinic acid, ribose				
Traes_5BL_FF9AA4B58		aconitic acid, alanine, citric acid, GABA, maltose-turanose, myo-inositol, maltitol, quinic acid, ribose, shikimic acid, valine				
Traes_5AS_BA57B5B56	down	aconitic acid, GABA, myo-inositol, valine maltitol, quinic acid, ribose	Purine/pyrimi dine metabolism	Ureidoglycolate hydrolase (allantoate amido hydrolase) (EC 3.5.1.116)	AT5G43600	x
Traes_5BL_369BF7271	down	GABA, myo-inositol, maltitol, quinic acid	others	Thioredoxin-like protein HCF164	AT4G37200	x
Traes_5BL_E123D8905	down	aconitic acid, alanine, citric acid, GABA, malic acid, maltose- turanose, myo- inositol, maltitol, quinic acid, ribose, valine	others	ALBINO3-like protein 1, chloroplastic	AT1G24490	x
Traes_6AS_0C1D497EA	down	aconitic acid, alanine, b-alanine, citric acid, GABA, malic acid, valine, maltose- turanose, myo- inositol, maltitol, quinic acid, ribose, shikimic acid	Amino acid metabolism	S-adenosylmethionine synthase 4 (EC 2.5.1.6)	AT3G17390	x
Traes_6AS_F3CC61A36	down	GABA, quinic acid, shikimic acid, valine	other C metabolisms	Terpene cyclase/mutase family member (EC5.4.99-)	AT1G78950	x
Traes_6BL_2B67C5E30	down	aconitic acid, GABA, maltose-turanose, myo-inositol, quinic acid, valine	transporter	Glycolipid transfer protein 1 (GLTP 1)	AT2G33470	x
Traes_6BS_A80520954	down	aconitic acid, alanine, aspartic acid, b- alanine, citric acid,	other C metabolisms	Phosphopantetheine- adenylyltransferase (PPAT) (EC 2.7.7.3)	AT2G18250	x

		fumaric acid, GABA, malic acid, maltose-turanose, myo-inositol, maltitol, quinic acid, ribose, shikimic acid, valine				
Traes_7AS_E477E850F	down	aconitic acid, alanine, aspartic acid, beta-alanine, fumaric acid, GABA, malic acid, maltose-turanose, myo-inositol, maltitol, quinic acid, valine	Stress	Protein DETOXIFICATION	AT4G25640	x
Traes_1AL_4BF6C25E1	up	aconitic acid, citric acid, GABA, maltose-turanose, myo-inositol, quinic acid, ribose, shikimic acid, valine	Others	Probable transmembrane GTPase FZO-like	AT1G03160	x
Traes_1AL_1A98A80B4	up	aconitic acid, GABA myo-inositol, quinic acid, ribose, shikimic acid, valine	C metabolism (photosynthesis)	Chlorophyll synthase, chloroplastic (EC 2.5.1.62)	AT3G51820	x
Traes_1BL_0FC423766	up	GABA, myo-inositol, maltitol, quinic acid, valine	Others	60S ribosomal protein L36	AT5G02440	x
Traes_1BL_714F4E4AC	up	aconitic acid, GABA, maltose-turanose, myo-inositol, quinic acid, ribose, shikimic acid, valine	Stress	Carotene epsilon-monooxygenase, chloroplastic (EC 1.14.99.45)	AT3G53130	x
Traes_1BL_8AC8D124C	up	aconitic acid, citric acid, GABA, myo-inositol, quinic acid, ribose, shikimic acid, valine	Others	50S ribosomal protein L1	AT3G63490	x
Traes_2AL_E7D1C8AA5	up	GABA, maltose-turanose, myo-inositol, maltitol, quinic acid, shikimic acid, valine	transporter	Probable inositol transporter 2	AT1G30220	x

Traes_2AL_FA3E7C60B	<i>up</i>	aconitic acid, GABA, isocitric acid, maltose-turanose, myo-inositol, maltitol, quinic acid, valine	Stress	Violaxanthin de-epoxidase, chloroplastic (VDE 1) (EC 1.23.5.1)	AT1G08550	<b>x</b>
Traes_2AL_20BC426B9	<i>up</i>	aconitic acid, aspartic acid, citric acid, GABA myo-inositol, maltitol quinic acid, ribose, valine	Stress	Peroxidase (EC 1.11.1.7)	AT5G17820	<b>x</b>
Traes_2AL_729CB1040	<i>up</i>	GABA, myo-inositol quinic acid, ribose, valine	C metabolism (glycolysis)	Aldose 1-epimerase (EC 5.1.3.3)	AT3G17940	<b>x</b>
Traes_2AL_E06A248EE	<i>up</i>	alanine, beta-alanine, fumaric acid, GABA myo-inositol, maltitol, quinic acid, ribose, shikimic acid, valine	Stress	Glutathione peroxidase (EC 1.11.1.9)	AT2G48150	<b>x</b>
Traes_2BL_363CA4ED8	<i>up</i>	aconitic acid, alanine, GABA, maltose-turanose, myo-inositol, maltitol, quinic acid, ribose, shikimic acid, valine	C metabolism (photosynthesis)	Ferredoxin-3	AT2G27510	<b>x</b>
Traes_2BS_FF8887BE5	<i>up</i>	aconitic acid, citric acid, GABA, maltose-turanose, myo-inositol, quinic acid, ribose, shikimic acid, valine	Others	Asparagine--tRNA ligase, chloroplastic/mitochondrial	AT4G17300	<b>x</b>
Traes_2BS_7135D68C5	<i>up</i>	alanine, GABA, myo-inositol, maltitol, quinic acid, ribose	Others	Ribosomal protein L19	AXX17-AT4G02830	<b>x</b>
Traes_2BS_E5A5144E0	<i>up</i>	alanine, fumaric acid GABA, maltitol, quinic acid, ribose	Others	tRNA (guanine(26)-N(2))-dimethyltransferase		<b>x</b>
Traes_3AS_3CB8A9C01	<i>up</i>	aconitic acid, GABA, myo-inositol, quinic acid ribose, valine	Amino acid metabolism	Glutamate decarboxylase (EC 4.1.1.15)	AT1G65960	<b>x</b>
Traes_3B_00CF2A894	<i>up</i>	GABA, myo-inositol,	Stress	ATP-dependent Clp protease	AT1G66670	<b>x</b>



		quinic acid, ribose, shikimic acid, valine		proteolytic subunit 3 (EC 3.4.21.92)		
Traes_4AL_497775E8F	up	alanine, beta-alanine GABA, myo-inositol, Maltitol, quinic acid, ribose, shikimic acid, valine	Stress	Ferritin (EC 1.16.3.1)	AT3G56090	x
Traes_4BS_8D508569E	up	aconitic acid, GABA, myo-inositol, quinic acid, ribose, shikimic acid, valine	Others	Pentatricopeptide repeat- containing protein At3g06430	AT3G06430	x
Traes_5AL_955D2899A	up	aconitic acid, alanine GABA, maltose- turanose, myo-inositol maltitol, quinic acid, ribose, shikimic acid, valine	Stress	Pectin acetylerase (EC 3.1.1.-)	AT5G23870	x
Traes_5AS_6D0CC3B1F	up	GABA, maltose- turanose, myo- inositol, Maltitol, quinic acid, shikimic acid, valine	Others	60S ribosomal protein L36	AT5G02440	x
Traes_5BL_304FAFA26	up	GABA, myo-inositol, maltitol, quinic acid, ribose, valine	Stress	Lipoxygenase (EC 1.13.11.-)	AT3G45140	x
Traes_6AL_D13D9D951	up	aconitic acid, GABA, maltose-turanose, myo-inositol, maltitol, quinic acid, ribose, valine	<u>stress</u>	Serine carboxypeptidase-like 34(EC 3.4.16-)	AT5G23210	x
Traes_6AL_58B6B7319	up	aconitic acid, alanine, aspartic acid, citric acid, GABA, malic acid, maltose-turanose, myo-inositol, maltitol, quinic acid, ribose, valine	transporter	Bidirectional sugar transporter SWEET	AT3G16690	x
Traes_6AS_0F0809F96	up	aconitic acid, GABA, maltose-turanose, myo-inositol, maltitol,	stress	Probable inactive linolenate hydroperoxide lyase	AT4G15440	x

		quinic acid, ribose, shikimic acid, valine				
Traes_6AS_87906149C	up	aconitic acid, GABA, maltose-turanose, myo-inositol, quinic acid, ribose, shikimic acid, valine	others	Protein Chlororespiratory Reduction 6 (CRR6)	AT2G47910	x
Traes_7AL_356F6FF0E	up	aconitic acid, citric acid, GABA, maltose- turanose, myo- inositol, maltitol, valine	others	Blue-light photoreceptor PHR2	AT2G47590	x
Traes_4AL_320703FD2		aconitic acid, alanine, aspartic acid, fumaric acid, GABA, malic acid, myo-inositol, maltitol, quinic acid, ribose, valine				
Traes_7AL_1B1FBCDE4	up	aconitic acid, alanine, beta-alanine, citric acid, GABA, malic acid maltose-turanose, myo-inositol, maltitol, quinic acid, ribose, valine	other C metabolisms	Xyloglucan endotransglucosylase/hydrolase (EC 2.4.1.207)	AT2G06850	x
Traes_7AL_8C4A9BEBF		aconitic acid, alanine, aspartic acid, b- alanine, citric acid, fumaric acid, GABA, malic acid, maltose-turanose, myo-inositol, maltitol, quinic acid, ribose, shikimic acid, valine				
Traes_7AS_020CCE3DB	up	aconitic acid, citric acid, GABA, maltose- turanose, myo- inositol, maltitol,	Stress	Peroxiredoxin Q, chloroplastic (EC 1.11.1.15)	<u>AT3G26060</u>	x

		quinic acid, ribose, valine				
Traes_7AS_545BDB6F1	<i>up</i>	aconitic acid, GABA, maltose-turanose, myo-inositol, quinic acid, ribose, shikimic acid, valine	Others	Alanine--tRNA ligase, chloroplatic/mitochondrial (EC 6.1.1.7)	AT5G22800	<b>x</b>
Traes_7BL_A42D6C984	<i>up</i>	aconitic acid, GABA, maltose-turanose, myo-inositol, maltitol, quinic acid, ribose, valine	Stress	Superoxidedismutase [Cu-Zn] 2 (EC 1.15.1.1) SOD2	AT2G28190	<b>x</b>
Traes_7BL_B5491A48C	<i>up</i>	aconitic acid, alanine, citric acid, GABA, malic acid, maltose- turanose, myo- inositol, maltitol, quinic acid, ribose, shikimic acid, valine	Amino acid metabolism	D-3-phosphoglycerate dehydrogenase (EC 1.1.1.95)	AXX17- AT4G39120	<b>x</b>
Traes_7BL_C35CD97E7	<i>up</i>	aconitic acid, alanine, citric acid, GABA, maltose-turanose, myo-inositol, maltitol, quinic acid, ribose, shikimic acid, valine	C metabolism (photosynthes is)	Delta-aminolevulinic acid dehydratase (EC 4.2.1.24)	AXX17- AT1G63860	<b>x</b>