

Supplemental Table 1. Newly designed SSR markers.

SSR name	Contig number (Apple Genome V1.0 contigs by Velasco et al. (2010))	Forward primer	Reverse primer	Motif	Predicted product size (bp)
Mdo.chr1.01	MDC029632.22	TTCTAAACCAATCCAACCGC	ACGCGCGTATTCTCTCATTT	(AT)15	303
Mdo.chr1.05	MDC013694.193	ACCCAAGTCTCATCTGCACC	CATGAGTGAACAGGGGGACT	(TC)20.5	347
Mdo.chr1.06	MDC010753.200	TGCAGTTCCTCGACTCATTG	ATGGTGTCTTTGGGTTGAAG	(AT)11	350
Mdo.chr1.08	MDC021770.295	CGTCCTAGATAGATGCCCCA	CAGGACTCTAAGGACTGCCG	(TA)14.5	223
Mdo.chr1.09	MDC009959.204	TGTAAGTGAACGTAGCGTCCG	TTTACAGCTACCGACACCCC	(AG)11	232
Mdo.chr1.10	MDC006308.247	AAAAATCGGGATCTCTTCCC	TTGCTATCAATTCCCAAGCC	(GT)10	221
Mdo.chr1.11	MDC016506.307	TGACTAAATCGGCAGTTCAC	CTTTGTCAACCAAAAAGAGGG	(GA)24	321
Mdo.chr1.15	MDC004709.213	GGCCTGTAAAAGAGGGAACC	GGCTTTTTCTCCGTCCTTCT	(CT)12	204
Mdo.chr1.18	MDC012246.295	CGTGTCCACAAGCTGAGAAA	AGGGATCCCCTCTACTGTT	(TC)13	283
Mdo.chr1.19	MDC013459.136	TTATTGACGGCCTTTGGTGT	CGAGCGAGCTTCTTTGTTCT	(TA)10.5	332
Mdo.chr1.21	MDC022241.434	TGCTGGCTATCTGCTACCCT	TGCTCTTCCTCTCCTCCCA	(GA)15.5	323
BCA141	-	ACCAAACCCAGACCAAA	TGTCCTTCTCATCATCTCTC	(GA)5	121

Supplemental Table 2. Overview of the genetic maps constructed for ‘Orin’ and ‘Akane’ (Fig. 1).

	Linkage Group	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	Total
‘Orin’	Genetic Distance (cM)	71.5	70.6	72.6	67.0	65.5	47.1	67.2	57.5	69.6	73.2	74.4	56.1	14.2	56.3	92.5	69.2	70.8	1095.3
	Number of loci (apple ^a)	15 (1) ^b	9	5	10	10	6	9	11	11	16 (1)	10	17	2	10	21 (2)	6	14 (1)	182
	Number of loci (pear ^a)	5	1	4	9	1	2	3	5	3	4	5	3	0	5	7	7	5	69
	Marker Density (cM/marker)	3.6	7.1	8.1	3.5	6.0	5.9	5.6	3.6	5.0	3.7	5.0	2.8	7.1	3.8	3.3	5.3	3.7	4.4
‘Akane’	Genetic Distance (cM)	64.1	69.8	81.8	56.6	80.8	63.4	73.0	54.3	69.4	73.1	77.2	56.9	60.4	33	99.1	41.3	42.5+1.5	1098.2
	Number of loci (apple ^a)	7	8	5	10	17	13	13	11	9	21	15	20	10	15	19 (1)	10	14+2	219
	Number of loci (pear ^a)	4	3	3	7	4	0	4	4	2	8	8	0	5	4	7	3	6+0	72
	Marker Density (cM/marker)	5.8	6.3	10.2	3.3	3.8	4.9	4.3	3.6	6.3	2.5	3.4	2.8	4.0	1.7	3.8	3.2	2.0	3.8

For ‘Akane’, LG17 is divided into LG17-1 and LG17-2.

^aNumber of loci is presented separately for loci detected using primer pairs designed from apple and pear sequences.

^bNumbers in parentheses represent the number of loci detected using a gene-specific marker.

Marker density was calculated by dividing the genetic distance by the number of loci.

Supplemental Table 3. Significant QTLs detected in the ‘Orin’ × ‘Akane’ F1 population in each year .

Map	Orin							Akane								
	Traits	Year	LG	Position (cM)	LOD	Significance ^a	% var.	Nearest marker	Year	LG	Position (cM)	LOD	Significance ^a	% var.	Nearest marker	
Harvest									2010	3	59.5	3.52	**	17.8	NB109a	
									2011	3	60.5	5.13	****	17.1	NB109a	
									2012	3	69.2	6.49	*****	19.8	NH030a-2	
		<i>2011</i>	<i>6</i>	<i>3.5</i>	<i>3.70</i>	<i>***</i>	<i>9.3</i>	<i>Hi08g03</i>								
		2010	15	69.2	3.10	**	13.3	CH02d11	2010	10	31.9	2.66	*	11.4	CH02c11	
		2011	15	65.2	4.27	***	10.8	MdACS1	2012	10	30.9	3.05	**	8.7	CH02c11	
		2010	16	26.1	3.05	**	13.0	TsuENH182-2								
		2011	16	31.1	6.97	*****	18.7	TsuENH182-2								
		2012	16	31.1	3.94	***	14.6	TsuENH182-2								
	Russet-Calyx ^b	2010	2	3.0	3.83	*** (KW: *****)	19.1	Hi22d06	2010	2	59.8	2.45	* (KW: ***)	12.7	TsuENH087	
								2011	2	50.4	5.80	***** (KW: *****)	19.1	MEST142		
								<i>2012</i>	<i>10</i>	<i>8.8</i>	<i>2.34</i>	<i>*</i> (KW: ***)	<i>8.8</i>	<i>MEST111</i>		
Russet-Pedice1 ^b	2011	4	55.9	2.78	** (KW: *****)	9.7	NB141b									
	2011	8	19.0	2.45	* (KW: ***)	7.8	CH01c06									
	2012	8	34.9	2.23	** (KW: *****)	8.4	Mdo.chr1.01	2010	6	39.0	2.64	* (KW: *****)	11.4	CH03d12		
								2012	6	38.6	2.28	* (KW: *****)	8.6	CH03d12		
								2010	15	87.0	3.22	** (KW: *****)	16.4	MEST128		
								2011	15	86.3	3.22	** (KW: *****)	11.1	Hi11a01		
Depth of Skin Color ^b	<i>2011</i>	<i>6</i>	<i>39.4</i>	<i>3.50</i>	<i>*** (KW: *****)</i>	<i>12.0</i>	<i>TsuENH126</i>									
								2010	9	69.4	3.17	** (KW: ****)	14.2	EMPC115		
								2011	9	69.4	3.49	*** (KW: *****)	12.0	EMPC115		
								2012	9	69.4	2.89	* (KW: *****)	11.1	EEMPC115		
								2010	16	19.5	2.62	** (KW: ***)	11.5	Hi15a13		
Juiciness	2011	16	4.0	2.72	*	9.5	Hi22f06									

The peak with the highest LOD is presented as the QTL, followed by its position and the percentage of the phenotypic variance that it explained (% var.).

^a Asterisks (*, **, ***, ****, *****) represent significance level of $p < 0.10$, < 0.05 , < 0.01 , < 0.001 , < 0.0001 respectively. ^b The significance of QTLs for traits with a non-normal distribution was confirmed using the Kruskal-Wallis (KW) single-locus analysis, using the nearest marker. Major QTLs that explained $> 20\%$ variance are indicated in bold. QTLs undetected in the analyses using average value of data during 2 or 3 years (Table 3) are shown by italic.

Supplemental Table 3. (Continued)

Map	Orin							Akane								
	Year	LG	Position (cM)	LOD	Significance ^a	% var.	Nearest marker	Year	LG	Position (cM)	LOD	Significance ^a	% var.	Nearest marker		
Firmness	2011	10	44.0	3.83	***	13.2	CH02c11									
	2012	11	6.9	2.63	*	9.8	IPP02									
								2012	3	74.2	2.60	*	9.7	NH030a-2		
Weight	2011	11	74.4	2.87	*	10.0	CH04d07									
	2012	17	23.8	2.84	**	10.8	Hi03c05									
Preharvest Fruit Drop ^b	2012	3	66.0	2.69	*	(KW: ****)	7.2	NB109a								
	2011	15	62.5	7.68	*****	(KW: *****)	24.5	MdACS1	2011	5	14.1	3.71	***	(KW: *****)	12.7	CH03a09
	2012	15	62.5	8.43	*****	(KW: *****)	28.2	MdACS1								
									2011	8	26.8	3.97	***	10.0	CH02g09	
Acidity									2012	8	27.8	4.38	***	12.6	CH02g09	
									2012	15	42.7	2.50	*	6.3	MdACS3	
	2011	16	9.1	6.83	*****	22.4	CH05c06	2011	16	6.2	9.51	*****	26.6	Hi12a02		
	2012	16	8.1	6.38	*****	22.2	CH05c06	2012	16	6.2	6.82	*****	20.5	Hi12a02		
°Brix	2011	15	63.2	3.72	***	10.7	MdACS1									
	2012 ^b	15	62.5	2.65	*	(KW: **)	8.6	MdACS1								
	2011	16	20.1	6.78	*****	19.8	TsuENH182-2	2012 ^b	16	22.5	3.50	**	(KW: ****)	12.9	Hi01a08	
	2012 ^b	16	12.6	3.86	***	(KW: ****)	14.1	CH05c06								
Sucrose								2012	10	26.3	4.21	***	14.3	TsuENH109		
Glucose								2012	15	92.5	3.06	**	10.1	MEST147		
Fructose								2012	5	0.0	3.34	**	12.4	Hi09b04		
								2012	6	8.6	3.27	**	10.9	CH03d07		
								2012	16	18.5	3.00	**	10.0	Hi15a13		
Sorbitol ^b	2012	12	23.6	2.79	*	(KW: ****)	10.5	CH05d11								
								2012	16	15.5	3.74	***	(KW: ****)	13.8	Hi15a13	
Juice browning ^b	2012	10	54.6	2.72	*	(KW: ***)	10.2	Hi22f04	2012	10	19.3	4.89	****	(KW: *****)	11.5	NH039a
								2012	16	9.3	10.55	*****	(KW: *****)	28.2	TsuENH022	
Flowering date ^b	2012	8	38.3	3.92	***	(KW: ****)	14.4	IPP019	2012	15	86.3	9.63	*****	(KW: *****)	31.8	Hi09f01