

**Supplemental Table S1 Detailed information of *PIP* genes identified in *C. cristatella*, *R. breviscula*, *J. effuses*, *O. sativa*, and *A. thaliana*.**

Gene name	Other name	Locus	Position	Intron no.	AA	MW (kDa)	pI	GRAVY	AI	II	TM	MIP	Duplicate	Mode
<i>AtPIP1;1</i>	<i>PIP1, PIP1a</i>	AT3G61430	Chr3:22733243..22735394(+)	3	286	30.69	9.14	0.367	95.21	34.19	6	44..273	<i>AtPIP1;5</i>	$\gamma$ WGD
<i>AtPIP1;2</i>	<i>PIP1b, AthH2</i>	AT2G45960	Chr2:18910081..18911982(+)	3	286	30.60	9.16	0.405	97.62	32.28	6	44..273	<i>AtPIP1;1</i>	$\alpha$ WGD
<i>AtPIP1;3</i>	<i>PIP1c</i>	AT1G01620	Chr1:225665..227543(-)	3	286	30.63	9.02	0.381	94.90	32.25	6	44..273	<i>AtPIP1;1</i>	$\beta$ WGD
<i>AtPIP1;4</i>	<i>PIP1e, TMP-C</i>	AT4G00430	Chr4:185285..187680(-)	3	287	30.69	9.00	0.378	94.56	32.46	6	45..274	<i>AtPIP1;1</i>	$\beta$ WGD
<i>AtPIP1;5</i>	<i>PIP1d, Pcr55</i>	AT4G23400	Chr4:12220641..12222468(+)	3	287	30.65	8.99	0.401	95.57	28.81	6	45..274	-	-
<i>AtPIP2;1</i>	<i>PIP2, PIP2a</i>	AT3G53420	Chr3:19803473..19805730(-)	3	287	30.47	8.60	0.506	97.94	30.27	6	31..266	-	-
<i>AtPIP2;2</i>	<i>PIP2b</i>	AT2G37170	Chr2:15613368..15615022(-)	3	285	30.45	7.67	0.460	96.21	29.17	6	29..264	<i>AtPIP2;1</i>	$\alpha$ WGD
<i>AtPIP2;3</i>	<i>PIP2c, RD28</i>	AT2G37180	Chr2:15617635..15619155(+)	3	285	30.43	7.69	0.501	96.53	29.72	6	29..264	<i>AtPIP2;2</i>	Tandem
<i>AtPIP2;4</i>	<i>PIP2f</i>	AT5G60660	Chr5:24375368..24377206(-)	3	291	30.95	8.22	0.490	96.29	29.29	6	31..266	<i>AtPIP2;1</i>	Dispersed
<i>AtPIP2;5</i>	<i>PIP2d</i>	AT3G54820	Chr3:20301759..20304309(+)	3	286	30.59	8.99	0.506	100.66	33.33	6	31..265	<i>AtPIP2;6</i>	$\alpha$ WGD
<i>AtPIP2;6</i>	<i>PIP2e</i>	AT2G39010	Chr2:16291280..16294101(+)	3	289	31.05	8.28	0.462	98.86	31.21	6	30..265	<i>AtPIP2;1</i>	$\gamma$ WGD
<i>AtPIP2;7</i>	<i>PIP3, PIP3a</i>	AT4G35100	Chr4:16708361..16710407(+)	3	280	29.74	8.97	0.451	98.32	27.66	6	30..258	-	-
<i>AtPIP2;8</i>	<i>PIP3b</i>	AT2G16850	Chr2:7301334..7303509(+)	3	278	29.50	9.02	0.521	100.43	29.37	6	29..256	<i>AtPIP2;7</i>	$\alpha$ WGD
<i>OsPIP1;1</i>	<i>OsPIP1a</i>	LOC_Os02g44630	Chr2:27044319..27047453(+)	3	289	30.76	8.99	0.374	96.61	30.14	6	47..276	<i>OsPIP1;2</i>	$\rho$ WGD
<i>OsPIP1;2</i>	-	LOC_Os04g47220	Chr4:28046537..28048542(+)	2	288	30.75	8.83	0.350	93.89	29.03	6	46..275	-	-
<i>OsPIP1;3</i>	<i>RWC-3</i>	LOC_Os02g57720	Chr2:35349673..35351454(+)	1	288	30.76	8.86	0.398	95.59	30.35	6	46..275	<i>OsPIP1;2</i>	Transposed
<i>OsPIP2;1</i>	<i>OsPIP2a</i>	LOC_Os07g26690	Chr7:15406442..15409801(+)	2	290	30.29	8.62	0.607	102.76	26.31	6	35..271	<i>OsPIP2;5</i>	Proximal
<i>OsPIP2;2</i>	-	LOC_Os02g41860	Chr2:25162543..25166617(+)	3	289	30.77	6.99	0.461	103.39	31.43	6	33..270	<i>OsPIP2;3</i>	$\rho$ WGD
<i>OsPIP2;3</i>	-	LOC_Os04g44060	Chr4:26099273..26101782(+)	2	290	30.42	7.75	0.509	103.07	32.91	6	34..271	<i>OsPIP2;4</i>	Dispersed
<i>OsPIP2;4</i>	-	LOC_Os07g26630	Chr7:15358960..15360495(+)	2	286	29.94	7.68	0.580	107.83	24.89	6	32..268	-	-
<i>OsPIP2;5</i>	-	LOC_Os07g26660	Chr7:15376916..15378292(+)	2	283	29.72	6.95	0.525	103.11	28.18	6	30..265	<i>OsPIP2;4</i>	Proximal
<i>OsPIP2;6</i>	-	LOC_Os04g16450	Chr4:8948206..8950028(-)	2	337	36.50	9.29	0.251	92.02	48.39	6	31..243	<i>OsPIP2;2</i>	Transposed
<i>OsPIP2;7</i>	-	LOC_Os09g36930	Chr9:21310129..21311548(+)	1	290	30.32	9.06	0.602	106.69	25.06	6	37..268	<i>OsPIP2;3</i>	Dispersed

<i>OsPIP2;8</i>	-	LOC_Os03g64330	Chr3:36360645..36361743(+)	0	280	28.68	9.48	0.488	96.64	32.17	6	28..257	<i>OsPIP2;3</i>	Transposed
<i>CcPIP1;1</i>	-	Ccri09g07310	Scf9:7326948..7329768(+)	3	288	30.78	8.59	0.361	95.28	27.55	6	47..276	-	-
<i>CcPIP1;2</i>	-	Ceri31g00050	Scf31:118749..120627(-)	3	291	31.16	8.79	0.353	95.26	34.12	6	48..276	<i>CcPIP1;1</i>	WGD
<i>CcPIP1;3</i>	-	Ceri31g00060	Scf31:124450..126514(+)	3	287	30.57	8.60	0.397	96.59	35.04	6	48..276	<i>CcPIP1;2</i>	Tandem
<i>CcPIP1;4</i>	-	Ccri05g06580	Scf5:7131308..7134522(-)	3	287	30.61	8.97	0.386	97.25	29.40	6	45..274	<i>CcPIP1;1</i>	Transposed
<i>CcPIP2;1</i>	-	Ceri09g09680	Scf9:9594125..9597630(-)	3	288	30.48	8.47	0.519	101.35	29.16	6	33..269	-	-
<i>CcPIP2;2</i>	-	Ceri03g09110	Scf3:9045188..9048227(-)	3	295	31.82	9.06	0.375	97.86	31.41	6	29..266	<i>CcPIP2;1</i>	Dispersed
<i>CcPIP2;3</i>	-	Ceri03g09100	Scf3:9041443..9044163(-)	3	287	30.86	9.49	0.385	101.95	31.37	6	28..263	<i>CcPIP2;2</i>	Tandem
<i>CcPIP2;4</i>	-	Ceri21g05920	Scf21:6667153..6670556(+)	3	285	30.57	8.58	0.488	100.70	29.32	6	28..265	<i>CcPIP2;2</i>	WGD
<i>CcPIP2;5</i>	-	Ceri21g05930	Scf21:6673320..6675756(+)	3	285	30.40	7.70	0.516	102.07	28.61	6	28..265	<i>CcPIP2;4</i>	Tandem
<i>CcPIP2;6</i>	-	Ceri21g05950	Scf21:6686023..6688262(-)	3	288	30.59	7.69	0.463	100.03	28.52	6	31..268	<i>CcPIP2;5</i>	Tandem
<i>CcPIP2;7</i>	-	Ceri21g05960	Scf21:6702418..6704988(+)	3	287	30.66	8.68	0.466	98.26	28.30	6	32..268	<i>CcPIP2;6</i>	Tandem
<i>CcPIP2;8</i>	-	Ceri21g04330	Scf21:4899109..4902027(+)	3	284	30.26	8.82	0.468	104.86	33.14	6	33..262	<i>CcPIP2;1</i>	Transposed
<i>CcPIP2;9</i>	-	Ceri21g04340	Scf21:4905741..4909532(-)	3	284	30.23	8.82	0.466	104.15	31.79	6	33..262	<i>CcPIP2;8</i>	Tandem
<i>CcPIP2;10</i>	-	Ceri10g05310	Scf10:6239306..6241323(-)	3	281	30.15	9.77	0.507	108.33	26.76	6	28..259	<i>CcPIP2;8</i>	Dispersed
<i>CcPIP2;11</i>	-	Ceri09g06820	Scf9:6867367..6868913(-)	3	274	29.27	9.46	0.540	110.40	21.97	6	31..262	<i>CcPIP2;10</i>	Dispersed
<i>RbPIP1;1</i>	-	LUZ63_011311	Chr3:45402380..45404877(+)	3	288	30.85	8.60	0.351	95.28	35.57	6	48..276	-	-
<i>RbPIP1;2</i>	-	LUZ63_011115	Chr3:42711363..42714003(-)	3	291	31.27	8.58	0.288	91.58	39.48	6	48..276	<i>RbPIP1;1</i>	WGD
<i>RbPIP1;3</i>	-	LUZ63_002884	Chr1:59893262..59897821(-)	3	287	30.67	8.97	0.369	97.28	31.92	6	45..274	<i>RbPIP1;1</i>	Transposed
<i>RbPIP2;1</i>	-	LUZ63_011491	Chr3:48007365..48011750(-)	3	291	30.98	8.26	0.582	101.27	28.55	6	33..269	-	-
<i>RbPIP2;2</i>	-	LUZ63_010760	Chr3:36582295..36584096(+)	3	291	31.37	8.67	0.374	96.53	29.96	6	31..267	<i>RbPIP2;1</i>	Dispersed
<i>RbPIP2;3</i>	-	LUZ63_010761	Chr3:36585696..36587674(+)	3	271	28.98	8.56	0.487	105.13	38.54	6	27..248	<i>RbPIP2;2</i>	Tandem
<i>RbPIP2;4</i>	-	LUZ63_010762	Chr3:36588809..36591311(+)	3	289	30.70	9.49	0.358	91.45	35.27	6	32..265	<i>RbPIP2;3</i>	Tandem
<i>RbPIP2;5</i>	-	LUZ63_001808	Chr1:39864832..39869385(+)	3	286	30.54	8.26	0.451	98.95	25.78	6	29..266	<i>RbPIP2;2</i>	WGD
<i>RbPIP2;6</i>	-	LUZ63_001809	Chr1:39877625..39880113(+)	3	285	30.25	7.69	0.470	100.32	24.56	6	30..267	<i>RbPIP2;5</i>	Tandem

<i>RbPIP2;7</i>	-	LUZ63_001810	Chr1:39883707..39886627(+)	3	280	29.96	8.17	0.449	99.32	30.06	6	25..262	<i>RbPIP2;6</i>	Tandem
<i>RbPIP2;8</i>	-	LUZ63_001650	Chr1:36780263..36783600(-)	3	284	30.17	8.68	0.455	103.80	34.66	6	33..262	<i>RbPIP2;1</i>	Transposed
<i>RbPIP2;9</i>	-	LUZ63_014934	Chr4:41748055..41750386(+)	3	283	30.16	8.59	0.489	105.83	28.59	6	32..262	<i>RbPIP2;8</i>	Dispersed
<i>RbPIP2;10</i>	-	LUZ63_014935	Chr4:41752649..41755069(+)	3	280	29.70	9.30	0.485	103.86	29.63	6	33..272	<i>RbPIP2;9</i>	Tandem
<i>JePIP1;1</i>	-	LUZ60_006943	Chr17:1278758..1281195(-)	3	289	30.83	8.60	0.369	93.56	36.69	6	47..276	-	-
<i>JePIP1;2</i>	-	LUZ60_012142	Chr3:12987272..12988754(+)	3	292	31.27	8.81	0.319	92.60	37.63	6	49..277	<i>JePIP1;1</i>	WGD
<i>JePIP1;3</i>	-	LUZ60_016758	Chr8:9132616..9135730(+)	3	287	30.67	9.11	0.420	97.28	34.31	6	45..274	<i>JePIP1;1</i>	Transposed
<i>JePIP2;1</i>	-	LUZ60_002280	Chr10:8950000..8952942(-)	3	288	30.54	8.60	0.521	103.40	28.70	6	33..269		
<i>JePIP2;2</i>	-	LUZ60_014898	Chr6:10299815..10301333(-)	3	286	30.51	9.01	0.466	101.68	34.32	6	25..262	-	-
<i>JePIP2;3</i>	-	LUZ60_016512	Chr8:3568279..3569774(+)	3	286	30.41	8.27	0.488	102.06	32.66	6	29..266	<i>JePIP2;2</i>	WGD
<i>JePIP2;4</i>	-	-	Chr8:3580588..3582825(+)	3	280	29.80	8.60	0.515	102.14	29.10	6	25..262	<i>JePIP2;3</i>	Tandem
<i>JePIP2;5</i>	-	LUZ60_016188	Chr8:888630..889783(-)	3	284	30.16	8.89	0.538	108.63	33.29	6	33..262		
<i>JePIP2;6</i>	-	LUZ60_012654	Chr4:11547704..11549714(-)	3	282	30.06	9.35	0.461	108.30	27.03	6	33..261	-	-