**Table S13** Candidate genes determined through linkage disequilibrium analysis

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| SNP ID | Chrom. | Position | Candidate Gene | *r*2 | Description |
| DSC01H2 | Chr01 | 21306230 | Potri.001G213400 | 0.33 | lysosomal Pro-X carboxypeptidase; serine-type peptidase activity |
|  |  |  | Potri.001G221900 | 0.32 | thaumatin-like protein; defense response; extracellular region |
| DSC01H3 | Chr01 | 43104197 | Potri.001G374600 | 0.28 | glutamate receptor 2; ligand-gated ion channel activity; signaling receptor activity |
|  |  |  | Potri.001G385200 | 0.23 | probable leucine-rich repeat receptor-like serine/threonine-protein kinase At3g14840; ATP binding; integral component of membrane; protein kinase activity |
| DSC01H4 | Chr01 | 47744299 | Potri.001G411300 | 0.40 | G-type lectin S-receptor-like serine/threonine-protein kinase At4g27290 |
|  |  |  | Potri.001G429430 | 0.27 | disease resistance protein At4g27; ADP binding |
|  |  |  | Potri.001G437950 | 0.27 | G-type lectin S-receptor-like serine/threonine-protein kinase ; ATP binding; integral component of membrane; protein serine/threonine kinase activity |
|  |  |  | Potri.001G444100 | 0.35 | disease resistance protein; ADP binding |
|  |  |  | Potri.001G447300 | 0.20 | transferase activity, transferring acyl groups other than amino-acyl groups |
| DSC03H1 | Chr03 | 2674990 | Potri.003G013200 | 0.41 | integral component of membrane |
|  |  |  | Potri.003G013300 | 0.29 | mediator of RNA polymerase II transcription subunit 15a; chromatin DNA binding; regulation of transcription, DNA-templated; transcription coregulator activity |
|  |  |  | Potri.003G014200 | 0.27 | TMV resistance protein N; ADP binding; signal transduction |
|  |  |  | Potri.003G025500 | 0.40 | mediator of RNA polymerase II transcription subunit 15a; chromatin DNA binding; regulation of transcription, DNA-templated; transcription coregulator activity |
|  |  |  | Potri.003G026308 | 0.37 | receptor-like protein 1; integral component of membrane |
|  |  |  | Potri.003G040800 | 0.33 | glyoxylate/succinic semialdehyde reductase 2, chloroplastic; 2-hydroxy-3-oxopropionate reductase activity; glyoxylate reductase (NADP) activity; NADP binding; nucleosome assembly; oxidoreductase activity, acting on the CH-OH group of donors, NAD or NADP as acceptor |
| DSC03H2 | Chr03 | 20842084 | Potri.003G188800 | 0.41 | sulfotransferase activity |
|  |  |  | Potri.003G210600 | 1.00 | catalase activity; heme binding; integral component of membrane; ligase activity; lipid biosynthetic process; phosphopantetheine binding; response to oxidative stress |
| DSC04H1 | Chr04 | 4423234 | Potri.004G054200 | 0.20 | carbohydrate metabolic process; L-malate dehydrogenase activity; malate metabolic process; mitochondrion; tricarboxylic acid cycle |
| DSC04H2 | Chr04 | 20708892 | Potri.004G175800 | 0.52 | glycerate dehydrogenase activity; glyoxylate reductase (NADP) activity; hydroxypyruvate reductase activity; NAD binding; oxidoreductase activity, acting on the CH-OH group of donors, NAD or NADP as acceptor |
|  |  |  | Potri.004G180000 | 0.55 | germin-like protein subfamily 1 member 1; manganese ion binding; nutrient reservoir activity |
|  |  |  | Potri.004G180200 | 0.48 | germin-like protein subfamily 1 member 1; manganese ion binding; nutrient reservoir activity |
|  |  |  | Potri.004G187100 | 0.32 | UPF0481 protein At3g47200; integral component of membrane |
|  |  |  | Potri.004G192400 | 0.70 | wall-associated receptor kinase 2; ATP binding; calcium ion binding; cell surface receptor signaling pathway; integral component of membrane; plasma membrane; polysaccharide binding; protein phosphorylation; protein serine/threonine kinase activity |
|  |  |  | Potri.004G232400 | 0.21 | leucine-rich repeat receptor-like protein kinase; 2-alkenal reductase [NAD(P)+] activity; ATP binding; integral component of membrane; MAP kinase activity; transmembrane receptor protein serine/threonine kinase activity |
| DSC04H3 | Chr04 | 21344054 | Potri.004G193300 | 0.24 | serine/threonine-protein kinase TOUSLED; ATP binding; intracellular signal transduction; peptidyl-serine phosphorylation; protein serine/threonine kinase activity; regulation of chromatin assembly or disassembly |
| DSC05H1 | Chr05 | 336929 | Potri.005G003900 | 1.00 | disease resistance protein ; signal transduction |
|  |  |  | Potri.005G030318 | 0.41 | disease resistance protein; protein SUPPRESSOR OF npr1-1, CONSTITUTIVE 1; ADP binding; integral component of membrane; signal transduction |
|  |  |  | Potri.005G057150 | 0.21 | 65-kDa microtubule-associated protein 3; microtubule binding; microtubule cytoskeleton organization |
|  |  |  | Potri.005G061860 | 0.23 | ADP binding |
|  |  |  | Potri.005G073100 | 0.24 | ABC transporter G family member 11; White-brown complex protein 11 isoform; ATPase-coupled transmembrane transporter activity; ATP binding; integral component of membrane; plasma membrane; transmembrane transport |
| DSC05H2 | Chr05 | 14685227 | Potri.005G140800 | 0.62 | CBS domain-containing protein CBSX1, chloroplastic |
| DSC06H1 | Chr06 | 810179 | Potri.006G008500 | 0.29 | 36.4 kDa proline-rich protein;  |
|  |  |  | Potri.006G013300 | 1.00 | integral component of membrane |
|  |  |  | Potri.006G047500 | 0.59 | arbonic anhydrase; carbonate dehydratase activity; integral component of membrane; zinc ion binding |
| DSC06H3 | Chr06 | 13575979 | Potri.006G154200 | 0.65 | nudix hydrolase 19, chloroplastic; hydrolase activity; metal ion binding; NAD catabolic process; NAD+ diphosphatase activity; NADH pyrophosphatase activity; NADP catabolic process |
| DSC07H1 | Chr07 | 9357528 | Potri.007G068200 | 0.29 | integral component of membrane; potassium ion transmembrane transporter activity |
| DSC07H3 | Chr07 | 10256748 | Potri.007G077000 | 0.27 | protein S-acyltransferase 8; endoplasmic reticulum; Golgi apparatus; integral component of membrane; oxidoreductase activity; peptidyl-L-cysteine S-palmitoylation; protein-cysteine S-palmitoyltransferase activity; protein targeting to membrane |
|  |  |  | Potri.007G141125 | 0.48 | LEAF RUST 10 DISEASE-RESISTANCE LOCUS RECEPTOR-LIKE PROTEIN KINASE-like 2; L-type lectin-domain containing receptor kinase IX.1-like; rust resistance kinase Lr10; ATP binding; integral component of membrane; polysaccharide binding; protein kinase activity |
| DSC08H1 | Chr08 | 13071948 | Potri.008G125100 | 0.32 | amino-acid permease BAT1; arginine transmembrane transporter activity; gamma-aminobutyric acid transmembrane transporter activity; integral component of membrane; L-alanine transmembrane transporter activity; L-glutamate transmembrane transporter activity; L-lysine transmembrane transporter activity |
|  |  |  | Potri.008G162500 | 0.51 | DNA binding; zinc ion binding |
|  |  |  | Potri.008G167001 | 0.67 | ATP-dependent DNA helicase; ATP binding; DNA duplex unwinding; DNA helicase activity; DNA recombination; DNA repair; DNA replication; replication fork; telomere maintenance |
|  |  |  | Potri.008G187100 | 1.00 | protein DETOXIFICATION 29; antiporter activity; integral component of membrane; vacuolar membrane; xenobiotic transmembrane transporter activity |
|  |  |  | Potri.008G214000 | 0.20 | F-box protein At5g |
| DSC09H1 | Chr09 | 11900120 | Potri.009G150600 | 1.00 | catalytic activity; coenzyme binding |
|  |  |  | Potri.009G156500 | 0.28 | BTB/POZ and MATH domain-containing protein 4 |
| DSC10H1 | Chr10 | 4825843 | Potri.010G017450 | 0.51 | G-type lectin S-receptor-like serine/threonine-protein kinase At4g27290; ATP binding; integral component of membrane; recognition of pollen |
| DSC10H2 | Chr10 | 8084409 | Potri.010G075501 | 0.27 | inhibitor of trypsin and hageman factor; response to wounding; serine-type endopeptidase inhibitor activity |
|  |  |  | Potri.010G081500 | 0.41 | meiotic recombination protein DMC1 homolog; eiotic recombination protein DMC1; ATP binding; chromosome organization involved in meiotic cell cycle; condensed nuclear chromosome; DNA binding; DNA-dependent ATPase activity; DNA recombinase assembly; reciprocal meiotic recombination; response to ionizing radiation; single-stranded DNA binding; strand invasion |
| DSC11H1 | Chr11 | 10094625 | Potri.011G072991 | 0.25 | probable LRR receptor-like serine/threonine-protein kinase At1g29720 isoform X; ATP binding; integral component of membrane; plasma membrane; protein autophosphorylation; protein serine/threonine kinase activity |
|  |  |  | Potri.011G101451 | 0.34 | major pollen allergen Ole e 10-like; glucan endo-1, 3-beta-glucosidase; integral component of membrane |
|  |  |  | Potri.011G102200 | 0.57 | protein phosphatase 2; metal ion binding; phosphoprotein phosphatase activity |
| DSC11H2 | Chr11 | 16687705 | Potri.011G098800 | 0.21 | cytochrome P450; integral component of membrane; iron ion binding; monooxygenase activity; oxidoreductase activity, acting on paired donors, with incorporation or reduction of molecular oxygen |
|  |  |  | Potri.011G125151 | 0.22 | G-type lectin S-receptor-like serine/threonine-protein kinase At4g27290; ATP binding; integral component of membrane; plasma membrane; protein phosphorylation; protein serine/threonine kinase activity; recognition of pollen; ubiquitin protein ligase binding |
|  |  |  | Potri.011G125951 | 0.53 | zinc finger BED domain-containing protein RICESLEEPER; DNA binding; protein dimerization activity |
|  |  |  | Potri.011G130850 | 0.58 | cytochrome P450 71D; iron ion binding; oxidoreductase activity, acting on paired donors, with incorporation or reduction of molecular oxygen, NAD(P)H as one donor, and incorporation of one atom of oxygen |
|  |  |  | Potri.011G133700 | 1.00 | ankyrin repeat-containing protein; protein ACCELERATED CELL DEATH 6; integral component of membrane |
|  |  |  | Potri.011G137400 | 0.33 | probable folate-biopterin transporter 4 isoform X; integral component of membrane |
| DSC12H1 | Chr12 | 4890486 | Potri.012G004000 | 0.21 | membrane protein of ER body-like protein isoform X |
|  |  |  | Potri.012G007800 | 0.39 | integral component of membrane |
|  |  |  | Potri.012G062700 | 0.37 | serine/threonine-protein phosphatase 2A 65 kDa regulatory subunit A beta isoform; protein dephosphorylation; protein phosphatase regulator activity |
|  |  |  | Potri.012G074700 | 0.45 | protein EDS1; lipase-like PAD4; hydrolase activity; lipid metabolic process |
| DSC13H1 | Chr13 | 4732990 | Potri.013G051600 | 0.43 | germin-like protein subfamily 1 member; manganese ion binding; nutrient reservoir activity |
| DSC13H2 | Chr13 | 10764896 | Potri.013G118200 | 0.40 | senescence-specific cysteine protease SAG39; cysteine-type endopeptidase activity; cysteine-type peptidase activity; proteolysis involved in cellular protein catabolic process |
|  |  |  | Potri.013G129500 | 0.77 | putative pentatricopeptide repeat-containing protein At5g09950 isoform; intracellular membrane-bounded organelle; zinc ion binding |
|  |  |  | Potri.013G133800 | 0.31 | protein ACCELERATED CELL DEATH 6; cellular response to salicylic acid stimulus; integral component of membrane; regulation of salicylic acid mediated signaling pathway; ribonuclease T2 activity; RNA binding |
| DSC14H1 | Chr14 | 14722576 | Potri.014G168000 | 0.54 | ATP synthesis coupled proton transport; integral component of membrane; mitochondrial inner membrane; proton transmembrane transporter activity; proton-transporting ATP synthase complex, coupling factor F(o) |
|  |  |  | Potri.014G179100 | 0.35 | brassinosteroid biosynthetic process; brassinosteroid homeostasis; endoplasmic reticulum; ent-kaurenoate oxidase activity; integral component of membrane; iron ion binding; monooxygenase activity; multicellular organism development; oxidation-reduction process; oxidoreductase activity; oxidoreductase activity, acting on paired donors, with incorporation or reduction of molecular oxygen; sterol metabolic process |
| DSC15H1 | Chr15 | 6813100 | Potri.015G024500 | 0.54 | disease resistance family protein /LRR family protein ; integral component of membrane; kinase activity |
|  |  |  | Potri.015G026500 | 0.25 | lipid metabolic process; phospholipase A1 activity |
|  |  |  | Potri.015G062000 | 0.30 | 3'-5' exonuclease activity; nucleic acid binding |
| DSC16H1 | Chr16 | 9864836 | Potri.016G090700 | 0.26 | mRNA binding; regulation of RNA metabolic process; ribonucleoprotein complex |
|  |  |  | Potri.016G122650 | 0.44 | lectin-domain containing receptor kinase VI; ATP binding; carbohydrate binding; defense response to bacterium; defense response to oomycetes; integral component of membrane; transmembrane receptor protein serine/threonine kinase activity |
|  |  |  | Potri.016G126900 | 0.32 | integral component of membrane; oxidation-reduction process |
| DSC17H1 | Chr17 | 7378390 | Potri.017G049000 | 0.50 | protein DMR6-LIKE OXYGENASE 2; putative 2-oxoglutarate/Fe(II)-dependent dioxygenase; dioxygenase activity; metal ion binding; oxidoreductase activity |
|  |  |  | Potri.017G087300 | 0.21 | aspartyl esterase activity; carboxylic ester hydrolase activity; cell wall modification; pectin catabolic process; pectinesterase activity |
|  |  |  | Potri.017G093966 | 0.23 | exocyst complex component |
| DSC17H2 | Chr17 | 10908093 | Potri.017G089000 | 0.21 | intracellular membrane-bounded organelle; transferase activity, transferring hexosyl groups; UDP-glycosyltransferase activity |
|  |  |  | Potri.017G105201 | 0.61 | TMV resistance protein N; ADP binding; signal transduction |
|  |  |  | Potri.017G108500 | 0.27 | late embryogenesis abundant protein 2-like; stress-induced protein KIN2  |
|  |  |  | Potri.017G133666 | 0.39 | putative disease resistance protein RGA; ADP binding |
|  |  |  | Potri.017G140200 | 0.27 | putative helicase senataxin; helicase activity |
|  |  |  | Potri.017G141400 | 0.43 | ATP binding; integral component of membrane; protein autophosphorylation; protein serine/threonine kinase activity |
|  |  |  | Potri.017G151400 | 0.33 | probable LRR receptor-like serine/threonine-protein kinase At3g47570; ATP binding; integral component of membrane; protein serine/threonine kinase activity |
|  |  |  | Potri.017G151600 | 0.52 | probable metal-nicotianamine transporter YSL7; integral component of membrane; transmembrane transport |
| DSC19H1 | Chr19 | 5741825 | Potri.019G011300 | 0.32 | serine/threonine-protein kinase ATG1t; ATP binding |
|  |  |  | Potri.019G021800 | 0.41 | cofactor of APC complex-like; anaphase-promoting complex binding; positive regulation of ubiquitin protein ligase activity |
|  |  |  | Potri.019G022400 | 0.20 | S-adenosylmethionine-dependent methyltransferase activity |
| DSC19H2 | Chr19 | 13202165 | Potri.019G060650 | 0.29 | MDIS1-interacting receptor like kinase 2; ATP binding; hormone-mediated signaling pathway; integral component of membrane; plasma membrane; protein kinase activity |
|  |  |  | Potri.019G060900 | 0.25 | E3 ubiquitin-protein ligase SHPRH; ATP binding; metal ion binding |
|  |  |  | Potri.019G094600 | 1.00 | probable LRR receptor-like serine/threonine-protein kinase At3g47570; ATP binding; integral component of membrane; protein kinase activity |
|  |  |  | Potri.019G094700 | 0.25 | probable LRR receptor-like serine/threonine-protein kinase At1g05700; ATP binding; integral component of membrane; protein kinase activity |
| DSC19H3 | Chr19 | 13578941 | Potri.019G094200 | 0.26 | probable LRR receptor-like serine/threonine-protein kinase; ATP binding; integral component of membrane; protein serine/threonine kinase activity |
|  |  |  | Potri.019G098950 | 1.00 | integral component of membrane |
|  |  |  | Potri.019G129300 | 0.48 | MDIS1-interacting receptor like kinase 2; ATP binding; hormone-mediated signaling pathway; integral component of membrane; plasma membrane; protein kinase activity |