

Table S6. Candidate genes across whole reference genome.

| ID | Chr | Pos | Gene families |
|-------------------------|-----|----------|--|
| <i>Phvul.001G088900</i> | 1 | 14088551 | YELLOW STRIPE like 6 |
| <i>Phvul.001G105400</i> | 1 | 26290093 | calcium exchanger 7 |
| <i>Phvul.001G105400</i> | 1 | 26290093 | calcium exchanger 7 |
| <i>Phvul.001G142750</i> | 1 | 38584393 | Cation efflux family protein |
| <i>Phvul.001G177500</i> | 1 | 43453927 | NRAMP metal ion transporter family protein |
| <i>Phvul.001G179100</i> | 1 | 43666739 | Heavy metal transport/detoxification superfamily protein |
| <i>Phvul.001G179100</i> | 1 | 43666739 | Heavy metal transport/detoxification superfamily protein |
| <i>Phvul.001G205300</i> | 1 | 46324641 | Heavy metal transport/detoxification superfamily protein |
| <i>Phvul.001G247400</i> | 1 | 49894723 | Heavy metal transport/detoxification superfamily protein |
| <i>Phvul.001G250300</i> | 1 | 50100939 | Heavy metal transport/detoxification superfamily protein |
| <i>Phvul.001G250300</i> | 1 | 50100939 | Heavy metal transport/detoxification superfamily protein |
| <i>Phvul.001G250300</i> | 1 | 50100939 | Heavy metal transport/detoxification superfamily protein |
| <i>Phvul.002G033800</i> | 2 | 3382174 | Heavy metal transport/detoxification superfamily protein |
| <i>Phvul.002G033800</i> | 2 | 3382174 | Heavy metal transport/detoxification superfamily protein |
| <i>Phvul.002G099700</i> | 2 | 19275657 | zinc transporter 10 precursor |
| <i>Phvul.002G100001</i> | 2 | 19321798 | zinc transporter 10 precursor |
| <i>Phvul.002G113500</i> | 2 | 24370429 | Vacuolar iron transporter (VIT) family protein |
| <i>Phvul.002G176300</i> | 2 | 33458683 | Cation efflux family protein |
| <i>Phvul.002G184200</i> | 2 | 34468080 | ZIP metal ion transporter family |
| <i>Phvul.002G205000</i> | 2 | 37162538 | Vacuolar iron transporter (VIT) family protein |
| <i>Phvul.002G205100</i> | 2 | 37176246 | Vacuolar iron transporter (VIT) family protein |
| <i>Phvul.002G205200</i> | 2 | 37188537 | Vacuolar iron transporter (VIT) family protein |
| <i>Phvul.002G205300</i> | 2 | 37195863 | Vacuolar iron transporter (VIT) family protein |
| <i>Phvul.002G208500</i> | 2 | 37516072 | Heavy metal transport/detoxification superfamily protein |
| <i>Phvul.002G262500</i> | 2 | 43427768 | Heavy metal transport/detoxification superfamily protein |
| <i>Phvul.002G285600</i> | 2 | 45486348 | Heavy metal transport/detoxification superfamily protein |
| <i>Phvul.002G292900</i> | 2 | 46189860 | Heavy metal transport/detoxification superfamily protein |
| <i>Phvul.002G314600</i> | 2 | 48136994 | Heavy metal transport/detoxification superfamily protein |
| <i>Phvul.002G322800</i> | 2 | 48774556 | vacuolar iron transporter 1 |
| <i>Phvul.002G322900</i> | 2 | 48779470 | vacuolar iron transporter 1 |
| <i>Phvul.002G323700</i> | 2 | 48857307 | vacuolar iron transporter 1 |
| <i>Phvul.003G006400</i> | 3 | 760614 | YELLOW STRIPE like 7 |
| <i>Phvul.003G006500</i> | 3 | 765645 | YELLOW STRIPE like 7 |
| <i>Phvul.003G006500</i> | 3 | 765645 | YELLOW STRIPE like 7 |
| <i>Phvul.003G021300</i> | 3 | 2036314 | Cation efflux family protein |
| <i>Phvul.003G022400</i> | 3 | 2135327 | Heavy metal transport/detoxification superfamily protein |
| <i>Phvul.003G086300</i> | 3 | 16877488 | Heavy metal transport/detoxification superfamily protein |
| <i>Phvul.003G092500</i> | 3 | 21113140 | Heavy metal transport/detoxification superfamily protein |
| <i>Phvul.003G099700</i> | 3 | 25708027 | Heavy metal transport/detoxification superfamily protein |
| <i>Phvul.003G104900</i> | 3 | 23350962 | Heavy metal transport/detoxification superfamily protein |
| <i>Phvul.003G108900</i> | 3 | 27536901 | Heavy metal transport/detoxification superfamily protein |
| <i>Phvul.003G108900</i> | 3 | 27536901 | Heavy metal transport/detoxification superfamily protein |

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|-------------------------|-----|----------|--|
| <i>Phvul.003G108900</i> | 3 | 27536901 | Heavy metal transport/detoxification superfamily protein |
| <i>Phvul.003G219900</i> | 3 | 44817176 | Heavy metal transport/detoxification superfamily protein |
| <i>Phvul.003G262400</i> | 3 | 50155639 | zinc transporter 10 precursor |
| <i>Phvul.003G262500</i> | 3 | 50167952 | zinc transporter 10 precursor |
| <i>Phvul.004G001200</i> | 4 | 36383 | Heavy metal transport/detoxification superfamily protein |
| <i>Phvul.004G019800</i> | 4 | 2331722 | Heavy metal transport/detoxification superfamily protein |
| <i>Phvul.004G049800</i> | 4 | 6070640 | calcium exchanger 7 |
| <i>Phvul.004G052700</i> | 4 | 7006062 | Heavy metal transport/detoxification superfamily protein |
| <i>Phvul.004G077300</i> | 4 | 13645167 | Heavy metal transport/detoxification superfamily protein |
| <i>Phvul.004G096500</i> | 4 | 15848521 | Vacuolar iron transporter (VIT) family protein |
| <i>Phvul.004G106900</i> | 4 | 35338479 | Heavy metal transport/detoxification superfamily protein |
| <i>Phvul.004G116300</i> | 4 | 40009283 | Heavy metal transport/detoxification superfamily protein |
| <i>Phvul.004G138900</i> | 4 | 43873548 | YELLOW STRIPE like 7 |
| <i>Phvul.004G161300</i> | 4 | 46564258 | Heavy metal transport/detoxification superfamily protein |
| <i>Phvul.005G048900</i> | 5 | 5682746 | zinc transporter 1 precursor |
| <i>Phvul.005G049300</i> | 5 | 5742223 | Cation efflux family protein |
| <i>Phvul.005G095400</i> | 5 | 29797811 | Heavy metal transport/detoxification superfamily protein |
| <i>Phvul.005G131500</i> | 5 | 37041480 | Heavy metal transport/detoxification superfamily protein |
| <i>Phvul.005G182000</i> | 5 | 40667944 | NRAMP metal ion transporter 6 |
| <i>Phvul.005G182000</i> | 5 | 40667944 | NRAMP metal ion transporter 6 |
| <i>Phvul.005G184600</i> | 5 | 40802614 | cation exchanger 2 |
| <i>Phvul.006G001000</i> | 6 | 321846 | zinc transporter 1 precursor |
| <i>Phvul.006G015061</i> | 6 | 2386258 | YELLOW STRIPE like 1 |
| <i>Phvul.006G060800</i> | 6 | 16929318 | cation exchanger 5 |
| <i>Phvul.006G060800</i> | 6 | 16929318 | cation exchanger 5 |
| <i>Phvul.006G067900</i> | 6 | 17933066 | cation exchanger 1 |
| <i>Phvul.006G070200</i> | 6 | 18248775 | ZIP metal ion transporter family |
| <i>Phvul.006G080700</i> | 6 | 19279972 | Cation efflux family protein |
| <i>Phvul.006G080700</i> | 6 | 19279972 | Cation efflux family protein |
| <i>Phvul.006G083800</i> | 6 | 19564418 | YELLOW STRIPE like 7 |
| <i>Phvul.006G093300</i> | 6 | 20450587 | cation exchanger 11 |
| <i>Phvul.006G139900</i> | 6 | 24687127 | Heavy metal transport/detoxification superfamily protein |
| <i>Phvul.006G139900</i> | 6 | 24687127 | Heavy metal transport/detoxification superfamily protein |
| <i>Phvul.006G139900</i> | 6 | 24687127 | Heavy metal transport/detoxification superfamily protein |
| <i>Phvul.006G153400</i> | 6 | 25863506 | Heavy metal transport/detoxification superfamily protein |
| <i>Phvul.007G079100</i> | 7 | 7671485 | Vacuolar iron transporter (VIT) family protein |
| <i>Phvul.008G015500</i> | 8 | 1278190 | Cation efflux family protein |
| <i>Phvul.008G015500</i> | 8 | 1278190 | Cation efflux family protein |
| <i>Phvul.008G015500</i> | 8 | 1278190 | Cation efflux family protein |
| <i>Phvul.008G015500</i> | 8 | 1278190 | Cation efflux family protein |
| <i>Phvul.008G015500</i> | 8 | 1278190 | Cation efflux family protein |
| <i>Phvul.008G058500</i> | 8 | 5220363 | Heavy metal transport/detoxification superfamily protein |
| <i>Phvul.008G070000</i> | 8 | 6339674 | vacuolar iron transporter 1 |

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|-------------------------|-----|----------|--|
| <i>Phvul.008G079500</i> | 8 | 7719539 | ZIP metal ion transporter family |
| <i>Phvul.008G104500</i> | 8 | 11470299 | cation exchanger 1 |
| <i>Phvul.008G157800</i> | 8 | 28064702 | YELLOW STRIPE like 3 |
| <i>Phvul.008G157800</i> | 8 | 28064702 | YELLOW STRIPE like 3 |
| <i>Phvul.008G157800</i> | 8 | 28064702 | YELLOW STRIPE like 3 |
| <i>Phvul.008G187600</i> | 8 | 52505573 | Vacuolar iron transporter (VIT) family protein |
| <i>Phvul.008G187600</i> | 8 | 52505573 | Vacuolar iron transporter (VIT) family protein |
| <i>Phvul.008G187600</i> | 8 | 52505573 | Vacuolar iron transporter (VIT) family protein |
| <i>Phvul.008G187600</i> | 8 | 52505573 | Vacuolar iron transporter (VIT) family protein |
| <i>Phvul.008G187600</i> | 8 | 52505573 | Vacuolar iron transporter (VIT) family protein |
| <i>Phvul.008G187600</i> | 8 | 52505573 | Vacuolar iron transporter (VIT) family protein |
| <i>Phvul.008G189300</i> | 8 | 52746631 | Heavy metal transport/detoxification superfamily protein |
| <i>Phvul.008G189400</i> | 8 | 52754968 | Heavy metal transport/detoxification superfamily protein |
| <i>Phvul.008G216200</i> | 8 | 56526044 | Heavy metal transport/detoxification superfamily protein |
| <i>Phvul.008G219600</i> | 8 | 56886320 | Heavy metal transport/detoxification superfamily protein |
| <i>Phvul.008G244200</i> | 8 | 59266794 | Cation efflux family protein |
| <i>Phvul.008G254900</i> | 8 | 60275655 | Cation efflux family protein |
| <i>Phvul.008G259200</i> | 8 | 60615253 | ZIP metal ion transporter family |
| <i>Phvul.008G261500</i> | 8 | 60843461 | cation exchanger 1 |
| <i>Phvul.009G027600</i> | 9 | 6422756 | Heavy metal transport/detoxification superfamily protein |
| <i>Phvul.009G038800</i> | 9 | 8217549 | Heavy metal transport/detoxification superfamily protein |
| <i>Phvul.009G038800</i> | 9 | 8217549 | Heavy metal transport/detoxification superfamily protein |
| <i>Phvul.009G038800</i> | 9 | 8217549 | Heavy metal transport/detoxification superfamily protein |
| <i>Phvul.009G038800</i> | 9 | 8217549 | Heavy metal transport/detoxification superfamily protein |
| <i>Phvul.009G040800</i> | 9 | 8411105 | vacuolar iron transporter (VIT) family protein |
| <i>Phvul.009G040800</i> | 9 | 8411105 | vacuolar iron transporter (VIT) family protein |
| <i>Phvul.009G040800</i> | 9 | 8411105 | vacuolar iron transporter (VIT) family protein |
| <i>Phvul.009G048800</i> | 9 | 9593088 | YELLOW STRIPE like 3 |
| <i>Phvul.009G048800</i> | 9 | 9593088 | YELLOW STRIPE like 3 |
| <i>Phvul.009G069700</i> | 9 | 12141306 | NRAMP metal ion transporter 2 |
| <i>Phvul.009G127900</i> | 9 | 19429094 | NRAMP metal ion transporter 6 |
| <i>Phvul.009G127900</i> | 9 | 19429094 | NRAMP metal ion transporter 6 |
| <i>Phvul.009G137100</i> | 9 | 20653368 | manganese tracking factor for mitochondrial SOD2 |
| <i>Phvul.009G164900</i> | 9 | 24527982 | Heavy metal transport/detoxification superfamily protein |
| <i>Phvul.009G247600</i> | 9 | 36846305 | Heavy metal transport/detoxification superfamily protein |
| <i>Phvul.010G001500</i> | 10 | 412065 | cation exchanger 3 |
| <i>Phvul.010G001500</i> | 10 | 412065 | cation exchanger 3 |
| <i>Phvul.010G021600</i> | 10 | 3076479 | Vacuolar iron transporter (VIT) family protein |
| <i>Phvul.010G021700</i> | 10 | 3083937 | vacuolar iron transporter (VIT) family protein |
| <i>Phvul.010G034132</i> | 10 | 4957830 | Heavy metal transport/detoxification superfamily protein |
| <i>Phvul.010G059200</i> | 10 | 9326694 | ZIP metal ion transporter family |
| <i>Phvul.010G103800</i> | 10 | 37309047 | Heavy metal transport/detoxification superfamily protein |

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|-------------------------|--------------|----------|--|
| <i>Phvul.010G103800</i> | 10 | 37309047 | Heavy metal transport/detoxification superfamily protein |
| <i>Phvul.010G110500</i> | 10 | 38414889 | NRAMP metal ion transporter 2 |
| <i>Phvul.010G119900</i> | 10 | 40027163 | metal tolerance protein A2 |
| <i>Phvul.010G119900</i> | 10 | 40027163 | metal tolerance protein A2 |
| <i>Phvul.010G119900</i> | 10 | 40027163 | metal tolerance protein A2 |
| <i>Phvul.010G119900</i> | 10 | 40027163 | metal tolerance protein A2 |
| <i>Phvul.010G128500</i> | 10 | 40925634 | cation calcium exchanger 4 |
| <i>Phvul.010G160800</i> | 10 | 43922651 | NRAMP metal ion transporter 6 |
| <i>Phvul.010G160800</i> | 10 | 43922651 | NRAMP metal ion transporter 6 |
| <i>Phvul.010G160800</i> | 10 | 43922651 | NRAMP metal ion transporter 6 |
| <i>Phvul.011G058500</i> | 11 | 5228604 | ZIP metal ion transporter family |
| <i>Phvul.011G061200</i> | 11 | 5460629 | metal tolerance protein B1 |
| <i>Phvul.011G061200</i> | 11 | 5460629 | metal tolerance protein B1 |
| <i>Phvul.011G068500</i> | 11 | 6085721 | Heavy metal transport/detoxification superfamily protein |
| <i>Phvul.011G084200</i> | 11 | 7945552 | Heavy metal transport/detoxification superfamily protein |
| <i>Phvul.011G088100</i> | 11 | 8454876 | vacuolar protein sorting 41 |
| <i>Phvul.011G178800</i> | 11 | 48990728 | Cation efflux family protein |
| <i>Phvul.011G178800</i> | 11 | 48990728 | Cation efflux family protein |
| <i>Phvul.L001741</i> | scaffold_142 | 17190 | Heavy metal transport/detoxification superfamily protein |
| <i>Phvul.L002137</i> | scaffold_13 | 221624 | Heavy metal transport/detoxification superfamily protein |
| <i>Phvul.L005301</i> | scaffold_14 | 415497 | YELLOW STRIPE like 1 |
| <i>Phvul.L005301</i> | scaffold_14 | 415497 | YELLOW STRIPE like 1 |
| <i>Phvul.L007443</i> | scaffold_15 | 499839 | zinc transporter 11 precursor |
| <i>Phvul.L007543</i> | scaffold_15 | 504259 | zinc transporter 11 precursor |
| <i>Phvul.L011443</i> | scaffold_15 | 796287 | ZIP metal ion transporter family |