

Article title:Genome-wide characterization of the WRKY gene family in *Juglans mandshurica* and expression profiling of *JmWRKY51* under drought stress

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**Table S1. Primer sequences used for qRT-PCR analysis.**

| <b>Gene</b>     | <b>Primer Name</b> | <b>Sequence (5'→3')</b> |
|-----------------|--------------------|-------------------------|
| <i>JmActin</i>  | JmActin-F          | AGGAGCTGGAGAAGGAGCCCA   |
| <i>JmActin</i>  | JmActin-R          | AACAGCAACGGTCTGGCGCA    |
| <i>JmWRKY51</i> | JmWRKY51-F         | GATCTCTTTGTCCGGCCGTT    |
| <i>JmWRKY51</i> | JmWRKY51-R         | AATCGGAGTGTGTGGGTGAC    |

**Table S2 Physicochemical properties of the JmWRKY**

| <b>Gene ID</b> | <b>Gene name</b> | <b>PL</b> | <b>MW</b> | <b>pI</b> | <b>SI</b> |
|----------------|------------------|-----------|-----------|-----------|-----------|
| Jm000115.1     | <i>JmWRKY5</i>   | 333       | 37493.42  | 5.81      | Nucleus   |
| Jm000624.1     | <i>JmWRKY88</i>  | 518       | 56790.69  | 5.47      | Nucleus   |
| Jm002332.1     | <i>JmWRKY84</i>  | 558       | 61408.64  | 6.58      | Nucleus   |
| Jm004665.1     | <i>JmWRKY50</i>  | 315       | 35264.34  | 7.11      | Nucleus   |
| Jm004700.1     | <i>JmWRKY49</i>  | 277       | 31098.99  | 8.11      | Nucleus   |
| Jm005277.1     | <i>JmWRKY68</i>  | 297       | 33484.36  | 6.06      | Nucleus   |
| Jm006201.1     | <i>JmWRKY59</i>  | 348       | 39140.17  | 5.41      | Nucleus   |
| Jm006524.1     | <i>JmWRKY66</i>  | 474       | 51782.73  | 9.3       | Nucleus   |
| Jm006583.1     | <i>JmWRKY65</i>  | 670       | 75465.45  | 8.57      | Nucleus   |
| Jm006732.1     | <i>JmWRKY67</i>  | 274       | 31509.33  | 5.08      | Nucleus   |
| Jm007108.1     | <i>JmWRKY41</i>  | 546       | 61100.08  | 6.21      | Nucleus   |
| Jm007199.1     | <i>JmWRKY64</i>  | 327       | 36768.66  | 6.67      | Nucleus   |
| Jm007549.1     | <i>JmWRKY18</i>  | 234       | 26453.85  | 8.78      | Nucleus   |
| Jm008080.1     | <i>JmWRKY52</i>  | 311       | 34459.68  | 8.5       | Nucleus   |
| Jm008090.1     | <i>JmWRKY53</i>  | 260       | 29667.21  | 6.38      | Nucleus   |
| Jm008225.1     | <i>JmWRKY57</i>  | 468       | 50223.64  | 5.16      | Nucleus   |
| Jm009177.1     | <i>JmWRKY36</i>  | 433       | 47315.68  | 6.08      | Nucleus   |
| Jm009269.1     | <i>JmWRKY4</i>   | 359       | 40252.56  | 5.41      | Nucleus   |
| Jm009816.1     | <i>JmWRKY29</i>  | 431       | 47368.2   | 5.99      | Nucleus   |
| Jm010020.1     | <i>JmWRKY30</i>  | 544       | 59780.39  | 5.91      | Nucleus   |
| Jm010521.1     | <i>JmWRKY81</i>  | 228       | 25731.13  | 6.99      | Nucleus   |
| Jm011442.1     | <i>JmWRKY12</i>  | 211       | 24118.42  | 8.82      | Nucleus   |
| Jm011503.1     | <i>JmWRKY11</i>  | 334       | 36685.26  | 5.31      | Nucleus   |
| Jm011717.1     | <i>JmWRKY25</i>  | 192       | 21751.72  | 9.42      | Nucleus   |
| Jm012018.1     | <i>JmWRKY86</i>  | 355       | 38332.64  | 9.38      | Nucleus   |
| Jm012057.1     | <i>JmWRKY83</i>  | 154       | 17485.74  | 6.39      | Nucleus   |
| Jm012138.1     | <i>JmWRKY16</i>  | 519       | 56667.99  | 8.09      | Nucleus   |
| Jm012499.1     | <i>JmWRKY8</i>   | 387       | 42674.41  | 6.06      | Nucleus   |
| Jm012514.1     | <i>JmWRKY9</i>   | 312       | 35101.06  | 5.54      | Nucleus   |
| Jm013726.1     | <i>JmWRKY54</i>  | 250       | 27823.02  | 5.29      | Nucleus   |
| Jm013848.1     | <i>JmWRKY70</i>  | 607       | 65535.09  | 6.95      | Nucleus   |
| Jm014028.1     | <i>JmWRKY34</i>  | 634       | 69160.75  | 6.49      | Nucleus   |
| Jm014166.1     | <i>JmWRKY39</i>  | 330       | 36462.39  | 6.94      | Nucleus   |
| Jm014662.1     | <i>JmWRKY19</i>  | 195       | 21984.38  | 7.69      | Nucleus   |
| Jm014758.1     | <i>JmWRKY20</i>  | 636       | 68792.95  | 6.03      | Nucleus   |
| Jm015091.1     | <i>JmWRKY13</i>  | 327       | 36609.73  | 6.61      | Nucleus   |
| Jm015222.1     | <i>JmWRKY79</i>  | 286       | 31985.09  | 7.54      | Nucleus   |
| Jm015415.1     | <i>JmWRKY78</i>  | 162       | 18416.94  | 10.01     | Nucleus   |
| Jm015455.1     | <i>JmWRKY77</i>  | 360       | 40463.82  | 5.89      | Nucleus   |
| Jm016510.1     | <i>JmWRKY87</i>  | 166       | 18931.51  | 4.9       | Nucleus   |
| Jm017001.1     | <i>JmWRKY63</i>  | 593       | 63596.37  | 6.09      | Nucleus   |
| Jm017021.1     | <i>JmWRKY62</i>  | 255       | 28592.89  | 5.14      | Nucleus   |
| Jm017361.1     | <i>JmWRKY73</i>  | 361       | 40616.32  | 9.3       | Nucleus   |
| Jm017950.1     | <i>JmWRKY33</i>  | 549       | 59256.37  | 7.29      | Nucleus   |
| Jm018194.1     | <i>JmWRKY32</i>  | 304       | 33627.82  | 5.78      | Nucleus   |
| Jm018196.1     | <i>JmWRKY31</i>  | 185       | 20899.4   | 9.18      | Nucleus   |
| Jm018382.1     | <i>JmWRKY14</i>  | 320       | 35292.35  | 9.06      | Nucleus   |
| Jm019084.1     | <i>JmWRKY17</i>  | 188       | 21812.5   | 9.5       | Nucleus   |
| Jm019514.1     | <i>JmWRKY21</i>  | 311       | 34807.71  | 8.36      | Nucleus   |
| Jm019693.1     | <i>JmWRKY56</i>  | 332       | 36394.29  | 6.72      | Nucleus   |
| Jm019727.1     | <i>JmWRKY55</i>  | 588       | 64092.27  | 6.11      | Nucleus   |
| Jm021227.1     | <i>JmWRKY22</i>  | 365       | 40894.66  | 9.63      | Nucleus   |
| Jm021738.1     | <i>JmWRKY51</i>  | 315       | 34451.15  | 9.85      | Nucleus   |
| Jm021924.1     | <i>JmWRKY37</i>  | 380       | 42799.34  | 5.86      | Nucleus   |

| <b>Gene ID</b> | <b>Gene name</b> | <b>PL</b> | <b>MW</b> | <b>pI</b> | <b>SI</b> |
|----------------|------------------|-----------|-----------|-----------|-----------|
| Jm022284.1     | <i>JmWRKY40</i>  | 181       | 20643.07  | 9.3       | Nucleus   |
| Jm023972.1     | <i>JmWRKY6</i>   | 528       | 58665.8   | 7.74      | Nucleus   |
| Jm024348.1     | <i>JmWRKY76</i>  | 480       | 53490.82  | 9.12      | Nucleus   |
| Jm025280.1     | <i>JmWRKY85</i>  | 347       | 37848.36  | 9.66      | Nucleus   |
| Jm025369.1     | <i>JmWRKY58</i>  | 488       | 53408.02  | 8.97      | Nucleus   |
| Jm025820.1     | <i>JmWRKY44</i>  | 528       | 57782.82  | 8.39      | Nucleus   |
| Jm026233.1     | <i>JmWRKY69</i>  | 152       | 17737.87  | 9.56      | Nucleus   |
| Jm026624.1     | <i>JmWRKY15</i>  | 389       | 42999.02  | 6.73      | Nucleus   |
| Jm027233.1     | <i>JmWRKY7</i>   | 312       | 34554.76  | 8.97      | Nucleus   |
| Jm027442.1     | <i>JmWRKY35</i>  | 376       | 42290.84  | 6.01      | Nucleus   |
| Jm027592.1     | <i>JmWRKY60</i>  | 562       | 62794.92  | 8.07      | Nucleus   |
| Jm027658.1     | <i>JmWRKY61</i>  | 316       | 35917.12  | 6.21      | Nucleus   |
| Jm028429.1     | <i>JmWRKY24</i>  | 535       | 58914.82  | 7.18      | Nucleus   |
| Jm028450.1     | <i>JmWRKY23</i>  | 517       | 56304.57  | 8.38      | Nucleus   |
| Jm029185.1     | <i>JmWRKY80</i>  | 577       | 62726.51  | 6.93      | Nucleus   |
| Jm029315.1     | <i>JmWRKY82</i>  | 573       | 63126.79  | 7.08      | Nucleus   |
| Jm029624.1     | <i>JmWRKY28</i>  | 348       | 39216.43  | 9.6       | Nucleus   |
| Jm029696.1     | <i>JmWRKY10</i>  | 337       | 37114.02  | 9.42      | Nucleus   |
| Jm030010.1     | <i>JmWRKY27</i>  | 625       | 67721.37  | 6.81      | Nucleus   |
| Jm030140.1     | <i>JmWRKY26</i>  | 238       | 26921.24  | 9.33      | Nucleus   |
| Jm030479.1     | <i>JmWRKY74</i>  | 590       | 64100.17  | 7.3       | Nucleus   |
| Jm030678.1     | <i>JmWRKY75</i>  | 747       | 80374.41  | 5.74      | Nucleus   |
| Jm030951.1     | <i>JmWRKY3</i>   | 203       | 22967.25  | 9.42      | Nucleus   |
| Jm031110.1     | <i>JmWRKY38</i>  | 523       | 56556.59  | 6.93      | Nucleus   |
| Jm031191.1     | <i>JmWRKY45</i>  | 315       | 34363.92  | 9.89      | Nucleus   |
| Jm031214.1     | <i>JmWRKY47</i>  | 314       | 35114.42  | 8.58      | Nucleus   |
| Jm031280.1     | <i>JmWRKY48</i>  | 264       | 29902.27  | 8.51      | Nucleus   |
| Jm031536.1     | <i>JmWRKY46</i>  | 346       | 37216.32  | 9.67      | Nucleus   |
| Jm031934.1     | <i>JmWRKY71</i>  | 357       | 40201.54  | 5.37      | Nucleus   |
| Jm032315.1     | <i>JmWRKY72</i>  | 366       | 40795.09  | 6.27      | Nucleus   |
| Jm032956.1     | <i>JmWRKY2</i>   | 341       | 37300.99  | 5.45      | Nucleus   |
| Jm033965.1     | <i>JmWRKY1</i>   | 341       | 37395.3   | 9.58      | Nucleus   |

**Table S4. Ka/Ks ratios of duplicated JmWRKY gene pairs.**

| <b>Gene name</b> | <b>Gene name</b> | <b>Ka</b>   | <b>Ks</b>   | <b>Ka/Ks</b> |
|------------------|------------------|-------------|-------------|--------------|
| JmWRKY4          | JmWRKY71         | 0.430831037 | 1.587886402 | 0.271323589  |
| JmWRKY2          | JmWRKY79         | 0.457381097 | 2.788314787 | 0.164034957  |
| JmWRKY3          | JmWRKY78         | 0.30824203  | 3.011707891 | 0.102347917  |
| JmWRKY1          | JmWRKY86         | 0.270963705 | 1.829713891 | 0.148090751  |
| JmWRKY7          | JmWRKY14         | 0.082454472 | 0.438218243 | 0.188158465  |
| JmWRKY8          | JmWRKY15         | 0.165249015 | 0.332232801 | 0.497389223  |
| JmWRKY2          | JmWRKY11         | 0.080436218 | 0.369741585 | 0.217547124  |
| JmWRKY3          | JmWRKY12         | 0.151298258 | 0.499563944 | 0.302860645  |
| JmWRKY5          | JmWRKY13         | 0.071437953 | 0.323027281 | 0.221151456  |
| JmWRKY4          | JmWRKY35         | 0.385338671 | 1.91270981  | 0.201462171  |
| JmWRKY2          | JmWRKY36         | 0.443623256 | 1.880119792 | 0.235954782  |
| JmWRKY4          | JmWRKY37         | 0.388452828 | 1.872983669 | 0.207397872  |
| JmWRKY7          | JmWRKY47         | 0.343634395 | 1.541081559 | 0.222982615  |
| JmWRKY5          | JmWRKY43         | 0.337906347 | 1.628989984 | 0.207433042  |
| JmWRKY6          | JmWRKY44         | 0.465679306 | 1.363972112 | 0.341414096  |
| JmWRKY5          | JmWRKY52         | 0.341051215 | 1.443665666 | 0.236239749  |
| JmWRKY9          | JmWRKY61         | 0.492610965 | 2.413728175 | 0.204087175  |
| JmWRKY65         | JmWRKY82         | 0.320701723 | 1.398527742 | 0.229313808  |
| JmWRKY65         | JmWRKY84         | 0.339967166 | 1.52262787  | 0.223276595  |
| JmWRKY63         | JmWRKY20         | 0.27640697  | 2.803565432 | 0.098591232  |
| JmWRKY62         | JmWRKY54         | 0.095681885 | 0.489952886 | 0.19528793   |
| JmWRKY63         | JmWRKY55         | 0.102948758 | 0.416676351 | 0.247071277  |
| JmWRKY64         | JmWRKY56         | 0.139232257 | 0.489083215 | 0.284680096  |
| JmWRKY65         | JmWRKY60         | 0.130176468 | 0.37754367  | 0.34479844   |
| JmWRKY66         | JmWRKY58         | 0.10128835  | 0.312941276 | 0.323665676  |
| JmWRKY67         | JmWRKY59         | 0.251697188 | 0.541503976 | 0.464811339  |
| JmWRKY68         | JmWRKY61         | 0.157431093 | 0.503601905 | 0.312610202  |
| JmWRKY71         | JmWRKY77         | 0.145093096 | 0.40705742  | 0.356443806  |
| JmWRKY72         | JmWRKY79         | 0.135567353 | 0.239297755 | 0.566521625  |
| JmWRKY74         | JmWRKY80         | 0.085778867 | 0.269448935 | 0.318349254  |
| JmWRKY70         | JmWRKY76         | 0.212707859 | 0.504360698 | 0.421737577  |
| JmWRKY72         | JmWRKY11         | 0.446526152 | 2.54713863  | 0.175305006  |
| JmWRKY69         | JmWRKY17         | 0.291302312 | 1.580631959 | 0.184294839  |
| JmWRKY74         | JmWRKY29         | 0.485806672 | 1.470767089 | 0.330308365  |
| JmWRKY69         | JmWRKY25         | 0.317334207 | 1.627173809 | 0.195021703  |
| JmWRKY69         | JmWRKY31         | 0.273137587 | 1.294408323 | 0.211013466  |
| JmWRKY71         | JmWRKY35         | 0.41706239  | 3.757186581 | 0.111003907  |
| JmWRKY70         | JmWRKY34         | 0.396175329 | 1.467727039 | 0.269924392  |
| JmWRKY71         | JmWRKY37         | 0.392899009 | 1.940849501 | 0.202436618  |
| JmWRKY76         | JmWRKY24         | 0.390529102 | 1.112576781 | 0.351013169  |
| JmWRKY80         | JmWRKY29         | 0.485821722 | 1.140579207 | 0.425942994  |
| JmWRKY79         | JmWRKY36         | 0.473694835 | 3.977478681 | 0.119094249  |
| JmWRKY76         | JmWRKY34         | 0.401710766 | 1.711422579 | 0.234723306  |
| JmWRKY77         | JmWRKY37         | 0.406337484 | 2.436939826 | 0.166740877  |
| JmWRKY82         | JmWRKY84         | 0.084136551 | 0.329616669 | 0.255255753  |
| JmWRKY82         | JmWRKY60         | 0.316729342 | 1.409908955 | 0.224645245  |
| JmWRKY84         | JmWRKY60         | 0.345593296 | 1.734360862 | 0.199262624  |
| JmWRKY11         | JmWRKY36         | 0.478389631 | 1.796164117 | 0.266339599  |
| JmWRKY14         | JmWRKY47         | 0.356180688 | 1.688162789 | 0.210987169  |
| JmWRKY13         | JmWRKY43         | 0.307870538 | 2.368718354 | 0.129973467  |
| JmWRKY13         | JmWRKY52         | 0.296304756 | 1.713548387 | 0.172918815  |
| JmWRKY14         | JmWRKY49         | 0.581192619 | 2.934017254 | 0.198087662  |

| Gene name | Gene name | Ka          | Ks          | Ka/Ks       |
|-----------|-----------|-------------|-------------|-------------|
| JmWRKY16  | JmWRKY23  | 0.087695383 | 0.236856013 | 0.370247654 |
| JmWRKY17  | JmWRKY25  | 0.12999889  | 0.469969874 | 0.276611114 |
| JmWRKY18  | JmWRKY26  | 0.07921376  | 0.274893711 | 0.288161414 |
| JmWRKY20  | JmWRKY27  | 0.104553214 | 0.416854884 | 0.250814414 |
| JmWRKY22  | JmWRKY28  | 0.040001016 | 0.308589862 | 0.129625177 |
| JmWRKY16  | JmWRKY33  | 0.275943154 | 1.221110434 | 0.225977231 |
| JmWRKY17  | JmWRKY31  | 0.307364281 | 1.719347841 | 0.178767945 |
| JmWRKY17  | JmWRKY40  | 0.218226361 | 1.863679987 | 0.117094331 |
| JmWRKY16  | JmWRKY38  | 0.289166669 | 1.172459621 | 0.246632518 |
| JmWRKY20  | JmWRKY55  | 0.263961629 | 2.477275641 | 0.106553193 |
| JmWRKY23  | JmWRKY33  | 0.264528    | 1.014321458 | 0.260793063 |
| JmWRKY25  | JmWRKY31  | 0.296121979 | 1.406057127 | 0.210604515 |
| JmWRKY25  | JmWRKY40  | 0.274266789 | 1.753870735 | 0.156377995 |
| JmWRKY23  | JmWRKY38  | 0.284525442 | 1.101255076 | 0.258364705 |
| JmWRKY27  | JmWRKY55  | 0.336418755 | 3.315420224 | 0.101470925 |
| JmWRKY30  | JmWRKY41  | 0.180129781 | 0.508511917 | 0.354229223 |
| JmWRKY31  | JmWRKY40  | 0.081109109 | 0.283635862 | 0.285962108 |
| JmWRKY32  | JmWRKY39  | 0.185787977 | 0.52593246  | 0.35325444  |
| JmWRKY33  | JmWRKY38  | 0.103689692 | 0.345556409 | 0.30006589  |
| JmWRKY35  | JmWRKY37  | 0.186833976 | 0.450062864 | 0.415128621 |
| JmWRKY42  | JmWRKY53  | 0.103193701 | 0.250171829 | 0.412491292 |
| JmWRKY43  | JmWRKY52  | 0.077316814 | 0.268803243 | 0.287633487 |
| JmWRKY45  | JmWRKY51  | 0.139010458 | 0.58231332  | 0.238721069 |