Genetic inheritance of Photoperiod sensitivity in runner bean

Supplementary Table 1. Scaling test for days to flowering, number of racemes and pods in seven runner bean crosses grown at two locations.

| Cross               | Traits | A          | B          | C          |
|---------------------|--------|------------|------------|------------|
|                     |        | Kabete     | Ol Joro-Orok | Kabete     | Ol Joro-Orok | Kabete     | Ol Joro-Orok |
| White Emergo x Kin1 | 1      | 0.62ns     | 0.41ns     | 0.11ns     | -0.33ns     | 0.08ns     | 0.12ns     |
|                     | 2      | -0.11ns    | 0.27ns     | 6.64ns     | 0.60ns      | 0.39ns     | 0.30ns     |
|                     | 3      | -0.58ns    | -0.11ns    | -0.51ns    | 0.06ns      | 0.51ns     | 0.36ns     |
|                     | 4      | -1.15ns    | -0.61ns    | -2.76ns    | 0.42ns      | 0.01ns     | 0.59ns     |
| White Emergo x Kin 2| 1      | 1.00ns     | 0.5ns      | 0.57ns     | -0.55ns     | 0.02ns     | 0.15ns     |
|                     | 2      | 0.13ns     | 0.33ns     | 0.25ns     | 0.19ns      | 0.08ns     | 0.35ns     |
|                     | 3      | 0.38ns     | 0.66ns     | -0.01ns    | 1.07ns      | 0.33ns     | 0.22ns     |
|                     | 4      | -0.14ns    | -1.14ns    | -0.06ns    | -0.21ns     | -0.12ns    | 0.39ns     |
| White Emergo x Kin 3| 1      | 0.95ns     | 0.22ns     | 0.39ns     | 0.06ns      | 0.06ns     | -0.19ns    |
|                     | 2      |            |            |            |            |            |            |
|                     | 3      | -0.29ns    | 0.29ns     | -0.45ns    | 0.65ns      | -0.08ns    | 0.62ns     |
|                     | 4      | -1.32ns    | -1.33ns    | -1.68ns    | -2.19ns     | 0.27ns     | 0.29ns     |
| White Emergo x Nyeri| 1      | 0.49ns     | 0.43ns     | 0.48ns     | 0.28ns      | -0.06ns    | 0.16ns     |
|                     | 2      | 0.17ns     | 0.69ns     | -0.27ns    | 0.22ns      | -0.19ns    | 0.14ns     |
|                     | 3      | -0.45ns    | 0.50ns     | 0.70ns     | 1.57ns      | 0.34ns     | 0.28ns     |
|                     | 4      | 1.29ns     | -1.81ns    | 0.36ns     | -1.15ns     | 0.32ns     | 0.06ns     |
| White Emergo x Dwarf 1| 1      | 0.69ns     | 0.36ns     | 1.16ns     | 0.28ns      | 0.02ns     | 0.05ns     |
|                     | 2      | 0.18ns     | 0.8ns      | 0.16ns     | 0.55ns      | 0.43ns     | 0.39ns     |
|      |       |       |       |       |       |       |
|------|-------|-------|-------|-------|-------|-------|
| 3    | 0.74ns| 1.49ns| 0.56ns| 0.32ns| 1.55ns| 0.47ns|
| 4    | 0.19ns| 0.78ns| -0.70ns| 0.19ns| 0.12ns| 0.17ns|
| White Emergo x Dwarf 2 |       |       |       |       |       |       |
| 1    | 3.14ns| 0.77ns| 0.51ns| -1.36ns| 0.21ns| 0.36ns|
| 2    | 0.29ns| 0.50ns| -0.16ns| 0.18ns| 0.23ns| 0.43ns|
| 3    | -0.29ns| 1.24ns| -0.42ns| 1.21ns| 0.15ns| 0.25ns|
| 4    | 0.53ns| -0.66ns| -2.26ns| -0.03ns| 0.49ns| 0.08ns|
| White Emergo x Dwarf 3 |       |       |       |       |       |       |
| 1    | 0.55ns| 0.24ns| 0.98ns| 0.49ns| 0.21ns| 0.34ns|
| 2    | 0.39ns| 0.24ns| 0.27ns| 0.1ns| 0.18ns| 0.39ns|
| 3    | 0.25ns| 0.46ns| 0.91ns| 1.13ns| 0.49ns| 0.68ns|
| 4    | -0.55ns| 0.15ns| -0.78ns| 0.09ns| 0.16ns| 0.68ns|
Supplementary Table 2. Estimates of gene effects based on 3(m+a+d) and 6 (m+a+d+aa+ad+dd) parameter models for four traits in seven crosses of runner bean evaluated at two locations.

**Number of racemes plant⁻¹ at first flowering**

| 3-model     | W x Kin 1 | W X Kin 2 | W x Kin 3 | W x Nyeri | W x Dwarf 1 | W x Dwarf 2 | W x Dwarf 3 |
|--------------|-----------|-----------|-----------|-----------|-------------|-------------|-------------|
| KAB          | OJ        | KAB       | OJ        | KAB       | OJ          | KAB         | OJ          |
| m 8.4*       | 7.0*      | 5.5*      | 7.0*      | NS        | 4.4         | 8.2*        | 7.3*        |
| a -5.2 ± 0.6*| -1.9 ± 1.7| -4.3 ± 0.3| -3.5 ± 0.6| NS        | -10.3 ± 1.2 | -6.3 ± 2.8  | -4.2 ± 3.2  |
| d -0.9 ± 1.2 | 2.6 ± 3.1 | 3.2 ± 1.6 | 1.3 ± 1.2 | NS        | 21.0 ±      | 17.2 ±      | 14.3 ±      |
| R² 0.86      | 0.66      | 0.89      | 0.87      | NS        | 0.83        | 0.89        | 0.87        |

| 6-model      | W x Kin 1 | W X Kin 2 | W x Kin 3 | W x Nyeri | W x Dwarf 1 | W x Dwarf 2 | W x Dwarf 3 |
|--------------|-----------|-----------|-----------|-----------|-------------|-------------|-------------|
| KAB          | OJ        | KAB       | OJ        | KAB       | OJ          | KAB         | OJ          |
| M 17.2 ± 4.8*| 11.3 ± 7.5| 14.3 ± 6.4| 10.6 ± 4.4| NS        | 6.2 ± 5.9   | 6.5 ± 3.9   | 12.1 ± 7.2  |
| A 5.2 ± 0.7* | 3.4 ± 1.2 | 0.9 ± 4.3 | 3.6 ± 0.6*| NS        | 7.7 ± 0.8*  | 6.6 ± 0.6*  | 2.7 ± 1.0*  |
| D 11.6       | 6.1 ± 18.1| 5.4       | 3.0 ± 10.6| NS        | 8.8 ± 14.3  | 0.7 ± 9.5   | 8.6 ± 17.4  |
| Aa 8.8 ± 4.8 | 6.1 ± 7.5 | 8.2 ± 6.3 | 4.1 ± 4.4 | NS        | 4.1 ± 5.9   | 1.1 ± 3.9   | 5.3 ± 7.2   |
| Ad 0.3 ± 3.1 | 1.4 ± 4.8 | 0.6 ± 4.1 | 1.2 ± 2.8 | NS        | 6.5 ± 3.8   | 10.7 ± 2.5  | 0.9 ± 4.6   |
| Dd 11.1 ± 7.2| 4.3 ± 11.2| 9.5       | 0.3 ± 6.5 | NS        | 2.4 ± 8.8   | 0.7 ± 5.9   | 2.3 ± 10.8  |
| R² 0.47      | 0.58      | 0.66      | 0.68      | NS        | 0.83        | 0.7         | 0.511       |

**Number of racemes plant⁻¹ at second flowering**

| 3-model     | W x Kin 1 | W X Kin 2 | W x Kin 3 | W x Nyeri | W x Dwarf 1 | W x Dwarf 2 | W x Dwarf 3 |
|--------------|-----------|-----------|-----------|-----------|-------------|-------------|-------------|
| KAB          | OJ        | KAB       | OJ        | KAB       | OJ          | KAB         | OJ          |
| M 8.3*       | 7.3*      | 7.8*      | 8.3*      | 10.7*     | 9.9*        | 9.9*        | 4.9*        |
| A -4.7 ± 6.6*| -3.9 ± 9.0| 4.5 ± 0.7*| 4.9 ± 1.2*| -4.5 ± 0.7*| -5.6 ± 1.4*| -7.5 ± 0.6*| -5.6 ± 0.9*|
| D 3.8 ± 3.0 | 1.3 ± 1.8 | 1.7 ± 1.2 | 0.9 ± 2.3 | -1.1 ± 1.4| -0.5 ± 2.3  | 0.9 ± 1.1   | 1.4 ± 1.7   |
| R² 0.88      | 0.68      | 0.81      | 0.57      | 0.77      | 0.58        | 0.63        | 0.46        |

| 6-model      | W x Kin 1 | W X Kin 2 | W x Kin 3 | W x Nyeri | W x Dwarf 1 | W x Dwarf 2 | W x Dwarf 3 |
|--------------|-----------|-----------|-----------|-----------|-------------|-------------|-------------|
| KAB          | OJ        | KAB       | OJ        | KAB       | OJ          | KAB         | OJ          |
| M 36.0 ± 10.1| 13.6 ± 4.7| 1.2 ± 8.3 | 16.2 ± 5.2| 27.1 ± 9.7| 3.3*        | 5.6 ± 6.4   | 6.8*        |
| A 4.6 ± 15.5 | 3.7 ± 13.0| 0.7 ± 4.4 | 4.8 ± 0.7*| 6.4 ± 1.4*| 7.4 ± 0.5*  | 5.5 ± 0.9*  | 0.7 ± 0.9   |
| D 24.4*      | 6.6 ± 21.8| 11.2      | 25.9 ± 20.0| 18.4 ± 12.5| 38.7 ± 23.2 | 4.8 ± 7.8   | 15.4        |

| 3-model     | W x Kin 1 | W X Kin 2 | W x Kin 3 | W x Nyeri | W x Dwarf 1 | W x Dwarf 2 | W x Dwarf 3 |
|--------------|-----------|-----------|-----------|-----------|-------------|-------------|-------------|
| KAB          | OJ        | KAB       | OJ        | KAB       | OJ          | KAB         | OJ          |
| M 10.2 ±     | 3.3*      | 5.6 ± 6.4 | 6.8*      | 8.9 ± 6.9 | 14.6 ± 6.9  | 5.9 ± 4.7   | 6.3 ± 7.3   |
| A 4.9 ± 10.1 | 4.7 ± 4.9 | 16.5 ± 39.1| 0.5 ± 0.5 | 15.9 ± 11.3| 11.3 ± 11.7 | 17.6 ± 17.6 | 17.6 ± 17.6 |
| D 14.1 ± 1.1 | 1.4 ± 11.1| 1.1 ± 0.9 | 2.0 ± 0.7 | 2.6 ± 2.2 | 1.7 ± 1.9   | 0.9 ± 0.9   | 1.1 ± 0.9   |

| 6-model      | W x Kin 1 | W X Kin 2 | W x Kin 3 | W x Nyeri | W x Dwarf 1 | W x Dwarf 2 | W x Dwarf 3 |
|--------------|-----------|-----------|-----------|-----------|-------------|-------------|-------------|
| KAB          | OJ        | KAB       | OJ        | KAB       | OJ          | KAB         | OJ          |
| M 28.6 ±     | 6.3 ±     | 7.5 ±     | 6.4 ±     | 6.3 ±     | 7.3 ±      | 7.5 ±      |
| A 0.89       | 0.89      | 0.89      | 0.86      | 0.89      | 0.89       | 0.89       |
| D 5.9*       | 5.9*      | 5.9*      | 5.9*      | 5.9*      | 5.9*       | 5.9*       |

[71x547]Supplementary Table 2. Estimates of gene effects based on 3(m+a+d) and 6 (m+a+d+aa+ad+dd) parameter models for four traits in seven crosses of runner bean evaluated at two locations.
|    | W x Kin 1 | W X Kin 2 | W x Kin 3 | W x Nyeri | W x Dwarf 1 | W x Dwarf 2 | W x Dwarf 3 |
|----|-----------|-----------|-----------|-----------|-------------|-------------|-------------|
| Aa | 27.5 ± 10.0* | 3.5 ± 8.9 | 6.1 ± 4.6 | 4.8 ± 5.1 | 17.5 ± 9.6  | 0.3 ± 3.2   | 2.7 ± 6.3   | 25.3 ± 6.7* |
| Ad | 1.3 ± 6.5  | 2.0 ± 5.8 | 3.7 ± 2.9 | 5.5 ± 5.3 | 2.4 ± 3.3   | 7.9 ± 6.2   | 0.5 ± 2.1   | 11.1 ± 4.4  |
| Dd | 15.1      | 4.4 ± 13.5| 3.9 ± 6.9 | 19.8 ± 12.3| 20.5 ± 14.3 | 6.8 ± 4.8   | 13.2 ± 9.5  | 10.0        |
| R² | 0.63       | 0.39      | 0.34      | 0.46      | 0.16        | 0.48        | 0.49        | 0.34        |

**Number of pods plant⁻¹**

|    | W x Kin 1 | W X Kin 2 | W x Kin 3 | W x Nyeri | W x Dwarf 1 | W x Dwarf 2 | W x Dwarf 3 |
|----|-----------|-----------|-----------|-----------|-------------|-------------|-------------|
| M  | 13.33*    | 17.99*    | 14.45*    | 17.72*    | 13.56*      | 21.19*      | 20.30*      | 18.42*      |
| A  | -9.2±2.4* | -9.1±1.6* | -11.6±3.3 | -14.6±3.2*| -15.3±2.1*  | -11±2.2*    | -6.8±1.2*   | -9.0±1.3*   |
| D  | 13.86±4.5*| 5.1±2.2*  | 12.5±9.2* | 12.9±6.1* | 3.9±3.9     | 10.9±2.2*   | 4.4±4.6     | 11.4±2.5*   |
| R² | 0.66      | 0.74      | 0.69      | 0.63      | 0.64        | 0.84        | 0.56        | 0.86        |

**3- model**

|    | W x Kin 1 | W X Kin 2 | W x Kin 3 | W x Nyeri | W x Dwarf 1 | W x Dwarf 2 | W x Dwarf 3 |
|----|-----------|-----------|-----------|-----------|-------------|-------------|-------------|
| M  | 13.33*    | 17.99*    | 14.45*    | 17.72*    | 13.56*      | 21.19*      | 20.30*      | 18.42*      |
| A  | -9.2±2.4* | -9.1±1.6* | -11.6±3.3 | -14.6±3.2*| -15.3±2.1*  | -11±2.2*    | -6.8±1.2*   | -9.0±1.3*   |
| D  | 13.86±4.5*| 5.1±2.2*  | 12.5±9.2* | 12.9±6.1* | 3.9±3.9     | 10.9±2.2*   | 4.4±4.6     | 11.4±2.5*   |
| R² | 0.66      | 0.74      | 0.69      | 0.63      | 0.64        | 0.84        | 0.56        | 0.86        |

**6- model**

|    | W x Kin 1 | W X Kin 2 | W x Kin 3 | W x Nyeri | W x Dwarf 1 | W x Dwarf 2 | W x Dwarf 3 |
|----|-----------|-----------|-----------|-----------|-------------|-------------|-------------|
| M  | 13.33*    | 17.99*    | 14.45*    | 17.72*    | 13.56*      | 21.19*      | 20.30*      | 18.42*      |
| A  | -9.2±2.4* | -9.1±1.6* | -11.6±3.3 | -14.6±3.2*| -15.3±2.1*  | -11±2.2*    | -6.8±1.2*   | -9.0±1.3*   |
| D  | 13.86±4.5*| 5.1±2.2*  | 12.5±9.2* | 12.9±6.1* | 3.9±3.9     | 10.9±2.2*   | 4.4±4.6     | 11.4±2.5*   |
| R² | 0.66      | 0.74      | 0.69      | 0.63      | 0.64        | 0.84        | 0.56        | 0.86        |

W=White Emergo, R²= coefficient of determination, KAB=Kabete, OJ=Ol Joro-orok, m = mean effect a = additive effect and d = dominance effect and NS = Means the populations did not show significant differences for this cross at (P≤ 0.05) hence excluded from this analysis.