# Competitive ability of a tetraploid selfing species (*Capsella bursa-pastoris*) across its expansion range and comparison with its sister species – Supplementary material

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**Table S1: List of accessions**

| Species | Country | Area for Cbp | Latitude | Longitude | Accession_number |
|---|---|---|---|---|---|
| Cr | Italy | | 39.36 | 16.23 | 75.13 |
| Cr | Italy | | 39.36 | 16.23 | 79.17 |
| Cr | Spain | | 43.09 | 6.25 | 82.16 |
| Cr | Italy | | 40.94 | 15.20 | 73.6 |
| Cr | Greece | | 38.09 | 22.40 | 74.9 |
| Cr | Greece | | 37.69 | 21.63 | 84.2 |
| Cr | Greece | | 37.73 | 21.69 | 80.15 |
| Cr | Greece | | 39.56 | 20.92 | 80.2 |
| Cr | Greece | | 39.56 | 20.92 | 80.13 |
| Cr | France | | 45.81 | 5.77 | 83.2 |
| Cr | Greece | | 39.56 | 20.92 | 82.17 |
| Cr | France | | 43.39 | 0.05 | VIC-FR7-2 |
| Cr | France | | 43.39 | 0.05 | VIC-FR7-3 |
| Cr | France | | 43.39 | 0.05 | VIC-FR7-4 |
| Cr | France | | 43.33 | 0.10 | TOS-FR8-3 |
| Cr | France | | 43.33 | 0.10 | TOS-FR8-4 |
| Cr | France | | 43.33 | 0.10 | TOS-FR8-6 |
| Cr | France | | 45.00 | 2.50 | VIB-FR10-1 |
| Cr | France | | 45.00 | 2.50 | VIB-FR10-2 |
| Cr | France | | 45.00 | 2.50 | VIB-FR10-3 |
| Cr | France | | 42.67 | 0.66 | AUZ-FR11-2 |
| Cr | France | | 42.67 | 0.66 | AUZ-FR11-5 |
| Cr | France | | 43.33 | 4.85 | MOS-FR12-3 |
| Cr | Greece | | 40.65 | 22.90 | THE-GR2-1 |
| Cr | Greece | | 40.65 | 22.90 | THE-GR2-4 |
| Cr | Greece | | 40.65 | 22.90 | THE-GR2-5 |
| Cr | Palestine | | 32.23 | 35.26 | NAB-PAL1-6 |
| Cr | Palestine | | 32.23 | 35.26 | NAB-PAL1-7 |
| Cr | Palestine | | 32.23 | 35.26 | NAB-PAL3-4 |
| Cr | Palestine | | 32.23 | 35.26 | NAB-PAL3-5 |
| Cr | Palestine | | 32.23 | 35.26 | NAB-PAL3-9 |
| Cg | Greece | | 39.80 | 21.27 | 28 |

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|---|---|---|---|---|---|
| Cg | Albania | | 39.92 | 20.21 | 1 |
| Cg | Albania | | 39.91 | 20.01 | 25 |
| Cg | Albania | | 40.49 | 19.83 | 28 |
| Cg | Greece | | 39.80 | 21.27 | 16 |
| Cg | Greece | | 39.80 | 21.27 | 86.1 |
| Cg | Greece | | 39.80 | 21.27 | 86.9 |
| Cg | Greece | | 39.80 | 21.27 | 87.26 |
| Cg | Greece | | 39.80 | 21.27 | 87.32 |
| Cg | Greece | | 39.80 | 21.27 | 88.5 |
| Cg | Greece | | 39.80 | 21.27 | 96.6 |
| Cg | Greece | | 39.80 | 21.27 | 96.7 |
| Cg | Greece | | 39.80 | 21.27 | 99.22 |
| Co | Russia | | 51.29 | 58.18 | 2 |
| Co | Russia | | 51.29 | 58.18 | 4 |
| Co | Russia | | 51.29 | 58.18 | 6 |
| Co | Russia | | 51.29 | 58.18 | 5 |
| Co | Russia | | 53.30 | 60.10 | 2 |
| Co | Russia | | 53.30 | 60.10 | 3 |
| Co | Russia | | 53.30 | 60.10 | 4 |
| Co | Russia | | 53.30 | 60.10 | 5 |
| Co | Russia | | 54.32 | 62.68 | 3 |
| Co | Russia | | 54.32 | 62.68 | 4 |
| Co | Russia | | 54.32 | 62.68 | 6 |
| Co | Russia | | 54.32 | 62.68 | 7 |
| Co | China | | 46.70 | 90.83 | 1 |
| Co | China | | 46.70 | 90.83 | 2 |
| Co | China | | 46.70 | 90.83 | 4 |
| Co | China | | 46.70 | 90.83 | 10 |
| Co | Russia | | 55.11 | 61.39 | 4 |
| Co | Russia | | 55.11 | 61.39 | 7 |
| Co | Russia | | 55.11 | 61.39 | 9 |
| Co | Russia | | 53.30 | 60.10 | par9 |
| Cbp | France | Europe | 48.08 | 7.37 | FR50 |
| Cbp | France | Europe | 44.51 | -1.21 | STJ2 |
| Cbp | Suède | Europe | 56.15 | 13.77 | SE33 |
| Cbp | UK | Europe | 56.20 | -2.47 | STA4 |
| Cbp | Suède | Europe | 62.64 | 17.94 | SE14 |
| Cbp | Suède | Europe | 59.87 | 17.63 | SE42 |
| Cbp | Italy | Europe | 41.17 | 13.57 | 22_17 |
| Cbp | Italy | Europe | 37.09 | 15.20 | 39_12 |
| Cbp | Espagne | Europe | 42.24 | 1.50 | 53_7 |
| Cbp | France | Europe | 44.33 | -0.21 | 6_19 |

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|---|---|---|---|---|---|
| Cbp | Czech Republic | Europe | 49.20 | 16.63 | CZ96 |
| Cbp | Greece | Europe | 36.17 | 28.00 | GR90 |
| Cbp | Bosnia_Hercegovina | Europe | 43.51 | 18.25 | TON_4 |
| Cbp | Russia | Europe | 50.55 | 128.28 | BEL_6 |
| Cbp | Russia | Europe | 51.23 | 109.51 | BAD_1 |
| Cbp | Russia | Europe | 52.16 | 104.18 | IRRU3 |
| Cbp | Russia | Europe | 48.28 | 135.05 | KAB_5 |
| Cbp | Russia | Europe | 53.44 | 119.45 | MOG_1 |
| Cbp | Russia | Europe | 43.13 | 131.40 | VLA_3 |
| Cbp | Russia | Europe | 51.39 | 39.11 | VORU1 |
| Cbp | Russia | Europe | 49.00 | 131.03 | OBL_4 |
| Cbp | Turkey | Middle-East | 41.02 | 28.97 | TR73 |
| Cbp | Jordan | Middle-East | 31.97 | 35.98 | JO56 |
| Cbp | Algeria | Middle-East | 35.45 | 7.96 | AL87 |
| Cbp | Jordan | Middle-East | 31.97 | 35.98 | JO59 |
| Cbp | Israel | Middle-East | 32.60 | 35.13 | MAE_4 |
| Cbp | Algeria | Middle-East | 36.77 | 5.08 | AL88 |
| Cbp | Syria | Middle-East | 33.50 | 36.30 | SY64 |
| Cbp | Syria | Middle-East | 35.33 | 40.15 | SY67 |
| Cbp | Syria | Middle-East | 36.20 | 37.17 | SY68 |
| Cbp | China | Asia | 38.56 | 121.35 | DL_174 |
| Cbp | China | Asia | 30.20 | 112.06 | JZH152 |
| Cbp | China | Asia | 26.53 | 112.33 | HY85 |
| Cbp | China | Asia | 30.16 | 120.13 | HJC419 |
| Cbp | China | Asia | 32.03 | 118.46 | NJ219 |
| Cbp | China | Asia | 37.55 | 112.32 | TY118 |
| Cbp | China | Asia | 23.97 | 120.95 | PL |
| Cbp | China | Asia | 26.37 | 106.43 | GY_35 |
| Cbp | China | Asia | 30.31 | 117.05 | AQ_413 |
| Cbp | China | Asia | 39.55 | 116.22 | BJA162 |
| Cbp | China | Asia | 39.56 | 116.20 | BJB_240 |
| Cbp | China | Asia | 28.12 | 113.05 | CSH_8 |
| Cbp | China | Asia | 36.36 | 114.29 | HD_70 |
| Cbp | China | Asia | 31.51 | 117.17 | HF_254 |
| Cbp | China | Asia | 30.16 | 120.13 | HJC_418 |
| Cbp | China | Asia | 45.45 | 126.37 | HRB_137 |
| Cbp | China | Asia | 30.12 | 115.06 | HSH_298 |
| Cbp | China | Asia | 29.39 | 115.59 | JJ_392 |
| Cbp | China | Asia | 25.05 | 102.41 | KMA_373 |
| Cbp | China | Asia | 25.06 | 102.41 | KMB_215 |
| Cbp | China | Asia | 27.37 | 113.50 | PX_269 |
| Cbp | China | Asia | 35.36 | 116.58 | QF_341 |

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|---|---|---|---|---|---|
| Cbp | China | Asia | 33.57 | 107.45 | TSB |
| Cbp | China | Asia | 39.38 | 118.11 | TSH_191 |
| Cbp | China | Asia | 30.37 | 114.16 | WH_46 |
| Cbp | China | Asia | 34.16 | 108.52 | XA_110 |
| Cbp | China | Asia | 36.37 | 101.46 | XN_442 |
| Cbp | China | Asia | 32.09 | 114.04 | XY_18 |
| Cbp | China | Asia | 27.47 | 114.23 | YC_312 |
| Cbp | China | Asia | 28.36 | 112.18 | YY_381 |
| Cbp | China | Asia | 34.45 | 113.40 | ZZH_279 |
| Cbp | Russia | Central_asia | 51.53 | 58.85 | DUB-RUS9 |
| Cbp | Kazakhstan | Central_asia | 47.00 | 83.01 | TACH-CHIN14 |
| Cbp | Kirghizistan | Central_asia | 40.00 | 72.00 | KIRG-3-14 |
| Cbp | Kirghizistan | Central_asia | 40.00 | 73.00 | KIRG-7 |

**Table S2: Genetic diversity of the 62 *Capsella bursa-pastoris* sampling sites analysed in (Cornille et al. 2016).**

n: number of individuals, S: number of usable nucleotides, missing data: percentage of missing SNPs per individual, π: mean standardize pairwise difference

| Country | Site | n | Latitude | Longitude | S | Missing data (%) | π |
|---|---|---|---|---|---|---|---|
| Italy | IT22 | 2 | 41.17 | 13.57 | 3736 | 31.8 | 0.0020 |
| Italy | IT39 | 6 | 37.09 | 15.2 | 3796 | 33.7 | 0.0016 |
| Spain | SP53 | 6 | 42.24 | 1.5 | 3790 | 20.5 | 0.0018 |
| France | FR6 | 8 | 44.33 | -0.21 | 3774 | 14.8 | 0.0016 |
| Algeria | AL87 | 1 | 35.45 | 7.96 | 3923 | 13.2 | 0.0018 |
| Algeria | AL88 | 1 | 36.77 | 5.08 | 3896 | 27.2 | 0.0023 |
| Russia | BAD | 5 | 51.23 | 109.51 | 3833 | 12.9 | 0.0012 |
| Russia | BEL | 5 | 50.55 | 128.28 | 3813 | 37.4 | 0.0014 |
| Czech Republic | CZ96 | 1 | 49.2 | 16.63 | 3860 | 17.5 | 0.0017 |
| France | FR50 | 1 | 48.08 | 7.37 | 3892 | 31.9 | 0.0015 |
| Greece | GR90 | 1 | 36.17 | 28 | 3655 | 22.8 | 0.0007 |
| Russian | IRRU | 2 | 52.16 | 104.18 | 3874 | 16.9 | 0.0016 |
| Jordan | JO | 2 | 31.97 | 35.98 | 3842 | 20.8 | 0.0018 |
| Russia | KAB | 6 | 48.28 | 135.05 | 3758 | 17.7 | 0.0014 |
| Italy | MAE | 6 | 32.6 | 35.13 | 3726 | 23.2 | 0.0023 |
| Russia | MOG | 6 | 53.44 | 119.45 | 3720 | 17.9 | 0.0023 |
| Russia | OBL-RU5 | 6 | 49 | 131.03 | 3667 | 35.0 | 0.0027 |
| Bosnia Herzegovina | SABO | 6 | 43.51 | 18.25 | 3594 | 12.8 | 0.0034 |
| Sweden | SE14 | 1 | 62.64 | 17.94 | 3884 | 26.5 | 0.0023 |
| Sweden | SE33 | 1 | 56.15 | 13.77 | 3902 | 26.0 | 0.0021 |
| Sweden | SE4x | 2 | 59.87 | 17.63 | 3784 | 24.4 | 0.0031 |
| United Kingdom | STA | 3 | 56.2 | -2.47 | 3763 | 16.9 | 0.0027 |
| France | STJ | 2 | 44.51 | -1.21 | 3843 | 20.6 | 0.0021 |
| Syria | SY6x | 2 | 33.5 | 36.3 | 3760 | 20.5 | 0.0027 |
| Syria | SY67 | 1 | 35.33 | 40.15 | 3813 | 36.8 | 0.0031 |
| Syria | SY7x | 3 | 36.2 | 37.17 | 3859 | 23.0 | 0.0027 |
| United Kingdom | TON | 3 | 58.28 | -4.25 | 3823 | 26.2 | 0.0030 |
| Turkey | TR | 5 | 41.02 | 28.97 | 3760 | 16.3 | 0.0019 |
| United States | US721 | 1 | 35.42 | -119.05 | 3768 | 27.6 | 0.0019 |
| United States | US740 | 1 | 39.5 | -119.78 | 3795 | 14.0 | 0.0016 |
| Russia | VLA | 6 | 43.13 | 131.4 | 3851 | 9.6 | 0.0011 |
| Russia | VORU | 4 | 51.39 | 39.11 | 3922 | 27.2 | 0.0018 |
| United States | WAC | 6 | 31.29 | -97.17 | 3875 | 17.5 | 0.0013 |
| China | AQ | 6 | 30.31 | 117.05 | 3856 | 16.8 | 0.0010 |

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|---|---|---|---|---|---|---|---|
| China | BJA | 1 | 39.55 | 116.22 | 3882 | 8.7 | 0.0010 |
| China | BJB | 5 | 39.56 | 116.2 | 3835 | 13.9 | 0.0013 |
| China | CSH | 6 | 28.12 | 113.05 | 3788 | 39.3 | 0.0011 |
| China | DL | 5 | 38.56 | 121.35 | 3892 | 46.1 | 0.0011 |
| China | GY | 5 | 26.37 | 106.43 | 3887 | 17.9 | 0.0016 |
| China | HD | 7 | 36.36 | 114.29 | 3858 | 28.1 | 0.0016 |
| China | HF | 5 | 31.51 | 117.17 | 3823 | 18.7 | 0.0015 |
| China | HJC | 4 | 30.16 | 120.13 | 3753 | 16.0 | 0.0027 |
| China | HRB | 3 | 45.45 | 126.37 | 3745 | 19.9 | 0.0022 |
| China | HSH | 5 | 30.12 | 115.06 | 3796 | 36.2 | 0.0016 |
| China | HY | 4 | 26.53 | 112.33 | 3814 | 19.8 | 0.0020 |
| China | JJ | 6 | 29.39 | 115.59 | 3848 | 12.5 | 0.0017 |
| China | JZH | 6 | 30.2 | 112.06 | 3746 | 23.9 | 0.0020 |
| China | KMA | 3 | 25.05 | 102.41 | 3772 | 21.0 | 0.0019 |
| China | KMB | 5 | 25.06 | 102.41 | 3888 | 38.6 | 0.0024 |
| China | NCH | 7 | 28.45 | 115.51 | 3748 | 19.4 | 0.0021 |
| China | NJ | 7 | 32.03 | 118.46 | 3843 | 24.8 | 0.0014 |
| Taiwan | PL | 1 | 23.97 | 120.95 | 3832 | 20.1 | 0.0018 |
| China | PX | 6 | 27.37 | 113.5 | 3901 | 20.1 | 0.0022 |
| China | QD | 4 | 36.05 | 120.2 | 3796 | 30.6 | 0.0022 |
| China | QF | 4 | 35.36 | 116.58 | 3867 | 53.5 | 0.0012 |
| China | TBS | 1 | 33.57 | 107.45 | 3809 | 10.7 | 0.0017 |
| China | TSH | 3 | 39.38 | 118.11 | 3915 | 3.8 | 0.0022 |
| China | TY | 6 | 37.55 | 112.32 | 1573 | 21.5 | 0.0014 |
| China | WH | 5 | 30.37 | 114.16 | 3844 | 18.5 | 0.0013 |
| China | XA | 1 | 34.16 | 108.52 | 3852 | 36.5 | 0.0013 |
| China | XN | 7 | 36.37 | 101.46 | 3869 | 13.2 | 0.0011 |
| China | XY | 6 | 32.09 | 114.04 | 3849 | 10.5 | 0.0013 |
| China | YC | 4 | 27.47 | 114.23 | 3736 | 31.2 | 0.0020 |
| China | YY | 6 | 28.36 | 112.18 | 3796 | 20.1 | 0.0016 |
| China | ZZH | 5 | 34.45 | 113.4 | 3790 | 36.0 | 0.0018 |

## Table S3: Comparison of the effect of competition among species: contrasts on the "species x treatment" term for flower numbers

The retained model was:
block + rosette + species + treatment + block x species + rosette x treatment + species x treatment
p-values ≤ 0.05 are in bold

| Contrast | LR | p-value |
|---|---|---|
| *C. grandiflora* vs *C. bursa-pastoris* | 7.57 | **0.007** |
| *C. grandiflora* vs *C. orientalis* | 44.27 | **8.59-11** |
| *C. grandiflora* vs *C. rubella* | 51.72 | **3.84e-12** |
| *C. bursa-pastoris* vs *C. orientalis* | 32.59 | **1.71-08** |
| *C. bursa-pastoris* vs *C. rubella* | 41.89 | **1.93-10** |
| *C. orientalis* vs *C. rubella* | 0.069 | 0.793 |

## Table S4: Comparison of the effect of competition among areas in *Capsella bursa-pastoris*: contrasts on the "species x treatment" term for rosette surface at time $t_2$

The retained model was:
block + area + treatment + area x treatment
p-values ≤ 0.05 are in bold

| Contrast | LR | p-value |
|---|---|---|
| Middle-East vs Europe | 11.93 | **0.002** |
| Middle-East vs Central Asia | 2.70 | 0.134 |
| Middle-East vs China | 22.88 | **1.04e-05** |
| Europe vs Central Asia | 0.52 | 0.471 |
| Europe vs China | 2.52 | 0.135 |
| Central Asia vs China | 2.84 | 0.135 |

## Table S5: Comparison of the effect of competition among areas in *Capsella bursa-pastoris*: contrasts on the "species x treatment" term for flowers number

The retained model was:
block + area + treatment + area x treatment
p-values ≤ 0.05 are in bold

| Contrast | LR | p-value |
|---|---|---|
| Middle-East vs Europe | 6.90 | **0.013** |
| Middle-East vs Central Asia | 2.13 | 0.173 |
| Middle-East vs China | 44.16 | **1.82e-10** |
| Europe vs Central Asia | 0.09 | 0.758 |
| Europe vs China | 24.28 | **2.50e-6** |
| Central Asia vs China | 10.67 | **0.002** |

**Table S6: Analyses of covariance to test for the effect of genetic diversity in *C. bursa-pastoris* on (A) rosette surface at time $t_2$ and (B) flowers number**

A)

| | DoF | SS | F | p-value |
|---|---|---|---|---|
| block | 3 | 85.55 | 23.40 | **1.50e-13** |
| treatment | 1 | 32.70 | 26.83 | **4.25e-07** |
| Pi | 1 | 5.24 | 4.30 | **0.044** |
| block x treatment | 3 | 2.72 | 0.75 | 0.523 |
| block x Pi | 3 | 0.72 | 0.20 | 0.896 |
| treatment x Pi | 1 | 5.24 | 4.35 | **0.038** |

B)

| | DoF | LR | p-value |
|---|---|---|---|
| block | 3 | 9.46 | **0.024** |
| treatment | 1 | 135.6 | **< 2e-16** |
| Pi | 1 | 3.27 | *0.070* |
| block x treatment | 3 | 1.53 | 0.675 |
| block x Pi | 3 | 1.27 | 0.737 |
| treatment x Pi | 1 | 2.39 | 0.122 |

**Figure S1: (A) rosette surface at time $t_2$ and (B) flowers number as a function of genetic diversity with (grey dots) and without (black dots) competitors**