## Table S1. Sample information of *Asteropyrum*

| Region | Location | Population Code | Latitude (°N) | Longitude (°E) | Elevation (m) | N | Hap. |
|---|---|---|---|---|---|---|---|
| Burma | Grape | PT | 27.6635 | 97.4266 | 2600 | 1 | H4(1) |
| Tibet | Mêdog | MT | 29.7135 | 95.5821 | 2820 | 24 | H7(24) |
| Yunnan | Fugong | FG | 27.1030 | 98.8190 | 2106 | 11 | H4(11) |
| | Gongshan | GS | 28.0500 | 98.5667 | 2700 | 9 | H4(9) |
| | Suijiang | SJ | 28.3928 | 104.0658 | 1217 | 9 | H6(9) |
| | Jingdong | WLS | 24.4156 | 100.7325 | 2200 | 8 | H8(7) |
| | Wenshan | WS | 23.3412 | 103.8684 | 2200 | 11 | H5(11) |
| | Yiliang | YL | 27.8078 | 104.3072 | 1800 | 21 | H9(21) |
| | Zhenxiong | ZX | 27.3756 | 104.6689 | 2004 | 12 | H10(10) |
| Sichuan | Dujiangyan | DJY | 30.9900 | 103.64 | 2500 | 12 | H1(8) |
| | Tianquan | ELS | 30.0253 | 102.8603 | 2079 | 12 | H2(12) |
| | Emei Shan | EMS | 29.5517 | 103.3623 | 2296 | 12 | H3(9) |
| | Ebian | HZG | 29.0106 | 103.0561 | 1535 | 13 | H3(13) |
| | Leibo | LB | 28.3567 | 103.4825 | 1659 | 12 | H6(12) |
| | Rongjing | LCG | 29.6356 | 102.8847 | 1346 | 7 | H2(7) |
| | Mabian | MB | 29.0278 | 103.4789 | 1150 | 12 | H6(12) |
| Guizhou | Majiang | MJ | 26.4183 | 107.335 | 1611 | 13 | H6(13) |
| Shanxi | Pingli | PL | 32.0027 | 109.2798 | 1617 | 12 | H1(12) |
| Chongqing | Youyang | YY | 29.2533 | 108.9869 | 1290 | 8 | H5(8) |
| | Wulong | WL | 29.1958 | 107.3936 | 1577 | 12 | H5(12) |
| Hubei | Shennongjia | SNJ | 31.4434 | 110.3045 | 3057 | 10 | H1(10) |
| | Xuanen | XE | 30.0361 | 109.7316 | 1374 | 12 | H1(12) |
| Hunan | Longshan | LS | 29.5814 | 109.7069 | 918 | 12 | H5(12) |
| | Sangzhi | SZ | 29.7674 | 110.0621 | 1310 | 12 | H1(12) |
| | Xinning | XN | 26.4064 | 110.9921 | 946 | 10 | H5(10) |
| | Yongshun | YS | 28.9936 | 109.8606 | 1310 | 12 | H5(12) |
| Guangxi | Longsheng | HP | 24.62 | 109.9205 | 846 | 12 | H5(9) |
| | Ziyuan | ZY | 25.9117 | 110.414 | 1190 | 12 | H5(10) |
| Total | | 28 | | | | 323 | |

Emei Shan indicates Emei Mountains. N, sample size; Hap., haplotypes of chloroplast *psb*A-*trn*H region.

**Table S2.** Description of the prior distribution of parameters from five scenarios in Figure 2 used in Approximate Bayesian Computation.

| Parameter | Distribution | Minimum | Maximum |
|---|---|---|---|
| Effective population size | | | |
| $N_1$ | Uniform | 10 | 3000000 |
| $N_2$ | Uniform | 10 | 3000000 |
| $N_3$ | Uniform | 10 | 3000000 |
| $N_a$ | Uniform | 10 | 3000000 |
| Time of events (in generations backward in time) | | | |
| $T_1$ | Uniform | 10 | 2000000 |
| $T_2$ | Uniform | 10 | 2000000 |
| Admixture rate | | | |
| $r_a$ | Uniform | 0.001 | 0.999 |
| Mean mutation rate | | | |
| $\mu$ | Uniform | $1 \times 10^{-10}$ | $1 \times 10^{-7}$ |

$N_1$, $N_2$, and $N_3$, current population sizes; $N_a$, ancestral population size;. $T_1$ and $T_2$, divergence time or admixture time of different clusters, and $T_2 > T_1$.

**Table S3. Variable sites of the *psbA-trnH* sequences for each of the haplotypes identified in *Asteropyrum***

| Haplotype | 9 | 15 | 28 | 40 | 57 | 66 | 75 | 127 | 132 | 135 | 198 | 205 | 215 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| H1 | C | C | G | C | T | A | G | A | T | T | T | T | G |
| H2 | T | T | G | C | T | A | G | A | A | T | T | C | G |
| H3 | C | C | G | C | T | A | G | C | A | T | G | T | G |
| H4 | C | C | C | C | T | A | G | A | A | G | T | T | G |
| H5 | C | C | G | C | T | A | G | A | A | T | T | T | T |
| H6 | C | C | G | C | T | A | G | C | A | T | T | T | T |
| H7 | C | C | C | T | T | A | G | A | A | G | T | T | G |
| H8 | C | C | G | C | T | A | G | C | A | G | T | T | G |
| H9 | C | C | G | C | T | A | G | A | A | T | T | T | G |
| H10 | C | C | G | C | C | G | A | A | A | T | T | T | G |

**Table S4. Results of *t*-tests on elevation and 19 bioclimatic variables between the two groups of *Asteropyrum***

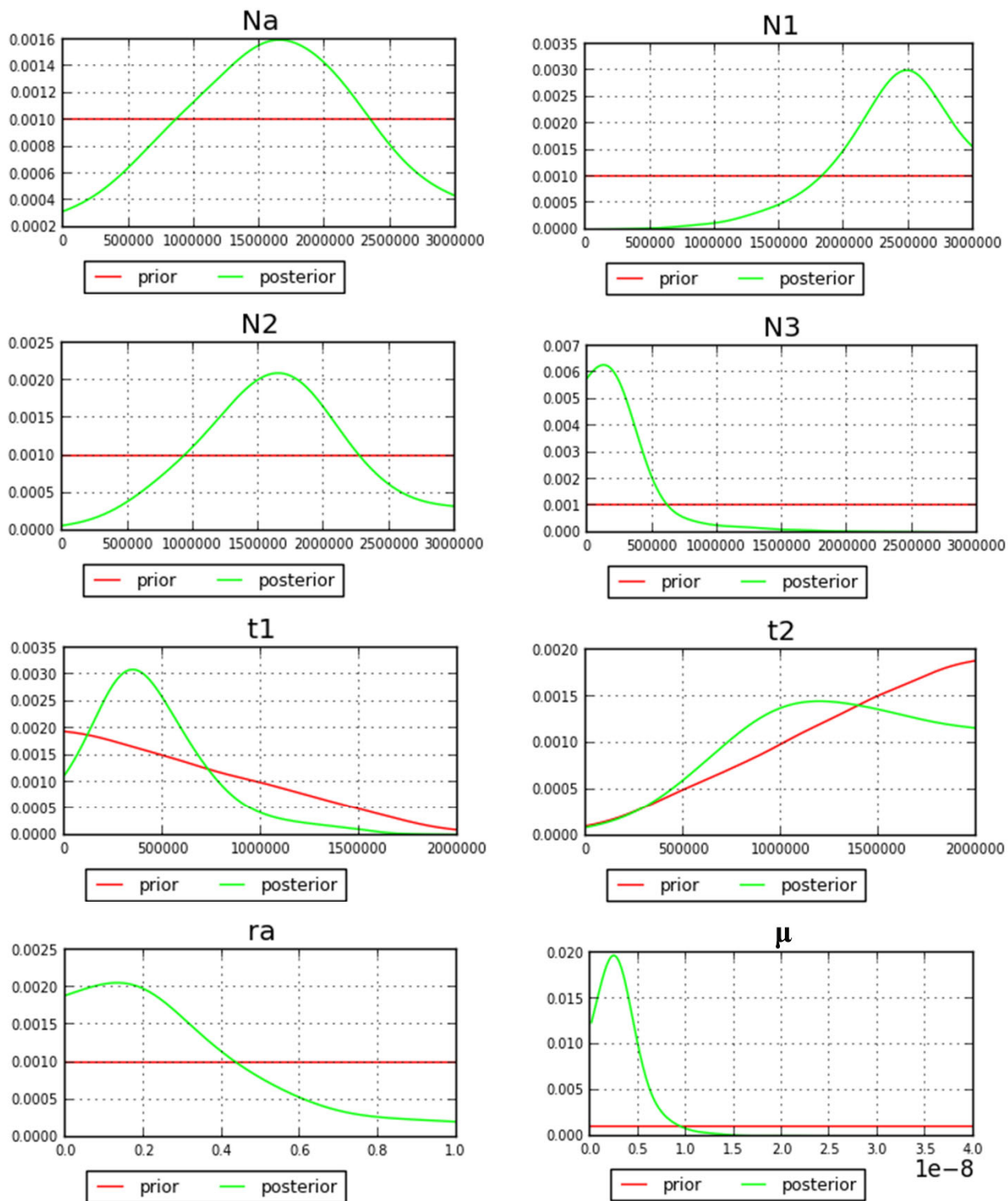| Group | | Elevation (m) | Bio1 (°C) | Bio2 (°C) | Bio3 (°C) | Bio4 (SD*100) | Bio5 (°C) | Bio6 (°C) | Bio7 (°C) | Bio8 (°C) | Bio9 (°C) | Bio10 (°C) | Bio11 (°C) | Bio12 (mm) | Bio13 (mm) | Bio14 (mm) | Bio15 (CV) | Bio16 (mm) | Bio17 (mm) | Bio18 (mm) | Bio19 (mm) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Mean | 2190.00 | 12.15 | 8.99 | 35.39 | 609.62 | 24.04 | -1.64 | 25.68 | 18.96 | 4.51 | 19.25 | 4.21 | 1275.14 | 269.64 | 11.86 | 88.05 | 718.50 | 43.57 | 693.00 | 46.50 |
| | SE | 135.87 | 1.04 | 0.47 | 2.21 | 28.12 | 0.94 | 1.15 | 0.52 | 0.93 | 1.22 | 0.95 | 1.18 | 139.51 | 33.89 | 1.36 | 3.10 | 92.32 | 4.60 | 81.10 | 5.25 |
| 2 | Mean | 1246.73 | 13.94 | 7.84 | 28.63 | 719.16 | 27.50 | 0.03 | 27.47 | 20.47 | 5.16 | 22.38 | 4.63 | 1361.18 | 234.73 | 29.36 | 66.99 | 634.91 | 99.55 | 580.82 | 104.73 |
| | SE | 84.75 | 0.67 | 0.22 | 0.98 | 18.94 | 0.74 | 0.62 | 0.40 | 0.88 | 0.78 | 0.72 | 0.67 | 77.83 | 12.94 | 4.44 | 3.91 | 26.70 | 15.79 | 16.29 | 17.94 |
| | P | 0.00 | 0.19 | 0.06 | 0.02 | 0.01 | 0.01 | 0.25 | 0.02 | 0.26 | 0.68 | 0.02 | 0.78 | 0.62 | 0.39 | 0.00 | 0.00 | 0.44 | 0.00 | 0.24 | 0.00 |

SE, standard errors.

**Figure S1**. Prior and posterior distributions of demographic parameters under scenario 5 in Figure 2 estimated by DIYABC