**Supporting information**

Behavioral adaptation of sympatric rodents to early germination of oak acorns: radicle pruning and embryo excision

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Table S1 Summary of statistical differences in seed fates (acorn consumption, scatter-hoarding, and radicle pruning) between different rodent species based on generalized linear mixed models in the emmeans package in R software. Fixed factors in bold had significant effects (*P* < 0.05). A.pe – *Apodemus peninsulae*, C.ca – *Cansumys canus*, N.co – *Nivirenter confucianus*, S.da – *Sciurotamias davidianus*, T.si – *Tamias sibiricus*.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Seed fates | Contrast | Estimate | SD | z | *P* |
| Probability of removal | A.pe - C.ca | 0.171  | 0.242  | 0.706  | 0.955  |
| **A.pe - N.co** | **0.929**  | **0.196**  | **4.733**  | **<0.001** |
| A.pe - S.da | 0.022  | 0.209  | 0.108  | 1.000  |
| **A.pe - T.si** | **1.057**  | **0.232**  | **4.560**  | **<0.001** |
| **C.ca - N.co** | **0.758**  | **0.233**  | **3.251**  | **0.010**  |
| C.ca - S.da | -0.149  | 0.221  | -0.672  | 0.963  |
| **C.ca - T.si** | **0.885**  | **0.243**  | **3.645**  | **0.002**  |
| **N.co - S.da** | **-0.907**  | **0.199**  | **-4.566**  | **<0.001** |
| N.co - T.si | 0.127  | 0.222  | 0.574  | 0.979  |
| **S.da - T.si** | **1.034**  | **0.210**  | **4.927**  | **<0.001** |
| Probability of consumption | A.pe - C.ca | -1.534  | 0.581  | -2.638  | 0.064  |
| A.pe - N.co | -0.861  | 0.579  | -1.487  | 0.571  |
| **A.pe - S.da** | **-3.173**  | **0.487**  | **-6.512**  | **<0.001** |
| **A.pe - T.si** | **-4.110**  | **0.497**  | **-8.277**  | **<0.001** |
| C.ca - N.co | 0.672  | 0.509  | 1.321  | 0.678  |
| **C.ca - S.da** | **-1.639**  | **0.372**  | **-4.407**  | **<0.001** |
| **C.ca - T.si** | **-2.576**  | **0.385**  | **-6.688**  | **<0.001** |
| **N.co - S.da** | **-2.311**  | **0.399**  | **-5.792**  | **<0.001** |
| **N.co - T.si** | **-3.249**  | **0.411**  | **-7.903**  | **<0.001** |
| **S.da - T.si** | **-0.937**  | **0.216**  | **-4.340**  | **<0.001** |
| Probability of scatter-hoarding | **A.pe - N.co** | **1.637**  | **0.196**  | **8.349**  | **<0.001** |
| A.pe - S.da | 0.134  | 0.182  | 0.732  | 0.884  |
| **A.pe - T.si** | **1.761**  | **0.240**  | **7.340**  | **<0.001** |
| **N.co - S.da** | **-1.504**  | **0.194**  | **-7.759**  | **<0.001** |
| N.co - T.si | 0.123  | 0.247  | 0.501  | 0.959  |
| **S.da - T.si** | **1.627**  | **0.223**  | **7.291**  | **<0.001** |
| Probability of radicle pruning | A.pe - C.ca | 0.473  | 0.261  | 1.813  | 0.366  |
| **A.pe - N.co** | **2.256**  | **0.362**  | **6.236**  | **<0.001** |
| A.pe - S.da | 0.009  | 0.199  | 0.045  | 1.000  |
| A.pe - T.si | 0.339  | 0.254  | 1.337  | 0.668  |
| **C.ca - N.co** | **1.783**  | **0.408**  | **4.365**  | **<0.001** |
| C.ca - S.da | -0.464  | 0.253  | -1.835  | 0.353  |
| C.ca - T.si | -0.134  | 0.298  | -0.449  | 0.992  |
| **N.co - S.da** | **-2.247**  | **0.372**  | **-6.044**  | **<0.001** |
| **N.co - T.si** | **-1.917**  | **0.404**  | **-4.747**  | **<0.001** |
| S.da - T.si | 0.330  | 0.246  | 1.346  | 0.663  |

Table S2 Summary of statistical differences in seed fates (acorn removal, consumption, and scatter-hoarding) between germinating and non-germinating *Quercus variabilis* acorns by different rodent species based on generalized linear mixed models in the lme4 package of R software. Fixed factors in bold had significant effects (*P* < 0.05).

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Seed fates | Rodent species | Estimate | Std. Error | *z* | *P* |
| Probability of removal | *A. peninsulae* | (Intercept) | 3.465  | 0.663  | 5.229  | <0.001  |
| **Non-germinating** | **-1.464**  | **0.330**  | **-4.432**  | **<0.001**  |
| *C. canus* | (Intercept) | 2.962  | 1.722  | 1.720  | 0.085  |
| Non-germinating | 0.218  | 0.571  | 0.381  | 0.703  |
| *N. confucianus* | (Intercept) | 0.935  | 0.634  | 1.476  | 0.140  |
| Non-germinating | -0.273  | 0.321  | -0.848  | 0.396  |
| *S. davidianus* | (Intercept) | 1.496  | 0.551  | 2.716  | 0.007  |
| Non-germinating | -0.326  | 0.302  | -1.080  | 0.280  |
| *T. sibiricus* | (Intercept) | 0.056  | 0.296  | 0.188  | 0.851  |
| Non-germinating | 0.053  | 0.326  | 0.163  | 0.870  |
| Probability of consumption | *A. peninsulae* | (Intercept) | -1.410  | 0.214  | -6.579  | <0.001  |
| Non-germinating | -0.259  | 0.253  | -1.021  | 0.307  |
| *C. canus* | (Intercept) | 9.406  | 3.591  | 2.619  | 0.009  |
| **Non-germinating** | **-1.464**  | **0.605**  | **-2.420**  | **0.016**  |
| *N. confucianus* | (Intercept) | -0.634  | 0.453  | -1.399  | 0.162  |
| Non-germinating | -0.211  | 0.287  | -0.736  | 0.462  |
| *S. davidianus* | (Intercept) | -0.861  | 0.430  | -2.001  | 0.045  |
| **Non-germinating** | **0.536**  | **0.260**  | **2.063**  | **0.039**  |
| *T. sibiricus* | (Intercept) | 0.161  | 0.292  | 0.550  | 0.582  |
| **Non-germinating** | **1.383**  | **0.376**  | **3.675**  | **<0.001**  |
| Probability of scatter-hoarding | *A. peninsulae* | (Intercept) | 0.964  | 0.306  | 3.149  | 0.002  |
| **Non-germinating** | **-0.578**  | **0.230**  | **-2.518**  | **0.012**  |
| *C. canus* | (Intercept) | - | - | - | - |
| Non-germinating | - | - | - | - |
| *N. confucianus* | (Intercept) | -1.359  | 0.003  | -423.497  | <0.001  |
| Non-germinating | -0.002  | 0.003  | -0.642  | 0.521  |
| *S. davidianus* | (Intercept) | 0.690  | 0.492  | 1.401  | 0.161  |
| **Non-germinating** | **-0.698**  | **0.260**  | **-2.679**  | **0.007**  |
| *T. sibiricus* | (Intercept) | -0.610  | 0.323  | -1.888  | 0.059  |
| **Non-germinating** | **-1.248**  | **0.404**  | **-3.086**  | **0.002**  |

Table S3 Summary of statistical differences in germination rate of embryo excision and radicle pruning *Quercus variabilis* acorns by *Apodemus peninsulae* based on the *Chisq.test* function in the stats package of R software. Fixed factors in bold had significant effects (*P* < 0.05).

|  |  |  |  |
| --- | --- | --- | --- |
| Contrast | χ2 | df | *P* |
| Embryo excision – Radicle pruning | 0.936 | 1 | 0.334 |
| **Embryo excision** – **Intact** | **51.532** | **1** | **< 0.001** |
| **Radicle pruning** – **Intact** | **32.204** | **1** | **< 0.001** |



Fig. S1 (a) Embryo excision of *Quercus variabilis* acorns by *Apodemus peninsulae* in enclosure experiment;(b) the acron status of *Q. variabilis*: non-germinating, germinating, radical pruning, embryo excision (from left to right).