Supplementary Materials for

**Naturalization of introduced plants driven by life-form-dependent cultivation biases**

**This WORD file includes:**

Tables S1 to S5

References

**TABLE 1** Results of univariate generalized linear models testing the effects of individual species characteristics on naturalization of cultivated alien species in China (excluding intraspecific taxa that had their binomial species name included in the checklist). Significant estimates (*p* < 0.05) are highlighted in bold. Nagelkerke R2 for each model is given.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Response variable | n | Estimate | Std. error | z-value | *p*-value | R2 |
| No. botanical gardensa | 13,103 | **0.704** | **0.030** | **23.800** | **<0.001** | 0.103 |
| No. provincesa | 13,103 | **0.730** | **0.031** | **23.942** | **<0.001** | 0.108 |
| Online-nursery availability | 13,103 | **1.719** | **0.082** | **20.878** | **<0.001** | 0.070 |
| Economic use | 13,103 | **2.163** | **0.11** | **19.583** | **<0.001** | 0.128 |
| Climatic suitabilityb | 5,987 | **0.708** | **0.036** | **19.654** | **<0.001** | 0.125 |
| Native range sizec | 12,257 | **1.347** | **0.043** | **31.44** | **<0.001** | 0.276 |
| Min. residence timec | 2,653 | **0.295** | **0.049** | **6.067** | **<0.001** | 0.023 |
| Life form\* | 10,619 |  |  |  |  | 0.067 |
| Short-lived herb |  | **1.981** | **0.106** | **18.679** | **<0.001** |  |
| Long-lived herb |  | **0.263** | **0.087** | **3.010** | **0.003** |  |
| Propagation mode† | 7,640 |  |  |  |  | 0.030 |
| Vegetative |  | **-1.094** | **0.156** | **-7.030** | **<0.001** |  |
| Both |  | **-0.876** | **0.097** | **-9.067** | **<0.001** |  |
| Maximum heightc | 7,560 | **0.318** | **0.043** | **7.447** | **<0.001** | 0.018 |

\*For life form, woody was the baseline.

†For propagation mode, seed was the baseline.

aThese variables were natural-log(x + 1) transformed.

bThis variables was natural-log(x + 0.001) transformed.

cThese variables were natural-log transformed.

**Table S2** Separate results of phylogenetic generalized linear models (PGLMs) testing the effects of each explanatory variable on naturalization of cultivated introduced plants in China (excluding intraspecific taxa that had their binomial species name included in the checklist). The phylogenetic correlation parameter (alpha) of each model is also given. Significant estimates (*p* < 0.05) are highlighted in bold.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Response variable | n | alpha | Estimate | Std. error | z-value | *p*-value |
| No. botanical gardensa | 13,103 | 0.039 | 0.950 | 0.060 | 15.833 | **<0.001** |
| No. provincesa | 13,103 | 0.040 | 0.891 | 0.055 | 16.072 | **<0.001** |
| Online-nursery availability | 13,103 | 0.035 | 3.131 | 0.249 | 12.552 | **<0.001** |
| Economic use | 13,103 | 0.054 | 1.839 | 0.133 | 13.815 | **<0.001** |
| Climatic suitabilityb | 5,987 | 0.066 | 0.702 | 0.046 | 15.407 | **<0.001** |
| Native range sizec | 12,257 | 0.074 | 1.313 | 0.060 | 21.933 | **<0.001** |
| Min. residence timec | 2,653 | 0.059 | 0.337 | 0.057 | 5.905 | **<0.001** |
| Life form\* | 10,619 | 0.067 |  |  |  |  |
| Short-lived herb |  |  | 1.896 | 0.15 | 12.665 | **<0.001** |
| Long-lived herb |  |  | -0.173 | 0.129 | -1.335 | 0.182 |
| Propagation mode† | 7,640 | 0.071 |  |  |  |  |
| Vegetative |  |  | -0.725 | 0.159 | -4.552 | **<0.001** |
| Both |  |  | -0.757 | 0.118 | -6.434 | **<0.001** |
| Maximum heightc | 7,560 | 0.065 | 0.326 | 0.055 | 5.944 | **<0.001** |

\*For life form, woody was the baseline.

†For propagation mode, seed was the baseline.

aThese variables were natural-log(x + 1) transformed.

bThis variables was natural-log(x + 0.001) transformed.

cThese variables were natural-log transformed.

The default logit link (“logistic\_MPLE”) was used in the analysis.

**Table S3** Results of generalized linear model testing the effects of maximum height, life form and their interaction on naturalization of cultivated introduced species in China (excluding intraspecific taxa that had their binomial species name included in the checklist). Significant estimates (*p* < 0.05) are highlighted in bold. The number of observation is 7,560.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Response variable | Estimate | Std. error | z-value | *p*-value |
| Maximum heighta | 0.034 | 0.071 | 0.476 | 0.634 |
| Life form\* |  |  |  |  |
| Short-lived herb | **1.937** | **0.123** | **15.736** | **<0.001** |
| Long-lived herb | **0.241** | **0.102** | **2.365** | **0.018** |
| Maximum height : Short-lived herb | **0.286** | **0.120** | **2.388** | **0.017** |
| Maximum height : Long-lived herb | **0.480** | **0.091** | **5.245** | **<0.001** |

\*For life form, woody was the baseline.

aThis variable was natural-log transformed.

**Table S4** Results of phylogenetic generalized linear models (PGLMs) testing the effects of maximum height, life form and their interaction on naturalization of cultivated introduced plants in China (excluding intraspecific taxa that had their binomial species name included in the checklist). The phylogenetic correlation parameter (alpha) of the model is 0.064. Significance (*p* < 0.05) are highlighted in bold. Number of observation is 7,560.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Response variable | Estimate | Std. error | z-value | *p*-value |
| Maximum heighta | -0.052 | 0.091 | -0.578 | 0.563 |
| Life form\* |  |  |  |  |
| Short-lived herb | 1.385 | 0.181 | 7.662 | **<0.001** |
| Long-lived herb | 0.393 | 0.128 | 3.076 | **0.002** |
| Maximum height : Short-lived herb | 0.369 | 0.165 | 2.241 | **0.025** |
| Maximum height : Long-lived herb | 0.446 | 0.105 | 4.230 | **<0.001** |

\*For life form, woody was the baseline.

aThis variable was natural-log transformed.

The default logit link (“logistic\_MPLE”) was used in the analysis.

**Table S5** Results of generalized linear mixed model (GLMM) testing the effects of climatic suitability, cultivation status, and their interaction on naturalization per province (*n* = 33) for the subset of cultivated introduced species that have become naturalized somewhere in China (excluding intraspecific taxa that had their binomial species name included in the checklist). In detail, for the species that have become naturalized in China, we assessed whether their provincial naturalization was associated with climatic suitability and cultivation status. Naturalization status in each province was obtained from Yan et al. (2019). For species that naturalized (n = 672 species with sufficient data), we fitted naturalization success in each of the 33 provinces using a binomial generalized linear mixed model (GLMM) with a cloglog link function as a function of climatic suitability, cultivation status and their interaction. To account for the non-independence of observations of the same species in different provinces, and of different species in the same province, species and province were treated as random factors. Significant estimates (*p* < 0.05) are highlighted in bold. The number of observation is 22,176.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Response variable | Estimate | Std. error | z-value | *p*-value |
| *Fixed effects* |  |  |  |  |
| Climatic suitabilitya | **1.041** | **0.032** | **32.78** | **<0.001** |
| Cultivation status | **1.082** | **0.047** | **22.928** | **<0.001** |
| Clim. suitability : Cult. status | **-0.321** | **0.040** | **-8.106** | **<0.001** |
| *Random effects* | Standard deviation | | | |
| Species | **1.285** |  |  |  |
| Province | **0.471** |  |  |  |

aThis variable was natural-log(x + 0.001) transformed.

**References**

Yan, X.-L., Wang, Z.-H., & Ma, J.-S. (2019). *The checklist of the naturalized plants in China*. Shanghai Scientific and Technical Publishers.