

Seed persistence and its role in species invasiveness. Insights from burial experiments.



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INTRODUCTION

Seed persistence in the seed bank is supposed to be one of the traits associated with successful plant invasion. The role of seed persistence in the process of naturalization and invasiveness of the alien plants was evaluated by compiling literature data from the Global seed persistence database (Gioria et al., 2021) and here we evaluate this role of seed persistence experimentally.

AIM

To assess the role of seed persistence in determining the invasiveness of alien species, we conducted a burial experiment to test the differences in seed persistence of 22 invasive and 37 non-invasive (naturalized) species in the Czech Republic.

METHOD

Seeds were collected in the field, samples were tested for viability (by germination experiment and tetrazolium test) and buried in nylon bags in the soil in a common garden at the Institute of Botany, Průhonice.

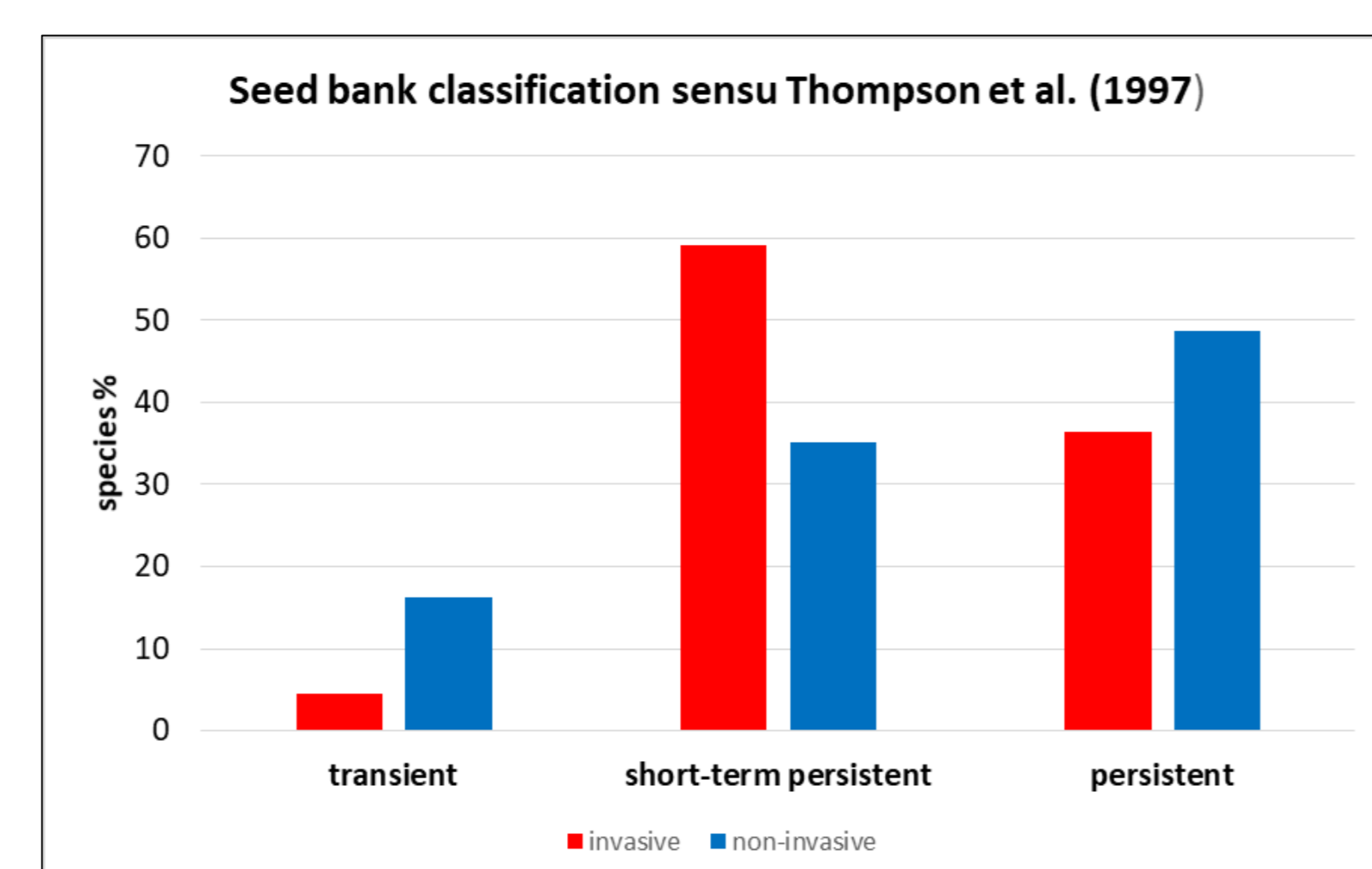
Seeds were exhumed once a year, each spring during the years 2014-2020 and tested for viability again.

The fraction of germinated or decayed seeds, and of non-germinated but living seeds, was determined in each sample.

This allowed us to ascertain seed persistence/viability after 1st, 2nd, 3rd, 4th, 5th, 6th and 7th year of burial in the soil.

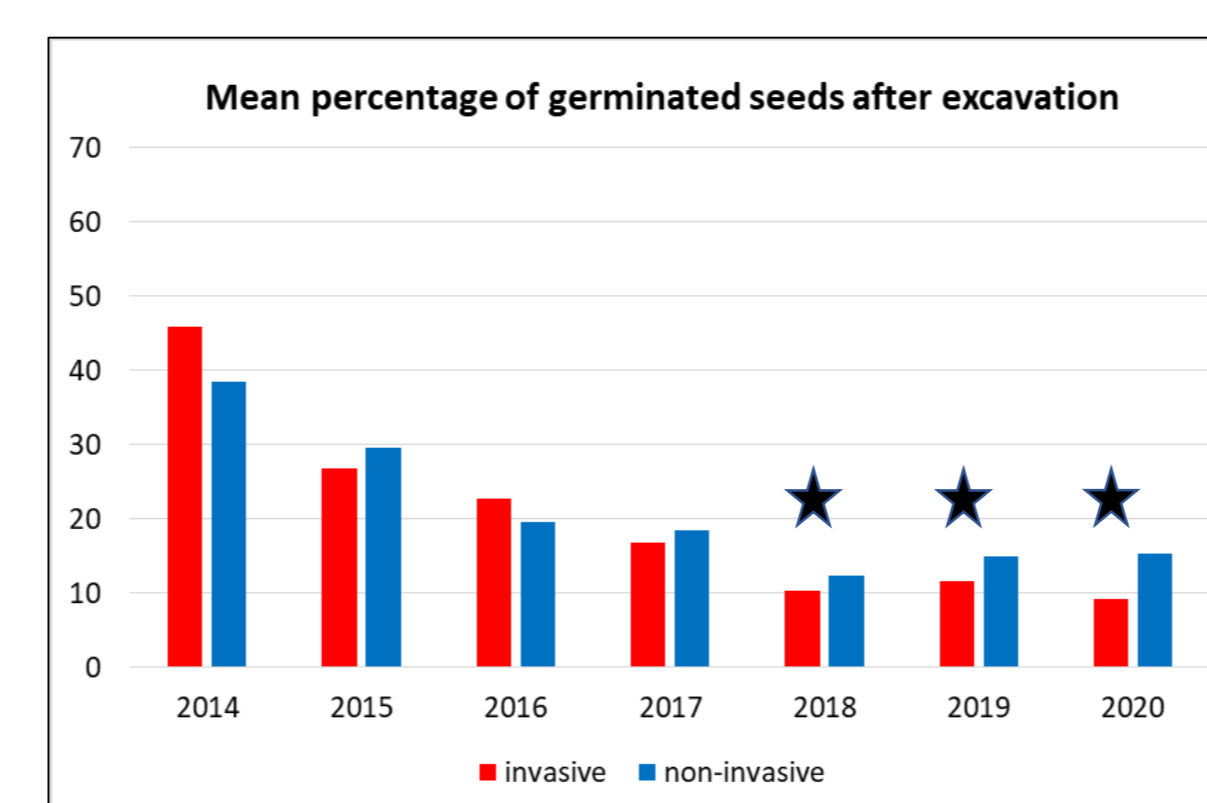
RESULTS

Comparison of seed bank type between invasive and non-invasive species

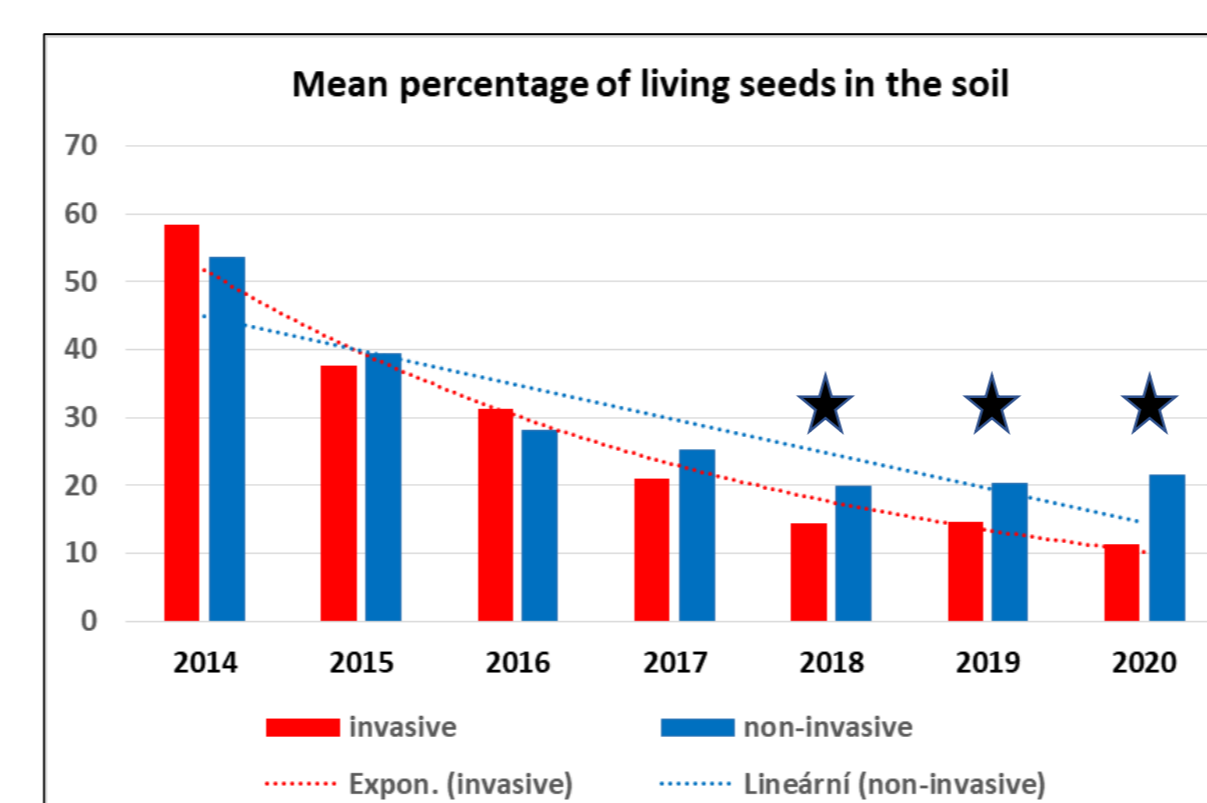


Among invasive species was the lower percentage of species with transient SB and higher percentage of species with short-term persistent SB and included the higher proportion of species with seeds surviving and germinating by higher percentage in the soil after the first year of the burial.

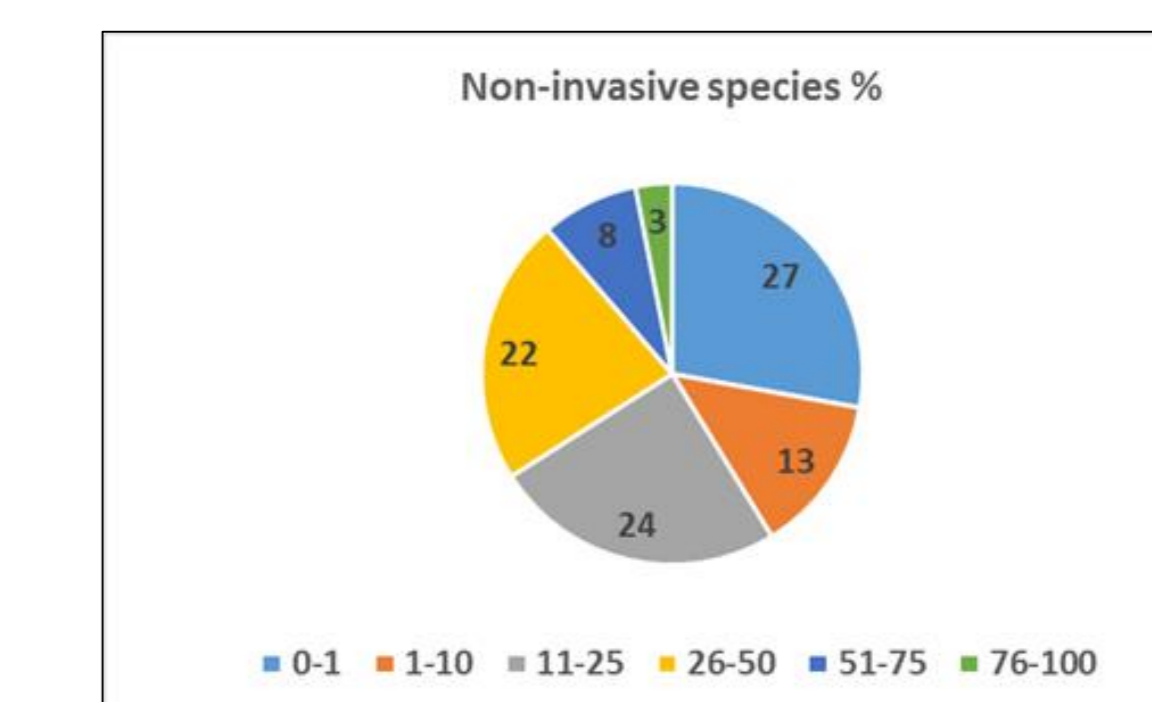
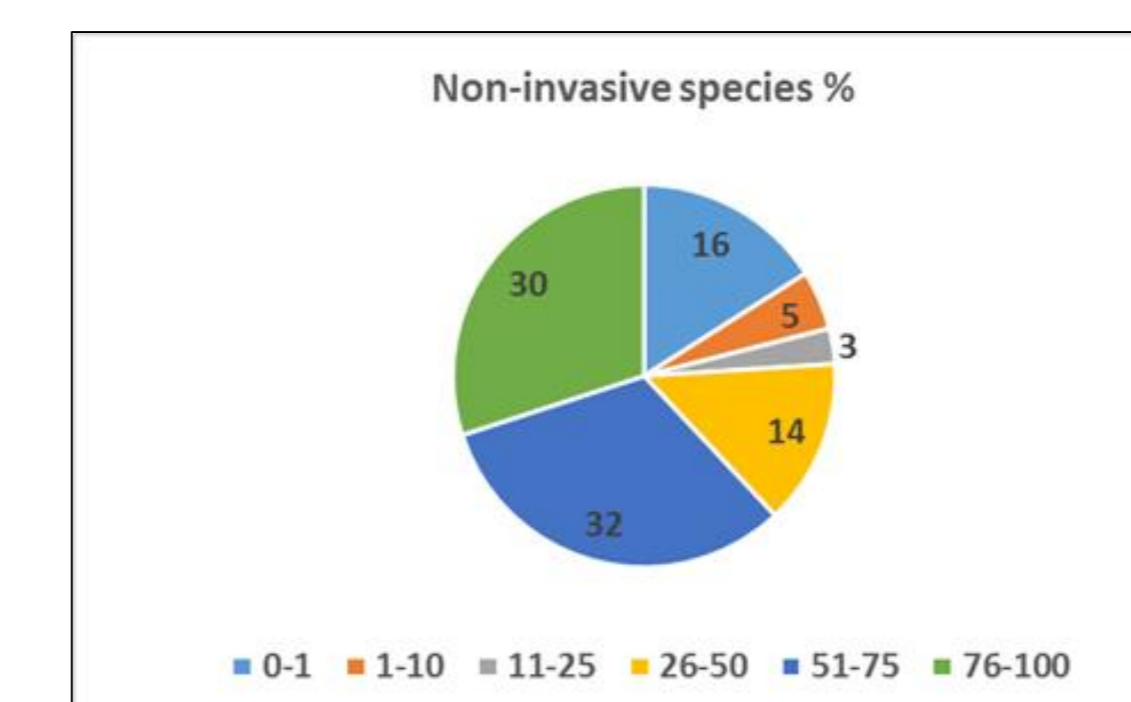
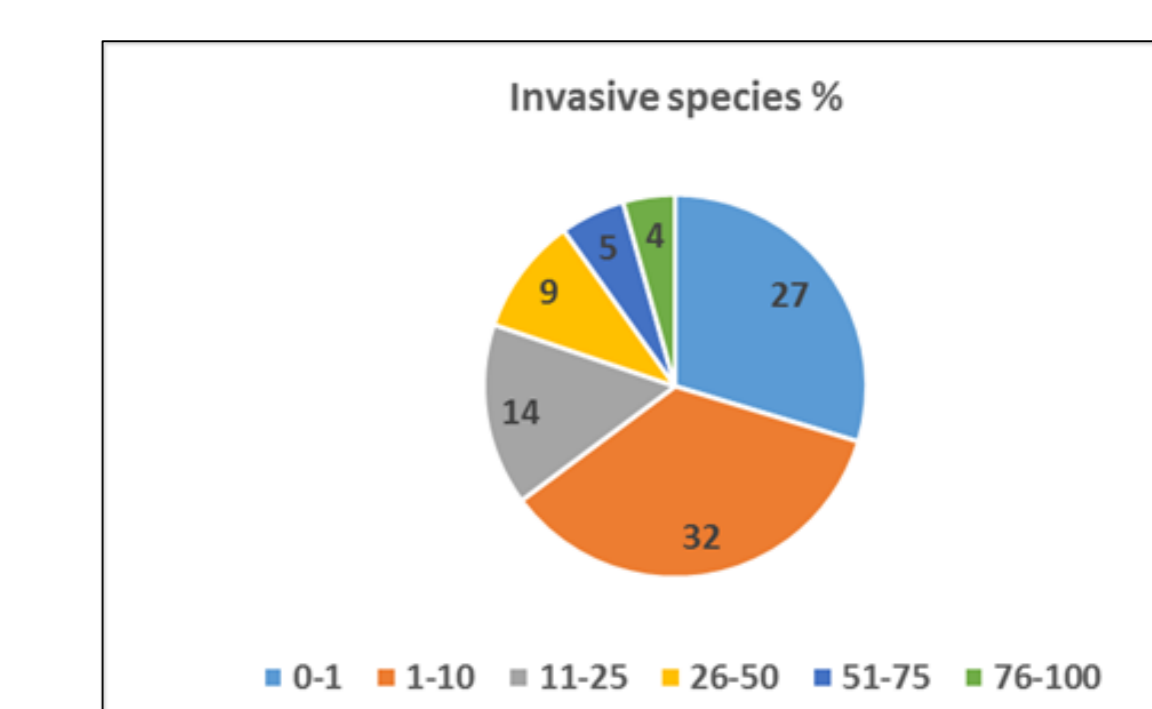
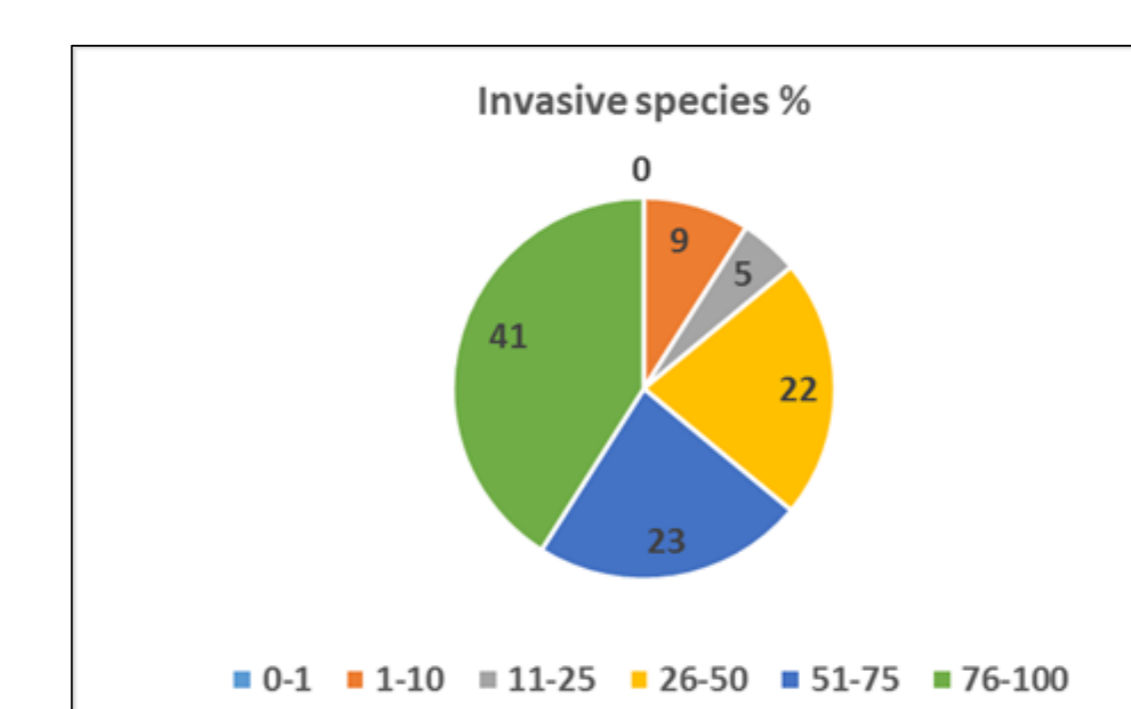
Comparison of germinated and living seeds between invasive and non-invasive species



Significant effect of invasiveness and its interaction with year, showing a significant difference between non-invasive and invasive species in germinated (up) as well as living (down) seeds after 5th (2018), 6th and 7th (2020) years of the burial.



Proportions of invasive and non-invasive species in percentage categories of seed survival in the soil after the 1st (left) and 7th year in the soil



All invasive species were viable to some percentage. 16% of non-invasive did not survive. 41% of invasive in highest survival category in comparison with 30% of non-invasive

27% of invasive as well as of non-invasive did not survive. 4% of invasive (3% non-invasive) still in the highest survival category. Non-invasive species have more species with the seed surviving longer in the higher categories.

CONCLUSIONS

Non-invasive species displayed the slower seed bank depletion and might benefit in time having the more species with long-term persistent soil seed bank

Invasive species might benefit from the higher number of living and more germinated seed in the soil in the initial stage of population development

High variability of the data indicates the importance of seed bank microsites

We found that seed persistence does not differ dramatically between invasive and non-invasive alien species and thus it can provide alien plants with an advantage already at the stage of naturalization and need not be necessarily associated with the final stage of the process, i.e. invasion phase (cf. Gioria et al. 2021)

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Gioria M, Carta A, Baskin C C, Dawson W, Essl F, Kreft H, Pergl J, van Kleunen M, Weigelt P, Winter M, Pyšek P (2021) Persistent soil seed banks promote naturalization and invasiveness in flowering plants. *Ecology Letters* 24: 1655-1667.

