Supporting Information

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SI Results

Below is a brief summary of the reviewed studies that used an experimental approach to test whether higher levels of among-individual genotypic or phenotypic diversity in founder groups promotes establishment success or population persistence, sorted in chronological order, separately for plants and animals.

Experiments on Plants. Martins and Jain (1) planted groups of Rose clover, *Trifolium hirtum*, seeds that represented low, medium, and high amounts of genetic variation (as estimated by a polymorphism index based on four morphological marker loci and four allozyme loci) in each of 135 10-m^2 quadrats and found that founder groups with high genetic diversity tended to have a higher establishment success measured after 2 y, compared with founder groups with medium and low diversity.

In a field experiment with the annual plant *Clarkia pulchella*, comparisons between two treatment groups differing in the relatedness of the founders, and thus in genetic effective population size (*Ne*), revealed that after three generations 75% of the high *Ne* treatment were still extant, whereas only 31% of the low *Ne* populations had survived (2).

Reusch et al. (3) planted shoots of the *Zostera marina* seagrass in groups of one-, three-, or six-genotype treatments within clearings of a large uninterrupted eelgrass meadow, and found that, when the experimental plots were sampled after 4 mo at the end of the growth period, there was a positive correlation between genotypic diversity and shoot density.

Procaccini and Piazzi (4) experimentally translocated groups of *Posidonia oceanica* sea grass and found that establishment success measured as percentage growth under field conditions was higher in groups that originated from genetically more diverse source populations.

Vilas et al. (5) reintroduced populations of the herb *Silene littorea* at different locations along a coastal shoreline, and found no effect of genetic diversity on establishment after 1 y, but the second year after reintroductions population sizes tended to be larger in plots where groups of genetically more diverse seedlings had been planted. The authors state, however, that their result should be interpreted with caution because sample sizes were quite small, with eight and five replicates for the high and low diversity treatments, respectively (5).

In a greenhouse experiment, Crawford and Whitney (6) found that colonization success of mouse-ear cress, *Arabidopsis thaliana*, was higher in genetically more diverse groups. However, in a more recent experiment on the same species, Hovick et al. (7) assessed the relative importance of community evenness and colonizer genetic diversity and found that diversity did not affect colonization success as estimated by seedling emergence, and speculated that strong interspecific competition may have substantially limited *A. thaliana* seedling emergence.

Drummond and Vellend (8) used experimental populations of the asexual clonal dandelion *Taraxacum officinale* in two types of environments and found that population performance (total leaf area, seed production, and biomass) consistently increased from low (one genotype) via medium (two genotypes) to high (four to five genotypes) genotypic diversity. The authors also state that the effect of diversity was pronounced more strongly in the fallow field versus the moved lawn environmental treatment.

Wang et al. (9) planted plots in a homogeneous marsh with ramets of the invasive perennial deciduous smooth cordgrass *Spartina alterniflora* representing one, three, or six clonal genotypes, and found that establishment success, measured as maximum spread distance at the termination of the experiment after two growing seasons, increased with increasing genotypic diversity.

Experiments on Animals. Leberg (10) tested for effects of founder diversity on establishment in aquatic pools of eastern mosquitofish, *Gambusia holbrooki* Giradr (Poeciliidae), and found that populations founded by pairs of full sibling individuals (n = 3 pools) were smaller after 1 y than those founded by unrelated individuals (n =4 pools) (P = 0.03, one-tailed).

Gamfeldt et al. (11) studied settling success in laboratory petri dishes of *Balanus improvisus* barnacle larvae experimental groups representing one, two, or three different broods, and report higher settling success in genetically more diverse groups.

In an experiment on honeybees, Mattila and Seeley (12) first inseminated queens with sperm from either 1 or 15 drones and then compared their ability to establish new colonies under seminatural conditions. Three out of 12 colonies established by polyandrous queens survived more than 1 y, whereas none of 9 colonies established from monandrous queens were alive after 1 y (12). However, multiple paternity was not confirmed, and the higher survival of colonies established by polyandrous queens might therefore have been due in part to a higher viability of offspring in the 15-drone treatment, if they were sired by males that were of higher than average genetic quality or genetically more compatible with the queen (13, 14).

Agashe (15) compared dynamics of laboratory populations of *Tribolium castaneum* flour beetles representing four genetic diversity levels over a period corresponding to approximately eight overlapping generations, and reports a lower extinction risk in genetically more diverse populations.

Markert et al. (16) created laboratory cultures of the estuarine crustacean *Americamysis bahia* with four distinct levels of genetic (amplified fragment length polymorphism) diversity (one, two, six, or eight) and monitored their numbers for 16 wk in both permissive (ambient seawater) and stressful conditions (diluted seawater) and found a significant positive correlation between genotypic diversity and population size at the termination of the experiment.

Ellers et al. (17) reared the arthropod springtail *Orchesella cincta* (Collembola) in monocultures and mixtures consisting of two, four, six, or eight genotypes in small microcosms kept in a climate room at constant temperature, and found that population size (number of adult individuals) after 9 wk, corresponding to two generations, increased with genotypic diversity.

Robinson et al. (18) exposed experimental populations of *Daphnia magna* populations consisting of one, two, or six genotypes to either constant or variable food input over a period of 170 d and found that the majority of populations (153 of 170) went extinct, but there was no evidence that genetic diversity facilitated population persistence in either environment. The authors speculate that the absence of sexual reproduction (reproduction was exclusively clonal over the experiment) or the phenotypic similarity in terms of fecundity, average lifetime condition, and longevity among the genotype lines may account for the lack of effect of diversity on population persistence (18).

Finally, two experimental studies have demonstrated higher establishment success in founder groups of *Tetrix subulata* pygmy grasshoppers with higher degree of genetic color pattern polymorphism. One of these experiments was performed under seminatural conditions in outdoor enclosures (19), and one was carried out under natural unconstrained conditions in the wild

(20). In both studies, it was found that, 1 y after the introduction events, the number of individuals representing the next generation increased with increasing number of color morphs (range, one to seven morphs) in the founder group.

1. Martins PS, Jain SK (1979) Role of genetic variation in the colonizing ability of Rose Clover (*Trifolium hirtum* All.). *Am Nat* 114(4):591–595.
2. Newman D, Pilson D (1997) Increased probability of extinction due to decreased genetic effective population size: Experimental populations of *Clarkia pulchella*. *Evolution* 51(2):354–362.
3. Reusch TBH, Ehlers A, Hämmerli A, Worm B (2005) Ecosystem recovery after climatic extremes enhanced by genotypic diversity. *Proc Natl Acad Sci USA* 102(8): 2826–2831.
4. Procaccini G, Piazzi L (2001) Genetic polymorphism and transplantation success in the mediterranean seagrass *Posidonia oceanica*. *Restor Ecol* 9(3):332–338.
5. Vilas C, San Miguel E, Amaro R, Garcia C (2006) Relative contribution of inbreeding depression and eroded adaptive diversity to extinction risk in small populations of shore campion. *Conserv Biol* 20(1):229–238.
6. Crawford KM, Whitney KD (2010) Population genetic diversity influences colonization success. *Mol Ecol* 19(6):1253–1263.
7. Hovick SM, Gümüser ED, Whitney KD (2012) Community dominance patterns, not colonizer genetic diversity, drive colonization success in a test using grassland species. *Plant Ecol* 213(9):1365–1380.
8. Drummond EBM, Vellend M (2012) Genotypic diversity effects on the performance of *Taraxacum officinale* populations increase with time and environmental favorability. *PLoS One* 7(2):e30314.
9. Wang XY, et al. (2012) Genotypic diversity enhances invasive ability of *Spartina alterniflora*. *Mol Ecol* 21(10):2542–2551.
10. Leberg PL (1990) Influence of genetic variability on population growth: Implications for conservation. *J Fish Biol* 37(Supplement A):193–195.
11. Gamfeldt L, Wallen J, Jonsson PR, Berntsson KM, Havenhand JN (2005) Increasing intraspecific diversity enhances settling success in a marine invertebrate. *Ecology* 86(12):3219–3224.
12. Mattila HR, Seeley TD (2007) Genetic diversity in honey bee colonies enhances productivity and fitness. *Science* 317(5836):362–364.
13. Simmons LW (2005) The evolution of polyandry: Sperm competition, sperm selection, and offspring viability. *Annu Rev Ecol Evol Syst* 36:125–146.
14. Jennions MD (1997) Female promiscuity and genetic incompatibility. *Trends Ecol Evol* 12(7):251–253.
15. Agashe D (2009) The stabilizing effect of intraspecific genetic variation on population dynamics in novel and ancestral habitats. *Am Nat* 174(2):255–267.
16. Markert JA, et al. (2010) Population genetic diversity and fitness in multiple environments. *BMC Evol Biol* 10:205.
17. Ellers J, Rog S, Braam C, Berg MP (2011) Genotypic richness and phenotypic dissimilarity enhance population performance. *Ecology* 92(8):1605–1615.
18. Robinson JD, Wares JP, Drake JM (2013) Extinction hazards in experimental *Daphnia magna* populations: Effects of genotype diversity and environmental variation. *Ecol Evol* 3(2):233–243.
19. Wennersten L, Johansson J, Karpestam E, Forsman A (2012) Higher establishment success in more diverse groups of pygmy grasshoppers under seminatural conditions. *Ecology* 93(12):2519–2525.
20. Forsman A, Wennersten L, Karlsson M, Caesar S (2012) Variation in founder groups promotes establishment success in the wild. *Proc Biol Sci* 279(1739):2800–2806.