Table S1. Selected examples of environment-influenced heterosis and environment-dependent heterosis.

Species	Common name	Treatment	Hybrid or cross breeding	Type*	Citation
Tigriopus californicus	Copepod	temperature	Within species	EIH	1
Ambrosia artemisiifolia	Ragweed	drought, herbivory	Within species	EIH	2
Salvelinus fontinalis	Brook trout	rearing environment	Within species	EIH	3
Laminaria digitata	Kelps	Thermal tolerance	Interspecific hybrid	EIH	4
Zea mays	Maize	environments (combinations)	Within species	EIH	5
Drosophila pseudoobscura	Fruit fly	temperature	Within species	EDH	6
Ipomopsis aggregata	Scarlet gilia	environmental conditions	Interspecific hybrid	EIH	7
Tribolium castaneum	Red flour beetle	diet environment	Within species	EIH	8
Drosophila melanogaster	Fruit fly	temperature; crowded	Within species	EDH	9
Zea mays	Maize	soil environment	Within species	EDH	10
Swine	Pig	herd environment	Within species	EIH	11
Haliotis rufescens	Abalone	temperature	Interspecific hybrid	EDH?#	12

*EIH: environment-influenced heterosis. EDH: environment-dependent heterosis.
Only one parent examined.

References

1. Pereira, R.J., Barreto, F.S., and Burton, R.S. (2014). Ecological novelty by hybridization: experimental evidence for increased thermal tolerance by transgressive segregation in Tigriopus californicus. Evolution *68*, 204-215. 10.1111/evo.12254.
2. Hahn, M.A., and Rieseberg, L.H. (2017). Genetic admixture and heterosis may enhance the invasiveness of common ragweed. Evol Appl *10*, 241-250. 10.1111/eva.12445.
3. Crespel, A., Audet, C., Bernatchez, L., and Garant, D. (2012). Effects of rearing environment and strain combination on heterosis in brook trout. North American Journal of Aquaculture *74*, 188-198.
4. Martins, N., Pearson, G.A., Gouveia, L., Tavares, A.I., Serrao, E.A., and Bartsch, I. (2019). Hybrid vigour for thermal tolerance in hybrids between the allopatric kelps Laminaria digitata and L. pallida (Laminariales, Phaeophyceae) with contrasting thermal affinities. European Journal of Phycology *54*, 548-561.
5. Munaro, E.M., Eyhérabide, G.H., D'Andrea, K.E., Cirilo, A.G., and Otegui, M.E. (2011). Heterosis× environment interaction in maize: What drives heterosis for grain yield? Field Crops Research *124*, 441-449.
6. Vetukhiv, M., and Beardmore, J. (1959). Effect of environment upon the manifestation of heterosis and homeostasis in Drosophila pseudoobscura. Genetics *44*, 759.
7. Wu, C.A., and Campbell, D.R. (2006). Environmental stressors differentially affect leaf ecophysiological responses in two Ipomopsis species and their hybrids. Oecologia *148*, 202-212.
8. Benyi, K., and Gall, G.A. (1981). Genotype-environment interaction effects on reproductive performance in Tribolium castaneum. Theor Appl Genet *59*, 123-128. 10.1007/BF00285903.
9. Dominguez, A., and Albornoz, J. (1987). Environment-dependent heterosis in Drosophila melanogaster. Genet

Sel Evol (1983) *19*, 37-48. 10.1186/1297-9686-19-1-37.

10. Wagner, M.R., Tang, C., Salvato, F., Clouse, K.M., Bartlett, A., Vintila, S., Phillips, L., Sermons, S., Hoffmann, M., Balint-Kurti, P.J., and Kleiner, M. (2021). Microbe-dependent heterosis in maize. Proc Natl Acad Sci U S A *118*. 10.1073/pnas.2021965118.

11. Kennedy, B., and Quinton, M. (1987). A note on the effects of health environment on heterosis for growth rate in pigs. Animal Science *44*, 443-445.

12. Tripp-Valdez, M.A., Cicala, F., Galindo-Sanchez, C.E., Chacon-Ponce, K.D., Lopez-Landavery, E., Diaz, F., Re-Araujo, D., and Lafarga-De la Cruz, F. (2021). Growth Performance and Transcriptomic Response of Warm-Acclimated Hybrid Abalone Haliotis rufescens (female symbol) x H. corrugata (male symbol). Mar Biotechnol (NY) *23*, 62-76. 10.1007/s10126-020-10002-7.

Table S2. Hatching rate of channel catfish (CC), blue catfish (BB), and their reciprocal hybrids (CB and BC).

Genetic type	Experiment	Num of eggs	Number of fry	Hatching rate
BB	Experiment 1	19720	9000	45.60%
BB	Experiment 2	4200	2400	57.10%
BB	Experiment 3	200	78	39%
BB	Experiment 4	553	207	37.40%
CC	Experiment 1	50344	29000	57.60%
CC	Experiment 2	2430	800	32.90%
CC	Experiment 3	6599	4200	63.65%
CB	Experiment 1	550	265	48.20%
CB	Experiment 2	560	345	61.60%
CB	Experiment 3	2040	899	44.07%
BC	Experiment 1	1200	212	17.70%
BC	Experiment 2	3025	315	10.40%
BC	Experiment 3	2500	400	16%
BC	Experiment 4	3355	302	9%

Table S3. Statistical significance of body weight comparisons in tank culture.

Genetic type1	Genetic type2	Age	MWU *P*-value	Significance	Genetic type1	Genetic type2	Age	MWU *P*-value	Significance
CC	BB	3-week	0.1	NS	CC	BB	10.8m	0.0078	*
CC	CB	3-week	1	NS	CC	CB	10.8m	0.0049	*
CC	BC	3-week	0.1	NS	CC	BC	10.8m	0.0050	*
BB	CB	3-week	0.1	NS	BB	CB	10.8m	0.0078	*
BB	BC	3-week	0.4	NS	BB	BC	10.8m	0.0436	NS
CB	BC	3-week	0.1	NS	CB	BC	10.8m	0.1262	NS
CC	BB	15m	8.4×10^{-5}	***	CC	BB	18.6m	5.3×10^{-8}	***
CC	CB	15m	9.8×10^{-7}	***	CC	CB	18.6m	5.2×10^{-8}	***
CC	BC	15m	0.0014	**	CC	BC	18.6m	1×10^{-6}	***
BB	CB	15m	1.3×10^{-5}	***	BB	CB	18.6m	2×10^{-4}	***
BB	BC	15m	0.4192	NS	BB	BC	18.6m	0.1855	NS
CB	BC	15m	0.0036	*	CB	BC	18.6m	0.0440	NS
CC	BB	20.2m	7.6×10^{-8}	***	CC	BB	21.8m	1.1×10^{-6}	***
CC	CB	20.2m	1.4×10^{-7}	***	CC	CB	21.8m	2.9×10^{-7}	***
CC	BC	20.2m	1.2×10^{-6}	***	CC	BC	21.8m	3.5×10^{-6}	***
BB	CB	20.2m	0.0018	**	BB	CB	21.8m	3.6×10^{-4}	*
BB	BC	20.2m	0.5112	NS	BB	BC	21.8m	0.7712	NS
CB	BC	20.2m	0.0223	NS	CB	BC	21.8m	0.0023	*
CC	BB	23.5m	2.5×10^{-5}	***	CC	BB	25m	0.0016	**
CC	CB	23.5m	2.3×10^{-6}	***	CC	CB	25m	5.5×10^{-6}	***
CC	BC	23.5m	1.6×10^{-5}	***	CC	BC	25m	0.0002	***
BB	CB	23.5m	0.0022	**	BB	CB	25m	1.1×10^{-5}	***
BB	BC	23.5m	0.1084	NS	BB	BC	25m	0.0235	NS
CB	BC	23.5m	0.1743	NS	CB	BC	25m	0.0195	NS
CC	BB	26.8m	0.051	NS	CC	BB	28.4m	0.1076	NS
CC	CB	26.8m	0.0005	**	CC	CB	28.4m	0.0256	NS
CC	BC	26.8m	0.0003	**	CC	BC	28.4m	0.0200	NS
BB	CB	26.8m	0.0016	**	BB	CB	28.4m	0.0442	NS
BB	BC	26.8m	0.0004	**	BB	BC	28.4m	0.0072	*
CB	BC	26.8m	0.7444	NS	CB	BC	28.4m	0.7345	NS

Mann–Whitney U test was used to assess the statistical significance (*, $p < 0.05$; **, $p < 0.01$; ***, $p < 0.001$). NS: not significant.

Table S4. Statistical significance of body weight comparisons in pond culture.

Genetic type1	**Genetic type2**	**Age**	**MWU *P*-value**	**Significance**	**Genetic type1**	**Genetic type2**	**Age**	**MWU *P*-value**	**Significance**
CB	BC	15-month	0.0993	NS	CB	BC	18.6-month	0.2531	NS
CB	CC	15-month	2.2×10^{-16}	***	CB	CC	18.6-month	2.5×10^{-15}	***
CB	BB	15-month	0.0046	*	CB	BB	18.6-month	0.025	NS
BC	CC	15-month	1.9×10^{-6}	***	BC	CC	18.6-month	1.9×10^{-7}	***
BC	BB	15-month	0.0036	*	BC	BB	18.6-month	0.0021	**
CC	BB	15-month	2.2×10^{-16}	***	CC	BB	18.6-month	7.4×10^{-15}	***
CB	BC	20.2-month	0.2875	NS	CB	BC	21.8-month	0.2427	NS
CB	CC	20.2-month	9.2×10^{-11}	***	CB	CC	21.8-month	1.8×10^{-6}	***
CB	BB	20.2-month	5.1×10^{-7}	***	CB	BB	21.8-month	5.4×10^{-5}	***
BC	CC	20.2-month	1.7×10^{-5}	***	BC	CC	21.8-month	0.0033	*
BC	BB	20.2-month	6.4×10^{-6}	***	BC	BB	21.8-month	7.7×10^{-6}	***
CC	BB	20.2-month	1.1×10^{-14}	***	CC	BB	21.8-month	1.1×10^{-10}	***
CB	BC	23.5-month	0.3164	NS	CB	BC	25-month	0.7584	NS
CB	CC	23.5-month	0.3054	NS	CB	CC	25-month	0.2648	NS
CB	BB	23.5-month	0.0086	*	CB	BB	25-month	0.0014	**
BC	CC	23.5-month	0.6591	NS	BC	CC	25-month	0.1687	NS
BC	BB	23.5-month	0.0012	**	BC	BB	25-month	0.0269	NS
CC	BB	23.5-month	0.0014	**	CC	BB	25-month	0.4127	NS
CB	BC	26.8-month	0.0591	NS	CB	BC	28.4-month	0.6587	NS
CB	CC	26.8-month	0.0739	NS	CB	CC	28.4-month	0.0118	*
CB	BB	26.8-month	0.0081	*	CB	BB	28.4-month	0.0020	**
BC	CC	26.8-month	0.0015	**	BC	CC	28.4-month	0.0249	NS
BC	BB	26.8-month	0.0002	***	BC	BB	28.4-month	0.0366	NS
CC	BB	26.8-month	0.8207	NS	CC	BB	28.4-month	0.6494	NS

Mann–Whitney U test was used to assess the statistical significance (*, $p < 0.05$; **, $p < 0.01$; ***, $p < 0.001$). NS: not significant.