

The tip of the iceberg: genome wide marker analysis reveals hidden hybridization during invasion

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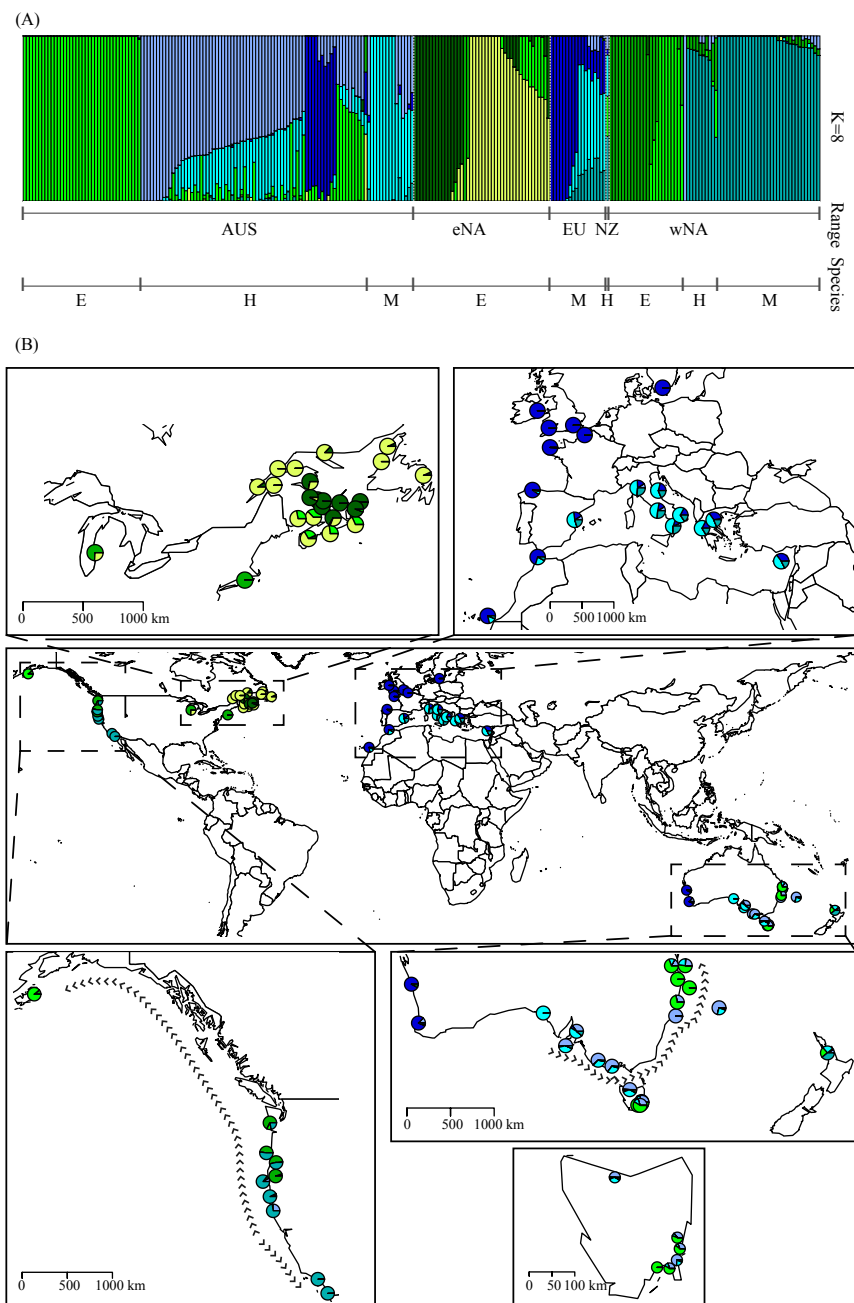
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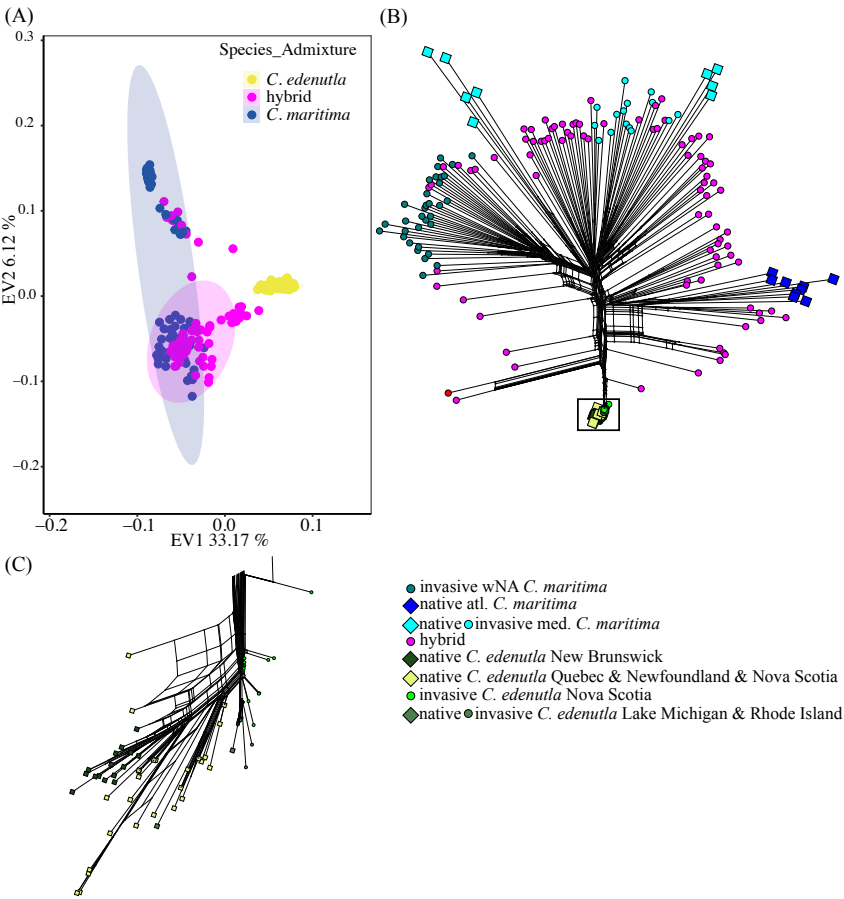
Abstract

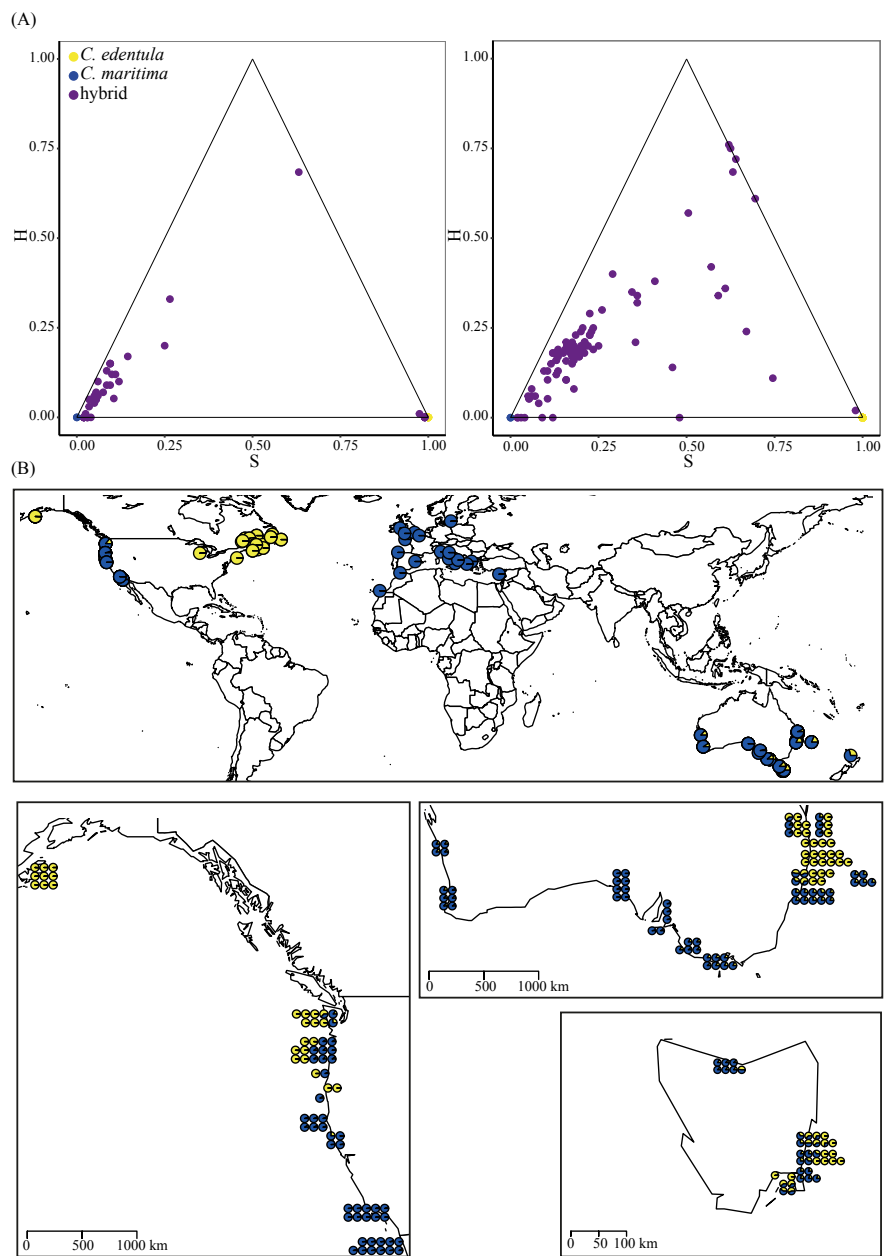
Biological invasions are accelerating, and invasive species can have large economic impacts as well as severe consequences for biodiversity. During invasions, species can interact, potentially resulting in hybridization. Here, we examined two *Cakile* species, *C. edentula* and *C. maritima* (Brassicaceae), that co-occur and may hybridize during range expansion in separate regions of the globe. *Cakile edentula* invaded each location first, while *C. maritima* established later, apparently replacing the former. We assessed the evidence for hybridization in western North America and Australia, where both species have been introduced, and identified source populations with 4561 SNPs using Genotype-by-Sequencing. Our results indicate that the *C. edentula* in Australia originated from one region of eastern North America while in western North America it is likely from multiple sources. The *C. maritima* in Australia were derived from at least two different parts of Europe while the introduction in western North America is from one. Although morphological evidence of hybridization is generally limited to mixed species populations in Australia and virtually absent elsewhere, our genetic analysis revealed relatively high levels of hybridization in Australia (58% hybrids) and supported the presence of hybrids in western North America (16%) and New Zealand. Hybrids might be commonly overlooked in invaders, as identification based solely on morphological traits may represent only the tip of the iceberg. Our study reveals a repeated pattern of invasion, hybridization and apparent replacement of one species by another, which offers an opportunity to investigate the role of hybridization and introgression during invasion.

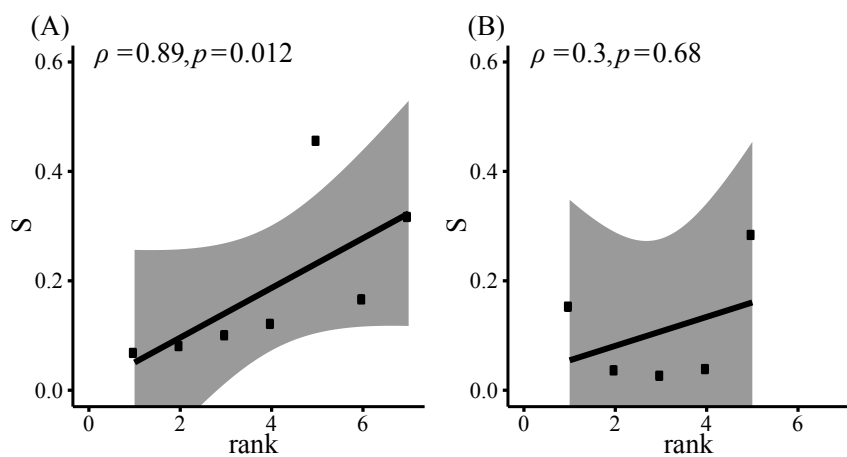
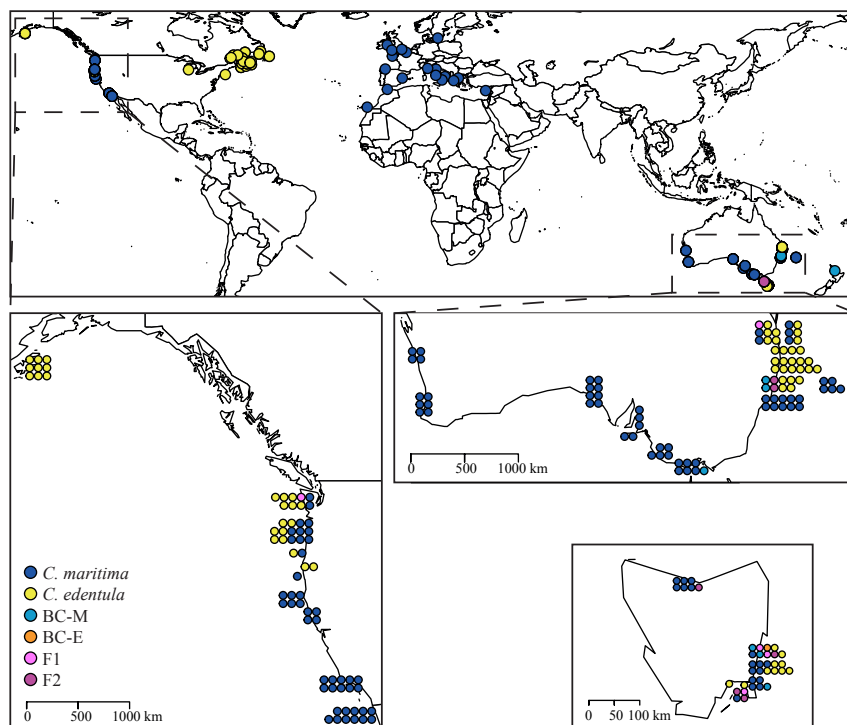
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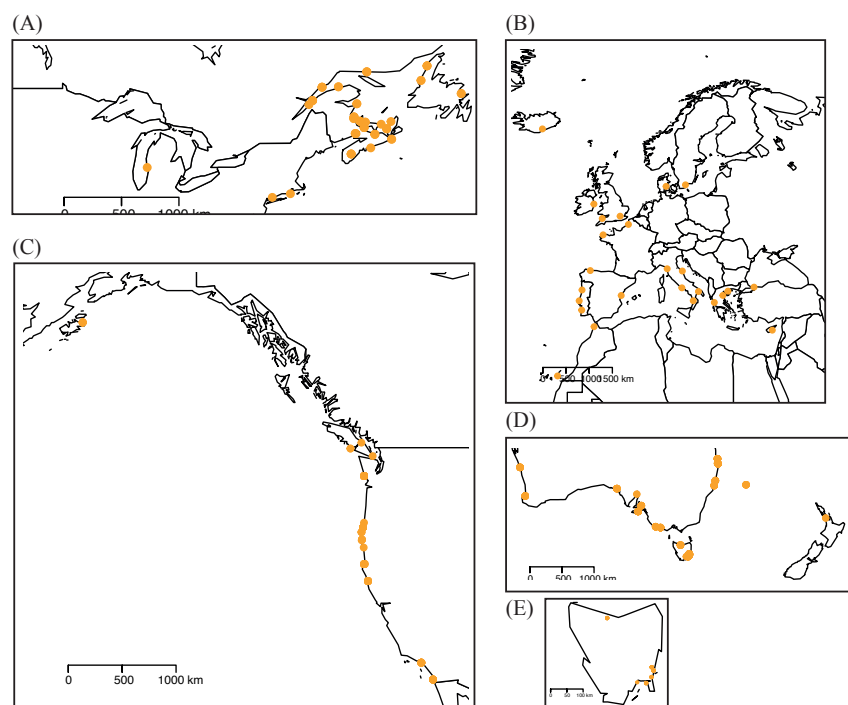
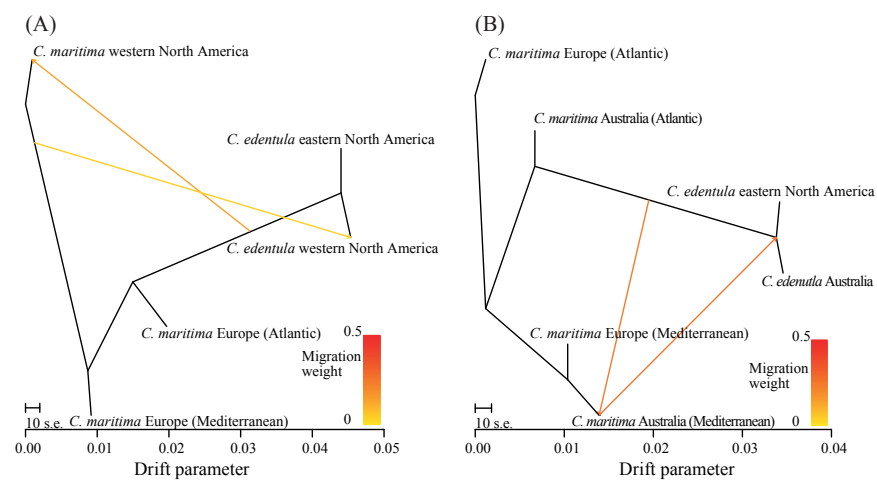
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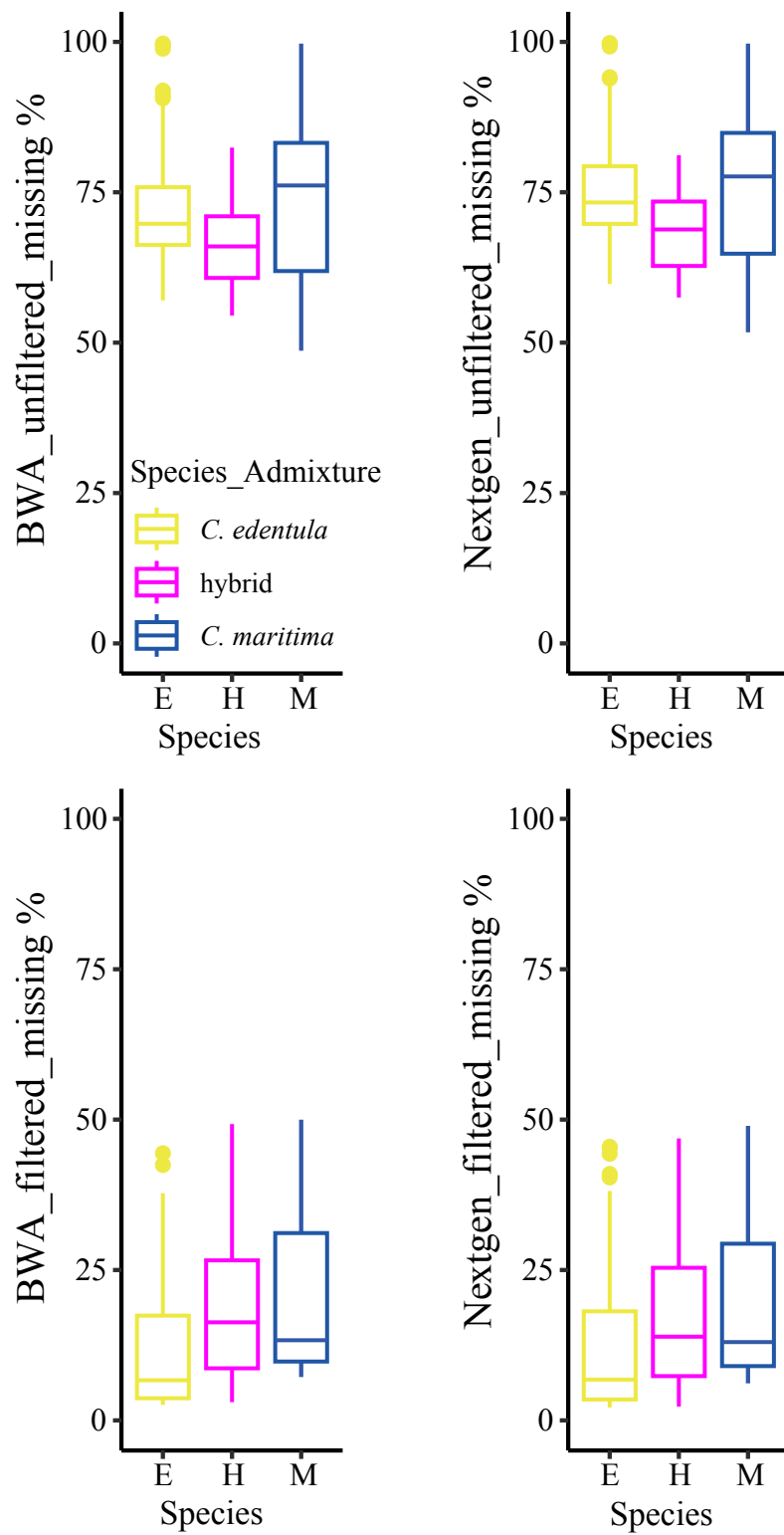


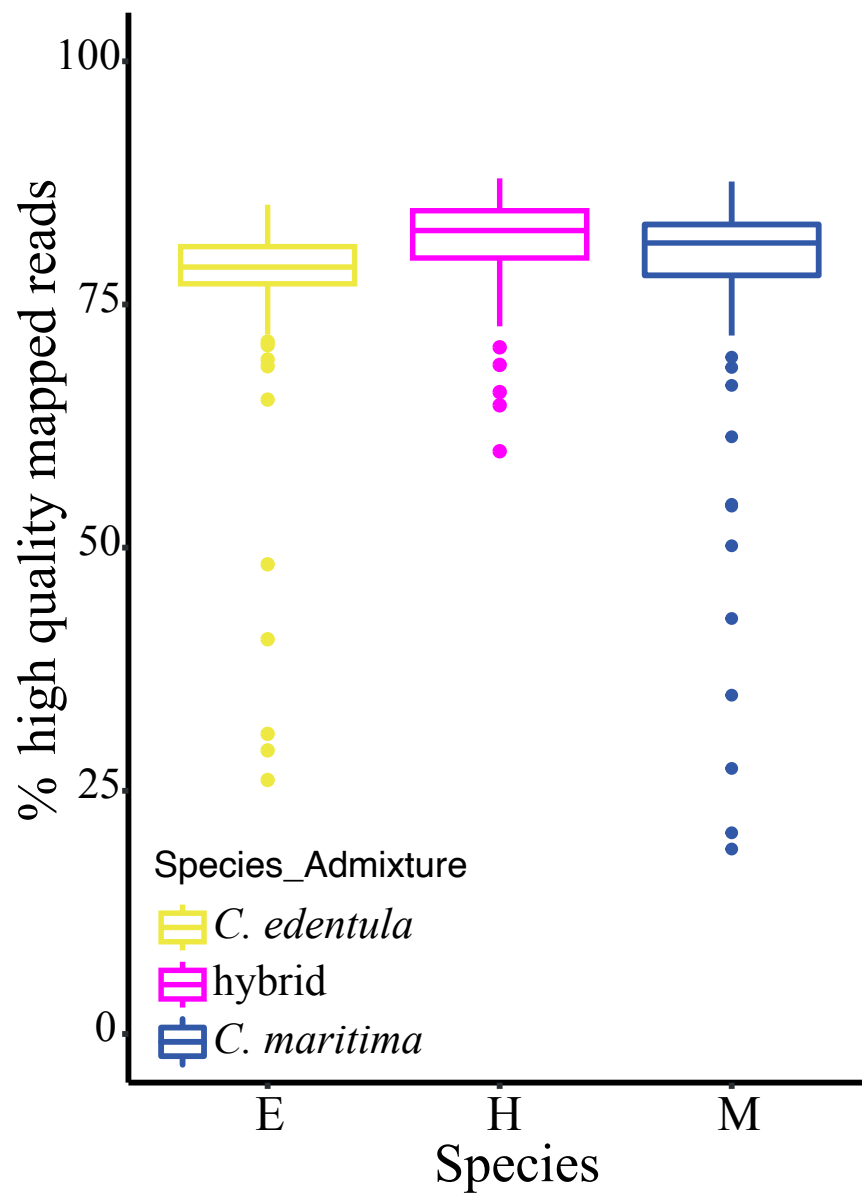


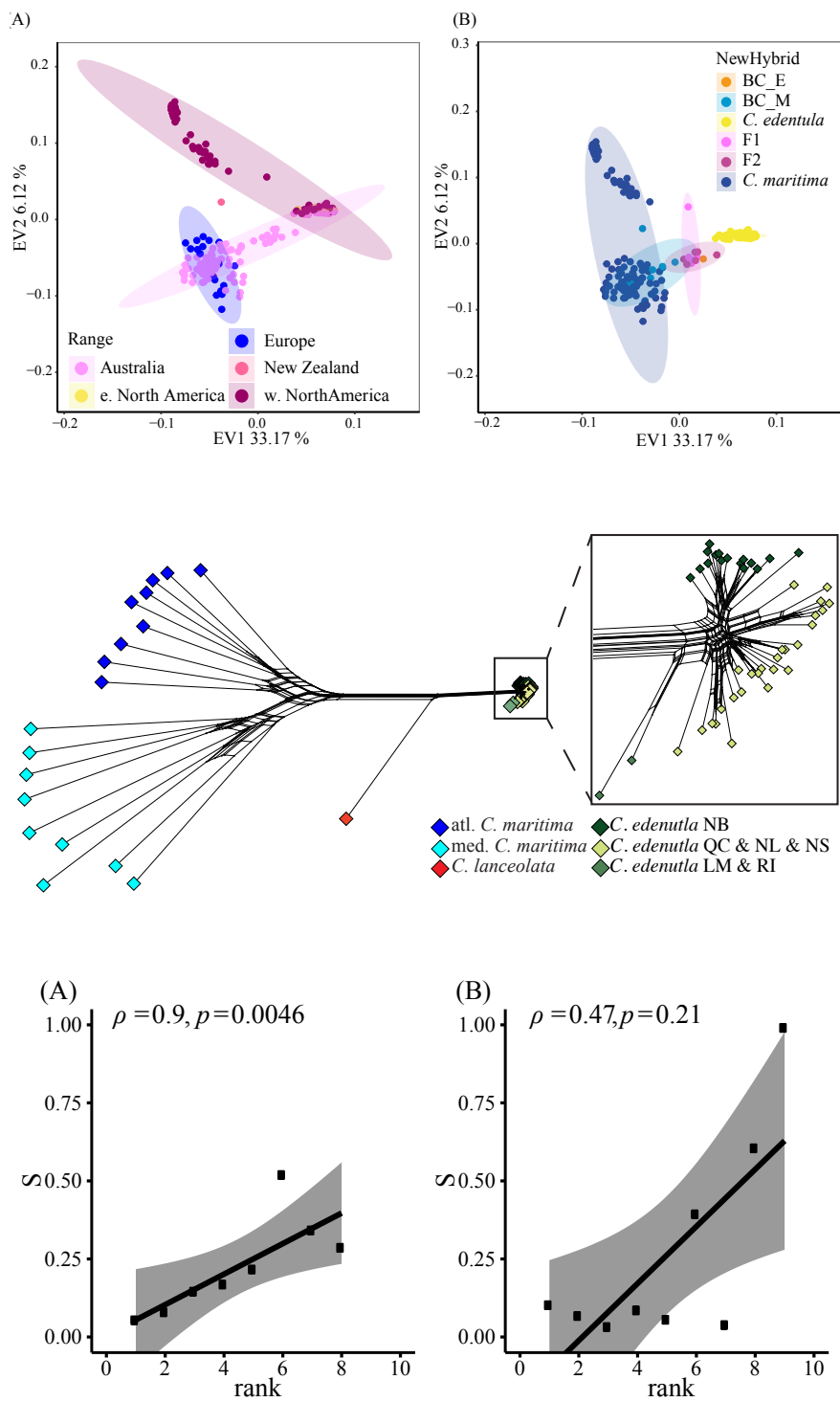


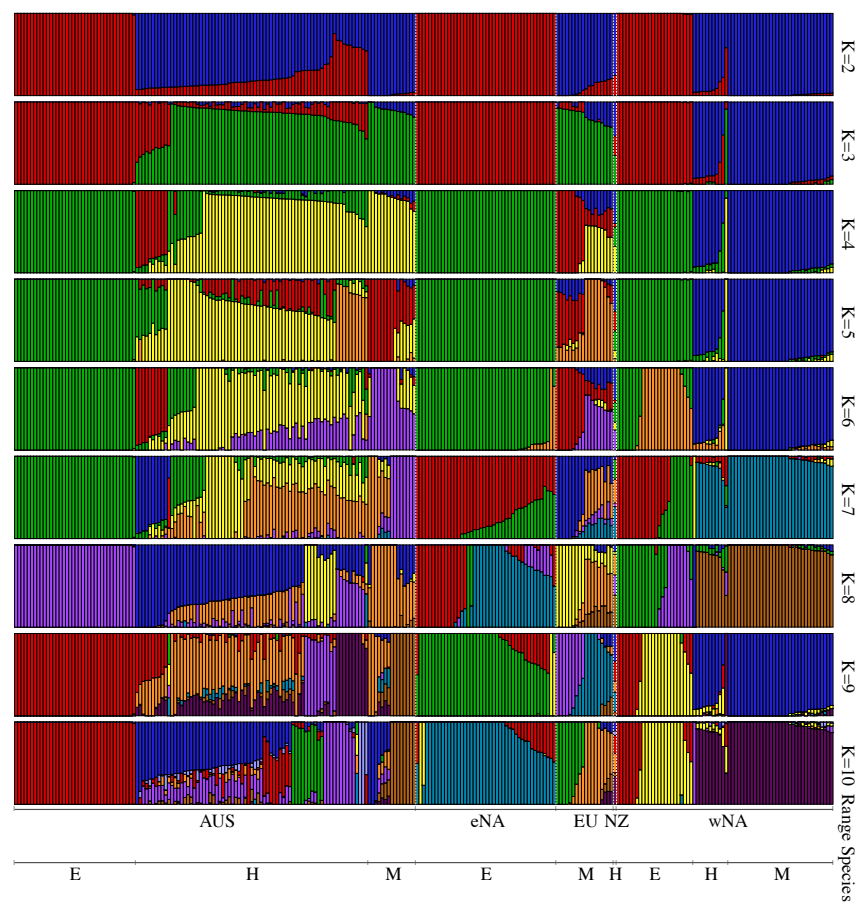


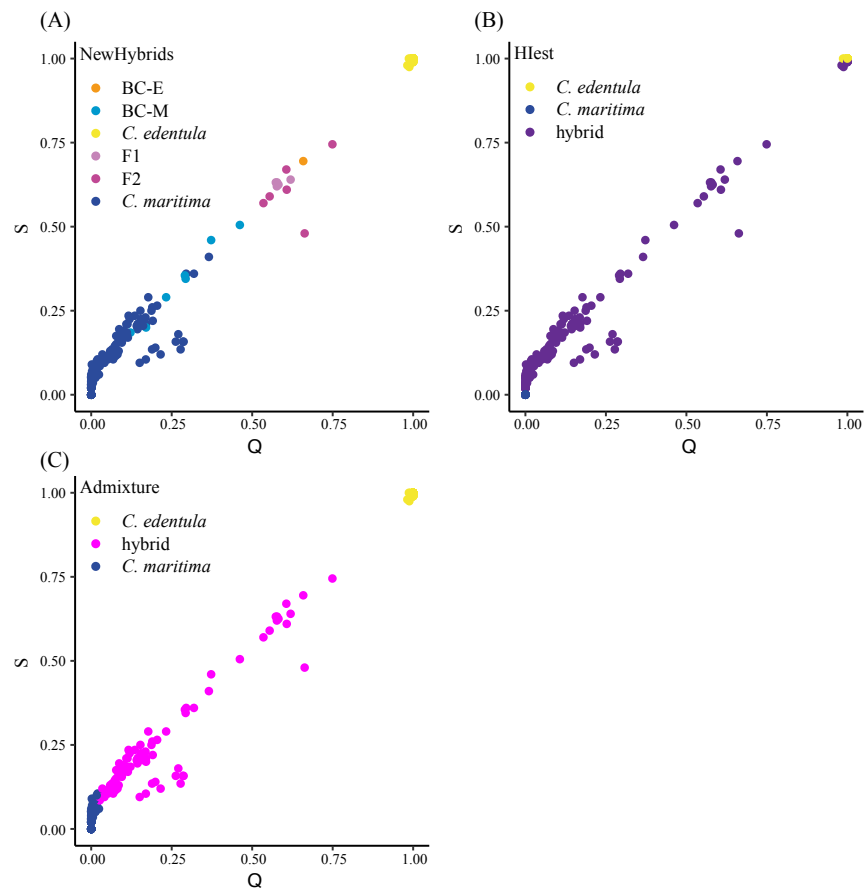












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Table S1.xlsx available at <https://authorea.com/users/335639/articles/490208-the-tip-of-the-iceberg-genome-wide-marker-analysis-reveals-hidden-hybridization-during-invasion>