Phylogenetic Signal of Sub-Arctic Beetle Communities

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Abstract

Post-glacial dispersal and colonization processes have shaped community patterns in sub-Arctic regions such as Churchill, Manitoba, Canada. Important questions remain about the species that colonized this area, in particular the role of glacial history and biological traits in governing colonization patterns from refugial and southerly geographic regions. This study quantifies sub-Arctic beetle phylogenetic community structure using the net relatedness index (NRI) and nearest taxon index (NTI); calculated using publicly available data from BOLD; compares patterns across families with different traits (habitat, diet) using standard statistical analysis (ANOVA) as well as phylogenetic generalized least squares (PGLS) using a higher-level beetle phylogeny; and compares phylogenetic community structure in Churchill with a region in southern Canada (Guelph, Ontario). The dominant pattern detected in our study was that aquatic families were much better represented in Churchill compared to terrestrial families, when compared against richness sampled from across Canada and Alaska. Individually, most families showed significant phylogenetic clustering in Churchill. Closely related species were likely found together due to the strong environmental filtering present in Arctic environments. There was no significant difference in phylogenetic structure between Churchill and Guelph, although the trend was towards stronger clustering in the North. Similarly, there was no difference in phylogenetic structure metrics calculated for aquatic vs. terrestrial beetle families, again with a trend towards stronger clustering in water beetles. By contrast, there was a significant relationship between traits and community structure. Predators showed significantly stronger clustering in Churchill compared to other feeding modes, perhaps due to phylogenetic conservatism of their overwintering ability or generalist diet of some clades within families. This study contributes to our understanding of the traits and processes structuring insect biodiversity and macroecological trends in the sub-Arctic.

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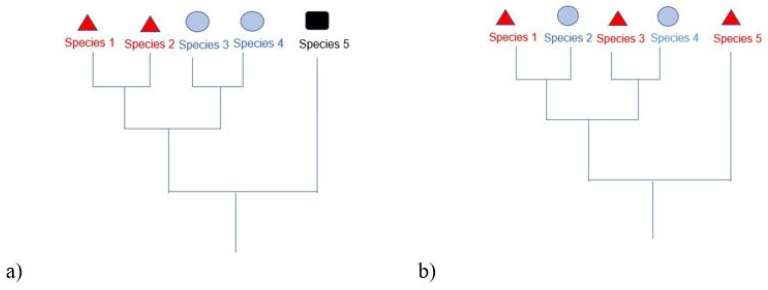

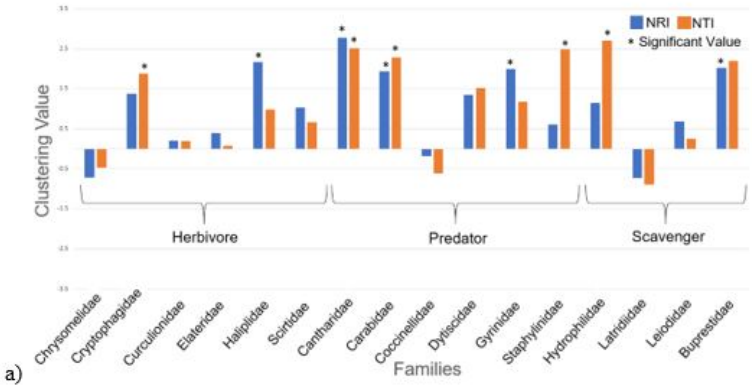

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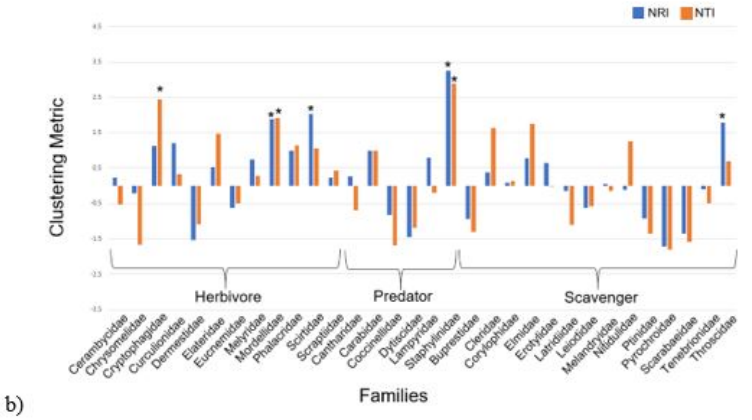

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