Species Diversity and Phylogenetic Relationships within the Family Rhodomelaceae (Ceramiales, Rhodophyta) in Canada

Abstract

Biodiversity of the red algae (Rhodophyta) has typically been underestimated due to a historical reliance on traditional morphological taxonomic techniques. The simple gross morphology of most red algae leads to a paucity of useful characters for species identification, and convergent evolution and phenotypic plasticity further aggravate matters. In this thesis, species diversity, biogeography and evolutionary relationships within the red algal family Rhodomelaceae in Canada were examined using a molecular-assisted approach, with a focus on the tribes Polysiphonieae and Pterosiphonieae. The Rhodomelaceae is the largest family of red algae, and despite significant study over the last 200 years, species diversity and evolutionary relationships within this group are poorly understood. Multiple molecular markers were used to delimit species boundaries and establish distributions for species of Neosiphonia in the northwest Atlantic, resolving conflict in the literature on the taxonomic status of Neosiphonia harveyi. Molecular data indicated that the Asian species Neosiphonia japonica was likely introduced to the northwest Atlantic, and sequence data from the internal transcribed spacer of the ribosomal cistron (ITS) indicated introgression of nuclear DNA from N. japonica into N. harveyi, a closely related local species. Subsequently, species diversity and evolutionary relationships were assessed for the tribes Polysiphonieae and Pterosiphonieae in Canada. The genus Pterosiphonia was reduced based on molecular phylogenetic analyses to include only the South African type and two additional species, with four North Pacific and Arctic species transferred to the newly resurrected genus Polyostea, and four Pacific species transferred to Symphyocladia. Based on DNA barcode (COI-5P) survey results, as well as morphological observations, two previously overlooked species of Symphyocladia were recognized from British Columbia (S. brevicaudis and S. rosea), and a new species of Pterosiphonia from South Africa (P. stegengae). Multi-gene phylogenetic analyses confirmed that the taxonomically challenging genus Polysiphonia was polyphyletic, and species of Polysiphonia were transferred to seven different genera – three extant genera, one resurrected, and three newly described here (Acanthusiphonia, Eutrichosphonia, and Kapraunia). DNA barcode surveys revealed the presence of nine putative cryptic or overlooked species of Polysiphonieae in Canada, and several species were recorded for the first time in Canadian waters including Polysiphonia morrowii.
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