

# Diversity of genomes and functions in non-photosynthetic plastids of Ochrophyta

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Photosynthesis provides ATP and NADPH from the solar energy, and synthesizes sugars from carbon dioxide. Therefore, retention of photosynthetic plastids is beneficial for cell viability. Nevertheless, some members of photosynthetic eukaryotes have lost photosynthesis. In Ochrophyta, there are numerous members that have lost photosynthesis independently. Previous studies revealed that a non-photosynthetic diatom possessed plastids and a plastid genome carrying genes for ATP synthase complex. The non-photosynthetic plastids potentially function for biosynthesis of Fe-S cluster, heme, fatty acids, and various amino acids. In order to understand evolutionary diversity of loss of photosynthesis in Ochrophyta, it is required to investigate non-photosynthetic plastids in other non-photosynthetic species of this lineage. In this study, we determined a complete plastid genome of the phagotrophic chrysophycean *Spumella* sp. NIES-1846. The non-photosynthetic plastid genome in *Spumella* sp. NIES-1846 is a 53-kb long, circular molecule with a tetrapartite structure comprised of two inverted repeat regions, a small single copy region, and a large single copy region, the genome structure which is common in photosynthetic plastid genomes of Ochrophyta. Although we detected 45 protein genes and 27 RNA genes in the non-photosynthetic plastid genome, no gene was identified for carbon fixation and photosynthesis, except for *petF* encoding Ferredoxin, suggesting a Ferredoxin-mediated electron transport in the non-photosynthetic plastids. We also performed transcriptome-based prediction of plastid functions in *Spumella* sp. NIES-1846. Proteins for Fe-S cluster assembly, biosynthesis of heme, and glycolysis are highly likely localized in plastids, while proteins for other plastid functions such as biosynthesis of fatty acids and isopentenyl pyrophosphates are likely localized in mitochondria or cytosol. By comparison of potential plastid functions, diversity of non-photosynthetic plastids in Ochrophyta will be discussed.