國 立 臺 灣 海 洋 大 學
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中文題目：從北極海域分離出的超微真核綠藻 *Micromonas* 的嗜菌行為

英文題目：Phagotrophy by the picoeukaryotic green alga *Micromonas*: implications for Arctic Oceans

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Abstract

Photosynthetic picoeukaryotes (PPE) are recognized as major primary producers and contributors to phytoplankton biomass in oceanic and coastal environments. Molecular surveys indicate a large phylogenetic diversity in the picoeukaryotes, with members of the Prymnesiophyceae and Chrysophyseae tending to be more common in open ocean waters and Prasinophyceae dominating coastal and Arctic waters. In addition to their role as primary producers, PPE have been identified in several studies as mixotrophic and major predators of prokaryotes. Mixotrophy, the combination of photosynthesis and phagotrophy in a single organism, is well established for most photosynthetic lineages. However, green algae, including prasinophytes, were widely considered as a purely photosynthetic group. The prasinophyte *Micromonas* is perhaps the most common picoeukaryote in coastal and Arctic waters and is one of the relatively few cultured representatives of the picoeukaryotes available for physiological investigations. In this study, we demonstrate phagotrophy by a strain of *Micromonas* (CCMP2099) isolated from Arctic waters and show that environmental factors (light and nutrient concentration) affect ingestion rates in this mixotroph. In addition, we show size-selective feeding with a preference for smaller particles, and determine P vs I (photosynthesis vs irradiance) responses in different nutrient conditions. If other strains have mixotrophic abilities similar to *Micromonas* CCMP2099, the widespread distribution and frequently high abundances of *Micromonas* suggest that these green algae may have significant impact on prokaryote populations in several oceanic regimes.

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中文摘要

光合微型真核生物 (PPE)是大洋和沿岸生態系中主要的初級生產者與同時也為植物性浮游生物生物量的主要貢獻者。由過往分生調查可知，超微真核生物具有高度親緣多樣性，在大洋中 Prymnesiophyceae 和 Chrysophyseae 是常見的種類，而在沿海和北極水域 Prasinophyceae 是常見的優勢種類。PPE 除了是初級生產者外，在過去的研究中 PPE 曾被指出其是混營物在大洋中是主要嗜菌者。混營是指說單一細胞中具有行光合作用及吞噬細菌能力。在大部分的光合作用生物分類群中都可發現混營生物的存在。然而，綠藻在內的青綠藻(prasinophyte)則被廣泛認為是一群純自營性生物。青綠藻中的 *Micromonas* 可能是沿海和北極水域中最常見的超微真核生物，並且是 PPE 中少數可培養的代表物種，且 *Micromonas* 已有一些生理研究。在本研究中，我們證明一株自北極水域分離出 *Micromonas* (CCMP2099)有嗜菌現象，並說明了環境因素（光照和營養濃度）會影響這種混營生物的攝食率。此外，在顆粒大小選擇性實驗中，*Micromonas* 偏好較小顆粒，並且在不同營養鹽下會影響 *Micromonas* 的 P vs I（光合作用對光照）反應曲線。如果其他 *Micromonas* 株具有像 CCMP2099 的混營能力，由於 *Micromonas* 分布極廣同時數量極高，在某些海域其嗜菌力可能會對原核生物族群造成重大影響。

參考資料

McKie-Krisberg, Zaid M., and Robert W. Sanders. "Phagotrophy by the picoeukaryotic green alga *Micromonas*: implications for Arctic Oceans." *The ISME journal* 8.10 (2014): 1953-1961.