

國立臺灣海洋大學  
海洋環境與生態研究所 專題討論

中文題目：一株新的 *Picochlorum* (共球藻綱) 物種提供了 Pico 級綠藻混營的證據

英文題目：Evidence for mixotrophy in Pico-Chlorophytes from a new *Picochlorum*( Trebouxiophyceae) strain

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### Abstract

Mixotrophs are increasingly recognized for their wide distribution in aquatic ecosystems and significant contributions to biogeochemical cycling. Many taxa within the phyla Chrysophyta, Cryptophyta, and Haptophyta are capable of phago-mixotrophy, however, phagotrophy in the Chlorophyta remains controversial due to insufficient research and solid evidence. In this study, we identified a new strain, *Picochlorum* sp. GLMF1 (Trebouxiophyceae), using 18S rRNA gene analysis and morphological observations. It displayed multi-cell division through autosporulation (two- or four-cell daughters) and has two unequal flagella that have never been reported in the genus *Picochlorum*. By using multiple methods, including 3D bioimaging analysis, acidic food vacuole-like compartment staining, and prey reduction calculation, we discovered and confirmed bacterivory in *Picochlorum*, which provided strong evidence for phago-mixotrophy in this green alga. In addition, we found that *Picochlorum* sp. GLMF1 cannot grow under complete darkness or prey-depleted conditions, suggesting that both light and bacteria are indispensable for this strain, and its mixotrophic nutrition mode is obligate. Like other phago-phototrophs, *Picochlorum* sp. GLMF1 is capable of regulating their growth and ingestion rates according to light intensity and inorganic nutrient concentration. The confirmation of mixotrophy in this *Picochlorum* strain advances our understanding of the trophic roles of green algae, as well as the photosynthetic picoeukaryotes, in marine microbial food webs.

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中文摘要

混營生物廣泛分佈特性和在生物地球化學循環的重要貢獻日益被認識。許多屬於金藻門、隱藻門和裸藻門的生物具噬菌能力的混營行為，然而，在門中，由於研究不足和證據不夠堅實，綠藻混營攝食仍然存在有相當爭議。在本研究中，我們通過 18S rRNA 基因分析和形態學觀察鑑定了一個新的物種，*Picochlorum* sp. GLMF1 (共球藻綱)；並發現其展示了透過孢子分裂的多細胞的特徵(二個或四個細胞的子代)，並且具有兩個不等長的鞭毛，這個種類在 *Picochlorum* 屬中尚未報導過。通過使用多種方法，包括 3D 生物成像分析、酸性食泡染色和餌料減少為 *Picochlorum* 中的噬菌能力提供了強而有力的證據。此外，發現 *Picochlorum* sp. GLMF1 無法在完全黑暗或無餌料的條件下生長，這表明光和細菌對於該物種均是不可或缺成長因子，可知其混營必要之生存模式。與其他噬菌光合作用生物一樣，*Picochlorum* sp. GLMF1 能夠根據光照強度和無機營養濃度調節其生長和攝食速率。這種 *Picochlorum* 行混營生活增進我們理解對綠藻以及行光合作用的真核生物在海洋微生物食物網中的營養角色。

參考資料

Pang, M., Liu, K., & Liu, H. (2022). Evidence for mixotrophy in pico-chlorophytes from a new *Picochlorum* (Trebouxiophyceae) strain. *Journal of Phycology*, 58(1), 80-91.