

洱海鱼腥藻优势种的形态鉴定与 16S rRNA 基因序列分析

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摘要: 分别在 2004 年、2005 年和 2006 年洱海鱼腥藻水华暴发时期, 分离优势种, 获得藻株 EH-A、EH-B 和 EH-C, 通过形态学特征和 16S rRNA 基因序列分析鉴定了藻株的种类。选用藻丝的形态、气囊的存在与否、异形胞和孢子的位置、各种细胞的形状以及营养细胞、异形胞和孢子的大小等传统的分类特征描述藻株的形态。依据形态特征, 初步判断这 3 个藻株可能为卷曲鱼腥藻(*Anabaena circinalis*)或 *A. crassa* 株系成员。利用 16S rRNA 基因序列构建邻接树分析了藻株间的系统进化关系, 分析表明: 藻株 EH-A、EH-B 和 EH-C 序列的同源性达到 100%, 且与 *A. circinalis* 和 *A. crassa* 藻株组成一个群(cluster), 其藻株间的序列相似度高达 100%, 进一步说明藻株 EH-A、EH-B 和 EH-C 为相同的物种, 且均为卷曲鱼腥藻(*A. circinalis*)或 *A. crassa*。

关键词: 洱海; 优势种; 形态特征; 系统进化; 卷曲鱼腥藻

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Taxonomic Evaluation of Dominant Species of *Anabaena* in Lake Erhai Based on Morphology and 16S rRNA Gene Sequences

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Abstract: Three strains of *Anabaena* EH-A, EH-B and EH-C were isolated from Lake Erhai during *Anabaena* blooms occurred respectively in 2004, 2005 and 2006 year. Taxonomic evaluation of the three strains were investigated based on morphology and 16S rRNA gene sequences in the study. Morphological features were described by the traditional morphological criteria: morphology of filament; presence or absence of gas vesicles; location of heterocytes and akinetes; shape of vegetative cells, heterocytes, akinetes and terminal cells; length and width of vegetative cells, heterocytes and akinetes. Based on these morphological characteristics, the three strains were classified as *A. circinalis* & *A. crassa* group. The phylogenetic tree inferred from sequence analysis of the 16S rRNA gene showed that strains EH-A, EH-B and EH-C displayed 100% sequence homology. Another, the three strains closely clustered a group with some strains of *A. circinalis* & *A. crassa* group and also exhibited 100% sequence similarity. Therefore, it was suggested that the three strains EH-A, EH-B and EH-C were all the members of *A. circinalis* & *A. crassa* group.

Key words: Lake Erhai; Dominant species; Morphology; Phylogenetic analysis; *Anabaena circinalis*

洱海位于云贵高原西部,大理白族自治州境内,湖面积 246 km²,平均水深 10.5 m,容积 27.7 亿 m³,为云南省第二大淡水湖泊,在大理地区担负着生活、工业、农灌、城市用水、航运、旅游、养殖、调节气候等多种功能,是大理州生态、经济、社会发展的基础条件^[1]。但近年来随着社会经济的发展,人类对洱海

开发活动的不断加剧,洱海现正处于中营养水平向富营养湖泊的过渡阶段^[2],蓝藻水华也频繁出现。尽管近两年加大了对洱海的治理,但蓝藻水华依然是困扰洱海可持续发展的重要问题。鱼腥藻水华^[3,4]是洱海常见的蓝藻水华,其发生面积广,持续时间长,一般洱海全湖在 5 ~ 10 月份都会出现鱼腥

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