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## Origin and molecular evolution of endosymbiotic cyanobacteria seen in rhopalodiacean diatoms

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Members of the diatom family Rhopalodiaceae possess cyanobacterium-like structures termed spheroid bodies, as well as the typical plastid, in their cells. Although the precise function of the spheroid bodies in the diatom cells remains unclear, photosynthesis is unlikely to occur in the spheroid bodies as they are devoid of chlorophyll autofluorescence and only possess degenerate thylakoid membrane. Rather, the spheroid bodies are proposed to carry out nitrogen fixation for the host cells, since nitrogen-fixing capacity was observed in *R. gibba*, one of spheroid-body-bearing diatoms. In addition, past studies showed that the spheroid bodies cannot survive outside host cells, implying that they are well integrated into the host cell system. Understanding of the organelle acquisition mechanism through endosymbiosis is one of major issue for trace evolution of eukaryotes and, in this matter, in-depth investigations on the spheroid bodies in rhopalodiacean diatoms may provide key insights. However, because most of past studies for spheroid body have been done with only *R. gibba*, origin and evolutionary process of spheroid bodies in Rhopalodiaceae still remain unclear.

In this study, firstly we amplified the small subunit ribosomal DNA sequences from both host and spheroid bodies in three rhopalodiacean diatom species. Phylogenetic analyses considering these new sequences clearly indicate that the spheroid bodies were acquired by a common ancestor of rhopalodiacean diatoms and have been retained during host speciation. Then we detected nucleotide sequence of the nitrogen-fixation gene cluster from spheroid bodies of *Epithemia turgida*, and compared it with corresponding region of *R. gibba* which has been already reported. Two sequences shared most of gene eliminations and pseudogenizations that likely occurred along with the genome reduction, but also certain difference has been found. This implies that major genome mutations have occurred before the split of present rhopalodiacean diversity and then independent evolutions accompanying host speciation have been going in spheroid body genomes.

Keywords: Endosymbiosis, Cyanobacteria, Nitrogen fixation, Diatom