東南極スカルブスネス露岩域湖沼群から
分離された培養可能な菌類の多様性と低温適応

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Cold adaptation of fungi obtained from soil and lake sediment in the Skarvsnes ice‐free area, East Antarctica

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A total of 71 isolates were collected from lake sediment and soil surrounding lakes in the Skarvsnes area, Antarctica. Based on ITS region sequence similarity, these isolates were classified to 10 genera. Twenty-three isolates were categorized as Ascomycetous fungi from five genera *(Embellisia, Phoma, Geomyces, Tetracladium* or *Thelebolus*) and 48 isolates were categorized as Basidiomycetes fungi in five genera (*Mrakia, Cryptococcus, Dioszegia, Rhodotorula,* or *Leucosporidium*). 35% of culturable fungi were of the genus *Mrakia*. Eighteen isolates from eight genera were selected and tested for both antifreeze activity and capacity for growth under temperatures ranging from -1°C to 25°C. *Rhodotorula* sp. NHT-2 possessed a high degree of sequence homology with *R. gracialis*, while *Leucosporidium* sp. BSS-1 possessed a high degree of sequence homology with *Leu. antarcticum* (Glaciozyma antarctica), and these two isolates demonstrated antifreeze activity. All isolates examined were capable of growth at -1°C. *Mrakia* spp., while capable of growth at -1°C, did not demonstrate any antifreeze activity and exhibited only limited secretion of extracellular polysaccharides. Since species of genus *Mrakia* possessed high concentrations of the unsaturated fatty acids, it was concluded that the genus may have achieved adaptation to cold environments through high membrane fluidity.

東南極スカルブスネス露岩域に点在する 16 の湖沼の周辺土壌および湖底堆積物から計 71 株の培養可能な菌類を取得した。これらの菌株を ITS 領域の配列に基づき分類したところ、23 株が 5 属*(Embellisia, Phoma, Geomyces, Tetracladium* or *Thelebolus*)の子嚢菌類に 48 株が 5 属(*Mrakia, Cryptococcus, Dioszegia, Rhodotorula,* or *Leucosporidium*)の担子菌類にそれぞれ分類された。最も分離頻度が高かったのは *Mrakia* 属菌で全体の約 35%を占めていた。分離した 8 属から 18 株を選抜し -1℃～25℃での生育試験と不凍活性を調べた結果、全ての菌株で -1℃での生育が確認できたのに対し、不凍活性は ITS 領域の配列で *Rhodotorula gracialis* と高い相同性を持つ *Rhodotorula* sp. NHT-2 株と *Leucsporidium antarcticum* と高い相同性を持っている *Leucosporidium* sp. BSS-1 のみが示した。 優先種であった *Mrakia* 属菌は 不凍活性が検出されていない上、菌体外多糖もわずかにしか分泌していないにも関わらず -1℃で生育できるという特徴を持っていた。そこで、今回分離した代表的な菌株の菌体脂肪酸組成を調べたところ、*Mrakia* 属菌は他の属と比べて高い不飽和脂肪酸濃度を持っていることから、この属は高い膜流動性によって低温環境に適応いていると予想した。

Reference

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