

Taxonomy of a new snow-inhabiting species of *Chloromonas* based on the use of cultured and field-collected materials

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Abstract:

Description of 'colored snow' dates back to the work of Aristotle. This phenomenon is principally caused by blooms of psychrophilic microalgae. Within green, reddish or brown snow, cold-adapted species of the unicellular biflagellate genus *Chloromonas* belonging to the Volvocales, are generally dominant (1).

Taxonomic studies of snow-inhabiting *Chloromonas* were primarily carried out based solely on the light microscopy of field-collected materials. Partial life cycles (from vegetative cells to zygotes) of several snow *Chloromonas* species were observed on the basis of continuous observations of field-collected materials from North America (e.g. 2). Among the species, *C. nivalis* was considered cosmopolitan because the cysts morphologically identical to the zygotes of this species from North America are distributed worldwide (2,3). Currently, *C. nivalis* is generally identified based solely on zygote or cyst morphology (e.g. 4), since germination of field-collected cysts of snow-inhabiting *Chloromonas* species has never been successfully induced (5). However, molecular data suggested the polyphyly of field-collected cysts identified as *C. nivalis* (6). Recently, Matsuzaki et al. (7) demonstrated that one Japanese lineage of such *C. nivalis* zygotes is actually conspecific with *C. miwae*, on the basis of molecular data of multiple DNA regions obtained from culture strains and field-collected cysts. Therefore, further taxonomic studies are required to reveal the accurate species identification and correct diversity of snow-inhabiting *Chloromonas* using combined molecular analyses of culture strains and field-collected cysts.

Here, we delineated a new snow-inhabiting species of *Chloromonas* based on the use of cultured and field-collected materials from Japan. The vegetative morphology of this species differed from those of all previously described snow *Chloromonas* species. Some field-collected cysts from Mt. Hakkoda, Aomori, Japan and Mt. Tateyama, Toyama, Japan could be identified as this new species on the basis of molecular data whereas they were morphologically similar to the zygotes of *C. nivalis* under light microscopy. Multigene phylogeny showed that the new species was sister to *C. miwae*, which also has *C. nivalis*-like cysts (7). However, the present field-emission scanning electron microscopy demonstrated that the cysts of the new species could be clearly distinguished from those of *C. miwae* by the differences of the flanges' form developing on the cell wall.

References:

1. Hoham & Duval (2001) Snow Ecology, Cambridge University Press, Cambridge.
2. Hoham & Mullet (1977) Phycologia 16:53.
3. Hoham & Mullet (1978) Phycologia 17:106.
4. Lukavský & Cepák (2010) Acta Botanica Croatica 69:163.
5. Remias et al. (2010) Protoplasma 243:73.
6. Muramoto et al. (2008) Cytologia 73:91.
7. Matsuzaki et al. (2015) Phycologia 54:491.