（学位第３号様式）

学 位 論 文 要 旨

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題　目	Ecophysiological study of some freshwater red algae from southern Japan （南日本産淡水紅藻類数種の生理生態に関する研究）

The temperature and light responses of photosynthesis in some freshwater red algae, *Thorea okadae* (*To*), *Thorea gaudichaudii* (*Tg*; Thoreaceae), *Virescentia helminthosa* (*Vh*) and *Sheathia arcuata* (*Sa*; Batrachospermaceae) that can be found in southern Japan were determined by a pulse amplitude modulation (PAM)-chlorophyll fluorometer and dissolved oxygen sensors. As for *T. gaudichaudii*, those in both macroscopic (MAC) and microscopic (MIC) life-history stages in the heteromorphic life history were determined. Net oxygenic photosynthesis–irradiance models of four species revealed that the response to the irradiance was different in species (saturation irradiance [E_k]: 55.2 for *To*; 26.6 [MAC] and 30.0 [MIC] for *Tg*; 18.8 for *Vh*, 17.7 μmol photons m^{-2} s^{-1} for *Sa*), and the latter three species were considered to be adapted to the low irradiance environment. A temperature–dependent model (8~40°C) of net photosynthesis and dark respiration for four species showed characteristic shingle-peak temperature responses, and the gross photosynthetic rate (GP_{max}), was highest at around 26 – 36°C (30.8°C for *To*; 32.1°C [MAC] and 35.7°C [MIC] for Tg; 26.4°C for *Vh*; and 30.3°C for *Sa*). The dark respiration rate exponentially increased in response to temperature. The maximum quantum yields (F_v/F_m) in the Photosystem II (PSII) for four species were dome-shaped with respect to temperature; however, it was generally stable at low temperatures (8–20°C) with the highest value of around 0.4 – 0.6 occurring at 18.4°C for *To*, 17.8°C [MAC] and 15.0°C [MIC] for *Tg*, 18.5°C for *Vh* and 20.9°C for *Sa*, respectively. Continuous exposure (12 hours) to low (50 or 100 μmol photons m^{-2} s^{-1}) and high (1,000 μmol photons m^{-2} s^{-1}) irradiance at 12, 16 and 24°C for four species revealed greater declines in their effective quantum yield (Φ_{PSII}) in all species under high irradiance, signifying the influence chronic photoinhibition. Nevertheless, the F_v/F_m mostly recovered after a subsequent 12-h dim-light acclimation for *V. helminthosa* and *S. arcuata*, suggesting the potential of recovery from day-time chronic photoinhibition. Diurnal change of Φ_{PSII} and incident irradiance of the macroscopic stage of *T. gaudichaudii* under the filed measurement revealed the midday depression of Φ_{PSII}; however, there was little direct sunlight due to the shading by the trees and algae were occurring on the shaded locations in the freshwater spring. Given the results of four freshwater red algae can be regarded to be well adapted to a low irradiance environment but can also be a partly tolerable relatively high irradiance environment that enables them to occur on the canal floor with no shade. Nevertheless, shading by the surrounding riparian vegetation is beneficial for many freshwater algae especially these four species, and it is relevant when proposing strategies for conservation and restoration.