（学位第３号様式）

学 位 論 文 要 旨

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題　目	The effect of temperature and irradiance on the photosynthesis of tree seagrasses, *Zostera marina*, *Halodule uninervis*, and *Enhalus acoroides* from southern Japan（南日本産海産顕花植物 3 種，アマモ，ウミジグサ，ウミショウブの光合成に対する光と温度の影響）

The effect of temperature and light on the photosynthesis of three seagrasses, *Zostera marina*, *Halodule uninervis*, and *Enhalus acoroides* from southern Japan was determined by field and laboratory measurements using a pulse amplitude modulation (PAM)-chlorophyll fluorometer and optical dissolved oxygen sensors. Regarding the seedlings of *Z. marina* from the annual population in Kagoshima, the temperature response of $\Delta F/F_m'$ under 50 μmol photons m^{-2} s^{-1} (12L12D photoperiod) and during five days of cultivation revealed that $\Delta F/F_m'$ gradually increased to the optimal temperature (19.0–27.4°C), then quickly declined at higher temperatures. The 12-hour chronic combined effects of temperature and light at 8 and 20°C, under 200 and 1,000 μmol photons m^{-2} s^{-1} showed that the depression of $\Delta F/F_m'$ was more pronounced under the low temperature with high light, indicating the occurrence of chronic low temperature–light stress. The temperature response of the oxygenic gross-photosynthesis curve indicated an optimal temperature at 31.0°C, then declined at higher temperatures. The underwater measurements of natural communities of *Z. marina* in Kagoshima showed that the $\Delta F/F_m'$ declined with increasing incident light, with a minimum occurring during noon to early afternoon. Nevertheless, $\Delta F/F_m'$ recovered by sunset. On a tropical seagrass, *Halodule uninervis* from Amami-Oshima Island, the response of oxygenic photosynthesis to irradiance (0–1000 μmol photons m^{-2} s^{-1}) at 15 and 24°C revealed that the maximum net photosynthesis (NP_{max}) was 14.7 and 51.9 μg O2 g_{ww}^{-1} min^{-1}, respectively. The temperature response of gross photosynthesis showed the highest gross photosynthetic rate occurred at 30.5°C. In contrast, the temperature response of the maximum quantum yield (F_v/F_m) of photosystem II after 3 days of cultivation in darkness revealed that F_v/F_m gradually increased to the optimal temperature at 23.9°C, then gradually declined at higher temperatures. The combined effects of 12-hour chronic exposure to temperature and irradiance at 15 and 24°C, under 300 and 1000 μmol photons m^{-2} s^{-1} showed that the depression of F_v/F_m was more pronounced under the low temperature with high irradiance, indicating the occurrence of chronic low temperature–light stress. The underwater measurements of the $\Delta F/F_m'$ in a tropical seagrass, *Enhalus acoroides* from Yaeyama Islands of Okinawa under incident sunlight from sunrise through sunset revealed that the $\Delta F/F_m'$ declined with increasing incident sunlight in the morning, with the $\Delta F/F_m'$ minima occurring during noontime. Thereafter, the $\Delta F/F_m'$ gradually recovered during the afternoon incident sunlight decreased, indicating a dynamic negative response to the excess sunlight. The decline of $\Delta F/F_m'$ in the *Z. marina* and *E. acoroides* habitats is likely a photoprotective response to protect the photosynthetic reaction center from damage by excess light energy. Apparently, three species seem to be adapted to the current temperature range at the habitat where it is in the northernmost/southernmost distributional limit; however, it might be close to their threshold level for each species. More importantly, the combined effect of low temperature and high irradiance might be caused a strong depression of the photochemical efficiency, and it might be influenced the flourishing or elimination of each species, especially for the habitat at the northern distributional limit.