FLUORESCENCE INDICATORS OF BEAN LEAVES WITH REDUCED CONTENT OF CHLOROPHYLL

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Assessment of the functional activity of the photosynthetic apparatus of plants by non-destructive methods is an important task of biophysics and ecology. The dependence of the fluorescence indices of photosynthetic species on a wide range of biotic and abiotic factors makes them attractive for monitoring the state of the photosynthetic apparatus.

The aim of this work is to study the fluorescence characteristics of plants with reduced content of chlorophyll under the action of different intensities of actinic light. The measurements of the fluorescence induction curves by the method of pulse fluorometry allowing to monitor the functional activity of the photosynthetic apparatus.

Sprouts were grown under conditions of natural shading at illumination intensities 10, 30-40 and 100-150 lx. Actinic light intensities were 150 and 500 $\mu E/(m^2 s^1)$. In the experiment a second tier of leaves counting from the root was used. In low light conditions, the sprouts had elongated stems and small pale coloured leaves. Chlorophyll content in the leaves was determined using acetone extracts according to the technique described in (1).

Fluorescence induction changes of bean leaves were recorded with a PAM-2500 fluorometer (Walz, Germany) with a five-minute pre-adaptation to the dark. The parameter Fv/Fm was measured in accordance with the standard protocol registration induction curves (Fv = Fm-F0 - variable fluorescence was measured in response to a saturating flash of light). It is considered that this parameter describes the maximum photochemical activity of photosystem 2. Fluorescence non-photochemical quenching $NPQ=Fm/F'm^{-1}$ was also measured (F'm - fluorescence in response to a saturating flash of light when leaf was exposed to actinic light). NPQ is known to reflect dissipation of excess radiation energy by heat emission (2).

There is a decrease in the value of fluorescence response to saturating flashes with a decrease of growing illumination (Figure 1). This indicates a reduction of the effective quantum yield (fPSII) of photosystem 2. A similar reduction in fPSII is even more expressed with increasing intensity of actinic light.

Values of Fv/Fm ratio remained almost invariable (about 0.75) up to a significant decrease in leaf chlorophyll content. This fact indicates on the compensating effect maintaining the high photochemical activity of photosystem 2. At the subsequent significant decrease in chlorophyll content, the Fv /Fm ratio sharply declined.

The increase in steady-state values of fluorescence non-photochemical quenching at rise of actinic light intensity indicates an increase in the proportion of the excitation energy dissipated as heat. Low stationary values of the photochemical quenching of fluorescence at high intensity of actinic light indicate an increase in the degree of reduction electron carriers between the photosystems.

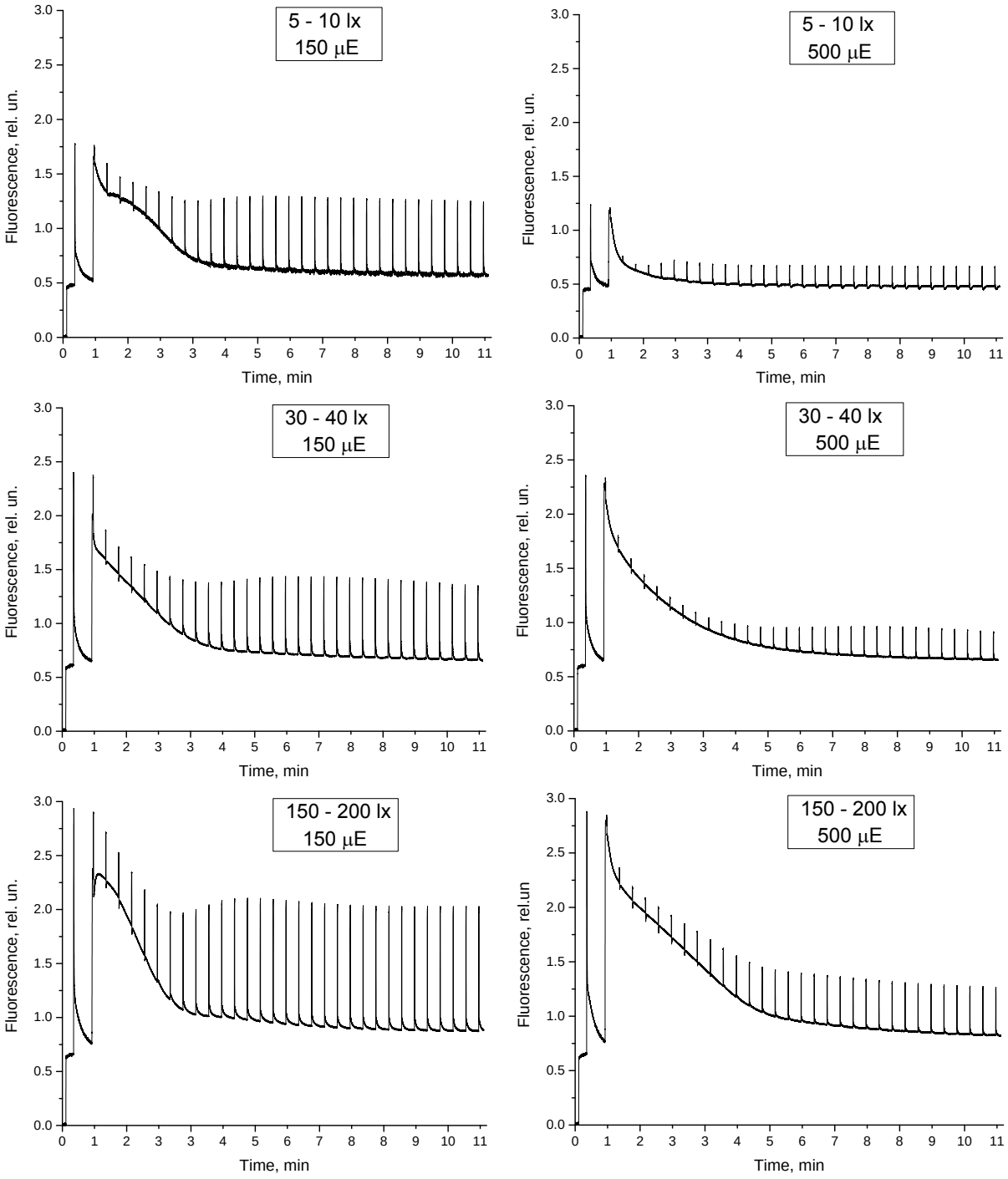

Figure 1: Fluorescent induction curves of bean leaves growing under different light condition.

REFERENCES

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