

Pengaruh Intensitas Radiasi UV-B Terhadap Ekspresi Gen Hsp70, mtHsc70-1, dan cpHsc70-2 pada Daun *Synedrella nodiflora* (L.) Gaertn = Effect of UV-B Radiation Intensity on Hsp70, mtHsc70-1, and cpHsc70-2 Gene Expression in *Synedrella nodiflora* (L.) Gaertn. Leaf

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Abstrak

Kemampuan menghadapi cekaman abiotik, termasuk radiasi UV-B menentukan kemampuan kolonisasi tumbuhan invasif *Synedrella nodiflora* (L.) Gaertn. yang tumbuh di tempat ternaung dan terbuka. *Synedrella nodiflora* diduga toleran terhadap intensitas UV-B yang relatif tinggi. Peningkatan ekspresi gen-gen penyandi Heat Shock Protein 70 (Hsp70) merupakan salah satu respons pertahanan tumbuhan terhadap cekaman UV-B. Oleh sebab itu, perlu dilakukan penelitian untuk membandingkan tingkat ekspresi gen penyandi Hsp70 di sitoplasma, mitokondria, dan plastida (Hsp70, mtHsc70-1, dan cpHsc70-2) pada daun *Synedrella nodiflora* terhadap kondisi lingkungan dengan intensitas radiasi UV-B yang berbeda. Penelitian dan pengukuran faktor lingkungan dilakukan di area kampus Fakultas Matematika dan Ilmu Pengetahuan Alam, Universitas Indonesia, Depok. Real-time PCR digunakan untuk kuantifikasi cDNA Hsp70, mtHsc70-1, dan cpHsc70-2. Kuantitas cDNA tiap gen dinormalisasi terhadap gen TUB sebagai reference gene. Tingkat ekspresi gen relatif dianalisis dengan metode Pfaffl. Lokasi kontrol, ternaung, dan terbuka secara berturut-turut memiliki rerata intensitas radiasi UV-B sebesar $18,4 \pm 0,1$, $44,1 \pm 0,6$, dan $260,1 \pm 78,3$ mW/m². Daun *S. nodiflora* dari lokasi ternaung memiliki tingkat ekspresi gen Hsp70, mtHsc70-1, dan cpHsc70-2 yang meningkat 85,54; 2,41; dan 30,58 kali relatif terhadap TUB. Daun dari lokasi terbuka memiliki tingkat ekspresi gen Hsp70, mtHsc70-1, dan cpHsc70-2 yang meningkat 2,01, 9,46, dan 2,50 kali relatif terhadap TUB. Tingkat ekspresi Hsp70 dan cpHsc70-2 relatif lebih tinggi pada daun yang dikoleksi dari lokasi ternaung, sedangkan mtHsc70-1 relatif lebih rendah. Sebaliknya, tingkat ekspresi Hsp70 dan cpHsc70-2 relatif lebih rendah pada daun yang dikoleksi dari lokasi terbuka, sedangkan mtHsc70-1 relatif lebih tinggi. *Synedrella nodiflora* di lokasi terbuka diduga telah teraklimatisasi terhadap kondisi lingkungan dengan suhu, intensitas cahaya, dan intensitas UV-B yang relatif lebih tinggi. Hal tersebut menyebabkan *S. nodiflora* di lokasi terbuka mengalami peningkatan suhu, intensitas cahaya, dan intensitas UV-B minimum yang dibutuhkan untuk menginduksi peningkatan ekspresi gen Hsp70 dan cpHsc70-2. Gen Hsp70, mtHsc70-1, dan cpHsc70-2 memiliki pola ekspresi yang berbeda pada kondisi lingkungan tumbuh *Synedrella nodiflora*, baik kondisi ternaung maupun terbuka (intensitas radiasi UV-B yang berbeda). Tingkat ekspresi Hsp70, mtHsc70-1, dan cpHsc70-2 diduga juga dipengaruhi oleh faktor lain, di antaranya suhu dan intensitas cahaya.

.....The ability to deal with abiotic stresses, including UV-B radiation determines the colonizing ability of an invasive plant species, *Synedrella nodiflora* (L.) Gaertn. that grows in shaded and open places. *Synedrella nodiflora* may possibly tolerant to relatively high UV-B intensity. Increased expression levels of genes encoding Heat Shock Protein 70 (Hsp70) are one of the plant defense responses against UV-B stress. Therefore, the study aimed was to compare expression levels of genes encoding cytosolic, mitochondrial, and plastid Hsp70 (Hsp70, mtHsc70-1, and cpHsc70-2) in *Synedrella nodiflora* leaves against environmental conditions with different UV-B radiation intensities. Research and measurement of environmental factors

were carried out in Faculty of Mathematics and Natural Sciences campus area, Universitas Indonesia, Depok. Real-time PCR was used to quantify Hsp70, mtHsc70-1, and cpHsc70-2 cDNA. cDNA quantity of each gene was normalized to TUB gene as reference gene. Relative gene expression levels were analyzed using Pfaffl method. Average UV-B intensity radiation in control, shaded, and open locations were $18,4 \pm 0,1$, $44,1 \pm 0,6$, and $260,1 \pm 78,3$ mW/m², respectively. *Synedrella nodiflora* leaves from shaded location had Hsp70, mtHsc70-1, and cpHsc70-2 expression levels that increased 85,54; 2,41; and 30,58-fold relative to TUB. Leaves from open location had Hsp70, mtHsc70-1, and cpHsc70-2 expression levels that increased 2,01, 9,46, dan 2,50-fold relative to TUB. Expression levels of Hsp70 dan cpHsc70-2 were relatively higher in leaves that collected from shaded location, while mtHsc70-1 was relatively lower. Inversely, expression levels of Hsp70 dan cpHsc70-2 were relatively lower in leaves that collected from open location, while mtHsc70-1 was relatively higher. *Synedrella nodiflora* in open location is possibly have acclimatized to environmental conditions with relatively higher temperature, light intensity, dan UV-B intensity. This acclimatization caused *S. nodiflora* in open location experienced an increase in minimum temperature, light intensity, and UV-B intensity required to induce an increase in Hsp70 dan cpHsc70-2 gene expression. The Hsp70, mtHsc70-1, dan cpHsc70-2 genes have different expression patterns under growth conditions of *S. nodiflora*, both shaded and open conditions (different UV-B radiation intensities). The expression levels of Hsp70, mtHsc70-1, dan cpHsc70-2 may also influence by another factors, including temperature and light intensity.