Fisiogenetik dan Seleksi Bunga Matahari (*Helianthus annuus* L.) Toleran Cekaman Kekeringan

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INTISARI

Tujuan penelitian ini adalah mempelajari respon fisiogenetik tanaman bunga matahari terhadap cekaman kekeringan dan memilih aksesi yang mempunyai kemampuan toleran terhadap tingkat cekaman tertentu. Penelitian dilakukan dalam tiga tahapan, yaitu (1) mengkaji respon tanaman bunga matahari dan penentuan batas toleransinya terhadap tingkat cekaman kekeringan, (2) mengevaluasi potensi plasma nutfah tanaman bunga matahari lokal Indonesia dan seleksi terhadap cekaman kekeringan, (3) toleransi bunga matahari terhadap cekaman kekeringan berdasarkan karakter fisiogenetik. Keseluruhan penelitian merupakan penelitian eksperimental. Rancangan penelitian di rumah kaca dan di lapang dilakukan menggunakan Rancangan Acak Kelompok. Data kuantitatif dianalisis menggunakan analisis varian (ANOVA), dan apabila terdapat perbedaan nyata maka digunakan analisis lanjut dengan uji Beda Nyata Jujur (BNJ). Data potensi keragaman plasma nutfah diuji menggunakan uji t, dilanjutkan dengan seleksi berdasarkan nilai batas seleksinya. Data hasil PCR dan sekuensing dianalisis secara deskriptif. Hasil sekuens masing-masing sampel dilacak dan dikonfirmasi antara hasil sekuen *forward* dan *reverse* dengan menggunakan *software Sequence Scanner* v1 dan *Bioedit*. Selanjutnya data disejajarkan dengan program *Clustal W* menggunakan *Software Bioedit* dan program *Basic Local Alignment Search Tool* (BLAST) yang terdapat di NCBI. Hasil penelitian diperoleh informasi bahwa: 1). Kondisi cekaman kekeringan di bawah 80% kapasitas lapang (KL) dapat menurunkan pertumbuhan tanaman, menghambat pembungaan, pembentukan biji bunga matahari dan menurunkan kadar minyak. 2). Tiga puluh tiga aksesi mempunyai potensi dan karakter yang beragam terhadap cekaman kekeringan. Terpilih 10 aksesi bunga matahari, yaitu: HA01, HA12, HA21, HA22, HA25, HA26, HA28, HA44, HA45, dan HA50 yang berpotensi untuk dapat dikembangkan di Indonesia. 3). Tanaman yang mengalami cekaman kekeringan mengalami perubahan karakter morfologi dan fisiologisnya, antara lain tinggi tanaman, ukuran daun, diameter batang, penampilan akar, kerapatan stomata dan bulu daun. Kemampuan fotosintesis, transpirasi, akan semakin berkurang, kecuali kandungan prolin dan ABA cenderung meningkat. Mekanisme toleransi terhadap kekeringan dikendalikan oleh salah satu gen kekeringan pada bunga matahari yaitu gen *HaDhn* yang berukuran 927 bp. Berdasarkan hasil sekuens daripada aksesi toleran (HA21) berbeda dengan aksesi lain yang moderat maupun peka, namun tidak berbeda pada *consensus region* untuk karakter gen tahan kekeringan. Hal ini menunjukkan bahwa setiap aksesi mempunyai tanggapan sendiri terhadap cekaman kekeringan. 4) Didapatkan tiga aksesi bunga matahari toleran terhadap kekeringan, yaitu: HA21, HA44, HA45.

Kata kunci: *Helianthus annuus* L., fisiogenetik, seleksi, cekaman kekeringan

Physiogenetic and selection of sunflower (*Helianthus annuus* L.) tolerant toward drought stress

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ABSTRACT

The aim of this research was to study the physiogenetic response and to screen on drought tolerant sunflower plants. The research was divided in three part: (1).the response of sunflower plants and the identification of their tolerance toward drought stress, (2). evaluating the potential of local sunflower plants and selection toward drought stress., (3). The tolerance of sunflower plants under drought stress based on physiogenetic characteristic. The quantitative data were analyzed by Analysis of Variant (ANOVA), and if there were significant differences then further analysed by Honestly Significant Difference (HSD) test. The data of potential of local sunflowers were tested using t-test, followed by a selection based on its selection limit value. The PCR and sequencing result data were analyzed descriptively. The sequent result of each sample was traced and confirmed between the forward and reverse sequent results using the Sequence Scanner v.1 and Bioeditsoftwares. Furthermore, the data were aligned with the Clustal W program using the Bioedit software and Basic Local Alignment Search Tool (BLAST) program on the NCBI. The result of the research were: (1). The condition of drought stress less above 80% of Field Capacity (FC) can reduce plant growth, inhibit the blossoming, seed formation of sunflower and decrease oil content.(2). Thirty three sunflower accessions had various potentials and characters toward drought stress. Ten sunflower accessions were selected, namely: HA01, HA12, HA21, HA22, HA25, HA26, HA28, HA44, HA45, and HA50 that have the potential to be cultivated in Indonesia., (3). Each sunflower accession that was put under drought stress had different tolerance level. HA21, HA45, and HA44 were the accessions with drought stress tolerance supported by their full-bodied seed character. Plants that suffered drought stress underwent character changes on both their morphology and physiology, including plant height, size of leaves, stem diameter, root appearance, stomatal density, and feather of leaves. Their abilities in photosynthesis and transpiration were decreasing, except for their prolin and ABA level that increased highly significant. The tolerance mechanism per plant that was controlled by one of drought genes on sunflower, namely *HaDhn* gene which is 927 bp in size.The sequence result of the tolerant accession (HA21) differed from other moderate or sensitive accessions, but was similar to the consensus region for the gene character of drought resistance. It showed that each accession responded differently toward drought stress. (4). Three accessions, namely: HA21, HA44, and HA45, respectively, were drought tolerance sunflowers.

Key words: *Helianthus annuus* L., physiogenetic, selection, drought stress, drought tolerance