ABSTRAK

DETEKSI, KARAKTERISASI MOLEKULER, DAN EKSPRESI GEN P5CS PADA VARIETAS TEBU (*Saccharum officinarum* L.) KOMERSIAL TOLERAN CEKAMAN KEKERINGAN

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Upaya yang dilakukan untuk menghasilkan varietas yang toleran terhadap cekaman kekeringan yaitu pemuliaan tebu melalui rekayasa genetika dengan mendeteksi dan mengkarakterisasi gen *Pyrroline 5-Carboxylate Synthetase* (P5CS) yang mampu mengkode sintesis prolin. Tujuan dari penelitian ini adalah mendeteksi keberadaan gen P5CS, mengkarakterisasi secara molekuler, dan menganalisis ekspresi gen P5CS pada varietas tebu komersial di PT Gunung Madu Plantations (GMP).

Penelitian ini dilaksanakan di Laboratorium *Polymerase Chain Reaction* (PCR) PT GMP, Lampung Tengah, Laboratorium Biomolekuler, Jurusan Biologi Fakultas Matematika dan Ilmu Pengetahuan Alam, Universitas Lampung, serta Laboratorium Bioteknologi, Fakultas Pertanian, Universitas Lampung pada bulan Juni 2023 s.d Maret 2024. Penelitian menggunakan 15 varietas tebu komersial di PT GMP yang diberikan cekaman kekeringan skala *green house* selama 6 hari. Metode yang dilakukan adalah pengamatan morfologis, PCR konvensional, dan *Real-Time* PCR (qPCR). Analisis data pengamatan morfologis dilakukan secara deskriptif dan skoring melalui analisis fenetik. Analisis data PCR konvensioanl melalui perhitungan nilai *Polimorfisme Information Content* (PIC) dan *alignment* menggunakan *Clustal W Alignment* BioEdit, lalu divisualisasikan melalui pohon filogenetik. Analisis data qPCR menggunakan uji BNJ 5% melalui *software* IBM SPSS versi 22.0 berdasarkan data ct-value.

Hasil penelitian ini yaitu deteksi gen P5CS dari 15 varietas tebu komersial di PT GMP yang berpotensi toleran terhadap cekaman kekeringan melalui PCR konvensional adalah varietas RGM210. Karakterisasi molekuler ditujukan pada hasil sekuensing 6 varietas perlakuan (GMP 3 ± 471 bp, GMP 5 ± 88 bp, GP 11 ± 164 bp, RGM 1183 ± 142 bp, RGM 210 ± 120 bp, RGM 665 ± 99 bp, dan 1 varietas kontrol (PSJT 941 ± 401 bp). Ekspresi gen pada 15 varietas tebu komersial di PT GMP menunjukkan nilai *ct value* tertinggi oleh varietas RGM210 sehingga berpotensi toleran cekaman kekeringan.

Kata Kunci: Deteksi, Ekspresi Gen P5CS, Karakterisasi Molekuler, PCR Konvensional, *Real-Time* PCR

ABSTRACT

DETECTION, MOLECULAR CHARACTERIZATION, AND EXPRESSION OF THE P5CS GENE IN COMMERCIAL VARIETIES OF SUGAR CANE (*Saccharum officinarum* L.) TOLERANT TO DROUGHT STRESS

By

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Efforts are being made to produce varieties that are tolerant to drought stress, namely sugar cane breeding through genetic engineering by detecting and characterizing the Pyrroline 5-Carboxylate Synthetase (P5CS) gene that can code for proline synthesis. This research aims to detect the presence of the P5CS gene, characterize it molecularly, and analyze the expression of the P5CS gene in commercial sugarcane varieties at PT Gunung Madu Plantations (GMP).

This research was carried out at the Polymerase Chain Reaction (PCR) Laboratory of PT GMP, Central Lampung, Biomolecular Laboratory, Biology Department, Faculty of Mathematics and Natural Sciences, University of Lampung, and Biotechnology Laboratory, Faculty of Agriculture, University of Lampung in June 2023 to March 2024. The research used 15 commercial sugarcane varieties at PT GMP subjected to greenhouse-scale drought stress for 6 days. The methods used were morphological observation, conventional PCR, and Real-Time PCR (qPCR). Morphological observation data was analyzed descriptively and scored through phenetic analysis. Analysis of conventional PCR data through calculating Polymorphism Information Content (PIC) values and alignment using Clustal W Alignment BioEdit, then visualizing via a phylogenetic tree. qPCR data analysis using the 5% BNJ test via IBM SPSS version 22.0 software based on ct-value data.

The results of this research are the detection of the P5CS gene from 15 commercial sugarcane varieties at PT GMP that have the potential to be tolerant to drought stress via conventional PCR, namely the RGM210 variety. Molecular characterization was aimed at the sequencing results of 6 treatment varieties (GMP 3 ± 471 bp, GMP 5 ± 88 bp, GP 11 ± 164 bp, RGM 1183 ± 142 bp, RGM 210 ± 120 bp, RGM 665 ± 99 bp, and 1 control variety (PSJT 941 ± 401 bp). Gene expression in 15 commercial sugarcane varieties at PT GMP showed the highest ct value by the RGM210 variety so it has the potential to be tolerant of drought stress.

Keywords: Detection, P5CS Gene Expression, Molecular Characterization, Conventional PCR, Real-Time PCR