

**DETEKSI DINI EKSPRESI SEKS PEPAYA (*Carica papaya* L) SECARA
MORFOLOGI DAN MOLEKULER**

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DETEKSI DINI EKSPRESI SEKS PEPAYA (*Carica papaya* L) SECARA MORFOLOGI dan MOLEKULER

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Abstrak

Tanaman pepaya memiliki tiga tipe pembungaan, yaitu tanaman dengan bunga jantan, bunga betina dan bunga hermaphrodit (bunga sempurna). Perbedaan dalam ekspresi seks mempengaruhi bentuk buah dan produksi tanaman. Untuk menentukan benih yang akan menjadi tanaman jantan, betina atau hermaphrodit sulit dilakukan sejak dini. Marka morfologi yang digunakan petani belum terbukti akurat dan valid. Pendekatan secara marka molekuler berbasis SNP (*single nucleotide polymorphism*) pada fragmen DNA tanaman jantan dan hermaphrodit diharapkan

Tujuan umum penelitian ini adalah pengembangan marka molekuler SNAP berbasis SNP DNA tanaman jantan dan hermaphrodit sehingga dapat digunakan untuk deteksi sejak dini tanaman betina, tanaman pepaya jantan dan tanaman hermaphrodit serta tervalidasi dengan marka morfologi tanaman di lapangan. Penelitian dilakukan di Laboratorium BPSI Tanaman Buah Tropika Solok, dengan menggunakan dua genotipe pepaya, yaitu varietas Merah Delima dan Lokal Semangko.

Karakter kuantitatif morfologi bunga jantan dari tanaman *hermaphrodit* lebih besar daripada bunga jantan dari tanaman jantan murni. Terdapat perbedaan ukuran panjang dan lebar mahkota bunga antara keduanya. Bunga betina (*female*) memiliki ukuran yang lebih besar dibanding dengan bunga hermaphrodit. Hasil seleksi enam primer SCAR terkait seks tanaman pepaya (W11, T1, T12, PKBT5, SDp, and Napf 2) terpilih dua primer W11 dan T12 yang konsisten menghasilkan amplicon DNA tanaman yang dapat membedakan betina dengan tanaman jantan dan hermaphrodit. Peruntukan nukleotida DNA tanaman jantan dan hermaphrodit teridentifikasi perbedaan variasi nukleotida (SNP) pada fragmen DNA tanaman jantan dan hermaphrodit, pada basa ke 25 bp [T/C.] Pengembangan marka SNAP berbasis SNP berhasil mendesain primer SNAP W11 dan T12 yang digunakan untuk membedakan fragmen DNA jantan, betina dan hermaphrodit. Pola amplifikasi DNA jantan yaitu terbentuknya amplicon DNA pada alel *reference*, jika betina amplifikasi tidak menghasilkan pita DNA dan jika terdeteksi hermaphrodit amplifikasi DNA terbentuk pada alel *alternate* saja. Validasi berdasarkan posisi benih dalam buah serta warna benih dengan primer SNAP T12 dan W11 menunjukkan bahwa benih bagian tengah dan pangkal cenderung menjadi tanaman hermaphrodit. Warna benih hitam dominan menghasilkan tanaman betina sedangkan warna benih coklat cenderung dominan menghasilkan tanaman hermaphrodit. Hasil validasi primer SNAP T12 dan W11 menunjukkan kesesuaian ekspresi seks pepaya Merah Delima dan Lokal Semangko sebelum dan setelah tanaman di lapangan. Hasil pengelompokan berdasarkan analisis PCA (*Principal Component Analysis*)

terhadap data pertumbuhan dan kualitatif daun, baik pepaya Merah Delima maupun Lokal Semangko menunjukkan adanya tingkat kemiripan karakter pertumbuhan yang antar individu dalam genotipe. Kedua genotipe pepaya dipengaruhi secara positif oleh karakteristik pertumbuhan vegetatifnya dan tidak ada pengaruh signifikan terhadap ekspresi seks tanaman.

Kata kunci: *pepaya, determinasi, seks, primer SNAP , morfologi*



MORPHOLOGICAL AND MOLECULAR SEX EXPRESSION OF PAPAYA (*Carica papaya* .L)

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Abstract

Papaya plants have three flowering types *i.e.*: plants with male flowers, plants with female flowers, and plants with hermaphrodite flowers (perfect flowers). Generative propagation of papaya is commonly carried out by farmers, but this method has a weakness, namely the segregation of plant sex expression so that there are differences in sex expression with the parent plants. Differences in sex expression affect fruit shape, fruit quality, and crop production. Early on determining which seeds will produce male, female, or hermaphrodite plants is difficult. The approach of molecular markers based on SNP (*single nucleotide polymorphism*) on male and hermaphrodite DNA fragments is expected to be able to predict the sex expression of papaya plants from an early age.

The aim of this study was to develop SNP-based SNAP molecular markers that would be used to validate morphological markers so that they could be used to identify and differentiate male and hermaphrodite plants from an early age. The research was conducted at the Solok Standard Testing Institute laboratory for The Instrument of Tropical Fruit Crops (BPSI), using two papaya genotypes, namely Merah Delima and the Local Semangko variety.

The results of the study of flower morphology showed that the size of the male flowers from *hermaphrodite plants* was larger than the male flowers from pure male plants. There is a difference in the length and width of the flower crown between the two. Female flowers (*female*) from female plants have a larger size than hermaphrodite flowers from hermaphrodite plants. From the several SCAR primers (W11, T1, T12, PKBT 5, SDp, and Napf 2) tested, two primers W11 and T12 were selected which could distinguish female from male and hermaphrodite plants. The results of nucleotide sequencing identified differences in nucleotide variation in male and hermaphrodite DNA fragments. The development of SNP-based SNAP markers succeeded in designing SNAP W11 and T12 primers that could distinguish male, female, and hermaphrodite DNA fragments. The results of SNAP primer validation on the detection of sex expression of Merah Delima and Local Semangko papayas molecularly using SNAP T12 and W11 primers showed the same plant sex expression after planting on the field. Morphological markers based on the position of the seeds in the fruit and the color of the seeds showed that the position of the seeds in the center of the fruit with the dominant brown seed color produced hermaphrodite plants. These two SNAP markers can be used as markers to detect early sex expression of papaya plants. The results of PCA (*Principal Component Analysis*) analysis of growth data and leaf morphology of the Merah Delima and Local Semangko papayas show that there is a level of similarity in growth characters between individuals in each genotype which is positively influenced by its vegetative growth characteristics.

Keywords: *papaya, determination, sex, SNAP, morphology*