

Penentuan Jenis Kelamin pada Pepaya Gunung (*Vasconcellea pubescens* A.DC.) di Jawa Berdasarkan Karakter Morfologis, Sitogenetis, dan Molekuler

Intisari

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Pepaya gunung (*Vasconcellea pubescens* A.DC.) merupakan anggota Suku Caricaceae yang telah berhasil diintroduksi ke Indonesia, dengan area pertumbuhan yang terfokus di Pulau Jawa. Tanaman buah ini berpotensi sebagai bahan pangan, bahan industri farmasi, dan bahan kosmetik. Pepaya gunung memiliki tiga jenis kelamin dalam populasinya, yaitu betina *dioecious*, jantan *dioecious*, dan *monoecious*. Informasi mengenai Penentuan jenis kelamin pada pepaya gunung masih terbatas. Perbedaan jenis kelamin pada tanaman ini penting bagi petani dalam rangka pembudidayaan. Penelitian ini bertujuan untuk menentukan jenis kelamin pepaya gunung berdasarkan karakter morfologis, sitologis, dan molekuler di Pulau Jawa. Data morfologis diperoleh melalui pengamatan dan pengukuran terhadap 58 karakter, data sitogenetis diperoleh dengan pengamatan dan pengukuran jumlah, ukuran, bentuk, kariotipe, dan indeks asimetri kromosom, sedangkan data molekuler diperoleh melalui deteksi panjang telomer dengan prosedur *Polymerase Chain Reaction* (PCR) dan penggunaan marka berbasis *Sequence Characterized Amplified Region* (SCAR) serta sekuensing DNA berdasarkan primer PMSM2 dan SDP. Data tersebut dianalisis secara deskriptif kualitatif, adapun kerapatan dan panjang trikoma, panjang kromosom, serta panjang telomer dianalisis varians selanjutnya pada perbedaan yang signifikan dilanjutkan dengan Uji Tukey. Sekuen DNA diedit, diolah, dan ditampilkan menggunakan *software* GeneStudio, MEGA 11, dan Bioedit.

Hasil penelitian menjelaskan penentuan jenis kelamin pepaya gunung dapat ditentukan berdasarkan karakter morfologis dan molekuler. Berdasarkan karakter morfologis, pembeda antara ketiga jenis kelamin adalah kerapatan dan panjang trikoma daun bagian abaksial, bentuk bunga, panjang tangkai bunga, bentuk pangkal buah, panjang tangkai buah, dan warna biji. Berdasarkan karakter sitogenetis, ketiga jenis kelamin menunjukkan kesamaan dalam jumlah, ukuran, bentuk, kariotipe, dan indeks asimetri kromosom dengan jumlah kromosom $2n=18$, rata-rata panjang kromosom $1,975 \mu\text{m}$, bentuk kromosom metasentrik, rata-rata indeks asimetri intrakromosomal $0,2136$, dan rata-rata indeks asimetri interkromosomal $0,009$. Berdasarkan karakter molekuler, pembeda pada ketiga jenis kelamin adalah berat molekul sebesar 381, 391, dan 396,67 bp berurutan pada betina *dioecious*, jantan *dioecious*, dan *monoecious*, serta adanya situs polimorfik pada sekuen DNA yang disejajarkan.

Kata kunci: penentuan jenis kelamin, molekuler, morfologis, sitogenetis, *Vasconcellea pubescens* A.DC.

Sex Determination in Highland Papaya (*Vasconcellea pubescens* A.DC.) in Java Based on Morphological Characteristics, Cytogenetic, and Molecular

Abstract

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Highland papaya (*Vasconcellea pubescens* A.DC.) belongs to the Caricaceae family and has been successfully introduced to Indonesia, particularly growing on the island of Java. This fruit plant holds potential as a food source, and for pharmaceutical and cosmetic industries. Highland papaya exhibits three types of sex in its population: dioecious female, dioecious male, and monoecious. Information on sex determination in highland papaya remains limited. Distinguishing the sexes in this plant is crucial for farmers in cultivation efforts. This study aims to determine the sex of highland papaya based on morphological, cytological, and molecular characteristics on Java. Morphological data were obtained through observation and measurement of 58 characters; cytogenetic data were collected by observing and measuring the number, size, shape, karyotype, and asymmetry index of chromosomes; while molecular data were acquired through telomere length detection using Polymerase Chain Reaction (PCR) procedures and Sequence Characterized Amplified Region (SCAR) markers, along with DNA sequencing based on PMSM2 and SDP primers. The data were analyzed descriptively and qualitatively, with trichome density and length, chromosome length, and telomere length subjected to analysis of variance, followed by Tukey's test for significant differences. DNA sequences were edited, processed, and displayed using GeneStudio, MEGA 11, and Bioedit software.

The study's results revealed that sex determination in highland papaya could be identified based on morphological and molecular characteristics. Morphologically, the distinguishing features among the three sexes were the density and length of trichomes on the abaxial side of the leaf, flower shape, pedicel length, shape of the base of the fruit, fruit stalk length, and seed color. Cytogenetically, the three sexes exhibited similarities in chromosome number, size, shape, karyotype, and asymmetry index, with a chromosome count of $2n=18$, an average chromosome length of $1.975 \mu\text{m}$, metacentric chromosome shape, an average intrachromosomal asymmetry index of 0.2136, and an average interchromosomal asymmetry index of 0.009. Molecularly, the sexes differed by molecular weights of 381, 391, and 396.67 bp for dioecious females, dioecious males, and monoecious individuals, respectively, along with the presence of polymorphic sites in the aligned DNA sequences..

Keywords: cytogenetic, molecular morphology, sex determination, *Vasconcellea pubescens* A.DC.