

Keanekaragaman Genetik dan Struktur Populasi *Azolla* di Daerah Istimewa Yogyakarta Berdasarkan Karakter Morfologis dan *Intergenic Spacer*

Aji Sukma Iqbal Najibulloh

22/502228/PBI/01870

INTISARI

Pertumbuhan aktivitas industri di Provinsi Daerah Istimewa Yogyakarta berpengaruh terhadap menurunnya potensi dan lahan pertanian di seluruh daerah. Penurunan luas area lahan pertanian di Provinsi Daerah Istimewa Yogyakarta sebagai salah satu habitat *Azolla* akan berpengaruh terhadap menurunnya jumlah populasi tiap spesies *Azolla* di habitat aslinya. Tujuan penelitian ini adalah untuk menganalisis keanekaragaman genetik dan struktur populasi *Azolla* di Daerah Istimewa Yogyakarta berdasarkan karakter morfologis dan *intergenic spacer region trnL-trnF*. Populasi *Azolla* terdistribusi pada area persawahan dan kolam budidaya di Kabupaten Sleman, Bantul, dan Kulon Progo. Pengamatan karakter morfologis pada fenotip sampel *Azolla* dan karakter molekuler menggunakan sekuens DNA dilakukan pada sebelas sampel *Azolla*. Analisis klustering menggunakan *Gower Coefficient Similarity* dan UPGMA menghasilkan dua kluster dengan persentase similaritas 68,1%. Analisis karakter molekuler menggunakan MEGA dengan algoritma Tamura-3 Parameter + Gamma (T92+1) memisahkan dua klad dengan jarak genetik 0,74%. Analisis variasi genetik menggunakan DnaSP dan NETWORK menunjukkan lima *variable sites* dan sebelas *sites with alignment gaps* dari sekuens 692 bp sehingga diversitas nukleotidanya rendah dengan diversitas haplotipe yang tinggi. Terdapat empat haplotipe *Azolla* dalam dua haplogrup yang terdistribusi di sisi barat dan timur Daerah Istimewa Yogyakarta. Berdasarkan hubungan kemiripan karakter (numerik-fenetik) dan kekerabatan evolusi (molekuler-filogenetik), sampel *Azolla* di Provinsi Daerah Istimewa Yogyakarta identik dengan *Azolla mexicana* Schltdl. & Cham. ex Kunze. dan *Azolla cristata* Kaulf. Marka *intergenic spacer trnL-trnF* menunjukkan hasil yang efektif sebagai kode batang DNA dan dapat digunakan sebagai marka untuk identifikasi dan verifikasi spesies pada tumbuhan paku.

Kata Kunci: DNA kloroplas, filogenetik *Azolla*, kode batang DNA, sebaran haplotipe, variasi genetik

Genetic Diversity and Population Structure of *Azolla* in Special Region of Yogyakarta Based On Morphological Character and Intergenic Spacer

Aji Sukma Iqbal Najibulloh

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ABSTRACT

The growth of industrial activity in the Yogyakarta Special Region Province has an impact on the decline in agricultural potential and land throughout the region. The reduction in the area of agricultural land in the Special Region of Yogyakarta Province as one of *Azolla*'s habitats will have an impact on the decline in population numbers of each *Azolla* species in their natural habitat. The aim of this research is to analyze the genetic diversity and population structure of *Azolla* in the Special Region of Yogyakarta based on morphological characters and intergenic spacer regions of *trnL-trnF*. Population of *Azolla* is distributed in rice fields and cultivation ponds in Sleman, Bantul and Kulon Progo Regencies. Observations of morphological characters on the phenotype of *Azolla* samples and molecular characters using DNA sequences were carried out on eleven *Azolla* samples. Clustering analysis using Gower Coefficient Similarity and UPGMA produced two clusters with a similarity percentage of 68.1%. Molecular character analysis using Tamura-3 Parameter + Gamma (T92+1) algorithm by MEGA separated two clades with a genetic distance of 0.74%. Genetic variation analysis using DnaSP and NETWORK showed five variable sites and eleven sites with alignment gaps from the 692 bp sequence with low nucleotide diversity but high haplotype diversity. There are four *Azolla* haplotypes in two haplogroups which are distributed on the western and eastern sides of the Special Region of Yogyakarta. Based on relationships character similarity (numerical-phenetic) and evolutionary relationship (molecular-phylogenetic), *Azolla* in Yogyakarta Special Region Province is identical to *Azolla mexicana* Schltdl. & Cham. ex Kunze. and *Azolla cristata* Kaulf. Intergenic spacer marker of *trnL-trnF* showed effective results as a DNA barcode and can be used as a marker for species identification and verification in ferns.

Keywords: chloroplast DNA, *Azolla* phylogenetics, DNA barcode, distribution haplotype, genetic variation