

ABSTRACT

Castanopsis argentea is a keystone species in the montane forest ecosystem of Java. The conversion of forests to agricultural land and felling of *Castanopsis argentea* trees are the main causes of the declining populations of *Castanopsis argentea*. This study aims to identify patterns of distribution and natural regeneration of *Castanopsis argentea*, analysing its genetic diversity and genetic structure in the mountain forests of central Java and to assess the potential and development of vegetative propagation techniques to support designing *in-situ* and *ex-situ* conservation strategies of *Castanopsis argentea*.

A vegetation analysis was conducted by creating 30 plots on Mount Merapi and Mount Ungaran. The observed parameters included the importance value index, species diversity index, species distribution index and natural regeneration potential. The genetic diversity and population structure of *Castanopsis argentea* were analysed in seven populations distributed across Mount Ungaran, Merapi and Lawu, using microsatellite DNA markers. The study of *Castanopsis argentea*'s vegetative propagation potential examined propagation techniques such as liquid medium and solid medium air layering, shoot cuttings, *in vitro* axillary bud culture and somatic embryogenesis.

The absence of seedlings and saplings in the Mount Merapi indicates the very low potential for natural propagation of *Castanopsis argentea* populations. The populations on Mount Ungaran showed a better potential for natural regeneration, since the high seedling density value (333 N/ha), but the absence of sapling on Mount Ungaran indicates a disruption of the *Castanopsis argentea*'s recruitment process in both forest ecosystems. The distribution pattern of individual trees of *Castanopsis argentea* on Mount Merapi is clustered, while in Mount Ungaran is in random pattern. Those differences are influenced by factors of altitude, slope, and ecosystem disturbance in those regions. The genetic diversity of *Castanopsis argentea*'s populations is at a moderate level, indicated by the average expected heterozygosity (H_E) parameter value of 0.595. The moderate level of genetic diversity is possible due to outcrossing mating system. This is reinforced by the negative value of the average inbreeding coefficient (F) (-0.162). Variation among *Castanopsis argentea*'s populations is low, and most of the total genetic diversity is distributed within the population (86%). The results of the study on the potential of vegetative propagation showed that the macro-vegetative propagation technique with highest success rate is air layering with solid medium (58%), while the most potential micro-vegetative propagation method is somatic embryogenesis.

Increasing the protection status of *Castanopsis argentea* populations in Mount Merapi and Lawu is an *in-situ* conservation approach through the management of conservation and protected areas. Individuals of *Castanopsis argentea* with rare and private alleles are prioritised for immediate rescue, through generative and vegetative propagation. The *ex-situ* conservation demonstration plots should be developed for producing high economic value of chestnut.

Keywords: *Castanopsis argentea*, genetic conservation, chestnut, vegetative propagation

INTISARI

Pohon saninten (*Castanopsis argentea*) merupakan spesies kunci dalam ekosistem hutan pegunungan di Pulau Jawa. Pengurangan populasi saninten disebabkan oleh konversi hutan menjadi lahan pertanian dan penebangan pohon yang berlangsung lama. Penelitian ini bertujuan untuk mengidentifikasi pola sebaran dan regenerasi alami saninten, menganalisis keragaman genetik dan struktur genetik populasi saninten di hutan pegunungan Jawa bagian tengah, serta mengkaji potensi dan pengembangan teknik propagasi vegetatif saninten untuk mendukung penyusunan strategi konservasi saninten secara *in-situ* dan *ex-situ*.

Analisis vegetasi dilakukan dengan pembuatan 30 petak ukur di Gunung Merapi dan Gunung Ungaran. Parameter yang diamati meliputi indeks nilai penting, indeks keanekaragaman jenis, indeks penyebaran jenis dan potensi regenerasi alami. Analisis keragaman dan struktur genetik populasi saninten dilakukan pada 7 populasi yang tersebar di Gunung Ungaran, Merapi dan Lawu menggunakan penanda DNA mikrosatelit. Kajian potensi propagasi vegetatif saninten meliputi perbanyakan dengan teknik cangkok media cair, cangkok media padat, stek pucuk, kultur *in-vitro* mata tunas aksiler dan embriogenesis somatik.

Potensi permudaan alami saninten di Gunung Merapi sangat rendah karena tidak ditemukan semai dan sapihan. Populasi di Gunung Ungaran menunjukkan potensi permudaan alami yang lebih baik, dengan kerapatan semai yang tinggi (333 N/ha), namun tidak ditemukannya sapihan saninten di Gunung Ungaran menandakan terganggunya proses rekrutmen saninten di kedua ekosistem hutan tersebut. Pola sebaran individu saninten di Gunung Merapi mengelompok, sedangkan di Gunung Ungaran cenderung acak. Perbedaan pola sebaran saninten dipengaruhi oleh faktor ketinggian tempat, kelerengan, serta tipe gangguan di kedua ekosistem tersebut. Keragaman genetik populasi saninten di hutan pegunungan Jawa bagian tengah berada dalam tingkat sedang dengan nilai parameter rata-rata heterozigositas harapan (H_E) 0,595. Keragaman genetik dalam tingkat sedang dimungkinkan karena pola perkawinan antar individu di dalam populasi secara *outcrossing*, diperkuat dengan nilai rata-rata koefisien *inbreeding* (F) sebesar -0,162. Variasi antar populasi saninten di Jawa bagian tengah rendah, dan sebagian besar keragaman genetik total terdistribusi di dalam populasi (86%). Hasil penelitian potensi propagasi vegetatif saninten menunjukkan teknik propagasi makro dengan tingkat keberhasilan tertinggi adalah cangkok dengan media padat (58%), sementara metode propagasi vegetatif mikro yang potensial dikembangkan adalah kultur *in-vitro* embriogenesis somatik.

Peningkatan status perlindungan populasi saninten di Gunung Merapi dan Gunung Lawu merupakan pendekatan konservasi *in-situ* melalui pengelolaan kawasan konservasi dan kawasan lindung. Individu saninten dengan alel langka dan alel privat menjadi prioritas penyelamatan, melalui perbanyakan generatif maupun vegetatif. Pembangunan demplot konservasi *ex-situ* saninten perlu dikembangkan untuk produksi *chestnut* yang bernilai ekonomi tinggi.

Kata kunci: *Castanopsis argentea*, konservasi genetik, *chestnut*, propagasi vegetatif