# I. INTRODUCTION

## 1.1. Background

Patchouli (*Pogostemon* sp.), known locally in Indonesia as "Nilam", is a plant renowned for its high-value essential oils. Globally, there are over 200 genera within the Lamiaceae family, and at least 20 species of patchouli have been identified. In Indonesia, three primary species are cultivated: *Pogostemon cablin* (Aceh Patchouli), *Pogostemon heyneanus* (Java Patchouli) and *Pogostemon hortensis* (Soap Patchouli) (Sitomoul, 2015). Aceh Patchouli is the most prominent species, recognized for its high oil yield, making it the dominant crop in Indonesia's patchouli production. As a tropical country, Indonesia provides ideal growing conditions for patchouli, which thrives in hot and humid climates (Kusumaningrum *et al.*, 2016). The plants is also cultivated in other tropical and subtropical regions such as Malaysia and Singapore, showcasing its adaptability (Nuryani *et al.*, 2002).

Indonesia is the world's leading producer of patchouli oil, contributing over 90% to global demand. From 1990 to 2022, the average area growth rate for patchouli plantations in Indonesia was 6.93%, with yield growth averaging 6.79% annually during the same period. More recent figures (2016–2022) show an average productivity growth of 3.10% (Ditjenbun, 2022). The country produces approximately 1,200-1,300 tons of patchouli oil annually, with over 14,000 hectares of cultivated land. Major production centres are located in Aceh, North Sumatra, West Java, Central Sulawesi and Papua. The Sulawesi region leads production, with a planted area of 9,490

hectares yielding up to 815 tons annually. Java follows with a planted area of 1,771 hectares and a yield of 294 tons (Ditjenbun, 2022). Despite fluctuations in market prices, Indonesia's dominance in patchouli production remains steady due to its favourable climate and extensive cultivation (Kusumaningrum *et al.*, 2022).

Patchouli is predominantly a tropical crop, but it can also thrive in subtropical regions. The plant grows optimally in humid, warm climates, with ideal growing conditions including altitudes of 800–1,000 meters above sea level, temperatures of 20–35°C, and relative humidity of 80–90%. It performs best in well-drained soils with a pH of 6.0–6.8, making regions like Indonesia, Malaysia, and Singapore highly suitable for cultivation (Ramya *et al.*, 2013). Vegetative propagation through stem cuttings is commonly used, ensuring genetic uniformity and consistent oil production (Kusumaningrum *et al.*, 2016).

Patchouli oil is widely utilized across medical, industrial, and aromatic sectors. It is a key ingredient in perfumes, soaps, and medicinal products, acting as a fixative to prolong fragrance in perfumes (Nuryani *et al.*, 2002). Additionally, the oil exhibits antimicrobial, anti-inflammatory, and antioxidant properties, making it valuable in pharmaceutical and cosmetic applications (Tahir *et al.*, 2019).

Molecular identification is an essential tool for understanding genetic diversity and developing superior plant varieties. The Internal Transcribed Spacer (ITS) region, located between the 18S, 5.8S, and 28S rDNA genes, is

widely used for phylogenetic analysis due to its combination of conserved and variable sequences. ITS can differentiate genetic variations between populations and provide insights into evolutionary relationships (Latief, 2014). In patchouli, ITS markers have proven effective in identifying genetic diversity among cultivars (Nuryani *et al.*, 2002). The success of ITS-based analysis relies on high-quality DNA, and the Doyle and Doyle (1990) CTAB-based method is one of the most reliable protocols for DNA isolation. This method ensures the purity and concentration required for PCR amplification and genetic analysis (Setyowati, 2013).

Considering the diversity and molecular applications of patchouli, this research aims to analyze the genetic diversity of patchouli from Konawe, South East Sulawesi and PSDKU Batang, Central Java. Using ITS molecular markers and the Doyle and Doyle (1990) DNA isolation method, this study seeks to uncover genetic relationships and morphological differences, supporting the development of superior patchouli varieties and the conservation of this economically significant crop.

## 1.2. Research Problems

1. What is the morphological variation of *Pogestemon* sp. from Konawe and Batang Regency?
2. What is the genetic variance of *Pogestemon* sp. from Konawe and Batang Regency based on ITS?

## 1.3. Research Objectives

1. To identify the morphological variation of *Pogostemon* sp. from Konawe and Batang Regency.
2. To analyze the genetic variance of *Pogostemon* sp. from Konawe and Batang Regency using ITS markers.

## 1.4. Research Benefits

This research is expected to provide valuable contributions to the essential oil industry, particularly in the production of patchouli oil. By exploring the diversity of *Pogostemon* sp. and analyzing their genetic variations, the study can lay the groundwork for more effective breeding strategies to enhance both the quality and quantity of patchouli oil yields. Furthermore, the results have the potential to drive the development of value-added products within the essential oil sector and boost the competitiveness of patchouli oil in the market.