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Proximate Composition and Phytochemical Analysis of Malaysian *Liberica* sp. Coffee Bean and Its Pulp

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ABSTRACT

Arabica, Robusta, and Liberica are the three main coffee species cultivated globally. Liberica coffee is a minor species, accounting for less than 1% of global cultivation. Due to favorable climatic conditions in Malaysia, Liberica coffee dominates coffee production, accounting for 73%, while Robusta makes up the remaining 27%. Nevertheless, the substantial coffee production resulted in approximately 15 million tons of discarded skin and pulp, contributing to environmental pollution. This study was conducted due to insufficient information and research on the proximate composition and phytochemical compounds of the coffee bean and pulp from *Liberica* sp. This study aims to determine the proximate composition of coffee beans and pulp extracts from *Liberica* sp. and to identify the phytochemical composition using liquid chromatography-mass spectrometry (LC-MS) analysis. The nutritional values of carbohydrates, protein, crude fiber, crude fat, and ash were obtained using proximate analysis. Coffee beans exhibited the highest value for crude protein (11.96%) and crude fiber (11.83%), whereas coffee pulp has the highest significant value for moisture content (68.81%) and ash (7.31%). LC-MS analysis shows emmotin A and

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deoxymiroestrol were the major phytochemical compounds. These findings contribute to understanding the nutritional value and phytochemical compounds of coffee beans and pulp from *Liberica* sp. that may contribute to sustainable waste management and other applications in the food and beverage industry.

Keywords: Coffee bean, *Liberica* sp., phytochemical composition, proximate, pulp

INTRODUCTION

Coffee is the most demanding beverage worldwide, mostly cultivated at 600 and 2,500 m a.s.l. in Africa, South-East Asia, and Central and South America (Schenker et al., 2002). Arabica and Robusta, the main coffee species, constitute about 80 and 20% of the world's production, respectively, while Liberica is the least grown, with only 1% of cultivation. According to Ismail et al. (2014), the optimal growing temperature of the coffee plant in Malaysia ranges from 18 to 28°C, where Arabica is found as the minor species, while Liberica dominates about (73%), and Robusta (27%) are found to be the main cultivated species. Liberica is known for its robustness and flavor, similar to Robusta, while Arabica coffee has a sweet and caramel flavor profile.

Two primary methods are normally used for processing coffee cherries, including dry and wet. Coffee farmers often use the wet processing method to meet market demand and improve coffee production quality (Campos et al., 2020). In this approach, the coffee cherries underwent pulping, fermented, washed, and dried, with the skin and pulp removed and discarded as waste. The coffee cherries must be processed before being sold commercially. However, the widespread commercialization of coffee production can lead to ecological damage, as the waste from coffee production can cause environmental pollution (Geremu et al., 2016). Coffee pulp is usually disposed of in large landfills without undergoing any treatments. Consequently, this issue has received greater attention in recent years as researchers have sought ways to reduce environmental pollution by finding alternative uses for waste. Despite the significant quantities produced, numerous studies have proposed strategies to reduce environmental pollution from coffee production waste.

In Malaysia, *Liberica* sp. is the main species cultivated and is native to southern Johor. The soil in Johor makes it suitable for cultivation due to the humidity, heat, and clay-like soil conditions. The coffee industry generates a significant amount of solid and liquid byproducts, approximately 15 million tons globally (Kovalcik et al., 2018), which are sources of pollution if not properly disposed of (Nabais et al., 2008). The primary source of solid byproducts in the industry was coffee pulp and ground coffee. Coffee cherries contain about 43% of pulp, and of the 15 million tons of waste generated annually, 8.5 million tons are pulp. The residues may contain bioactive compounds that have potential