CHAPTER 7

ENHANCING ANTIDIABETIC PROPERTIES IN CAT'S WHISKERS

Nur Kamilah Mohd Nordin, Azman Abd Samad,
Nik Ahmad Nizam Nik Malek, and Wan Rosmiza Zana Wan Dagang

7.1 INTRODUCTION

Orthosiphon stamineus, also known as Java tea or cat's whiskers, is a perennial herb belonging to the Lamiaceae family. It has a long history of traditional medicinal use in Southeast Asia and Europe. Febjislami et al. (2019) identified three varieties of this plant based on flower colour: White, purple, and an intermediate type with a combination of white and purple hues. The white variety dominates, constituting approximately 69% of the plant population. Although the intermediate variety may appear mostly white from a distance, careful observation reveals a subtle purple tinge along the edges of the flowers.

Based on findings from the National Health and Morbidity Survey (NHMS) carried out by the Ministry of Health Malaysia, the prevalence of diabetes among adults aged 18 years and above was recorded at 18.3% (Akhtar et al., 2022). This figure represents a noteworthy rise compared to the previous NHMS survey conducted in 2015, which indicated a prevalence of 17.5%. The escalating trend of diabetes in Malaysia raises concerns, leading to the implementation of diverse initiatives and programmes that aim to encourage healthy lifestyles and promote early detection and effective management of diabetes.

There have been studies documenting the presence of phytochemicals in *Orthosiphon stamineus* that possess antidiabetic and anti-inflammatory properties. These phytochemicals, including rosmarinic acid (RA), sinensetin (SIN), and eupatorine (EUP), are predominantly found in the leaves of *Orthosiphon stamineus* (Saidan et al., 2015). However, the concentrations of these bioactive compounds within the plant can vary due to multiple factors, such as genetic variability, environmental conditions, and the growth stages of the plant (Gao et al., 2019; Li et al., 2020). The variation in the concentration of these bioactive compounds has motivated researchers to explore plant tissue culture techniques as a means of enhancing their production.

Stem cuttings are typically used for field cultivation to increase this species' yield. For example, Suman (2017) stated that employing the conventional method will lead to inadequate supply for a significant market demand for bananas. Besides that, this chapter will also report on several plant tissue culture system that has been used to enhance the micropropagation of shoot.

In this chapter, the organisation begins with a presentation of the phytochemical content in Section 7.2. Subsequently, Section 7.3 delves into the identification of antidiabetic compounds, while Section 7.4 provides an explanation of the enhancement of shoot biomass and secondary metabolites in *Orthosiphon stamineus*.

7.2 BIOACTIVE COMPOUNDS IN *ORTHOSIPHON STAMINEUS*

The pharmacological properties of *Orthosiphon stamineus* are attributed to the presence of bioactive compounds in its leaves. In their study, Abdul Aziz et al. (2020) aimed to optimise the extraction parameters and mass transfer process for extracting SIN, isosinensetin, and RA from *Orthosiphon stamineus* leaves using the supercritical carbon dioxide extraction technique. They employed response surface methodology to optimise the operating temperature (ranging from 40°C to 80°C) and pressure (ranging from 10 MPa to 30 MPa) during the extraction process. The study determined that the optimal parameters were a pressure of 10 MPa and a temperature of 80°C, resulting in the extraction of 440.3 mg/kg of SIN, 392.9 mg/kg of isosinensetin, and 752.0 mg/kg of RA.

In their study, Abdul Aziz et al. (2020) aimed to optimise the extraction parameters and mass transfer process for extracting SIN, isosinensetin, and RA from *Orthosiphon stamineus* leaves using the supercritical carbon dioxide extraction technique. They employed response surface methodology to optimise the operating temperature (ranging from 40°C to 80°C) and pressure (ranging from 10 MPa to 30 MPa) during the extraction process. The study determined that the optimal parameters were a pressure of 10 MPa and a temperature of 80°C, resulting in the extraction of 440.3 mg/kg of SIN, 392.9 mg/kg of isosinensetin, and 752.0 mg/kg of RA.

Another study conducted by Mohamed-Mahmood et al. (2019) employed a similar extraction method. However, unlike the previous study, both the temperature and pressure were kept constant. The researchers found that 50% ethanol (v/v) resulted in the highest yield percentage (4.64% ± 0.02) compared to eight other co-solvents tested. The yield percentages for the various solvents were as follows: Water (4.32% ± 0.03), pure ethanol (3.19% ± 0.08), 25% ethanol (3.05% ± 0.16), 50% ethanol (4.64% ± 0.02), 75% ethanol (3.81% ± 0.15), pure methanol (2.85% ± 0.01), 25% methanol (3.3% ± 0.14), 50% methanol (4.52% ± 0.01), and 75% methanol (3.40% ± 0.14).

A study conducted by Hashim et al. (2016) provided valuable insights into the influence of solvent type, solvent extraction duration, and time of extraction on the yield percentage of bioactive compounds. For instance, the optimal parameters for obtaining a high yield of RA were using 50% (v/v) methanol as the solvent for 4 hours, resulting in a yield of 240.16 µg/g dry weight. Conversely, the lowest yield of RA (4.80 µg/g dry weight) was observed when extracted with water for 2 hours. In contrast, pure methanol extraction for 8 hours produced the highest yield of another bioactive compound, 3-hydroxy-5,6,7,4 tetra-methoxy-flavone (TMF), which amounted to 5.31 µg/g dry weight.