BIODIVERSITAS
Volume 25, Number 1, January 2024
Pages: 404-411

ISSN: 1412-033X
E-ISSN: 2085-4722
DOI: 10.13057/biodiv/d250147

Phytochemical analysis and antioxidant activities ethanol extract of propolis *Trigona* spp. from different vegetation in Lombok Nusa Tenggara Barat, Indonesia

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Manuscript received: 12 August 2023. Revision accepted: 31 January 2024.

Abstract. *Tirtasari K, Suwanti LT, Mufasirin, Hastutiek P, Indasari EN, Kurnijasanti R, Plumeriastuti H, Safitri E, Hestianah EP. 2024. Phytochemical analysis and antioxidant activities ethanol extract of propolis* Trigona *spp. from different vegetation in Lombok Nusa Tenggara Barat, Indonesia. Biodiversitas 25: 404-411.* Propolis is a natural substance containing a resin that is collected by honey bees from various plants and has a significant effect on human health such as antibacterial, antifungal, anti-inflammatory, antiviral, anesthetic, antioxidant, antitumoural, antiprotozoal, anticancer, antihypertensive, anticarcinogenic, antihepatotoxic and has cytotoxic activity. Cultivation of *Trigona* spp. in Lombok is growing rapidly. *Trigona* spp. produces more propolis than honey bees of *Apis* spp., but bee products that are maximally utilized are only honey, and propolis has not been utilized optimally. Currently, there is no scientific validation of the phytochemical content, bioactive compounds, and biological activities of ethanol extract propolis *Trigona* spp. from Lombok, Nusa Tenggara Barat. So, this study aimed to determine the phytochemical compounds, bioactive compounds, and antioxidant activity of propolis. Gas Chromatography-Mass Spectrometry (GC-MS) analysis was performed to determine the bioactive compounds of ethanol extract propolis. DPPH (2,2-diphenyl-1-picrylhydrazyl) was used to evaluate antioxidant activity. The composition of propolis compounds is different for each propolis depending on the bee species and the vegetation source from which the resin was collected. In this research, propolis was collected from different vegetation sources (cashews, moringa, coffee, and lote trees). This study used qualitative and quantitative phytochemical analysis and the antioxidant DPPH test. Different components and percentages cause significant variations in the results obtained from phytochemical tests. The content is different in various propolis, there are saponins, flavonoids, and tannins. The highest antioxidant activity was found in propolis with moringa resin 38.4150 (very strong), followed by lote tree resin -66.0420 (strong), cashew resin 81.8140 (strong), and coffee resin 100.7465 (moderate).

Keywords: Antioxidant, DPPH, GC-MS, propolis, *Trigona* spp.

INTRODUCTION

There are thousands of distinct bee species found in the tropics and subtropics. One species that caught the interest of researchers is the Meliponini, popularly known as the stingless bee (Reyes-González et al. 2014). The most diversified species of bees are stingless ones (Goh et al. 2023). There are at least 500 species of stingless bees, and there may be as many as 100 species (Michener 2013). According to Kahono et al. (2018), there are 46 different species of stingless bees in Indonesia, most of which build their nests in the ground or various natural settings including bamboo, sugar palm stalks, tree trunks, or woodlands. Beekeepers in Indonesia have been using stingless bees in the rational farming of stingless bees (meliponiculture) to generate honey, bee bread (pot-pollen), and propolis (Erwan et al. 2023). *Trigona* spp. is a group of stingless bees that live socially and in a colony. *Trigona* spp. a produces small amount of honey, but it produces propolis in higher quantity than the other bees or genus *Apis* (Michener 2013; Agussalim et al. 2015). A natural product with great promise, propolis has been thoroughly investigated for both health and medicinal uses (Nayak et al. 2023a). Different propolis production depends on the stingless bee species, which is related to their activity to collect resin and the availability of plants as

resin sources (Agussalim and Agus 2022). The spread of *Trigona* spp. bees in Indonesia are generally found on the islands of Java, Sumatra, Kalimantan, Maluku, and Lombok (Yarlina et al. 2020). *Trigona* spp. cultivation on Lombok is growing rapidly because, in addition to producing honey, Trigona bees produce propolis in large quantities. Trigona bees produced more propolis than *Apis* spp. honey bees. It is said that the potential of *Trigona* spp. as propolis production of 500 grams/colony during a production time of three months, while honey production is only 250 grams/colony, so *Trigona* spp. are called propolis bees (Riendriasari and Krisnawati 2017).

Propolis, known as the bee glue, combines resins collected by the honey bees from different plant organs, and with beeswax that honey bees additionally incorporate (Svečnjak et al. 2020). Propolis is a natural substance containing resin collected by honey bees from various plants such as palm, pine, and rubber, which is used to seal gaps and prevent predators from entering the beehive (Anjum et al. 2019). Chemical compounds in propolis, include resin, pollen, vitamins, flavonoids, and phenols (Ahangari et al. 2018). Flavonoids, phenols, and various acids are components of the resin, and the types of flavonoids in propolis include pinocembrin, acetin, chrysin, and catechins as antimicrobial, antifungal and antioxidant compounds (Anjum et al. 2019). The composition of propolis is not the same in different geographical areas (Ahangari et al. 2018) and a review (Sawicka et al. 2012) of several studies has confirmed that the percentage of propolis components differs depending on the origin of the plant from which the resin was collected and the species of bee. Season and environmental factors also affect the profile of bioactive compounds in propolis (Yarlina et al. 2020; Šuran et al. 2021).

The composition of propolis depends on several factors. The classification of propolis is based on geographical location, color, agricultural characteristics, and flora where the bees collect the resin which is the raw material for propolis production. Due to the presence of flavonoids and phenolic acids, propolis, a product of honey bees, is a rich source of natural antioxidants. Folk medicine has long utilized propolis because of its wide range of biological effects, which include treating diarrhea, eye conditions, wound healing, fever, ulcers, skin rashes, scorpion stings, mouth infections, liver problems, and more. Due to the inclusion of phenolics, alkaloids, vitamins, flavonoids, coumarins, tannins, terpenoids, and other compounds, propolis has a high antioxidant content. Hence, it can be used to treat illnesses linked to oxidative stress. The advantages of propolis-derived natural antioxidants were investigated through several epidemiological research (Nayak et al. 2023b).

Propolis has high antioxidant activity determined by its phenolic compounds (Kurek-Górecka et al. 2022). The stingless bee's phytochemical profile showed the presence of a variety of phytochemicals, including tannins, alkaloids, flavonoids, triterpenoids, steroids, carotenoids, coumarins, and saponins as secondary metabolites and carbohydrates as primary metabolites (Syafrizal et al. 2020). Propolis contains flavonoids, which are potent antioxidants that can scavenge free radicals. Numerous propolis-derived substances have been identified as strong oxidative stress inhibitors. Although it is generally known that propolis's composition varies, one of its main constituents is Caffeic Acid Phenethyl Ester (CAPE) (Daleprane and Abdalla 2013). The use of propolis has a major effect on human health and is used for various purposes, such as antibacterial, antifungal, anti-inflammatory, antiviral, anesthetic, antioxidant, antitumoural, antiprotozoal, anticancer, antihypertensive, anticarcinogenic and antihepatotoxic and has cytotoxic activity (Anjum et al. 2019). In this study, we wanted to examine the phytochemicals and antioxidant activity of the ethanol extract of propolis from *Trigona* spp. bees taken from four different vegetation sources, there are cashew, moringa, coffee, and lote tree vegetation in Lombok, Nusa Tenggara Barat, Indonesia.

MATERIALS AND METHODS

Propolis sample and extraction

A sampling of propolis from four locations of *Trigona* spp. cultivation in Lombok, Nusa Tenggara Barat with different vegetation (cashew, moringa, coffee, and lote tree). Propolis sourced from cashew resin, was taken from Montong Singgah, Salut Village, Kayangan District. Propolis sourced from moringa resin from Tanak Seban, Salut Village, Kayangan District. Propolis sourced coffee resin from Pawang Tenun, Andalan Village, Bayan District. Propolis is sourced from lote tree resin from Lendang Gagak, Sukadana Village, Bayan District.

The material is stored in the refrigerator for further extraction with ethanol. The collected propolis samples were then prepared for extraction by maceration method. The sample used in the analysis is crude propolis which was previously collected directly from the *Trigona* spp. bee nest. Propolis was macerated for 7 days with 70% ethanol using propolis: ethanol ratio (1:10). Propolis that has been macerated with 70% ethanol is filtered through filter paper until there is filtrate and dregs. The filtrate was evaporated at 75°C-80°C. Propolis extract is formed (Hegazi et al. 2017). Analysis of bioactive components from propolis extract was carried out using Gas Chromatography-Mass Spectrophotometry (GC-MS).

Qualitative phytochemical test

The qualitative phytochemical analysis used was the maceration method (Julianto 2019), which is an examination of saponins, tannins, flavonoids, alkaloids, and steroids/triterpenoids. Maceration is one of the traditional extraction methods, which is very simple and cost-effective as it only requires a simple vessel as the extraction location, but this method requires a long time for the extraction process. The extraction process by maceration is carried out by immersing the sample in an extraction solvent (Tambun et al. 2021). The method of saponins, tannins, flavonoids, alkaloids, and steroids/triterpenoids examination using the method by Julianto (2019).

Saponin examination

As much as 2 mL of propolis extract plus 3 mL of distilled water is boiled with 20 mL of water in a water

bath. The filtrate was shaken and left for 5 minutes. The formation of stable foam indicates a positive presence of saponins.

Tannin examination

The filtrate (saponin yield) was added with 3 drops of 1% FeCl3 and the formation of a greenish-brown or blackish-blue color indicated the presence of tannins.

Flavonoid examination

A total of 2 mL of extract was added to 1 tablespoon of Mg powder plus 3 drops of concentrated HCl and 3 drops of alcohol. A positive reaction if there is a yellow-orange-red color change.

Alkaloid examination

Wagner's reagent. As much as 2 mL of the extract was added 3 drops of Wagner's reagent, a positive reaction if a brown precipitate formed.

Mayer's reagent. As much as 2 mL of the extract was added 3 drops of Mayer's reagent solution, a positive reaction was indicated by the formation of a white or yellow precipitate.

Dragondorff reagent. As much as 2 mL of extract was added 3 drops of Dragondorff reagent solution, a positive reaction was indicated by the formation of a red precipitate.

Steroid/Triterpenoid examination

A total of 2 mL of the extract was added with 3 drops of acetic acid plus 3 drops of concentrated H_2SO_4. A green-blue color change indicates the presence of steroids and a red-purple color change indicates the presence of triterpenoids.

Gas Chromatography-Mass Spectrophotometry (GC-MS) method

Quantitative phytochemical tests used the Agilent 5977B Gas Chromatography-Mass Spectrophotometry (GC-MS) method. The solvent used for optimization was 3 mL of ethanol with a sample concentration of 10% (100 mg extract/10 mL solvent). Gas chromatography parameters can be optimized with some modifications. Optimization was carried out on the selection of carrier gas, carrier gas flow rate (helium), injection mode and volume (splitless 1 µL), injection temperature (250°C), oven temperature (programmed), ion source temperature (230°C), and interface temperature (300°C) (Kartal et al. 2002). The column used in this analysis is the Agilent 19091S-433 HP-5MS column (5% Phenyl Methyl Silox)

DPPH antioxidant test

A stable organic free radical known as DPPH loses its absorption band at 517 nm when it accepts an electron or another free radical species. This test is a well-liked technique for assessing the antioxidant capacity of natural products, including propolis. It was determined how well propolis reduced DPPH, and the IC50 values were established as the amounts of propolis ethanol extract that resulted in a 50% reduction in DPPH. The quantity of the unreduced DPPH radical can also be stated as residual DPPH (Kurek-Gorecka et al. 2022).

The antioxidant activity effect was carried out using the radical scavenging free of DPPH method and the absorbance was measured using a UV-Vis spectrophotometer at a wavelength of 517 nm (Baliyan et al. 2022). Preparation and dilution of the extract antioxidant test solution made with a concentration of 1000 ppm dissolved in methanol solvent. The solution was centrifuged at 5000 rpm until homogeneous. Then the extract was diluted with a concentration of 200 ppm; 150 ppm; 125 ppm; 100 ppm; 75 ppm; 50 ppm; 35 ppm; and 25 ppm in methanol until it reached 200 µl and added at the end 100 µL DPPH solution (1 mg/mL). The total volume per well is 300 µL. Samples are difficult to dissolve in methanol (especially propolis samples with lote tree vegetation sources) so the solution is in the form of a cloudy substrate which can affect the OD value of the sample. The absorbance was measured using a UV-VIS spectrophotometer at 517 nm. The percentage of antioxidant activity was calculated using the equation:

$$\%\ antioxidant\ activity\ = \frac{abs\ control - abs\ sample}{abs\ control}\ x\ 100\ \%$$

The IC50 value was determined using linear regression of plots, where the ordinate indicated the percentage of antioxidant activity and the abscissa the concentration of extract solution. data evaluationThe findings of investigations on phytochemicals and antioxidants were presented as mean values standard deviation of three replicates. Additionally, the IC50 value was used to derive the antioxidant activity value using linear regression analysis (Manurung et al. 2022).

RESULTS AND DISCUSSION

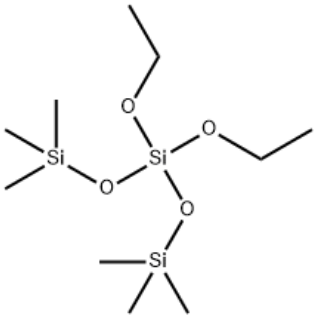
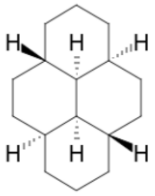
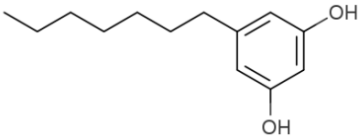
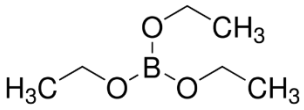
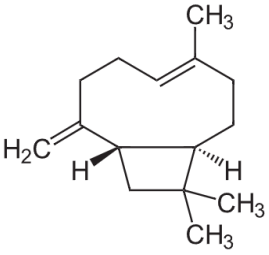
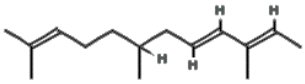
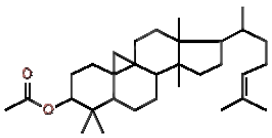
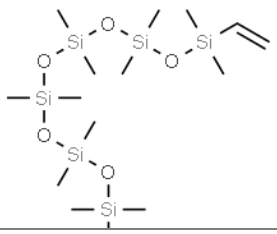
Phytochemicals analysis

Phytochemical testing includes tests for alkaloids, flavonoids, steroids, saponins, and tannins (Rumagit et al. 2015). The following are the results of the phytochemical test of *Trigona* spp. bee propolis from four different vegetation sources. The results of the content of the phytochemical tests vary widely with different components and percentages. In this publication, only the active compounds with a percentage of more than 80% are listed.

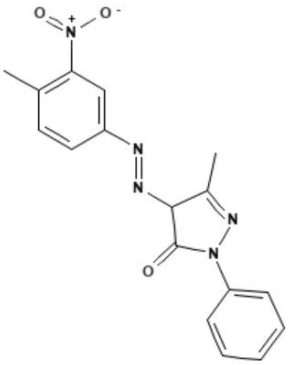
Antioxidant activity

Based on the results obtained, the strongest antioxidant content was in propolis with a source of Moringa vegetation with an IC50 value of 38.4150 (very strong). The antioxidant activity of propolis was obtained by using free radical scavenging activity DPPH Assay. In propolis extract, the concentrations used to measure antioxidant activity are 25; 35; 50; 75; 100; 125;150, and 200 µg/ml. The absorbance of the sample solution and DPPH-ethanol solution was measured by a spectrophotometer with a wavelength of 517 nm. Then look for the % value of antioxidant activity in each concentration, the results are in Table 2.

Table 1. Phytochemical analysis of *Trigona* spp. from Lombok, Nusa Tenggara Barat, Indonesia

Propolis vegetation source	Chemical formula	Qualitative phytochemical	Quantitative phytochemical (>50%)	Chemical structures
Cashew	$C_{18}H_{23}O_3$	Saponins Flavanoids Tannins	Silicic Acid, diethyl bis (trimethylsilyl) ester (64%)	
Moringa	$C_{15}H_{10}O_6$	Saponins Flavanoids Tannins	Pyrene, hexadecahydro- (51%)	
			5-Heptylresorcinol (53%)	
			Triethyl borate (95%)	
Coffee	$C_8H_{10}N_4O_2$	Flavanoids Tannins	Caryophyllene-(I1) (68%)	
			Caparratriene (86%)	
			9,19-Cyclolanost-24-en-3-ol, acetate, (3.beta.)- (90%)	
Lote tree	$C_{25}H_{43}NO_{18}$	Saponins Flavanoids Tannins	Heptasiloxane,1,1,3,3,5,5,7,7,9,9,11,11,13,13-tetradecamethyl- (53%)	

3H-Pyrazol-3-one,2,4-dihydro-5-methyl- (74%)



1,2-Cyclopentanedione (83 %)

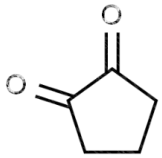


Table 2. Antioxidant activity of *Trigona spp.* from Lombok, Nusa Tenggara Barat, Indonesia

Concentration	% Antioxidant activity of propolis from various vegetation sources			
	Cashew	Moringa	Coffee	Lote tree
25	85.476±3.255	67,410±22,917	85.476±3.255	-4,880 ±24,450
35	84.444±4.265	52.169±2.556	81.746±7.856	-32,892±14,824
50	70.714±6.173	39.036±5.282	71.508±0.112	-68.554±1.193
75	63,413±3,928	26.205±2.811	65.397±6.061	-87.169±24.621
100	40.476±6.509	0.060±25.473	62.857±7.183	-122.349±6.559
125	32,857±2,694	-9,759±17,549	32.222±3.591	-131.506±3.834
150	-0.476±0.898	-17.108±14.483	25.556±3.816	-138.735±2.300
200	-61.746±13.918	-51.928±15.335	-0.794±1.122	-174.096±27.603

After the % value of antioxidant activity is known, then the IC50 value (50% Inhibition Concentration) is calculated. According to Syawal et al. (2019), calculate the IC50 value using a linear regression equation which shows the relationship between extract concentration (X-axis) and the % inhibition value (Y-axis). The formula used to determine the IC50 value when % inhibition is 50% is Y = AX+B. The IC50 value is a number indicating the concentration of the test sample (µg/mL) which provides 50% DPPH absorption (able to reduce the DPPH oxidation process by 50%). A value of 0% means that it has no antioxidant activity, while a value of 100% means total absorption and the test needs to be continued with dilution of the test solution to see the limit of its activity concentration. Inhibition Concentration (IC50) is the concentration of an antioxidant that can cause 50% of DPPH to lose its radical characteristic or the concentration of an antioxidant that gives a 50% inhibition. In particular, substances that have high antioxidant activity will have a low IC50 value (Batubara et al. 2020). A compound is said to be a very strong antioxidant if the IC50 value is less than 50 ppm, strong for IC50 is in the range 50-100 ppm, moderate if IC50 is in the range 100-150 ppm, and weak if IC50 is in the range 151-200 ppm (Table 3) (Mardawati et al. 2008). The sample is difficult to dissolve in methanol, especially the Bidara sample, so the solution appears as a feculent substrate, which can affect the OD value of the sample.

The following is a graph of the regression equation for each propolis from various vegetation sources (Figure 1).

Table 3. Linear regression equation of IC50 value in propolis extract

Propolis vegetation source	Linear regression equations	IC50 value (category)
Cashew	Y = -0.8039x + 115.77; R2 = 0.9525	81.8140 (Strong)
Moringa	Y = -0.6492x + 74.939; R2 = 0.9788	38.4150 (Very strong)
Coffee	Y = -0.4903x + 99.396; R2 = 0.9753	100.7465 (Moderate)
Lote tree	Y = -0.9005x + 9.4709; R2 = 0.9137	-66.0420 (Strong)

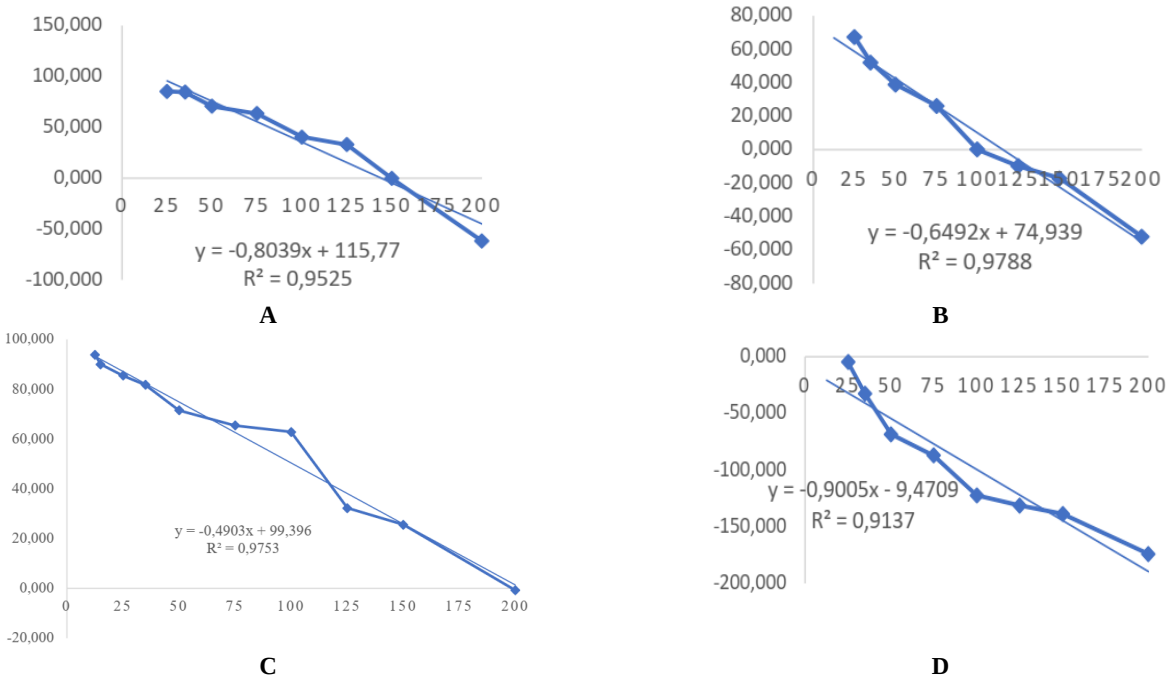


Figure 1. A. Propolis is a source of cashew resin, B. Propolis is a source of Moringa resin, C. Propolis is a source of coffee resin, D.. Propolis is a source of lote tree resin

Discussions

Propolis from various geographical places contains a wide range of diverse components, but flavonoids are among the most significant ones because of their anti-inflammatory, antiviral, anti-allergic, anti-cancer, anti-bacterial, and antioxidant properties (Ahangari et al. 2018). Propolis is used as a traditional medicine and has been researched for its efficacy through research. The main component of propolis is Caffeic Acid Phenethyl Ester (CAPE) which is proven to have antimicrobial, antioxidant, anti-inflammatory, cytotoxicity, and neuroprotective effects. Research proves the antioxidant effects of propolis by increasing Malondialdehyde (MDA) levels and lowering Superoxide Dismutase (SOD) and Glutathione Peroxidase (GPx) levels. CAPE from propolis also inhibits apoptosis by preventing caspase 3, nitric oxide synthase, and cytochrome production (Alqarni et al. 2019).

The extract of bioactive components depends on the solvent used. Commonly used propolis extraction solvents include ethanol, propylene glycol, and water. Ethanol extraction with different concentrations results in different concentrations of active components (Yarlina et al. 2020). Although the content of propolis varies depending on extraction, however, the biological activity of different extracts remains comparable, meaning that these differences do not significantly affect activity as antimicrobials (Šuran et al. 2021).

Based on this research, the propolis content obtained from different vegetation has different active components. This is by previous research. The composition of propolis compounds is not the same for each propolis from different geographical areas (Ahangsari et al. 2018) and a review of several studies has confirmed that the percentage differences in the components of each propolis depend on the origin of the plant from which the resin was collected. Season and environmental factors also affect the profile of bioactive compounds in propolis (Šuran et al. 2021). In this study, the phytochemical analysis and antioxidant activity of propolis with vegetable sources of Moringa had the best content. Propolis with moringa resin contains saponins, flavonoids, and tannins and has the highest active substance, Triethyl borate (95%). Triethyl borate is an ester of boric acid and ethanol. The highest antioxidants are found in propolis with Moringa resin 38.4150 (very strong), followed by bidara -66.0420 (strong), cashew 81.8140 (strong), and coffee 100.7465 (moderate). Numerous factors affect the composition of propolis. Propolis is categorized according to its geographic location, color, and agricultural traits. It is also divided into groups based on the types of plants that the bees use to gather the resins that are used to make propolis. The high antioxidant activity of propolis is attributed to its phenolic components (Kurek-Gorecka et al. 2022). Phenolic acids are usually divided into two main groups: benzoic acids, containing seven carbon atoms (C6-C1), and cinnamic acids, comprising nine carbon atoms (C6-C3). These compounds exist predominantly as hydroxybenzoic and hydroxycinnamic acids and may occur either in their free or conjugated forms (Hakim et al. 2021).

Cited a study showing that phenolic compounds make up about 58% of the content of propolis, while the rest is a group of flavonoids. Several phenolic groups present in propolis are phenolic acids, phenolic aldehydes, phenols and their esters, keto phenols, coumarins, and other

compounds, including eugenol, anethol, hydroquinone, pterostilbene, and naphthalenes (Šturm and Ulrih 2019). Flavonoids contained in propolis are a group of phenolic compounds that have a C6-C3-C6 carbon chain structure, which is classified into several classes, there are chalcones, flavones, flavanols, flavanones, isoflavonoids, anthocyanidins, catechins, and tannins (Galeotti et al. 2019). The biological activity of propolis is mainly due to the presence of phenolic and flavonoid groups and one of the best known bioactivities is the antioxidant effect. The antioxidant activity of propolis samples correlated with the total phenol content and with the number of identified main compounds such as phenolic acids and their esters, anthraquinones, flavonoids, and terpenes (Hossain et al. 2022). Propolis' antimicrobial and antiparasitic activities should be taken to count on both a pathogen-specific level and a host-specific one. Propolis' antiviral, antifungal, and antiparasitic properties are mediated by immunomodulatory mechanisms. Numerous modes of action are used by propolis and its bioactive components to achieve antiviral activity (Zulhendri et al. 2021).

The bioactive compounds in propolis are rich in flavonoids and phenolics (Segueni et al. 2016). These compounds are antioxidants that can be used to fight free radicals. The content of phenolic compounds and propolis flavonoids depends on the geographical location and the type of bee (Hossain et al. 2022). Differences in the characteristics and types of bees will affect the products produced. The ability of bees to fly in search of food will affect the quality of propolis. The content contained in propolis will vary because the bees will take the resin found in trees around the grazing area. Grazing locations that have few plant species will affect the amount of flavonoid content in propolis. Limited plants in grazing areas make it difficult for bees to find food because of the different flight ranges of bees. Apart from the limitations of the plants around grazing, the flying ability of each bee is different.

Propolis in its raw form cannot be used for immediate analysis or treatment. To dissolve and release the most active compounds, it must first be removed. As extractants, ethanol, methanol, water, hexane, acetone, dichloromethane, and chloroform are employed. Propolis content in extracts is around 70%. Propolis' chemical makeup is quite similar to the resins and balsams derived from plant sources. More than 300 chemical components of propolis have been found as the study has advanced. Waxes, polyphenols (phenolic acids, flavonoids), and terpenoids are the main classes of chemical substances that have been discovered in propolis, except resins (Przybyłek and Karpiński 2019).

Raw propolis has a different bioactive chemical composition depending on its botanical and geographic origins, season, the genetics of the bees, and the environment (Ruffato et al. 2018; Do Nascimento et al. 2019). The variety and availability of plants, the location and timing of collection, beekeeper methods and practices, and environmental health all affect the quality and quantity of propolis collected. One of the most well-known honeybee products is propolis, which has been utilized in traditional medicine for a variety of health benefits since ancient times. Pollen, beeswax, plant resins, and essential oils are the majority of propolis. Propolis contains a variety of organic substances, including polyphenols, terpenes, esters, amino acids, vitamins, minerals, and sugars. The extraction processes, solvent ratio, and kind of extraction solvent will all affect the chemical profile of the propolis extracts. Over 500 bioactive compounds exist in total (Šuran et al. 2021).

This study shows that the resin derived from moringa vegetation sources has a high and diverse phytochemical content. Its antioxidant activity is also the highest compared to other vegetation sources. Various studies show that moringa leaves have many benefits and are high in antioxidants. Based on Fitriana et al. (2016), indicated that moringa leaves can be used as an antioxidant source, with the IC50 value of methanol extracts being 49.30 µg/ml. Research Ibrahim et al. (2022), also showed the highest DPPH radical scavenging with IC50 values of 2.397±0.10 mg/mL in the moringa leaf. In conclusion, this study shows that propolis extracts from Trigona bees from various locations in Lombok Nusa Tenggara Barat have a strong antioxidant activity because of the content of various profiles of bioactivity compounds.

ACKNOWLEDGEMENTS

Thank you to the Directorate General of Higher Education for the research grant for the doctoral program with contract number 902/UN3.15/PT/2022.

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