*International Journal of Research in Engineering and Science (IJRES)*
*ISSN (Online): 2320-9364, ISSN (Print): 2320-9356*
*www.ijres.org Volume 12 Issue 1 ǁ January 2024 ǁ PP. 62-65*

# Phytochemical Content of Various Local Balinese Shallot Bulb Varieties

Putu Cindi Besita Sesia Andani[1], I Nyoman Rai[2], Ida Ayu Putri Darmawati[3]
[1,2,3] *Department of Agroecotechnology, Faculty of Agriculture, Udayana University, Bali, Indonesia*
*Corresponding Author: rainyoman@unud.ac.id*

***Abstract***
*Shallot (Allium cepa L.) is one of the most popular bulb vegetables and intensively cultivated by Indonesian farmers. Currently, local varieties that are spread and have adapted to various agroecosystems are most likely derived from different elders, giving rise to the phytochemical diversity of shallots. This research was conducted in shallot growing centers in Tabanan and Bangli districts from June to September 2023. This research aimed to determine differences in the phytochemical properties of shallot variety bulbs. This research extracted the phytochemical content of bulbs with maceration method using 96% ethanol solvent, flavonoids with UV-Vis spectrophotometer, while antioxidant activity with DPPH method and bacterial inhibition with disc diffusion method. The results of phytochemical analysis of shallot variety bulbs showed differences in the concentration of flavonoids with the highest value obtained at Super Philip Nganjuk (743.43 mg QE/100 g) and Bali Karet has phytochemical properties by forming the highest antioxidant activity ($IC_{50}$) which is 252.64 ppm and the ability to inhibit the highest Staphylococcus aureus is obtained in Local Kintamani with a value of 6.33 mm.*

***Keywords:*** *shallots, varieties, phytochemicals, bulbs.*

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Date of Submission: 02-01-2024 Date of acceptance: 14-01-2024

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## I. INTRODUCTION

Shallots are layered bulbs that are easy to find, have economic value, and contain high chemical compounds. The many types of shallots used by the community cause the available shallots also vary. Therefore, further studies are needed related to the content and phytochemical properties of local Balinese shallot bulbs so as to obtain potential utilization in addition to those that are commonly known to the public. Phytochemicals are produced naturally by plants through secondary metabolism [1]. There are various secondary metabolite contents such as flavonoids, tannins, saponins, essential oils, alkaloids, kaempferol, flavonglikosida, fluroglusin, dihydroaliin, cycloaliin, metialiin, quercetin, polyphenols, sulfur in shallots [7]. The phytochemical content of shallots is known to have many benefits, such as acting as an antioxidant and antimicrobial and can be used to reduce blood glucose levels, diabetes mellitus, diarrhea, skin, respiratory, and wound healing drugs [2,14].

The high content of secondary metabolite compounds in shallot bulbs makes shallots the best natural antioxidant in inhibiting free radicals and also functions to stop the development of microorganisms and control the growth of bacterial infections [3,15]. One of the bacteria that cause infections and diseases that are commonly found in the surrounding environment is *Staphylococcus aureus*. *S. aureus* bacteria are grey to brownish yellow and can cause skin infections [13]. The bacterial infection can be transmitted through contaminated hands, so pathogenic bacteria from the body, faces, or other sources can be transferred to food and then enter and develop into the body's organs. Pathogenic bacteria can be prevented by the use of natural antibacterials sourced from the active ingredient extract of shallot bulbs, with this can also reduce the emergence of resistant bacteria.

Fresh shallot bulbs are not harmful to the environment and surroundings, but more profitable utilization needs to be sought in addition to making them a mixture of food seasonings and traditional herbal medicines. Research related to the potential of peel off gel masks from Dayak shallot bulb extract [9], is one sign that the use of shallot bulbs has successfully developed into various industries, so phytochemical analysis on various bulbs of local Balinese shallot varieties will greatly help provide a description of the potential use of shallots.

## II. RESEARCH METHODS

The research was conducted in shallot growing centers in Tabanan and Bangli districts. Preparation of shallot bulb extract and analysis of bacterial inhibition were carried out at the Food Analysis Laboratory, Faculty of Agricultural Technology, Udayana University. Analysis of phytochemical content and antioxidant

activity at the Integrated Research Laboratory, Faculty of Mathematics and Natural Sciences, Udayana University. The research was conducted from June to September 2023.

Preparation of shallot bulb extract. The shallot bulbs of Bima Brebes, Local Kintamani, Super Philip Bima, Super Philip Nganjuk, and Bali Karet used have been dried in the sun for 1 week, then cleaned and cut from the part of the stem that is directly connected to the leaves as much as 1.5 kg. Furthermore, the shallot bulbs were dried, the bulb samples were cut thinly and then oven at 50 ºC for 12 hours. After the bulbs are dry, then the bulb sample is finely blended into powder after which it is sieved and weighed as much as 700 g, then put into a container and added 96% ethanol solvent until the sample is submerged, allowed to stand for 24 hours at room temperature, the results of maceration are filtered with filter paper into a container, then the filtrate is separated from the pulp. All filtrates obtained were concentrated using a rotary evaporator at 50 ºC until a concentrated extract was obtained [4].

Flavonoid content analysis. Samples were extracted with 5 ml of 99.9% ethanol, homogenized and centrifuged at 3000 rpm for 15 minutes, until a supernatant was obtained. The supernatant was filtered to obtain the filtrate. Filtrate was pipetted 0.5 mL placed in a test tube, added 0.5 mL ethanol and 1.0 mL of 2% $AlCl_3$ reagent, vortexed until homogeneous and allowed to stand 30 minutes at room temperature before reading the colour absorption at a wavelength of 415 nm. A standard curve was prepared by dissolving quercetin in 99.9% ethanol at various concentrations of 0-30 $mgL^{-1}$ [17].

Determination of antioxidant activity. Preparation of gallic acid standard curve with various concentrations (0-2 mg/L). Treatment of the sample was carried out by weighing 0.05 g of sample, diluted with 99.9% methanol to a volume of 5 mL in a volumetric flask, then the sample extract was vortexed or liquid homogenization first and then centrifuged at 3000 rpm for 15 minutes. Standard and supernatant were pipetted 0.5, added 0.5 mL of 0.1 mM DPPH (in 99.9% methanol solvent) in a test tube, then vortexed. Then incubated at 25 $^0$C for 30 minutes to give time for DPPH to react with hydrogen atoms donated by the sample antioxidants, the absorbance was measured at λ 517 nm. The antioxidant capacity was calculated using the linear regression equation $y = ax + b$. $IC_{50}$ value can be calculated using linear regression equation. The linear regression equation is obtained by entering the concentration of the test sample as the abscissa (x-axis) and the percent DPPH inhibition value as the ordinate (y-axis) [19].

Determination of bacterial inhibition. Preparation of Muller Hinton Agar (MHA) media. MHA was weighed as much as 19 g and dissolved into an Erlenmeyer flask with distilled water to a volume of 500 ml, then heated until homogeneous. The media was sterilized first using an autoclave at 120 ºC for 20 minutes. Next, pour the media into a Petri dish as much as 25 ml and let it solidify. A colony suspension of *Staphylococcus aureus* test bacteria was made by taking one ose of colonies from solid MHA media into a test tube containing 5 mL of NaCl. The turbidity of the test colony suspension is standardized to 0.5 McFarland standard (1.5 x 108 CFU/mL). The suspension should be used immediately as inoculum within 10 minutes. The test bacterial suspension is inoculated on 0.1 ml of MHA medium and allowed to dry. Paper discs that have been soaked for 15 minutes are then placed on the surface of the media aseptically. The suspension was incubated for 24 hours at 37 ºC [12,14]. Bacterial growth was observed in the clear zone formed around the discs. Data analysis. Data from the phytochemical properties of tubers such as flavonoids, antioxidant activity and bacterial inhibition were described descriptively qualitatively.

## III. RESULT AND DISCUSSION

The highest flavonoids were obtained in the Super Philip Nganjuk variety which increased significantly by 263.82% compared to the Bali Rubber variety. The content of phytochemicals with high concentrations is influenced by the solvent so that it has an impact on the yield of flavonoid extracts quantitatively. In this study, 96% ethanol solvent was chosen because it has a level of safety and ease when evaporated and its properties are able to dissolve substances that are polar, semipolar to nonpolar and can attract secondary metabolite compounds optimally [21]. The high yield produced from ethanol extracts of chives and taro leaf powder shows that ethanol solvents are able to extract more bioactive compounds, because in the ethanol molecular structure there is an OH group that is able to dissolve polar molecules, this is in accordance with the principle of like dissolve like where a compound will easily dissolve in a solvent if it has the same polarity properties [8]. In addition, the drying method on flavonoid content also affects the level of concentration produced and is in line with [6] that the total flavonoids produced through oven drying method is higher than sun drying (Table 1).

**Table 1:** Effect of Different Bulb Varieties of Shallot on Phytochemical

| | Shallot Varieties | Flavonoids (mg QE/100 g) | Value $IC_{50}$ (ppm) | Antioxidant Activity Category |
|---|---|---|---|---|
| 1 | Bima Brebes | 490.24 | 338.15 | Weak |
| 2 | Local Kintamani | 415.11 | 360.03 | Weak |
| 3 | Super Philip Bima | 418.01 | 338.15 | Weak |
| 4 | Super Philip Nganjuk | 743.43 | 428.89 | Weak |
| 5 | Bali Karet | 204.34 | 252.64 | Weak |

The highest concentration of antioxidant activity ($IC_{50}$) of shallot bulb extract was obtained from the Bali Karet variety at 252.64 ppm. Stated that based on the results of the standard regression equation of antioxidant activity, the $IC_{50}$ value will be obtained, where the lower the $IC_{50}$ value will show higher antioxidant activity [5]. Base on [18] that one of the important influences in increasing antioxidant activity is flavonoid content, this content is the most powerful main compound that plays an active role as an antioxidant in the phenol class and in line with [11] which states that there is a correlation between flavonoids and antioxidant activity, as in flavonoid content which is significantly positively correlated with antioxidant activity supported by the correlation value (r = 0.95*). Based on their structure, flavonoid compounds have hydroxyl groups that can donate hydrogen atoms to free radicals by chelating metals, are in the form of glucosides (glucose side chains) or in free form called aglycones, so flavonoid compounds can function as antioxidants [15].

Antioxidant activity in this study showed that there was a high value of flavonoid content in Super Philip Nganjuk variety 743.43 mg QE/100 g, but produced a low $IC_{50}$ value of 428.89 ppm, while the lowest flavonoid value was obtained by Bali Karet which was 204.34 mg QE/100 g, but showed the highest $IC_{50}$ value of 252.64 ppm. Different concentrations of flavonoid content are caused by differences in environmental conditions where it grows, temperature, light intensity, humidity, soil type, nutrients, water availability and $CO_2$ levels in the atmosphere, that soursop leaf extracts from lowlands and high light intensity have high flavonoid levels, and vice versa at high altitudes produce low flavonoids [16]. In terms of high altitude, low temperature, high humidity, and the lowest flavonoid content in the Bali Karet variety compared to Super Philip Nganjuk may indicate the best antioxidant activity. Bali Karet bulbs with their flavonoid content can support the use of shallots as an alternative for natural antioxidants. The utilization of antioxidants in balanced amounts has many benefits for the body and is in line with [7] who state that antioxidants have the potential to reduce the risk of various acute and chronic diseases by reducing free radical compounds involved in pathogenesis (Table 1).

**Table 2:** Effect of Shallot Varieties on Bacterial Inhibition

| | Shallot Varieties | Diameter of Clear Zone (mm) | Inhibition Category |
|---|---|---|---|
| | | Bacteria *Staphylococcus aureus* | |
| 1 | Bima Brebes | 5.65 | Medium |
| 2 | Local Kintamani | 6.33 | Medium |
| 3 | Super Philip Bima | 5.72 | Medium |
| 4 | Super Philip Nganjuk | 5.50 | Medium |
| 5 | Bali Karet | 5.38 | Medium |

Notes: Medium category (clear zone diameter 5-10 mm).

The tuber extracts produced in this study can inhibit the growth of *S. aureus* bacteria. The antibacterial activity caused by the extracts of Bima Brebes and Kintamani local bulbs can occur due to the high content of secondary metabolites such as flavonoids. The flavonoid content plays a role in inhibiting or stopping the development of bacteria by forming complex compounds against extracellular proteins by disrupting the bacterial cell membrane and blocking DNA gyrase so that the function of the cytoplasmic membrane is disrupted [20]. The zone of inhibition formed is highly dependent on the amount of extract dripped on the disc, incubation temperature, antibacterial solubility in the media, and antibacterial effectiveness [10] (Table 2).

## IV. CONCLUSION

Phytochemistry of shallot variety bulbs showed differences in flavonoid concentration with the highest value obtained by Super Philip Nganjuk (743.43 mg QE/100 g). Bali rubber has phytochemical properties by forming the highest antioxidant activity ($IC_{50}$) which is 252.64 ppm and the highest ability to inhibit *S. aureus* is obtained in Local Kintamani with a value of 6.33 mm.

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