

The Antibacterial Properties of Bayur Tissues' Extract (*Pterospermum subpeltatum* C.B. Rob)

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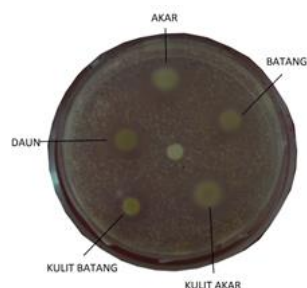
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Graphical abstract



Abstract

Pterospermum is of plant genus in the Sterculiaceae family, which has never been studied for its secondary metabolite compound. The others species from this genus have long been used in generations of traditional medicine. For example, *P. Javanicum* has been used to treat dysentery, toothaches and ulcers. From the antibacterial testing carried out on some tissues of *Pterospermum subpeltatum* by GNA diffusion method, this plant showed antibacterial potential, especially toward *Shigella boydii* and *Staphylococcus aureus*.

Keywords: *Pterospermum Subpeltatum* C. B. Rob; antibacterial; traditional medicine; *Shigella boydii*; *Staphylococcus aureus*

Abstrak

Pterospermum adalah salah satu jenis tumbuhan genus yang terkandung dalam keluarga Sterculiaceae, di mana sebatian metabolit sekundernya tidak pernah dikaji. Akan tetapi, species lain daripada genus ini telah diselidik untuk menghasilkan ubat tradisional. Sebagai contoh, *P. Javanicum* telah digunakan untuk mengubati disenteri, sakit gigi dan ulser. Daripada ujian antibakteria dengan kaedah peresapan GNA yang telah dilakukan ke atas tisu *Pterospermum subpeltatum*, tumbuhan ini memiliki potensi sebagai antibakteria, terutamanya terhadap *Shigella boydii* dan *Staphylococcus aureus*.

Kata Kunci: *Pterospermum Subpeltatum* C. B. Rob; antibakteria; ubat tradisional; *Shigella boydii*; *Staphylococcus aureus*

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1.0 INTRODUCTION

Poor sanitary conditions and weather changes are often characterized by very hot temperatures and high humidity that can cause infections in wounds. Infectious diseases due to cuts and sores on the skin's surface are commonly suffered by people who live in developing tropical countries. Therapies using synthetic antibiotics are not desirable due to the high costs involved. To overcome these problems, people usually use ingredients acquired from traditional herbs, which are often unsupported by scientific explanation.

In Indonesia, the development of drugs from natural materials has great potential due to the tropical climate. Tropical plants are believed to have the ability to manipulate a wide range of chemical compounds that possess a variety of interesting bioactivity. This ability is one of their self-defense mechanisms against the environment. In general, these plants live in harsh environmental conditions, both climatic factors and disorders of herbivores, insect and pests. Tropical plants are capable of producing chemical compounds as potential natural insecticide and antifungal. For examples, *Sterculia africana* contains antifungal compounds [1] and *Azadirachta indica* can be used as insecticides [2].

There are approximately 250,000 species of tropic plants in the world and approximately 30,000 species of them are in the islands of Indonesia. One type of the high level plants is tropics plants and the chemical compositions from most of these plants (99.6%) have not yet been investigated. As a matter of fact, more than 25% of drugs recipes being used now, including bioactive materials, are sourced from high level plant [3]. An example of an Indonesian tropical plants is Sterculiaceae, which has large families, consisting of 70 genres and about 1500 species [4]. Sterculiaceae is a tropical plant that belongs to the group of flowering plants, such as trees, shrubs and sometimes in the form of lianas or herbs [5]. Some species of Sterculiaceae had been used by people as traditional medicine. *Kleinhovia hospital* Linn and *Melochia umbellate* are two kinds of Sterculiaceae that are known by the people of South Sulawesi as Paliasa is kanbium. Its tree is used to cure pneumonia and also to lose louse in hear and antitumor in sarcoma mencit [6]. Extracted paliasa leaf can also prevent hepatitis in female white mouse, *Strain Wister* caused by CCl₄ and consisting of saponin and antarkuinon compound [7]. The other genus from Sterculiaceae family is Melochia, where one of the species, *M. chameidris*, is used in Brazil as drugs for cancer and hypertension treatments [8]. *M. umbellate* of Narmada

(northern part of Lombok) consists of alkaloid in trunk bark, root, and leaf [9].

Besides *Klenhovia* and *Melochia*, *Pterospermum* is also included in the family of Sterculiaceae. It is efficacious as medicinal plants. For example, the bark of *P. javanicum* can treat dysentery, toothache, ulcers and sprains, and leaves of *P. diversifolium* have been used as medicine to treat itchiness and root bark of this plant has been used as fish poison [10]. The use of leaves of *P. acerifolium* in Central Sulawesi to reduce itchiness has also been reported [11]. Another species of Sterculiaceae, *P. subpeltatum*, has never been studied before for its chemical content. *Sterculia foetida* from cold steeping timber has been used as an elimination drug (oabortivum), while lumatan leaves are usually placed on the body to treat strains or injuries from falls. The fruit's skins ashes can be mixed with water and drunk to treat gonorrhoea. *Herrania heartwood* *cuatrecasana* suspended in water is used for snake bite antidote and the bark suspended in alcohol is used as a medicine for throat irritation and dry cough [12]. *Africana* leaves are also used as drug seizures [1]. *Isora Helicteres*' root is used to treat chronic inflammation of the kidneys and the fruit as a herbal medicine to eradicate tapeworms [13].

It has been reported that a species from Sterculiaceae family (*Guzuma ulmifolia*) has shown antibacterial activities [14]. Hexane extract of the plant bark can inhibit the growth of bacteria *E. coli*, while its methanol inhibits the growth of *Pseudomonas*. There has been a study on the antibacterial activity of various extracts of cola plant species and it was reported that the ethyl acetate fraction inhibits bacterial growth actively [15]. Some phylogenetic species of Sterculiaceae plants still have some benchmarks to be explored. *Waltheria dourandinha* *Waltherion oksimetilasi-A* compounds and its derivatives which have antibacterial properties, have been isolated from the root bark [16]. *Stigmasterol glycoside* has been isolated from the root wood of *Ambroma augusta* [17]. Compounds such as *pregnan* and *coumarin* have also been isolated from the plant *Helicteres angustifolia* has shown significant inhibitory activity against the growth of cells in vitro melanoma SK-MEL-28 acute [18]. Based on these data, it can be assumed that the extract of *Pterospermum* also has potential as an antibacterial.

This research is a preliminary study undertaken to determine the early stages of the antibacterial effects of this plant (*Pterospermum*) and the inhibitory effects of methanol extracts of plant tissues against *Shigella boydii* and *Staphylococcus aureus* are also investigated.

2.0 EXPERIMENTAL

2.1 Plant Determination

Tissue samples of *P. subpeltatum*, were acquired from the Mamuju, West Sulawesi and were determined or identified in Herbarium Bogoriense, Biology Research and Development Center, LIPI Bogor.

2.2 Extract Preparation

100 g of samples of leaves, bark, stem, root bark and roots of *P. subpeltatum* was dried and then milled to obtain a smooth sample. Then, each plant's part was put into a vessel and methanol was poured in until the parts were completely submerged (maceration). The vessel was then tightly capped and stirred for 24 h. After that, it was filtered with a Buchner funnel. The pulp was macerated again with fresh methanol for another 24 hours and repeated three times. Evaporation was carried out until a thick extract was

obtained. The extract was evaporated to obtain dry extract which already contains methanol.

2.3 Antibacterial Test

2.3.1 Preparation of Test Bacteria

Test bacteria of *Shigella boydii* and *Staphylococcus aureus* (ATCC 25923 from pure cultures) was taken one dose each and then they were inoculated by streaking on medium Nutrient Agar (NA) followed by further incubation at 37°C for 24 hours.

2.3.2 Preparation of Test Bacteria Suspension

Test bacteria aged for 24 hours from slant agar were suspended in 0.9% NaCl saline solution and then measured by a spectrophotometer.

2.3.3 Antibacterial Testing

Seeding layer for bacteria testing was made by preparing 15 mL of Muller Hinton Agar (MHA) medium at 40-45° C and then poured aseptically into a petri dish, before addition of 0.2 mL of bacterial suspension. It was then whisked slowly until homogeneous and allowed to solidify. Paper disc was aseptically placed on the surface of the solidified medium and 20 µl of the sample was dripped on the paper disc using Eppendorf pipett, and then incubated for 24 hours at 37°C. Inhibition was measured using calipers in the clear zone.

3.0 RESULTS AND DISCUSSION

The antimicrobial ability of the methanol extracted from the plant was tested. The two types of bacteria that are pathogenic can cause infections of the skin are *Staphylococcus aureus* and *Shigella boydii*, which are present in our digestive system. Antibacterial power of methanol extracts from bayur tissues (*P. subpeltatum* C. B. Rob) against *Shigella boydii* and *Staphylococcus aureus* can be calculated by measuring the diameter of the obstacle region (DDH) of bacterial growth around the paper disc that looks clear or the formation of a clear zone on the surface of the medium which has overgrown colonies, as can be seen in Figure 1 and 2.

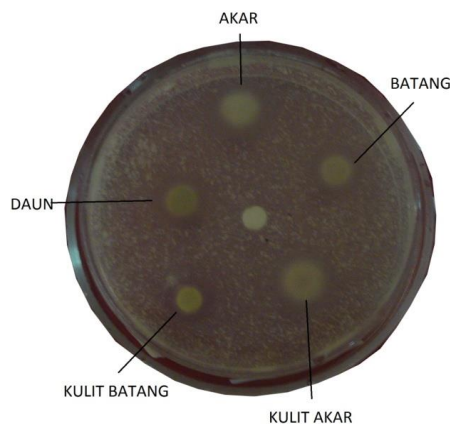


Figure 1 *Shigella boydii*

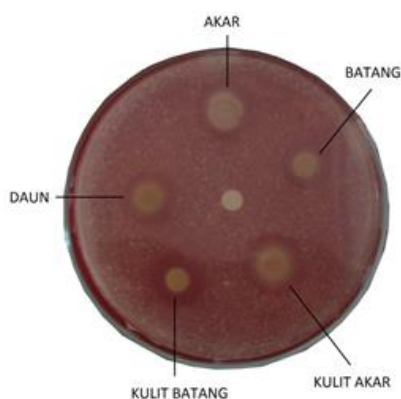


Figure 2 *Staphylococcus aureus*

Test results of antibacterial activity against *Shigella boydii* and *Staphylococcus aureus* showed a clear zone which indicates the presence of inhibition. Measurement results of DDH DDH values obtained are listed in Table 1.

Table 1 Result of antibacterial inhibitory testing of methanol extract from plant tissues.

Methanol Extract	Inhibitory Diameter (mm)	
	<i>S. boydii</i>	<i>S. aureus</i>
Roots	15,3	15,6
Stem	14,2	14,8
Leaves	13,4	13,8
Root bark	15,7	16,6
Bark	13,6	14,7

The results showed that the methanol extracts of *P. subpeltatum* plant tissues are able to inhibit the growth of *Shigella boydii* and *Staphylococcus aureus*. This is presumably due to the chemical content of the compounds in the form of secondary metabolites. Secondary metabolites are thought to be the product form the detoxification of toxic metabolites and these piles cannot be disposed of by plants, causing them to stockpile in certain tissues of the plants [19].

This metabolic detoxification product may be due to the ability of plants to produce chemical compounds as a weapon to defend themselves against pests and environmental factors. The type of secondary metabolites depends on the plant's biogenetic factors. Chemical compounds such as alkaloids, flavonoid, triterpenoids, tannins, and saponins, can act as an active ingredient, which might inhibit the growth of *Shigella boydii* and *Staphylococcus aureus*. The inhibited growth of bacteria or bacterial death due to an antibacterial agent may be caused by inhibition of cell wall synthesis, cell membrane function, protein synthesis, or even the synthesis of nucleic acids [20]. Bacterial cell wall composed of peptidoglycan can provide power to the integrity of the cell. The process of bacterial cell wall assembly begins with the formation of the peptide chain forms cross-bridge peptide chains that incorporate glycan chains of peptidoglycan in another chain, causing cell walls to assemble perfectly. If there is damage to the cell wall or any obstacles in its formation, incorporation of glycan chains are not crosslinked into the peptidoglycan cell wall that can lyse the bacterial cells and bacteria lose the ability to form colonies, followed by lysis of bacterial cell death.

4.0 CONCLUSION

The results provided the empirical data to support the existence of a potential antibacterial power plant tissue extracted from *P. subpeltatum*, especially against *Shigella boydii* and *Staphylococcus aureus*. Further researches need to be done, especially on tracking and identification of secondary metabolite content of chemical compounds that inhibit the growth of *Shigella boydii* and *Staphylococcus aureus*. This can later be developed as a drug to prevent diseases caused by these bacteria.

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