

Morphological Analysis of Ciplukan Plant (*Physalis angulata* L.) Pollen for Macroscopic Identification

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Abstract.

This research addresses the prevalence of arthritis in Indonesia, focusing on traditional medicinal plants like Ciplukan due to the side effects of synthetic treatments. Arthritis, affecting 23.6-31.3% of the population, with Osteoarthritis (50-60% in the elderly) being the most common, necessitates alternative, less toxic remedies. Traditional medicine, relying on plant-derived remedies, is explored for its accessibility, affordability, and lower side effects. The study delves into Ciplukan, known for its anti-arthritis properties, conducting in vitro tests on its methanol extract. Results reveal anti-arthritis activity attributed to steroids, flavonoids, and alkaloids. The methodology involves macroscopic and microscopic examinations of Ciplukan plants, verifying authenticity and confirming the accuracy of plant samples. Organoleptic assessments highlight distinctive features, contributing to the plant's identification. Microscopic examination reveals the presence of stomata and palisade cells in the upper epidermis, aligning with literature data. The vascular system analysis emphasizes the efficiency of resource transport and adaptation to environmental changes. In conclusion, the study provides a comprehensive understanding of Ciplukan's characteristics, supporting its potential in arthritis treatment. The findings contribute to the utilization of traditional medicine in healthcare, emphasizing the importance of plant-based remedies with fewer side effects.

Keywords: Morphological, *Physalis angulata* L.) and Macroscopic.

I. INTRODUCTION

In Indonesia, research findings indicate a prevalence of arthritis ranging from 23.6% to 31.3%. Osteoarthritis (OA) is the most common type among the elderly, accounting for 50-60%, followed by extra-articular rheumatic conditions, and gout at approximately 6-7%. Rheumatoid arthritis (RA) in Indonesia is only 0.1% or 1 in 1000-5000 people (Nainggolan, 2009). The Ciplukan plant (*Physalis angulata* L.) is an herbal plant that has long been used in traditional medicine in various regions. The diversity of health benefits associated with Ciplukan, including its anti-inflammatory properties, makes it an interesting subject of research (Nuranda, A., 2016). Research on this plant involves various aspects, one of which is the macroscopic identification of the plant's pollen (Oktadiana, I., 2024). According to the Royal College of Physicians (RCP), widespread inflammation in arthritis can affect joints, leading to systemic diseases. In patients with a significant release of proteins, inflammation processes can be triggered, such as tumor necrosis factor- α (TNF- α). In conditions of high fatigue, symptoms like influenza, fever, sweating, and weight loss may occur. Besides synthetic treatments, various methods can be used to manage arthritis, including acupuncture, acupressure, massage, reflexology therapy, flotation therapy, heat and cold therapy, TENS (*Transcutaneous Electrical Nerve Stimulation*), and dietary adjustments (reducing animal product consumption, except fish, and increasing fruit, vegetable, and grain intake). The Arthritis Foundation (AF) mentions drugs that can be used to treat arthritis, such as anti-inflammatory drugs, corticosteroids, and antirheumatic drugs. The use of these drugs can lead to side effects and toxicity.

Anti-inflammatory drugs can cause kidney damage, ulceration, and gastrointestinal bleeding, while corticosteroids can result in hypertension, hyperglycemia, and osteoporosis (Yulinah, 2008). Other side effects of NSAIDs use include acute kidney function impairment (Nugroho, 2012). Due to the side effects and toxicity of these treatments, numerous studies have been conducted on traditional medicinal plants known for their anti-arthritis properties, which carry a lower risk of side effects. Traditional medicine involves remedies derived from plant materials, animals, minerals, or galenic preparations, lacking clinical data and used based on experience. The advantages of traditional medicine include easy accessibility, the ability to grow raw materials,

affordability, and the possibility of self-preparation. Traditional treatment offers numerous benefits, such as lower side effects compared to chemical drugs and easier absorption into the body (Ankrah *et al.* 2003). In vitro testing of methanol extract from the roots conducted by Jayaprakasam R and Ravi T.K (2012) indicates anti-arthritis activity, manifested by protein denaturation inhibition, proteinase inhibition, and hyaluronidase enzyme inhibition. The ability to inhibit these enzymes is believed to be due to the presence of steroids, flavonoids, and alkaloids. Ciplukan is an annual plant from the Solanaceae family. Ciplukan contains plant chemical compounds such as alkaloids, flavonoids, saponins, physalin A, physalin B, withaphysalin A, withaphysalin B, terpenes, and citric acid.

Traditionally, Ciplukan is used to heal wounds, liver inflammation, malaria, genital diseases, rheumatism, and earaches (Freiburghaus *et al.* 1996). Based on previous research proving the anti-arthritis activity of Ciplukan, further studies are conducted to enhance this activity. The identification of plant pollen is a critical element in plant morphology research. Morphological analysis of pollen, including macroscopic observations, provides in-depth insights into the unique characteristics of this plant (Nugroho, B. P., 2024). In this context, Ciplukan is noteworthy due to its potential in the development of natural medicines and health products (Saristiana, Y., 2024). Previous studies have laid the groundwork for understanding the morphological nature of Ciplukan at the macroscopic level, but further exploration in the analysis of this plant's pollen is necessary (Mildawati, R., 2024). Accurate identification of pollen can provide critical additional information for understanding the reproductive nature of the plant and can guide the selection of genetic resources for the development of improved plants (Prasetyawan, F., 2024). This research aims to conduct morphological analysis on the pollen of the Ciplukan plant (Sutjiatmo, A. B., 2011). Special focus is given to the macroscopic identification of pollen to gain a more comprehensive understanding of the unique characteristics of this plant (Muslikh, F. A., 2023). The results of this study are expected to make a significant contribution to the enhancement of knowledge about the morphology of Ciplukan, paving the way for further development in utilizing this plant in the field of health and natural medicines (Kusumaningtyas, R., 2015).

II. MATERIAL AND METHODS

The optical microscope serves as the primary tool utilized for observing morphology at the macroscopic level. Additionally, the electron microscope can be employed for more in-depth analysis at the microscopic level. Stereoscopic microscopes are also applied for three-dimensional observations at the macroscopic level, facilitating the identification of more complex morphologies. In the analysis process, pipettes and measuring glasses are used for extracting and measuring the quantity of pollen to be analyzed. The use of slides and cover glasses is necessary to prepare the pollen samples under the microscope. If needed, a microscope camera can be utilized to document images of the observed pollen. Furthermore, image analysis software can be applied for further analysis and measurements of pollen morphology with the assistance of a computer. It is important to note that the choice of tools may vary depending on the selected analysis methods and the desired level of detail within the context of this research.



Fig 1. optical microscope

The next step in this research is to conduct a macroscopic examination of the Ciplukan plants. The purpose of this examination is to verify the authenticity of the samples by comparing the morphological characteristics of the Ciplukan plant thoroughly with its plant description in the book "Materia Medika Indonesia," editions II and V. This macroscopic examination will provide more detailed information about the physical and visual characteristics of the plants, serving as the basis for determining the identification and authenticity of the samples used in this research. The process of obtaining Ciplukan plants is carried out in a clean, dry condition, and without undergoing the process of decay. Subsequently, the plants are washed with flowing water to remove any remaining dirt that may still adhere to the raw materials or plant materials. After the washing process, the plants are carefully dried in a drying cabinet with a controlled temperature of around 40°C.

Once reaching the optimal level of dryness, the plants are then finely ground into powder using suitable equipment, and the powder is sieved using a sieve or mesh with a size of 40. The entire process aims to ensure that the plant material used in this research is in a clean, dry condition and ready for the next stage of processing. Microscopic testing is conducted with the primary aim of confirming the accuracy of the plant samples used in this research. The microscopic testing process involves the identification of several parameters, including but not limited to, water content, and other microscopic characteristics in the powder of the raw materials from the Anting-anting and Ciplukan plants. Through this microscopic testing, it is anticipated that more in-depth information regarding the microscopic structure and components of both plants can be obtained, ensuring the quality and authenticity of the samples being analyzed within the context of this research.

III. RESULTS AND DISCUSSION

The ciplukan plant undergoes a macroscopic identification process through meticulous organoleptic examination. The primary focus of this macroscopic identification is to gain an in-depth understanding of the physical characteristics inherent to the ciplukan plant. This macroscopic examination encompasses various aspects, including the overall shape of the plant, emitted aroma, perceivable taste, and the color spectrum exhibited by the plant. The results of the organoleptic examination of the ciplukan plant's crude drug are then detailed in Table 1, presenting highly valuable information regarding the plant's characteristics.

Table 1. Results of Organoleptic Examination of the Ciplukan Plant's Crude Drug

Organoleptic Characteristic	Examination Results
Aroma	Bitter
Taste	Greenish-brown
Color	Powdered
Shape	Distinctive

With the meticulous examination, it is revealed that the ciplukan plant exhibits distinctive shape characteristics, a bitter aroma, a taste encapsulated in a greenish-brown hue, and uniquely colored powder. These findings not only provide a comprehensive understanding of the physical features of the ciplukan plant but also serve as a crucial foundation in the plant identification process. The organoleptic examination of the ciplukan plant has yielded findings that provide in-depth insights into its characteristic properties. The aroma of this plant is identified as bitter, providing potential clues related to the chemical compounds causing the bitter sensation and its implications. The taste of the ciplukan plant, with its greenish-brown color, suggests the presence of taste elements that can be linked to specific chemical or nutritional contents.

The transformation of the plant's color into a powdered form opens possibilities for use in traditional remedies or supplements. The distinctive shape of the plant becomes an identity marker that distinguishes ciplukan from other plants, proving crucial in ensuring its authenticity and quality, both in research contexts and traditional medicinal use. Each organoleptic characteristic not only records results but also provides a deeper understanding of the physical nature of this plant. This information forms a robust foundation for recognizing and utilizing the ciplukan plant in various contexts, ranging from traditional medicine to further research on its health potential. The overall findings from organoleptic assessments constitute an integral basis for understanding the inherent characteristics of the ciplukan plant, illustrating its complexity and potential in various applications.

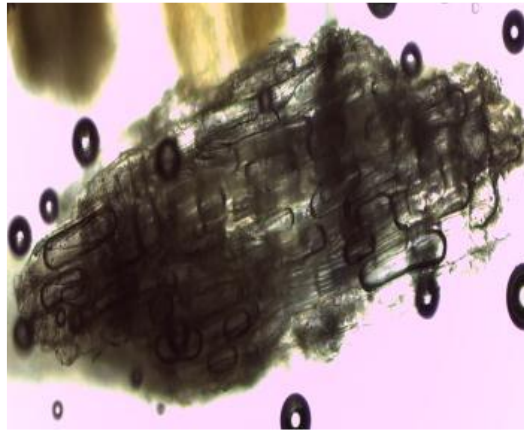


Fig 2. Identification of ciplukan plant powder under a microscope of upper epidermis

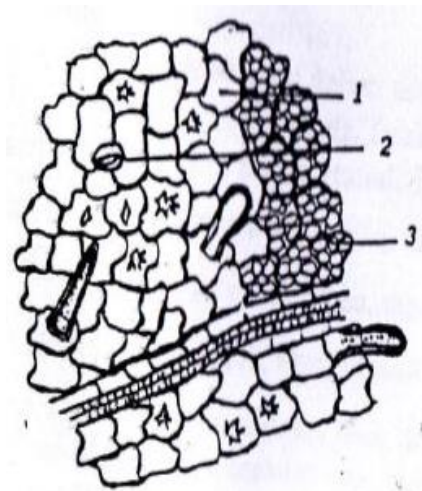


Fig 3. References upper epidermis

From the results of microscopic examination, it can be observed that the upper epidermis shows the presence of stomata and palisade cells that appear in a tangential position. This information is consistent with the data found in the literature (References), confirming the microscopic morphological characteristics of the ciplukan plant powder. The process of microscopic identification not only provides an overview of the structure and components of the ciplukan plant but also opens up deeper insights into these aspects. The understanding gained from microscopic identification serves as a crucial foundation for evaluating the quality and authenticity of the samples used in this research context. These results support the validity and reliability of using ciplukan plant powder in this study, reinforcing the scientific basis of the research by providing a more comprehensive insight into the microscopic characteristics of the plant.

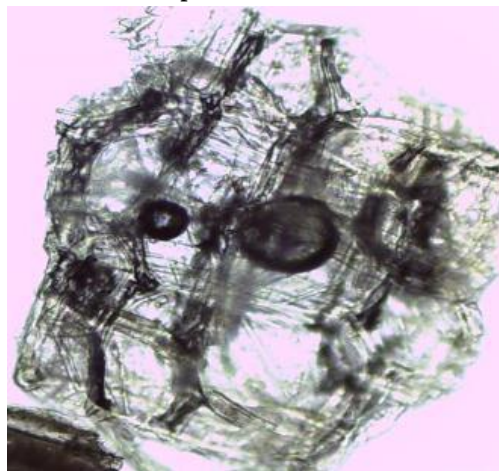


Fig 4. Identification of ciplukan plant powder under a microscope of lower epidermis

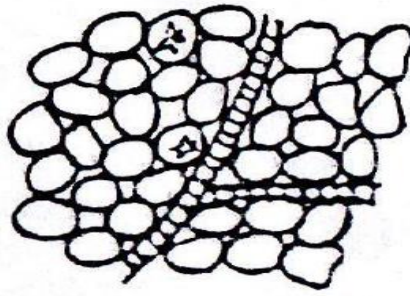


Fig 5. References lower epidermis

The epidermis in the ciplukan plant is a layer of cells located on the outer surface of the leaves. This structure plays a crucial role in the functions of the plant, especially in gas exchange and moisture regulation. There are two types of epidermis, namely the upper epidermis and the lower epidermis, each having specific characteristics. The upper epidermis in the ciplukan plant consists of closely packed cells and contains stomata. Stomata are small structures that open and close to regulate gas exchange, such as carbon dioxide and oxygen, as well as water evaporation through the transpiration process. In the upper epidermis, there is a well-organized palisade, providing rigidity and contributing to the absorption of sunlight for photosynthesis. On the other hand, the lower epidermis in the ciplukan plant also has stomata, but generally more numerous and aiding in the transpiration process. The cells of the lower epidermis have a flatter shape compared to those of the upper epidermis. The presence of stomata in both epidermal layers allows for gas exchange and moisture regulation, which are essential for the growth and survival of the plant.

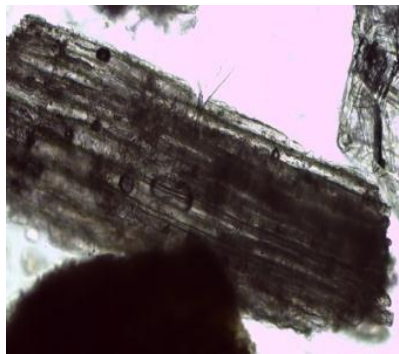


Fig 6. Identification of ciplukan plant powder under a microscope of vascular

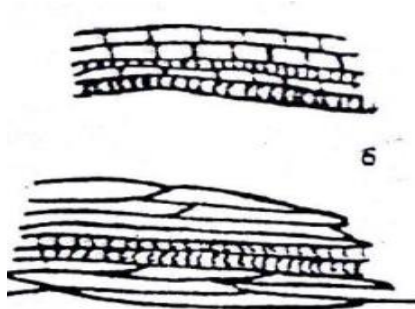


Fig 7. References vaskuler

The ciplukan plant has a complex vascular system, consisting of vascular bundles that transport water, nutrients, and organic substances throughout the plant. This vascular system comprises two main types, namely xylem and phloem, which serve as the backbone in the processes of transportation and distribution in the plant. The xylem is responsible for transporting water and minerals from the roots to the leaves and upper parts of the plant, supporting the processes of photosynthesis and growth. Meanwhile, the phloem takes up the products of photosynthesis, such as sugars and other organic substances, and distributes them from the leaves to all parts of the plant, providing vital support for the functions and development of the plant. The anatomical structure of the vascular bundles in the ciplukan plant ensures efficiency in the transport and distribution of necessary resources. It is essential to remember that this vascular system not only supports the growth and metabolism of the plant but also responds to environmental changes, enabling necessary adaptations for optimal survival. Through in-depth studies on these vascular bundles, we can gain a better insight into how the ciplukan plant interacts with its environment and maintains a healthy and balanced life.

IV. CONCLUSION

In conclusion, the prevalence of arthritis in Indonesia, ranging from 23.6% to 31.3%, highlights the significance of addressing this condition. Osteoarthritis (OA) is predominant among the elderly, constituting 50-60% of cases, followed by extra-articular rheumatic conditions and gout at approximately 6-7%. Rheumatoid arthritis (RA) in Indonesia is relatively rare, affecting only 0.1% or 1 in 1000-5000 people. Widespread inflammation in arthritis can lead to systemic diseases, triggering processes like tumor necrosis factor- α (TNF- α) release, accompanied by symptoms such as influenza-like symptoms, fever, sweating, and weight loss. While synthetic treatments exist, various methods, including acupuncture, acupressure, massage, and dietary adjustments, are employed to manage arthritis. However, synthetic drugs may lead to side effects and toxicity, emphasizing the need for alternative treatments. Traditional medicinal plants, known for their anti-arthritis properties, are being explored due to their lower risk of side effects. In vitro testing of the methanol extract from Ciplukan roots has shown anti-arthritis activity, attributed to the presence of steroids, flavonoids, and alkaloids. Ciplukan, a plant from the Solanaceae family, traditionally used for various ailments, is under further study to enhance its anti-arthritis activity. The research methodology involves macroscopic and microscopic examinations of Ciplukan plants, ensuring the authenticity of the samples.

The macroscopic examination aims to provide detailed information about the physical and visual characteristics, while the microscopic examination involves identifying parameters like water content. These examinations contribute to a comprehensive understanding of the plant's characteristics, laying the foundation for subsequent analyses. The organoleptic examination of Ciplukan has revealed distinctive characteristics, including a bitter aroma, greenish-brown taste, powdered color, and a distinctive shape. These findings contribute not only to the physical description but also offer insights into potential chemical compounds and traditional uses of Ciplukan. Microscopic identification, particularly of the upper epidermis, demonstrates the presence of stomata and palisade cells in a tangential position. This aligns with literature data, confirming the microscopic characteristics of Ciplukan. The results support the use of Ciplukan plant powder in the study, enhancing the scientific basis by providing a more comprehensive insight into the microscopic characteristics of the plant. The examination of the epidermis in Ciplukan reveals its crucial role in gas exchange and moisture regulation. The upper epidermis, with stomata and a palisade structure, aids in photosynthesis, while the lower epidermis, with more stomata, supports the transpiration process. The plant's vascular system, comprising xylem and phloem, ensures efficient transport of water, nutrients, and organic substances, vital for its growth and adaptation to the environment. In summary, the research on Ciplukan not only sheds light on its potential in arthritis treatment but also emphasizes the importance of traditional medicine. The comprehensive examination of the plant at macroscopic and microscopic levels contributes to a deeper understanding of its characteristics, paving the way for further exploration of its medicinal properties.

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