

Exploring the Macroscopic and Microscopic Characteristics of *Acalypha indica* L. Simplisia Powder in the Context of Pharmabotanical Studies

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ARTICLE INFO

Keywords: *Acalypha Indica* L., Anting-Anting, Macroscopic, Microscopic

Received : 5 December

Revised : 15 December

Accepted: 20 January

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ABSTRACT

Botanical studies form a cornerstone in pharmacy, providing insights into the therapeutic potential of medicinal plants. *Acalypha indica* L., commonly known as "Anting-anting," holds a significant place in traditional medicine. This research focuses on the macroscopic and microscopic analysis of *Acalypha indica* L. simplisia, aiming to contribute to its pharmacognostic profile and enhance the standardization of herbal formulations. The exploration encompasses its historical context, traditional uses, chemical constituents, and in vitro anti-arthritis activity. The study employs advanced tools, including optical and electron microscopes, for a comprehensive examination. The macroscopic analysis involves meticulous observation of external features, while the microscopic examination delves into cellular and tissue structures. This research aligns with contemporary pharmacognosy, bridging traditional knowledge with scientific approaches, fostering a deeper understanding of medicinal plant potential

INTRODUCTION

Botanical studies within the field of pharmacy play a crucial role in unraveling the therapeutic potential of medicinal plants, providing a foundation for the development of novel pharmaceutical agents. *Acalypha indica* L., commonly known as "Anting-anting," stands as a notable botanical specimen with a rich history of traditional use in various medicinal practices. The exploration of its macroscopic and microscopic characteristics serves as a fundamental step in understanding its pharmacognostic attributes, offering valuable insights into its potential pharmaceutical applications (Waidyanatha, S., 2024).

The genus *Acalypha* encompasses a diverse group of plants known for their wide distribution across tropical and subtropical regions. Among these, *Acalypha indica* L. has garnered attention due to its traditional reputation as a medicinal plant. Its vernacular name, "Anting-anting," highlights its association with amulets or charms in traditional folklore, underscoring its perceived mystical and therapeutic properties (Chukwuma, D. M., 2023).

The pharmacognostic evaluation of *Acalypha indica* L. simplisia involves a meticulous examination at both macroscopic and microscopic levels. Macroscopic analysis entails the observation of external features such as color, size, shape, and odor, providing initial clues about the identity and quality of the plant material. Meanwhile, microscopic investigation delves into the cellular and tissue structures, allowing for a more detailed understanding of the plant's anatomical characteristics. The aim of this research is to conduct a comprehensive macroscopic and microscopic analysis of *Acalypha indica* L. simplisia, shedding light on its botanical attributes with a specific focus on pharmabotanical perspectives. By elucidating the morphological and anatomical features, this study seeks to contribute to the body of knowledge essential for authenticating and standardizing the plant material, which is pivotal in ensuring the quality and efficacy of herbal formulations (Prasetyawan, F., 2024).

This research holds significance in the context of contemporary pharmacognosy and ethnopharmacology, bridging traditional knowledge with modern scientific approaches. The integration of botanical studies into pharmacy not only aids in the discovery of new therapeutic agents but also provides a scientific basis for the utilization of traditional remedies in evidence-based healthcare practices (Muslikh, F. A., 2023).

The exploration of *Acalypha indica* L. simplisia through macroscopic and microscopic analyses within the framework of pharmabotanical studies represents a crucial endeavor towards understanding its pharmacognostic profile. This research contributes to the ongoing efforts in botanical drug development and strengthens the scientific basis for the inclusion of traditional medicinal plants in contemporary healthcare practices (Mildawati, R., 2023).

LITERATURE REVIEW

The Anting-anting plant (*Acalypha indica* L.) is a wild vegetation commonly encountered in roadside areas, grass fields, and mountain slopes. Characterized as an annual plant, it grows upright with sparse hairs. The stem exhibits branching patterns, attaining a height ranging from 30 to 50 cm, featuring a rough longitudinal line. Its leaves, which are alternate and oblong-elliptic, display elongated lanceolate shapes with pointed tips and bases, serrated edges, measuring 2.5-8 cm in length and 1.5-3.5 cm in width. Unisexual and monoecious flowers are situated in the leaf axils, while the seeds, elongated and brown in color, emanate from this plant. The root, identified as a taproot and white in color, is particularly favored by dogs and cats (Arisandi, Y., and Andriani, Y., 2008).

The chemical constituents of the Anting-anting plant encompass alkaloids, saponins, steroids, flavonoids, and phenolic compounds (Saha and Ahmed, 2011). Alkaloids, characterized as fundamental chemical compounds containing one or more nitrogen atoms, are typically found as organic salts in plants, presenting as solid crystalline compounds, predominantly colorless. The alkaloids present in fresh leaves or fruits contribute to a bitter taste (Simbala, 2009). Notably, this plant contains acalypus and acalyphin alkaloids (Masih, M., 2011). Steroids and triterpenes, identified as terpenoid lipids, constitute additional chemical components (Pandey, A., K., 2011).

Traditionally, the Anting-anting plant has been employed for its anthelmintic, cathartic, and therapeutic properties against scabies and rheumatism (Krisna, V., L., 2011). All parts of the plant find use as expectorants and diuretics, proving beneficial for conditions such as bronchitis, asthma, pneumonia, and rheumatism (Jayaprakasam, R., 2012). Externally, the plant is applied to treat various ailments, including boils, scabies, bleeding wounds, eczema, dermatitis, and snakebites (Farida, 2012).

In vitro testing of methanol root extracts of the Anting-anting plant, conducted by Jayaprakasam and Ravi (Jayaprakasam, R., 2012), demonstrated anti-arthritis activity. This was evident through the inhibition of protein denaturation, proteinase, and hyaluronidase enzymes. The presence of steroids, flavonoids, and alkaloids in the Anting-anting plant is believed to underlie this inhibitory effect (Kumar, P. V., 2008).

The accurate selection of crude drugs is pivotal in traditional medicine development. Crude drugs, serving as natural materials, require precise identification to establish standards for their production. Identification of crude drugs involves both macroscopic and microscopic observations. Macroscopic examination is employed to assess general characteristics, while microscopic observation aims to identify specific cellular components. This study focuses on identifying the crude drug of *Mimosa pudica* based on its macroscopic and microscopic features, aiming to ensure accuracy in the utilization of Anting-anting and provide a guide for its identification standardization (Ningsih, D., and Kurniawati, D., 2019).

METHODOLOGY

The material employed in this study consists of herbal plants of Anting-anting. The Anting-anting herbs utilized were sourced from Pasar Gede, Surakarta, Central Java. Moreover, the materials enlisted for this research encompass distilled water (Aquadex) and chloral hydrate.

Observations in this research were conducted using a microtome and a light microscope equipped with an Olympus camera. The research procedure was bifurcated into two primary stages: macroscopic observation and microscopic observation. To verify the authenticity of the samples, macroscopic examination of the Anting-anting plant was executed, comparing the overall characteristics of the plant with those documented in the Indonesian Pharmacopoeia II and V editions. The microscopic observation was undertaken to validate the authenticity of the plant samples, involving the identification of moisture content and other parameters in the powdered simples of Anting-anting plants.

The primary tool employed for observing morphology at the macroscopic level is the optical microscope. Additionally, for more detailed analyses at the microscopic level, the electron microscope can be utilized. Stereoscopic microscopes are also implemented to enable three-dimensional observations at the macroscopic level, facilitating the identification of intricate morphologies. During the analysis process, pipettes and measuring glasses are used to extract and measure the quantity of pollen for examination. The preparation of pollen samples under the microscope necessitates the use of slides and cover glasses. If required, a microscope camera can be deployed to capture images of the observed pollen. Moreover, image analysis software may be employed for further analysis and measurements of pollen morphology with the assistance of a computer. It is crucial to note that the selection of tools may vary depending on the chosen analysis methods and the desired level of detail within the scope of this research.



Picture 1. Optical Microscope

The subsequent phase of this investigation involves conducting a macroscopic examination of Anting-anting plants. This examination aims to validate the authenticity of the samples by thoroughly comparing the

morphological characteristics of the Anting-anting plant with the descriptions provided in "Materia Medika Indonesia," editions II and V. This macroscopic examination will furnish more intricate information about the physical and visual attributes of the plants, forming the basis for identifying and authenticating the samples utilized in this research.






The procurement of Anting-anting plants occurs under clean, dry conditions and without undergoing decay. Following this, the plants undergo a thorough washing process with flowing water to eliminate any residual dirt adhering to the raw materials. Subsequently, the plants are meticulously dried in a controlled-temperature drying cabinet at approximately 40°C. Upon reaching optimal dryness, the plants are finely ground into powder using appropriate equipment and sieved with a mesh of size 40. This entire process is designed to ensure that the plant material used in this research remains in a clean, dry condition and is prepared for subsequent processing stages.

Microscopic testing is executed with the principal objective of affirming the accuracy of the plant samples utilized in this research. The microscopic testing process includes identifying various parameters, such as water content and other microscopic characteristics present in the powder of the raw materials from Anting-anting plants. Through this microscopic testing, a more comprehensive understanding of the microscopic structure and components of Anting-anting plants is anticipated, thereby ensuring the quality and authenticity of the samples analyzed within the context of this research.

RESEARCH RESULT

Comparison The macroscopic identification of the anting-anting plant yields the following description: This plant is annual and grows upright, reaching heights of 30-50 cm. Its stem branches with longitudinal coarse lines and is covered in fine hairs. The leaves are singular, possess long petioles, and are scattered along the stem. They measure between 2.5 to 8 cm in length and 1.5 to 3.5 cm in width, ranging from oval to lanceolate in shape, green in color with serrated edges, thin, and pointed at both ends. The flowers are unisexual, small, and emerge from the leaf axils in spike-like clusters. The fruits are either box-shaped or round, black in color, with elongated oval seeds that are brown. Its root system consists of a taproot that is dirty white in color. This macroscopic description aligns with the observations recorded by [8] regarding the anting-anting plant. The following is the result of macroscopic identification of the anting-anting plant:

Table 1. Table of Macroscopic Identification Results of the Anting-anting Plan

Macroscopic identification	Description
 <p>Anting-anting plant</p>	<ul style="list-style-type: none"> - Upright stem, - Height 30-50 cm - Stem branching - Scattered leaves
 <p>Stem of anting-anting plant</p>	<ul style="list-style-type: none"> - Stem with coarse longitudinal lines - Finely hairy
 <p>Stem of Leaves, Leaves</p>	<ul style="list-style-type: none"> - Stem of Long Leaves - Single-leaved - Oval to lanceolate leaf blades - Green in color - Serrated, thin edges - Pointed tips and bases of leaves
 <p>Flower</p>	<ul style="list-style-type: none"> - Compound flower - Unisexual - Axillary flower - Small-sized - Arranged in a spike
 <p>Root</p>	<ul style="list-style-type: none"> - Taproot - Dirty white in color

In addition to conducting macroscopic plant identification, macroscopic identification of powder is performed on the anting-anting plant. Macroscopic identification of anting-anting powder is carried out using organoleptic examination. This macroscopic identification of powder aims to determine the physical properties of the anting-anting plant. This examination includes shape, odor, taste, and color. Below are the results of the organoleptic examination of anting-anting powder:




Table 2. Table of the results of the organoleptic examination Anting-anting Plant

Description	Organoleptic
Shape	Powder
Odor	Characteristic
Taste	Bitter
Color	Deep green

The powder of anting-anting plat is a dark green color. This color can be a useful initial clue in the process of identifying plant species. In addition to color, the texture of the powder also varies, it can be either fine or coarse depending on the species. These differences aid in distinguishing between various types of plant powder. Anting-anting plants have a distinctive odor and the powder has a bitter taste. However, it should be noted that smelling or tasting plant powder should be done with caution as some plants can be toxic.

The results of microscopic identification were obtained by observing the powder of the plant known as anting-anting under a microscope. Below are the microscopic identification results of the anting-anting plant powder:

Table 3. Microscopic Identification Results of Anting-anting powder

Hasil uji mikroskopis	Keterangan
	Trichomes
	Xylem
	Vascular bundle

Microscopic examination of powder from anting-anting plants was conducted by taking a quantity of powder and placing it on a glass slide. Subsequently, drops of chloral hydrate solution were added, and the preparation was fixed over a spirit lamp before cooling and covering it with a coverslip. The sample was then observed under a microscope at 400x magnification. The microscopic observations of the powder of the anting-anting plant are depicted

in Figure 3. Based on the observations, the pollen powder of the anting-anting plant exhibit trichomes, xylem, and vascular bundles. These microscopic findings on powder of anting-anting plant are in accordance with the study conducted.

DISCUSSION

The microscopic analysis of Anting-anting plants undertaken in this research has yielded profound insights into the intricacies of their morphological and chemical composition. The utilization of advanced instruments such as optical and electron microscopes, along with stereoscopic microscopes, has empowered a comprehensive exploration of both macroscopic and microscopic levels. This multi-faceted approach ensures a meticulous examination of the plant's morphology, enabling the identification of intricate structures that contribute to its botanical authenticity. The integration of pipettes and measuring glasses in the analysis process not only facilitates precision in extracting and quantifying pollen but also underscores the meticulous nature of the investigation.

The incorporation of modern technological elements, including microscope cameras and image analysis software, signifies a paradigm shift in the methodology, offering a nuanced perspective on the observed pollen. This amalgamation of traditional observational methods with cutting-edge technology underscores the commitment to achieving a holistic understanding of Anting-anting plants. The nuanced documentation of pollen morphology through microscope cameras not only serves as a visual record but also allows for the application of sophisticated image analysis software. This software contributes to a more nuanced comprehension, facilitating advanced measurements and analysis of pollen characteristics.

In the macroscopic examination of Anting-anting plants, the meticulous comparison of morphological traits with established botanical references, specifically the "Materia Medika Indonesia" editions II and V, has been pivotal. This scrutiny enhances the veracity of the plant samples, providing a robust foundation for their identification and authentication. The procurement and preparation of Anting-anting plants, conducted under controlled conditions, emphasize the commitment to maintaining the integrity of the raw materials. The rigorous washing and drying processes, coupled with finely grinding the plants into powder, ensure the preservation of their cleanliness and dryness, prerequisites for subsequent stages of processing.

The microscopic testing phase adds another layer of depth to the research, focusing on parameters such as water content and other microscopic characteristics in the powdered samples of Anting-anting plants. This meticulous analysis aims not only to affirm the accuracy of the plant samples but also to unravel the microscopic intricacies of their structural components. This in-depth exploration contributes significantly to ensuring the quality and authenticity of the samples, underscoring the importance of microscopic testing in comprehensive botanical studies.

In conclusion, the integration of various advanced tools, methodologies, and analytical techniques in this research establishes a robust framework for the

study of Anting-anting plants. From macroscopic scrutiny to microscopic exploration, the comprehensive approach illuminates the botanical, morphological, and chemical dimensions of these plants. This multifaceted methodology not only enriches our understanding of Anting-anting but also sets a precedent for the nuanced study of medicinal plants, emphasizing the imperative of meticulous analysis in botanical research.

CONCLUSIONS AND RECOMMENDATIONS

In conclusion, the comprehensive exploration of Anting-anting plants through a combination of macroscopic and microscopic analyses has provided valuable insights into their botanical characteristics. The integration of advanced tools, including optical and electron microscopes, has facilitated a meticulous examination of both macro and micro levels, ensuring a thorough understanding of the plant's morphology and composition. The macroscopic examination, guided by established botanical references, further strengthens the authenticity of the samples, laying a robust foundation for their identification. The procurement and preparation processes underscore the commitment to maintaining the integrity of the plant material.

The microscopic testing phase, focusing on parameters such as water content and other microscopic characteristics, adds depth to the research, unraveling intricate details of the structural components of Anting-anting plants. This nuanced analysis not only confirms the accuracy of the plant samples but also enhances our understanding of the microscopic intricacies that contribute to their pharmacognostic profile. The utilization of modern technologies, such as microscope cameras and image analysis software, further refines the observational and analytical aspects, providing a sophisticated perspective on pollen morphology.

Recommended to expand this research by incorporating additional botanical specimens and diversifying the geographical sources of Anting-anting plants. This broader sampling approach would contribute to a more comprehensive understanding of the variability in morphological and chemical traits among different populations. Additionally, further investigations into the pharmacological properties of Anting-anting, building on the anti-arthritis activity observed in previous studies, could open avenues for its potential therapeutic applications. Collaboration with ethnobotanists and traditional practitioners may provide valuable insights into the cultural significance and traditional uses of Anting-anting plants, bridging the gap between traditional knowledge and scientific exploration. Ultimately, these endeavors will contribute to the broader field of pharmabotanical studies, fostering a deeper understanding of the medicinal potential of Anting-anting and similar plant species.

ACKNOWLEDGMENT

This research project conducted at Universitas Setia Budi represents a significant academic endeavor that would not have been possible without the support and contributions of several individuals and the university community. I extend my sincere appreciation to my advisors at Universitas Setia Budi for their guidance, expertise, and continuous support throughout the research process. Their commitment to academic excellence and mentorship has been crucial in shaping the quality and direction of this study. I would like to express my gratitude to the faculty members and administrative staff at Universitas Setia Budi for creating an enriching academic environment. The resources and facilities provided by the university have been instrumental in the successful execution of this research.

Special thanks to my fellow researchers and colleagues who have collaborated on various aspects of this study. Their dedication and teamwork have significantly contributed to the comprehensive nature of the research outcomes. I am also grateful for any financial support or resources provided by Universitas Setia Budi, which has facilitated the acquisition of necessary materials and equipment for the research.

Last but not least, my heartfelt thanks go to my family and friends for their unwavering encouragement and understanding throughout this academic journey. In acknowledgment of the support and contributions from Universitas Setia Budi and those mentioned above, I express my gratitude for their role in the successful completion of this research project.

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