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# DEVELOPMENT OF A REFERENCE BOOK BASED ON THE IDENTIFICATION DATA OF MEDICINAL PLANTS IN THE COMMUNITY OF THE SULTANATE OF MOLOKU KIERAHA, NORTH MALUKU, INDONESIA

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***Keywords***
*Reference Book, Medicinal Plants, Moloku Kieraha Sultanate Community, Secondary Metabolites*

**ABSTRACT**

The aim of this research is to develop teaching materials in the form of a reference book based on studies of plant medicinal identification in the people of the Moloku Kieraha sultanate. The research involved students in semester 2 of the Unkhair Postgraduate Biology Education program for the 2023/2024 academic year. The study used interview sheets, observation sheets, validation sheets, and response questionnaires for data collection, and validation sheet and product trial analysis for analysis. The results of the research identifies 36 medicinal plants used by the Serawai tribe community in Torano Village, Central Ternate District, Maluku Province. Phytochemical analysis reveals that these plants contain secondary metabolite compounds, including tannins, alkaloids, saponins, flavonoids, terpenoids, and steroids. Students showed a positive response to the medicinal plant reference book that had been developed, with an interest level reaching 98%. Therefore, teaching materials are needed to guide students in conducting phytochemical tests to determine the content, benefits, and techniques of phytochemical screening in natural materials.

## INTRODUCTION

Indonesia is located in the tropical region between the continents of Asia and Australia, possessing geographical conditions that allow for a diverse range of flora and fauna from both continents (Hardianto et al., 2024; Ichsan et al., 2024; Prinandari & Sahrina, 2024). This results in a highly diverse level of biodiversity in Indonesia. The natural diversity also makes Indonesia one of the largest consumers of medicinal plants in Asia along with countries like India and China. Indonesia has more than 9,609 plant species with significant potential for development as efficacious medicinal plants (Rahayu et al., 2024; RAMBEY et al., 2024).

The utilization of plants as medicinal ingredients has been practiced by ancestors since ancient times. This medicinal technique involves various types of plants believed to cure diseases (Siburian &


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Angrianto, 2024). The plants commonly used are usually spices that are processed into herbal remedies which are then consumed. The utilization of plants as medicinal ingredients is supported by the proximity of forests and human settlements since ancient times (Ulmillah et al., 2024). More than 370 indigenous tribes in Indonesia live within or around forest areas, granting them knowledge about plants beneficial for traditional medicine. There is abundant evidence of civilization from ancient to modern times regarding traditional treatments recorded in temple reliefs and ancient manuscripts preserved in museums (Sahidin et al., 2023).

The ethnic groups within the territory of the Sultanate of Tidore and Ternate are among the largest in terms of population in North Maluku province. The communities of the Tidore and Ternate ethnic groups reside in the island and mainland areas of Halmahera in North Maluku province (Putri, 2023). Their lives in island, mountainous, and forest areas have encouraged the use of plants as medicines for many years. The use of plants as traditional medicine has been a long-standing practice among the communities of the Tidore and Ternate ethnic groups. Based on observations, 39 types of plants have been identified that are still used by the community as traditional medicines (Fahrurin et al., 2023; Komariah et al., 2023; Sari, 2024).

The use of plants as traditional medicine among the Tidore and Ternate ethnic communities is currently declining, due to a lack of understanding, especially among the younger generation, about traditional medicine. Knowledge about the use of traditional medicines is largely transmitted orally within the family environment, and this information is not widely disseminated, leading to a decline in knowledge among the next generation. One step to prevent this is by providing education to the younger generation about the benefits of using traditional medicinal plants, both through formal education and other methods (Akbar, 2020; Dapar et al., 2020).

The Master's Program in Biology Education is part of the undergraduate program at Khairun University. One of the goals of this program is to train students to become educators in the field of Biology. There are various courses taught there, including Pharmaceutical Biology, which is an elective course with a weight of 2-0 credits. This course aims to enable students to master the concepts of pharmaceutical biology, understand basic laboratory techniques, and identify the components of primary and secondary metabolite compounds in plants (Sukmawati et al., 2021).

The process of identifying bioactive secondary metabolite compounds can be carried out through a chemical compound analysis called phytochemical screening. The initial step in phytochemical research is phytochemical screening, which aims to provide an overview of the types of compounds present in the plants under study. This method involves the reaction between plant samples and reagent compounds, followed by observation of the color changes that occur after the reaction. Plant samples used in phytochemical screening can be in the form of solid powder, simplisia, or wet extracts, depending on the stage and needs of the research. Groups of secondary metabolite compounds commonly analyzed include alkaloids, flavonoids, terpenoids, tannins, and saponins (Acquavia et al., 2021; Twaij & Hasan, 2022).

According to interviews with lecturers of Pharmaceutical Biology courses in the Master's Program in Biology Education, materials regarding secondary metabolites in Pharmaceutical Biology courses are only presented through books and materials provided by the lecturers. This limitation makes it difficult for students to learn the material independently, especially in terms of gathering information about the potential of plants as medicines and the phytochemical screening process. Therefore, teaching materials are needed to guide students in conducting phytochemical tests to determine the content, benefits, and techniques of phytochemical screening in natural materials. These teaching materials are also expected to have an attractive and practical design to increase the learning interest of Master's students in Biology Education (Kebede et al., 2021; Purwaningsih, 2024).

Currently, there are many innovations in the development of teaching materials to meet the needs of users. One example of an innovative, practical, and effective teaching material is a reference book. Reference books are printed teaching materials that are interesting because they are equipped with

comprehensive content and pictures, which encourage learners to be more motivated in the learning process. Their size makes reference books very practical and easy to carry, helping learners to study independently wherever they are. Reference books have several advantages such as their ability to present a lot of material, learners' ability to study according to their interests and speeds, flexibility in studying anywhere and anytime, enhancing the effectiveness of learning through the use of colorful pictures, and ease of making corrections or revisions (Adillah, 2021; Habiba et al., 2023; Nadya, 2023; Rahma et al., 2023)

Based on the background provided, there is a need for research to address the issues at hand. Therefore, the aim of this research is to develop teaching materials in the form of a reference book based on studies of plant medicinal identification in the people of the Moloku Kieraha sultanate. The research contributes by addressing a gap in educational resources related to the ethnobotanical knowledge of the Moloku Kieraha sultanate, specifically through the development of a reference book on plant medicinal identification. This has implications for education, cultural preservation, and potentially for the broader field of medicinal plant studies.

## METHODS

The research method used in this study is research and development, a model developed by Borg and Gall (1983) for limited trial stages. The stages include research and information gathering, planning, initial product development, small scale trials, product revision, limited trials, and revision limited trial products. The study involved students in semester 2 of the Unkhair Postgraduate Biology Education program for the 2023/2024 academic year. The small-scale trial involved 9 students selected using purposive sampling, while the limited trial involved 20 students in the same class who had taken the Pharmaceutical Biology course. The study used interview sheets, observation sheets, validation sheets, and response questionnaires for data collection, and validation sheet and product trial analysis for analysis.

Data collected from the validation sheet is analyzed descriptively, then processed using a Likert scale to measure the attitudes, opinions and perceptions of a person or group regarding a social phenomenon. After obtaining the score from the expert assessment on the validation sheet, the percentage of product validity is then calculated. The validity percentage obtained is then converted into an assessment statement to determine the feasibility and quality of the product produced. The percentage assessment scale used can be seen in Table 1.

**Tabel 1.** Validity Percentage Qualification

| Achievement level (%) | Qualification | Information |
|---|---|---|
| 81 – 100 | Very Worth It | No need for revision |
| 61 - 4,2 | Worthy | No need for revision |
| 41–60 | easonably decent | Revised |
| 41–40 | unworthy | Revised |
| 0–20 | Very inadequate | Revised |

Response data obtained from student questionnaires regarding responses to the use of teaching materials were then analyzed and processed in the form of a Likert scale. This scale is used to measure responses made with intervals of 1-5. After that, the percentage of product response is calculated using the following equation:

$$\text{Percentage} = \frac{\sum Assessment\ Score}{\sum Maximum\ score} x100$$

Information :
∑Assesment score = the number of scores selected
∑Maximum score = number of questionnaire items x maximum score of questionnaire items

## RESULTS

Based on the results of interviews, observations and documentation with four medicinal plant experts from Torano Village, Central Ternate District, Ternate City, North Maluku Province, it was found that many plants are used as medicine by the local community. From these results, selection or selection of plants is carried out according to the sample criteria that will be used in the research. In this study, 36 plants were selected that met the research criteria and then analyzed their secondary metabolite content. Based on this information, the next step in plant identification is to determine the common name and scientific classification. The results of plant identification can be seen in Table 2.

**Table 2.** Results of Medicinal Plant Identification in the people of the Moloku Kieraha Sultanate

| No | Plant Species | Local Designations | Utilization |
|---|---|---|---|
| 1 | *Jatropha curcas* | Balacai, Fence Distance | Internal heat, white tongue, treatment cough |
| 2 | *Hibiscusrosasinensis* | Ubo-ubo leaves, Flowers Shoe | Treatment of stomach ache, ulcers |
| 3 | *Karika Papaya* | Peace, peace, Papaya | Malaria treatment |
| 4 | *Arcangelisia flava Merr.* | Gogorati, your day | Stomach ache |
| 5 | *Phaleria mac rocarpa (Sch eff) Boerl.* | Crown of gods | Internal Medicine |
| 6 | *Areca catechu* | Pinang hutan, Pinang | Breast cancer |
| 7 | *Menovan Phyllanthus urinaria* | Babiji back | Back pain medication |
| 8 | *Sembung Blumea balsamifera* | Daun leper | Neutralizes toxins in the body |
| 9 | *Piper betle* | Bido banga, Siri utan | Treating vomiting in children |
| 10 | *Selaginella d oederleinii Hi eron* | Rutu-rutu, chicken claw nails | Stopping blood circulation, |
| 11 | *Syzygium aromaticum* | Cengkeh | Treating malaria, |
| 12 | *Plumeria* | *Batang Tabasari, Cambodia* | Neutralizing toxins in the body |
| 13 | *Colocasia esculenta L.* | Гopo-rop | Removes dirty blood, |
| 14 | *Kananga Odorata (Lam) Hook.f. & Thomson* | Kananga | unhealthy body |
| 15 | *Lansium domesticum* | Langsa, Langsat | Appetite enhancer, white tongue, cancer, diarrhea, |
| 16 | *Pterocarpus indicus Willd.* | Ligua | Jaundice |
| 17 | *Graptophyllum pictum* | In the middle of the day, the home | Treatment of malaria, fever, itching |
| 18 | *Impatiens balsamina* | Downy lacquer | Medicine for wounds on nails |
| 19 | *Scleria scorbiculata Nees.* | Linua duku | Sore throat, postpartum cough |
| 20 | *Syzygium malaccense (L.) Merr. & Perry* | Gosale | Appetite Enhancer |
| 21 | *Ficus adenosperma Miq.* | Waringin air | Unhealthy body |
| 22 | *Morinda citrifolia* | Kome fruit, Pangkudu, Mengkudu | Treatment of fever, headache, internal heat, treatment, stomach/ulcer, |
| 23 | *Lansium domesticum Corr.* | Ports | Malaria |

| | | | |
|---|---|---|---|
| 24 | *Vitex coffasus Reinw.ex. Bl.* | Gofosa | Jaundice |
| 25 | *Musa balbisiana* | White Shoe Banana | Bloody bowel movements |
| 26 | *Paspalum conjugatum P.J.Bergius* | Dishes-dishes | Facilitate childbirth |
| 27 | *Hibiscus schizopetalus (Dyer) Hook.f.* | Ubo-ubo | Facilitate childbirth and improve the condition of pregnant women |
| 28 | *Hibiscus rosa-sinensis L.* | Bali flowers, Hibiscus flowers | Prenatal care |
| 29 | *Psidium guajava* | Giyawas, Jambu biji | Treatment of diarrhea |
| 30 | *Tabernaemontana aurantiacaGaud.* | Tutuhuru wood | Abdominal pain (baby) |
| 31 | *Senna alata (L.) Roxb.* | Blood flowers | Kudis |
| 32 | *Annona muricata* | Dutch jackfruit, soursop | Reduces fever, asthma, cough, aches, high blood pressure |
| 33 | *Psidium guajava* | Gayawa | Obat Muntaber |
| 34 | *Hibiscus tiliaceus L.* | New tree | Postpartum, Luka |
| 35 | *Polyscias scutellaria* | Daun mangko | Treating Hernias |
| 36 | *Donax canniformis (G.Forst.) K.Schum* | Chicken | Wound |

The next stage is to analyze the content of secondary metabolite compounds in each plant that has been identified. Qualitative analysis of phytochemical compounds was carried out through laboratory experiments using phytochemical screening methods. Phytochemical screening aims to identify secondary metabolite compounds present in plants. This research was conducted at the Biology Laboratory of FKIP Khairun University. The results of phytochemical tests and previous research can be seen in Table 3

**Tabel 3.** Index Value of Cultural Significance (ICS)

| No | Plant types | ICS Value (%) |
|---|---|---|
| 1 | *Jatropha curcas* | 14,4 |
| 2 | *Hibiscusrosasinensis* | 14,4 |
| 3 | *Karika Papaya* | 14,4 |
| 4 | *Arcangelisia flava Merr.* | 42,2 |
| 5 | *Phaleria mac rocarpa (Sch eff) Boerl.* | 18,2 |
| 6 | *Areca catechu* | 18,2 |
| 7 | *Upper Phyllants Urinariya* | 42,2 |
| 8 | *Sembung Blumea balsamifera* | 14,4 |
| 9 | *Piper betle* | 42,2 |
| 10 | *Selaginella d oederleinii Hi eron* | 18,2 |
| 11 | *Syzygium aromaticum* | 18,2 |
| 12 | *Plumeria* | 42,2 |
| 13 | *Colocasia esculenta L.* | 14,4 |
| 14 | *Kananga Odorata (Lam) Hook.f. & Thomson* | 14,4 |

| | | |
|---|---|---|
| 15 | *Lansium domesticum* | 14,4 |
| 16 | *Pterocarpus indicus Willd.* | 14,4 |
| 17 | *Graptophyllum pictum* | 14,4 |
| 18 | *Impatiens balsamina* | 14,4 |
| 19 | *Scleria scorbiculata Nees.* | 14,4 |
| 20 | *Syzygium malaccense (L.) Merr. & Perry* | 14,4 |
| 21 | *Ficus adenosperma Miq.* | 42,2 |
| 22 | *Morinda citrifolia* | 14,4 |
| 23 | *Lansium domesticum Corr.* | 14,4 |
| 24 | *Vitex coffasus Reinw.ex. Bl.* | 14,4 |
| 25 | *Musa balbisiana* | 42,2 |
| 26 | *Paspalum conjugatum P.J.Bergius* | 14,4 |
| 27 | *Hibiscus schizopetalus (Dyer) Hook.f.* | 14,4 |
| 28 | *Hibiscus rosa-sinensis L.* | 14,4 |
| 29 | *Psidium guajava* | 14,4 |
| 30 | *Tabernaemontana aurantiacaGaud.* | 14,4 |
| 31 | *Senna alata (L.) Roxb.* | 14,4 |
| 32 | *Annona muricata* | 14,4 |
| 33 | *Psidium guajava* | 14,4 |
| 34 | *Hibiscus tiliaceus L.* | 42,2 |
| 36 | *Polyscias scutellaria* | 14,4 |
| 36 | *Donax canniformis (G.Forst.) K.Schum* | 14,4 |

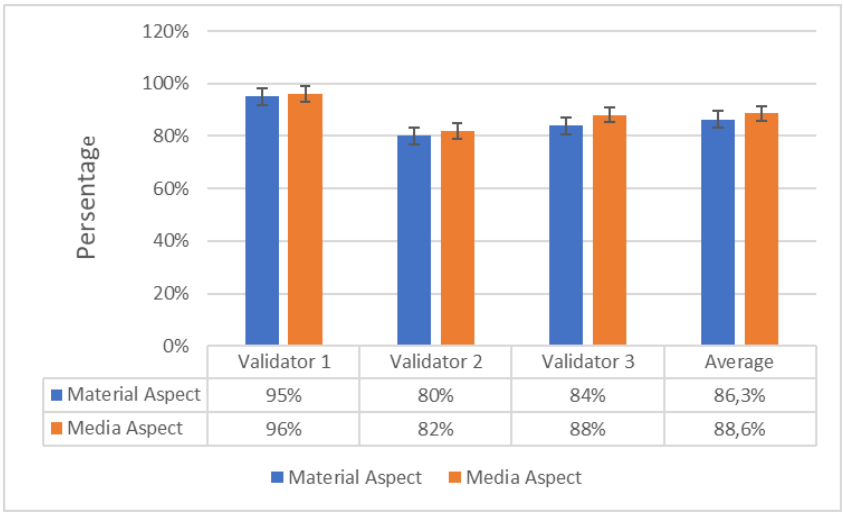
Based on the data listed in Table 2, it can be explained that the analysis carried out using the Index of Cultural Significance (ICS) aims to assess the benefits of a particular plant. There are 25 plants with a percentage of 14.4%, 4 plants with a percentage of 18.2%, and 7 plants with a percentage of 42.2%. The results of this assessment are then classified into four function categories, namely most important, important, least important, and not important

**Tabel 4.** Category Significance Index of Plant Importance Values.

| No | Significance Category Importance Value Index (ICS) | Plant Types |
|---|---|---|
| 1 | The most important (40- 100 And Over) | 4 |
| 2 | Important (20-39) 35 | 0 |
| 3 | not too important (0-19) | 16 |
| 4 | not important (0) | 0 |
| | Total | 20 |

**Product Development**

The reference books that have been prepared are then produced according to the desired specifications. After the reference book printing process is complete, the next step is to carry out validation to evaluate aspects of the material and media contained in it. The results of the reference book validation are shown in Figure 1. The overall analysis of the reference book validation results shows that the average percentage for the material aspect is 87% and for the media aspect is 88%. Based on the data from the validation results, it can be concluded that the pocket book on medicinal plants that has been made meets the excellent criteria and can be used as teaching material.




**Picture 1.** Pocket Book Validation Results

**Limited Trial**

This trial aims to determine user responses to the products that have been developed. This assessment was carried out by distributing questionnaires to 20 Unkhair Postgraduate Biology Education Masters students who had taken the pharmaceutical biology course. The questionnaire consists of 30 questions which aim to determine the appropriateness of the material, media and benefits aspects of the pocket book. The results of the response questionnaire from the limited scale test can be seen in Figure 2.

This trial aims to evaluate user responses to the products that have been developed. This evaluation was carried out by distributing questionnaires to 20 Unkhair Postgraduate Biology Education Masters students who had taken the pharmaceutical biology course. The questionnaire consists of 30 questions designed to assess the suitability of aspects of the material, media and benefits contained in the reference book. The results of the questionnaire responses on the limited scale test can be seen in Figure 2.

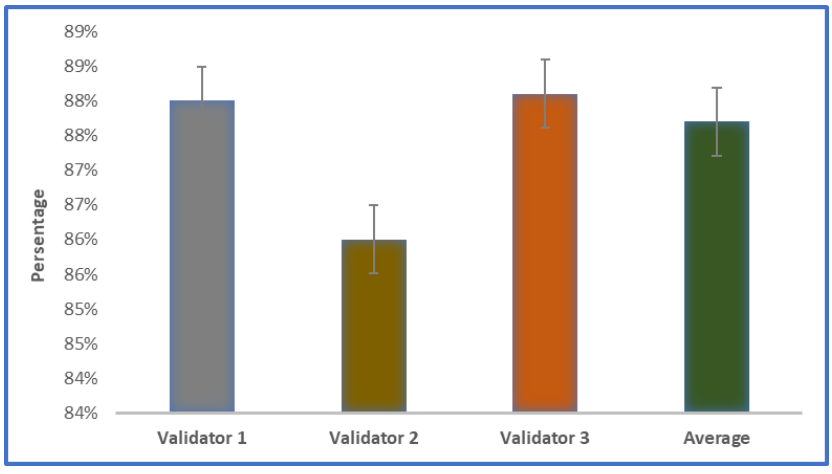



**Figure 2.** Graph of Student Response Results

Based on Figure 2, it can be seen that the results of the student response test on the limited scale test on the aspects of material, media, benefits respectively obtained percentages of 88%, 86% and 88.1% which are included in the very good criteria. The average percentage results for all aspects of the limited scale test obtained a percentage of 87.7% which is included in the very good criteria. Apart from

that, students also gave a positive response to the pocket book on medicinal plants that was developed with an interest percentage of 98%.

Data from Figure 2 indicates that the results of evaluating student responses to reference books in the limited scale test show very good percentages for the material, media and benefit aspects, respectively reaching 88%, 86% and 88.1%. The average percentage of all aspects in the limited scale test is 87.7%, which is also in the very good category. Apart from that, students showed a positive response to the medicinal plant reference book that had been developed, with an interest level reaching 98%.

## CONCLUSION

The research identifies 36 medicinal plants used by the Serawai tribe community in Torano Village, Central Ternate District, Maluku Province. These plants include balacai, ubo-ubo leaves, popaya, gogorati, areca palm, and more. Phytochemical analysis reveals that these plants contain secondary metabolite compounds, including tannins, alkaloids, saponins, flavonoids, terpenoids, and steroids. The most commonly found compounds are tannins, alkaloids, saponins, flavonoids, terpenoids, and steroids.

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