



## The validity of the popular science book on Rubiaceae in the Special Purpose Forest Area of Lambung Mangkurat University

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### Abstract

Popular science books (PSB) on Rubiaceae in the Special Purpose Forest Area of Lambung Mangkurat University (KHDTK ULM) are not available, let alone validated. PSB is a form of teaching material that supports critical thinking skills. This study aims to test the validity of the PSB on the Rubiaceae Family in KHDTK ULM as a learning resource in the Phanerogamae course. PSB contains 15 species of the Rubiaceae family as learning objects. The subjects were three experts (validators). They work as ULM lecturers and one of them teaches the Phanerogamae course. Validation was carried out on eight linguistic aspects with 14 assessment criteria. The average scores for the aspects of coherence (89.6%), readability (91.7%), use of vocabulary (100%), understanding of sentence meaning (83.3%), use of doubtful words (91.7%), application and implication (91.7%), use of definitions or explanations (83.3%), and other styles (83.3%). The PSB is categorized as highly valid and can be used as teaching material or a learning resource for the Phanerogamae course. Practicality and effectiveness tests are recommended to ensure the PSB is truly suitable for use.

**Keyword:** learning resource; popular science book; Rubiaceae; validity; Phanerogamae

**Abstrak.** Buku sains populer (BSP) tentang Rubiaceae di Kawasan Hutan Dengan Tujuan Khusus Universitas Lambung Mangkurat (KHDTK ULM) tidak tersedia, apalagi tervalidasi. BSP merupakan salah satu bentuk bahan ajar yang mendukung keterampilan berpikir kritis. Penelitian ini bertujuan untuk menguji validitas BSP tentang Famili Rubiaceae di KHDTK ULM sebagai sumber belajar pada mata kuliah Phanerogamae. Buku ini mengandung 15 spesies famili Rubiaceae sebagai obyek pembelajaran. Subjeknya tiga ahli (validator). Mereka berprofesi sebagai dosen ULM dan salah satunya pengampu mata kuliah Phanerogamae. Validasi dilakukan terhadap delapan aspek kebahasaan dan 14 kriteria penilaian. Nilai rerata aspek koherensi (89,6%), keterbacaan (91,7%), penggunaan kosa kata (100%), pemahaman atas makna kalimat (83,3%), penggunaan kata-kata meragukan (91,7%), aplikasi dan implikasi (91,7%), penggunaan definisi atau penjelasan (83,3%), serta gaya lain (83,3%). BSP tersebut terkategori sangat valid, sehingga dapat digunakan sebagai bahan ajar atau sumber belajar pada mata kuliah Phanerogamae. Uji kepraktisan dan uji keefektifan direkomendasikan untuk dilaksanakan sehingga BSP tersebut benar-benar layak digunakan.

## INTRODUCTION

The Special Purpose Forest Area of Lambung Mangkurat University (KHDTK ULM) is a 1,617 ha forest area located in Karang Intan District, Banjar Regency, South Kalimantan Province. The management of this forest area was handed over by the Ministry of Environment and Forestry (KLHK) to ULM for educational and training purposes. The handover for this purpose is an honor that must be utilized optimally by ULM because this interest is in line with or in accordance with the main duties and functions of ULM as a higher education institution. This forest area serves as a natural laboratory for ULM, the oldest university on the island of Kalimantan (Hendra and Soendjoto, 2024). In this area, both biological resources, as studied by Lefi et al. (2024), Nugroho et al. (2022), Purbaya et al. (2020), and Susilawati et al., (2023) and physical resources, as studied by Harahap et al. (2019) and Suryanto et al. (2024) to become a source of knowledge and learning materials that support the Tri Dharma activities (education, research, community service) of higher education institutions.

Research must continue to be carried out by ULM or anyone interested in KHDTK ULM, as many biological and renewable resources remain undiscovered in this natural laboratory. One such resource is Rubiaceae, a plant family with high species diversity and potential as an economic resource and traditional medicine (Cruz et al., 2020; Murdiyanti et al., 2022; Putri et al., 2021). There are no records regarding the species or the morphology of species belonging to the Rubiaceae family growing and developing in KHDTK ULM. On the other hand, the Rubiaceae family is relevant material to be taught in Phanerogamae courses at universities that discuss higher plants. However, no teaching materials have been found that have been tested or used to convey anything about Rubiaceae. Several articles report that certain material has been delivered in the Phanerogamae course through e-module teaching materials, such as those by Putri and Muthmainnah (2022), encyclopedias (Hidayati et al., 2024), pocket books (Iqbal et al., 2022), and popular science books (Latifah et al., 2020). Each of these teaching materials certainly has advantages and disadvantages.

Therefore, the Rubiaceae material in KHDTK ULM packaged in a popular science book (PSB) is one of the options in learning Phanerogamae. The consideration is that only the Anacardiaceae, Fabaceae, Moraceae, and Myrtaceae families are used as learning materials in the form of PSB (Febriyanti et al., 2023; Khatimah et al., 2023; Latifah et al., 2020; Nufus et al., 2022; Noorannisa et al. 2022). This PSB is considered appropriate to be developed in the context of field learning. The narrative can be made simple but remains scientific. Visual illustrations can be made attractive and easy to understand so that communication becomes lively and in accordance with real conditions in the field. Rahayu et al. (2022) argue that PSB should be developed or implemented based on local potential. Nurfatma et al. (2020) and Putri et al. (2020) showed that PSB helps students understand complex concepts through stories, concrete examples, and engaging visualizations that are close to the local context. Azhari et al. (2024) proved that PSB can improve students' critical thinking skills.

This study aims to test the validity of the PSB on Rubiaceae in the KHDTK ULM so that it can be used as teaching material in the Phanerogamae course. This validation is the initial step for subsequent tests so that the book can be used to encourage active student engagement, strengthen critical thinking skills, and ultimately improve the quality of learning.

## RESEARCH METHODS

Data collection related to species from the Rubiaceae family in KHDTK ULM and the development of the PSB (draft-1) were carried out in February - April 2025. The book development used the Educational Design Research (EDR) model (McKenney and Reeves, 2013). The assessment followed Tessmer's (2013) formative evaluation which consisted of self-evaluation, expert review, one-to-one, small group, and field test. The title of the PSB development is Species Diversity of the Rubiaceae Family in KHDTK ULM. The main material in this product consists of 15 species that are indeed found or grow and develop in this forest area, namely *Chassalia curviflora* (kaki punai), *Coffea arabica* (kopi arab), *Gardenia jasminoides* (kacapiring), *Hypobathrum microcarpum* (capit udang), *Ixora chinensis* (soka cina), *I. coccinea* (soka merah), *I. finlaysoniana* (soka karang putih), *Morinda citrifolia* (mengkudu), *Mussaenda glabra* (balik adap), *Nauclea officinalis* (bangkal sungai),

*Neolamarckia cadamba* (jabon), *Neonauclea calycina* (bangkal gunung), *Psychotria malayana* (salung), *P. viridiflora* (jirak), dan *Tarenna fragrans* (jejeruman).

The researchers conducted a self-evaluation to eliminate errors and add relevant material to the PSB (draft-1), the follow-up of which was the PSB (draft-2). The front and back covers of the book are shown in Figure 1.



Figure 1 Front and Back Covers of BSP (draft-2) on Rubiaceae in KHDTK ULM (in Indonesian)

The evaluation or validation test of the PSB (draft-2) was conducted at the ULM campus in late April and early May 4, 2025. The test subjects were three experts or validators. They were lecturers in the Master of Biology Education Study Program at ULM. One of them taught the Phanerogamae course. The test results are reported in this article.

The final three stages of Tessmer's formative evaluation are not discussed in this article. The testing and test results (readability, practicality, effectiveness) of the PSB (draft-3) product, which is an improvement on the PSB (draft-2), have not been implemented.

The validator evaluated eight aspects of the PSB (draft-2): coherence, readability, use of scientific vocabulary, comprehension of sentences, use of ambiguous words, application and implications, use of definitions and explanations, and use of other styles. These eight aspects comprise 14 assessment criteria.

Each criterion is assessed using a score ranging from 1 to 4. A score of 1 means invalid, 2 less valid, 3 valid, and 4 very valid. An average score is applied to each aspect. This score is then converted into a mean value through a calculation using the Formula 1 by Mulkan et al. (2022). The average values obtained were then expressed in qualitative categories (Table 1).

$$x = \frac{\sum X}{n} \times 100 \dots \dots \dots \text{Formula 1}$$

Description:

x = average value of each aspect (in %)

$\sum X$  = total scores from the validators

n = maximum number of scores

**Table 1 Validity criteria and categories PSB (draft-2)**

| Value criteria    | Qualitative category                                                |
|-------------------|---------------------------------------------------------------------|
| $85 < X \leq 100$ | Very valid; PSB can be used without revision                        |
| $70 < X \leq 85$  | Valid; PSB can be used but after minor revisions                    |
| $50 < X \leq 70$  | Less valid; PSB should not be used because it needs major revision. |
| $0 < X \leq 50$   | Invalid; PSB should not be used                                     |

Note: The value criteria and the qualitative categories are modified from Akbar (2022)

## RESULTS AND DISCUSSION

### Overall PSB Assessment

In general, the validation results indicate that the PSB (draft-2) is highly valid (Table 2). These results indicate that the developed book is not only suitable for use but also has good content and presentation quality. The book has met the standards for developing teaching materials that can effectively support learning objectives. These results align with Irianti and Mahrudin (2021) who stated that a highly valid PSB after the expert review stage is considered suitable for use to meet learning objectives. Hera et al. (2014) confirmed the statement that valid teaching materials reflect quality that is suitable for integration into learning activities.

Although the PSB (draft-2) is of excellent quality, suggestions and input from the validators should be taken into account. This validation not only confirms the product's feasibility but also forms part of a continuous development cycle. This approach aligns with the principles of educational product development, which emphasize continuous improvement to achieve optimal learning outcomes. Therefore, these suggestions and input serve as the basis for revising the PSB (draft-2) to become the PSB (draft-3). This final book can be further processed through one-to-one stages (readability test, content practicality test), small group tests (expected practicality/effectiveness test), and field tests (actual practicality/effectiveness test).

**Table 2 Validation results of PSB (draft-2) from the validators and the average value of each aspect**

| PSB assessment aspects and criteria (draft-2)                                                                   | Validator |   |   | Total score | Average score/value |
|-----------------------------------------------------------------------------------------------------------------|-----------|---|---|-------------|---------------------|
|                                                                                                                 | 1         | 2 | 3 |             |                     |
| <b>A. Coherence</b>                                                                                             |           |   |   |             |                     |
| 1. One main idea in each paragraph                                                                              | 3         | 4 | 4 | 43          | 0.89<br>(89.6%)     |
| 2. Main ideas are sequential between paragraphs                                                                 | 4         | 4 | 4 |             |                     |
| 3. Connecting words or sentences are found between paragraphs                                                   | 3         | 3 | 3 |             |                     |
| 4. Sentences in a paragraph lead to one understanding or concept                                                | 4         | 4 | 3 |             |                     |
| <b>B. Readability</b>                                                                                           |           |   |   |             |                     |
| 5. The text or narrative is arranged according to the level of education                                        | 4         | 4 | 3 | 11          | 0.91<br>(91.7%)     |
| <b>C. Use of vocabulary, especially academic or scientific vocabulary</b>                                       |           |   |   |             |                     |
| 6. No excessive expressions are found.                                                                          | 4         | 4 | 4 | 24          | 1.00<br>(100%)      |
| 7. The vocabulary used is appropriate for the educational level.                                                | 4         | 4 | 4 |             |                     |
| <b>D. Understanding the meaning of the sentence</b>                                                             |           |   |   |             |                     |
| 8. Use meaningful sentences to structure paragraphs so that they can be understood or are easy to understand.   | 3         | 4 | 3 | 10          | 0.83<br>(83.3%)     |
| <b>E. Use of words with double or unclear meaning</b>                                                           |           |   |   |             |                     |
| 9. Words whose meaning is unclear are not found                                                                 | 4         | 4 | 3 | 11          | 0.92<br>(91.7%)     |
| <b>F. Applications and implications</b>                                                                         |           |   |   |             |                     |
| 10. Raising current issues and their applications in the real world for the benefit of readers.                 | 4         | 3 | 4 | 11          | 0.92<br>(91.7%)     |
| <b>G. Use of definitions or explanations</b>                                                                    |           |   |   |             |                     |
| 11. Use operational words (describe, give examples, analogies, or metaphors) to facilitate reader understanding | 4         | 3 | 3 | 10          | 0.83<br>(83.3%)     |
| <b>H. Use of other styles</b>                                                                                   |           |   |   |             |                     |
| 12. Using analogies to explain complex ideas.                                                                   | 3         | 3 | 3 | 30          | 0.83<br>(83.3%)     |
| 13. Using simple sentences in narratives to explain difficult-to-understand contexts.                           | 4         | 4 | 3 |             |                     |
| 14. Using statements or questions that are oriented towards indicators of critical thinking skills.             | 4         | 3 | 3 |             |                     |
| <b>Average value of validation (%)</b>                                                                          |           |   |   |             | <b>89,3</b>         |
| <b>Qualitative category</b>                                                                                     |           |   |   |             | <b>Very valid</b>   |

### Assessment of Each Aspect

The average score for most aspects (7 out of 8) in the book was below 100%. Only the use of scientific vocabulary achieved a mean score of 100%. A discussion of each aspect is as follows.

A coherence score of slightly below 90% indicates that the general organization of ideas in the PSB (draft-2) meets the principles of paragraph unity and cohesion. This means that each paragraph has one main idea. The sentences are well-connected through the use of conjunctions, with a logical flow of ideas, making it easier for readers to understand the material. The paragraphs demonstrate a sequential sequence of main ideas. The sentences in each paragraph guide students in understanding the material appropriately. The PSB's ability to maintain the reader's flow of thought is crucial, especially in the context of developing students' critical thinking skills. Coherence in writing is not merely a technical aspect, but a crucial part of effective cognitive learning (Fajeriadi et al., 2019). The coherence aspect is realized through simple language that is easy to understand, in accordance with Indonesian EYD, as well as sentences that have integration in each material so that the context of the discussion can be understood systematically (Putra et al., 2020; Rahmawati et al., 2022; Sintia et al., 2021).

In general, the readability of the PSB (draft-2) is quite good. The presentation of the material is communicative. Sentences are not too long. Word choice is adjusted to the reader's educational level. A score lower than 100% indicates that there is still room for improvement in the book; for example, the layout and paragraphs need to be arranged more visually attractively. Visual appeal certainly influences the learning motivation of students with a predominantly visual learning style. Latifah et al. (2020) and Nurfatma et al. (2020) explain that PSB must pay attention to the level of readability. The length or size of the text, for example, must be appropriate to the reader's educational level.

A single 100% score for vocabulary usage indicates that excessive expressions or terms are no longer found. Such expressions and terms should not be used in any book or product that prioritizes scientific value. The PSB, which serves as teaching material in higher education, prioritizes this value and is generally tailored to the student's level of understanding and field of study. The variety of vocabulary used also reflects the richness of the language and supports the reinforcement of scientific concepts. A glossary in a book is essential to prevent scientific terms from causing ambiguity or conceptual alienation for students new to the topic. Khairroh et al. (2014) explain that a book is considered appropriate if it uses vocabulary that is easy, light, and concise, so that readers can easily understand the content of the material or story presented. According to Sintia et al. (2021), PSB can be considered appropriate if the vocabulary used is simple, concise, and easily understood by readers. Putra et al. (2020) add that PSB must use vocabulary that conforms to Indonesian language rules to prevent students from misunderstanding the meaning.

Regarding sentence structure, linguistic rules are key in PSB. Sentences in each paragraph should be easy to understand. The book certainly excels when it uses good and appropriate sentence structure because it directly impacts the clarity of the information conveyed. The dominance of active sentences indicates the book's orientation towards clarity and assertiveness, while the presence of controlled passive sentences demonstrates a varied writing style that adapts to the context of the explanation. The use of active and passive sentences must remain appropriate and should not be excessive, as this can cause problems understanding the material's context. In general, the use of active sentences is better for increasing student activity. Fitriansyah et al. (2018) explain that in PSB, active and passive sentences should still be used according to the context, although the active sentence is more dominant in increasing reader activity. According to Fitriyani et al. (2022), appropriately used active and passive sentences can help direct readers' activities.

The use of words with unclear meanings should be avoided. Researchers have made this happen. The validator did not find any words with unclear meanings in the PSB (draft-2). However, words with potentially ambiguous or difficult meanings were still found. Replacing such words with appropriate ones is not easy. To address readers' misunderstanding of these words, the PSB (draft-2) is equipped with a glossary. Sintia et al. (2021) argue that the PSB should contain words with definite meanings. Words with uncertain meanings lead readers to uncertainty and doubt. Readers are likely to stop reading and ignore the book or continue reading without understanding the message.

The presentation of material in the PSB is excellent, contextual, and applicable. The material is not merely theoretical but related to students' daily lives. This aligns with the principles of contextual learning,

which emphasize the importance of connecting learning content, student needs, and relevance to the surrounding environment. It can be used to increase learning motivation and make learning more meaningful. Illustrations, stories, or examples that are more relevant to students' lives, such as various phenomena in South Kalimantan or Banjarmasin, can be developed. PSB should have learning materials that motivate readers or students and are useful or relevant to everyday life (Rahmawati et al., 2022; Sintia et al., 2021), for example, related to local potential (Putra et al., 2020).

In general, PSB presents concepts in a concise, clear, and informative manner. The use of examples, analogies, or metaphors that are closer in context to the object or whatever they are developing their understanding of is intended to help students easily connect the context of the actual material and then grasp the concept.

PSB should not simply convey facts and data, but should be designed to be more lively, engaging, and engaging with readers, reinforced with questions and statements oriented toward critical thinking skills. In this way, readers do not passively enjoy the reading, but rather actively engage with and enhance their imagination and train of thought. Humor and analogies in PSB narratives serve as a bridge to simplify complex concepts. The questions and statements constructed help enhance critical thinking skills, even during independent study by readers or students. Delivery styles are crucial for reaching readers with diverse learning styles and backgrounds. According to Fitriansyah et al. (2018); Putra et al. (2020); and Sintia et al. (2021), to increase reader motivation and understanding of a concept, PSB should describe the material through engaging narratives and stories, provide relevant examples, analogies, or metaphors, and convey discussion with an analogy and a sense of humor.

## CONCLUSION

The validation results confirmed that the developed popular science book meets the very valid categories and is feasible as a learning resource. This book can be used as supplementary material to foster students' critical thinking in the Phanerogamae course. We recommend further research, including one-on-one, small group, and field testing, to ensure that the PSB product on Rubiaceae at KHDTK ULM is truly suitable for learning.

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