



An analysis of the potential of local durian biodiversity in Sukadana District as a biology learning resource

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Article Information	Abstract
Keyword: Biodiversity; Local durian; Sukadana; Biology learning; Resources Kata Kunci: Keanekaragaman hayati; Durian lokal; Sukadana; Pembelajaran biologi; Sumber belajar History: Received : 14/02/2026 Revised : 12/06/2026 Accepted : 25/05/2026 Published : 29/06/2026	Kayong Utara Regency, particularly Sukadana District, possesses a high diversity of local durian genetic resources. However, their documentation, educational utilization, and the availability of contextual teaching materials remain limited, resulting in biology learning that is not yet optimally connected to students' surrounding environment. This study aimed to analyze the potential of local durian diversity in Sukadana District as a biology learning resource using a qualitative descriptive method. Data were collected through field observations, interviews with 120 durian farmers and traders, documentation, and questionnaires distributed to five biology teachers. The data were analyzed descriptively to identify the characteristics, classification, and suitability of local durians as biology learning resources. The results identified six local durian varieties with high morphological diversity that met the criteria as biology learning resources and have the potential to support contextual learning on biodiversity topics. The teachers' evaluation yielded an overall score of 82% (excellent) based on the aspects of clarity, target suitability, alignment with learning objectives, information clarity, exploration guidelines, and expected learning outcomes, indicating that local durians are highly relevant as biology learning resources. Therefore, local durians in Sukadana District have strong potential to be developed as contextual and meaningful biology learning resources, particularly for biodiversity topics. <i>Abstrak. Kabupaten Kayong Utara, khususnya Kecamatan Sukadana, memiliki keanekaragaman sumber daya genetik durian lokal yang tinggi, namun dokumentasi, pemanfaatannya dalam pendidikan, dan ketersediaan bahan ajar kontekstual masih terbatas sehingga pembelajaran biologi belum optimal mengaitkan konsep dengan lingkungan sekitar. Penelitian ini bertujuan menganalisis potensi keanekaragaman durian lokal di Kecamatan Sukadana sebagai sumber belajar biologi menggunakan metode deskriptif kualitatif. Data dikumpulkan melalui observasi, wawancara terhadap 120 petani dan pedagang durian, dokumentasi, serta penyebaran kuesioner kepada lima guru biologi, kemudian dianalisis secara deskriptif untuk mengidentifikasi karakteristik, klasifikasi, dan kesesuaiannya sebagai sumber belajar. Hasil penelitian mengidentifikasi enam varietas durian lokal yang memiliki keragaman morfologis tinggi dan memenuhi kriteria sebagai sumber belajar biologi, sehingga berpotensi mendukung pembelajaran kontekstual pada materi keanekaragaman hayati. Penilaian guru memperoleh skor 82% (kategori sangat baik) berdasarkan aspek kejelasan, kesesuaian sasaran, keselarasan tujuan pembelajaran, kejelasan informasi, pedoman eksplorasi, dan hasil belajar yang diharapkan, yang menunjukkan bahwa durian lokal sangat relevan sebagai sumber belajar biologi. Dengan demikian, durian lokal di Kecamatan Sukadana memiliki potensi kuat untuk dikembangkan sebagai sumber belajar biologi yang kontekstual dan bermakna, khususnya pada topik keanekaragaman hayati.</i>

A. Introduction

Indonesia is recognized globally as one of the world's megabiodiversity countries, possessing the second-largest biodiversity after Brazil (Lubis, 2021). This designation is supported by Indonesia's natural conditions, particularly its tropical climate, which provides suitable habitats for a wide variety of flora and fauna (Maulida et al., 2020). Biodiversity is not merely a raw natural wealth, but a valuable asset with strategic ecological, economic, and cultural significance that must be managed optimally. Within this strategic framework, durian (*Durio zibethinus*) emerges as one of the local fruit commodities that plays a crucial role, as it simultaneously represents these three values. With its distinctive characteristics and close association with local communities, durian is not only an integral part of cultural identity and a contributor to ecosystem balance, but also has broad prospects for future economic development (Khaksar et al., 2024).

Durian (*Durio zibethinus*) is a native tropical fruit that is widely popular and produced on a large scale in Southeast Asia, (Lestari et al., 2024). As a plant known as the "king of fruits" in Southeast Asia, durian represents a significant potential of local genetic resources that warrants further in-depth study (Muna & Prayoga, 2024). In this regard, Sukadana District is one of the regions with high potential for local durian diversity; however, it harbors a rich variety of durian that has not yet been comprehensively explored.

Biodiversity is one of the most valuable natural resources for human life (Sari et al., 2024). Indonesia, as an archipelagic country located in the tropical region, possesses exceptionally high biodiversity in terms of both flora and fauna. However, it is currently facing global challenges related to the biodiversity loss crisis caused by climate change and massive land-use conversion, which threaten global food security (Halawa & Zakiyah, 2025), field evidence indicates that the richness of local durian in Sukadana District has not been systematically documented and is threatened with extinction due to low community interest in cultivation. Meanwhile, scientific identification of these varieties is urgently needed to prevent genetic erosion. This condition creates a gap in national education, where the curriculum demands contextual biology learning, yet the utilization of local potential as learning media remains very limited (Yani et al., 2021).

Preliminary observations and interviews conducted with 20 respondents, consisting of local farmers and durian traders in Sukadana District, revealed that knowledge regarding local durian varieties is still largely based on traditional practices and has not been systematically documented. As a result, several local durian varieties are at risk of being lost due to land-use conversion and the declining interest of younger generations in maintaining local germplasm. Field exploration further identified six local durian varieties with distinct morphological

characteristics, highlighting the rich genetic diversity that remains underdocumented. These findings are supported by previous studies indicating that durian (*Durio zibethinus*) represents an important genetic resource that requires conservation efforts (Purbosari & Putri, 2022; Yuniastuti et al., 2018). Despite its ecological and genetic significance, the utilization of local durian diversity as an educational resource remains limited. Furthermore, studies on the Merdeka Curriculum emphasize the need for contextual biology learning materials to improve students' understanding of biodiversity concepts (Sari et al., 2024).

The integration of empirical findings from Sukadana with this theoretical foundation provides a strong basis for this study to analyze the morphology of local durian as a practical learning instrument (Wulandari et al., 2025). The integration of empirical findings from Sukadana with the theoretical framework provides a solid foundation for this study to analyze the morphology of local durian as a practical educational resource.

Although various studies have examined biodiversity and the utilisation of local potential as a source of contextual learning, the majority of these studies have focused on the utilisation of the local environment in general, such as aquatic ecosystems, conservation areas, or the development of teaching materials based on local potential (Yani et al., 2021; Fajeriadi et al., 2025). These studies indicate that local biological resources can enhance the relevance and meaningfulness of biology learning. However, to date, no research has specifically explored the diversity of local durian in Sukadana Sub-district or integrated the results of its morphological characterisation into structured biology learning resources. Consequently, there is a research gap regarding the utilisation of local durian germplasm as a biodiversity-based contextual learning resource. The novelty of this study lies in the integration of scientific data from the identification and morphological characterisation of six local durian varieties in Sukadana Sub-district with the requirements of biology education on the topic of biodiversity. This research not only produces documentation of local biodiversity but also provides a scientific basis for the development of learning resources relevant to the learners' environment. Therefore, this research serves as a bridge between efforts to conserve local genetic resources and innovations in biology learning based on local contexts.

Based on the identified research gaps and the need for contextual biology learning resources, this study aims to identify and characterise the diversity of local durian varieties in Sukadana Sub-district through morphological analysis, and to evaluate their potential as a biology learning resource. This study is expected to produce scientific documentation on local durian genetic resources whilst supporting the development of contextual teaching materials aligned with the

Merdeka Curriculum, particularly regarding biodiversity content.

This study takes a stance to support and reinforce the findings of previous research by Noor (2023) and Sari et al. (2023) regarding its strategic value local biodiversity and the importance of contextual learning in biology education (Arif, 2025). However, rather than relying solely on general theory, this study takes a step further by addressing the lack of specific data on durian varieties in Sukadana District, which has long been overlooked in scientific literature and educational resources. Accordingly, this research not only validates the importance of integrating local potential into the national curriculum but also serves as a complementary study that provides a new empirical database to support conservation efforts and the development of innovative biology teaching materials in schools (Lendemer et al., 2020).

B. Material and method

This study employs a descriptive mixed-methods approach that combines qualitative and quantitative data to analyse the potential of local durian diversity in Sukadana Sub-district as a resource for biology education. Qualitative data were obtained through field observations, interviews and documentation to identify the morphological characteristics, distribution and diversity of local durian varieties, whilst quantitative data were obtained through a teacher questionnaire, analysed using percentages to assess their suitability as a biology learning resource. The research was conducted in two stages: an exploratory stage comprising a preliminary survey, purposive sampling, and morphological characterisation of local durians; and an evaluation stage involving the distribution of questionnaires to assess the potential of the exploratory findings as a biology learning resource.

According Harahap et al. (2024) which affect the growth of durian in Sukadana District without any experimental manipulation of variables. The research was carried out in two primary phases: (1) the exploration phase, comprising a preliminary survey, purposive sample selection, and the inventory of morphological characteristics via field observation;

and (2) the evaluation phase, which involved administering questionnaires to assess the potential of the collected data as a biology learning resource (Sekarsari, 2024).

Data were collected through direct observation, in-depth interviews, visual documentation, and questionnaires (Fadhilah et al., 2025). The study was conducted from June to July 2025 in Sukadana District, North Kayong Regency, West Kalimantan. Durian accessions were selected using purposive sampling based on recommendations from local farmers, village leaders, and agricultural extension officers. The selected accessions represented local durian varieties that were recognized by the community as having distinct morphological characteristics and were distributed across five villages: Pampang Harapan, Gunung Sembilan, Benawai Agung, Pangkalan Buton, and Harapan Mulya. Morphological data were obtained through field observations and documentation of tree, leaf, and fruit characteristics. In addition, in-depth interviews were conducted with 120 respondents consisting of farmers and durian traders using a snowball sampling technique, whereby initial informants recommended other knowledgeable respondents (Hidayat, A., & Maesyaroh, S.S. 2022). To evaluate the educational potential of local durian diversity, semi-structured questionnaires based on a Guttman scale were distributed to five biology teachers from SMAN 01 Sukadana, SMAN 02 Sukadana, SMAN 03 Sukadana, MAN Kayong Utara, and MTSN 03 Sukadana (Rahman et al., 2025).

In addition, secondary data were obtained through literature studies and specimen identification using the Flora of Java guide and relevant literature (Damayanto et al., 2022). The data were qualitatively analyzed to examine the morphological and physiological variations of durian. These findings were subsequently reduced and validated for their suitability as learning resources, assessed based on their alignment with the Basic Competencies (KD) through the percentage scores derived from the questionnaires (Sawitri et al., 2025) The questionnaire employed a Guttman scale with binary response options, as presented in Table 1.

Table 1 Questionnaire scoring criteria for the analysis of local durian diversity as a learning resource

Answer	Score
Yes	1
No	0

Table 2 Criteria for evaluating teacher responses

No.	Range of scores	Assessment category
1	86%-100%	Excellent
2	76%-85%	Good
3	66%-75%	Fair
4	56%-65%	Poor
5	0%-55%	Very Poor

(Source: Agustha et al., 2021)

$$P = \frac{F}{N} \times 100\% \dots \dots \dots \text{Formula 1}$$

Description:
P = Percentage
F = Total score achieved
N = Maximum possible score

As shown in Table 1, each questionnaire item was scored using a binary scale, where a "Yes" response was assigned a score of 1 and a "No" response was assigned a score of 0. To ensure the validity of the findings, source triangulation and member checking techniques were employed to verify the consistency and accuracy of data obtained from the field and informants (Mulia, 2024). To calculate the percentage

of the teacher questionnaire responses, the Formula 1 was used. Subsequently, the percentage scores obtained from the questionnaire on plant potential were analyzed based on the rubric indicator criteria for potential categories, as outlined in Table 2.

C. Results and discussion

Field observations carried out across five villages (Pampang Harapan, Gunung Sembilan, Benawai Agung, Pangkalan Buton, and Harapan Mulya), combined with interviews conducted with 120 respondents (farmers and traders) in June 2025, revealed six outstanding local durian varieties, the details of which are presented in (Table 3).

Table 3 Local durian varieties in Sukadana District

No	Local name	Fruit description & characteristics	Tree & morphological characteristics
1	Durian semelimbing	Sweet and creamy taste, smooth texture, strong but non-pungent aroma. Thick skin, golden-yellow flesh (Romadloni et al., 2024)	Height 25–50 m, has buttress roots, lanceolate leaves 10–15 cm. Leaf undersides are silver/golden.
2	Durian ujang belia	Large fruit (3–4 kg), greenish-yellow skin, densely spaced sharp spines. Very sweet taste, pale yellow smooth flesh (Mardudi et al., 2021) Local superior variety known for thick, creamy flesh and relatively flat seeds (Selviyanti & Suwardi, 2021).	Local superior variety with thick, creamy flesh and slightly flattened seeds.
3	Durian burok	also known as Durian Aden, recognized for its sweet taste and fragrant aroma. Soft pale-yellow flesh with medium thickness	High productivity (150–200 fruits/tree). Resistant to root rot disease but susceptible to borer pests.
4	Durian jepit ketam	Balanced sweet-bitter taste (similar to Montong), very soft texture, golden-yellow flesh, thick skin (Di et al., 2023).	Known as the local “Montong Banyumas”. Characteristics influenced by soil and local climate.
5	Durian setungal	Endemic to Kalimantan. Small fruit, round star-shaped (ribbed), blunt spines. Golden-yellow flesh, very sweet.	Very high productivity (200–400 fruits/tree). Mild aroma, very smooth flesh texture
6	Durian sekunyit	Monthong-introduced variety. Elongated fruit with pointed tip, 2–4 kg, bright yellow thick flesh, sweet taste (Fauziah et al., 2021).	Tree 5–8 m tall, umbrella- or cone-shaped crown. Dense branching starts at 1 m above ground.

Tabel 4 Suitability aspect of durian varieties in Sukadana District as a biology learning

No.	Assessment category	Percentage (%)	Interpretation
1	Clarity of potential	81.81 %	Excellent
2	Clarity of target	90.90%	Excellent
3	Clarity of purpose	100%	Excellent
4	Clarity of information	90.90%	Excellent
5	Clarity of exploration guidelines	54.55%	Very poor
6	Clarity of expected outcomes	72.73%	Fair
Average		Tota score (82%)	Excellent



Figure 1 Durian semelimbing: (A) Habitus, (B) Fruit skin, (C) Fruit content



Figure 2 Durian ujang belia: (A) Habit, (B) Fruit skin, (C) Fruit content

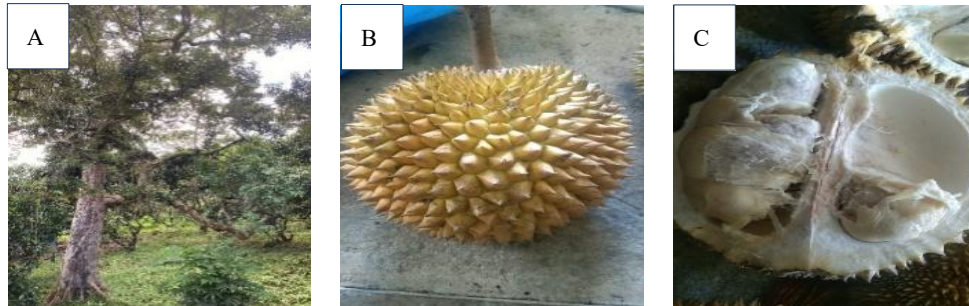


Figure 3 Durian burok: (A) Habit, (B) Fruit skin, (C) Fruit content

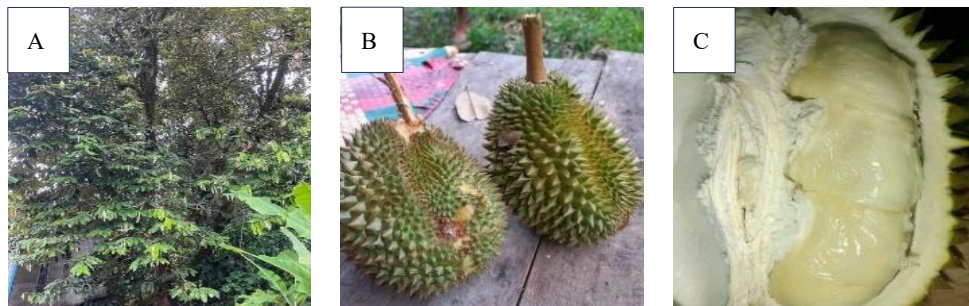


Figure 4 Durian jepit ketam: (A) Habit, (B) Fruit skin, (C) Fruit content



Figure 5 Durian setunggal: (A) Habit, (B) Fruit skin, (C) Fruit content

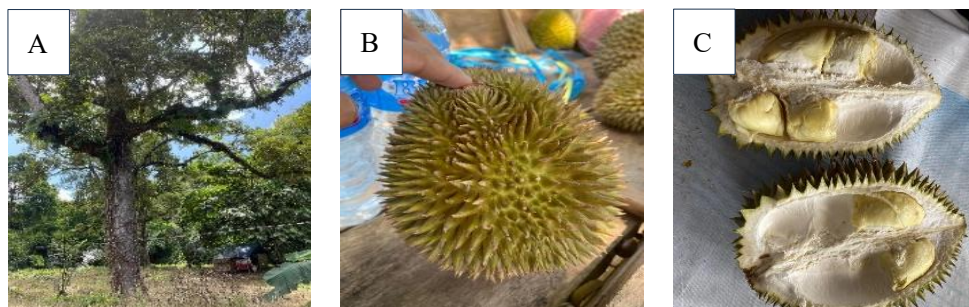


Figure 6 Durian sekunyit: (A) Habit, (B) Fruit skin, (C) Fruit content

The data suggest that durian varieties in Sukadana District are relatively evenly distributed across the observation sites, reflecting the stability of the local community-managed agroecosystem. The suitability of local durian as a learning resource was evaluated via questionnaires distributed to five science/biology teachers from different educational institutions (MAN Kayong Utara, MTSN 03, SMAN 01, 02, and 03 Sukadana), as evidenced by variations in fruit morphology, tree characteristics, aroma, and taste. This genetic diversity has been preserved through traditional domestication practices maintained by local farmers over generations. Significant variation in fruit size, spine thickness, and flesh color (ranging from pale yellow to orange) indicates that this area serves as a strategic center of genetic resources, with potential for plant breeding and as a superior regional commodity. Beyond its economic and cultural value (e.g., as raw material for lempok), local durian in Sukadana shows strong potential as a contextual biology learning resource. Students can explore topics such as morphology, pollination, tropical adaptations, and ecology through real-life objects in their surrounding environment.

Beyond serving as observable objects, the identified local durian varieties provide authentic biological evidence that enables students to understand how intraspecific variation arises within a single species. Differences in fruit morphology, tree architecture, rind characteristics, flesh colour, and seed morphology allow learners to distinguish between phenotypic variation, genetic diversity, and environmental adaptation. Consequently, these local accessions can function as living examples for explaining biological concepts such as variation, adaptation, inheritance, plant diversity, and the importance of conserving plant genetic resources, which are central themes in life science education.

Biological significance of local durian diversity for life science education

The six identified local durian varieties represent more than regional agricultural commodities; they constitute valuable biological materials for supporting life science education. Morphological variation among these varieties reflects naturally occurring biological diversity that can be directly investigated by students through observation, comparison, measurement, and classification activities. Unlike commercially standardized cultivars commonly presented in textbooks, locally adapted durian accessions expose students to authentic examples of phenotypic diversity shaped by genetic variation and environmental conditions. Such authentic biological phenomena enable learners to understand biodiversity as a dynamic biological process rather than as a collection of memorized concepts. Furthermore, the utilization of local durian diversity creates opportunities for integrating several biological disciplines within a single

learning context, including plant morphology, taxonomy, ecology, evolution, genetics, and conservation biology. Students are therefore encouraged not only to recognize species characteristics but also to analyse the biological significance of variation and its implications for maintaining plant genetic resources. This integration aligns with current directions in life science education, which emphasize inquiry-based learning, contextual understanding, and biological literacy through direct interaction with living organisms.

Based on observations, interviews, and teacher questionnaire responses, the potential of local durian was rated as “Good” and deemed suitable as a biology/science learning resource for junior and senior high school students. This suitability is based on meeting the six criteria for learning resources according to (Prastowo, 2016). Specifically, these criteria include: the clarity of the resource’s potential, consistency with the intended learning objectives, suitability of the material for the target students, clarity and accuracy of information, guidance for exploration, and the extent to which the expected learning outcomes are achieved see in (Table 4).

In general, Sukadana’s local durian exhibits a “excellent” potential (82%) for incorporation into biology teaching, especially in lessons covering biodiversity and classification. Suitability of Teaching Materials junior and senior high school. The analysis results indicate a strong correlation between the local potential and the curriculum (K13 and Merdeka Curriculum) (Sholeh et al., 2025):

- 1) Junior High School (Grades VII–IX): Classification of Living Organisms (Grade VII), Structure and Function of Plants (Grade VIII), and Inheritance of Traits (Grade IX).
- 2) Senior High School (Grades X–XI): Biodiversity and Classification (Grade X), Plant Tissues and Biotechnology (Grade XI).
- 3) Senior High School (Grade XII): Evolution and Conservation of Genetic Resources (Pratiwi & Widyaningrum, 2021).

Clarity of potential and information revealed

This study demonstrates that Sukadana’s local durian is not merely an economic commodity, but a rich biological object. With a potential score of 81.81% and an information clarity score of 90.90%, it is evident that morphological diversity (flesh color, texture, spine shape) provides students with concrete learning experiences. Direct field observation (as a natural laboratory) can reduce verbalism in learning, in line with the principle that real-life objects offer deeper experiential understanding compared to theoretical instruction alone (Husamah, 2020). From a life science perspective, the documented morphological diversity also provides opportunities for students to develop scientific inquiry skills. Learners may formulate hypotheses regarding the causes of morphological

differences, compare observable traits among varieties, classify specimens based on diagnostic characters, and communicate scientific findings using biological terminology. Therefore, the identified local durian diversity does not merely function as contextual learning material but also supports the development of essential biological process skills that are expected in biology education.

Suitability and alignment with learning goals and target students

The learning objective component received a perfect score of 100%, indicating that the identified local durian diversity is highly relevant to the achievement of biology learning outcomes, particularly in topics related to biodiversity, classification, and plant morphology. Similarly, the target suitability component obtained a score of 90.90%, demonstrating that the learning resource is appropriate for both junior and senior high school students. These findings support previous studies that emphasize the importance of integrating local biodiversity into biology education to make learning more contextual and meaningful (Yani et al., 2021). Contextual learning enables students to connect scientific concepts with real objects found in their surrounding environment, thereby improving understanding and retention of knowledge. Furthermore, the Merdeka Curriculum encourages the use of local potential and local wisdom as learning resources to strengthen scientific literacy and student engagement. Through direct observation of local durian varieties in Sukadana District, students can actively develop skills in observing, identifying, classifying, and analyzing biological characteristics, which are essential competencies in biology learning. Therefore, the high scores obtained in this study suggest that local durian diversity has strong potential to support contextual and student-centered biology learning. Moreover, the use of local durian diversity enables students to integrate biological knowledge across multiple levels of organization, ranging from organismal morphology and species diversity to ecosystem interactions and biodiversity conservation. Such integration reflects the interdisciplinary nature of life science, where students are encouraged to connect structural characteristics with ecological functions and conservation values. This approach promotes systems thinking, which has become an increasingly important competency in contemporary biology education.

Evaluation of exploration guidelines and expected outcomes

A critical note was observed regarding the Exploration Guidelines aspect, which scored 54.55%. This relatively low score was attributed to the absence of specific modules or practical guides developed by the researcher for students. This finding serves as a recommendation for future research to create more structured exploration guidelines. In this study, the

local durian plants of North Kayong Regency can be utilized as a means of a natural laboratory in biology learning, as no researcher-designed practical guides are currently available. Instruction can be conducted outdoors, taking advantage of the surrounding environment as a natural laboratory (outdoor education).

Clarity of anticipated learning outcomes (72.73%)

These findings suggest that the potential of local durian can exert positive effects across three domains: cognitively, by enhancing understanding of genetic variation and taxonomy; affectively, by cultivating environmental awareness and pride in local biodiversity; and psychomotorically, by developing students' skills in observing, organizing data, and independently identifying morphological characteristics. From a theoretical perspective, the integration of local resources into learning promotes meaningful learning, enabling students to link academic concepts with real-world environmental observations (Apriana, 2019).

Sukadana's local durian diversity serves as both a symbol of regional identity and a natural laboratory, making it highly suitable for integration into science education. The anticipated outcomes of this study are the comprehensive identification of local durian varieties in North Kayong Regency and an assessment of their ecological, economic, and educational potential. Thus, this research not only documents the richness of durian varieties but also highlights their significance as local resources that can be leveraged in agriculture, tourism, and educational applications. In addition, the identified local durian varieties provide opportunities to introduce students to authentic biological investigation methods commonly used in biodiversity research. Students may conduct morphological measurements, prepare simple identification keys, compare phenotypic traits, document species characteristics, and interpret variation using scientific reasoning. These learning experiences strengthen biological literacy by exposing learners to the processes through which biological knowledge is generated rather than merely presenting biological facts.

D. Conclusion

This study identified six local durian varieties in Sukadana District, namely Semelimbing, Ujang Belia, Burok, Jepit Ketam, Setungal, and Sekunyit, which exhibit diverse morphological characteristics and represent valuable local biodiversity resources. Biology teachers rated the potential of these local durian varieties as biology learning resources at an average of 82% (excellent), indicating their suitability for contextual biodiversity learning. From the perspective of life science education, the documented local durian diversity contributes not only as contextual teaching material but also as an authentic biological resource that facilitates observation, classification, scientific

inquiry, biodiversity analysis, and conservation awareness. Accordingly, the integration of local biodiversity into biology learning can strengthen students' biological literacy by connecting theoretical concepts with real biological phenomena found in their immediate environment. The findings demonstrate that local durian diversity can serve as a relevant learning resource by connecting biological concepts with students' surrounding environment and enriching local biodiversity documentation. Local durian diversity in Sukadana District has strong potential to be integrated into biology learning through field observations, project-based learning activities, and the development of local-potential-based teaching materials aligned with the Merdeka Curriculum. Future studies are recommended to develop structured learning modules and conduct molecular or genetic analyses to strengthen the scientific classification of the identified varieties

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