RESEARCH ARTICLE

The five key types of *Marsilea crenata* as a potential identification tool for biology students

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Abstract: An identification key is one of the tools used to determine the identity of a plant specimen. This research aims to design an identification key for *M. crenata* and analyze its potential as an identification tool. The research uses an observational descriptive method. The identification keys were designed for populations growing in aquatic floating, emergent, and terrestrial habitats. The key types designed are (1) short parallel, (2) long parallel, (3) numerical, (4) circular diagram, and (5) columnar diagram. The key characters are qualitative and quantitative, consisting of seven morphological and two anatomical characters. The potential of the identification keys was evaluated based on expert judgment regarding the quality and relevance of the keys as identification tools, accuracy, time, and assessment of student satisfaction. The data were analyzed quantitatively and descriptively. The reliability of expert judgment data was determined based on the percentage of agreement and Cronbach α, while the Kruskal Wallis and Mann-Whitney tests were used to analyze student assessment data and to determine the mean as well as SD of identification time. Student responses were processed in the form of percentages. The results of the expert assessment show that five key types have potential as a tool of identifying ferns diversity. Based on the effectiveness of key use and student assessment, numerical keys are the type that has the least potential, while short parallel keys have the best potential as a tool of identification. However, the five key types that have been developed can be used in learning to train students' identification skills.

Keywords: higher education; identification tool; keys of *Marsilea crenata*; learning environment

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Introduction

Ferns and lycophytes are the second most diverse group of vascular plants, estimated to have 11.916 species (Ebihara & Nitta, 2019). They are distributed worldwide but thrive in high humidity and moderate temperature environments, particularly in tropical and subtropical mountain forests (Salazar et al., 2015). In Indonesia, ferns are estimated to reach 1.300 species, or 13% of the total species in the world (Rahayuningsih et al., 2019) and one of the most common genera is *Marsilea.* This genus is known as water clover because its characteristics resemble clover, especially in habit and leaf type. *Marsilea* is a heterosporous aquatic fern distributed in areas with elevation, from lowland up to 900 m altitude.
Marsilea is a genus of aquatic ferns that belongs to the family Marsileaceae. The distribution of this genus is cosmopolitan, but the species are generally absent in areas with moderate or winter climates and island regions. Despite this, the genus exhibits a wide range of morphological adaptations to suit its habitat (Sharma & Bhardwaj, 2014). Variations in morphological characters include the length of the rhizome and petiole segments, the shape of the margin of the leaflet lamina, leaf heterophyly, trichome density, and the total stomatal pore area index.

Marsilea crenata is the only *Marsilea* species distributed in Indonesia (Rahayuningsih et al., 2019). This species is known locally as "*semanggi*" and is used by local communities as a vegetable Winarti & Susiloningsih (2019) as well as a bioindicator of water pollution (Nurhayati et al., 2015; Retnaningdyah et al., 2017). It is characterized as an herb with creeping rhizomes, long erect petioles, and 4 compound leaflets at the end of each petiole (Setyawati et al., 2015). Although an aquatic fern, this species can grow in terrestrial habitats and is commonly found growing wild in rice fields or open areas, irrigation channels, and shallow ponds. Due to variations in habitat, this species tends to exhibit morphological differences. Sharma & Bhardwaj (2014) stated that different populations of this species growing in various habitats tend to appear as distinct species because the populations exhibit very clear morphological plasticity. Furthermore, Agil et al., (2017) showed that populations growing in different habitats displayed variations in petiole length, rhizome internode, roots, and leaflets (lamina).

The morphological variation among *M. crenata* populations in different habitats can be used as a valuable resource for studying intraspecific diversity in ferns. The morphological variation from individuals and expressed as intraspecific population diversity is a key component in understanding biodiversity. Consistently, Raffard et al., (2019) define biodiversity as diversity among organisms, populations, ecotypes, subspecies, communities, and ecosystems or refers to intraspecific, interspecific, and ecosystem diversity. Biodiversity can also be interpreted as biological variability within unique or intraspecific populations, as well as interspecies and intercommunity interactions (Eduardo, 2016).

Biodiversity is a primary topic examined in the field of systematics (Ohl, 2015), alongside relationships among organisms. Systematics typically refers to the theory and practice of describing, identifying, and classifying living organisms. Species identification practice is a useful tool for biology education. According to Seo & Oh (2017), species identification is a fundamental and routine process in plant systematics. Learning plant systematics in higher education aims to train students to use dichotomous keys effectively to identify plants accurately (Kirchoff et al., 2014). For biology students, mastering dichotomous keys provides a way to identify the organisms investigated (Buck et al., 2019; Watson & Miller, 2009). However, in reality, the botanical identification skills of students are still inadequate (Stagg & Donkin, 2013).

It is crucial to address the weaknesses of students in the aspects of their identification skills. According to (Stucky et al., 2021), teachers should create their own identification keys according to the plants that students will encounter, rather than using keys for regional or foreign countries. Similarly, UNESCO (2014) recommended instructional strategies for learning biodiversity by having students conduct simple investigations on the identification of flora/fauna in their local area/country to facilitate their understanding of the biodiversity in that area. Teacher-designed identification keys can be customized to the curriculum content or local environment, making it more relevant to students' lives (Stefano & Nimis, 2014) and having the potential to promote nature-related learning (Stagg et al., 2014).

Traditionally, the instructional approach trains students to identify preserved specimens using paper-based identification keys (Pfeiffer et al., 2011). These printable keys are considered a traditional identification tool that is generally dichotomous, where each step presents two choices (Hagedorn et al., 2010). Although traditional, previous studies showed that print keys are more effective than electronic keys. Therefore, it can be concluded that traditional keys are not outdated for student identification practice (Stagg et al., 2014). According to Stucky et al. (2021), traditional dichotomous keys are suitable for teaching inexperienced students to identify plants in the field.

As plant-based identification keys in the local environment are one of the factors that need to be considered in practicing identification skills, this study aimed to design several key types for *M. crenata*. Key type research has been carried out by Ogunkunle (2014) for species that are useful as medicinal plants, namely *Ocimum*, *Hyptis*, and *Ficus*. The key type designed based on the epidermal character of the leaves and the anatomy of the wood. The identification key for *M. crenata* prepared in this study is different from previous studies because it is focused on variations in fern characters at the infraspecific level and the characters used are a combination of morphology, paradermal and anatomy. In addition, the key developed can be used for identification based on herbarium specimens.

Method

This research uses an observational description method with two main stages, namely designing and applying identification keys as shown in Figure 1. The first stage includes the activities of determining the diagnostic character traits, the type and format, forming the key, and assessment by experts. Meanwhile, the second stage includes the use of identification keys followed by key assessment and response by students. Parameters used to determine potential key identification include assessments by experts and students, effectiveness and efficiency, and student responses can be seen in the Figure 1.

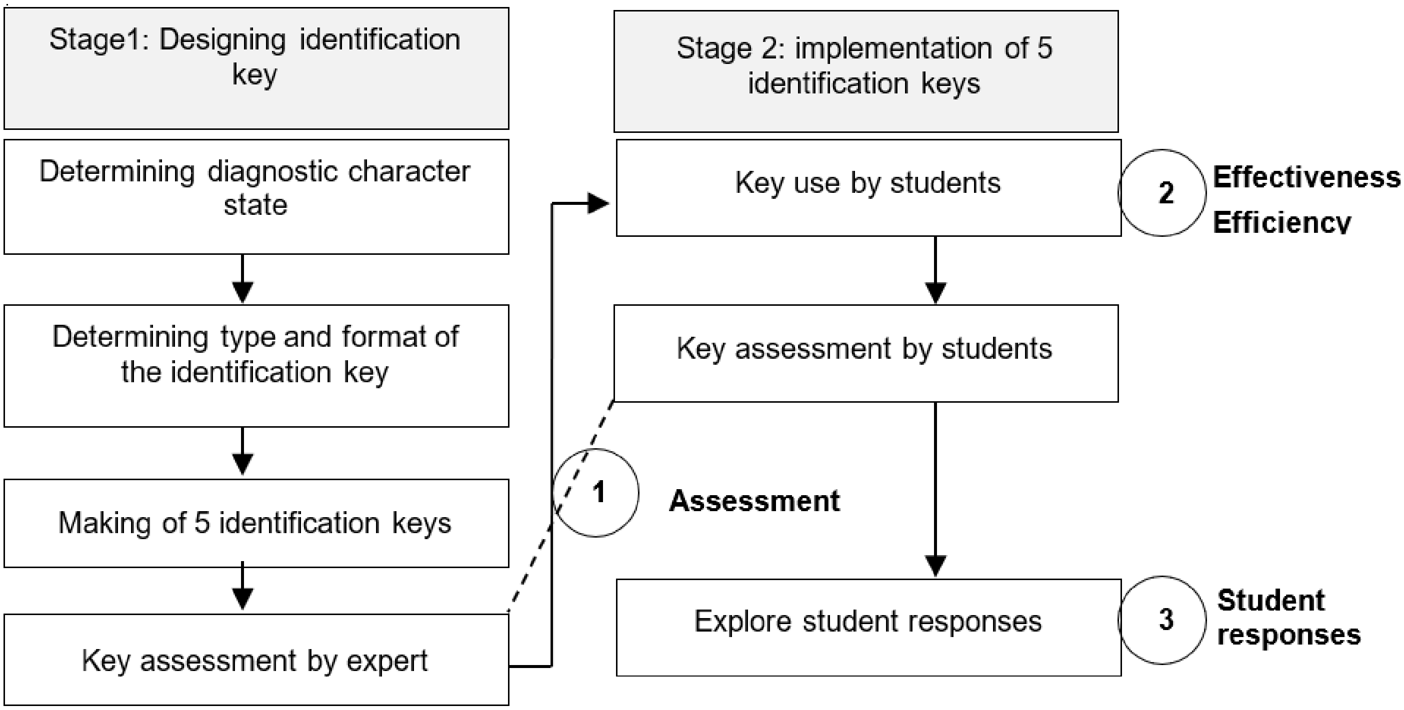


Figure 1. The flowchart of activities for the two main stages of the study accompanied by potential key identification parameters (numbers 1, 2, and 3).

Designing identification keys

Identification keys were constructed for three intraspecific variants of *M. crenata* that grow in different habitats, namely aquatic floating and emergent, as well as terrestrial. There were five types of identification keys designed, including short and long dichotomous keys, numerical keys, as well as circular and columnar diagrams. These types follow the format developed by Ogunkunle (2014), and each step presents choices with two alternatives. All identification keys were presented in print format and the characters applied were limited to vegetative organs, as *M. crenata* is rarely found in its habitat, forming reproductive organs in the form of sporocarps (Whitten et al., 2012). The characters included in the keys are qualitative and quantitative. Qualitative characters consist of the shape of the lamina margin, the position among leaflets, the presence or absence of red streaks on the abaxial lamina, and the color of the rhizome. Meanwhile, quantitative characters include the length of the petiole, the length of the nodal roots, the number of aerenchyma spaces in the rhizome, and the stomatal index of the lamina (Wisanti et al., 2021). The qualitative and quantitative characters consist of seven morphological characters and two anatomical characters. The application of morphology and anatomy as diagnostic characters in this research ensures that the identification key prepared is reliable.

Each type of key was evaluated for its relevance as an identification tool by experts in the field of plant systematics. The key assessment instrument consists of nine aspects divided into three namely key characters, format, and use. Each aspect was assessed using a 4-point Likert scoring method, comprising 1 (disagree) to 4 (strongly agree). The nine aspects of the assessment include; (1)Characters show diagnostic feature; (2) The number of characters represents the principle of natural classification; (3) Authentic key character; (4) The terminology is easy to understand; (5) Compact key; (6) Practical key; (7) The specimen does not need to be in the field to be identified; (8) The user is free to choose any character in the sequence, thereby avoiding a rigid format; (9) Identity confirmation can be accomplished in no time.

Implementation and testing of identification keys

The five keys were applied in the teaching of Plant Systematics with the topic, "identification tool" at the Systematics Laboratory of Surabaya State University, Indonesia. A total of 75 Biology students participated in the implementation of the identification keys. All the students had learned botanical knowledge related to the morphology and anatomy of ferns. Each identification key was applied and evaluated by 15 students, culminating in five groups corresponding to the number of key types. Identification was performed by the students based on herbarium specimens accompanied by photos, preserved cross-section rhizome slices, and one paradermal lamina preserved specimen in Figure 2. The equipment provided included an electric microscope (Carl Zeiss Axiostar 10-031) equipped with a digital camera (Dino-lite USB AM 4023X) and a laptop for observing anatomical characters.

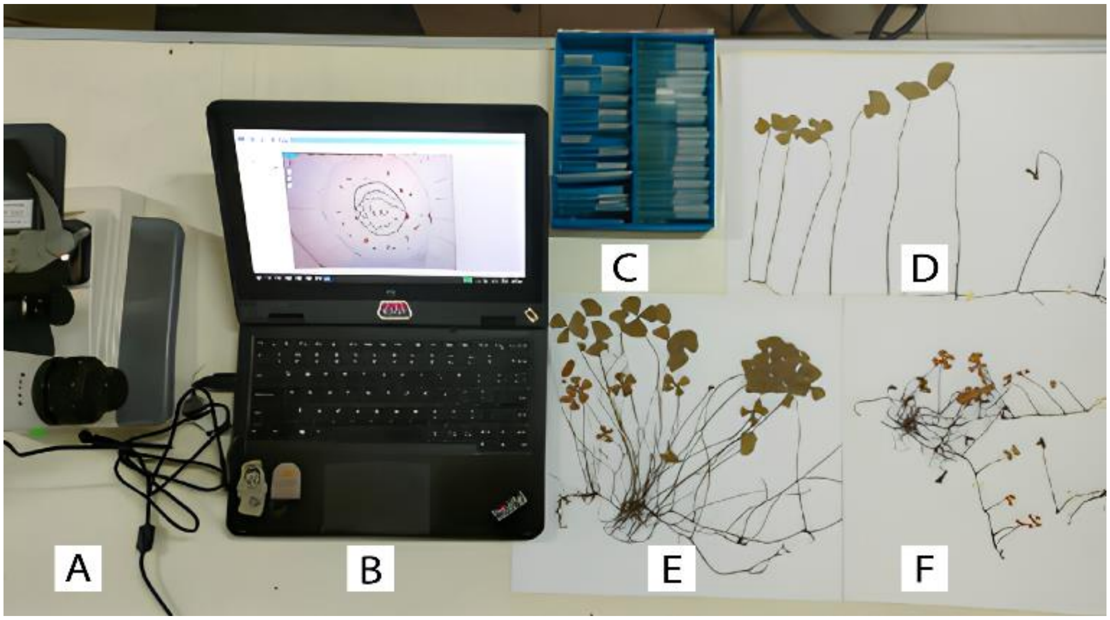


Figure 2. Specimens and fixtures used in the key implementation. A. Electric microscope, B. Laptop, C. Microscopic preparations, D. Aquatic floating population herbarium, E. Aquatic emergent population herbarium, F. Terrestrial population herbarium.

The implementation of identification keys was carried out for three days and each group of students was observed by five observers to record the time spent and the number of students who accurately identified the specimens. The number of students who accurately identified the specimen was used to assess the key's effectiveness, while the time required was used to measure efficiency. After identification, students gave an assessment of the key based on satisfaction which included the level of familiarity ranging from none, low, moderate, to high; level of use from very difficult, difficult, easy, to very easy; level of acceptance from very low, low, high, to very high; and level of confidence including definitely wrong, probably wrong, probably right, and definitely right (Ogunkunle, 2014). Students were also asked to provide feedback on the identification key through a questionnaire consisting of four Likert 4-point statements, from 1 (disagree) to 4 (strongly agree). Moreover, students were free to provide additional feedback at the end of the questionnaire.

Data analysis

The data obtained were analyzed based on a quantitative descriptive approach, while expert judgment data, student assessments, key effectiveness, and student responses were used to evaluate the potential of each identification key. The results of expert judgment on key quality were determined based on interrater reliability using the percentage of agreement and Cronbach α. Interrater reliability is accepted when the percentage of agreement is ≥ 80% (McHugh, 2012) and Cronbach α is acceptable, if ≥ 0.7 (Otsetova & Dudin, 2017). Furthermore, the results of key assessments by students were determined by the average using the Kruskal Wallis test and followed by the Mann-Whitney test to analyze the differences in averages between key types. Data in the form of time taken by students for identification were determined by the mean and standard deviation using SPSS version 23. Student response data in the form of scores were analyzed simply in the form of a percentage.

Results and Discussion

Profile of five identification key types

The identification keys were designed for three populations of *M. crenata,* with different habitats namely aquatic floating and emergent, as well as terrestrial. These include single-access text-based keys that consist of short parallel, long parallel, and numerical keys, as well as circular and columnar diagrams. The five types of keys were developed to allow students practice identification based on classroom settings.

Parallel keys, also known as linked or bracket keys, consist of a series of paired statements, called couplets. The statement or clue from one couplet contains the same character as the diagnostic feature. Two formats of parallel keys were developed in this study namely short parallel keys consisting of two couplets (Figure 3A) and long parallel keys consisting of 6 couplets (Figure 3B). Each lead in the short parallel key contains 4-5 qualitative and quantitative characters, while the long parallel key consists of only one character, either qualitative or quantitative.

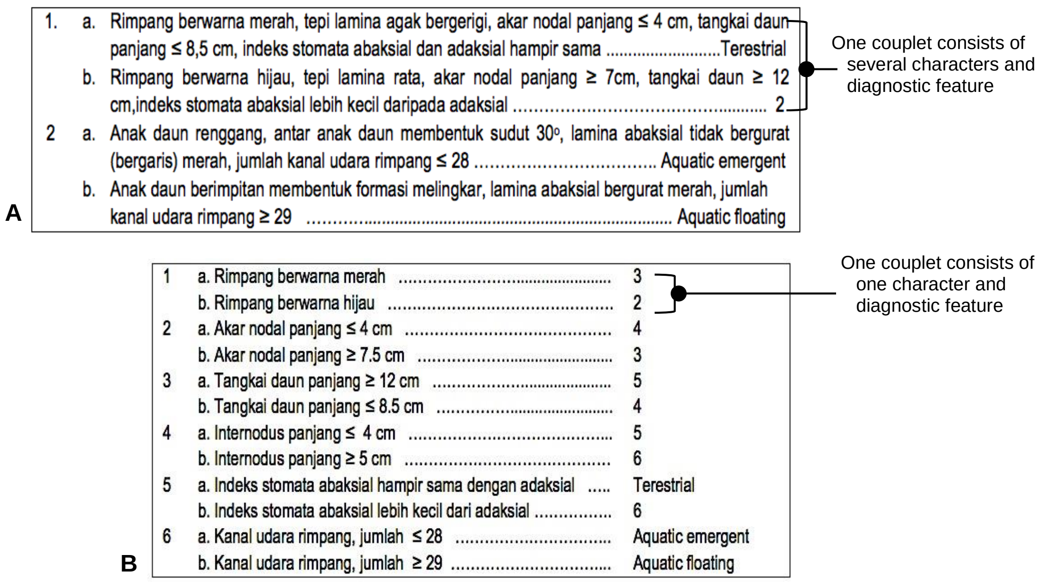
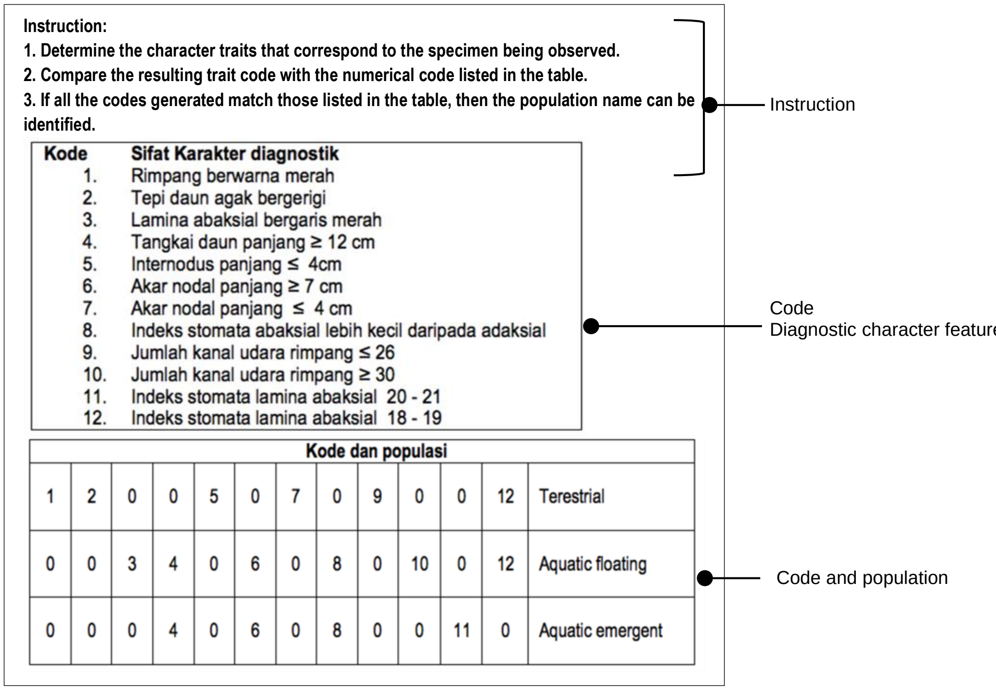


Figure 3. *M. crenata* infraspecific keys with types: A. Parallel short version (2 couplets), B. Parallel long version (6 couplets).

The numerical key consists of two main parts, namely a list of codes with diagnostic character features as well as a table of codes and populations (Figure 3A). The list contains seven characters comprising both qualitative and quantitative features. One character consists of a pair of diagnostic features with numerical codes in sequence, for example, code 1 for red rhizomes, and 2 for green rhizomes. Consequently, this type represents a dichotomous key. The number of characters for each population (Figure 4) includes six for terrestrial and aquatic floating, as well as five for aquatic emergent.

In principle, the circular and the columnar diagram key for *M. crenata* are the same. These two types consist of two main parts separated by the type of character, namely morphological and anatomical as shown in Figures 3B and Figure 3C. The difference between these two keys lies in the form of the diagram, one being circular shown Figure 5 and the other being columnar (Figure 6), both keys use more characters than the other three types. There are ten key characters comprising six morphological and four anatomical, both qualitative and quantitative.



Instruction:
1. Determine the character traits that correspond to the specimen being observed.
2. Compare the resulting trait code with the numerical code listed in the table.
3. If all the codes generated match those listed in the table, then the population name can be identified.

Kode	Sifat Karakter diagnostik
1.	Rimpang berwarna merah
2.	Tepi daun agak bergerigi
3.	Lamina abaksial bergaris merah
4.	Tangkai daun panjang ≥ 12 cm
5.	Internodus panjang ≤ 4cm
6.	Akar nodal panjang ≥ 7 cm
7.	Akar nodal panjang ≤ 4 cm
8.	Indeks stomata abaksial lebih kecil daripada adaksial
9.	Jumlah kanal udara rimpang ≤ 26
10.	Jumlah kanal udara rimpang ≥ 30
11.	Indeks stomata lamina abaksial 20 - 21
12.	Indeks stomata lamina abaksial 18 - 19

Kode dan populasi												
1	2	0	0	5	0	7	0	9	0	0	12	Terestrial
0	0	3	4	0	6	0	8	0	10	0	12	Aquatic floating
0	0	0	4	0	6	0	8	0	0	11	0	Aquatic emergent

Figure 4. Numerical key intraspecific populations of *M. crenata*

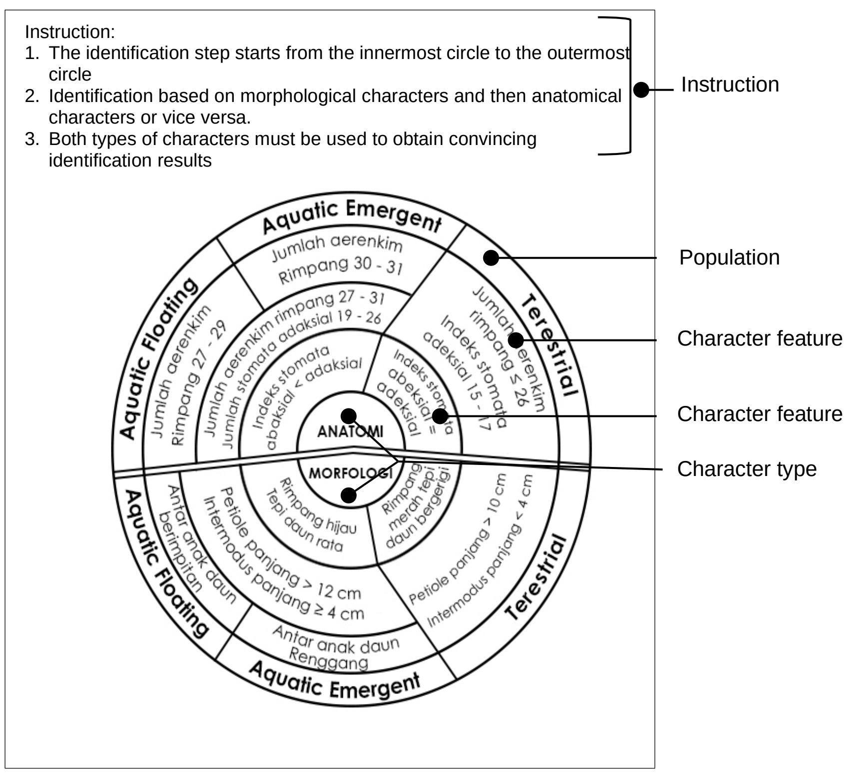


Figure 5. Circular key intraspecific populations of *M. crenata*

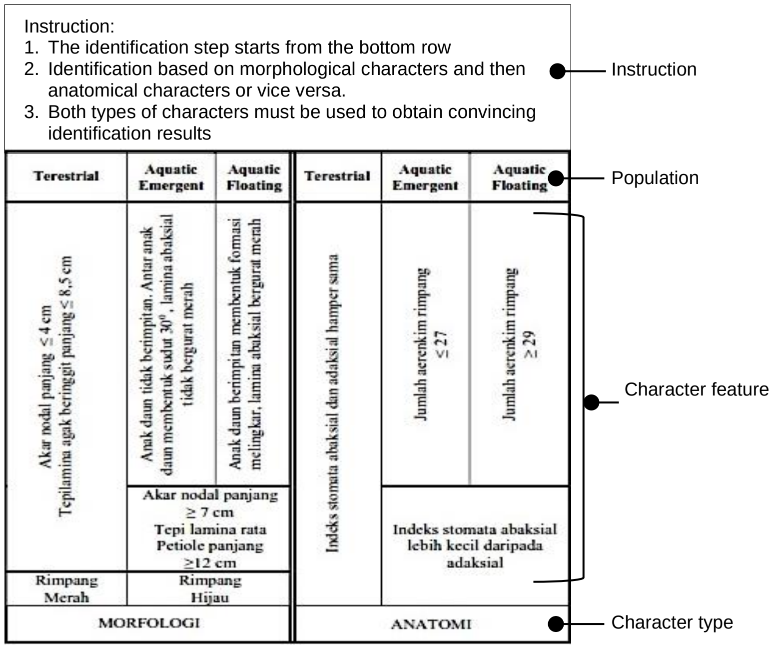


Figure 6. Columnar key intraspecific populations of *M. crenata*

Identification key assessment

Three systematic experts provided quality and relevance assessments for each key type, as presented in Table 1. Based on the results, the five keys achieve high reliability with κ of 0.834 and Cronbach α of 0.891 (short parallel), 0.984 (long parallel), 0.829 (numerical), 0.911 (circular diagram) and 0.829 (columnar diagram), indicating excellent quality and relevance as identification tools for *M. crenata* diversity. The experts strongly agreed that the key characters are diagnostic, authentic, and present a natural classification. Similarly, they strongly agreed that users do not need to observe specimens in the field when using the five key types. The terminology aspect has the same score (3) for all five key types, indicating that the terminology is easily understood by key users.

Table 1. The results of the expert assessment regarding the quality and relevance of each key type as an identification tool with a 4-point Likert scale, ranging from 1 (disagree) to 4 (strongly agree) (n=3).

Assessment Aspect	Average Score				
	Type I	Type II	Type III	Type IV	Type V
1.	3.67	4	4	4	4
2.	4	4	4	4	4
3.	4	4	4	4	4
4.	3	3	3	3	3
5.	3.78	3	3.78	3	3.78
6.	4	3.78	3	4	4
7.	4	4	4	4	4
8.	4	3.33	4	4	4
9.	3.33	3	3	3.67	4

Description, Type I: short parallel; type II: long parallel; type III: numerical; type IV: circular diagram; type V: columnar diagram. The inter-rater agreement value of Kappa (κ) is 0.834 (excellent) with a significance value of $p < 0.001$, indicating that the results are highly reliable. The reliability Cronbach α value is 0.954 (excellent) with a significance value of 0.211 ($P>0.05$).

The assessment results of the five key types presented in Table 2, show that for the students, the most familiar key type is the parallel key, while the circular and columnar diagrams are considered unfamiliar. Although unfamiliar, the usage level of the circular diagram is the same as the short parallel key, with a category of very easy. The lowest confidence level was found in the numerical key (2.4), while the highest was observed in the short parallel key (3.5). Therefore, students knowledge the possibility of misidentification with the numerical key but they are more confident in their results when using the short parallel key. In terms of acceptance level, the lowest average score was found in the numerical key at 2.4, while the highest was obtained in the short parallel key at 3.65.

Table 2. Student assessment of the five key types

Key Types	N	Assessment Average			
		Familiarity Level	Usage Level	Acceptance Level	Confidence Level
1. Short parallel	15	3.95[a]	3.7[a]	3.65[a]	3.5[a]
2. Long parallel	15	3.9[a]	2.95[b]	3.05[b]	3.05[b]
3. Numerical	15	2.2[b]	2.35[c]	2.4[c]	2.4[c]
4. Circular diagram	15	1.4[c]	3.55[a]	3.25[ab]	3.2[ab]
5. Columnar diagram	15	1.4[c]	3.2[ab]	3.2[ab]	3.1[ab]

Assessment average followed by different superscripts represents a significant difference at $p > 0.05$.

Effectiveness and efficiency of key identification

The application of the five key types showed that all students were able to identify one herbarium specimen of *M. crenata*, except with the numerical key. Five students or 33.33% failed to identify the specimen using the numerical key. The average time required for identification showed significant differences between the long and short parallel keys, as well as the numerical key with P>0.05 as shown in Table 3. However, there was no significant difference between the short parallel key, as well as the circular and columnar diagram. The average time required for accurate identification ranged from 3.5 minutes for the short parallel key to 8.3 minutes for the numerical key. The time required for identification using the short parallel key is faster because the number of steps is less namely 4. The minimum and maximum times for identification were the longest for the numerical key.

Table 3. The average length of time spent by students to identify one specimen.

TYPE	N	Minimum (minute)	Maximum (minute)	Average and SD
Short parallel	15	2	5	3.50±0.827[a]
Long parallel	15	3	10	5.50±1.572[b]
Numerical	15	6	13	8.30±1.625[c]
circular diagrams	15	3	5	4.05±0.759[a]
columnar diagrams	15	3	7	4.05±1.099[a]

Average and SD followed by different superscripts represent significant differences at $p > 0.05$

Student response

Figure 7, shows student responses to the implementation of the keys in Plant Systematics learning presented in a bar diagram. The students responded very positively to the application of the keys, as it provided them with an opportunity to learn how to use the keys, compare characters, and observe the diversity of ferns. A small percentage of students namely 7.35% disagreed that the key characters are easy to observe. This might be due to anatomical characteristics, such as stomatal indexes, which require observation and measurement using a microscope.

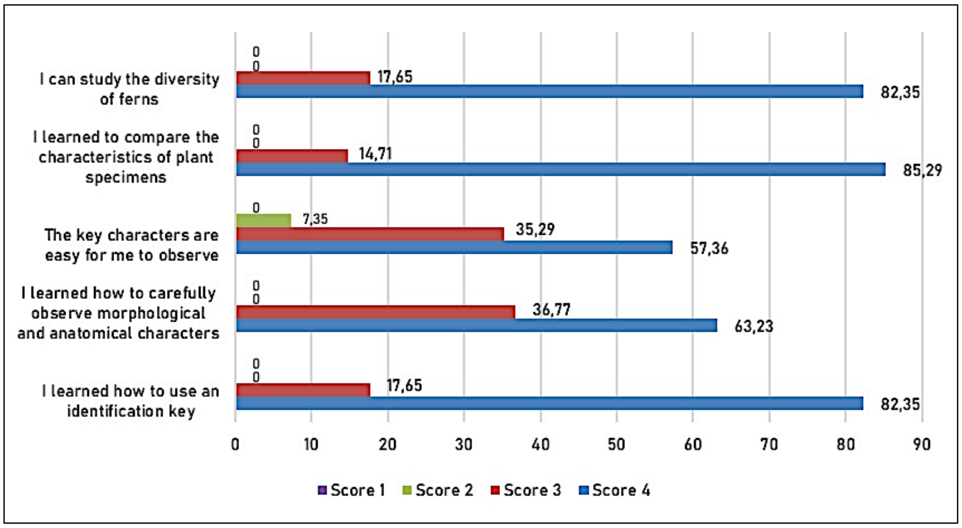


Figure 7. Students' responses to the application of the identification key based on a Likert scale of 4 points, 1 (disagree) to 4 (strongly agree) (n=68).

The five types of *M. crenata* keys are dichotomous because they consist of a sequence of paired steps, and each pair presents an option with two alternatives (Wäldchen & Mäder, 2018). Traditionally, textual dichotomous keys have been the main tool used for species identification (Seo & Oh, 2017). According to Bonnet et al., (2018), despite the portability and convenience of mobile computers, as well as the increasing availability of multiple-access keys, most users prefer the navigation of print identification guides. To date, most published books on plant taxonomy use dichotomous keys.

In the Biology curriculum of higher education, students typically begin learning about biodiversity by distinguishing preserved specimens using dichotomous identification keys (Pfeiffer et al., 2011). All developed key types received a score of 4 from experts, meaning the experts strongly agreed that the use of keys does not require specimens to be in the field. Based on this consideration, the implementation of the five key types was conducted in the classroom through the observation of herbarium specimens. Buck et al., (2019) Revealing little knowledge about plant species among young students or the student generation can be overcome by introducing students to herbarium techniques, so that they can identify a large number of plants correctly. The series of characters that should be examined is a weakness of text-based dichotomous keys, specically when several characters may be damaged or missing in the specimen. This weakness can be overcome by including complete illustrations and/or photos (Hagedorn et al., 2010; Morrison, 2012). Therefore, the specimens used in this study are accompanied by photos of the *M. crenata* rhizome to show its color, and photos of the leaflets to demonstrate the position and the shape of the leaf margin in more detail. This information will help beginners to decide which key steps to take.

Given the highly diverse nature of plant characters, it is often necessary to consider several characteristics for a key to function as a reliable identification tool. These characteristics include simple, easily observable, stable, and reliable (El-Gazzar et al., 2015, 2020). Based on the expert assessment, the number of key characters for *M. crenata* is adequate, consisting of nine characters as a combination of morphology, anatomy, qualitative, and quantitative characters. These combinations can be used to make more precise and reliable key statements, including the morphology and anatomy of vegetative organs. The most abundant key characters for *M. crenata* are leaf morphology, accounting for five out of nine. This is because leaves are easily visible in most plants and are available almost all year round, compared to reproductive organs. Leaves are vegetative organs that present the highest structural variation and produce many important features in identification.

Plant anatomy characters have significant value in the context of taxonomy because they reveal essential character combinations (Simioni et al., 2017). One of the anatomy characters is the number of aerenchyma air spaces. Aerenchyma is a representative character of *M. crenata* as a hydrophyte. Similarly, the stomatal index describes the differences between aquatic populations with floating and aerial leaves. The use of anatomy characters leads to changes in the interpretation of fern morphology, culminating in a more natural classification (Christenhusz & Chase, 2014). Other keys developed using anatomy characters include leaf epidermis and wood anatomy for the species key of *Ficus*, the species key of *Ocimum* (Ogunkunle, 2014), leaf epidermis for Phyllanthus (Uka et al., 2014), and petiole anatomy for *Curcuma* (Anu & Dan, 2020).

According to the students, the parallel key type is very familiar, easy, and also acceptable. A study by Ogunkunle (2014) on key familiarity showed that although parallel keys are very familiar, their usage level is difficult and the acceptance level is low. Similarly, the students agreed that circular and columnar keys are less familiar but very easy to use. The high user preference for short parallel, as well as the circular and columnar diagrams, did not show significant differences in identification accuracy. The identification time for these three key types was the fastest, with a maximum of 5-7 minutes. According to a previous study, the accuracy of the plant species identified, and the time required for identification are parameters of key application efficiency (Stagg et al., 2014; Stagg & Donkin, 2013). In contrast, Lombard et al. (2021), stated that identification accuracy should be given more priority than time. This is because accurate organism identification is an important aspect when measuring the biodiversity of an area. Therefore, the five key types created are aimed at helping students learn the intraspecific diversity of ferns through identification, prioritizing accuracy, and ease of use. Through the application of various keys in practicing identification, it has a positive impact on students to explore and handle innovative tools of identification, for example using digital keys.

Plant identification using a taxonomic key is a necessary skill that should be possessed and mastered by beginner taxonomy students (Kusumawardani et al., 2019). Identification is not limited to recognizing the identity but also to become familiar with the essential characters of an organism. Character recognition can only be accomplished through observation. Therefore, Griffing (2011) defined a dichotomous key as a series of observations used for identification. Species identification facilitates students to engage in close observation of plants as whole organisms (Nyberg & Sanders, 2014). The implementation of the five key types developed is also expected to build students' appreciation for *M. crenata,* as a bioindicator and traditional food. According to Silva et al. (2011), beginners should be involved in the key's implementation by linking applied aspects or benefits of plants, such as their use as food or medicine, to the plants being identified.

The dichotomous key is a more accurate method of identification because it can include highly specific descriptive terms that differentiate superficially similar and consistent taxa. Based on the data obtained, the five key types developed are accurate identification tools because they apply specific descriptive characters for *M. crenata* that separate populations according to their habitats. Through observation of the key characters, students automatically learn about intraspecific diversity at the scale of aquatic floating and emergent, as well as terrestrial. Hahn et al. (2017), stated that interspecific and intraspecific characteristic variations generate the biodiversity effect on ecosystem function. Biodiversity can be observed at several organism-based scales, including individual organisms, populations, species, and plant communities. Observing a wide variety of characters for plant identification will attract user attention, thereby increasing their interest in plants and appreciation of biodiversity (Wäldchen & Mäder, 2018).

Conclusion

Five types of *M. crenata* identification keys were designed as single access keys including parallel keys (short and long versions), numerical, circular and columnar keys. Based on the theoretical assessment, the five key types meet the quality and relevance as an identification tool for intraspecific diversity. However, in practice, numerical keys are not effective and efficient. Thus the keys that have the potential as a means of identification are parallel, circular and columnar types. The short parallel key is the best type of key based on expert and student assessments as well as the length of identification time. For students, the key to identifying *M. crenata* is useful for studying plant diversity, especially ferns and their character variations. Through the implementation of identification keys, students gain various learning experiences, experience observing herbarium specimens, using digital microscope camera software, and applying anatomical characters for identification. A series of appropriate learning experiences for students can improve student performance and active involvement so that learning becomes meaningful.

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Conflicts of Interest

The authors declare that there is no conflict of interest regarding the publication of this paper.

Author Contributions

W. Wisanti: preparation for writing the original draft, manuscript draft, research conception and design, conducting research, analyzing data, revising the manuscript. **S. Zubaidah:** review and editing research conception and design. **S. R. Lestari:** review and editing research conception and design. **N. K. Indah:** data collection and data analysis; Eva Kristinawati Putri: data collection and data analysis.

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