JPBI (JURNAL PENDIDIKAN BIOLOGI INDONESIA)
Indonesian Journal of Biology Education

Vol. 4 No. 1, 2018; pp. 67-74
ISSN: 2442-3750 (print); ISSN: 2527-6204 (online)
http://ejournal.umm.ac.id/index.php/jpbi

Received: 22/01/2018
Revised: 22/03/2018
Accepted: 26/03/2018

DEVELOPING POSTER BASED ON DIVERSITY OF *NEPENTHES* IN PADAT KARYA FOREST, KRAYAN NORTH KALIMANTAN

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ABSTRACT

Nepenthes is a unique carnivores plant that can be found in Padat Karya forest, Krayan at the North Kalimantan. The existence of these plants can be used as a media of learning so that learning activities become more contextual. The aims of this study are 1) to know the diversity of Nepenthes in Padat Karya forest, 2) to determine the feasibility of learning media in the form of poster developed from the results of the Nepenthes diversity research. This research consisted of two stages. The first was research stage which involved inventory, identification, and diversity index determination of Nepenthes. The second stage was development research i.e developing the results gained from the first stage into poster form. The research and development model employed in this study was the modified-Borg and Gall (2006) model. There were five steps conducted, namely (1) need analysis, (2) planning, (3) develop the preliminary form of product, (4) preliminary field testing, and (5) main product revision. The results showed that the diversity index value of Nepenthes was categorized as 'medium'. In addition, based on the validation and response obtained, the poster developed was feasible to be utilized as a learning media in senior high school.

Keywords: *Diversity, learning media, Nepenthes, poster*

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INTRODUCTION

Nepenthes is a carnivorous plant that preys insects to meet the needs of nitrogen in the body. Mansur (2007) stated that *Nepenthes* is included in liana plant. Mardhiana, Parto, Hayati, and Priadi (2012) stated that the *Nepenthe*s plant is very well adapted to grow in nutrient-poor soils in term of low nitrogen, phosphorus, and potassium, besides possessing high soil acidity, yet these are limiting factors for plant growth. The uniqueness of *Nepenthes* lies in the way of getting food. Not only do the roots absorb nutrients from the soil, but this plant also absorbs nutrients from insects trapped in its 'pocket'. The insects are destroyed by a kind of gastric acid-like compound to suck its juice. That is why the plant is able to survive in barren areas.

Some benefits were identified for growing *Nepenthes*. Generally, *Nepenthes* can grow well in poor nutrient and somewhat exposed to sunlight (Hernawati & Akhriadi, 2006). *Nepenthes* can be used as a traditional medicinal plant (a liquid from a closed pouch used as an eye remedy and cough medicine), and even it can be used as a clue as a climate indicator (Susanti, Natalia, & Aisyah, 2016). *Nepenthes* has a potential ability as an insect controller, conventional multipurpose plant, unique ornamental plant as its leaf tips can appear pouches, medicinal plants, and protein-producing plants (Eilenberg et al., 2010; Mardhiana et al., 2012).

Nepenthes belongs to liana plants (propagating) which has two homes, means, male and female flowers are separated in different individuals (Mansur, 2006). It is commonly attached (epiphytes) on stems or branches or grows terrestrially. A single leaf is the common form of a lanceolate or a spatula, with tendrils on the tip of the leaf in which the petiole is not always present (Clarke, 2007). The grown plants grow up and the trunk forms an elongated segment and ultimately produces flowers and fruits (Clarke, Shen, Wong, Barkman, & Carow, 1997). In some types of *Nepenthes*, seedling or young plants form a rosette that usually produces leaves and 'pockets' on a short stalk. Although the shape of the bag varies on each type, it generally has

Citation: Amin, A. M., & Adiansyah, R. (2018). Developing poster based on diversity of Nepenthes in Padat Karya forest, Krayan North Kalimantan. *JPBI (Jurnal Pendidikan Biologi Indonesia), 4*(1), 67-74. https://doi.org/10.22219/jpbi.v4i1.5231

the same characteristics, consisting of lids, peristome (lips) and pockets (Clarke, 2007).

Nepenthes is a typical tropical plant that is also widely known by the name of *Nephentes*. The status of *Nepenthes* is protected by law and government regulations. However, the current population of *Nepenthes* is threatened with extinction so it is important to conduct a study to maintain its sustainability.

Forests on the island of Kalimantan have poor nutrient conditions and have a high degree of acidity. Therefore *Nepenthes* can be found in Kalimantan forest. Ilma (2014) stated that there were four species of *Nepenthes* have been found in Borneo Tarakan University, these species were: *Nepenthes ampularia, Nepenthes rafflesiana, Nepenthes mirabilis and Nepenthes hirsuta*. Based on the observations in the Padat Karya forest, has found a lot of *Nepenthes*. But the existence of this plant has not been integrated into biology learning activities. Based on the results of interviews with the student, they do not know about the existence and benefits of *Nepenthes*.

After knowing the diversity of *Nepenthes* in Padat Karya Forests, an environmental evaluation can be conducted which leads to the conservation effort of *Nepenthes* plant in Padat Karya Forest area. In order to instill a caring and responsible of *Nepenthes*, the results of this study will be arranged in a poster which can be utilized as a media for biodiversity in high school.

This study aims to find out the diversity of *Nepenthes* in the Padat Karya Forest. After knowing the description of the vegetation of *Nepenthes* in the Padat Karya Forest, it can be done an evaluation of the environment, which leads to the conservation efforts of the plant *Nepenthes* in the Padat Karya Forest. In order to instill a caring and responsible attitude towards students in the presence of *Nepenthes*, the results of this study will be constructed as learning materials in the form of the poster for biodiversity learning in high school. The purpose of preparing *Nepenthes* diversity poster media is to help students to understand the concept of biodiversity and to invite students to caring the local plants around.

Jannah and Serevina (2016), stated that using poster in physical learning can ease student to understand and memorize the learning materials. Due to the poster contents are writings and drawings, it can increase the student interest in learning.

METHOD

Research Stage

This research consisted of two stages. The first stage was research, consist of inventory, identification, and diversity index determination of *Nepenthes*. The second stage was developing the research results into Poster.

Inventory and Identification

Data collection on the existence of *Nepenthes* was done by using purposive sampling with the exploration method of combination plot (Muller-Dombosis & Ellenberg, 1974). Sampling area was divided into five tracks, based on the presence or absence of *Nepenthes* in Padat Karya Forest, at the North Kalimantan.

Diversity index of *Nepenthes*

The calculation of *Nepenthes* diversity index was used Shanon-Wienner index (Ludwig & Reynolds, 1988) as follows.

$$H' = - \sum \{Pi(\ln Pi)\} \quad (1)$$

Description:
H' = Shannon – Wienner diversity index
Pi = (ni / N)
ln = natural logarithm
n = the number of individuals of each type
N = total number of individuals of all types

The diversity index of species in an area depends on the type of ecosystem of the sample area. Generally, lowland forests have fewer species than wet tropical forests. The criteria of the Shannon-Wiener diversity index are: (a) H'>3: High diversity, the spread of the number of individuals per species high and high community stability, (b) 1<H'<3: Medium diversity, the spread of the number of individuals per medium species and moderate community stability, and (c) H'<1: Low diversity, the spread of individual species per species is low and community stability is low.

Developing Stage

The development model in this research and development used modified Borg and Gall (2006) model. This study used only five steps of Borg and Gall model, namely, (1) need analysis, (2) planning, (3) develop a preliminary form of product, (4) preliminary field testing,

and (5) main product revision. The reason for this modification was the time and cost issues.

Need Analysis Stage

Need analysis is an early stage in the developing procedure. Need analysis is focused on the existence of course and the availability of the material learning about biodiversity in high school.

Planning Stage

The planning stage was done by making a poster design based on the identification and study of the diversity of *Nepenthes* in the Padat Karya Forest, at the North Kalimantan. Poster planning is designed by adjusting the learning objectives to be achieved. The format of the developed poster consists of several parts about *Nepenthes*, namely: classification, species, stead, and conservation.

Product Developing Stage

The product developing stage consists of two stages, comprising the preparation of the poster format and the validation sheet submission. The compilation of validation sheets is used to determine the feasibility of the posters that have been developed. After developing the product, the validation was done. Validation was done by media experts, material experts, and practitioners. Once the poster developed was valid, then the poster would be field-tested.

Initial Field Trial Test

Initial field trials were conducted by distributing poster products to students. At this stage, students were not only asked to provide an assessment only, but also provide advice on product development.

Major Product Revisions

Revisions would be made if the improvement is needed for the product being developed. The developing flow done in this research is presented in the diagram in Figure 1.

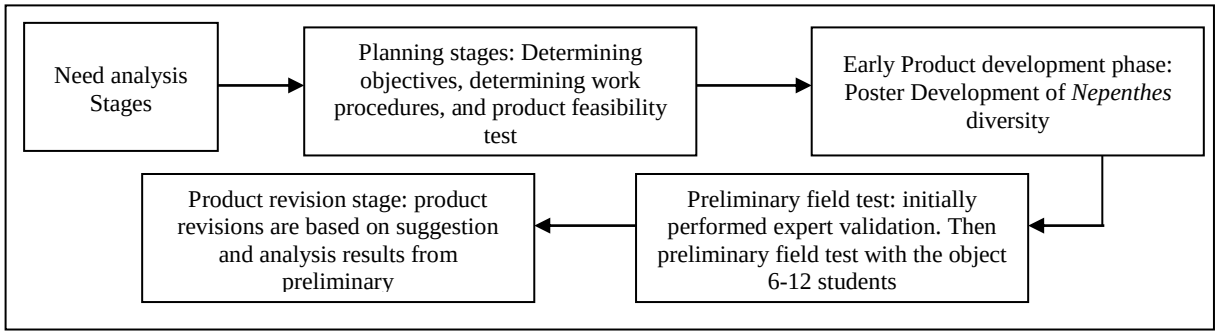

Figure 1. The model of poster development (Source: modified from Gall et al., 2006)

Product Trial

Product trials is a part of the preliminary field test developing phase. The data obtained from the preliminary field test was validation results from material experts and practitioners as well as student responses to the poster which being developed. The subjects of this study were ten students in high school.

Data Collection Instruments

The data collection used in this study was the instrument in form of validation sheet of the poster and student response questionnaire.

Data analysis technique

The data analysis techniques used to process data from the results of the expert review, namely descriptive qualitative and descriptive analysis. Qualitative descriptive data analysis is used to process data from the validation results of material experts, in the form of comments and suggestions of improvements contained in the validation instrument. Data analysis is used as a reference to improve or revise the product.

Quantitative descriptive data analysis is used to analyze the data obtained in the form of percentage analysis. The data that has been collected in the validation questionnaire is basically a qualitative data because each statement item is divided into categories not very good, not good, good and very good. The data is first converted into quantitative data according to the weight of the score. The conversion is done by using formula (2) (Arikunto, 2001).

$$P = \frac{\sum x}{\sum xi} x\ 100\% \quad (2)$$

Description:

P = percentage of ratings

$\sum x$ = The number of respondents in 1 item

$\sum xi$ = ideal score in the item

100% = constants

The data was analyzed descriptively by determining the eligibility and feasibility criteria (Table 1).

Table 1. Eligibility and feasibility criteria

Achievement Level (%)	Qualification	Information
81-100	Very good	Valid
61-80	Good	Valid
41-60	Enough	Revision/invalid
21-40	Less	Revision/invalid
0-20	Very less	Revision/invalid

(Source: Suwastono, 2011)

RESULTS AND DISCUSSION

Diversity Index of *Nepenthes*

This research was conducted by using roaming method. This cruising method has been done by exploring the research location that is labor-intensive forests to know the type of *Nepenthes* contained in the area. The roaming method was carried out in 5 tracks. Identification of *Nepenthes* species has been done with observing its morphological characteristics. After that, the morphological features had matched with relevant images or books and adapted to identification and classification in taxonomic order. Types of *Nepenthes* contained in Padat Karya Forests at the North Kalimantan include *N. ampularia, N. garcilis, N. mirabilis, and N. reinwardtiana* (Figure 2).

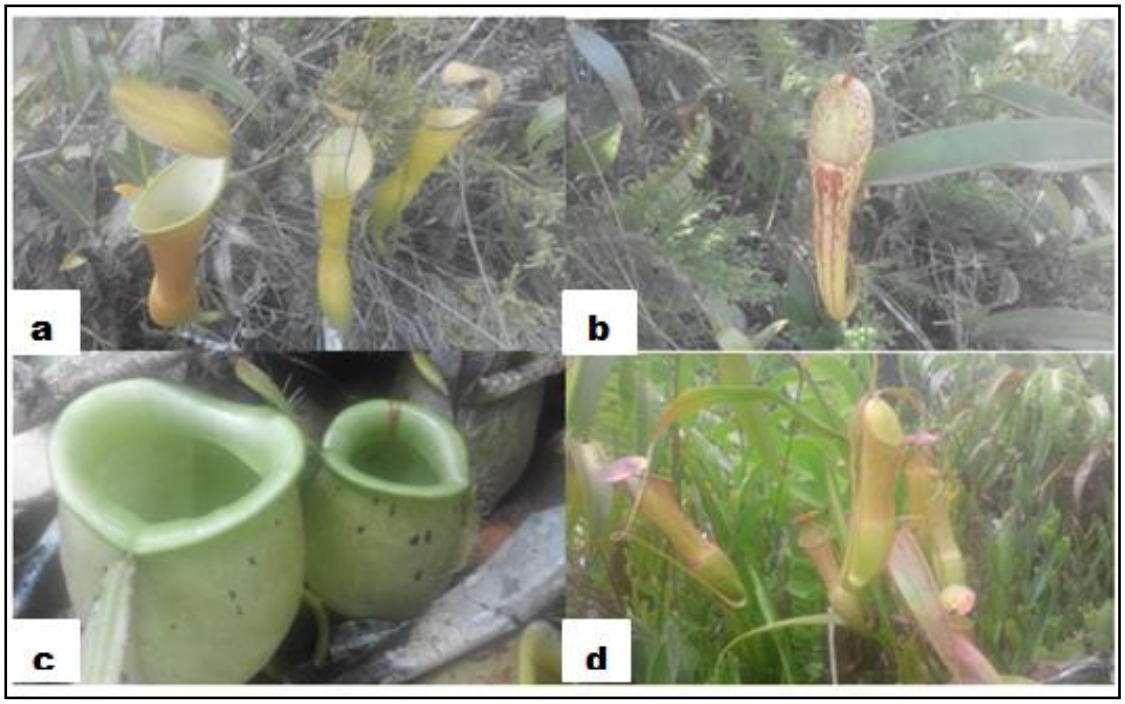

Figure 2. *Nepenthes* contained in the Padat Karya Forest Krayan, at the North Kalimantan (a) *N. reinwardtiana*, (b) *N. grasilis*, (c) *N. ampularia*, (d) *N. mirabilis* (Source: primary data, 2016).

Based on Figure 2, it is known that each species of *Nepenthes* is unique based on its pockets. *Nepenthes* diversity has different index values on each path in sampling. The diversity index of *Nepenthes* can be seen in Figure 3.

Based on Figure 3, it can be seen that the highest diversity index was track I (0.49) in which the second highest value was possessed by track II (0.30). In contrast, the lowest diversity index was on track IV (0.16). Track III and V were 0.27 and 0.29 respectively.

Of the five tracks, the track I has the largest diversity index. This is because there are four species that can be found in line 5, while in other tracks only 3 species found. Track I is a shade-shaded path and the average pH soil value was 5. This is consistent with the results of some studies (Ellison & Gotelli, 2001;

Mansur, 2006) which revealed that *Nepenthes* is found in infertile areas with low nutrient content such as N, P, and K, acid soils with soil pH ranging from 2 to 5 and high humidity. Maysarah, Zuhud, and Hikmat (2016) also stated that temperature and humidity play an important role in the growth of *Nepenthes.*

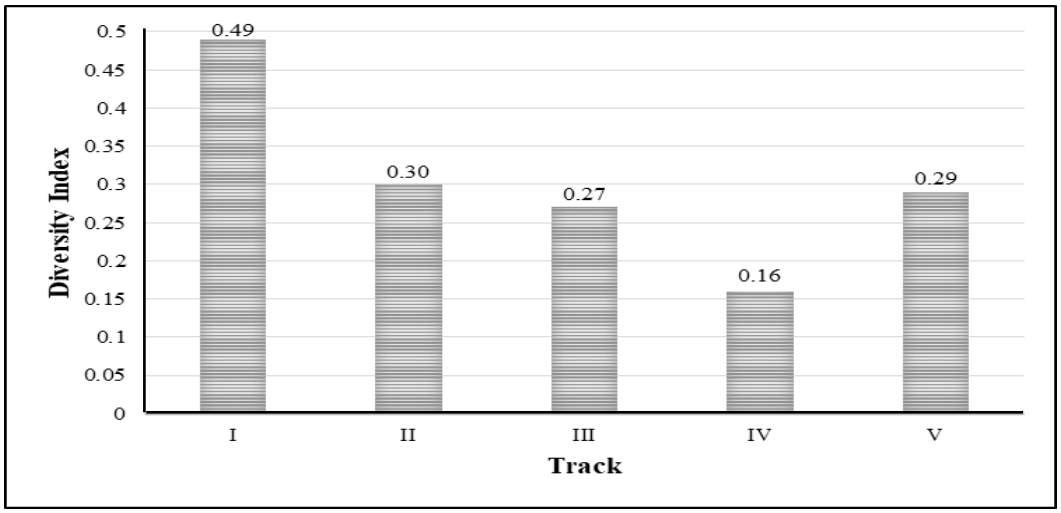

Figure 3. Diversity index of *Nepenthes* in Padat Karya Forests Krayan, at the North Kalimantan (Source: primary data, 2016).

The diversity of species is characteristic of the community level based on its biological organization. High species diversity shows that a community has a high complexity because the interaction of a community is very high. The highest *Nepenthes* species diversity index of 0.4942 lies on track I. Based on the Shannon-Winner if the diversity index value meets the criterion as 1<H'<3, it is categorized as medium diversity, the spread of the individual number of each species being moderate and the stability of the moderate community. This is due to the four types of *Nepenthes* can be found on track I. The results of this study are higher than the index of diversity of *Nepenthes* research results Baloari, Linda, and Mukarlina (2013) showed that the diversity of *Nepenthes* species in Mount Semahung Pontianak is H1 <1. This value indicates that species diversity is low in all study sites.

According to Barbour (1987), the index of species diversity is an important information about a community. The larger the sample area and the more species encountered, the value of the species diversity index will tend to be higher. The relatively low value of the diversity index is common in communities that have reached a climax. To maintain a high diversity, the community requires regular and random distractions. Very stable, regional, and homogeneous communities have a lower diversity index than mosaic forms or are periodically interrupted by fire, wind, flood, pest and human intervention. Usually, after the disturbance passes, there will be an increase in species diversity to a point where the community reaches a climax. Furthermore, after the climax, there is a tendency of diversity index to decrease again.

Based on the results of identification and diversity determination of *Nepenthes*, the results were developed into a poster media for biodiversity materials in class X of high school. The poster developed was firstly validated by a material expert, a media expert, and a practitioner before being tested to the students. The results of the validation of material experts as shown in Table 2.

Table 2. The result of expert material validation

No.	Aspect	Percentages of ratings (%)
1	Material	80
2	Language	85
3	Presentation	80
4	Full view	80
Mean		81.25
Catagories		Very Good

(Source: primary data, 2017)

Based on the validation results of material experts, the media poster developed was categorized as very good. But there were some things that need to be added such as the effort of conserving *Nepenthes* ex-situ and in-situ. In accordance with the suggestion, the concept of

Nepenthes conservation then was added. Ilma (Ilma, 2016) stated that *Nepenthes* can be preserved by in-situ and ex-situ, preserving with tissue culture, integrating local wisdom in local school lessons, and socializing to the community to preserve the natural habitat of *Nepenthes*. The results of media expert validation were as showed in Table 3.

Table 3. The result of learning media expert validation

No.	Aspect	Percentages of ratings (%)
1	Language	80
2	Presentation	80
3	Full view	80
Mean		80
Catagories		Very Good

(Source: primary data, 2017)

Based on the results of the validation of learning media experts, the poster developed was categorized as very good. The suggestions given by the media expert was about the color contrast, font variations, and the alphabetical size.

Table 4. The results of practitioner validation

No.	Aspect	Percentages of ratings (%)
1	Material	82
2	Posters' effect on learning	85
3	Language	80
4	Presentation	85
5	Full view	80
Mean		82.4
Catagories		Very Good

(Source: primary data, 2017)

Table 4 shows the results of practitioners' validation. Based on the results of media practitioner validation, the rating gained for the *Nepenthes* diversity posters was 82.4% which means that it was very good. Then the poster then was tested of the introductory field by 6 students. The results of the student responses to the *Nepenthes* diversity poster in the Padat Karya Forest, at the North Kalimantan can be seen in Table 5.

Table 5. The results of preliminary field test

No.	Aspect	Percentages of ratings (%)
1	Simplicity	87
2	Attractiveness	90
3	Understanding	85
Mean		87.3
Catagories		Very Good

(Source: primary data, 2017)

The percentage rating gained from student response to the *Nepenthes* diversity poster was 87.3% which was considered as the very good category. The student responses were very good to the poster produced because the poster displays a real picture with an interesting mix color. Moreover, the poster also contains local plants that exist around the students so that the learning activities become more contextual. Some of the respondents stated that with the poster that contains these local plants can help them in understanding the concept of biodiversity. Thus, it can be concluded that the *Nepenthes* diversity poster can be used in learning at senior high school.

This is in accordance with Ilma et al. (2017) which concluded that local potential-based textbooks have reached 94.27% of assessment on aspects of comprehension, which means that textbooks are considered as a media that able to assist students in understanding the concept due to its contextuality. In line with the results above was Jannah et al. (2016) conclusion about the good student response to the fluid physics poster which achieved 85.54% rating. Students felt greatly helped by the poster in learning statical-fluid physics. The final product of the poster media developed as shown in Figure 4.

Figure 4. The poster of "The diversity of *Nepenthes* in Padat Karya Forest Krayan, at the North Kalimantan".

A poster is one of the media that consists of symbols of words or symbols are very simple and generally contain a suggestion or ban. Poster served to convey messages, information, ideas, and so on. Media posters of 'The diversity of *Nepenthes* in the Padat Karya forest Krayan, at the North Kalimantan' was created to convey information on biodiversity and information on the conservation of the surrounding *Nepenthes* plants. This is in accordance with the statement of Hermina and Prihartini (2016) which reported that poster of nutrient education has increased student's knowledge about nutrition as high as 78.25%.

CONCLUSION

Based on the results of the research that has been done, it can be concluded that; 1) the highest diversity index of *Nepenthes* species was lied on track I as high as 0.4942. Based on the Shannon-Winner 1 <H '<3 criterion it means medium diversity; and 2) based on the validation and response to the poster, it can be determined that the poster is feasible to be used in learning for senior high school.

ACKNOWLEDGMENT

Thanks to all those who have assisted with the implementation of this research and development. Particularly to fellow lecturers who have become validators in this poster medium of *Nepenthes* diversity.

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