Mushroom Diversity in the River Flow in the TAHURA Area of Palu City and its Untilizaio as a Learning Media

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Abstract

This study aims to analyze the diversity of mushroom species in the TAHURA watershed in Palu City and to make media posters that can be used as learning media. This type of research is descriptive research with the belt transect method. Sampling is divided into 3 stations in the TAHURA area of Palu City, along the river flow 10 Belt Transects will be made and the distance between transects is 20 m. The results of the study found 16 species belonging to 2 divisions, where in the Basidiomycota division there were 15 types of fungi and in the Ascomycota division there was 1 type of fungus. medium category or value H' = 2.57. The results of the research were used as learning media in the form of posters about the diversity of mushroom species in the TAHURA watershed area of Palu City, after going through validation by the lecturer, media validation, and due diligence by 24 students who were divided into 2 groups, with an average score of the large group of 86.8 % and small group 88.3%, the results obtained are classified as suitable for use as learning media.

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Introduction

Mushrooms are one of the kingdoms in the classification system for living things. Like the plant kingdom, mushrooms also have a high level of diversity. Mushrooms are one of the various organisms that play an important role in maintaining balance and preservation of nature. Fungi act as decomposers to help the decomposition of organic matter in forest ecosystems (Akinyele & Adetuyi, 2005).

Macrofungal groups significantly affect food webs in the forest, such as the survival or germination of saplings and tree growth. The beginning of the rainy season is the time for the growth of some macrophages. Where some fungi can form fruit bodies, but there are also several other types that can form fruit bodies. The appearance of fruit bodies will make it easier to observe, but the appearance of macrofungal fruit bodies also depends on the rainy season (Wahyudi et al., 2012).

Mushrooms have various characteristics, one of which is the diversity of species. Diversity can be used to express community structure and can be used to measure community stability, namely the ability of a community to keep itself stable even though there are disturbances to its components (Mshandete & Cuff, 2007).

According to Jamlis L. (2016), he states that the Central Sulawesi Forest Park (TAHURA) is one of the conservation areas confirmed by Ministerial Decree No.24 / Kpts-II / 1999 covering an area of 7,128 ha, currently in government administration, the Sulawesi Tahura area. Tengah is located in the districts of Sigi and Palu City. With the regional buffer villages in Sigi Regency include Pombewe Village, Loru Village, and Ngatabaru Village. Meanwhile, the regional. Supporting villages in Palu City include Layana Indah Village, Lasoani Village, Poboya Village, Tondo Village, and Layana Indah Village. According to Government Regulation No. 104 of 2015 concerning procedures for changing the designation and function of forest areas.

A watershed is a land area that is an integrated ecosystem with rivers and their tributaries which function to accommodate, store, and flow water naturally derived from rainfall to the sea, boundaries on land are topographical dividers (Muchtar & Abdullah, 2007).

Increased community activity in the TAHURA area can have a direct impact on the existence of flora and fauna if it is not managed

properly and there is no public education. This is as stated by Butarbutar & Soemarno (2013), that exploiting nature without paying attention to its sustainability causes biodiversity as the support of human life will experience many changes.

The diversity of flora species in nature, especially in the types of fungi plants can be used as a learning medium. According to Gilliland (1968), learning is a relatively permanent change in behavior or potential behavior from the process between stimulus and response. The learning process can be done indoors or outdoors (in nature), the learning process in nature prioritizes proof of theory that is given indoors so learning in nature requires a place or location of learning that can support the learning process.

Based on the potential diversity of plant species, fungi that have an ecological role as a decomposer and as learning medium are strongly influenced by the level of disturbance to their habitat. In connection with this, it is necessary to conduct research on the diversity of types of fungi in the watershed in the TAHURA area and their role as a learning medium.

According to Semin (2005), learning media can be understood as the media used in the process of achieving a learning goal. In essence, the learning process is also communication, so learning media can be understood as a communication medium used in the communication process. The existence of the types of mushrooms in the TAHURA area can be developed into learning media such as posters.

Materials and Method

Research is a careful and critical inquiry in search of facts and principles; something very ingenious to find something. The type of research carried out is descriptive, namely research that aims to describe or describe the existing phenomena. The sampling method used is the line (Belt Transect).

The sampling location is done by dividing the stations based on three watersheds (watersheds) in Lasoani Village, Poboya Village and Vatutela Village. There will be 10 Belt Transects along the river flow and the distance between the transects is 20 m. Line length (Belt Transect) 100 m with a plot width of 2×2 m and a distance between plots of 2 m. At each location, observations will be made regarding the type of fungus, the substrate, the number of fungi, and the physical and chemical conditions of the environment.

Calculating the level of diversity of mushroom species in the TAHURA area of hammer city, using the Shannon-Wienner species diversity index formula (Odum, 1996):

$H' = -\sum Pi \ln (Pi)$ where $Pi = \sum ni / N$

Information :
H '= Shannon-Wienner diversity index
ni = number of individuals of one kind
N = total number of individuals

According to Ariyanto et al. (2005), said that the diversity index or diversity is categorized as follows:

Value H '> 3 indicates that diversity is high.
The value of H '$1 \leq H' \geq 3$ indicates that diversity is moderate.
Value H '<1 Indicates that the diversity is little or low.

Results and Discussion

Species diversity can be taken to indicate the number of species in a certain area or the better the species diversity index, the more stable an ecosystem will be.

Analysis of the level of diversity of mushroom species in the watershed in the City TAHURA area The research results obtained at In the watershed area of TAHURA, Palu City, there are 16 types of fungi belonging to the Basidiomycota division, there are 15 types of mushrooms and in the Ascomycota division, there is 1 type of fungus. The types of mushrooms found consisted of 16 types of fungi, then can be seen in Table 1.

Table 1. Habitat and number of individuals of each type of fungus in the watershed in the TAHURA area of Palu City.

Division	Species	Habitat	Station 1	Station 2	Station 3	Σ
	Auricularia auricular (Peck.) Sacc.	Kayu lapuk	0	0	6	6
	Dacryopinax spathularia (G.W.) Martin	Kayu lapuk	6	12	17	35
	Entoloma cetratum (Fr.) M.M. Moser	Humus	0	5	4	9
	Entoloma clandestinum (Bres.) E. Horak	Humus	2	0	0	2
	Ganoderma lucidum (Curtis) P. Karst	Kayu lapuk	3	7	5	15
	Ganoderma tornatum (Curtis) P. Karst	Kayu lapuk	0	6	4	10
	Gymnopus dryophilus (Bull.) Murrill	Humus	12	0	8	20
	Gymnopus erythropus (Fr.) Halling	Serasa	0	24	0	24
Basidiomycota	*Micropus affinis* (Blume & T. Nees) Kuntze	Kayu lapuk	0	8	15	23
	Micropus xanthopus (Fr.) Kuntze	Kayu lapuk	0	5	0	5
	Pycnoporus sanguineus (L.) Murrill	Kayu lapuk	0	8	6	14

Division	Species	Habitat	Station 1	Station 2	Station 3	Σ
	Strobilurus esculentus (Wulfen) Singer	Serasa	0	16	12	28
	Schizophyllum commune (Fr.) Fries	Kayu lapuk	0	9	21	30
	Trametes ochracea (Pers.) Gilb. & Ryvarden	Kayu lapuk	5	11	9	25
	Trametes pubescens (Schumach.) Pilat	Kayu lapuk	0	4	2	6
Ascomycota	*Daldinia concentric* (Bolton) Cesati	Kayu lapuk	0	6	0	6
	amount					258

Diversity is a community characteristic that shows the many types that exist in a community. Species diversity shows all the variations found in living things between types. The differences between the species of organisms within a family are more striking so that they are easier to observe than the differences between individuals within a species. Diversity shows the types of all variations found in living things or interspecies within one genus. The different types of species are shown in Table 2.

As for the results obtained, it can be seen that the level of diversity of mushroom species in the river basin in the TAHURA area of Palu City is classified as moderate because H'= 2.57, this is because the level of individual distribution of each type of fungus is not evenly distributed in the TAHURA area of Palu City. According to Ganjar (2006), the higher the level of diversity of a plant species, the higher the level of sustainability and the forest ecosystem. This statement can describe the level of damage to the forest ecosystem in the TAHURA area of Palu City. The complete analysis of the level of diversity of mushroom species can be seen in Table 2.

Table 2. Diversity index of mushroom species in the watershed in the TAHURA area of Palu City.

No.	Species name	Σ	Pi	LnPi	H'
1	*Auricularia auricular*	6	0.02	-3.76	0.09
2	*Dacryopinax spathularia*	35	0.14	-2	0.27
3	*Entoloma cetratum*	9	0.03	-3.36	0.12
4	*Entoloma clandestinum*	2	0.01	-4.86	0.04
5	*Ganoderma lucidum*	15	0.06	-2.84	0.17
6	*Ganoderma tornatum*	10	0.04	-3.25	0.13
7	*Gymnopus dryophilus*	20	0.08	-2.56	0.2
8	*Gymnopus erythropus*	24	0.09	-2.37	0.22
9	*Micropus affinis*	23	0.09	-2.42	0.22
10	*Micropus xanthopus*	5	0.02	-3.94	0.08
11	*Pycnoporus sanguineus*	14	0.05	-2.91	0.16
12	*Strobilurus esculentus*	28	0.11	-2.22	0.24
13	*Schizophyllum commune*	30	0.12	-2.15	0.25
14	*Trametes ochracea*	25	0.1	-2.33	0.23
15	*Trametes pubescens*	6	0.02	-3.76	0.09
16	*Daldinia concentrica*	6	0.02	-3.76	0.09
	amount	258			2.57

Environmental physical and chemical factors are very influential for the life of fungi species in the watershed area of the TAHURA area of Palu City, so in this study apart from taking mushroom samples at each station in the research location, environmental factors were also measured in the form of temperature, soil pH, humidity and light intensity. The results of the measurement of these environmental factors can be seen in Table 3

Table 3. The physical and chemical conditions of the environment in the watershed in the TAHURA area of Palu City.

No.	Parameter	Unit	Observation Station 1	Observation Station 2	Observation Station 4	Average
1	Temperature	°C	33	27	29	30
2	pH	%	6,4	6,6	6,6	6,5
3	Humidity	%	65	80	73	73
4	Intensity	Cd	1200	800	900	73

The physical and chemical conditions of the environment at each station are different, the parameters of the environmental conditions measured include conditions of temperature, pH, humidity, and light intensity. The lowest temperature conditions are at station 2, this is influenced by several factors including dense trees, height, and river water discharge.

This is due to the environmental hue at station 1 which is only decorated by shrubs, acacia trees, cacao trees, hazelnut trees, and the lack of trees that are in the river area. This makes the tree canopy less dense so that the humidity in station 1 is low.

Classification or classification has long been studied by experts. Previously, classification was only based on morphological characteristics, but in modern times, except for morphological characteristics, phylogenetic relationships, and physiological and biochemical characteristics are also considered.

Classifications that are commonly used in classifying mushrooms include kingdom, division, class, nation (order), family, clan (genus), and Species. According to Chang & Lee (2004), each function is included in the taxonomy, differentiated by the type of spores, the morphology of hyphae, and the sexual cycle. Taxonomic classification begins based on spore reproduction, then based on morphological traits of vegetative traits. The types of fungi found in this study are:

Auricularia auricula

Dacryopinax spathularia

Entoloma cetratum

Entoloma clandestinum

Ganoderma lucidum

Ganoderma tornatum

Gymnopus dryophilus

Microporus affinis

Microporus xanthopus

Pycnoporus sanguineus

Strobilurus esculentus

Schizophyllum commune

Trametes ochracea

Trametes pubescens

The result of the calculation of the percentage assessment of the feasibility of learning media in the form of a poster by the media validation lecturer has an eligibility value of 71%.

Learning media in the form of posters is said to be quite feasible to be tested. Details can be seen in Table 4.

Table 4. Percentage of poster feasibility by media validation lecturers

No	Assessment Aspect (Design Expert)	Assessment	Percentage
A	Title		
1.	Title accuracy	4	80
2.	Font size accuracy	4	80
3.	The beauty of the appearance	3	60
B	Material description		
1.	Font size accuracy	4	80
2.	Clarity of sentences	4	80
3.	Writing organization	3	60
4.	The attractiveness of the material description display	3	60
C	Picture		
1.	Suitability of the image with the description of the material	4	80
2.	Image clarity to understand	4	80
3.	The beauty of the image display	3	60
D	Image caption text		
1.	Location Accuracy	3	60

No	Assessment Aspect (Design Expert)	Assessment	Percentage
2.	Correct writing color	4	80
3.	Font size accuracy	3	60
4.	The attractiveness of the display	4	80
	amount	50	1000
	Average	3.5	71

After the validation was carried out by the validation lecturer, the poster learning media was then tested on 2 groups of students consisting of a large group of 15 students and a small group of 9 students who the lower adaptation rate of the fungus.

This is consistent with the statement from. This percentage is considered feasible to be tested. Details can be seen in Table 5. Presentation of poster due diligence by students.

Table 5. Presentation of poster due diligence by students

No.	Assessment aspects	Small group presentation	Presentation large group
1.	Do you think the contents of this poster are interesting?	86,6	86,6
2.	Do you think the contents of this poster are easy to understand?	79,3	89,3
3.	How clear is the picture in this poster?	80,6	90,6
4.	How clear is the text (text) in this poster?	89,3	89,3
5.	Do you think the image on this poster is attractive?	83,2	93,2
6.	Do you think this poster is overall interesting?	90,6	90,6
7.	Can this poster help make it easier to find out the types of mushrooms?	72	76
8.	Is the Latin writing used in this poster correct?	80,6	90,6
	Total score	34,7	795
	Rata-rata	4,33	88,3
	The average value indicates that the poster media is feasible to be tested		

Species diversity can be taken to The results of the research obtained in the watershed in the TAHURA area of Palu City, which found 16 types of fungi belonging to the Basidiomycota division, there are 15 types of mushrooms and in the Ascomycota division, there is 1 type of mushroom. Based on the results obtained, the Basidiomycota division is the mushroom division with the most species found in river basins in the TAHURA area of Palu City than the Ascomycota division type.

The difference in the types of fungal divisions is because the degree of adaptation of each type of fungus is different, the higher the level of adaptation of a type of fungus, the more likely it is that the fungus can live, in this case, the degree of adaptation of this type of fungus can be seen from its diverse living space or habitat. the more habitats that can be used as a place for the fungus to live, the higher the level of adaptation, and vice versa, the less habitat that can be used as a habitat for mushrooms.

Who stated has an eligibility percentage value of 86.8% for the large group and 88.3% for the small group.

As organisms that do not have chlorophyll, fungi cannot carry out the photosynthetic process like plants do. Thus, mushrooms cannot directly use solar energy. Mushrooms get food in finished form such as cellulose, glucose, lignin, protein, and starch compounds. These food ingredients can be broken down into absorbable compounds that are used to grow and develop. Mushrooms are a group of fungi that form fleshy fruit bodies. This body is generally in the form of an umbrella that has a pseudo root (Rhizoid), and a hood stalk, sometimes accompanied by a ring and a vulvar plate (Dai & Yu-Cheng, 2009).

According to Anggriawan (2014) habitat is something that cannot be separated from the life of fungi because the habitat is something that is supportive of a food source for mushrooms. Some types of mushrooms have specificities in choosing where to grow, for example, they like open areas with enough light, while other types prefer a place that is sheltered and has lots of trees. This study shows that the Basidiomycota mushroom species can live in areas that are open to light and covered in light, while in their habitat, the Basidiomycota fungi are more commonly found in different habitats. This is different from the type of Ascomycota fungus which is only found in light-covered areas or trees and their habitat is only found in weathered wood.

This study is in line with research conducted by Parlindungan (2003) who stated that as heterotrophic organisms, fungi are more likely to choose a place to live that has a good source of nutrition in terms of fat, protein, carbohydrates, and other compounds. Ascomycota fungi tend to prefer their habitat compared to the Basidiomycota types which are found mostly living in several habitats. The Ascomycota species tend to be found frequently in weathered wood habitats in shaded places, while the Basidiomycota fungi are found in several habitats such as rotten wood, leafy taste, and humus soil. These nutrients are found in fungi in weathered wood, taste, animal dung, and also dead fungi.

The results of the calculation of the diversity index of mushroom species obtained the index value of H'= 2.57, from the number of H' obtained it can be said that the index of mushroom species diversity in the river basin in the TAHURA area of Palu City can be classified in the medium category, this is because the level of individual distribution of each type of fungus is not evenly distributed in the TAHURA area of Palu City.

According to Ganjar (2006), the higher the level of diversity of a plant species, the higher level of sustainability and the forest ecosystem. This statement can describe the level of damage to the forest ecosystem in the TAHURA area of Palu City, where the researchers saw several factors affecting the damage to the TAHURA area of Palu City such as deforestation, conversion of forest areas to plantations and illegal mining in the TAHURA area of Palu City. This statement is also in line with research conducted by Jamlis L. (2016) arguing that in the TAHURA area of Central Sulawesi Province,

there has been forest damage caused by the activities of the surrounding community, where the forest area in TAHURA is used as plantation land for the community and logging illegal logging is used either as building materials or as firewood.

Community activities that have resulted in forest destruction in the TAHURA area of Palu City have also decreased the diversity of mushroom species so that the index of mushroom species diversity in the TAHURA area of Palu City is classified as moderate. The diversity of these types of fungi can also be seen from the differences in species found in the Basidiomycota and Ascomycota divisions, this is due to environmental factors that cause the spread or growth of fungi to decrease.

According to Mayasari et al. (2015), where air temperature and high humidity can help the spread or growth of fungi better. These temperature and humidity factors can be influenced by community activities in terms of deforestation which causes the opening or closure of the tree canopy which can affect differences in light intensity at each location. Fungi that exist in the watershed in the TAHURA area of Palu City are mostly found in weathered wood substrates, while the fungi that grow in other habitats are less.

The level of forest damage has made environmental conditions change, as for the physical and chemical conditions of the environment obtained, namely an average temperature of 30 ºC, an average pH of 6.5%, and an average humidity of 73%. This is due to the reduced number of trees covering the forest floor due to tree felling so that the intensity of the incoming light is increasing, making the soil and leaf litter that are not shaded dry and not damp anymore, making it difficult for fungi to grow. This research states that environmental factors are one of the supporting factors for the growth of types of fungi.

According to Darwis et al. (2011), argued that temperature can affect the level of water availability around the fungus and affect water availability in cells that play a role in nutrient transportation so that the optimal temperature for the growth of this type of fungus ranges from 20-28 ºC. Soil moisture or litter can help fungal hyphae spread to the surface which feels like, the optimal humidity for the growth of this type of fungus is between 70-85%.

Fungi are plants that are saprophytic and have an important role in an ecosystem where fungi

are good decomposers for the forest floor, they will decompose as if decomposing leaves or rotten wood on the forest floor to be converted into nutrients used for the environment or the surrounding ecosystem. If the fungus that acts as a decomposer is no longer found in a forest ecosystem, it will have an impact on living things that are producers in that ecosystem and will result in an imbalance in the food chain. This statement is in line with what Tampubolon (2014) stated, that in the ecological aspect fungi can affect the balance of the ecosystem, this is because fungi are one of the decomposers that play a role in maintaining the availability of inorganic nutrients which are very important for plant life in forest ecosystems.

Learning is a need of every human being, especially students, fun learning is usually supported by various factors, including interesting information. Interestingly, information is obtained through the development of teaching materials that are based on research based on facts in the environment so that learning objectives can be achieved, for this we need good learning resources in the process of transforming knowledge. Learning resources have an important role in supporting the quality of the teaching and learning process. Learning resources are also able to motivate students in seeking knowledge, provide experience in solving problems and make it easier for students to understand the material presented, one of the classifications of learning resources is printed learning resources in the form of posters that are currently developing (Setiawan & Efendi, 2014).

Media is one component of communication namely as a messenger from the communicator to the communicant. Based on this definition, it can be said that learning media is an intermediary tool in the learning process. In the learning process, learning media is needed because, in essence, the teaching and learning process is a communication process, conveying messages from the introduction to the recipient. Messages in the form of material are poured into communication symbols both verbally (words and writing) and nonverbally (Candra, 2011).

Sometimes students succeed and sometimes they do not succeed or fail in receiving the message delivered. This failure occurs when students are unable to understand what is heard, read, seen, or observed besides it provides an incentive for students so that the learning process occurs, messages that cannot be absorbed properly are due

to disturbances and obstacles (Aminullah et al., 2010).

Posters have the power to be digested by the viewer because they emphasize the power of message, visuals and colors. that posters are a strong medium of color, message, and intent to capture people's attention, but for a long time to instill meaningful ideas in their memory (Erwan & Mukhidin, 2013).

Posters can be images that have attractive colors so that they can capture people's attention by imparting a certain meaning that the poster maker wants to convey, according to the purpose of the poster's meaning. The use of appropriate and consistent poster learning media can be useful for teachers in increasing student motivation and interest in learning biology subjects so that teachers can optimize all the potential that exists in each student (Dina, I. 2011).

Making learning resources in the form of posters was initially carried out with the preparation stage, observation to the research stage of species diversity in the river basin area in the TAHURA area of Palu City. After the data is obtained, the next process is to design learning resources in the form of posters. After that, the media validation lecturer conducted a validation to find out the weaknesses of the poster and then corrected it.

The improved instructional media design was then tried out on 24 students of the Biology Education Study Program who were divided into large groups and small groups. Based on the results of the poster assessment conducted by students they stated that the learning resource in the form of a poster was suitable for use as a learning resource and could support the learning process with a large group percentage of 86.8% and a small group percentage of 88.3%. One of the efforts to improve the quality of learning outcomes can be done through the use of this poster media. A study of the results of the assessment from the validation lecturer and large and small groups can provide an overview of the learning outcomes achieved by students after the teaching and learning process.

Conclusions

Based on the results of research conducted in the watershed in the TAHURA area of Palu City, it can be concluded that: There are 16 types of mushrooms found in the river basin in TAHURA area of Palu City and the index of the diversity of mushroom species in the Sidole mountain climbing route is in the medium category with the value of H'= 2.57. Based on the results of the development of learning media made in the form of posters, the results of the validation and the feasibility test have a value that is included in the appropriate category for use as learning material.

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