Development of Learning Unit Book based on Insect Inventory Results of *Amorphophallus titanum* as an Effort to Foster Students' Concern to the Environment

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ABSTRACT

Natural Science subject learning materials emphasize the observation of natural phenomena and their application in daily life. This research aims to foster students' concern for the environment through a learning unit book on the interaction of living things. The type of research was a "research and development method" with the design of 4-D model development research. The learning unit book was made based on the results of insect inventory on *Amorphophallus titanum*. The learning unit book was presented to the 8th grade students of SMP Negeri Rejang Lebong, Bengkulu. The subject in this study was class VIII B on a limited trial. The subject was selected using the purposive sampling method. The data from the study was obtained by providing a questionnaire on environmental concerns. Analysis used test-n-Gain, and small-scale test results of environmental concern found an average score of 77.24 that are well categorized.

Keywords: *Amorphophallus titanum*, insects, environmental care, learning unit book.

INTRODUCTION

In the 21st century, students will be faced with complex life situations, full of opportunities, challenges. Each learner needs a variety of life competencies to develop effectively, productively, dignifiedly and self-esteem and the environment (Kemendikbud, 2019). Biological scientific products are in the form of a collection of facts and concepts as a result of the biological scientific process (Sudjoko, 2001). In addition, the process of learning biology is a lesson oriented towards the development of science and technology that presents as scientific activities one of the interactions of living creatures with the environment.

The term environment is derived from the word "Environment", which has the meaning "The physical, chemical, and biotic condition surrounding an organism." Based on that term, ling-kungan can generally be interpreted as everything outside of an individual. Everything outside the individual is a complex system, so it can affect each other (Kemendikbud, 2019). These inter-affecting conditions make the environment dynamic and subject to change according to the conditions. In addition, the environmental components can influence each other strongly. Based on the observations and discussions that have been conducted at SMPN 8 Rejang Lebong, in terms of mastery of basic concepts that support the learning of the interaction of living beings with the environment there are still many difficulties in mastery and delivery of basic materials about the interaction of living beings with the environment. During this time, most teachers in teaching material interaction of living beings with the environment still use the method of lectures or just the delivery of concepts. Whereas in learner the interaction of living creatures with the environment not only through concept but also application (Rustaman, 2007). Therefore, teachers need to understand and master skills that can support teaching and learning activities. Among them, packaging teaching materials becomes effective and innovative to motivate students to learn. In general, teaching materials given in schools in the form of package books and worksheets of students who are in fact less able to give students attractiveness to read. One reason is that too much material is spelled out in the package book while for worksheets students prefer training questions. Based on these reasons, teachers should be able to develop teaching materials that are efficient and practical for

students, additional teaching materials here that are modules. The use of teaching materials in the form of modules developed from local potential research results has never been done on the material of the interaction of living creatures with the environment. One of the local potentials is insects in the flower *Amorphophallus titanum* which can be used as research for learning sources in the form of teaching materials.

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One reason is that too much material is spelled out in the package book while for worksheets students prefer training questions. Based on these reasons, teachers should be able to develop teaching materials that are efficient and practical for students, additional teaching materials here that are modules. The use of teaching materials in the form of modules developed from local potential research results has never been done on the material of the interaction of living creatures with the environment. One of the local potentials is insects in the flower *Amorphophallus titanum* which can be used as research for learning sources in the form of teaching materials. One of the rare plant species that can be used to study symbiosis mutualism is the carcass flower (*Amorphophallus titanum Becc*) with insects. Based on observations in the conservation area of the rare puspa park of Kepahiang Regency, carrion flower (*Amorphophallus titanum Becc*) The bloom of *Amorphophallus Titanum* flower emits a smell resembling the smell of the carcass. The stench becomes an attraction for various insects such as flies that will help in the pollination process (Primack, 2007). Insects get into the part of the flower and move on to other flowers to get something that insects need. The activity of the transfer of insects from one flower to another allows insects to help the pollination process on the flower.

The interaction between pollinator insects and flowering plants is a mutually beneficial relationship. In the interaction, plants provide a source of feed, namely pollen and nectar and a place to reproduce, while plants benefit from pollination. Therefore, the visit of insects becomes an important aspect in the pollination process and survival for dioeceous plants due to its role as the distribution of pollen. However, not all insects act as pollinator agents on *Amorphophallus Titanum* flowers such as the order Coleoptera and Hymenoptera, and astiosoma flaveolum flies whose visits are only accidentally and inactive on *Amorphophallus Titanum* (Kahono et al., 2010) In the flowering period, flies that are attracted and attached to flowers will inactively transfer pollen from male plants to female plants. After fertilization, the female *Amorphophallus Titanum* flower will form fruit. Fruits eaten by small animals or insects and seeds can be scattered around the rainforest. If the seed lands on the corresponding host, then the shoots will form and mature more than a year before the plant grows again (Low, 2016). There is little research on pollinating insects in *Amorphophallus Titanum* flowers. Therefore it is necessary the identification of visitors insects that may be pollination agents on *Amorphophallus Titanum* flowers. Information about *Amorphophallus Titanum* flower visitor insect is still very limited, so it is not yet known the species of insect slog. Therefore, research is needed that aims to identify the types of insects that become the flower-eating in an effort to preserve *Amorphophallus Titanum* flowers in the Conservation Area of Puspa Langka Park area. The existence of Puspa Langka Conservation Area in Tebat Monok Village can be used as one of the sources of biology study in junior high school based on the environment. Learning by

utilizing puspa langka conservation area is expected to be a means to foster the character of environmental care in students. So from the learning process, students have environmental literacy in them.

RESEARCH METHODS

The primary data on the *Amorphophallus Titanum* research was done in the laboratory and Puspa Lang conservation field. The data was then used a source to build an instrument and applied to the classroom. The 4-D development model consists of 4 stages namely Define, Design, Develop, and Disseminate or adapted into a 4-P model, namely definition, design, development, and deployment. This 4-D model was used in this study and adapted to development needs in the field.

Place and Time of Research

This research was conducted at SMP Negeri 8 Rejang Lebong Bengkulu Province in January - March 2020. Research on the inventory of visitor insects on carrion flowers (*Amophophallus titanum*) in Tebat Monok District kepahiang regency was done. The population of this study is grade VII students of SMPN 1 Rejang Lebong which is 5 classes. The subjects in this study were class VIII B in limited trials and class VII A, VII B in extensive trials. The subjects used in this study were selected using the Purposive Sampling method. Purposive Sampling understanding is a sample determination technique with certain considerations. His consideration of samples to be taken in the study was in schools and classes where researchers teach (Sugiyono, 2014).

Tools and Research Materials

Equipment used was stationery, plastic hood, camera, meter, tweezers, soil tester, thermohygrometer, killing bottle, and glass bottle. The materials used in the study were chloroform, 70% alcohol and cotton, junior high school biology teaching material classification of living beings, instruments.

RESULTS AND DISCUSSION

A. Types of Insects in *Amorphopallus Titanum* Habitat

Based on observations made, the insect species around the plant Amorphopallus consists of four different species namely *Sarcophaga sp*, *Lucilia sp*, *Chrysomya sp*, and Tetragoluna sp. Species from the family are *Lucilia sp* and *Chrysomya sp* (Masduki, 2019) while others are from different families. The insect's predeath is an idea that intraspecific interactions are still well underway. Here's a description of the species found:

1. Gray Fly (*Sarcophaga* Sp.)

The body is gray, with black patches or elongated black stripes on thorax, and the abdomen has a chessboard-like pattern of 9.5 mm body length and a wing venation length of 7 mm. Having three dark lines on the thorax, his stomach has a chess-like pattern (Putri, 2015).

(a)

(b)

Classification	
Kingdom	: Animalia
Phylum	: Arthropoda
Class	: Insecta
Ordo	: Diptera
Famili	: Sarcophagidae
Genus	: *Sarcophaga*

Figure 1. Gray Insect (a) Looks dorsal, (b) Focus on the eyes

2. Metallic Green Fly (*Lucilia* Sp.).

Features found in Lucilia sp. have a body length of 8 mm, metallic green body color, black legs and 7.5 mm wing venation length (Putri, 2015).

(a) (b)

Classification
Kindom : Animalia
Phylum : Arthropoda
Class : Insecta
Ordo : Diptera
Famili : Calliphoridae
Genus : Lucilia
Species : *Lucilia* sp.
Source : (ITIS, 2018).

Figure 2. Metallic green fly insect. (a) Dorsal look, (b) visible eyes

3. Metallic Bluish Green Fly (*Chrysomya Megacephala*)

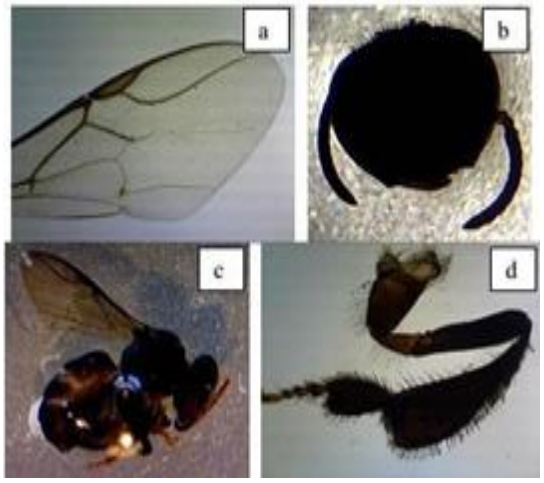
Observations and measurements that have been made signs of Chrysomya megacephala morphology are metallic bluish green body color, body length 9.5 mm, wing venation length 5 mm, thorax brownish green color, body surface covered with hard short feathers and rarely located. The metallic green abdomen has transverse stripes. His mouth is yellow. The eyes are large and dark red. Clear wings with clear veins (Putri, 2015).

Classification
Kingdom : Animalia
Phylum : Arthropoda
Class : Hexapoda
Ordo : Diptera
Family : Calliphoridae
Genus : Chrysomya
Species : *Chrysomya megacephala*

Figure 3. Metallic bluish fly insects. (a) Dorsal look, (b) visible eyes

4. Kalenceng Bees (*Trigona Laeviceps*)

Kalenceng bees have an overall black body color with an average body length range of between 3.7 and 4.5 mm, a range of head widths between 1.7– 1.9 mm, wing lengths measured from the distance between the M-Cu branch and the basal base of marginal cells ranging from 1–1.2 mm, and the length of the hind limbs between 1.4–1.6 mm (Putra, 2016).



Classification:
Kingdom : Animalia
Phylum : Arthropoda
Class : Insecta
Ordo : Hemynoptera
Family : Apidae
Genus : *Tetragonula*
Species : *Tetragonula laeviceps*

Figure 4. Kalenceng bees (a) Wing-looking, (b) eye-looking, (c) body-looking, (d) Visible feet

B. Frequency of Arrival of Insects

Table 1. Frequency of Arrival of Insects Found

No	Types of Insects	Observation Time			Amount
		Day 1	Day 2	Day 3	
1	Grey fly	4	3	1	8
2	Metallic Green Fly	10	6	1	17
3	Metallic Bluish Green Fly	7	5	1	13
4	Kalenceng Bees	4	2	0	6
	Amount	**25**	**13**	**3**	**44**

Based on the table above the frequency of arrival of insects as a whole there are 4 types of insects with a total of 44 flies. For the first day of insects that come quite a lot are 25 flies, consisting of 4 gray flies, metallic green flies 10 flies, metallic bluish flies 7 flies and bees 4 flies that appear in the afternoon at this time the condition of the flower of the carcass is perfect by emitting a very pungent stench, while in the morning and during the day there are no insects approaching the carcass flower, this is because the flower has not bloomed or flowered. On the second day of frequency the presence of insects decreased slightly by 16 flies with 3 gray flies, 6 metallic green flies, 5 metallic bluish flies, and 2 bees. On the third day, the frequency of arrival of insects decreased significant namely there are 3 types of insects with the number of 3 flies consisting of gray flies 1, metallic green flies 1 and metallic bluish flies 1 that appears in the morning during the day and evening there is no arrival of insects on the carcass flowers because the carcass flowers have withered and damaged.

Expert Validation Results (*Expert Appraisal*)

Table 2. Learning Unit Book Validation Results of The Interaction of Living Beings (students) and Their Environment

No	Validators Name	Field	Value percentage (%)	Classification
1	Validator 1	Material	96,60	Very decent
2	Validator 2	Material	88,89	Very decent
3	Validator 3	Media	92,85	Very decent
4	Validator 4	Media	91,07	Very decent

Table 2 shows that the Learning Unit Book of the interaction of living beings and their environment is declared feasible because the validation value exceeds 70% of the material validation value of 96.60% and 88.89%. The media expert percentages were 92.85 % and 91.07% that the percentage of validation values > 85% is categorized very well whereas if the percentage is below 70 % of the percentage of validation value < 85% then it is categorized as good. Based on the results of other materials and media experts, there are some suggestions for improvement. The improvement suggestion is outlined in Table 2 which shows the advice of both validators (material and media experts).

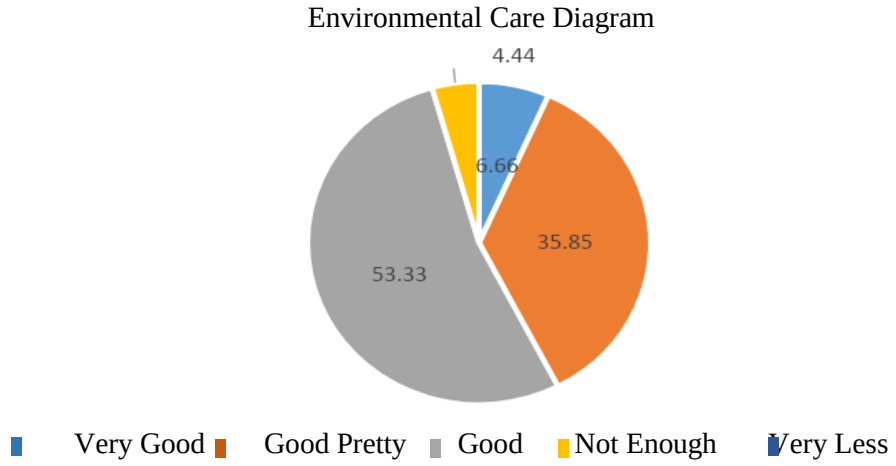


Figure 5. Environmental Care Diagram Primary data source

Product Trial Results (*Development testing*)

The purpose of this stage is to provide the opportunity for Learning Unit Book to be disseminated in order to be able to see its shortcomings and advantages. The result of the product distribution stage is student feedback related to learning by using Learning Unit Book development results. Learning Unit Book product denomination activities have been conducted at the junior high school education level in Kepahiang Regency. The number of students who were respondents in this denomination was 15 students.

Based on the diagram above that environmental care has done learning with the help of Learning Unit Book shows 6.66% very good, 35.85% good, 53.33% good enough, 4.44% less and 0% very lacking. This means that in the application of Learning Unit Book can be stimulating to support students' concern for the environment, but there are still 4.44% that are categorized as lacking due to the lack of teaching materials and modules related to nature and the environment so there are still weaknesses in the way students think in terms of concern for the environment, this is in accordance with the opinion of Achyani (2010) the availability of ecological and local biology teaching books aimed at increasing students' concern for the environment is still very lacking. As one of the efforts to solve the problem, it is necessary to develop a model of writing high school biology teaching books that are ecologically and locally minded in an effort to increase students' concern for the environment.

Based on the chart above that environmental concern with Learning Unit Book learning shows selfishness 76.89, humanistic 73.50, biosphere 81.33 with an average of 77.24 which is well categorized, this is due to the influence of student residence directly related to nature so that students become part of the environment so as to make students become concerned, this agrees with Widyaningrum (2016) for observation sheet with a result of 73.75% so it is concluded that students in SMS Negeri 5 Kediri care about the environment. With the attitude of students who care about the environment, students will be able to maintain the environment properly so that the environment around us will not be damaged.

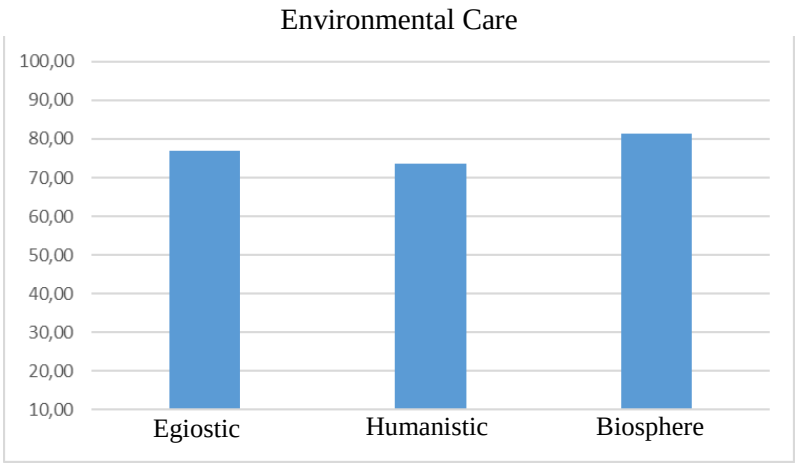


Figure 6. Environmental Care Graph Primary data source

CONCLUSION

In summary, the frequency of the arrival of insects as a whole was four types of insects with the number of 44 flies namely gray flies, metallic green flies, metallic bluish flies, and bees. On the first day with the number of 25 flies, the second day 13 flies, and the third day as many as 3 flies were occurred. Interaction of students and their environment was declared feasible because of the material validation value with an average of 92.75 %. Media expert judges with an average of 91.96%. Overall, environmental concern of students of grade VIII SMPN 8 Rejang Lebong with the help of module of the interaction of students with an average of 77.24 on a well categorized.

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