JOSAR, Vol.9 No.1 March 2024
ISSN: 2502-8521 (Print) / 2503-1155 (Online)
DOI: https://doi.org/10.35457/josar.v8i1.xxxx

IDENTIFICATION OF SOIL INSECT DIVERSITY AT SIRAH KENCONG TEA PLANTATION AS AN ATLAS SUPPORTING ANIMALIA

Ayu Siti Mariati[1*]
Eva Nurul Malahayati[1]
Marinda Sari Sofyana[1]

[111] Department of Biology Education, Faculty of Teacher Training and Education, Balitar Islamic University, Blitar, East Java, Indonesia

Abstract
This research purpose to determine the index of soil insect diversity, feasibility and student and teacher responses to the soil insect diversity atlas. Research and Development with the Borg and Gall used in the research method which is limited to the seventh stage. The instrument used was a questionnaire for expert validation, readability and response using a Likert scale. Analyzing the Diversity Index using the Shanon-Weiner formula. With descriptive qualitative as technigue data analysis . The results of the overall diversity index amounted to 2.29 while the diversity index (H') of stations 1, 2 and 3 were 2.32, 2.43 and 1.99 respectively. The results of the validation of material, language, and media experts respectively obtained a score of 84%, 93%, and 90% while the readability of teachers and students obtained a score of 95% and 96%. Teacher and student responses obtained a score of 98%, and 91%. So it can be concluded that the media Atlas of soil insect diversity can be used as a supporting media for animalia material.

Keywords: *Diversity of Soil Insects, Atlas, Animalia*

1. INTRODUCTION

[1*]Corresponding author, email: ayusm2077@gmail.com

Citation in APA style: Mariati, Ayu. (Year). Title of article. *JOSAR,* Vol. 9. No. (1): March 2024

Received:	**Revised:**	**Published:**
January, 8th 2024	March, 1st 2024	March, 31st 2024

ISSN: 2502-8521 (Print) / 2503-1155 (Online)
DOI: https://doi.org/10.35457/josar.v8i13435

Biodiversity is a term commonly used to illustrate the variety of life forms on earth, the interaction between various living things and their environment (Setyowati, 2014). Biodiversity includes habitat, species and genetic diversity. Indonesia is passed by the equator line located in the tropics, has a relatively stable climate and is geographically included in the archipelago, so that the diversity of flora and fauna can be found in Indonesia. This is evidenced by the fact that in 2017 Indonesia was recorded to have 31,750 species of plants, including flowering plants and high fauna diversity, namely 115 species of mammals, 600 species of reptiles, 1500 species of birds, 270 species of amphibians (LIPI, 2021) and 250,000 species of insects out of 751,000 on earth (Meilin, 2016).

Insects are the most dominant animal species among other animal species in the phylum Artropoda, almost 80% of the total number of animals on earth. The high number of insects is due to insects being able to maintain their survival in varied habitats, high reproductive capacity and good ability to save themselves from enemies (Sarumaha, 2020).Insects are attracted to plants both for food and as a place to live so that the role of insects is very important for ecosystems and human life (Ministry of Agriculture, 2011). Pollinators, decomposers, predators and parasitoids are the role of insects in the ecosystem. Insects have several properties both detrimental as pests and beneficial, as flower pollinators and destroyers of organic material debris. Insects can be distinguished based on their habitat, namely insects that live in water, air and soil habitats (Zebua, 2022). Soil insects are organisms that usually live in the soil, as well as on the surface of the soil. The existence of soil insects in an environment is influenced by both biotic and abiotic environmental factors. Biotic environmental factors are other organisms found in their habitat. Such as microflora, plants while, abiotic environmental factors consist of physical factors (temperature, moisture content, porosity and soil texture), chemical factors (pH, soil organic content, and soil mineral elements). Abiotic environmental factors determine the structure of the animal community in a habitat. Humidity, soil pH, high temperature affect the proliferation of soil insects, this is what underlies the researcher choosing Sirah Kencong Tea Garden as a research location because it meets the characteristics of soil insect life.

Sirah Kencong Tea Plantation is located in Ngadirenggo Village, Wlingi District, Blitar Regency, East Java 66184. This area is ± 46 km from Blitar City and 370 Km from Surabaya City. The topography is hilly with a slope above 45o. Based on the results of observations and interviews, the Sirah Kencong Tea plantation in 2021 has an area of 188.2 hectares and then there is a reduction determined by the board of directors so that in 2022 the plantation area is only 150 hectares with an altitude of 1000 - 1300 meters above sea level. It has a temperature of 10○C - 17○ C and 95% humidity. Soil types are andosol and lithosol with a pH of 6 -7 with the main commodity of this afdeling namely as well as other plants such as suren, acacia, and trigas orange.

Previous research conducted (Qiptiyah, 2014) on arthropod diversity in PTPN XII Bantaran Blitar tea plantation using pitfall trap and hand sorting methods. The pitfall trap method found 1896 individuals consisting of 12 orders and 29 families while the hand sorting method found 1910 individuals consisting of 15 orders and 45 families. In addition, it is also proven by research (Sumiswatrika, 2012), about the diversity of insects in PTPN XII Wonosari Lawang tea plantations in the pesticide application area

ISSN: 2502-8521 (Print) / 2503-1155 (Online)
DOI: https://doi.org/10.35457/josar.v8i1.xxxx

(AAP) and in the pesticide-free area (ABP) using the pitfall trap, window trap and light trap methods found as many as 594 individuals consisting of 9 orders and 22 families.

Based on the results of observations that researchers conducted in 3 regency and city high schools, one of which was SMAN 1 Kademangan on March 4, 2022, the understanding of Animalia material on the insect subtheme was still low. This condition is based on the results of the needs analysis questionnaire distribution test conducted on X IPA 1 with a total of 36 students showing the results of 72.2% of students find it difficult to understand the Animalia subtheme insect material, because the material about insects is difficult to learn because of the high number of species and their wide distribution. Students find it difficult when learning this material because there are many memorized insect groupings, and many of them are not familiar with these insects (Tari, 2019). In addition, students do not have other teaching materials as support for understanding insect material, biology teaching materials used in learning class X students are only printed books and Student Worksheets (LKS).

Understanding of insect material requires other teaching materials so that researchers have the initiative to develop an Atlas of Soil Insect Diversity in the form of printed media. This atlas will help students understand insect material with clear illustrations taken from research results and explanations that are easy to understand. This atlas includes classification, body shape, body symmetry, body cavity, reproduction and also insect morphology. Atlas has several advantages, namely: students can be helped to learn independently, understanding teaching materials can be done casually, information can be conveyed to friends and family, reproduced, corrected, and adjusted, note-taking activities are reduced, at a relatively low cost, durable (Efendi, 2009).

Based on the background that has been described, the authors are interested in proposing a study **entitled "IDENTIFICATION OF DIVERSITY OF SOIL INSECTS IN THE SIRAH KENCONG FARM AS ANIMALIAN MATERIAL SUPPORTING ATLAS".**

2. LITERATURE REVIEW

In this section researchers present some of the apparatus relevant to the research.

2.1. Insects

Insects are animals characterized by having six legs (hexapods) (Rosniar et al., 2019). Insects are the most numerous animals among other animals in the phylum Artropoda of the total number of animals on earth. Indonesia has about 250,000 insect species out of 751,000 on earth (Meilin, 2016). Arthropods (arthros podos foot) means animals whose legs are jointed or branched. The segment between two joints is called a segment. The general characteristics of arthropods are having appendages or additional tools that are brushes, bilateral symmetry body consists of a number of segments, wrapped by chitin substance commonly called the exoskeleton. These segments have parts that are not chitinized, making it easy to move..

Insects can be distinguished based on their habitat, namely insects that live in water, air and soil habitats (Zebua, 2022). In general, the soil and soil surface are a place

ISSN: 2502-8521 (Print) / 2503-1155 (Online)
DOI: https://doi.org/10.35457/josar.v8i13435

for soil insect organisms to live. Several things that affect the presence of soil insects are soil structure affects insect movement and penetration, available nutrient content and soil moisture affect the development of the insect life cycle, soil temperature affects insect egg laying, light and airspace affect insect activity (Anggriawan et al., 2020). Breaker of organic matter through the decomposition process is paly an main role to maintaining the balance of ocosystem. That process humus of ecosystem a source of nutriens.

2.1.1 Morphology

In general, soil insect morphology consists of three main components, namely: Head (Head), Thorax (Mesosoma), and Abdomen (Metasoma), one area of unity is called tagma. The three parts are protected by a curticula composed of a hard chitin substance. Tools for entering food, compound eyes (facet eyes), single eyes (oseli) are found on the head that some insects do not have, as well as a pair of embelan called antennae. The thorax consists of three successive segments from the front: prothorax, mesothorax, and metathorax. The three thoracic segments are present in almost all adult insects and some young insects have limbs. Wings, if present, are found on the mesothorax, metathorax (if two pairs of wings) and mesathorax (if one pair of wings).

a) Head

It is the front part of the insect body, consisting of 6 segments and 4 organs including the mouth, a pair of compound eyes, single eyes, and a pair of antennae. Antenna is composed of several segments containing sensory hairs. Compound eyes are composed of omatidia, except for three simple eyes called ocelli (Rahmalina, 2023). The head functions as a means of receiving stimuli, collecting food, and processing information in the brain.

b) Antenna

It is the organ that receives stimuli, such as smell, taste, touch and heat. Insect antennae consist of three segments. The base segment is called the scape and the second segment is called the flagella.

c) Thoraks (chest)

The thorax consists of three segments: the protothorax (front part), mesothorax (middle part), and metathorax (back part). All three parts of the thorax have a pair of legs, and the mesothorax generally also has a pair of wings. Some species have a pair of wings and some are wingless (apterygota).

d) Abdomen (stomach)

The abdomen of insects consists of 11 segments, but the 11th segment is usually smaller. The 11th segment is called tergum and a pair of appendages called cerci. As for the other segments, namely, segments 1-7 pre-male, segments 8-9 genitalia, the function in these segments is related to copulation and egg laying.

ISSN: 2502-8521 (Print) / 2503-1155 (Online)
DOI: https://doi.org/10.35457/josar.v8i1.xxxx

2.1.2 Classification

Arthropods are divided into 3 subphyla, namely Trilobites, Mandibulata and Chelicerata. The Mandibulata subphylum is divided into 6 classes, one of which is the Insect class (Hexapoda). Hexapoda class is divided into Apterygota and Pterygota sub-classes. The Apterygota sub-class is divided into 4 orders, and the Pterygota sub-class is still divided into 2 groups, namely the Exopterygota group (simple metamorphosis Pterygota group) consisting of 15 orders, and the Endopterygota group (perfect metamorphosis Pterygota group) (Azwir et al., 2019).

1) Trilobite Subphylum

Trilobites are marine arthropods that existed around 245 million years ago. Very few members of the trilobite subphylum are known, as they are generally found in fossilized form.

2) Subphylum Mandibulata

This group has mandibles and maxillae in the mouth, mandibulates are Crustacea, Myriapoda, and Insecta (insects). Group mandibulata, crustacean class has adapted to marine life so that its population is spread throughout the oceans. Members of the Myriapoda class are Millipedes and Centipedes adapted to human life.

3) Subphylum Chelicerata

The subphylum Chelicerata is a predatory animal that has cellicerae with poison glands. Spiders, mites, scorpions and crabs are animals that belong to the subphylum Chelicerata..

2.1.3 The role of soil insects

A. Insects that are beneficial to humans.

Soil surface insects generally feed on living and dead plants, so insects play the decomposition process. The decomposition process in the soil will not be able to run fast if it is not supported by the activities of soil surface insects (Utami et al., 2022). The existence of soil insects is dependent on the food sources and availability of energy to sustain their lives, suppose that organic matter and living biomass, are related to the flow of the carbon cycle in the soil. The availability of energy and nutrients affects the development and activity of soil surface insects (Gesriantuti et al., 2016). Soil fauna has an important role in breaking down organic materials, namely:

a. Break down selected materials such as sugars, sellulose and increase the availability of space for bacterial and fungal activity.
b. Turning the remains of plant organs into humus.
c. Bringing together decaying material in the topsoil.
d. Compilation of organic and mineral materials.

Soil organisms have an important role for the sustainability of the ecosystem, one of which is as a breaker of organic matter available to green plants. Various plant

ISSN: 2502-8521 (Print) / 2503-1155 (Online)
DOI: https://doi.org/10.35457/josar.v8i13435

residues will undergo a decomposition process to source of soil nutrients by humus. The benefits of insects are very important for the sustainability of natural ecosystems (Meilin, 2016). Some types of soil insects verry use full indicators of soil fertility. Soil insects also play a role in improving soil physical properties and increasing soil organic content (Karyaningsih & Hendrayana, 2021).

B. Insects that Harm Humans

Insects can cause both direct and indirect losses. Direct losses include the emergence of harmful insects that attack various plants. Insects attack by biting or stinging, and some of them are even agents in the transmission of some of the most severe diseases affecting humans and animals. Humans are more familiar and aware of destructive insects and their effects than beneficial insects (Meilin, 2016).

2.1.4 Factors Affecting Soil Insects

Factors that affect the soil insect community are divided into biotic and abiotic factors. The abotic environment is divided into physical and chemical factors. Physical factors include temperature, pH, moisture content. Chemical factors include salinity, soil C-organic content, and soil mineral elements. The structure of the abiotic environment determines the structure of the animal community found in a habitat. Biotic environmental factors for soil animals are other animals both of the same species and different species, plants and microbes around the animal (Irma, 2018).

1. Abiotic factors

Abiotic factors can affect the types of animals that live in the habitat, because there are certain animals whose lives require protection provided by the canopy of plants in the habitat. The factors that affect the presence of soil insects in the ecosystem are growth, population, and interactions between species (Basna et al., 2017). There are several supporting abiotic factors for the survival of insect life as follows :

a. Soil moisture

Extremely high humidity conditions can cause insects to migrate to other places, leading to insect mortality. Dry conditions sometimes also reduce the diversity of certain insects, due to reduced populations. In addition, humidity also controls activity and feeding (Jannah et al., 2021).

b. Soil temperature

ISSN: 2502-8521 (Print) / 2503-1155 (Online)
DOI: https://doi.org/10.35457/josar.v8i1.xxxx

It is one of the soil physical factors that determine the presence and density of soil organisms. Soil temperature will determine the rate of decomposition of soil organic matter. Fluctuations in soil temperature are lower than air temperature, so soil temperature is very dependent on air temperature. Topsoil temperature fluctuates within one day and one night depending on the season. Fluctuations also depend on weather conditions, regional topography and soil conditions (Rosinta et al., 2021).

c. Soil pH

The degree of acidity (pH) of the soil is a limiting factor for the life of organisms both flora and fauna. soil pH can make organisms experience imperfect life or even die in pH conditions that are too acidic or too basic (Al Nakir, 2022).

d. Soil Organic Matter

Many soil insects are found in the topsoil or top soil layer. In this layer there is a layer of leaf litter that has decomposed which is a source of food for soil insects. The results of these various activities enter the soil along with the roots and bodies of dead microorganisms decomposed in the soil (Astuti & Titah, 2021).

2. Biotic Factors

Biotic environmental factors for soil animals are other animals of the same species or different species, plants and microbes around the animal (Irma, 2018). In the decomposition process, soil fauna as part of soil biodiversity plays an important role in improving physical, chemical and biological properties through the humification process. Soil fauna organic matter plays more of a role in the fragmentation process (Karyaningsih & Hendrayana, 2021).

2.2 Atlas

Atlas is a collection of complete illustrations accompanied by the material studied therein (Wulansari et al., 2015). Atlas provides real illustrations taken from the results of research showing the real object and provides a more efficient learning meaning that can stimulate students' thinking skills. The use of atlases is generally used as a supporting media for practicum activities, confirmation media when making identification so that it makes it easier for students to ensure the truth of what is observed, and helps the learning process when the original observed material cannot be found.

3. METHODS

ISSN: 2502-8521 (Print) / 2503-1155 (Online)
DOI: https://doi.org/10.35457/josar.v8i13435

The research development using descriptive qualitative. The qualitative descriptive approach, it can be observed based on results of data obtained from validation results from several experts, response questionnaires, and readability. The development research procedure is guided by the Borg and Gall development research design in (Sugiyono, 2017). This research uses the Borg and Gall method because this method has the advantage that more respondents and validation experts are involved so that product being tested has higher validity and feasibility.

The Borg and Gall development method consists of 10 steps, namely: 1) Potential and problems 2) Data collection 3) Product design 4) Design validation 5) Design revision, 6) Product trial, 7) Product revision, 8) Usage trial 9) Product Revision 10) Mass production. However, researchers only limit it to 7 steps because of limited time and costs. This research was conducted at the Sirah Kencong Tea Plantation and the identification process was carried out at the UM Biology Laboratory. Validation is carried out after the identification process in the form validations of material expert, validations of media expert and validation of linguist expert. After carrying out a validity analysis according to several experts, product results will be obtained which will be revised. After analyzing the validity according to several experts, the results of the product will be revised. The product revision process is adjusted to the request or suggestion of several experts, if the expert has approved the results of the product revision then the product trial is carried out by dividing the two, namely the readability trial of class XI IPA students and class X biology teachers and the product response trial of class XI IPA students and class X biology teachers SMAN 1 Kademangan. After the product was finished, the population for the readability questionnaire was taken from 2 schools, namely SMAN 1 Kademangan and SMAN 1 Sutojayan with purposive sampling technique. Data analysis was carried out with 2 types of analysis, namely qualitative data in the form of comments and suggestions obtained from expert validators, teachers, and students used for product improvement and improvement and quantitative data in the form of scores from the results of expert validation, teacher and student readability and teacher and student response tests guided by the Likert Scale.

4. RESULTS

In this section researchers present the results of product development and product trials.

4.1 Product Development Results

a) Material Expert Validation Results

The material expert validators in this study were 2 lecturers of Plant Pests and Diseases (HPT) at the Faculty of Agriculture, Balitar Islamic University and 1 lecturer at the Faculty of Teacher Training and Education, Balitar Islamic University who have experience teaching and mastering insect material. The validators were Mrs. Rima Dewi Oryza Sativa, MP, Mrs. Army Dita, MP, and Mrs. Dwi Kameluh Agustina, S.Si., M.Pd. Material expert validation was carried out by filling out an assessment questionnaire

ISSN: 2502-8521 (Print) / 2503-1155 (Online)
DOI: https://doi.org/10.35457/josar.v8i1.xxxx

consisting of several aspects related to the relevance of insects. The results of the material expert assessment can be seen in Table 1

Tabel 1. Material Expert Assessment Results

No. Statement	Scale			Score
	Validator 1	Validator 2	Validator 3	
1	5	5	4	14
2	5	5	4	14
3	5	5	4	14
4	5	5	2	12
5	5	5	2	12
6	5	4	3	12
7	5	4	2	11
8	5	5	2	12
9	5	4	4	13
Total				**114**
Criterion Score				**135**
Percentage				**84%**

b) Language Expert Validation Results

The linguist validators in this study were 2 lecturers of Indonesian Language at Nahdlotul Ulama University, namely Mr. Agus Hermawan M.Pd, Mr. Radhitya Wempi Ansori M.Pd and 1 Indonesian Language teacher of SMAN 4 Blitar, namely Dra. Sri Andayani. The linguist validation was carried out by filling out an assessment questionnaire sheet. The results of the assessment can be seen in Table 2.

Tabel 2. Results of Linguist Assessment

No. Statement	Scale			Score
	Validator 1	Validator 2	Validator 3	
1	5	4	4	13
2	5	5	5	15
3	5	4	5	14
4	5	5	4	14
Total				**56**
Criterion Score				**60**
Percentage				**93%**

c) Media Expert Validation Results

Media expert validators in this study were 3 Balitar Islamic University lecturers who are experts and experienced in the field of learning media, namely Mrs. Ida Putri Rarasati, M.Pd, Mrs. Devita Sulistiana Sari, Si, M.Pd, Mr. Luky Priyanto, M.E. Media validation was carried out by filling out a questionnaire assessment questionnaire sheet for learning media. The results of the questionnaire sheet assessment for learning media can be seen in Table 3.

Tabel 3. Media Expert Assessment Results

No. Statement	Scale			Score
	Validator 1	Validator 2	Validator 3	

ISSN: 2502-8521 (Print) / 2503-1155 (Online)
DOI: https://doi.org/10.35457/josar.v8i13435

1	4	5	4	14
2	5	4	4	14
3	5	5	5	15
4	5	4	5	14
5	5	5	3	13
6	4	4	5	13
7	5	5	5	15
8	5	5	4	14
9	5	4	5	14
10	5	4	5	14
11	5	4	5	14
12	5	5	4	14
13	5	4	5	14
14	5	5	3	13
15	4	5	5	14
16	5	4	4	13
17	5	4	5	14
Total				**236**
Criterion Score				**255**
Percentage				**92%**

4.2 Product Trial

The Media Atlas of Soil Insect Diversity that the researchers developed was tested individually and in small groups. The individual subjects in this study were 1 biology teacher at SMAN 1 Kademangan namely Mr. Ihsanul Habib S.Pd, 2 biology teachers from SMAN 4 Blitar namely Mrs. Dra.Endang Subiarti, and Mrs. Nindia Ayutrisna. The small group subjects were students of SMAN 1 Kademangan and SMAN 1 Sutojayan.

a) Student Readability Test Results

The Media Atlas of Soil Insect Diversity has been tested individually. The subjects of this readability test are students of class XI IPA 1 SMAN 1 Kademangan as many as 5 students who have taken animalia subtheme insecta material taken randomly. The results of the readability test can be seen in Table 4.

Tabel 4. Student Readability Test Results

ISSN: 2502-8521 (Print) / 2503-1155 (Online)
DOI: https://doi.org/10.35457/josar.v8i1.xxxx

No. Statement	Students					Score
	1	2	3	4	5	
1	5	5	5	5	5	25
2	4	5	5	5	5	24
3	4	5	5	5	5	24
4	4	5	5	5	5	24
5	4	5	5	5	5	24
6	5	5	5	4	5	25
7	4	5	5	4	5	23
8	4	5	5	5	5	24
9	4	5	5	5	5	24
10	5	5	5	5	4	24
11	5	5	5	5	4	24
12	5	5	5	5	5	25
Total						**290**
Criterion Score						**300**
Percentage						**96 %**

b) Teacher Readability Test Results

This data is used to determine the readability and assessment of biology teachers on the media atlas of soil insect diversity that has been developed. The results of the tabulation of assessments from expert practitioners or teacher readability can clearly be seen in Table 5.

Tabel 5. Teacher Readability Test Results

No. Statement	Dra.Endang Subiarti	Ihsanul Habib, S.Pd	Nindia Ayutrisna S.Pd	Score
1	5	5	5	15
2	4	5	4	13
3	5	5	5	15
4	5	5	5	15
5	5	5	5	15
6	5	5	3	13
7	3	5	4	14
8	5	5	5	15
9	4	5	5	14
Total				**129**
Criterion Score				**135**
Percentage				**95%**

c) Student Response Test Results

The response questionnaire was used to determine the response of 30 students of class XI IPA SMA / MA to the media atlas of soil insect diversity. The results of the assessment analysis can be seen in Table 6.

Tabel 6. Student Response Test Results

ISSN: 2502-8521 (Print) / 2503-1155 (Online)
DOI: https://doi.org/10.35457/josar.v8i13435

Student	No. Statement								Score
	1	2	3	4	5	6	7	8	
1	5	4	4	5	5	4	5	5	37
2	5	4	4	4	5	5	4	4	35
3	5	5	4	5	4	5	5	5	38
4	4	5	5	4	4	5	5	5	32
5	5	4	4	4	5	4	4	4	34
6	5	4	5	5	5	5	5	5	39
7	3	4	4	5	5	4	5	5	35
8	4	4	4	4	4	4	4	4	32
9	5	4	5	4	5	4	5	5	37
10	5	3	5	5	5	5	5	5	38
11	5	5	5	4	4	5	5	5	38
12	5	5	5	4	5	4	4	4	36
13	5	5	4	4	5	4	4	4	35
14	5	5	5	5	5	5	5	5	40
15	5	5	5	5	4	5	5	4	38
16	5	4	4	4	4	5	4	4	34
17	4	4	4	4	4	4	4	4	32
18	5	5	4	4	5	4	5	5	37
19	4	4	5	4	5	4	5	5	36
20	5	5	5	4	5	5	5	5	39
21	5	4	4	5	4	5	5	5	41
22	5	5	4	5	4	4	5	5	36
23	5	5	5	5	5	5	5	5	40
24	5	4	4	5	4	5	5	4	36
25	5	5	5	5	5	5	5	5	40
26	5	5	4	4	5	5	5	5	38
27	4	4	5	4	5	5	4	4	35
28	5	4	5	5	4	4	5	5	41
29	5	5	5	5	4	5	4	4	32
30	5	5	5	5	4	4	4	4	36
Total									**1097**
Criterion Score									**1200**
Percentage									**98 %**

d) Teacher Response Test Results

This data is used to determine the biology teacher's response and assessment of the developed Soil Insect Diversity Atlas media. The results of the teacher response test assessment can clearly be seen in Table 7.

ISSN: 2502-8521 (Print) / 2503-1155 (Online)
DOI: https://doi.org/10.35457/josar.v8i1.xxxx

Tabel 7. Teacher Response Test Results

No. Statement	Dra.Endang Subiarti	Ihsanul Habib, S.Pd.	Nindia Ayutrisna S.Pd	Score
1	5	5	5	15
2	5	5	5	15
3	5	5	5	15
4	5	5	4	14
5	5	5	5	15
6	5	5	5	15
7	5	5	5	15
8	5	5	4	14
9	5	5	5	15
10	5	5	5	15
Total				**148**
Criterion Score				**150**
Percentage				**98 %**

5. DISCUSSION

5. 1 Diversity Index of Soil Insects in Sirah Kencong Plantation

This research was conducted on June 17-28, 2022 at Sirah Kencong Tea Plantation found as many as 326 individuals of 28 species divided into 28 genus, 23 families and 10 orders namely Orthoptera, Blatarria, Coleoptera, Hemiptera, Hymenoptera, Spirostreptida, Polydesmida, Lithobiomorpha, Scutigeramorpha, Aranea. However, for the sake of research, the insects that will be used as material in making the atlas are insecta classes, namely in the orders Orthoptera, Blatarria, Coleoptera, Hemiptera, and Hymenoptera.

Based on observations of soil insect inventory in Table 8 Results of Identification of Soil Insects, it is known that the most insects found are Diacama species, family Formicidae, order Hymenoptera with a total of 120 individuals. Precisely at station 3 Diacama species amounted to 60 individuals more than other stations. This is due to differences in plant vegetation at each observation station as well as the amount of tea leaf litter at station 3. Litter is material - dead material located above the soil surface and undergoes decomposition and mineralization. The components of litter are leaves, twigs, small branches, bark, flowers and fruit (Jayanthi & Arico, 2017). The accumulation of litter will provide habitat and food sources for micro and macro invertebrates which are an important basis in the food chain (Wijayanto et al., 2022). Therefore, if the amount of leaf litter in a place is large, the diversity of insecta will also be high.

.

The Formicidae group is a very common and widespread group (Maesyaroh, 2016). The Formicydae group has diverse feeding habits. Many are carnivorous and some are herbivorous, feeding on plants, fungi, plant juices and honey supply. Diacama species act as predators. Some of the roles of these organisms are as decomposers, pollinators, soil aerators, predators and indicators (Sari et al, 2015).

ISSN: 2502-8521 (Print) / 2503-1155 (Online)
DOI: https://doi.org/10.35457/josar.v8i13435

The data obtained in each capture were counted and identified and then analyzed by calculating the diversity index of insect species according to Shanon Weaner (Krebs, 1978). Where the criteria for diversity index (H) according to (Odum, 1971) are low species diversity when $H < 1$, moderate species diversity when $1 \leq H \leq 3$, high species diversity when $H > 3$. The results obtained as a whole amounted to 2.29 while for the diversity index at stations 1, 2 and 3 respectively amounted to 2.32, 2.43, and 1.99. Through the results obtained, it can be seen that the diversity index (H') at station 2 is higher than the diversity index at stations 1 and 3. This condition is caused because at station 2 is a pesticide-free area so that the diversity of soil insects can spread widely in the area even though the number of insects obtained is not much. The diversity of pesticide-applied arthropods is lower than that of pesticide-free because arthropods are very sensitive and vulnerable to pesticides, resulting in mass mortality and reducing the types and populations of arthropods (Soedijo et al., 2022).

5. 2 Feasibility of Soil Insect Diversity Atlas

The assessment of the feasibility of the soil insect diversity atlas media was obtained from the results of filling out a set of validation instruments by media expert validators, material experts, language experts as well as readability tests and teacher and student response tests. This research data was obtained from the results of filling out a set of validation instruments given to media experts, material experts, linguists as well as a number of student and teacher responses to assess the feasibility results of the developed atlas. The results obtained by material experts amounted to 84%. A high enough value lies in statements 1,2,3 which reads the material on the media in accordance with KI, KD Curriculum 2013 and in line with the learning objectives in KD 3.9 and 4.9, so that the material can be right on target according to student needs. Basic competencies are the basis for developing subject matter in the development of learning media. Basic competencies are the direction and foundation for developing subject matter, learning activities, and indicators of competency achievement in the development of learning media (Suherman, 2014).

Based on Table 1, the material expert assessment obtained a score of 84%. This value is included in the range of 80-100% with very feasible criteria. The value that is quite high with a score of 14 is located in statements 1,2,3 which reads the material on the media in accordance with KI, KD Curriculum 2013 in line with the learning objectives in KD 3.9 and 4.9. The material can be right on target according to student needs. Basic competencies are the direction and foundation in developing subject matter, learning activities, and indicators of achievement of learning media development competencies. Material expert validators provide suggestions for improving the quality of the Atlas to be developed, including body shape, body symmetry, body cavity, reproduction is more emphasized in predators or pests so that the information presented is clearer. Illustrations of Valanga species, the tartus and tibia body parts are not visible so they need to be replaced with whole illustrations so that all insect limbs are clearly visible.

The linguist assessment based on Table 2 obtained a score of 93% successfully entered in the range of 80 - 100% with very feasible criteria. The high value with a

ISSN: 2502-8521 (Print) / 2503-1155 (Online)
DOI: https://doi.org/10.35457/josar.v8i1.xxxx

score of 15.14 is in statement number 2, 3 which reads the language used in communicative media, spelling accuracy and consistency in the use of terms. Written language is a secondary language. Written language must be better organized, more complete, and more organized (Sukirman, 2020). Through the variety of written language, we are required to have complete word elements such as word form or sentence structure, accuracy of word choice, correct use of spelling and use of punctuation in expressing ideas. In order to achieve the objectives of the atlas media development, the validator provides suggestions as a basis for improvement, among others, at the end of the sentence a full stop is added and consistent in the use of connecting words (and) is not allowed to use punctuation marks (&) this applies on the first page to the last page of the atlas. The use of words in sentences needs to be addressed di- as a prefix or di- as an affix (for passive verbs).

Based on Table 3, the media expert assessment obtained a score of 92%. This value is included in the range of 80-100% with very feasible criteria in terms of appearance and presentation. The high value with a score of 15 is located in statement 3.7 containing an attractive appearance and the letters used can be easily read and understood by the reader. The brain tends to like images / illustrations and colors compared to writing (Purwaningsih, 2018). Illustrations can help readers visualize organ structures easily. Color also plays a role in providing a pleasant atmosphere for readers. The validator provides written suggestions listed in the questionnaire, among others, as follows, the layout of the bibliography with the author's biodata is swapped in position so that it is sequenced systematically, then for the color combination in the title font and the outer cover design is less attractive so it needs to be corrected to make it more contrast with the cover, another suggestion for the description is replaced with a description of the image to make it easier for readers to understand.

In Table 4, it can be seen that the assessment of student readability test results obtained a score of 96%. The value is included in the range of 80 - 100% with very feasible scoring criteria. The high score results are in statements number 1 and 2 containing the clarity of the material presented, the ease of language used, the readability of letters and sentences and writing according to EYD. The teacher's readability test assessment based on Table 5, the assessment of the results of the class X biology teacher's readability test obtained a score of 95% successfully entered in the range of 80 - 100% with very feasible scoring criteria. The highest score is in statement points number 3, 4, and 5 containing the language used in communicative media, spelling accuracy and consistency in the use of terms. . At this stage there are no revisions from students or from teachers so that they can continue at the next stage, namely the student and teacher response test.

5.3 Student and teacher responses to soil insect diversity atlas media

The results of the student response test assessment sourced in Table 6 obtained a percentage of 91%. This value is included in the range of 80 - 100% very feasible scoring category. The highest assessment lies in points 14 and 15. Both points contain a minimalist display design not too much writing and illustrations are clearly visible. The brain tends to like images / illustrations and colors compared to writing (Purwaningsih, 2018), while the results of the teacher response test percentage of 98% made it into the

ISSN: 2502-8521 (Print) / 2503-1155 (Online)
DOI: https://doi.org/10.35457/josar.v8i13435

range of 80 - 100 with a very feasible description. The high assessment lies in the statement points 1,2,3,5,6 containing the suitability of writing according to EYD and clear images equipped with ringakas explanations making it easy for students to understand the material. Judging from these results, it can be concluded that the development of atlas media provides a positive response from students and teachers so that it can be used as a supporting media for animalia subtheme insecta material.

Tabel 8. Soil Insect Identification Results

Ordo	**Species**	**Stasiun**			**Total**
		1	**2**	**3**	
Orthoptera	*Brachytrupes Portentosus*	15	8	12	35
	Valanga sp	6	3	4	13
	Gryllotalpa sp	4	2	4	10
Blattaria	*Ischnoptera sp*	4	0	4	8
	Blatella asahinai	4	1	3	8
	Blatella germanica	3	0	0	3
Coleoptera	*Onthophagus sp*	5	1	4	10
	Altica sp	4	1	3	8
	Xyloterinus sp	2	0	3	5
	Xystrocerini sp	1	0	0	1
	Cerotoma trifurcata	1	0	0	1
	Stenolophus sp	1	0	0	1
	Paederus sp	1	1	1	3
	Phyllobratica quadrimaculata	1	0	0	1
Hemiptera	*Bothogonia ferruginea*	2	1	1	4
	Rhyparochromussp	1	0	2	3
	Triatoma infestans	1	1	1	3
Hymenoptera	*Diacama sp*	50	10	60	120
	Pheidole sp	17	8	20	45
Spirostreptida	*Spirostreptus seychellarum*	0	1	0	1
Polydesmida	*Ochthocelata adynata*	0	2	0	2
	Orthomorpha coarctata	0	1	0	1

ISSN: 2502-8521 (Print) / 2503-1155 (Online)
DOI: https://doi.org/10.35457/josar.v8i1.xxxx

Lithobiomorpha	*Lithobius forficatus*	0	1	0	1
Scutigeramorpha	*Scutigera Coleoptrata*	0	1	0	1
Aranea	*Xysticus Fervidus*	12	8	10	30
	Agyneta sp	0	0	1	1
	Erigone atra	1	0	0	1
	Zoropsis Spinama	1	0	0	1
	Phalagium Opilio	2	1	2	5
Total		**139**	**52**	**135**	**326**

6. CONCLUSION

Based on the results of research and development that has been carried out, it can be concluded as follows.

1. The overall diversity index was 2.29 while the diversity index (H') at stations 1, 2 and 3 was 2.32, 2.43 and 1.99 respectively. With the following criteria. If H'< 1 indicates low diversity, H' 1 < 1 H' < 3 is moderate, H'> 3 indicates high diversity. So it can be concluded that the diversity index (H') at station 2.

2. Media atlas of soil insect diversity is feasible to use as supporting media for animalia subtheme insecta material. This is based on the feasibility results based on the assessment by the validation of material, language and media experts respectively 84%, 93% and 90% with very feasible criteria. The results of the teacher readability test obtained a score of 95% while the readability test obtained a score of 96% with a very feasible category.

3. The results of the teacher's response obtained a value of 98% while the results of the student response test obtained a value of 91% with very feasible criteria. So it can be concluded that the media atlas of soil insect diversity in terms of the results of the response test is said to be feasible as a supporting media.

4. Limitations in the study include adapting the development steps developed by Borg and Gall in Sugiyono but limited only to the seventh step, namely product revision, for the achievement of indicator 3.9.3 grouping invertebrates based on their characteristics found in observations and indicator 3.9.4, namely explaining the data findings of observations about the general characteristics of animal grouping. Then in sampling only on insects caught by pitfall traps and identified up to the genus stage and insects that are included in the atlas are only insect classes.

ISSN: 2502-8521 (Print) / 2503-1155 (Online)
DOI: https://doi.org/10.35457/josar.v8i13435

5. The research took place during the rainy season, it is hoped that further research will be carried out during the dry season so that it can determine the comparison of insect diversity indices. This development uses the Borg and Gall model adapted from Sugiono only up to the seventh stage, it is hoped that further research can continue to the tenth stage so that the product can be disseminated. Then for the development of print-based atlases, it is hoped that further research can develop digital-based soil insect diversity atlases so that they can be accessed online.

REFERENCES

Anggriawan, R., Mulyawan, R., & Santari, P. T. (2020). SOIL MESOFAUNA: DIVERSITY AND THEIR ABUNDANCE ON DIFFERENT LAND USE TYPES IN BOGOR, WEST JAVA Soil Mesofauna: Diversity and Their Abundance on Different Land Use Type in Bogor Region, West Java. 18(1), 107-115.

Astuti, A. D., & Titah, H. S. (2021). Study of Phytoremediation of Petroleum Pollutants in Polluted Coastal Areas Using Mangrove Plants (Case Study: Crude Oil Spill Well YYA-1 Coastal Karawang West Java). ITS Engineering Journal, 9(2), F111-F116

Azwir, A., Jalaluddin, J., Rubiah, R., & Listiana, L. (2019, December). Identification of insect species diversity in corn (Zea mays L.) plants in Gampong Sukamulia, Seulawah Valley District, Aceh Besar Regency. In Proceedings of USM National Seminar (Vol. 2, No. 1, pp. 358-365)

Basna, M., Koneri, R., Papu, A., & Biologi, J. (2017). Distribution and Diversity of Soil Insects in Gunung Tumpa Botanical Forest Park, North Sulawesi. 6(1), 36-42.

Efendi, A. (2009). Some Notes on Textbooks in Schools. 14(2), 1-10.

Gesriantuti, N., Trantiati, R., & Badrun, Y. (2016). Diversity of Soil Surface Insects in Fired Peatland and Protected Forest in Kasang Padang Village, Bonaidarusalam District, Rokan Hulu Regency, Riau Province. Photon: Journal of Science and Health, 7(01), 147-155.

Irma, W. (2018). The Effect of Peatland Conversion on Environmental Resilience in Kampar Watershed, Riau Province, Sumatra. 24(2), 170-191.

Jannah, M., Supeno, B., & Windarningsih, M. (2021). "Building Synergies between Universities and the Agricultural Industry in the Framework of Implementing Independent Campus Learning" Diversity of Corn Armyworm Predators (Spodoptera frugiperda) during Corn Plant Growth (Zea mays L) in Ireng Village, West Lombok. 5(1), 1134-1152.

Jayanthi, S., & Arico, Z. (2017). Effect of Vegetation Density on Forest Litter Productivity of Gunung Leuser National Park. Elkawnie: Journal of Islamic Science and Technology, 3(2), 151-160.

Karyaningsih, I., Hendrayana, Y., & Kustiawan, I. (2021). Soil Macrofauna Diversity in the Rehabilitation Zone of Mount Ciremai National Park Pasirbatang Block Karangsari Village, Kuningan Regency. 13, 60–67. https://doi.org/10.25134/quagga.v13i1.3521.Received

Kirat, N., & Nakir, A. (2022). Diversity of ground surface arthropods in the temple area abang berbah sleman yogyakarta. 1, 35-41.

ISSN: 2502-8521 (Print) / 2503-1155 (Online)
DOI: https://doi.org/10.35457/josar.v8i1.xxxx

Maesyaroh, S. S., Study, P., Faculty, A., & University, P. (2016). Abundance of Insects Potentially as Pests and Natural Enemies in Carrots Agroecosystems In Garut District Cikajang. 1(1), 48-56.

Meilin, A. (2016) Insects and their role in agriculture and life. Journal of Agricultural Media, 1(1), 18-28

Novi, E., Zebua, K., & Rangrang, S. (2022). Ethological study of rangrang ants (. 1(2), 95-107.

Purwaningsih, E. (2018). Recognizing colors, numbers, letters and shapes in early childhood through interactive animation. JITK (Journal of Computer Science and Technology), 3(2), 203-210

Rosniar, N., Perdana, I., & Hamama, S. F. (2019). Classification of Insect Species and their Role in Coffee Plants in Kenawat Village - Bener Meriah. 264-272.

Rosinta, M., Artayasa, I. P., & Ilhamdi, M. L. (2021). Journal of Tropical Biology Diversity of Soil Insect in Kerandangan Ecotourism Nature Park Area West Lombok Island. 21, 870-877.

Sari, R. W., Yolanda, R., & Purnama, A. A. (2015). Ant species (Hymenoptera: Formicidae) in oil palm plantations around Pasir Pengaraian University Campus. Scientific Journal of FETT Biology Study Program Students, 1(1)

Sarumaha, M., & Pracaya, M. (2020). Identification of insect pests on rice plants in bawolowalani village. 8(3), 86-91.

Setyowati, E. (2014). Planning Islamic Perspective Skill-Based Learning Resources for Biodiversity Education. Ta'allum: Journal of Islamic Education, 2(1), 17-35.Soedijo, S., Ghanisa, P. A., & Salamiah, S. (2022). Pengaruh Pemberian Pestisida Nabati pada Tanaman Bawang Merah (Allium Ascalonicum L.) Terhadap Keanekargaman Anthropoda di Dalam Tanah Lahan Gambut. Rawa Sains: Jurnal Sains STIPER Amuntai, 12(2), 59-67.

Soedijo, S., Ghanisa, P. A., & Salamiah, S. (2022). The Effect of Application of Vegetable Pesticides on Shallot Plants (Allium Ascalonicum L.) on Anthropod Diversity in Peatland Soil. Swamp Science: Science Journal of STIPER Amuntai, 12(2), 59-67.

Suherman, A. (2014). PHYSICAL EDUCATION LESSONS (Descriptive Qualitative Study at Cilengkrang Elementary School). 1(April), 71-76.

Sukirman, S. (2020). Writing skills ability test in Indonesian language learning at school. Journal of Conception, 9(2), 72-81

Utami, U. F., Febriana, V. U., & Zuraidah, Z. (2022, June). Nocturnal land surface insects in the PULO ACEH GLASS COAST ECOSISTEM. In Proceedings of the National Seminar on Biotics (Vol. 8, No. 1, pp. 122-127).

Wulansari, L. D. (2015). Development of plant diversity atlas: Euphorbiales, myrtales, and solanales as a means of identification. Biology Education Scientific Periodical (BioEdu), 4(3)