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Abundance of Insects using Light Traps in the Nursery Area at State Agricultural Polytechnic of Samarinda

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Abstract: It is known that insect species amount to 686,000 or 72% of the total species of the animal world. And when viewed in terms of human interests, insects can be divided into 2 groups, namely insect pests and useful / useful insects (Partosoedjono, 1985).

The purpose of this study was to identify and determine the abundance of insects to know the diversity of species, frequency of presence (fluctuation), abundance and dominance in the nursery area at State Agricultural Polytechnic of Samarinda.

The expected results of this study are to determine the number and abundance and density of insect populations both the number (n) and composition in the nursery area at State Agricultural Polytechnic of Samarinda.

The research was carried out for 3 months which included literature study, field orientation, preparation of tools and materials, data collection, data processing and preparation of research reports. Insect capture was carried out using the light trap method as a lure for insect gathering at night, insects were identified by equating, matching or comparing with literature books (Key to Insect Determination).

Data analysis was carried out by calculating the abundance of species based on the Species Dominance Index (Di) according to Heddy and Kurniati (1996), and knowing the level of dominance based on the Important Value Index (INP %) according to Curtis (1959) in Bratawinata (1998).

- ***The Results of Research During 1 Month of Data Collection in the Field Obtained the Following Results:***

- **There is an abundance of 115 insect individuals consisting of 18 species. Of the 18 species consisted of 4 orders namely Orthoptera, Lepidoptera, Diptera and Coleoptera. Of the 4 orders consists of 10 families namely Blattidae, Gryllidae, Acrididae, Arctiidae, Drosophyllidae, Cerambycidae, Scarabaeidae, Lampyridae, Chrysomelidae, and Coccinellidae. And there are 18 genera namely Blatta, Gryllus, Valanga, Pareuchaetes, Drosophylla, Xenolea, Pterolophia, Clepmetopus, Epepeotes, Epicasta, Rhytidodera, Apomecyna, Leucopholis, Photuris, Aphthona, Zygograma, Chrysolina and Brachiacantha.**
- **Based on the Dominance Index (Di) there are species that occupy the most dominant position, namely by Pareuchaetes insulata (21.74%), Photuris lucicrescens (15.65%), Blatta sp (12.17%), Aphthona nonstriata (11.30%), and Gryllus pensylvanicus (9.57%).**
- **Based on the frequency of presence, 2 species have a high frequency of presence, namely Blatta sp (4 frequencies, 10.26%), and Photuris lucicrescens (4 frequencies, 10.26%).**
- **Based on the value of the Index of Important Value (INP) there are 6 most dominant species namely Pareuchaetes insulate, Photuris lucicrescens, Blatta sp, Aphthona nonstriata, Gryllus pensylvanicus and Xenolea tomentosa. There are 6 sub-dominant species and 6 species that are not dominant.**

Keywords: *Insects, Dominance Index, Frequency and Species Importance Index Values.*

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I. INTRODUCTION

Insect pests include insects that can cause losses, such as insects that destroy leaves or destroy plant buds, insects that destroy plant stems / branches, insects that destroy fruit / flowers, insects as disease spreaders (vectors), insects that destroy / eat agricultural products or grains stored in warehouses.

The existence and population density of an animal/insect species is highly dependent on environmental factors, namely the abiotic and biotic environment. Abiotic environmental factors can be broadly divided into physical and chemical factors. Physical factors include temperature, moisture content, porosity, and soil texture. Chemical factors include salinity, pH, soil organic content, and soil mineral elements. Environmental factors present in a habitat greatly determine the abiotic structure of the animal community in a habitat (Natawigena, 1990). Insect species number 686,000 or 72% of the total number of species of the animal world. When viewed in terms of human interests, insects can be divided into 2 groups, namely insect pests and useful / beneficial insects. Useful insects include honey-producing insects, fiber-producing insects, and there are types of insects that can be food for humans and animals. There are several types of insects as destroyers of dead animals and plants, insects as natural enemies of insect pests and insects that help pollinate plants (Partosoedjono, 1985).

Biotic environmental factors for insects are other organisms that are also found in their habitat such as microflora, plants, and other animal groups. In the community, these types of organisms interact with each other. The interaction can be in the form of predation, parasitism, competition, and disease. Measurement of abiotic environmental factors is important because of the influence of abiotic environmental factors on the existence and population density of animal/insect groups. By measuring abiotic environmental factors, it will be known which factors have a major influence on the existence and density of the insect population to be studied (Suin, 1989).

II. METHOD

➢ *Place and Time of Research*

The research was conducted in the nursery area State Agricultural Polytechnic of Samarinda. The research was conducted for 3 months starting on November 25, 2020 - February 25, 2021. Included literature study, field orientation, preparation of tools and materials, data collection, data processing and preparation of research reports. Insect capture was carried out using the light trap method as a lure for insect gathering at night, insects were identified by equating, matching or comparing with literature books (Key to Insect Determination).

➢ *Materials and Tools*

- *The Tools used Include:*

✓ Emergency lights with a 3-4hour batery duration.
✓ Bottles / jars as preservation media in alcohol solution
✓ Wooden stick supporting the night trap (light trap)
✓ Digital camera for documentation.
✓ Flashlight to help with lighting
✓ Tweezers to pick up trapped insects
✓ Machete to clean the research site
✓ Stationery to take notes.
✓ Calculator to calculate research result

- *The Materials used in this Study are:*

✓ 70% alcohol to preserve trapped specimens
✓ White cloth measuring 1.5 x 3 m as light trap media.
✓ Mothballs, raffia rope as light trap equipment

➢ *Research Methods*

- *The Research Procedure Has the Following Work Sequence:*

✓ *Field Orientation*

Field orientation is carried out as a predecessor study whose purpose is to determine the work system in research and obtain a clear picture of the situation and conditions of the research area.

✓ *Literature Study*

Literature study is carried out to gain an understanding of the object to be observed.

✓ *Preparation of Tools and Materials*

Prepare all tools and materials that will be used in data collection in the field.

✓ *Trap Installation*

Light traps are set using a wooden stick on its side that is driven into the ground. To prevent the traps from being easily displaced, the ends are tied with rope and tied to the supporting sticks. There were 6 wooden sticks needed to set up the trap which were stuck on each side. The purpose of the sticks was to spread a 1.5 x 3 m white cloth for the insect trapping field with lamp bait at night. Traps were set at 2 different points in the nursery area. Specimens were collected using tweezers which were then placed in alcohol solution in a jar starting from 20.00-24.00 daily and recapitulated weekly in conditions not under a full moon.

✓ *Identification of Insect Species*

The method of insect identification is by comparing the insects found with insects found in literature books.

➢ *Data Processing*

The data obtained in this study were processed as follows:

- *Insect Species Composition*

According to Hedy and Kurniaty (1996), insect composition is the variety of species and the number of individual insect trapped in traps. From the data we have obtained, we can know which species of insect are dominant and not in the research area by knowing the number of species and their abundance, as follows:

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$$Di = \frac{ni}{N} x\ 100\ \%$$

Description: *Di* = dominance index of a species

ni = number of individuals of species i

N = total number of individuals

Dominance criteria according to Hedy and Kurniati (1996), organize the range of Dominance index values (*Di*) in 3 criteria, namely:

- Dominant: If the Dominance Index

Value (*Di*) ≥ 5%

- Sub-dominant: When the Dominance Index

Value (*Di*) is 2%-5%

- Not Dominant: When the Dominance Index

Value (*Di*)

➢ Relative Abundance/Nisbi (KR)

According to Hedy and Kurniaty (1996), the number of insect in question is the number of individuals of each spsecies of insect that was successfully obtained and identified in each research location. The relative abundance of insect presence can be calculated as follows:

$$KR = \frac{\sum \text{individuals of a species}}{\sum \text{individuals of all species}} \text{ x } 100\%$$

Dominance criteria according to Hedy and Kurniati (1996), organize the range of values in 3 criteria, namely:

- Dominant: If the value is ≥ 5%

- Sub-dominant: If the value is 2%-5%

- Not Dominant: If value ≤ 2%

➢ *Important Value Index (INP)*

The Important Value Index is calculated using the relative value of each parameter which can be obtained by the formula according to Curtis (1959) in Bratawinata (1998) as follows:

$$RF = \frac{\sum \text{frequency of a species}}{\sum \text{frequency of all species}} \text{ x } 100\%$$

$$KR = \frac{\sum \text{individuals of a species}}{\sum \text{individuals of all species}} \text{ x } 100\%$$

INP (%)= FR (%) + KR (%)

Description: INP = Index of Importance

FR = Relative Frequency

KR = Relative Density

According to Curtis (1959) in Bratawinata (1998) compiled the range of values in 3 criteria, namely:

- Dominant: When the value is 10.33 –36.64%

- Sub-dominant: If the value is 5 - 10%

- Not Dominant: If the value is ≤ 5%

III. RESULTS AND DISCUSSION

The results of the study obtained there is an abundance of 115 individual insects consisting of 18 species. Of these 18 species consist of 4 orders namely Orthoptera, Lepidoptera, Diptera and Coleoptera. Of the 4 orders consists of 10 families namely Blattidae, Gryllidae, Acrididae, Arctiidae, Drosophyllidae, Cerambycidae, Scarabaeidae, Lampyridae, Chrysomelidae, and Coccinellidae. And there are 18 genera namely Blatta, Gryllus, Valanga, Pareuchaetes, Drosophylla, Xenolea, Pterolophia, Clepmetopus, Epepeotes, Epicasta, Rhytidodera, Apomecyna, Leucopholis, Photuris, Aphthona, Zygograma, Chrysolina and Brachiacantha. The species of insects found can be seen in Table 1.

Table 1 Order, Family, Genus and Species of Insects Identified in the Nursery Area at State Agricultural Polytechnic of Samarinda

No	Order	No	Family	No	Genus	No	Species
1	Orthoptera	1	Blattidae	1	Blatta	1	Blatta sp
		2	Gryllidae	2	Gryllus	2	Gryllus pensylvanicus
		3	Acrididae	3	Valanga	3	Valanga nigricornis
2	Lepidoptera	4	Arctiidae	4	Pareuchaetes	4	Pareuchaetes insulata
3	Diptera	5	Drosophyllidae	5	Drosophylla	5	Drosophylla sp
4	Coleoptera	6	Cerambycidae	6	Xenolea	6	Xenolea tomentosa
				7	Pterolophia	7	Pterolophia melanura

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				8	Clepmetopus	8	Clepmetopus grossepunctatus
				9	Epepeotes	9	Epepeotes luscus
				10	Epicasta	10	Epicasta turbida
				11	Rytidodera	11	Rytidodera simulans
				12	Apomecyna	12	Apomecyna histrio
		7	Scarabaeidae	13	Leucopholis	13	Leucopholis rorida
		8	Lampyridae	14	Photuris	14	Photuris lucicrescens
		9	Chrysomelidae	15	Aphthona	15	Aphthona nonstriata
				16	Zygograma	16	Zygograma signatipennis
				17	Chrysolina	17	Chrysolina staphylaea
		10	Coccinellidae	18	Brachiacantha	18	Brachiacantha ursina

Then to find out the number of individuals during the study period, individual abundance data were obtained as many as 115 individuals. The following is shown the arrangement of insect species found in Table 2 which is arranged based on the level of dominance as follows:

Table 2 Insect Abundance Based on Species Dominance in the Nursery Area at State Agricultural Polytechnic of Samarinda

No	Species	ni	Di (%)	Dominance
1	Pareuchaetes insulata	25	21.74	Dominant
2	Photuris lucicrescens	18	15.65	Dominant
3	Blatta sp	14	12.17	Dominant
4	Aphthona nonstriata	13	11.30	Dominant
5	Gryllus pensylvanicus	11	9.57	Dominant
6	Xenolea tomentosa	6	5.22	Sub Dominant
7	Chrysolina staphylaea	5	4.35	Sub Dominant
8	Valanga nigricornis	4	3.48	Sub Dominant
9	Brachiacantha ursina	3	2.61	Sub Dominant
10	Leucopholis rorida	3	2.61	Sub Dominant
11	Drosophylla sp	3	2.61	Sub Dominant
12	Pterolophia mellanura	2	1.74	Not Dominant
13	Clepmetopus grossepunctatus	2	1.74	Not Dominant
14	Apomecyna histrio	1	0.87	Not Dominant
15	Epepeotes luscus	2	1.74	Not Dominant
16	Zygograma signatipennis	1	0.87	Not Dominant
17	Epicasta turbida	1	0.87	Not Dominant
18	Rytidodera simulans	1	0.87	Not Dominant
Total		115	100	

From this data, information on the frequency of presence of each species of insect can be found every week of the data collection period. For more details can be seen in Table 3 below:

Table 3 Frequency of Presence (Fluctuation) of Insects in the Nursery Area at State Agricultural Polytechnic of Samarinda

No	Species	Week to …				Total F	Total N
		1	2	3	4		
1	Pareuchaetes insulata	7	17	-	1	3	25
2	Photuris lucicrescens	2	3	5	8	4	18
3	Blatta sp	6	5	1	2	4	14
4	Aphthona nonstriata	5	6	2	-	3	13
5	Gryllus pensylvanicus	-	7	3	1	3	11
6	Xenolea tomentosa	-	1	1	4	3	6
7	Chrysolina staphylaea	4	-	-	1	2	5
8	Valanga Nigricornis	4	-	-	-	1	4
9	Brachiacantha ursina	-	1	2	-	2	3
10	Leucopholis rorida	2	-	1	-	2	3
11	Drosophylla sp	1		2	-	2	3
12	Pterolophia mellanura	1	1	-	-	2	2
13	Clepmetopus grossepuncatatalus	-	-	2	-	1	2
14	Apomecyna histrio	-	1	-	-	1	1
15	Epepeotes luscus	-	-	-	2	1	2

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16	Zygograma signatipennis	1	-	-	-	1	1
17	Epicasta turbida	-	-	-	1	1	1
18	Rytidodera simulans	-	-	-	1	1	1
Total		33	42	19	21	37	115

Then to determine the level of dominance of the species based on the value of the Index of Important Value (INP) according to the formula proposed by Curtis (1959) cited by Bratawinata (1998). The results of the calculation can be seen in Table 4 below, where the order of the species (composition) is arranged based on the value of the Index of Important Value (INP %).

Table 4 Insect Dominance in the Nursery Area at State Agricultural Polytechnic of Samarinda Based on the Order of Importance Index (INP).

No	Species	N	F	KR (%)	FR (%)	INP (%)	Dominance
1	Pareuchaetes insulata	25	3	21.739	7.692	29.431	Dominant
2	Photuris lucicrescens	18	4	15.652	10.256	25.909	Dominant
3	Blatta sp	14	4	12.174	10.256	22.430	Dominant
4	Aphthona nonstriata	13	3	11.304	7.692	18.997	Dominant
5	Gryllus pensylvanicus	11	3	9.565	7.692	17.258	Dominant
6	Xenolea tomentosa	6	3	5.217	7.692	12.910	Dominant
7	Chrysolina staphylaea	5	2	4.348	5.128	9.476	Sub dominant
8	Brachiacantha ursina	3	2	2.609	5.128	7.737	Sub dominant
9	Leucopholis rorida	3	2	2.609	5.128	7.737	Sub dominant
10	Drosophylla sp	3	2	2.609	5.128	7.737	Sub dominant
11	Pterolophia mellanura Pascoe	2	2	1.739	5.128	6.867	Sub dominant
12	Valanga nigricornis	4	1	3.478	2.564	6.042	Sub dominant
13	Clepmetopus grossepunctatus Br	2	1	1.739	2.564	4.303	Not dominant
14	Epepeotes luscus Fabricus	2	1	1.739	2.564	4.303	Not dominant
15	Apomecyna histrio	1	1	0.870	2.564	3.434	Not dominant
16	Zygograma signatipennis	1	1	0.870	2.564	3.434	Not dominant
17	Epicasta turbida	1	1	0.870	2.564	3.434	Not dominant
18	Rytidodera simulans White	1	1	0.870	2.564	3.434	Not dominant
Total		115	37	100	100	200	

To describe the abundance of species, it is calculated based on the dominance index. The dominance index in addition to describing the composition of species in the community, also shows the role of many types of organisms in relation to the community as a whole. The range of dominance index values used is > 5% for dominant species and between 2 - 5% for subdominant species while < 2% is not dominant (Heddy and Kurniati, 1996; Odum, 1998).

The level of dominance classification shows that the species that occupy the top position (dominant) with the highest Di value range is occupied by *Pareuchaetes insulata* (21.74%), *Photuris lucicrescens* (15.65%), *Blatta* sp (12.17%), *Aphtona nonstriata* (11.30%), and *Gryllus pensylvanicus* (9.57%). While there are 6 species that occupy sub-dominant positions with a range of index values between 5.22% (*Xenolea tomentosa*) to 2.61% (*Drosophylla* sp) and the remaining 7 species occupy the lowest rank (not dominant).

From the frequency of species presence, it can be seen from Table 3 that there are 2 species that have a high level of frequency of presence, namely the *Blatta* sp (4 frequencies, 10.30%), and *Photuris lucicrescens* (4 frequencies, 10.30%). The medium frequency level was occupied by *Pareuchaetes insulata*, *Gryllus pensylvanicus*, *Aphtona nonstriata*, and *Xenolea tomentosa* (3 frequencies, 7.69%) respectively. And the remaining 12 species occupy a low level of frequency of presence. The high and low level of frequency of presence of a species is determined by whether or not a species occupies (trapped) in the trap set (Heddy and Kurniati, 1996).

Then from the Index of Importance (INP) value, there are 6 dominating species that rank in the top 3 including *Pareuchaetes insulate*, *Photuris lucicrescens*, *Blatta* sp. There are 6 sub-dominant species that rank in the top 3 such as *Chrysolina staphylaea*, *Brachiantha ursine* and *Lycosa pseodoannulata* and there are 6 non-dominant species that rank in the top 3 including *Clepmetopus grossepunctatus* Br, *Epepeotes luscus Fabricus*, *Apomecyna histrio*.

The lack of individuals and species trapped may be due to the short observation time because it depends on the ability of batteries (emergency lights) which are very limited in electrical power storage, on average only able to last between 3-4 hours or may be due to the placement of traps that are not close to the nest (target) of insects or may also be due to the location or position of the lamp that is too low, on the forest floor, not at a certain height so that the light is blocked by trees. Another cause may be due to frequent rain at night so that data collection cannot be done.

The presence of insects makes an important contribution in forestry because insects help in pollinating plants, thus supporting the success of fertilization. These insects are commonly called pollinating insects, for example,

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butterflies (Lepidoptera), various beetles (Coleoptera) and several species of bees (Hymenoptera). In addition to these types of insects, there are also several types of insects that can improve the physical condition of the soil, so that the soil becomes fertile and there are several types of insects that are decomposers of dead plants and animals.

IV. CONCLUSION

- There is an abundance of 115 insect individuals consisting of 18 species. Of the 18 species consisted of 4 orders namely Orthoptera, Lepidoptera, Diptera and Coleoptera. Of the 4 orders consists of 10 families namely Blattidae, Gryllidae, Acrididae, Arctiidae, Drosophyllidae, Cerambycidae, Scarabaeidae, Lampyridae, Chrysomelidae, and Coccinellidae. And there are 18 genera namely Blatta, Gryllus, Valanga, Pareuchaetes, Drosophylla, Xenolea, Pterolophia, Clepmetopus, Epepeotes, Epicasta, Rhytidodera, Apomecyna, Leucopholis, Photuris, Aphthona, Zygograma, Chrysolina and Brachiacantha.

- Based on the Dominance Index (Di) there are species that occupy the most dominant position, namely by *Pareuchaetes insulata* (21.74%), *Photuris lucicrescens* (15.65%), *Blatta* sp (12.17%), *Aphthona nonstriata* (11.30%), and *Gryllus pensylvanicus* (9.57%).

- Based on the frequency of presence, 2 species have a high frequency of presence, namely *Blatta* sp (4 frequencies, 10.26%), and *Photuris lucicrescens* (4 frequencies, 10.26%).

- Based on the value of the Index of Important Value (INP) there are 6 most dominant species namely *Pareuchaetes insulate*, *Photuris lucicrescens*, *Blatta* sp, *Aphthona nonstriata*, *Gryllus pensylvanicus* and *Xenolea tomentosa*. There are 6 sub-dominant species and 6 species that are not dominant.

ADVICE

Based on the results of the research that has been carried out, suggestions that can be conveyed are: A similar (follow-up) study should be conducted using other traps over a longer period of time and with different locations.

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