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The Effectiveness of The Color Lamp on The Diversity of Insects in Onion Plantations

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ABSTRACT
Onions (Allium cepa L) are horticultural commodity that cannot be abandoned by people in everyday life. One of the limiting productivity of onions is pest and disease attack. Study of insect diversity is the first step in controlling pests in plants. The common alternative used by farmers to eradicate insect pests that do not damage the environment is using lights at night as a trap media. This study identified the diversity of insects that correlate to onions which are attracted to the color of the light that have been installed using 5 light colors, namely red, blue, white, yellow, and green. Insect diversity index found in this study contained 16 families, as many as 14,048 entity. Consisting of Chrysomelidae, Coccinellidae, Nitidulidae, Anthicidae, Delphacidae, Alydidae, Cucujidae, Noctuidae, Tipulidae, Agromyzidae, Cecidomyiidae, Tettigoniidae, Acrididade, Thripidae, Ichneumonidae, and Cicadellidae. The value of the diversity index(H') of insects in red is 1.78, yellow is 2.19, green is 2.28, white is 2.12 and blue is 0.74. The diversity on red, yellow, green, and white color is moderate, while blue color show low diversity. The dominance index in red is 0.28, yellow is 0.17, green is 0.14, white is 0.20, and blue is 0.66. This shows that the land has variety of insect species and there is no insect species that dominate.

***Keywords**: Diversity; Important Value Index; Domination.*

INTRODUCTION

Onion *(Allium cepa L.)*Is a horticultural commodity that can not be left out of society in everyday life. Besides being useful as a flavoring in cooking, shallots also contain nutrients that are indispensable for human health. Onion is one of the main vegetable commodities in Indonesia and has many benefits. Onion is one of the non-substituted spice groups that functions as food seasoning and traditional medicinal ingredients. Based on data from the *National Nutrient Database*, shallots contain carbohydrates, sugars, fatty acids, proteins and other minerals needed by the human body (Waluyo & Sinaga, 2015).

One of the limitations of shallot productivity is pest and disease attacks (Nelly et al., 2015). A large percentage of damage to plants can result in reduced tuber weight. This is because the formation of new leaves to replace damaged leaves results in smaller tubers and fewer in number (Nusyirwan, 2013). Therefore, damage due to pest attacks during the vegetative period greatly affects the formation of tubers (Purba, 2020).

Insects are the main group of pests. According to plant protection expert (Alim & Ramza, 2012). there are at least five reasons that can support this statement. First: insects are the largest group in the animal kingdom, approximately 2/3 animal species that have been identified are insects. Second: insects have a high adaptability to environmental conditions. Third: insects have a variety of food types. Fourth: insects can reproduce quickly. Fifth: insects can become resistant to insecticides.

Study of insect diversity is the first step in controlling pests in plants. Diversity can be used to identify and detect disturbances of existing ecosystem components, so that natural balancing efforts can be made without using chemical pesticides (Arifin et al., 2016). The light produced by the lamp is a detector to attract insects. many insect pests are very sensitive to light, especially at night (Adriansyah, 2020).

Another alternative that is commonly used by farmers to eradicate insect pests that do not damage the environment is to use lights at night as a medium for trapping grasshoppers. The lamp's electrical energy source is a generator with premium fuel. However, in this way the farmers have to spend additional funds to provide premium fuel which is quite expensive. The electrical energy used to turn on the lights can actually be obtained from solar power by utilizing solar panels. Solar panels will store electrical energy in the battery during the day and at night can be used to turn on the lights. Thus, farmers do not incur additional costs (Alamsyah et al., 2017).

For this reason, it is necessary to apply technology to modify the energy source and the type of lamp selected in order to make it more effective as a power source that can be easily relocated, the type of LED lamp (*Light-Emitting Diode*) and the color of the LED as a modification to the insect trap lamp in order to identify The color of the lamp is effective for trapping insect pests of onion cultivation. In this study, researchers will test the effectiveness of the color of the lamp on the diversity of insects in onion plantations.

METHOD

This research uses descriptive quantitative method. The parameters observed were the types of shallot plant insects attracted to various lightcolors *trap*. The collected insects will be identified according to the insect's body parts under a microscope, with comparisons using a minimum termination key to naming the family level. The tools used in this study were the manufacture of pest traps using the light method and solar panel electricity, namely solder, scissors, hammer, saw,gas *portabletorch*, ruler, AVO, identification book,*hand counter,* microscope and plastic basin. The materials used in the study were alcohol, 1 wp solar panel, 1 watt hpl led, 100 ohm resistor, 1 ampere diode, d882 transistor, 5000 mah battery, pvc pipe, wood, nails, wire / rope, detergent water, and cables. .

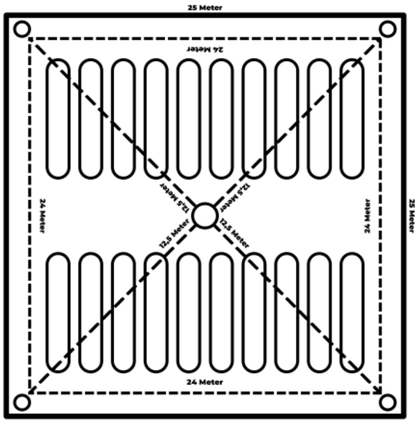

Figure 1. The Layout of The Laying of The *Light Trap* on The Shallot Plantations.

Description : o = *light trap*
▯ = the seedbed
--- = is the distance between *the light trap*

RESULT AND DISCUSSION

Based on the results obtained insect totaled 14 048 individuals consisting of 16 families. The most families found in blue light were thefamily *Delphacidae*. In *trap* the yellow light, 192 individuals were obtained consisting of 13 families. Family *Delphacidaecommon* is the mostfamily found in this color. In *trap* the red light, there were 51 individuals consisting of 9 families. The families *Tipulidae, Cecidomyiidae*, and *Tettigoniidae* are the smallest families found in this coloration. In *trap* the green light, there were 232 individuals consisting of 15 families. Family *Delphacidaecommon* is the mostfamily found in this color. In *trap* the white light, there were 525 individuals consisting of 14 families. On the light trap color is blue insect attraction is very significant in the compare with other color light traps (Andani & Nasirudin, 2021).

Table 1. Observation of The Number of Insects Caught in The Light Traps

NO	Family	Observations (tails)					Total
		Red	Yellow	Green	White	Blue	
1	*Chrysomelidae*	4	11	49	88	372	524
2	*Coccinellidae*	6	11	23	18	48	106
3	*Nitidulidae*		9	3	24	67	103
4	*Anthicidae*		8	11		12	31
5	*Delphacidae*	24	68	62	203	10390	10747
6	*Alydidae*		5	3		10	18
7	*Cucujidae*		6	2	11	10	29
8	*Noctuidae*	5	24	5	21	30	85
9	*Tipulidae*	2		2	11	10	25
10	*Agromyzidae*	3		18	39	60	120
11	*Cecidomyiidae*	2	17	18	25	70	132
12	*Tettigoniidae*	2	17	14	16		49
13	*Acrididade*				16	60	76
14	*Thripidae*		5	8	9	20	42
15	*Ichneumonidae*	3	11	7	36	1869	1926
16	*Cicadellidae*			7	8	20	35
TOTAL							14048

Table 2. Identification of Insect Role in Onion Plantantions.

Ordo	Family	Role	Literature
Coleoptera	*Chrysomelidae*	Herbivor	Sartikasari, 2015
	Coccinellidae	Predator	Mujalapah et al., 2019
	Nitidulidae	Herbivor	Rahayu et al., 2017
	Anthicidae	Predator	Rahayu et al., 2017
Hemiptera	*Delphacidae*	Herbivor	Sari *et al.*, 2017
	Alydidae	Herbivor	Sari *et al.*, 2017
	Cucucijae	Herbivor	Sumiati, 2018
Lepidoptera	*Noctuidae*	Herbivor	Astari, 2018
Diptera	*Tipulidae*	Predator	Siwi, 1991
	Agromyzidae	Herbivor	Sipayung, 2018
	Cecidomyiidae	Herbivor	Soesanthy dan Trisawa, 2011
Orthoptera	*Tettigoniidae*	Predator	Mujalapah et al., 2019
	Acrididade	Herbivor	Boror dkk, 1992
Thysanoptera	*Thripidae*	Herbivor	Soesanthy dan Trisawa, 2011
Hymenoptera	*Ichneumonidae*	Parasitoid	Boror dkk, 1992
Homoptera	*Cicadellidae*	Herbivor	Sari *et al.*, 2017

Result

According to Furlong and Zalucki (2010), the diversity of predatory insects in an ecosystem is very important to know, especially in terms of suppressing insect pest populations through biological control. The greater diversity of predators in an ecosystem can reduce yield losses due to insect pests.

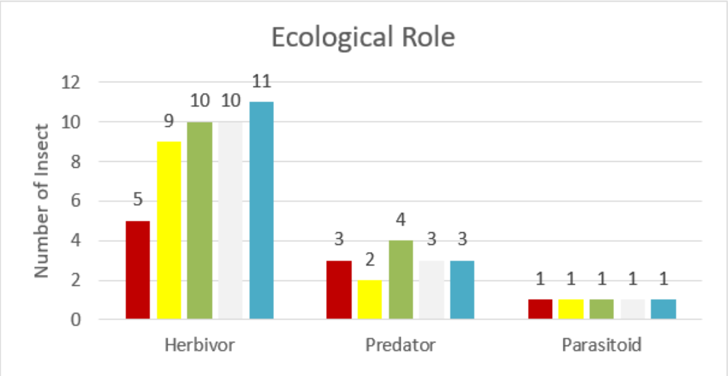

Figure 2. Ecological Role In Onion Cultivation

Based on the data in Figure 2. There are 11 families of herbivores who have the most roles in blue. The role of predators is at least found in yellow, amounting to 2 families. The colors red, yellow, green, white, and blue have the same effect on the role of parasitoids. Figure 2. Percentage of the role of insects in onion plantations.

Table 3. Percentage of The Role Insects in Onion Planting.

No	Role	Red		Yellow		Green		White		Blue	
		Total	**%**	**Total**	**%**	**Total**	**%**	**Total**	**%**	**Total**	**%**
1	Herbivora	38	74.51	156	81.25	175	75.43	444	84.57	11109	85.14
2	Predator	10	19.61	25	13.02	50	21.55	45	8.57	70	0.54
3	Parasitoid	3	5.88	11	5.73	7	3.02	36	6.86	1869	14.32
Total		51	100	192	100	232	100	525	100	13048	100

Based on the results of the study found the highest percentage of herbivores in blue 85.14%. The role of predators has the lowest value in the blue color 0.54%. In the blue color there is the highest percentage of the role of parasitoids 14.32%.

Discussion

Based on the data from the identification of insects found in the shallot, the most common insects found were the family *plantation Delphacidae* with a total of 10747 individuals. This was because the *Delphacidae* were insects that had a high social spirit and lived in colonies which caused the there are many (Siwi, 1991). The amount that is not much different is caused by environmental factors. The land used for observation is not a center for onion cultivation. The land is applied using chemical pesticides and is surrounded by rice fields. So that insects found in rice fields come to the light source.

Diversity Index (H'), dan Dominance Index (C) Insects in onion plantations.

The diversity index is a mathematical description to make it easier to analyze information about and how many individual species exist in an area (Purba, 2020) This is in accordance with the literature of which states that by knowing the value of the insect dominance index in the vegetable plant environment, it is expected that we can detect disturbances to the environment or pollution, for example the side effects of using synthetic pesticides and other chemicals on the environment and non-target biota.

In Figure 3. it can be seen that the value of the diversity index on shallot land in Plosoblole Village, Ploso District on *trap* the red lightis H' = 1.78, yellow color H' = 2.19, green color H' = 2.28, white color H' = 2.12, and blue color H' = 0.74. This indicates that the diversity of insects in the land environment is in the moderate category because H' = 1-3 but in blue is the environmental condition, indicating that the diversity of insects in the land environment is low. These environmental conditions are supportive for people in Plosoblole Village to cultivate shallots because there are still few people who cultivate shallots.

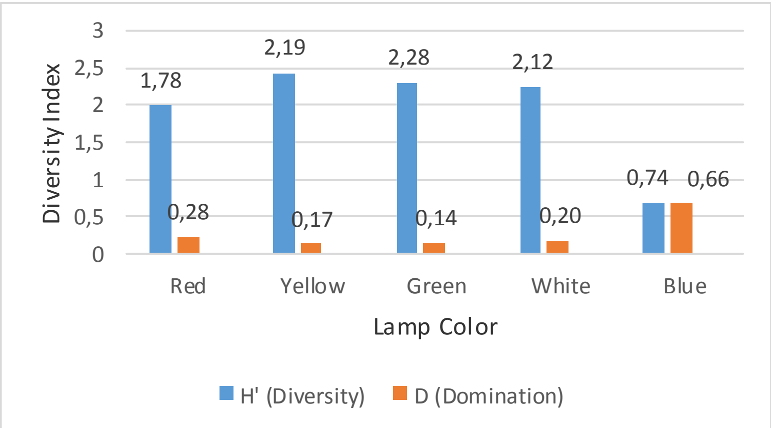

Figure 3. Insect Diversity And Dominance Index In Onion Plantations

From Figure 3. it is known that the dominance index in red is 0.28, yellow is 0.17, green is 0.14, white is 0.20, and blue is 0.66. The *light traps* yellow, white, red, green and blueindicate that the land has diverse insect families and no insect family dominates. If the dominance index > 1, then the family is not diverse. This is in accordance with the literature of (Astari et al., 2019) which states that the dominance of species in the observed insect community is calculated based on the dominance index. If the dominance index value <1 then the insect family is diverse, otherwise if the dominance index value = 1, then the insect species are not diverse. If there is an insect species that dominates a place, it can be immediately addressed for the sake of a balanced insect diversity.

CONCLUSION

Based on the results of research conducted in Plosoblole Village, Ploso District, Jombang Regency, the following conclusions:

- The color of the lights greatly affects the arrival of insects due to the nature of insects that are attracted to light. *Blue light traps* attract more insects than *light traps* other.
- Insect diversity index found in this study contained 16 families, as many as 14,048 individuals. Consisting of *Chrysomelidae, Coccinellidae, Nitidulidae, Anthicidae, Delphacidae, Alydidae, Cucujidae, Noctuidae, Tipulidae, Agromyzidae, Cecidomyiidae, Tettigoniidae, Acrididade, Thripidae, Ichneumonidae*, and *Cicadellidae.* The diversity index value (H') of insects is red 1.78, yellow is 2.19, green is 2.28, white is 2.12 and blue is 0.74. Red, yellow, green, and white colors show moderate diversity, while blue colors show low diversity. The Dominance Index for red is 0.28, yellow is 0.17, green is 0.14, white is 0.20, and blue is 0.66. This shows that the land has a variety of insect species and no insect species dominates.

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