The Modified Micro Environment Beans (Fabaceae) Storage and Effect to Behavior of Callosobruchus maculatus Fab. (Coleoptera: Bruchidae)

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Abstract. Irradiation is one element of the microclimate around the storage space can be controlled. Control of micro elements can be done using light. Beans are the second source of food after rice and wheat. Quantitative and qualitative losses during storage due to insect dominant. Callosobruchus maculatus (Fab.) is a species of insect damage to beans during storage. This study aimed to manipulate the microenvironment of storage space by using a light color. This research was conducted in the laboratory of the Faculty of Agricultural Technology, Serambi Mekkah University, Banda Aceh. Data collection and analysis using completely randomized design (CRD) factorial. The first factor to use four colors comprising light: red (L1), yellow (L2), green (L3) and white (L4). The second factor consists of three kinds of beans, namely: green beans (K1), soybean (K2), and red beans (K3) with 3 repetitions. The results showed an unpopular environment of C. maculatus Fabricius in a room that was illuminated in white (L4). The highest eggs placement preference for C. maculatus Fabricius on red beans (K3).

1. Introduction
Micro environment is a very limited space condition and can be controlled according to the needs of the environment. Microclimate modification is an attempt to create a more optimal environment in order to maintain the condition of storage space. According to [1] the elements of microclimate that influence each other's insect activities include irradiation, temperature, air circulation and relative humidity.

Pulses from the family Fabaceae, such as red beans, green beans and soybeans are well known and widely used because it is rich in vitamins, minerals, complex carbohydrates, protein, fat and fiber. Insect interest in nuts caused by several things, including aromas, color and structure morphology. Red bean (Vigna angularis) containing 18.55% protein; carbohydrates and fats 61.80% 1.62% [2] Green
beans (Phaseolusradiatus) contains protein 21.78%, 61.92% carbohydrate; 0.64% fat [3]. Soybeans (Glycine max) contain protein 31.62%; carbohydrates 26.82%; 20.57% fat [4].

The organism that causes damage to save material consisting of a rat (rodentia), birds (Aves) and insects. One species of insect food in storage is C. maculatus (Fab.) Of the order Coleoptera, family Bruchidae. Peanut damage during storage reaches 20-50% [5].

This research was initiated from several previous studies involving insect attraction to color. According to [6] Sitophylusoryzae is interested in yellow and green colors of feed during its development. Insects can be controlled by setting the physical factors such as light, temperature, humidity and noise [7]. Insects of C. maculatus (Fab.)Are attracted to peanut seed pigments [8].

Agroekosistem terrestrial insects in corn plants like yellow and green. Therefore it is necessary to study the manipulation of the microenvironment in the storage legumes (Fabaceae) and its influence on the behavior of Callosobruchusmaculatus (Fab.) (Coleoptera: Bruchidae). The research objective was to determine the influence of the microenvironment of the manipulation of the egg laying behavior of C. maculatus (Fab.) On beans in storage.

2. Methodology

This research was conducted at the Laboratory of Faculty of Agriculture Technology, Serambi Mekkah University, Banda Aceh from June-August 2018.

Materials used in this study is the green bean (Vignaradiata), soybean (Glycine max Merril), red beans (Phaceolus vulgaris) and the test insect species C. maculatus (Fab.) As many as 20 pairs for each experimental unit with a sex ratio (1:1). The tools used on: plastic jar diameter 81 cm, height 36 cm, standard thermometer, thermometer normal GEA glass micro brands, the brand Kenko hygrometer, moisture meter MD814 Digital 9 vol models, philip brands 5W incandescent bulbs.

This study uses a completely randomized design (CRD) factorial with three replications. Factors studied were: the color of the light and the type of bean. The first factor of light (L) is composed of red (L1), yellow (L2), green (L3) and white (L4). The second factor is the type of beans (K) consisting of green beans (K1), soy beans (K2) and red beans (K3).

data analysis using Analysis of Variance, if significant effect is continued with the Least Significant Difference (LSD) at the 0.05% level [9]. The variables observed were the number of adult insects that were attracted to the light and the type of bean in the micro storage environment. The number of eggs produced by female adult insects on the type of bean in a micro storage environment.

Research Procedures

The first step, the search for the inoculum of the test insects C. maculatus (Fab.) From farmers, traders storage and nuts. The second step, the mass rearing on each of the bean, the green bean, soya beans and red beans. The third step, the purification of the species C. maculatus (Fab.). The fourth step, the results of pure culture carried out mass breeding for two generations. The fifth step, prepare the place, tools research material. Sixth step, conducting research, observing, analyzing data.

3. Results and Discussion

1. The behavior of C. maculatus (Fab.) On the light and the type of beans

During the study the average temperature of the room was 29-32 oC, Rh 65-80%, the average peanut moisture content was 13-14%. The results of further tests (LSD 0.05%) of the number of adult insects C. maculatus (Fab.) Which were attracted to the light of the lamp and the type of bean as shown in figure 1.
Figure 1. Effect of lamp light and bean type on the presence of C. maculatus (Fab.) In a micro storage environment. Values followed by the same letter show no significant differences (P> 0.05; LSD 0.05 = 0.7453; KK = 24.2770)

Based on Figure 1 above shows that the preference of adult insects C. maculatus (Fab.) is directed to the color of red, yellow, green and white lights. While preference by type of bean, the highest found in red bean sequentially followed by soybeans and green beans.

The interest of the test insects C. maculatus (Fab.) on color, because color can be used in the search for traces of insects. Colors can also be used as insect flight navigation. Insects have two types of eyes, which consist of compound eyes and single eyes. The function of a single eye to detect distant objects, while the function of a compound eye to detect nearby objects. According to (Dorji, 2014) the compound eyes of insects are equipped with dozens of animals, so that insects can detect light from various directions. Likewise with a single eye to detect distant objects because of the reflection of light from the object.

Legumes have an outer shell that is smooth and shiny, so that when the light is given, then the outer skin will bounce the light in all directions. This light reflection is used by insects to choose the bean seeds to place the eggs [10]. On the other hand, the selection of peanuts because of the nutritional content needed by insects for their growth and development. The macro elements contained in bean seeds consist of protein, karbohira, fat, vitamins and other minerals. Green beans (Phaseolus radiatus) contain 21.78% protein, karbohirat 61.92%; 0.64% fat Maryam (2015). Soybeans (Glycine max) containing 31.62% protein; carbohydrates 26.82%; 20.57% fat (Rani et al. 2013). Red beans (Vigna angularis) contain 13.30% protein, 75.09% carbohydrates, and 5.05% fat [2].

Interest in C. maculatus (Fab.) in light is estimated, because each color of the lamp has a different wavelength. Red lights wavelength between 630-760 nm, long yellow lights wave 560-590 nm, green light with wavelength 490-560 nm. While the white lamp is a combination of all light called polychromatic light. The wavelength of white light will have an impact on the behavior of insects, which when white light is reflected on the material, the insect will avoid the light [11]. Furthermore [8] added, that the effect of the reflected color is the cause of insect preference in peanut seeds. Micro environmental modification with the use of lamp light can be used to provide warmth to the storage space. The warmth of the storing space will provide freshness to the storage material, especially in the stability of moisture content and humidity in the air around the storage room [12].

Peanut beetles C. maculatus (Fab.) Are pests from insect groups in the storage of humid conditions and without lighting with lighting will greatly benefit insect pests. Therefore, the storage room conditions must be controlled. The ideal temperature of storage space ranges from 28-33oC and
relative humidity ranges from 65-70%. Prevention of C. maculatus (F.) can be done physically, including using low UV light (254 nm), heating at 60 oC, high UV light (366 nm), and decreasing temperature to 0 oC [11].

Prevention of C. maculatus (Fab.) can be done by manipulating the microenvironment with the aim of changing the behavior of insects, so that the placement of eggs can be reduced in the material stored. According to [13] the behavior of insects can be changed by manipulating the atmosphere of the microenvironment by flowing nitrogen gas (N2) to inhibit the placement of eggs. Furthermore, [13] added that the addition of 5% nitrogen gas can reduce the number of eggs from C. maculatus (Fab.) insects. Manipulation of the environment by using microwave radiation can suppress the placement of the eggs of C. maculatus (Fab.). Modified atmosphere on the storage of nuts can reduce the level of damage reaches 30-50%.

Manipulation of the microenvironment of the storage space by using multiple colors of light dipen yimpanan an effort to manage insect pests physically. This research is the latest and renewable to be tested in the management of insulated C. maculatus (Fab.) insects.

2. Oviposition behavior of eggs C. maculatus (Fab.)

Anova test results and (0.05% LSD) preferences of adult insects Callosobruchus maculatus (Fab.) on the light and nuts as shown in Figure 2.

Figure 2. Effect of light illumination and beans on the population of C. maculatus eggs (Fab.) on storage environment. Values followed by the same letter show no significant difference (P > 0.05; LSD 0.05 = 4.070; KK = 17.4946)

Figure 2 has shown that the preference of the eggs of C. maculatus (Fab.) focused on the light yellow, red, green and white. Preferences based on the type of bean, the highest found in red bean sequentially followed by soybean and the lowest number of eggs on green beans.

From the picture above can be explained that the insect C. maculatus (Fab.) on the preference of the egg placement on the bean is affected by the lighting. Because of the nature of light can be reflected, while the seeds receive reflection and is reflected back into the surrounding environment. Insects in this case to receive a response from the second reflection. According to [14] insects will only put its eggs in the place where the venue sebagagai food for the child generation. Another possibility insects pick beans for aroma stimulus and insects receive stimulus [15]. Judging from the content of the essential elements contained in each of the bean will be different, such as soy bean protein content of 22%, 19% red beans, green beans and 18% [16].

4. Conclusion
The results showed that there is the influence of the use of light bulbs to change the behavior of C. maculatus beetles (Fab.) On a micro-climate storage. Adult test insect behavior changes seen in the light color selection and placement types of beans for eggs. The preferred light color is red, yellow, and green, while the color white is very unpopular. The best treatment of this research is on illumination with white light (L4) on all kinds of nuts. The use of white light can reduce egg oviposition C. maculatus (Fab.) On the surface of the seed beans at storage.

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