

STUDY OF PEST ATTACK INTENSITY ON COMMERCIAL STRAWBERRIES (*Fragaria x ananassa*)

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Abstract

This study aims to determine the types of pests that attack the various stages of plant development strawberries and measure the extent of damage to strawberry plants caused by pests. These observations were made in Tlekung Experimental Station, Research Institute for Citrus and Subtropical Fruit, Batu municipality, East Java in July until September 2018. The strawberry plants were observed consisting of three varieties, namely Sweet Charlie (SC), Dorit (DR), and Early Bright (EB). Each variety consisted of 20 plants in the vegetative and generative phases with different planting locations were in the screen house and open fields. Observations intensity of pest attacks were divided into three, namely the intensity of leaf-eating pests, pest mites and pests of fruit eaters. The results showed pests that attack strawberry plants consist of the phylum Mollusca and Arthropods. The highest intensity level of pest attacks occur at the location of strawberry cultivation in open fields than the strawberries grown in the screen house that is the pest mites reached 91,25%, which is included in the category very heavy attack on the variety SC. SC varieties were most susceptible varieties against leaf-eating pests and pest mites. Susceptibility to pests highly dependent on the age of the plant, character growth, and morphological characters.

Keywords: *pests, strawberries, intensity of attack, varieties*

1. INTRODUCTION

Modern or commercial strawberry plants (*Fragaria x ananassa*) is a subtropical fruit crops are widely cultivated in Indonesia. This plant is entered in Indonesia around the 1980s and was developed extensively in the 1990s (Rukmana, 2003). Strawberries and quite popular with the public because it has a fairly high economic value. In addition, the strawberry fruit including exotic fruits because it has a tiny form and a striking red color.

Strawberry fruit production in Indonesia until 2016 is still decreasing. Statistical data vegetables and seasonal fruits from the Central Statistics Agency explained that the production of strawberries in the country decreased from the year 2015 amounted to 31.801 to 12.090 tons in 2016 (Anonymous, 2016). In fact, if seen from the area of harvest, in 2016 over an area of 888 ha compared to 2015 amounted to only 746 ha. Issues production results are not comparable with the harvested area could be caused by several factors, one of which is the disruption of the strawberry crop pests and pest management systems by farmers rated not on target. The damage caused by pests and diseases on strawberry plants can occur in the vegetative parts of plants, for example roots, stems, and the leaves and on the generative plant in flower and fruit e.g. Diversity of

pests that attack strawberry plants depending on the phase of growth that resulted in damage to crops, so as to reduce the quantity and quality of the crop.

The intensity of pest attack or damage is parameters that can be used to measure the level of damage to crops caused by the existence of certain pests. The different types of pests that attack each strawberry varieties can also be distinguished by the degree of vulnerability of the plant. The vulnerability level can be measured by the level of pest attack in some varieties of strawberry plants. The characteristics of each strawberry varieties will also affect the level of pest attacks on certain varieties of strawberry plants. The calculation of the intensity of these pests can be distinguished by the type of pest that attacks such as leaf-eating pests, sucking leaves, leaf roller, fruit eaters, and others.

This study aims to determine the types of pests that attack the strawberry plants, and measure the extent of the attacks that have arisen, so it can be used to determine the pest control measures. Thus, the process of plant protection can be carried out just before the pests that attack exceeds the economic threshold, so the advantages of fixed production results can be achieved

2. MATERIALS AND METHODS

Research conducted at the Experimental Station Tlekung Research Institute for Citrus and Subtropical Fruit (Balitjestro) Batu, East Java, which lies at an altitude of ± 950 m above sea level. The timing of the research started from July 2018 until September 2018. This study used three varieties of strawberries that Sweet Charlie (SC), Dorit (DR), and Early Bright (EB). Each variety consisted of 20 plants in the vegetative and generative phases with different planting locations are in the screen house and open field. Observations intensity of pest attacks are divided into three leaf-eating pests intensity, the intensity of pest mites and intensity of fruit-eating pests.

The tools used in this research is the implementation of the loop, plastic, cutter, tweezers, brushes, microscopes, glass slide, and stationery. While the material used is 70% alcohol, and three varieties of strawberry plants.

Observations intensity of pest attacks on crops by determining scores strawberry pest damage on plants qualitatively with observations based on the value of the damage score (v) a specific category. Explanation of scores and categories are described in Table 1. The formula for calculation of the intensity of the attack as follows:

$$IS = \frac{\sum V \times ni}{N \times Z} \times 100\%$$

Note:

- IS = intensity of attack
 V = Score damage to the sample
 Ni = number of samples on the score damage
 N = the total number of samples
 Z = highest score of categories attack

Table 1. Categories score pest damage.

Damage score (v)	Damage level (%)	Category
0	0	Healthy
1	≤ 25	Light
2	$> 25-50$	Moderate
3	$> 50-75$	Heavy
4	> 75	Very heavy

Source: Pedoman Pengamatan dan Pelaporan Perlindungan Tanaman Pangan (Ano-nymous, 2008).

3. RESULTS AND DISCUSSION

Type Pests on Strawberry Plants

Strawberry plants are seasonal fruit crop plant that has developed quickly and can be harvested every season. The observation of the identification of pests that attack strawberry plants in the vegetative and generative phase is shown in Table 2. All pest attack strawberry plants in the vegetative phase and generative. Parts of plants attacked depending on the type of pests that attack.

The level of diversity of pests that attack strawberry plants may depend on the location of the crops or the strawberry plant growing environments. Strawberry plants can be grown in open fields or in the screen house. The observation of pest species are listed in Table 3 explains that all kinds of pests of strawberries can be found in open fields, but if in the screen house pests that attack less. The pests do not attack strawberry plants in the screen house that snails and grasshoppers. This means that the location of the planting strawberries in the screen house can suppress pests that attack the strawberry plants. Prabaningrum and Moekasan (2017) reported that the planting of crops in the screen house can suppress pest populations so as to improve the efficiency of the use of insecticides

Table 2. Types of pests in strawberry crop development phase

No	Type pests	Phylum: order	Phase development of plants		Part plant attacked			
			vegetative	generative	stems	leaf	flower	fruit
1	Armyworm	Arthropods: Lepidoptera	√	√	√	√	√	√
2	Snail (keong)	Mollusca: Pulmolata	√	√	√	√	√	√
3	Snail (bekicot)	Mollusca: Pulmolata	√	√	√	√	X	√
4	Slug	Mollusca: Pulmolata	√	√	X	√	X	√
5	Beetle	Arthropod: Coleoptera	√	√	X	√	√	X
6	Mite	Arthropod: Acarina	√	√	X	√	X	X
7	Lice leaves	Arthropod: Homoptera	√	√	X	√	√	X
8	Grasshopper	Arthropod: Orthoptera	√	√	X	√	X	X

Note: √ = attacked; X = not attacked

Table 3. Type of crop pests on the location of the different strawberry plants.

No.	Type pests	Phylum: order	Locations	
			Screen house	Open fields
1	Armyworm	<i>Arthropods: Lepidoptera</i>	√	√
2	Snail (<i>keong</i>)	<i>Mollusca: Pulmolata</i>	√	√
3	Snail (<i>bekicot</i>)	<i>Mollusca: Pulmolata</i>	X	√
4	Slug	<i>Mollusca: Pulmolata</i>	√	√
5	Beetle	<i>Arthropod: Coleoptera</i>	√	√
6	Mite	<i>Arthropod: Acarina</i>	√	√
7	Aphids	<i>Arthropod: Homoptera</i>	√	√
8	Grasshopper	<i>Arthropod: Orthoptera</i>	X	√

Note: √ = attacked; X = not attacked

Balitjestro have developed about ± 30 varieties of strawberries. Most cultivated population in Balitjestro ie varieties Sweet Charlie, Early Bright, Brastagi, Dorit, Osogrande, and California. At this pest identification made observations on three varieties of strawberries, namely SC, DR and EB. The observation of the type of pests that attack several varieties of strawberries in Table 4 shows the average is the same. There is only one different pest and only strike at any EB varieties namely aphids. Pests only attack aphids on strawberry crop varieties because of the character of EB only EB strawberry plants different from other varieties. Based

on morphological observation of three varieties of the strawberry plant, strawberry plant varieties EB has a habit of growth or type of crown spread. The shape of the leaf is wider with a long petiole and stem with a feather in a horizontal position. Based on morphological characters resulted in their growing environment preferred by aphids compared to the other varieties. Smith (1989) states that some plant characters such as hairs (trichomes), glandular hairs (glandular trichome), fur, thorn, cellulose layer, a layer of wax, and a layer of thick skin that can serve as a factor in plant defense against pests.

Table 4. Type of pest on three commercial varieties of strawberry plants.

No.	Type pests	Phylum: order	Varieties				
			Sweet (SC)	charlie	Dorit (DR)	Early (EB)	bright
1	Armyworm	<i>Arthropods: Lepidoptera</i>	√		√	√	
2	Snail (<i>keong</i>)	<i>Mollusca: Pulmolata</i>	√		√	√	
3	Snail (<i>bekicot</i>)	<i>Mollusca: Pulmolata</i>	√		√	√	
4	Slug	<i>Mollusca: Pulmolata</i>	√		√	√	
5	Beetle	<i>Arthropod: Coleoptera</i>	√		√	√	
6	Mite	<i>Arthropod: Acarina</i>	√		√	√	
7	lice leaves	<i>Arthropod: Homoptera</i>	X		X	√	
8	Grasshopper	<i>Arthropod: Orthoptera</i>	√		√	√	

Note: √ = attacked; X = not attacked

The intensity of the attack pests Leaf-eating pests

Leaf-eating pests that attack strawberry plants consist of armyworms, slugs, snails, beetles, and grasshoppers. The fifth of these pests eat the leaves of strawberries alternately and cause leaf damage in the form of the leaves undergo a hole or exhausted nothing left. This leaf damage can lead to the inhibition of plant growth because it leaves the main function is to produce photosynthesis.

The result of the calculation of the intensity of leaf-eating pests that occur on the 3 varieties of

strawberries on a bar chart (Figure 1) shows that the SC on the generative phase varieties grown on land that is the highest damage in the category of heavy attacks (50 <s<75%). This occurs because the varieties of strawberry plants SC is a plant that has the oldest age among other strawberry plants which is about two years. The older age of the plants of pests of plants is also getting old, pest attack began when the vegetative to the generative phase. Rodriguez (1979) states that a severe attack by pests resulting in death of the plant, it really

depends on the duration of the attack and the age of the plant.

Mite pests

Pest mites are polyfage and has more than 100 types of plants that can be attacked, namely beans, eggplant, peanuts, oranges, and others (Pracaya, 2008). Mites are not a major pest on strawberries, but in planting strawberries Experimental Station Tlekung Balitjestro these pests are found. It can be caused by the migration of pests by several factors such as wind, humans, and others. This migration is derived from citrus groves which are hosts for the pest mites.

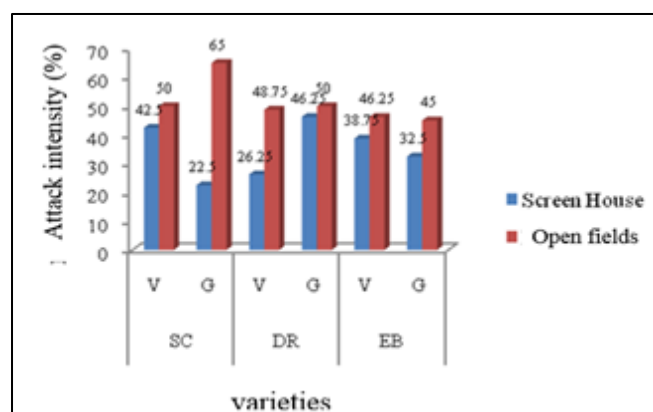


Figure 1. Diagram leaf stem intensity of pest attack.

Note: SC = Sweet Charlie; DR = Dorit; EB = Early Bright; V = vegetative; G = generative

Symptoms caused mite pests that cause spots - yellowish white spots on the leaves, because the mites suck leaf chlorophyll substance. But to be able to see these pests can clearly using a loop to the observations in the field. Severe attack of this mite will make a nest on strawberry plants and eventually the plant will dry out and die due to failure due to loss of photosynthetic leaf chlorophyll substance.

Pest mites known populations are most numerous in the strawberry crop land open than in the screen house. The spread of pests very easily occur in open land with the help of the wind and other factors. When viewed from the level of intensity of pests, degree of damage to crops in open fields is certainly greater than in the screen house. Screen house has a very important role to prevent pests on crops.

Mite pests with the highest intensity of the attack shown in the bar chart (Figure 2) that occurred on strawberry plants in the vegetative phase SC varieties are planted in open fields, reaching 91,25% included in the category of attack dried up. While the intensity of the attack was lowest in the DR varieties included in the light weight category.

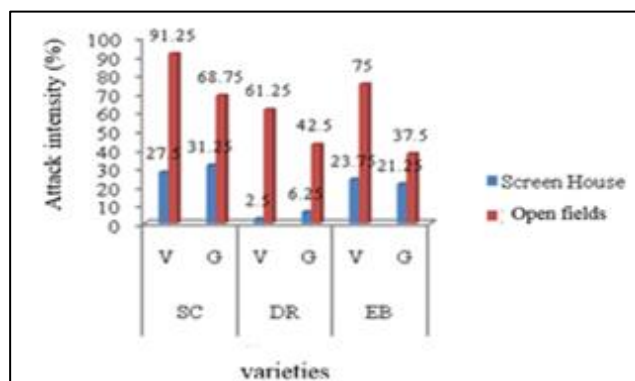


Figure 2. A bar chart intensity mite pests.

Note : SC = Sweet Charlie; DR = Dorit; EB = Early Bright; V = vegetative; G = generative

The highest attack rate occurred because of the character of the strawberry plant varieties SC differs from other varieties that cause mite prefers characters SC varieties of strawberry plants. SC varieties grown or type growth habit spreading crown, so that the moisture level in the low plant. Different varieties of mites attack DR experiencing low as strawberry varieties DR has the character of plants with leaf canopy that collects overlap one another. Petiole shorter than other varieties pose a higher humidity conditions in the plant environment. Knapp, et al. (2003) states that the mites appear in the dry season, in the summer period and a long dry capable of spinning threads of the web. Hot, dry weather supports the reproduction and survival of red mite, because in such conditions biological control by entomopathogenic fungi is virtually nonexistent. Thus mite prefers environmental conditions a plant that has a lower moisture at higher temperatures.

Fruit-eating pests

Fruit-eating pests that attack strawberries are armyworms, slugs, snails, and slugs. Fourth these pests cause damage on the quantity and quality of strawberry fruit. Pest on strawberries is very important and need to be considered. Even a mild attack of fruit-eating pests heavy attack will hurt farmers because the strawberries were injured although little will result in the form of fruit is not perfect. In addition, the fruit has been damaged very easily eaten by pests will rot. Thus if it is not done quickly control it could lead to crop failure.

Fruit-eating pest that occurs in all three varieties of strawberry plants were observed almost the same as other pests that there are significant differences in the different planting locations. Pests in open fields is greater than the strawberry plants were planted in the screen house. Planting strawberry plants in open fields causes the results of the strawberries would be lower because of an attack of various pests.

The result of the calculation of the intensity of pest-eating fruit in a bar chart (Figure 3) shows the three varieties of strawberry plants in the area were damaged hopper by category heavy attack ($50 < s < 75\%$) and in the screen house the medium category ($25 < s < 50\%$). All varieties experiencing the same level of pest attacks, differing only in its location.

According to research Syahroni, et al. (2015) EB strawberry varieties have the lowest levels of fruit aromas and texture of the loudest. While most software are varieties SC. For fruit sweetness levels were not significantly different. This means that the fruit-eating pests are not based on aroma, sweetness, and the fruit of violence.

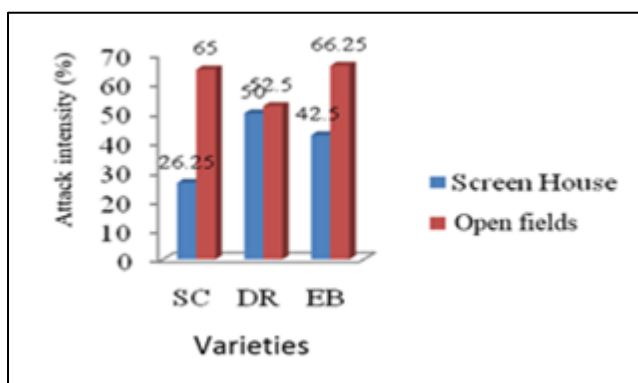


Figure 3. The bar chart intensity of fruit pests.

Note: SC = Sweet Charlie; DR = Dorit; EB = Early Bright

4. CONCLUSION

Pests that attack commercial strawberry plants consist of the phylum Mollusca and Arthropod. The average pest attack on vegetative and generative phase strawberry plants by attacking some parts of the plant such as leaves, stems, flowers and fruits depending on the type pests. Pests can be observed through the symptoms and signs of any pest attacks that have certain characteristics. The highest intensity level of pest attacks occur at the location of strawberry cultivation in open fields than the strawberries grown in the screen house. In addition, the vulnerability of some varieties of strawberries against leaf-eating pests and mites depends on the age of the plant, planting media, character growth, and morphological characters. Yet at the fruit-eating pests

5. ACKNOWLEDGEMENTS

The authors wish to thanks to the Head of Research Institute for Citrus and Subtropical Fruit, Batu, East Java, which has provided the opportunity to observe pests in strawberry crops.

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