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Distribution Patterns of Fruit Borer Pest *Hypothenemushampei* in Arabica Coffee Plantation, Bener Meriah Regency

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Abstract
Background*: The fruit borer pest Hypothenemushampeiattacks the young fruit; so, it falls and decreases the quality and quantity of the harvest. The attack leaves marks on the seeds and negatively affects the flavors. This study is conducted to see the distribution pattern at three different altitude in BenerMeriah Arabica coffee plantations. It can help farmers to control the Hypothenemushampei pest because the Arabica coffee plant has a fairly high economic value.*
Materials and Methods: *This research is conducted on Arabica coffee plantations at three altitudes: 1300-1400 m above sea level, 1400 -1500 m above sea level, and 1500 to 1600 m above sea level with a regular cultivating system, and there are not many dead plants.The Data distribution pattern is analyzed using the binomial distribution index, the intensity of the variance relationship, the green coefficient, and the Morisita index.*
Results*: The results show the value of 2 <K <8,0 the value I<1, the value of CX>1, and the value of I $_{\delta}$ <1. Therefore, it is concluded that the Hypothenemushampei distribution pattern is well clustered at an altitude of 1300-1400 masl, 1400-1500 masl, and 1500-1600 masl.*
Conclusion:*The conclusion of this research was the distribution pattern of Hypothenemushampei in BenerMeriah coffee plantations was clustered (grouped).*
Key Word*:Hypothenemushampei, Arabica coffee, distribution, altitude.*

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I. Introduction

Arabica coffee is the type of coffee that is widely commercialized in the world. Coffee also consumes worldwide due to its organoleptic and stimulating properties and beneficial health effects (Rodrigues and Bragagnolo, 2013). One of the obstacles in coffee plantations is pest infestation. There are several types of pests that attack coffee plants, including coffee fruit borer (*Hypothenemus hampei*), stem borer (*Zeuzera* sp.), Branch borer (*Xylosandrus* spp.), Green lice (*Coccus viridis*), mealybugs (*Ferrisia virgata*), and *Antestiopsis thunbergii* (Adi, 2015)

The coffee fruit borer pest (*Hypothenemus hampei*) is a major pest of coffee plants that cause a lot of harvest loss in the coffee producer regions such as Indonesia, South America, and Southeast Asia (Vega, Infante, Castillo, and Jaramillo, 2009; CABI, 2011). The attacked coffee plant can suffer young fruit fall, decrease quality and quantity of harvest, and the coffee taste is a defect due to the bite mark of pest attack on coffees beans (Damon, 2000; Jaramillo, Borgemeister, and Baker, 2006; Romero and Cortina, 2007).

To find out the sampling method and the number of samples to obtain to observe the level of fruit borer pest attack, the distribution of this pest must be determined in advance. The results of in-depth research conducted by Wiryadi Putra (2014) stated that the distribution of this pest in Arabica coffee plantations in Salvador follows a group (clustered) distribution, and it is in accordance with the negative Binomial law (Decazy *et al.*, 1989). However, the distribution type of fruit borer pests in Bener Meriah district has not been revealed, both in the spatial distribution and vertical distribution. The type distribution of a pest is very important to develop a control strategy in an integrated manner. Therefore, it is necessary to investigate the distribution patterns of Coffee fruit borer pest (*Hypothenemus hampei),* simultaneously measuring the level of damage caused by *Hypothenemus hampei* in Arabica coffee plantation in Bener Meriah. This study aims to determine the distribution pattern of *Hypothenemus hampei* in three areas based on altitude.

II. Material And Methods

In this study, the distribution pattern of the *Hypothenemus hampei* pest was carried out on the arabica coffee plantation at Bener Meriah district, with an altitude of 1300-1600 meters above sea level (masl). It was divided into three stations: Station 1 at altitude 1300-1400 masl, Station 2 at altitude 1400-1500 masl, and Station 3 at altitude 1500-1600 masl. As an observation plot, 400 coffee plants were used in each station with a

uniform productive habitus, a regular planting system and fewer dead plants. The trees were observed for the pest population parameters, with a plot size of 20 m x 20 m at the predetermined stations.

The observation was conducted on four coffee branches located in the center of the tree. The determination of the four branches in each section followed the cardinal directions; the branches that lead to the north, east, south, and west. Observation of the pest attacks intensity was carried out by calculating the percentage of affected fruit on all fruits for each branch, with the formula:

$$\mathbf{I = (Bb/Bt)*100\%}$$

Information: I = intensity of attack; Bb = fruit attacked by pest / branch; and Bt = total number of fruits / branches. (Wiryadiputra, 2014)

Observations were conducted at the peak of the harvest period when some of the coffee fruit was still green and about 6 - 7 mm in diameter, and the seeds began to harden. This observation time was based on the time available and the presence of fruit borer pests. The fruit borer pest attack on Arabica coffee started around 2- 3 weeks. For the Binomial distribution index (k), if the value is low and positive (k <2.0), the level of aggregation or grouping is high; if 2.0 <k <8.0 means *moderate aggregation*; and if k> 8.0 means random or random distribution. To clarify the spatial distribution pattern of fruit borer pests, mapping was carried out based on the level of attack and population level in Arabica coffee.

From the data obtained, the mean (x_r) and variance (s^2) are calculated with the following formula ;

$$\mathbf{X_r} = \frac{\sum \boldsymbol{x}}{\boldsymbol{n}}$$

Information: X_r = average sample ; n = Number of samples taken; $\sum$ x : Data taken (level of attack and fruit borer pest population) . (Southwood, 1975):

$$\boldsymbol{s^2} = \frac{\{\sum(\boldsymbol{x^2}) - (\sum \boldsymbol{x})^2/\boldsymbol{n}\}}{(\boldsymbol{n-1})}$$

Information: S^2 = Variance ; x^2 = Sample mean ; $\sum$ x = Data taken (level of attack and fruit borer pest population) ; n = Number of samples taken . (Southwood, 1975):

$$\mathbf{k} = \frac{(\boldsymbol{x}_r)}{(\boldsymbol{s^2 - x}_r]}$$

Information: K = Negative Binomial distribution index ; S^2 = Variance ; x_r = Sample average . (Costa *et al.*, 2010).

The relationship between variance and mean (I) can be explained if I = 1, it means the random spatial distribution; if I <1, then the distribution is regular or uniform; and if I> 1, then the distribution is grouped (aggregate, contagious, clumped). For the Binomial distribution index (k), if the value is low and positive (k <2.0), the level of aggregation or grouping is high; if 2.0 <k <8.0 means moderate aggregation; and if k> 8.0 means random distribution. To clarify the spatial distribution pattern of fruit borer pests, mapping was carried out based on the level of attack and the level of the population.

III. Result

Based on research that has been conducted at three altitude levels, namely 1300-1400 m asl, 1400-1500 m asl, 1500-1600 m asl, it is found that the distribution pattern of the Hypothenemus hampei is clustered. Presented in Figure 4.1 with a K value <of 2 (grouped).

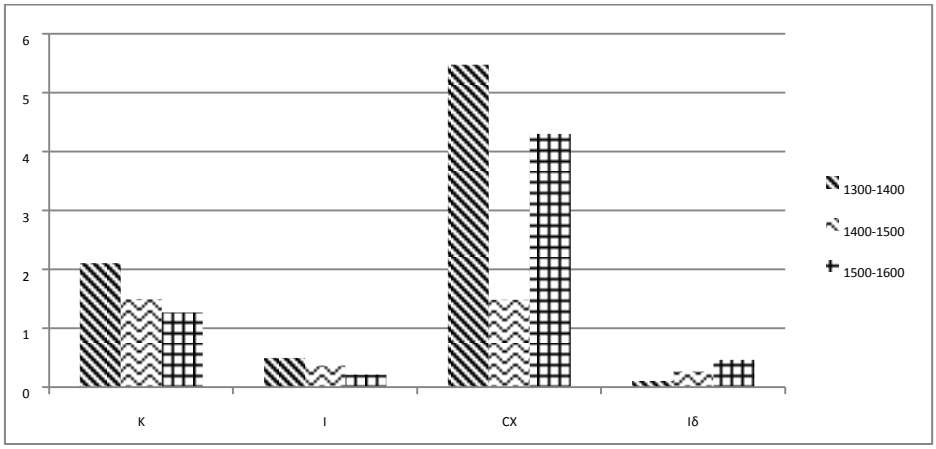

Fig 1. Binomial Distribution Index, Intensity of Variant Relationship, Green Coefficient, Morista Index

IV. Discussion

Distribution pattern of *Hypothenemus hampei* at Bener Meriah coffee plantation.

Coffee plants dominate plantation in Bener Meriah. Coffee in Bener Meriah consists of several types; however, the types of coffee observed in this study are Arabica coffee. Arabica coffee production has decreased in the last seven years and one of the reasons for the decline is the increased spread of coffee fruit pests. It gnaws at the fruit flesh so the higher the pest spread, the higher the number of coffee fruit damaged. *Hypothenemus hampei* is a pest that lives on coffee fruits. Based on research carried out at three altitude levels (1300-1400 masl, 1400-1500 masl, and 1500-1600 masl), the distribution patterns of *Hypothenemus hampei* were clustered. The data processing uses four benchmarks: the relationship of mean and variance, Morisita's index, Green coefficient, and the binomial distribution index. The Green coefficient analysis results showed the value was far from 1; therefore, the classification level is not interpreted as optimal. This was in line with research by Wiryadiputra (2014), which stated the distribution pattern of the pest on Arabica coffee. Both attack and population levels did not appear significantly different from Robusta coffee, the clustered distribution.

Based on the results, it was found that the distribution pattern of the *Hypothenemus hampei* was clustered at three altitude levels (1300-1400 masl, 1400-1500 masl, 1500-1600 masl).Seranganhama kopi telahmenajdipermasalahan yang cukupumumpadatumbuhan kopi (Acharya, 2014). It was presented in Figure 1 with the value of $K < 2$ (clustered). Distribution of the *Hypothenemus hampei* most commonly found at an altitude of 1300-1400 m above sea level; thus, this altitude assumed to be a very good location for the growth of *Hypothenemus hampei*. The pest was also growing faster at lower altitudes, as explained by PCW (2002) and Susniahti *et al.* (2005). At the height of 500 m above sea level, the insect took 25 days to develop. At an altitude 1200 m above sea level, it took 33 days to develop. It was similar to Jaramilo *et al*. (2009), who explained that the development of *H. hampei* was affected by temperature and the coffee fruit availability. *H. hampei* could live at 15^0 C - 35^0 C. The optimum temperature for the development of eggs was between 30^0 C - 32^0 C, and for the larvae, pupae, and adults were between 27^0 C - 30^0 C. The female insect couldeat the fruit coffee between 20^0 C - 33^0 C; however, at 15^0 C and 35^0 C, the female insects could not bore the fruit or could bore the coffee fruit but did not lay eggs. In addition, it is necessary to manage soil nutrition as one of the most important agronomic practices for damage by stem borer pests (Thapa, 2016).

V. Conclusion

The conclusion of this research was the distribution pattern of *Hypothenemus hampei* in Bener Meriah coffee plantations was clustered (grouped) whether at an altitude 1300-1400 masl, 1400-1500 masl, or 1500-1600 masl. Moreover, most of the *Hypothenemus* pests were found at the first station, at an altitude of 1300-1400 masl.

References

[1]. Adi, S. (2015). *Pengenalan Hama Penting Tanaman Kopi*. Dinas Perkebunan Provinsi Lampung. Bandar Lampung

[2]. Acharya, B. and Dhakal, S.C., (2014). Profitability and major problems of coffee production in Palpa District, Nepal. International Journal of Applied Sciences and Biotechnology, 2(4), pp.460-463.

[3]. Bragagnolo, N. (2013). Antioxidant enzyme activity and hydrogen peroxide content during the drying of Arabica coffee beans. *European Food Research and Technology* 236: 753-758.

[4]. Damon, A. (2000) A review of the biology and control of the coffee berry borer Hypothenemus hampei (Coleoptera: Scolytidae). *Bulletin of Entomological Research*, 90, 453–465.

[5]. Decazy, B.; H. Ochoa & R. Lotode (1989). Indices de distribution spatiale et methode d'echantillonnage des populations du scolyte des drupes du cafeier, Hypothenemus hampei Ferr. (Spatial distribution indices and sampling method for populations of the coffee berry borer, Hypothenemus hampei Ferr.). *Cafe Cacao The (Paris)*, 33, 27—41.

[6]. Infante, F., Pérez, J., dan Vega, F. E. (2012). Redirect research to control coffee pest Nature, 489, 502.

[7]. Jaramillo, J., Chabi-Olaye, A., Kamonjo, C., Jaramillo, A., Vega, F. E., Poehling, H-M., dan Borgemeister, C. (2009). Thermal tolerance of the coffee berry borer *Hypothenemus hampei*: predictions of climate change impact on a tropical insect pest. *Plos One*, 4(8), 1–11.

[8]. Rodrigues, N. P., Benassi, M. T., and Bragagnolo, N. (2013). *Scavenging capacity of coffee brews against oxygen and nitrogen reactive species and the correlation with bioactive compounds by multivariate analysis*. Food Research International.

[9]. Romero, J. V., & Cortina, H. (2007). Life tables of Hypothenemus hampei (Coleoptera: Curculionidae: Scolytinae) on three coffee accessions. *Rev Col Entomol*,33: 10–16.

[10]. Thapa, S. and Lantinga, E.A., (2016). Infestation by coffee white stem borer, Xylotrechus quadripes, in relation to soil and plant nutrient content and associated quality aspects. Southwestern Entomologist, 41(2), pp.331-336.

[11]. Southwood, T. R. E. (1980). *Ecological Methods Second Edition*. Chapman and Hall. New York.

[12]. Trujillo, H. I., Aristizábal, L. F., Bustillo A. E., dan Jiménez Q. M. (2006). Evaluación de métodos para cuantificar poblaciones de broca del café, *Hypothenemus hampei* (Ferrari) (Coleoptera: Curculionidae: Scolytinae), en fincas de caficultores experimentadores. *Revista Colombiana de Entomología*, 32(1), 39–44.

[13]. Vega, F. E., Infante, F., Castillo, & A., Jaramillo, J. (2009). The coffee berry borer *Hypothenemus hampei* (Ferrari) (Coleoptera: Curculionidae): A short review, with recent findings and future research directions. T*errestrial Arthropods* Review, 2: 129– 147.

[14]. Wiryadiputra, S. (2014). Distribution Pattern of Coffee Berry Borer (*Hypothenemus Hampei*) on Arabica and Robusta Coffe. *Pelita Perkebunan*, 30(2) , 123–136