

Exploration of Clove stem border in East Bolaang Mongondow District

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Abstract : Over the last few years, clove production in North Sulawesi has decreased significantly compared to previous years, thus placing North Sulawesi as the fifth clove producer, but in terms of area it ranks first in Indonesia. This study aims to determine the species and percentage of attacks as well as the distribution pattern of stem borer pests that attack clove plants in East Bolaang Mongondow District. The method used is by observing directly the symptoms of damage caused by stem borer pests in clove plantations in several villages and sub-districts of East Bolaang Mongondow District. The results showed that the species of pest that attacks clove plant stems in East Bolaang Mongondow District is *Hexamitodera semivelutina* Hell. (Cerambycidae: Coleoptera). The average percentage of stem borer pests from the Cerambycidae family in several villages was relatively high, ranging from 49.20% -79.40%, while stem borer pests from the Buprestidae family in several villages and sub-districts in East Bolaang Mongondow District were not found attacking the stems of clove plants, such as those found attacking cloves in South Bolaang Mongondow District.

Keywords : Clove, Cerambycidae, *H. semivelutina*, Buprestidae, stem borer.

1. Introduction

Clove productivity in Indonesia is between 150 and 600 kg per hectare, and North Sulawesi is the province with the highest productivity¹. Clove productivity is strongly influenced, especially by appropriate agroecology and agro-climate, as well as maintenance and control of pests and plant diseases. The results of a survey conducted by researchers, namely in August - September 2014 and 2015, it turns out that in addition to the main pests and diseases that have long been known to attack clove plants in North Sulawesi, namely stem borer, *H. semivelutina*², and leaf fall disease³, also found insects which are new pests and have been identified with the scientific name *Cryptophasa watungi*^{4,5}.

Indonesia is a major clove producing country, currently supplying approximately 80% of the world's clove demand, and especially the islands of Sulawesi and Java, which are the centers of clove production in Indonesia. Unlike other plantation commodities whose exploitation is mostly handled by private and state

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plantations, clove plantations in Indonesia are mostly or 90.00% of the production of smallholder plantations, so their contribution is closely related to the economy of the clove farming community. A 2010 report from the Ministry of Agriculture stated that 31 provinces in Indonesia have data on clove production with varying plantation areas from small areas to more than 2,000 ha. The large plantation areas are North Sulawesi, South Sulawesi, Central Sulawesi, East Java, Central Java, West Java, Aceh and North Maluku. More than 70% of the national clove production is supplied by the eight clove producing provinces, namely 79.48 tons⁶.

The results of research conducted by⁷ that the results of a survey in the South Bolaang Mongondow area found clove plants showing symptoms of sudden death, the leaves of the clove plant were brownish overall. Various pests for clove plants are always a challenge for farmers. Currently, if an attack is suspected to be a new pest from the Buprestidae family that attacks clove plants, it is necessary to know the attack accurately so that the damage it causes can be handled properly.

Pest and disease attacks greatly affect the production of clove plants. The decline in clove production due to pests and diseases can reach 10-25%^{6,8}. Pests and diseases cause disrupted plant growth, decreased production and even death of plants. Some important pests and diseases that attack clove plants are stem borer, branch / twig borer, mealybugs, pathogens in the form of fungi that attack leaves, including leaf blister and leaf fall⁹, which can cause leaf loss, even plant death. Global climate change has triggered an escalation of attacks by plant pests at production centers in various countries, including Indonesia. It was reported by¹⁰ that global climate change can trigger the emergence of new races, strains, biotypes, genomes of pests and plant pathogens and have a wide impact on agricultural development. Like other crops, clove plants are also subject to various pests and diseases that can cause losses. No matter how small the influence of pests and disease attacks on plants, it must be controlled so that there is no wider attack transmission, so that greater losses can be avoided.

One of the important pests in clove plants, namely the stem borer, known by the scientific name *H. semivelutina*, is the main pest on clove plants in North Sulawesi. According to², this pest has attacked clove plants in Minahasa since 1924. In 1966, the percentage of affected plants reached 43.30% and the tree mortality rate was 14.20%. This pest is spread in North Sulawesi and Maluku provinces. It was reported by the staff of BPTP or Plantation Plant Protection Agency in Plantation Office of North Sulawesi Province that branch / twig borer insects were found attacking clove plantation areas in Minahasa District (especially Kakas Sub-district) at the end of 2014. Branch borer insects that attack clove plants in North Sulawesi have been described by⁴ with the scientific name *Cryptophasa watungi* (Lepidoptera: Xyloryctidae).

The results of research conducted by¹¹ found several species of pests and diseases that previously had never been reported to attack clove plants. The species of pests and diseases include *Paraputo odontomachi* (Hemiptera: Pseudococcidae), sp1. (Basidiomycetes), *Paralecta* sp. (Lepidoptera: Xyloryctidae) and several other species of pests and diseases. Furthermore, it was reported by⁷ that the results of the initial survey in the South Bolaang Mongondow District found several new species of pests that had never been reported attacking clove plants. One of these important pests is from the Buprestidae family which severely damages clove stems. It was reported by several researchers in the United States that these pests from the Buprestidae family were very destructive to tree crops and became a national problem in the United States (USA) and North America^{12,13,14}. Therefore, this research is very important, especially to determine the species of stem borer pests, the percentage of attacks and their distribution patterns.

This research is quite important because until now there has been no institutional report on the existence of this new pest so that the related agencies (agencies) have not thought about handling it. Therefore the results of this study will provide basic information about the intensity of the attack and the distribution pattern of these pests so that control efforts can be handled properly and correctly. Besides that, the stem borer pest which has been attacking clove plants for a long time, namely *H. semivelutina*, also needs to be reported on its presence, especially regarding the percentage of its attacks in East Bolaang Mongondow District.

2. Experimental

This research was conducted in the clove plantation area in East Bolaang Mongondow District. The research was conducted for six months, from June to November 2020. Materials and equipment used in the study were samples of stem borer, hand counters, aspirators, insect nets, collection bottles, brushes, loops, machetes, plastic bags, cameras, writing instruments, and others.

The study was conducted using a survey method at a predetermined location. Of the seven sub-districts in East Bolaang Mongondow District, five sub-districts were selected as samples as observation areas. Two villages with the highest number of clove trees were selected for each sub-district as observation sites which were coordinated with the East Bolaang Mongondow District Agriculture Office. The activities carried out in this research as follows (1) knowing the species of stem borer pests. The species of stem borer was observed based on the symptoms found on the surface of the clove plant stem. Symptoms of attack are based on the presence or absence of dirt / faces / colored liquid and / or dirt found on the surface of the clove stem, (2) percentage of stem borer attack attacking clove plants. Observations were made based on the attack symptoms seen on the clove plant stem. Each village is assigned two points which are observation plots. Each observation point was determined as many as 100 clove trees as observation samples. Each plant was observed based on the symptoms seen in the clove plant stem. Symptoms of attack are based on the presence or absence of faces / stains / colored liquid and / or dirt found on the surface of the clove stem. Thus, for each village as a place of observation, 200 cloves would be obtained to observe the percentage of attacks, and (3) knowing the distribution pattern of these pests. The distribution pattern of stem borer insects was detected by means of attack symptoms, which is the only variable being measured. The variables are differentiated according to the level which ordinary follows two levels of symptoms, as follows: there is no attack and there is an attack in the form of faces / stains / liquid on the surface of the clove stem. The spatial distribution pattern of stem borer pests on cloves was calculated using the Standardized Morisita Index (I_p) formula¹⁵. Furthermore, the final step is to determine the pattern of pest distribution based on the magnitude of the I_p value mentioned above as follows:

If $I_p < 0$: The distribution pattern is uniform

If $I_p = 0$: The distribution pattern is random

If $I_p > 0$: The distribution pattern is aggregate

3. Results and Discussion

3.1. Symptoms of Stem Borer Attack

The results of observations based on the symptoms of attacks seen on clove plant stems, the species of stem borer found in East Bolaang Mongondow District is *H.semivelutina*. (Figure 1). Symptoms of attack on clove stems from the Buprestidae family (Figure 2), were not found during five observations in East Bolang Mongondow District. Reported by¹⁶, the Buprestidae family was found to attack clove plant stems in South Bolaang Mongondow District, especially in Pinolosian Sub-district, Lungkap Village.

From Figures 1 and 2, it can be seen that the difference in attack symptoms caused by *H. semivelutina* and the Buprestidae family on the stem of the clove plant. The attack of *H. semivelutina* is to destroy the deep tissue of the plant stem, while the attack of Buprestidae only shows liquid on the surface of the stem. If the skin of the clove stem is peeled on the part of the stain or black spot, it can be seen clearly that there are black grinding marks and larvae droppings. The living larvae will move the cambium part of the clove stem so that the cambium is damaged, especially in the xylem and phloem tissue, as a result inhibits the translocation of water and food nutrients from below and or above the surface of the clove plant, causing the plant to slowly die.



Figure 1. Symptoms of *H. semivelutina* (Cerambycidae: Coleoptera) attack



Figure 2. Symptoms of clove stem borer (Buprestidae: Coleoptera)

3.2. Percentage of Stem Borer Attack on Clove Plants

The results showed that the attack of the clove stem borer, *H. semivelutina* as a whole in several villages and sub-districts in East Bolaang Mongondow District can be seen in Figure 3. From these data it can be seen that the average percentage of *H. semivelutina* pests in all the location of the observation has exceeded 50.00%, the highest was found in Tombolikat Village, Tutuyan District with 79.40%, while the lowest was in Nuangan Village, Nuangan District, which is 49.20%. The percentage of *H. semivelutina* attacks in several villages can be seen in Figure 3.

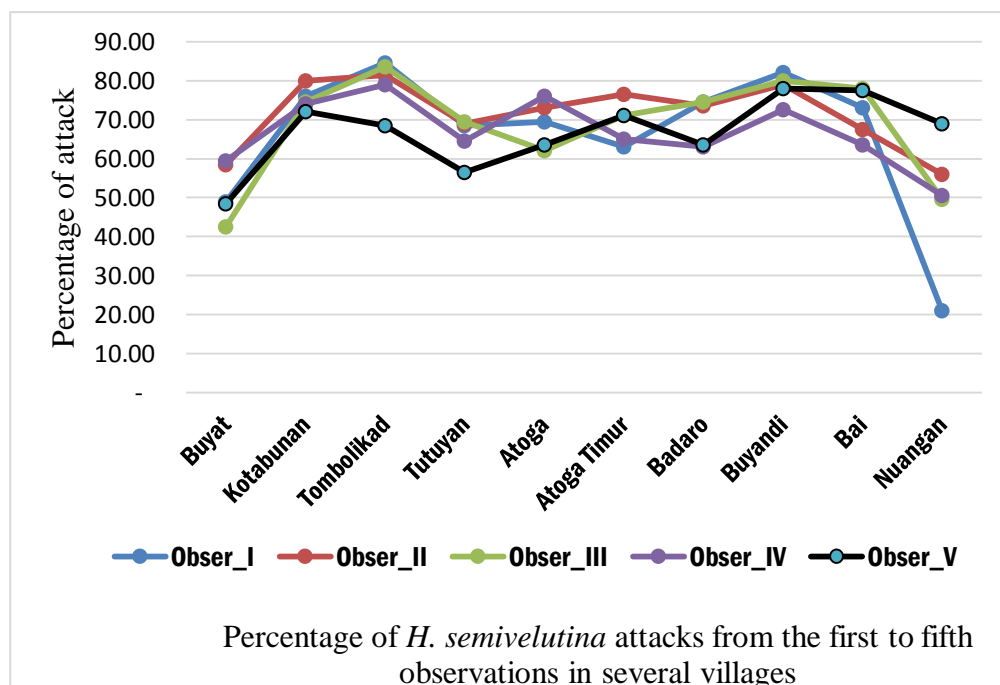


Figure 3. Graph of *H. semivelutina* attack percentage in several villages in East Bolaang Mongondow District

From Figure 3, it can be seen that in general the average attack of stem borer in the family of cerambycidae (*H. semivelutina*) at all sampling locations has reached above 50 percent. This indicates that the clove plant in East Bolaang Mongondow District has been attacked in a very high category. Unlike the case with the attack of clove stem borer from the buprestidae family, none of the sampling locations found

symptoms of attack from the buprestidae family. When compared with research conducted by^{5,16} that the average attack of Buprestidae pests at PT. Kawanua Kahuripan Pantera (PT. KKP) in the village of Lungkap reached between 50.00 - 75.00 percent, very different from the attacks found in this study.

3.3. The distribution pattern of the stem borer *H. semivelutina*

The result of calculating the standardized Morosita Index (Ip) is 2.14. The results of this calculation indicate that the *H. semivelutina* pest that attacks clove plants in East Bolaang Mongondow District spreads in groups (aggregate) which is marked with $Ip > 0$. The pattern of spread of a pest is important to know because it is necessary to determine an appropriate sampling pattern for optimization purposes. Integrated pest management as well as planning for research implementation¹⁷. The pattern of the spread of a pest can be used as an example for monitoring purposes in order to develop an IPM management program and forecast the explosion of a pest.

Determining the appropriate sampling pattern and the optimal number of samples, it is necessary to know the distribution pattern of a pest¹⁸. It is further stated that there are three types of insect distribution that are often found in the field, namely even, random, and clustered. The evenly distributed spatial distribution of a pest is generally very difficult to find, because what is said to be even is that the distance between individual pests and each other is the same. Thus the individual pests are spread out completely evenly. According to¹⁹, generally the distribution patterns of pests are usually randomized and / or clustered. The results of this study show that the spatial distribution of stem borer *H. semivelutina* which attacks clove plants in East Bolaang Mongondow District follows a clustering pattern, so that the appropriate method of sampling for the purpose of observing pests is regular or systematic patterns. The results of this study and supported by other research results indicate that recommendations for sampling methods based on pest distribution patterns can be suggested to policy makers and are accurate enough to be implemented.

4. Conclusions

The species of stem borer of clove plants found in East Bolaang Mongondow District is *H. semivelutina* Hell. There were no stem borer pests from the Buprestidae family during sampling, such as those found in South Bolaang Mongondow District. All of the sampling locations showed an incidence of *H. semivelutina*. The highest average percentage of attacks was found in Tombolikat Village, Tutuyan Sub-dist, which was 79.40 percent and the lowest was in Nuangan Village, Nuangan Sub-district, which is 49.20 percent. The distribution pattern of the stem borer *H. semivelutina* attacking clove plants in East Bolaang Mongondow District spreads in groups (aggregate).

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