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# Liquid Tobacco Smoke Concentration Test Against the Intensity of Stem Borer (*Chilo saccharipagus*) Attack on Sugar Cane

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**ABSTRACT**

One of the most harmful insect pests of sugar cane is striped stem borer (Chilo sacchariphagus) because it causes a decrease in the quality and quantity of sugar cane. Scratched wounds can be a place of infection of various pathogens so that it can result in fatal losses that can cause the death of the crop. The purpose of this study was to determine the concentration of tobacco liquid smoke that precisely suppressed the attack of striped stem borer. The study was conducted in the Experimental Garden Sweetener and Fiber Crops Research Institute Malang in May to September 2018. The study was conducted using a randomized block design with 3 replications. The treatments consist of: concentration of tobacco liquid smoke: 10 ml /L ; 8 ml /L ; 6 ml /L ; 4 ml /L ; 2 ml /L ; chemical pesticides at concentration of 2 ml / L, and no treatment. Spraying of liquid tobacco smoke was done one every 2 weeks. The results showed that the treatment of liquid tobacco smoke had an effect on the intensity of attack of striped sugarcane stem borer, number of sugarcane tillers, and sugar content. A suitable concentration of tobacco liquid smoke is 2 ml / l.

## INTRODUCTION

The development of sugar production can increase the value of the economy, and also provide employment for the community (Ardiansyah and Purnomo, 2015). Sugar cane (*Saccharum officinarum*) as the main raw material for making sugar. The problem is the presence of pests that can damage the crop, one of which is a striped stem borer (*Chilo sacchariphagus*). These insect can reduce the quality and productivity of sugar cane causing substantial losses (Bursatriannyo,2013; Rajawali, 2018; Conlong and Goebel, 2002). This pest attack can cause losses reaching 30-45% (Meidalima and Ramadhalia, 2014; Subiyakto, 2017). During this time, to overcome these pests, farmers tend to use chemical pesticides. Chemical pesticides can increase crop productivity and are more economical and efficient but can cause soil damage and environmental pollution (Subiyakto, 2017; Maryani, 2013; Meidalima et al., 2012). Chemical pesticides can kill soil fauna so that soil fertility decreases and the soil becomes more acidic (Subiyakto, 2016). For this reason, a safe method is needed, for example by spraying plant-based liquid tobacco smoke (Misran and Erni, 2005). The purpose of this study was to determine the effect of the concentration of tobacco liquid smoke on the

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intensity of stem borer attack and sugarcane production.

## MATERIALS AND METHODS

The study was conducted at the Experimental Garden of the Indonesian Fiber and Tobacco Crops Research Institute in Malang, East Java from May to September 2018. The study was conducted using a randomized block design with 3 replications. The treatments consisted of: concentration of tobacco liquid smoke: 10 ml/L; 8 ml/L; 6 ml/L; 4 ml/L: 2 ml/L; chemical pesticides at concentration of 2 ml/L, and no treatment.

### Research Implementation

Tobacco liquid smoke was made through the pyrolysis process, which was a high-temperature combustion process by changing tobacco material into liquid smoke. Pyrolysis is a thermochemical treatment that is applied to organic products so that pure results can be obtained (Kuntjahjawati and Darmaji, 2004). In this treatment, the tobacco material was exposed to high temperatures and no oxygen passes through chemical and physical separation into different molecules.

Condensed smoke that was released is a process of changing substances from gases to liquids. The smoke that comes out of the chimney was collected in a cold water bath for condensation. Initially, the liquid that came out was dark brown because it contained a lot of tar. As the process continued, the liquid color changed to clear. The process of pyrolysis took a long time and the results were few. In this research, 1 kg of raw tobacco resulted in 30 ml of liquid.

Sugarcane plants of 5 months old were used in this experiment. Liquid tobacco smoke was sprayed every 2 weeks for 2 months. The dose used was 500 ml/plot with the concentration following the treatments. Each plot contains 5 sugar cane clusters, so the dose used was 100 ml/cane clumps. The observation variables included pest intensity, number of cane segments attacked, number of tillers and sugar content. Sugar levels were observed using a refractometer. Observations were made on the lower stem of the 1-5th segment, the middle stem of the 7-12 segment, and the upper stem of the 15-20 segment. Data were analyzed using analysis of variance, if there was a significant effect then a 5% of Tukey HSD test was applied to compare between treatments.

## RESULTS AND DISCUSION

### Sugarcane borer attack intensity (%)

The analysis of variance showed that the treatment of liquid tobacco smoke did not significantly affect the intensity of sugar cane borer attack. The average intensity of sugar cane borer attack is presented in Figure 1.

The ability of tobacco smoke to suppress the striped stem borer in sugarcane varies. As shown in Figure 1, the concentration of 2 ml/L tobacco smoke is the most effective in suppressing these pests as shown by the lowest attack intensity compared to other treatments at each age of observation.

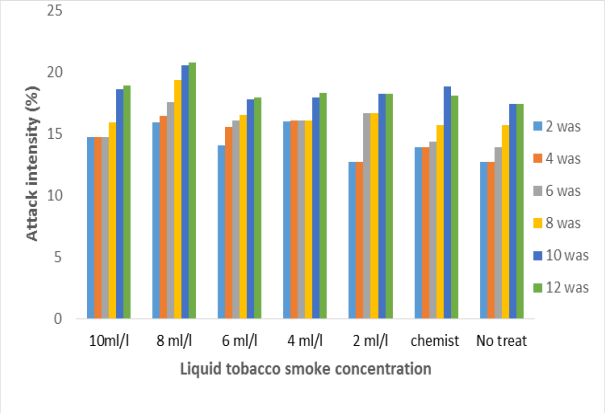


Figure 1. The average intensity of the striped stem borer attack due to the treatment of tobacco liquid smoke concentration. (Notes: age of observation, 2 w.a.s, weeks after spraying, and etc.)

### The number of segments attacked by stem borer

The analysis of variance showed that the treatment of liquid tobacco smoke did not significantly affect to the number segments of sugarcane borer attacked. The average intensity the number segments of sugarcane borer attacked is presented in Figure 2.

As is the case with the intensity of the attack, the average number of cane segments damaged by the striped stem borer also varies according to the treatment of the liquid tobacco smoke concentration. In figure 2 it appears that a concentration of 2 ml/l has been able to suppress the number of cane segments that have been attacked by striped borer.

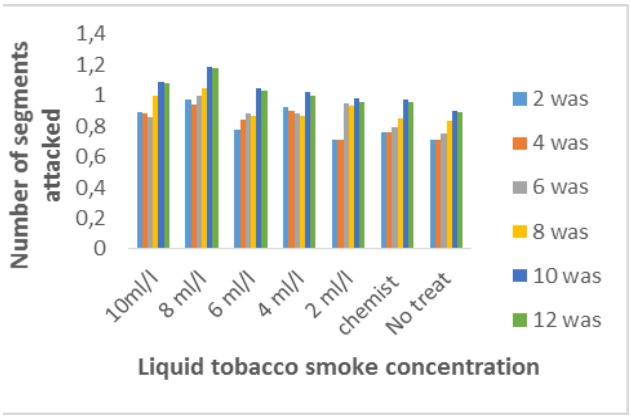


Figure 2. The average number of cane segments affected by striped borer due to the treatment of tobacco liquid smoke concentration. Notes: age of observation, 2 w.a.s, weeks after spraying, and etc

## Average Number of Tillers

The analysis of variance results showed tobacco liquid smoke treatment showed significant differences in the number of sugarcane tillers. The average number of tiller is presented in Figure 3.

In figure 3, it appears that the highest average number of tillers was found in the treatment of liquid tobacco smoke concentration of 6 ml / l, and it is significantly different from the treatment of chemical pesticides. The application of liquid tobacco smoke is more able to increase the number of tillers than chemical pesticides.

## Average Sugar Level (% Brix)

The results of the analysis of variance types of tobacco liquid smoke treatment on lower sugar cane and middle sugar cane stem showed an effect significantly, while the upper sugarcane content showed no effect. The results of the sugar content analysis are presented in Figure 4.

In Figure 4 above shows that the sugar content of each section of the stem (upper stem, lower stem, and middle stem). The treatment of tobacco liquid smoke concentration affects the sugar content of the middle and lower stems, but this treatment does not affect the sugar levels of the upper stem. The treatment of tobacco liquid smoke concentration did not affect the sugar content of the upper stems because the sugar content was used for plant growth, while the middle sugar levels and lower sugar levels tended to be a place for accumulation of food reserves. The concentration of tobacco liquid smoke of 6 ml / l is good for sugar content.

Based on the observation that the treatment of the concentration of liquid tobacco smoke affected the sugar content, the number of sugarcane tillers, and the intensity of the striped stem borer pest attack. In figure 2 it appears that a concentration of 2 ml / l has been able to suppress the number of cane segments that have been attacked by striped borer. This is presumably due to the imperfect pyrolysis process or the concentration being treated less high. Extraction of nicotine levels from tobacco leaves is determined by time, ie the longer the extraction time is the more extracted nicotine levels are obtained. As stated by Aji et al. (2015) and Sujak and Nanik

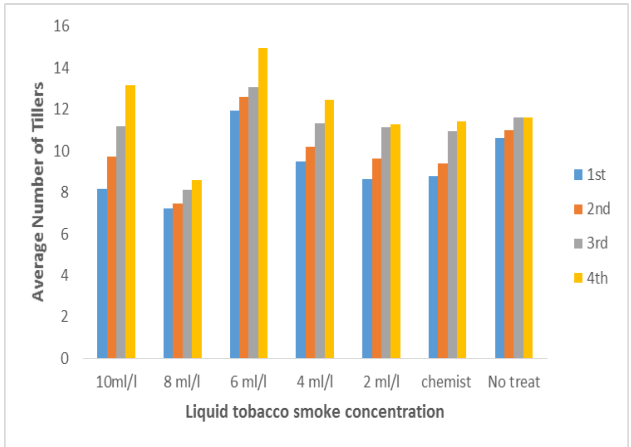


Figure 3. An average number of sugarcane tillers resulting from the treatment of liquid tobacco smoke concentrations. (Notes: 1st month ; 2nd month ; 3rd month ; 4th month.)

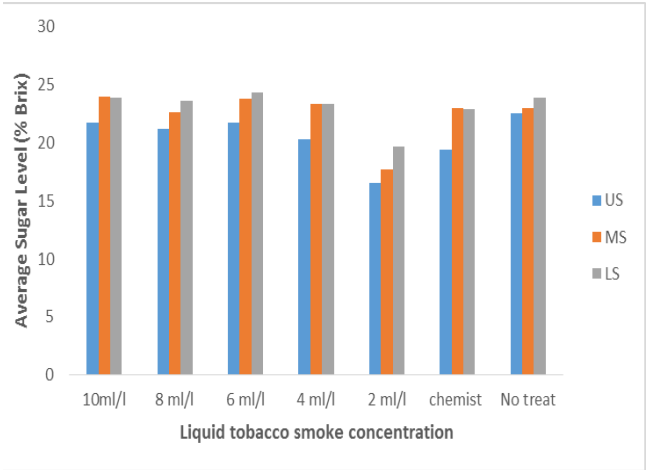


Figure 4. An average sugar level (brix %) resulting from the treatment of liquid tobacco smoke concentrations. (Notes: US, Upper Stem ; MS, Middle Stem ; LB, Lower Stem)

(2012), that the extraction of tobacco leaves in alcohol 5% with 10% dilution is effective as a vegetable pesticide. According to research that soaking tobacco smoke 2% concentration for 30 minutes can preserve gourami fish and can suppress the growth of bacterial microbes (Mu'tamar et al., 2015). Likewise, Wahyuni et al.(2018) that the nicotine content extracted from 5 kg of dried tobacco leaves with 70% ethanol solvent produced 457 grams of a concentrated extract. Furthermore, nicotine levels of 3.61-4.69% play an effective role as *Aedes aegypti* larvicides. The results of his study showed that nicotine concentration of 200 ppm was able to kill 69% of *Aedes aegypti* larvae. tobacco extraction by soaking 2 kg of fresh tobacco leaves in 1000 ml of 50% ethanol for 3 days, then the liquid extract was evaporated until thick (solid) and diluted to a concentration of 30 ml / l effectively killed insect pests starting larvae, pupae and imago (Muhiddin and Hartati, 2009; Fitri and Migunani, 2014).

Tobacco contains chemical compounds including alkaloids (for example nicotine), tar, carbon monoxide which can act as biodegradable insect control and safe for the environment (Emiliani et al., 2017; Harwanto, 2012). Tobacco liquid smoke contains ketones, acids, and some aromatic compounds. Phenol and acetic acid are the main compounds found in tobacco liquid smoke, and these compounds act as biopesticides (Mu'tamar et al., 2018). The results of the extraction process of tobacco leaves by pyrolysis using a reactor at a temperature of 400 $^{o}$C for 2.5 hours produced components: tar, acetic acid, carboxyl, phenol, nitrogen, nicotine (Kuntjahjawati and Darmaji, 2004). Dissolved nicotine $C_{12}H_{14}N_2$ bioactive compound effectively suppresses Spodoptera exigua larvae by the mechanism through stomach poison and contact poison (Harwanto,2012). Compounds that play a role in tobacco liquid smoke include nicotine with a mechanism of action that can affect brain function and the functioning of the nervous system. The mechanism of action of nicotine involves some compound such as organophosphate and carbamate. Organophosphate and carbamate are chemical pesticides. Nicotine is an alkaloid with a high level of poisoning. As an insecticide, molluscicides, acaricides works as contact, fumigant and stomach poison.

## CONCLUSIONS

The treatment of tobacco liquid smoke concentration had no significant effect on the intensity of the striped stem borer attack, but the number of sugar cane tillers and sugar content showed a significant effect.

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