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BIOACARICIDE ACTIVITY OF SAPPAN WOOD (*Caesalpinia Sappan L.*) INFUSION AGAINST TICKS *BOOPHILUS MICROPLUS* IN CATTLE

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ABSTRACT

This research aims to exploit the potential of sappan wood (*Caesalpinia sappan L.*) as a bioacaricide on *Boophilus microplus* ticks. This research used a completely randomized design method with ticks as the research object. There were five treatments in this study, two of which were in the positive control group (Kututox) and negative control (Aquades), and three treatments in the group were given sappan wood infusion with concentrations of 25%, 50%, and 75%. Each treatment consisted of 5 replications, each replication using five ticks. The sappan wood infusion bioacaricide test was carried out in vitro, and tick death was observed for 5 hours with observation time every hour after spraying. The data obtained were analyzed using one-way variance, followed by the LSD test. Then, a probit analysis of LC_{50} and LC_{90} was performed to determine the concentration of sappan wood infusion that can kill ticks, and LT_{50} and LT_{90} were used to determine the time of death of B. microplus ticks. The research results showed that sappan wood infusion with a concentration of 75% effectively killed 50% of *Boophilus microplus* ticks at 0.67 hours and killed 90% of *Boophilus microplus* ticks at 1.17 hours. Sappan wood infusion can be an alternative bioacaricide to kill *Boophilus microplus* ticks.

Keywords: bioacaricide, *Boophilus microplus*, *Caesalpinia sappan L.*, infusion

INTRODUCTION

An obstacle that must be faced in maintaining and developing livestock is decreased productivity, which can result in economic and physical losses for farmers. Many factors, including parasitic infections, can attack livestock if they ignore cow health management. Parasitic infections are divided into endoparasites and ectoparasites (Yusuf dan Zubaidah, 2023). Endoparasites enter and exist in the host's body, so they are called internal parasites, such as worms and protozoa. Ectoparasites are parasites on the outside and attack the skin's surface, so they are called external parasites, such as flies, mites, ticks, and mosquitoes (Arifa *et al*., 2022).

The highest distribution and population of ectoparasites is the *Boophilus microplus* tick (Pappa *et al*., 2020). Based on research by Sahara *et al*. (2019), the prevalence of ticks in cattle in Indonesia is *Rhipicephalus pilans* 0.95% (15/1575), *Haemaphysalis bispinosa* 26.73% (241/1575) and *Boophilus microplus* 72.32% (1139/1575). The *Boophilus microplus* tick is a tick that sucks blood in livestock, which causes reduced meat production and milk production. The *Boophilus microplus* tick can become an intermediate host and vector for other disease agents, such as anaplasmosis, babesiosis and theileriosis, ricketsiosis, and q-fever, resulting in livestock dying (Kristina dan Setiyono, 2020).

The spread of *Boophilus microplus* tick infections can be controlled by administering acaricides. This effort is expected to reduce the spread of tick infections. The types of acaricides that are widely available are chemical acaricides, which, of course, will cause negative impacts such as the development of resistant races from uncontrolled use, killing of non-target organisms, poisoning of livestock, acaricide residues in meat and milk, and environmental pollution. The large number of negative impacts caused by the need for other alternatives (Theresia *et al*., 2023).

Dealing with this can be done using natural plant acaricides, which contain terpenoid, saponin, and tannin compounds that can act as anti-bacterial, anti-parasitic, and anti-oxidants (Dhea *et al*., 2023; Nurullita dan Irawati, 2022). This has been proven by research Pappa *et al*. (2020), namely that cocoa fruit peel (*Theobroma cacao l.*) is a natural acaricide

against *Boophilus microplus* ticks. Cocoa pod skin contains terpenoid, saponin, and tannin compounds, which can kill the best at a concentration of 30% with methanol solvent with a death time of 6.21 hours while ethanol solvent is 5.91 hours.

Several plants that can be used as alternatives to natural acaricides include the sappan (*Caesalpinia sappan L.*). Natural acaricides, namely sappan wood infusion, can be used to prevent *Boophilus microplus* ticks, which can be used as a substitute for chemical acaricides, which are suitable for livestock and environmentally friendly (Siregar, 2023). Chemical compounds in plants such as flavonoids, saponins, triterpenoid alkaloids, steroids, and tannins have the potential to act as natural acaricides that are toxic to *Boophilus microplus* ticks. According to Fajriani *et al.* (2019) in research on tobacco leaf extract (*Nicotiana tabacum*) as an acaricide on ticks (*Boophilus microplus*), the tannin content in tobacco leaf extract can reduce enzyme activity (protease and amylase) and disrupt intestinal activity, resulting in nutritional disorders, The bitter taste of tannins will have an antifeedant effect. Based on this background, the researchers aimed to examine the potential of sappan (*Caesalpinia sappan L.*) as a natural acaricide against the *Boophillus microplus* tick. Extraction using the infusion method was chosen in the study so that the chemical components contained in sappanwood are not damaged and the application for use by livestock farmers is easier than other extraction methods.

RESEARCH METHODS

Research types and samples

This research used a completely randomized design method using ticks as the research object. This study's selection and sampling were conducted selectively with physiological considerations and the same sample size. There were five treatments in this study, two of which were in the positive control group (Kututox) and negative control (Aquades), and three treatments in the group were given sappan wood leaf infusion with concentrations of 25%, 50%, and 75% determination of dosage based on research by Kurniawati (2020). To avoid bias in data analysis, it was of five replications, each replication using five adult ticks, so the number of samples required was 125 tick samples.

125 samples of *Boophilus microplus* ticks were taken from cow pens. Ticks were taken selectively with the same sample size as the criteria for yellowish-brown ticks with an average length of 0.3 to 0.6cm and a width of 0.3 to 0.5cm. The tick's body has a hard skin, is round, and has a cephalothorax, legs, and abdomen; indeed, the tick taken is still alive (Fajriani *et al.*, 2019). Then, tick identification was carried out to differentiate *Boophilus microplus* ticks from other types of ticks, which was carried out at the integrated laboratory at the University of West Sulawesi.

Sappan Wood Infusion

Sappan wood is collected, washed using clean water, and dried. The sappan wood is weighed and made into simplicia. Then, 1kg of sappan wood simplicia is added with 1L of water (1:1), and hot maceration is carried out by boiling for 30 minutes at a temperature of 50^{o}C (Parwata *et al.*, 2016). Then, it is filtered and stored for use in the subsequent treatment, making sappan wood infusion with 25%, 25ml of infusion mixed in 75ml of distilled water.

Data Collection

The sappan wood infusion bioacaricide test was carried out in vitro. The ticks were placed in a petri dish lined with cotton and then sprayed with sappan wood infusion, distilled water as a negative control, and Kututox for positive control or standard therapy. Each cup was sprayed twice, and then observations were made. Tick death was observed for 5 hours, with observation time every hour after spraying (Pappa *et al.*, 2020). Ticks are declared dead if they cannot turn over or move. The number of ticks that died was expressed as mortality.

Data Analysis

The data obtained were analyzed using one-way variance, followed by the LSD test. Then, a probit analysis of LC_{50} and LC_{90} was performed to determine the concentration of sappan wood infusion that can kill ticks, and LT_{50} and LT_{90} were used to determine the time of death of *B. microplus* ticks.

RESULTS AND DISCUSSION

The bioacaricide activity of sappan wood infusion (*Caesalpinia sappan L.*) had a significant effect on the death of *Boophilus microplus* ticks (P<0.05). Concentrations of 50% and 75% killed *Boophilus microplus* ticks more quickly than the positive control (Kututox). The fastest death time was in treatment P3 (75% sappan wood infusion), 1.17±0.28[a] hours, then P2 (50% sappan wood infusion), 1.22±0.31[a]. The longest death time was in treatment P1 (25% sappan wood infusion), namely 3.22±1.12[c], while no death of Boophilus microplus ticks occurred for the negative control treatment. Mortality data for Boophilus microplus ticks after treatment can be seen in Table 1, while complete LC_{50} and LC_{90} and LT_{50} and LT_{90} data can be seen in Table 2 and Table 3.

Table 1. Mortality data for *Boophilus microplus* ticks

Treatment	Tick Death Time (Hours)
Negative Control	0
Positive Control	2,13±0,51[b]
P1 (25% Sappan Wood Infusion)	3,22±1,12[c]
P2 (50% Sappan Wood Infusion)	1,22±0,31[a]
P3 (75% Sappan Wood Infusion)	1,17±0,28[a]

Different superscripts in the same column have a significant effect (P<0.05) between treatments.

Table 2. Lethal Concentration (LC) of *Boophilus microplus* ticks after they were given sappan wood infusion and observed every hour for 5 hours

Number of Ticks	Period (Hour)	Concentration (%)	
		LC_{50}	LC_{90}
25	1	78,3	86,2
25	2	63,8	68,1
25	3	44,1	52,5
25	4	36,3	41,2
25	5	24,9	31,6

Table 3. Lethal Time (LT) of Boophilus microplus ticks when given sappan wood infusion with observation every hour for 5 hours

Number of Ticks	Concentration	Time (Hour)	
		LT_{50}	LT_{90}
25	Negative Control	0	0
25	Positive Control	1.93	2,13
25	P1 (25% Sappan Wood Infusion)	2,42	3,22
25	P2 (50% Sappan Wood Infusion)	1,91	2,06
25	P3 (75% Sappan Wood Infusion)	0,67	1,17

Based on research data, the infusion test of sappan wood (*Caesalpinia sappan L.*) using the spray method at 25%, 50%, and 75% treatment was able to kill *Boophilus microplus* ticks; this was due to the presence of chemical compounds contained (gallic acid and brazilin) in sappan wood at various doses. In each treatment, observation of each concentration used as a bioacaricide against *Boophilus microplus* ticks resulted in ticks that died quickly. However, some ticks were killed for a long time at each concentration.

Based on the probit analysis results for LC_{50} and LC_{90}, the higher the concentration of sappan wood infusion sprayed, the faster the tick death time. This means that if the dose of sappan wood infusion is increased, the mortality of *Boophilus microplus* ticks will also increase;

besides that, the toxic working power of a compound is determined mainly by the concentration (Azeez *et al*., 2022).

Spraying using concentrations of 50% and 75% sappan wood infusion was able to produce LT_{50} and LT_{90} equal to or even faster than positive controls using chemical acaricides, namely Permethrin 1% and Pipronyl butoxide 2% (Kututox). Dead ticks are characterized by stiff legs and no response to touch (Coles dan Dryden, 2014). This can be caused by sappan wood infusion, which contains an active chemical compound, gallic acid (Illmianti *et al*., 2021). Furthermore, Vij *et al*. (2023)stated that sappan wood extract which contains brazilin > 200 mg/g, as well as the high flavonoid content in sappan wood extract (*Caesalpinia sappan L*.) of 6.02%, can influence the metabolic activity of ticks.

The mechanism of action of flavonoids in the body is divided into 3: inhibiting nucleic acid synthesis, inhibiting cell membrane function, and inhibiting energy metabolism (Junita *et al*., 2020). In inhibiting nucleic acid synthesis, the A and B rings of flavonoid compounds play an essential role in the intercalation or hydrogen bonding process, namely by accumulating nucleic acid bases, thus inhibiting the formation of DNA and RNA (Nomer *et al*., 2019). The results of flavonoid interactions will also cause damage to cell wall permeability (Nurdiana *et al*., 2021). In inhibiting the function of cell membranes, flavonoids will form complex compounds from extracellular and dissolved proteins so that the cell membrane will be damaged. Intracellular compounds will come out, inhibiting energy metabolism by inhibiting the use of oxygen and preventing energy formation in the cytoplasmic membrane (Zhang *et al*., 2019). Flavonoid compounds are toxic plant defense compounds because they can inhibit the digestive tract (Kinansi *et al*., 2018).

The bitter taste of sappan wood indicates the saponin content, namely that it has a working mechanism that can cause a decrease in digestive enzyme activity and food absorption so that saponin is stomach toxic (Karlina *et al*., 2016; Rina, 2013). Alkaloid compounds can degrade cell walls, thereby damaging digestive tract cells. The tannin compounds in sappan wood can interfere with the digestive process of food by reducing the activity of an enzyme so that it can inhibit growth (Nurdiana *et al*., 2021). A similar thing was also stated in research by (Fajriani *et al*., 2019), who said that the tannin content in tobacco leaf extract could reduce enzyme activity (protease and amylase) and can interfere with intestinal activity so that you will experience nutritional disorders coupled with the bitter taste of tannin which will have an effect. Antifeedants affect eating behavior reactions. As an antiparasitic, Tannin can inhibit the work of enzymes and remove substrates (proteins) that bind to lipids and proteins that bind to protease enzymes, which catalyze proteins into amino acids (Halimah *et al*., 2023). Apart from that, Wulandari *et al*. (2021) stated that sappan wood extract also contains high levels of terpenoids. Research by (Pappa *et al*., 2020) also noted that the results of the phytochemical test extract of cocoa fruit skin contained terpenoid, saponin, and tannin compounds, which could be anti-bacterial and anti-parasitic. Cocoa fruit skin extract had the best killing power at a concentration of 30% with methanol solvent at 6.21 hours.

CONCLUSIONS

Sappan wood infusion (*Caesalpinia sappan L.)* at a 75% concentration effectively killed 50% of *Boophilus microplus* ticks at 0.67 hours and 90% of *Boophilus microplus* ticks at 1.17 hours. Thus, sappan wood infusion (*Caesalpinia sappan L*.) can be an alternative bioacaricide for killing *Boophilus microplus* ticks.

SUGGESTIONS

The author advises that further research needs to be carried out regarding the effectiveness of sappan wood in treating scabies with different medicinal preparations, such as liniment and ointment.

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