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Coconut Oil Salve from Gamal Tree Leaves (Gliricidia sepium) as an Alternative Treatment for Lumpy Skin Disease (LSD) in Cattle

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Abstract *— Lumpy Skin Disease (LSD) is an infectious skin disease caused by the Lumpy Skin Disease Virus (LSDV), posing a significant threat to cattle and buffalo farming. This research aims to determine the effectiveness of a salve made from gamal tree (Gliricidia sepium) leaves and coconut oil for the treatment of LSD in cattle. The study is divided into two parts: 1) the production of Gamal Leaf Oil Salve (SMDG), involving the collection of gamal leaves and the creation of a salve by mixing gamal leaves with coconut oil; and 2) the application of SMDG to cattle exposed to LSD with three concentrations: 1) 50%: 500 grams of gamal leaves in 1 liter of coconut oil (SMDG 50%); 2) 75%: 750 grams of gamal leaves in 1 liter of coconut oil (SMDG 75%); 3) 100%: 1000 grams of gamal leaves in 1 liter of coconut oil (SMDG 100%). The data were analyzed using Kruskal-Wallis, and significant differences among treatments were further analyzed using Mann-Whitney comparisons. The results of the study indicate that the application of Gamal Leaf Oil Salve (SMDG) with a concentration of 100% resulted in the highest recovery compared to concentrations of 75% and 50% for cattle exposed to LSD. Nodules began to flatten, and ulcers started to dry on the seventh day (Day 7), where in Experiments S2 and S3, the results were relatively similar with sizes ranging from 1 to 1.5 cm, which was better than in S1 where nodule size was 1.5 to 2 cm. A concentration of 100% SMDG is safe for use as a botanical antiviral and can reduce nodule size and dry ulcers in the treatment of Lumpy Skin Disease (LSD) after 14 days of application.*

Keywords *— **Lumpy Skin Disease (LSD), Gamal Tree Leaves (Gliricidia Sepium), Coconut Oil***

I. INTRODUCTION

Lumpy Skin Disease (LSD) is an infectious skin disease caused by the Lumpy Skin Disease Virus (LSDV), a DNA-genetic material virus from the Capripoxvirus genus and Poxviridae family, which is non-zoonotic in nature. This virus commonly affects cattle and buffalo, with no reported occurrences in other ruminants such as goats and sheep. LSD is also known as Pseudo-urticaria, Neethling virus disease, exanthema nodularis Bovis, and knopvelsiekte [1]. LSD was first discovered in Zambia, Africa, in 1929 and became endemic, progressively spreading across Africa, the Middle East, southeastern Europe, Central Asia [20]. Subsequently, LSD outbreaks occurred in Southeast Asia, specifically in Bangladesh in July 2019, followed by India and China (August 2019), Taiwan and Nepal (June 2020), Bhutan, Vietnam, and Hong Kong (October 2020), Myanmar (November 2020), Thailand (March 2021), and Cambodia, Malaysia, and Laos (May 2021).

The primary transmission of the LSD virus occurs mechanically through arthropod vectors such as mosquitoes (Culex mirificens and Aedes natrionus), biting flies (Stomoxys calcitrans and Biomyia fasciata), and male ticks (Riphicephalus appendiculatus and Amblyomma hebraeum). Direct transmission occurs through direct contact with skin lesions, while indirect transmission occurs through contaminated equipment and tools, such as barn clothing, barn equipment, and syringes. Furthermore, that intrauterine transmission is possible, with the virus being transmitted from infected cow mothers to calf offspring through milk secretion and injured skin [37].

Lumpy Skin Disease poses a significant threat to cattle and buffalo farming due to its potential to cause acute or subacute diseases in all age and breed categories, especially in young cattle and those in the peak of lactation/nursing. Clinical symptoms of LSD are influenced by age, breed, and the immune status of the animals. The main clinical sign of LSD is skin lesions in the form of nodules ranging from 1 to 7 cm, typically found on the neck, head, legs, tail, and udder. In severe cases, these nodules can be found all over the body. The appearance of these nodules is usually preceded by a fever exceeding 40.5°C. If left untreated, these skin nodules can become necrotic and ulcerative. Other clinical signs include weakness, nasal and ocular discharge, swelling of the subscapular and prefemoral lymph nodes, and edema in the legs. Additionally, LSD can lead to abortion, decreased milk production in dairy cows, infertility, and prolonged fever [35]. The incubation period for LSD ranges from 1 to 4 weeks, with a mortality rate below 10% and a morbidity rate around 45%.

In January 2023, Lumpy Skin Disease had infected cattle in the Garut Regency of West Java Province, causing significant economic impacts on the livestock industry. Affected animals tend to experience permanent skin damage, reducing their commercial value. As of now, there is no specific treatment for diseases caused by viruses, including Lumpy Skin Disease (LSD). Treatment for LSD is symptomatic, focusing on addressing clinical symptoms and supportive measures to improve the condition of infected livestock. Infected cattle are given drugs to alleviate disease symptoms such as fever and skin pain, with the goal of accelerating recovery and enhancing the animal's immune resistance. The use of medicinal plants by communities is one approach to addressing health problems, especially in treating diseases. Traditional medicine is preferred due to its accessibility to the public in terms of both cost and material availability [10]. Additionally, the potential side effects of chemical drugs in animal husbandry need to be considered, as they can have adverse effects on both livestock and their products. The occurrence of side effects from chemical drug use has led many farmers to return to using natural remedies, aligning with the current back-to-nature concept. Utilizing locally available plants, such as gamal tree (Gliricidia sepium) leaves, for herbal medicine purposes is one way to address the challenges posed by LSD.

Gamal tree (Gliricidia sepium) is commonly used as a protective plant in tropical regions, and its leaves (in fresh form) are utilized as forage for ruminant livestock due to the presence of coumarin, a primary allelochemical. This natural compound has the potential to replace synthetic herbicides or serve as a foundation for the synthesis of biodegradable chemical herbicideS. Allelopathic plants or products are believed to be less harmful to the environment than synthetic herbicides because they degrade easily. Furthermore, gamal tree leaves can function as an insecticide, bactericide, larvicide, and plant-based anti-inflammatory agent. Gamal tree leaves can be used to treat dermatitis, itching, act as an insect repellent, treat rheumatism, heal wounds, and address skin diseases/scabies. The active chemical composition in gamal tree leaves (G. sepium) includes active phytochemical compounds such as flavonoids, sterols, alkaloids, glycosides, tannins, saponins, medicarpin, coumarin, and coumaric acid [2]. The LD50 value of gamal tree leaf methanol extract in rats is higher than 5000 mg/kg body weight, demonstrating its safety [30]. A chemical substance is classified as non-toxic, non-fatal, or non-hazardous if the LD50 is greater than 5000 mg/kg body weight [28].

Gamal tree leaves contain coumarin, a chemical compound belonging to the class of organic compounds called benzopyrones. Coumarin possesses various biological properties, including antimicrobial, antiviral, anti-inflammatory, antidiabetic, antioxidant, and enzyme inhibition activities. Different derivatives of coumarin exist, such as umbelliferone (7-hydroxycoumarin), which acts as a strong ultraviolet-absorbing compound and an antioxidant; aesculetin (6,7-dihydroxycoumarin), commonly used as a sunscreen but also reported as a photosensitizer for DNA damage; herniarin (7-methoxycoumarin), considered a methoxy derivative of coumarin or a methyl derivative of umbelliferone [31]; psoralen (furanocoumarin), used for photochemotherapy to treat psoriasis and vitiligo; and imperatorin, reported to be used for respiratory and gastrointestinal disorders, acting as a diaphoretic, antipyret.

Palm oil is an excellent oil for the skin as it functions effectively as a moisturizer, preventing dry and flaky skin [38]. The fatty content in coconut oil is beneficial for moisturizing both the skin and hair. Lauric acid triglycerides (the main fatty acid) in coconut oil have a high affinity for hair proteins. Due to their low molecular weight

and straight linear chains, they can penetrate the hair shaft, preventing hair protein damage. The gamal tree leaves contain a relatively high level of coumarin (around 1000 ppm) [40]. Furthermore, that coconut oil is one of the best natural nutrients for hair, promoting hair growth and effectively reducing protein loss that can lead to various quality issues in hair growth [38].

The objective of this research is to determine the effectiveness of various doses of a combination salve of coconut oil and gamal tree leaves for the treatment of Lumpy Skin Disease (LSD) in cattle.

II. MATERIALS AND METHODS

The research material consisted of 20 infected beef cattle with Lumpy Skin Disease (LSD) owned by farmers in the Garut Regency, West Java Province. The research was conducted through an experimental method designed with two variable observation groups: (1) Concentration of salve with coconut oil and gamal tree leaves, and (2) Application of salve with coconut oil and gamal tree leaves on experimental animals (cattle infected with LSD).

All experimental cattle were provided with basal food in the form of pasture grass, while drinking water was given ad libitum. They received supportive treatment to improve the condition of the infected livestock, including the administration of antipyretic and multivitamin drugs. Three concentrations were used in this study: 1) 50%: 500 grams of gamal leaves in 1 liter of coconut oil (SMDG 50%); 2) 75%: 750 grams of gamal leaves in 1 liter of coconut oil (SMDG 25%); 3) 100%: 1000 grams of gamal leaves in 1 liter of coconut oil (SMDG 100%). The experimental cattle were divided into four groups (each consisting of 5 cattle): Group 1 (SMDG 50%), Group 2 (SMDG 75%), Group 3 (SMDG 100%), and Group 4 (Control group treated with antibiotics, antipyretics, anti-inflammatory, and multivitamins for 5 days). Treatment was administered once daily for 14 days, applying SMDG using a brush/sponge and rubbing it on the entire skin surface of LSD-infected cattle.

Preparation of Gamal Leaf Salve with Palm Oil:

Gamal leaves selected for treating Lumpy Skin Disease (LSD) in cattle were mature and estimated to contain high levels of coumarin (around 1000 ppm). The preparation of Gamal Leaf Oil Salve (SMDG) was conducted according to the modified method by Philipine Medicinal Plant 2009. Fresh gamal leaves were finely chopped or blended and mixed with coconut oil. The mixture was then heated to boiling for one hour. After boiling, the heat was reduced, and it continued to be heated for another hour, totaling two hours of heating. After cooling, the gamal leaf salve and palm oil were topically applied to the entire skin surface of LSD-infected cattle. Healing parameters were based on the reduction in nodule size and the drying of ulcers/wounds on the skin surface.

Data Analysis

The collected data were analyzed using the Kruskal-Wallis analysis. Significant differences among treatments were further analyzed using the Mann-Whitney comparison analysis.

III. RESULT

The. The clinical symptoms of Lumpy Skin Disease (LSD) are influenced by the age, breed, and immune status of the livestock. The main clinical sign of LSD is skin lesions in the form of nodules/bumps ranging from 2-5 cm, typically found on the neck, head, legs, tail, and udder. In severe cases, these nodules can be found on almost all parts of the body. Nodules with a diameter of 2-5 cm on the skin, especially on the head, neck, limbs, udder, genitalia, and perineum, appear within 48 hours after the onset of fever. These nodules are circumscribed, hard, round, and elevated on the skin, subcutaneous tissue, and even muscles. Larger nodules can become necrotic, eventually fibrotic, and persist for several months (sitfasts), with scars lasting a long time. Small nodules may heal without causing significant effects. Myiasis in nodules can occur, and vesicles, erosions, and ulcers may occur on the oral mucosa, alimentary canal, trachea, and lungs [20]. The research results indicate that the size of nodules and ulcers after treatment with gamal leaf oil salve (SMDG) is presented in Table 1.

Table 1: Post-Topical Treatment Conditions of Nodules and Ulcers with EMDG

Treatment	n	1	7	14	Explanation
S1. 50 % SMDG	5	-	+	++	Not healed
S2. 75 % SMDG	5	-	++	+++	Improving
S3.100% SMDG	5	- -	++	++++	Unhealed
Ivermectin	5	- -	++	++++	Unhealed

Nodule and Ulcerative Scores on Day

Explanation:

(-) No change yet.

(+) Partial improvement (50%), nodules are shrinking with a diameter of 1.5-2 cm, ulcers are still wet.

(++) Significant improvement (75%), nodules are shrinking (1-1.5 cm), ulcers are starting to dry.

(+++) Nodules 90% smaller, 0.7-1.0 cm, and ulcers are drying.

(++++) Nodules are gone, and ulcers are dry (healed).

Based on the data in Table 1, it is evident that the application of Gamal leaf oil salve (SMDG) with a concentration of 100% resulted in the highest healing compared to using concentrations of 75% and 50% for cattle exposed to LSD. This is presumed to be due to the higher content of coumarin, saponin, and tannin in SMDG 100%, giving it a higher efficacy in deactivating the LSD virus and reducing inflammation. Coumarin possesses various biological properties, including antimicrobial, antiviral, anti-inflammatory, antidiabetic, antioxidant, and enzyme inhibition activities [31]. Furthermore, that Gliricidia sepium leaves contain various active phytochemical compounds such as flavonoids, sterols, alkaloids, glycosides, tannins, saponins, medicarpin, coumarin, and acids [2]. Tannins play a significant biological role as protein precipitants and metal chelators, suggesting their potential as biological antioxidants [24]. That saponins can lower cholesterol, exhibit antioxidant properties, act as antivirals, and have anticarcinogenic effects, as well as influence rumen fermentation [11, 34].

Analysis of variance on the average reduction in nodule size showed statistically significant differences ($P<0.05$) between treatment S3 and S1 starting from week 1 (after 7 days of treatment) with a decrease in nodule size and drying ulcers. Subsequently, in treatment S3, there were no statistically significant differences ($P>0.05$) in the healing parameters (nodules no longer visible, and ulcers dried) after 14 days of treatment compared to the control treated with a single dose of ivermectin.

The research results indicate that nodules start to flatten, and ulcers begin to dry on the seventh day (7). In Experiment S2 and S3, the results are relatively similar with sizes of 1-1.5 cm, and they are better than in S1, where nodule size is 1.5-2 cm, as presented in Table 2 / Figure 2.**

Table 2: Progress of Gliricidia Leaf Oil Ointment Treatment in Lumpy Skin Disease (LSD) Cases

Date	Development of the Case	Images		Assessment Scoresof Gliricidia Ointment Therapy
		Left	Right	
2/16/2023	The initial report indicated the presence of LSD symptoms, specifically bloody lumps on the cattle.			-
2/27/2023	The Gliricidia leaf ointment was applied daily, and the progression of the case showed the healing of the skin lumps.			++
3/8/2023	As the case progressed, the wounds showed improvement, healing, and drying.			+++

Explanation:

(-) No change in Gliricidia leaf ointment therapy.

(++) Significant improvement in Gliricidia leaf ointment therapy; the wound starts to dry.

(+++) The wound is drying, and healing is observed.

The occurrence of scab peeling after SMDG application is suspected to be due to the presence of one of the coumarin derivatives (furocoumarin) in Gliricidia leaves, which acts as an active photosensitizer. Furocoumarin induces phototoxicity when exposed to sunlight, marked by increased capillary blood flow on the skin surface and damage to skin tissue cells (scab peeling). This aligns with Letteron et al. [27], stating that one coumarin derivative, furocoumarin, can reversibly alter the detoxification ability of an organism or irreversibly inhibit cytochrome P450 detoxification enzymes. Furthermore, that scab peeling will occur more quickly if the livestock is exposed to sunlight post-treatment [32].

In this study, it is presumed that palm oil also provides significant benefits. Palm oil may adhere longer to the skin, not dissipating when the cattle move, moisturizing the skin to accelerate the softening and easy peeling of scabs. This aligns with Vala and Kapadiya [38], stating that palm oil serves as an effective moisturizer preventing dry and peeling skin, providing essential proteins needed for hair growth, and repairing damaged hair. Lauric acid triglycerides (main fatty acid) in palm oil have a high affinity for hair protein due to their low molecular weight and straight linear chain, penetrating the hair shaft and preventing hair protein damage [18, 27].

IV. CONCLUSION

A concentration of 100% SMDG is safe for use as a botanical antivirus and can reduce nodule size and dry ulcers in the treatment of Lumpy Skin Disease (LSD) after a 14-day application.

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Further research is needed for extract formulation in stability tests to ensure that Gliricidia leaf oil ointment can be stored for an extended period at room temperature.

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