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The Use of Citronella Essential Oil (*Cymbopogon nardus*) to Treat ORF Disease in Local Sheep

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ABSTRACT

ORF disease is a contagious skin infection in sheep caused by a virus of the Parapoxvirus genus. The resulting scabby lesions can lead to decreased productivity and secondary infections. This study aimed to evaluate the effectiveness of citronella (*Cymbopogon nardus*) essential oil in accelerating the healing of ORF wounds. A total of 24 local sheep infected with ORF were divided into three groups: Group I (1% concentration), Group II (5%), and Group III (10%). The treatment solution was applied topically every two days over a 14-day period. The results showed that Group III had the fastest healing time. Citronella essential oil at 10% concentration was proven effective as a natural treatment for ORF and holds potential for further development in veterinary applications for sheep farmers.

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Introduction

Indonesia is a tropical country and thus possesses a rich diversity of natural biological resources that have long been utilized as traditional medicine by local communities. This cultural practice continues to evolve alongside modern technological innovations aimed at enhancing the added value of medicinal plants [1]. One promising plant is Citronella (*Cymbopogon nardus* L.), commonly known in Indonesia as sereh wangi. Its essential oil, widely referred to as citronella oil, contains bioactive compounds such as citronellal, citronellol, and geraniol. These compounds exhibit antiviral and antibacterial properties that support wound healing. The essential oil of *Cymbopogon nardus* and its

major component, citronellal, have demonstrated effective antibiofilm and antifungal activity against clinical strains of *Candida albicans*, reinforcing its clinical potential for managing oral fungal infections and wounds [2]. ORF disease (*Ecthyra contagiosa*), caused by a virus from the Parapox genus, poses a serious threat to local sheep. This disease produces scabby lesions around the mouth, eyelids, and non-hairy areas, leading to feeding difficulties, reduced productivity, stunted growth, and poor livestock performance [3].

It causes declines in productivity, body weight, and growth, resulting in economic losses for farmers due to high morbidity despite low mortality rates [4]. Conventional treatments using antibiotics and antiseptics are often ineffective over extended periods and may contribute to antimicrobial resistance, thus highlighting the need for safe and efficient natural therapeutic alternatives [5].

Local sheep play a strategic role in Indonesia's economy, society, and culture. Preserving genetic diversity is essential for national food security and livestock development. Consequently, managing diseases such as ORF, which threaten the local sheep population, is a high priority. The use of essential oils as active ingredients in veterinary topical preparations, such as ointments and spray gels, has also been explored to enhance the effectiveness and stability of active compounds during use [6].

The utilization of citronella essential oil as an alternative treatment offers dual advantages: the antiviral activity of citral, myrcene, and limonene, which disrupt viral membranes and inhibit replication; and antibacterial and repellent effects that help prevent secondary infections and myiasis [7]. This study aims to determine the effective concentration of citronella essential oil to accelerate wound healing in local sheep affected by ORF. The results are expected to offer a scientific, locally sourced solution for farmers in managing ORF while supporting the development of sustainable and innovative products.

Method

This study was conducted from May to June 2024 at the Young Farmer Farm (YFF) livestock facility, located in Cibiru Wetan, Cileunyi District, Bandung Regency. The equipment used in this study included field clothing, rubber boots, pens, notebooks, funnels, pipettes, measuring cylinders, a measuring tape for wound measurement, a camera for documentation, and a laptop for data processing. The equipment used for treatment included 100 mL spray bottles. The materials used consisted of 24 local sheep. Treatment materials included distilled water, citronella essential oil, natural liquid soap, and natural coloring agents.

The research procedure began with the recording of the identity of local sheep diagnosed with ORF infection. The wound area caused by ORF was then measured for each sheep. The sheep were divided into three treatment groups, each consisting of eight replicates, based on the concentration of citronella essential oil administered: Group I received a 1% concentration, Group II a 5% concentration, and Group III a 10% concentration. Treatment was applied once every two days, and observations were conducted on days 3, 5, 7, 9, 11, and 13. The observations focused on the progression of wound healing by measuring the reduction in ORF lesion size.

Results and Discussion

Physical and clinical examinations were conducted on 24 local sheep exhibiting clinical symptoms of ORF, characterized by scabby lesions around the mouth and nostrils (Figure 1). The measurement results of ORF lesion area in local sheep treated with citronella essential oil are presented in Table 1.

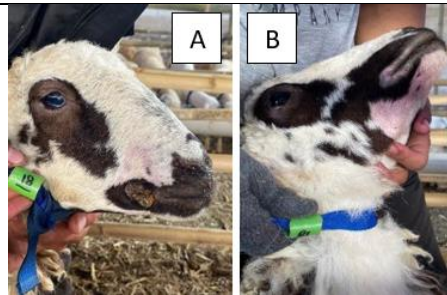


Figure 1. Healing process of ORF lesions in local sheep. A: Before treatment; B: After treatment.

The treatment procedure involved manually opening and cleaning the lesions using gloves until the wound area was visibly clean. The appropriate treatment solution, based on the group assignment, was then sprayed onto the wound. The results indicated a gradual reduction in lesion area across all treatment groups; however, the rate and extent of healing varied between groups. Group III (10% concentration) showed the most rapid wound healing, with lesions beginning to dry by day 7 and most wounds nearly or fully closed by day 11. Group II (5% concentration) showed moderate healing progress, while Group I (1% concentration) demonstrated the slowest healing response.

Table 1. Reduction in ORF lesion area in local sheep

Group	No. Sheep Tag	Initial Wound Area (cm ²)	Wound after Day-(cm ²)					
			3	5	7	9	11	13
I	128	0,5	0,25	0	0	0	0	0
	136	4,8	4,2	2,5	0	0	0	0
	156	6,75	6,75	1,25	0	0	0	0
	103	8	8	6	5,25	2	0	0
	142	9,35	8,25	5	2,5	0	0	0
	94	10,8	10,2	9	5,5	0	0	0
	154	13,6	13,6	13,6	10,5	8,25	3,5	0
	75	16	16	9,75	8	2	0	0
	Average	8,72	8,40	5,88	3,96	1,53	0,43	0
II	152	0,9	0,75	0,25	0	0	0	0
	161	2	1	1	1	0	0	0
	89	3	0,5	0	0	0	0	0
	108	3	3	3	0	0	0	0
	149	5,18	4,2	3	2,5	0	0	0
	160	9	6,75	3,6	3	0	0	0
	78	9,6	8,1	5,04	3	1,25	0	0
	141	17	17	11,25	11,25	7,5	7,5	0
	Average	6,21	5,16	3,39	2,59	1,09	0,93	0
III	105	4	4	4	3	1,5	0	0
	77	6	5,55	2,5	1	0	0	0
	146	7,65	6	3,5	1,75	0	0	0
	92	7,8	6	1,5	0	0	0	0
	162	10,8	9	3,84	3,5	3,5	0	0
	81	11	10	10	7,5	3	3	0
	100	17	10,5	5,25	0	0	0	0
	144	19	13,5	13,5	12,75	0	0	0
	Average	10,40	8,06	5,51	3,68	1	0,37	0

A study on shampoo formulations based on citronella essential oil demonstrated strong antifungal activity against *Candida albicans*, reinforcing its potential for topical treatment [8]. The main constituents of citronella essential oil, namely citronellal (22.15%), citronellol (16.34%), and geraniol (11.16%) [9], are believed to contribute to the acceleration of wound healing in sheep infected with ORF. In addition, the antiseptic properties of the essential oil may prevent secondary infections commonly caused by environmental bacterial contamination and fly infestations. This finding is consistent with the results of [10], which reported that citronella essential oil exhibits antibacterial and wound-healing properties due to the presence of citronellal, geraniol, and citronellol, compounds known to provide anti-inflammatory and broad-spectrum antibacterial effects, thereby making it a promising topical therapeutic agent.

The current study aligns with previous research demonstrating the dual function of citronella essential oil as an antiviral and wound-healing agent. The oil inhibits viral replication by destabilizing viral lipid membranes [11] and promotes angiogenesis and fibroblast proliferation during the proliferative phase of wound healing [12]. Furthermore, citronellal has been shown to accelerate burn wound healing in white rats, with a 1% concentration producing the most effective results [13]. Citronella essential oil also exhibits antibiofilm activity against *Staphylococcus aureus*, a key factor in accelerating chronic wound healing [14]. In addition, the oil has demonstrated antifungal activity against pathogenic fungal species such as *Aspergillus* and *Penicillium* at relatively low concentrations, with citronellal and linalool identified as the principal active compounds [15]. From a veterinary application perspective, *Cymbopogon nardus* essential oil has been deemed safe for all livestock species when used at appropriate concentrations [16].

Its antioxidant activity and cellular protection capabilities further support its use in wound care by inhibiting cellular aging and suppressing MMP-2 expression, which can delay tissue regeneration [17]. From a metabolomic standpoint, recent studies have identified citronellal, geraniol, and limonene as key antibacterial biomarkers in citronella essential oil [18]. Topical formulations such as spray gels have been developed to enhance the stability and ease of application of citronella essential oil [19]. Finally, the high bioactive compound content in healthy plants underscores the importance of disease control in source crops to ensure optimal essential oil productivity [20]. In this study, higher concentrations of citronella essential oil resulted in a faster healing process of ORF lesions. Therefore, citronella essential oil holds potential as a natural therapeutic agent for the treatment of ORF in local sheep, offering a safe, cost-effective, and practical solution for farmers.

Conclusions

Citronella (*Cymbopogon nardus*) essential oil was proven effective in accelerating the healing of ORF lesions in local sheep. Treatment with a 10% concentration produced the most favorable results, demonstrating the fastest healing time and a significant reduction in lesion size compared to the 1% and 5% concentrations. Therefore, citronella essential oil holds potential for development as a safe, effective, and practical natural alternative for the treatment of ORF in local sheep.

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