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Original Research Article

ANTIMICROBIAL POTENTIAL OF CREAM FORMULATION CONTAINING ESSENTIAL OIL (CITRONELLA OIL) OF *CYMBOPOGON NARDUS* LINN.

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Abstract: Objective-The main objective is to prepare an efficacious, stable and economic cream containing the essential oil (citronella oil) of *Cymbopogon nardus* for its antimicrobial activity.
Methods- Topical formulations containing essential oil of *Cymbopogon nardus* were developed for their promising antimicrobial activity against selected microbes. The formulations (cream-w/o type) were prepared using standard methods and assessed for different pharmaceutical parameters. An in vitro antimicrobial study of the formulation was performed by using Agar-cup plate method. The cream formulations evaluated for pH, Viscosity and Spreadibility.
Result- Among the four formulations (F1-F4), F4 showed good spreadability, viscosity & pH. The pH result shows that the formulations are considered acceptable without the risk of any irritation on application to the skin. As the formulation F4 was found to be the most suitable preparation and hence subjected for the antimicrobial activity. Cream formulation shown range for zone of growth inhibition (ZGI) 22.6 ± 0.58 for *Staphylococcus aureus*& 23.8 ± 1.15 mm for *Escherichia coli*. The BOROLINE and BOROPLUS cream are used for the comparative study. The Data obtained in the form of zone of growth inhibition (mm in diameter) indicate that the activity of cream formulation was more pronounced against Staphylococcus *aureus & Escherichia coli*.
Conclusion- From the present work it was concluded that the formulated antimicrobial cream using essential oil is natural, safe, effective, usable for the skin and stable too.

Keywords- Cream, Citronella oil, *Cymbopogon nardus*, Antimicrobial cream

Introduction: Infectious diseases represent prominent health issues in both developed and developing nations with an alarming increase in the incidence of new and emerging drug resistant microbes due to indiscriminate use of antibiotics and other drugs. To combat the challenge of multi drug resistance pathogens, scientists, researchers and pharmaceutical industries have been looking into natural products derived from plants as an alternative to

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the synthetic counter parts (Jinukuti and Giri, 2013). Essential oils obtained from aromatic plants, spices, and herbs are being investigated as a potential source of novel antimicrobial agents possessing broad spectrum antimicrobial activities. They are not only found effective in the treatment of infectious diseases but also mitigate many of the side effects that are often associated with synthetic antimicrobial agents.

Citronella oil is one of the major essential oils. It has a rose like odour and bitter taste. It is mainly used in the perfumery and cosmetic industry. Citronella oil is a raw material for production of geranial, citronellal, hydroxy-citronellal and other similar high value perfumery bases. It is also widely used as a starting material for various aromatic chemicals used in scented soaps, sprays, deodorants, detergents, polishes, mosquito repellants etc Citronella essential oil (CEO) is extracted from an herbaceous grass like tropical plant, *Cymbopogon nardus*, through steam distillation. Though it contains more than 22 compounds, geraniol, trans-citral, cis-citral, geranyl acetate, citronellal (6-octenal, 3, 7-dimethyl) and citronellol are the major constituents. Citronellal alone constitutes about 29.6% of CEO Its use started long back as mosquito repellent. CEO had immunomodulatory effect. Besides, it has also been reported antifungal and antimicrobial. It has been used as an alternative to commercial antibiotics in aquaculture and also in aromatherapy for acne cures. As an antimicrobial, citronella essential oil (CEO) has been shown to be inhibitory for about 50%strains of bacteria and fungi.

Material & Methods

Material: The authentication of *Cymbopogon nardus* Linn. Was done at Botanical Survey of India , Central National Herbarium, P. O. – Botanic Garden , Howrah – 711 103 ,West Bengal, India. All other ingredients and chemicals used were of analytical grade and provided by Bajiraoji Karanjekar College of Pharmacy, Sakoli (M.S.).

Extraction of oil: The Clevenger apparatus was named from its inventor, Joseph Franklin Clevenger, who published in 1928. A few models exist. The most common one (Figure 1) is a piece of specific glassware, as can be seen above the round bottom flask. The flask, of variable size, contains water which is boiled as well as the plant to be extracted. The steam rises in the assembly to a condenser (out of picture), and the condensate falls into the small burette on the right. Oil floats on the water, which for its part is gradually returned to the heated flask through the diagonal conduit. After 2 hours of extraction, the oil volume collected in the burette can be directly measured. [8]

Fig.1:- Clevenger Extraction Apparatus& Plant material

Preparation of various Formulation: The w/o type cream have the two phase aqueous phase and oil phase .The ingredients are hydrophilic in nature in the aqueous phase and lipophilic in oil phase .Both the phases. Ingredients are heated on 70° c on separate containers .Then add aqueous phase in oil phase with continuous stirring at 1000 - 1500 rpm by using metallic stirrer . Check the temperature, add citronella oil at 40°c in the formulation to avoid the Volatization of oil. After cooling the final product got faint yellowish green colour.

Table 1: Antimicrobial Formulations

Sr. No.	Ingredients (%w/w)	F1	F2	F3	F4	F0
1	Citronella oil	1	3	5	10	-
2	Petroleum jelly (yellow)	70	70	70	70	70
3	Bees wax	2	2	2	2	2
4	Liquid paraffin	10	8	5	2	10
5	Glycerin	5	5	5	5	5
6	Borax	1	1	1	1	1
7	Propyl paraben	0.01	0.01	0.01	0.01	0.01
8	Methyl paraben	0.10	0.10	0.10	0.10	0.10
9	Water	q.s.	q.s.	q.s.	q.s.	q.s.

Evaluation of cream

pH: pH was determined by preparing 1:20 cream to methanol mixture that was subjected to a digital pH meter.

Viscosity and Rheology: Viscosity of creams was determined by using Brookfield viscometer. Further the rheology was also studied using same viscometer.

Spreadability- Measured the Spreadability of an ointment with the apparatus principally based as shown in fig. Therefore an apparatus based as same principle was fabricated in the laboratory. An excess of cream was placed between the two glass slides and a weight of 1000 g was placed on slides for about 5 minutes to compress the sample to a uniform thickness. Weight of 100g was added to the pan. The time in seconds required to separate two slides, was taken as measure of Spreadability. It was calculated using the formula:

$$S=W \times L/T$$

Where S is spreadability,

m is weight of tied to the upper slide,

l is the length of glass slide and

t is the time taken to separate two slides.

***IN VITRO* Evaluation of the Antimicrobial Activity of Creams:** As the formulation F4 was found to be the most suitable preparation, its antimicrobial activity can be seen.

Agar-cup plate method was used in the procedure. Briefly Nutrient agar plates were prepared by adding 0.75% w/v Sodium tauracholate into Nutrient agar for good miscibility of oils in the medium. Freshly grown cultures of *S. aureus* and *E. coli* in the Nutrient broth were firmly sweeped over the Nutrient Agar Tauracholate (NAT) surface in different plates, by the help of sterile cotton swab in order to get lawn cultures of the organisms. Wells of 3.0 mm diameter were punched in the plates with the help of sterile gel puncher. 50 mg of each cream preparation was placed into the wells and incubated at 37°C for 20 hrs and observed for zones of inhibition around the wells .[9]

Result and Discussion: Four formulation were prepared containing varying concentration of citronella oil .to study antimicrobial effects of *Cymbopogon nardus* oil F1,F2,F3&F4 was prepared. In all preparation the F4 gives better activity as compared to other formulation.

The F4 gives better results compare with Boroline and Boroplus marketed preparation.

1) **pH, Viscosity and Spreadability:** The pH of all the formulation is acidic. Spreadability was better as formulation base itself is oil. The F4 has more Spreadability as compared to other formulations.

Table 2- pH, Viscosity and Spreadability of Various Formulations

Formulation	pH	Viscosity (poise)#	Spreadability
F1	5.42	148	4.2
F2	5.52	139	4.4
F3	5.69	132	4.9
F4	6.15	110	5.1

2) **In Vitro Evaluation of Antimicrobial Activity of Creams:** The study of antimicrobial activity can be done by using cup plate method. It indicates that the formulation F4 has maximum activity among these four formulations. The boroline and boroplus cream are used for the comparative study. The F4 preparation gives more result than these two marketed preparation. They show less activity as compared to F4 preparation. The observation is shown in table no 3.

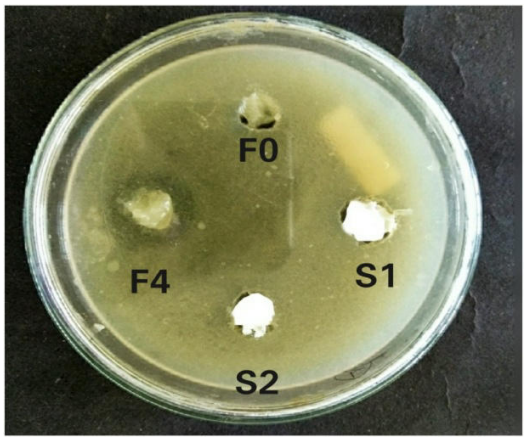

Fig. 2: Agar cup plate

Table 3-Antimicrobial Study

Sr. No.	Organism	Zone of inhibition (mm)			
		F0	F4	Boroplus (S1)	Boroline (S2)
1	Staphylococcus aureus	0.0	22	11	8
2	Escherichia coli	0.0	23	12	10

Conclusion: *Cymbopogon nardus* is an herb known to antimicrobial; it is especially effective for the antibacterial, antiseptic, antifungal and insect repellent activity.

In the recent study, the demand of the essential oil is increased day by day. They are use for the different types of formulation like, soap, perfumery, cosmetics, flavouring industries throughout the world.

The oil of *Cymbopogon nardus* are well known for the insect repellent activity and used mostly for the fragrance .The formulation is prepared for topical application in the form of cream. The selected due to many reasons i.e. it is easy to use and apply to the skin. It gives the sustained release of drug and efficacy.

The evaluation studies were performed which showed positive results. The Spreadability was better as base itself was oil. The formulation was stable for long period. The in vitro study activity was also better as compared to marketed preparation.

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