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Review Article

The Medicinal Potential of *Calpurnia Aurea* and *Lantana Camara* to Produce Antimicrobial Textiles: Review

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Abstract

The demand for antimicrobial textiles has increased in the recent global market owing to the booming demand for fresh lifestyles by customers. This can be achieved by using synthetic or natural antimicrobial agents. However, ecological problems have reduced the demand for synthetic antimicrobial agents. Natural antimicrobial agents can be obtained from plants and animals. Traditionally, multiple species of plants have been used to treat various diseases. *Calpurnia Aurea* and *Lantana Camara* have been used as medicinal plants in rural Ethiopia. The health benefits of *Calpurnia Aurea* and *Lantana Camara* have been proven by different scholars. The presence of phytochemicals that act against photogenic micro-organisms, such as bacteria and fungi indicate the potential of herbs to be used as eco-friendly and sustainable antimicrobial agents in different applications. Thus, the pharmaceutical value of plants has been approved. However, none of these herbs is used in the manufacture of antimicrobial textiles.

Keywords: Antimicrobial; *Calpurnia Aurea*; Eco-friendly; *Lantana Camara*; Textiles

Introduction

In recent decades, textiles with antimicrobial activity have become extremely important in the health protection of the human body. Metals or metal salts, quaternary ammonium compounds, polybiguanides, N-halamine, chitosan, and triclosan are the main antimicrobial agents used for textile functionalization. Most of the antimicrobial agents enlisted are having disadvantages such as discharge on laundering causing environmental problems (Shabbir, Yusuf, & Mohammed, 2017). Finding a new high-quality antimicrobial agent, such as from a plant source, can significantly diminish the unwanted toxicity and non-biodegradability associated with products. Only a few of these latest possibilities have been discovered and commercialized, to date.

The antimicrobial functionalization of fibers by the means of diverse plant and other natural agents for medical applications is thus the creation of new prosperity, especially, due to, the fact that biomedical and biodegradable products will be the soon largest application of antimicrobial textiles (Ristić et al., 2011). Development of organic, non-toxic, non-allergic, eco-friendly finish is becoming necessary. The antimicrobial potential of *Lantana Camara and Calpurnia Aurea* are discussed in this paper to investigate an alternative green and ecofriendly antibacterial finishing agent from a natural source to safeguard our ecosystem from severe damage by use of toxic chemicals. Herbal-based antibacterial agents are widely used in pharmaceutical industries as a source of medicine.

Overview of Antimicrobial Finishing Process and Agents

Antimicrobial finishing of textile material is one of the innovations to improve the performance properties of the textile substrate and protect the wearer (Sood, 2014). The antimicrobial finish imparted to textile material to enhance their ability, to inhibit the growth of bacteria or to kill at least some types of bacteria's. Therefore, an antimicrobial finish should be capable to kill the bacteria or inhibiting their growth to safeguard both wearer and textile from damage by altering cell membrane permeability, obstructing the synthesis of proteins of microbes, blocking enzyme production necessary for microbe food (Nayak & Padhye, 2014). Another researcher also revealed that antibacterial are any chemical that interferes with the growth of microbes, work either in contact or by controlled release of antimicrobial agents (Parthiban & Thilagavathi, 2012). Antimicrobial substances can be divided into biocides and biostats, leaching and bound, synthetic and natural (Gao & Cranston, 2008).

Synthetic Antimicrobialagents

They includes antibacterial dyes, quaternary ammonium compounds, polyhexamethylene biguanides (PHMB), triclosan (2, 4, 4'-trichloro-2'- hydroxydiphenyl ether), negenerable N-halamine and peroxyacids and metals and metal salts such as silver, zinc, copper (Simoncic & Tomsic, 2010). Synthetic antimicrobial finishes can provide long-lasting finish with higher durability (Sood, 2014). However, most of synthetic antimicrobial finishes are not eco-friendly, toxic to environment, cause pollution and effect the wearer in one or more ways which can be addressed by using natural antimicrobial finishing agents (El-Shafei, Shaarawy, Motawe, & Refaei, 2018).

Natural Antimicrobial Agents

Both plant and animals consists of certain bioactive chemicals which can inhibit growth or kill microbial (Shalini G, 2016). Chitosan

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is an effective natural antibacterial agent derived from Chitin. Natural herbal products such as neem, tulsi, pomegranate, aloe Vera, prickly chaff flower, Turmeric, and clove also exhibit antibacterial activity due to the presence of bioactive chemicals like flavonoid, terpenoid, tannin, phenol and others in their chemical structure (Landage & Wasif, 2012). Natural antimicrobial finishing agents have a great advantage over their counterpart synthetic antimicrobial finishes.

Plants as Source of Antimicrobial

Along time ago, plants and herbal preparations have been used as medicine, flavor, scent, or other qualities. The principal use behind plant extract is that low toxicity, environmentally friendly product, and less pollution. Moreover, the efficacy and safety of plant-based medicine have diverted the major pharmaceutical population towards medicinal plant's research. Plants are one of the most important sources of medicines in world. In the last few years, there has been an exponential growth in the field of herbal medicine, and these drugs are gaining popularity both in developing and developed countries because of their natural origin and less side effects (Kaur, Dhari, Sharma, Gupta, & Kharb, 2012)

Calpurnia Aurea

Calpurnia Aurea is member of the subfamily Papilionoideaeis a genus of Flowering Plants within the family offabaceae (Mulata, Gnanasekaran, Melaku, & Daniel, 2015). It is commonly known as Natal laburnum. The genus comprises shrubs or small trees in or along the margin of forests in most part of east Africa including Ethiopia and southern India. This grows as shrub or a slender tree (Mengistu, Daniel, & Gnanasekaran, 2019). The size of tree is varying from region-to-region soil to soil and other related condition. The plant may have length up to 15*Calpurnia Aurea* is commonly known as chekata in Afaan Oromo and digita in Amharic in Ethiopia (Eyasu, Shibeshi, & Giday, 2013). It is often found in overgrazed areas and is easily cultivated (Birhan, Tessema, Kenubih, & Yayeh, 2018). It is widely available in almost all part of Ethiopia.

Traditional medicinal use of *Calpurnia Aurea***:** Approximately about 80% of Ethiopian medicine involves traditional medicines which mainly depend on plants product. Especially in the countryside, people use plant extract as a first-aid treatment process. *Calpurnia Aurea*, a member of the subfamily Papilionoideae, is a plant commonly used in traditional medicine to treat diverse medical conditions and parasitic infestation, both in humans and animals (Belayneh, Birru, & Ambikar, 2019; Birhan et al., 2018). Since time immemorial, *Calpurnia Aurea* has been used as phytomedicine product. For such medicinal purposes the plant part such as bark, flower, root, leave, bark and have been used for different medicinal purposes (Eyasu et al., 2013).

The leave and stem of *Calpuniaaureaused* for the treatment of both human and animal diseases. Traditionally, in Ethiopia, it is used for the treatment of syphilis, malaria, rabies, diabetes, hypertension, diarrhoea, leishmaniasis, trachoma, elephantiasis, fungal diseases and different swellings, stomach-ache, bowel, and bladder disorders. The leave and powdered roots of *Calpurnia Aureais* also used for the treatment of lung TB, abscesses, to destroy maggots, to destroy lice, to relieve itches, used as a fish-poison or as a cure for dysentery, exhibit activity against amoebiasis and giardiasis, cough and snake bite (Belayneh et al., 2019). It is also used to treat stomach complaints, headaches, eye diseases, scabies and skin infection caused by ticks and as an insecticide as well (Mengistu et al., 2019). *Calpurnia Aureais* used for wound healing. The leaves had many confirmed *In vitro* activities that can promote wound healing effects (Birhan et al., 2018). The plant has also been used to induce uterine contractions and to treat coughs and wounds as well as vomiting, and eye diseases (Mengistu et al., 2019). A combination of the leaves and seeds is used to treat diarrhoea, rabies, and diabetes. The plant has also been used as an insecticide to kill lice (Korir et al., 2014).

Antibacterial potential of *Calpurnia Aurea*: *Calpurnia Aurea* plant leaves and seeds both contain flavones and polyphenols which

Figure 1: Tree of *Calpurnia Aurea*.

Figure 2: *Lantana Camara* plants.

Table 1: Reported medicinal use of *Lantana Camara*.

Activity	Part used	Reference
Anticancer and antiproliferative	Leaf of plant used as ant cancer	(Obinna et al., 2013; Reddy, 2013)
Antibacterial	Ethanolic extracts of leaves and roots	(Reddy, 2013)
Antifungal	Ethanol and hot water extract of leave	(Kalita, Kumar, Karthik, Rao, & Technology, 2012; Obinna et al., 2013; Reddy, 2013)
Antiulcerogenic	Ethanol and methanol extract of leave	
Antioxidant	Ethanolic extract of leave	(Dubey et al., 2011; Obinna et al., 2013)
Antihyperglycemic	Methanol extract of leave and fruit	(Reddy, 2013)
Anti-inflammatory	Aqueous extract of leave	(Obinna et al., 2013)
Wound healing	Ethanol extract of leaf	(Dubey et al., 2011)
Anti-inflammatory	Methanol extract of leave	(Mariajancyrani, 2014; Reddy, 2013)
Antiurolithiatic	Ethanolic extract of leave	(Obinna et al., 2013)
Mosquito	Methanol and ethanol extract of leave	(Reddy, 2013)
Antifertility	Hydroalcoholic extract of leave	(Obinna et al., 2013; Reddy, 2013)

have outstanding antibacterial activity, with a higher level of active chemicals content in leave than seed. The extract of both parts of the plant (leave and seed) has shown good antioxidant activity. It has also proven ability to reduce intraluminal fluid accumulation or stimulate water absorption (Mengistu et al., 2019). Research by Eyasu also proven the excellent antibacterial and antioxidant activity of *Calpurnia Aurea* (Eyasu et al., 2013). Another research has also proven antibacterial and antioxidant activity of *Calpurnia Aurea* and the plant have been used to treat bacterial dermatitis. It has also been used as a natural pesticide to improve grain storage (Zorloni, Penzhorn, & Eloff, 2010).

Lantana Camera

Lantana Camara; with kingdom *Plantae* (Ghisalberti, 2000), subclass *Asteridae*, order *Lamiales* (Ghisalberti, 2000) family *Verbenaceae and genus lantana L.*(Mishra, 2014) is found widely in different part of east Africa and Ethiopia.

It is a low erect or sub scan dent vigorous shrub with tetrangular stem, stout recurved pickles and a strong odour of black currents. It has small flower covered in cluster. Both leaves and steam of *Lantana Camara* are covered with hair (Obinna, John, & Peter, 2013). *Lantana* is considered as a weed and spread widely in more than 60 countries. It has its economic effect as it dominates other plant diversity around it owing to its densely spreading ability and competes for food and reduces plants productivity. Most variants have a preference for fertile organic soils, but some or all can survive on siliceous sands and sandstone-derived soils where these are of moderate depth and other conditions, especially year-round moisture, are suitable (Reddy, 2013).

Traditional medicinal use of *Lantana Camara***:** Leaves are used to treat cuts, rheumatisms, ulcers, catarrhal infection, tetanus, rheumatism, malaria, cancer, chicken pox, asthma, ulcer, swelling, eczema, tumour, high blood pressure, bilious fever, ataxy of abdominal viscera, sores, measles, fevers, cold and high blood pressure (Obinna et al., 2013). Another author reported that various extracts and essential oil of this plant are used in herbal medicines for the treatment of various human diseases such as skin itches and leprosy. *antana. camara* is a well-known medicinal plant in the traditional medicinal system. It is used as a cure to various ailments including rheumatism, wound, fever, and asthma, antitumor, analgesic, antifungal, and hepatotoxic activities (Reddy, 2013).

Antibacterial potential of *Lantana Camara***:** Leaf extracts of *Lantana Camara* have shown promising antimicrobial, fungicidal, insecticidal, and nematicidal properties (Ghisalberti, 2000). Analysis of these plants provides a variety of bioactive molecules for the development of newer pharmaceutical products (Obinna et al., 2013). It has a broad spectrum not only against bacterial pathogens but also fungal pathogens and can be a novel source for the development of future antibacterial drugs from a plant source which if well exploited will be safe to use compared to the synthetic antibiotic that is no longer effective against most of the pathogenic organisms (Obinna et al., 2013). *L. camara* contains lantadenes, the pentacyclic triterpenes which is reported to possess many useful biological activities. Studies have revealed the presence of terpenoids, steroids, and alkaloids as major chemical constituents in *L. camara (Obinna et al.*, 2013).

Studies of *Lantana species* lead to the identification and isolation of terpenoids, flavonoids, phenylethanoid glycosides, furano naphthoquinones, iridoid glycosides, and steroids (Sousa et al., 2012). Another research also shown that the medicinal property of *Lantana Camara* is related to the presence oftriterpenoids, anthraquinones, flavonoids, alkaloids, and glycosides with diverse biological activities (Ajiboye, Oyedara, Agboola, & Familola, 2014). Phytochemical screening of ethanol extract indicates the presence of saponins, tannins, terpenoids, and terpenoid, compounds are believed to be responsible for the broad-spectrum activity of the plant extracts (Salada, Balala, & Vasquez, 2015).

Conclusion

The medicinal use of *Calpurnia Aurea* and *Lantana Camara* was known traditionally for a long period. As discussed in the literature review *Calpurnia Aurea* and *Lantana Camara* have immense potential to be used as antibacterial for medicinal purposes. Different parts of the plants have been using to cure different diseases caused by antibacterial. From the literature review, the researchers proved the use of *Calpurnia Aurea* and *Lantana Camara* as anti-inflammatory, anti-cancer, antibacterial, antifungal, wound healing, and others. The

medicinal value of such herbal is due to the presence of one or more biologically active components such as flavonoid, alkaloid, tannin, terpenoid, saponin and phenol. The presence of such components enables the plants to act as antimicrobial agents. The antibacterial activities of plants have been proved for both bacteria and fungus. Based on the previous works and traditional use of *Calpurnia Aurea* and *Lantana Camara* as a medicinal plant, they can be used as good antimicrobial agent for textile finishing. However, applications of these excellent antibacterial agents have not been documented in textile. Based on the approved quality of antimicrobial agent and their availability, *Calpurnia Aurea*, and *Lantana Camara* can be used as excellent antibacterial agents in textile finishing. The only disadvantage raised with herbal-based antimicrobial finishes of textile is that poor durability to washing which can be improved by using the cross linking agent to improve the antimicrobial the durability of antimicrobial finish, cross linking such as BTCA, citric acid and others ecofriendly cross linking agent can be used.

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