Antimicrobial Activity of Silver and Zinc Green Synthesis of Nanoparticles Using *Elettaria cardamomum* Fruits Extract in Western Ghats of India.

Dr. Kalaiarasan. A

Centre for Bioscience and Nanoscience Research, Coimbature, Tamil Nadu, India.
Corresponding Author: Email – myla_kalai@yahoo.com
Mobil no: +91 9943110536, 7092240630.

Abstract: Introduction: *Elettaria cardamomum* is one of the Indian export economically important roles of crops. As pest major constitute of plant. Now day's medicinal plants is very important this is due as per world health organization estimates, the population of developing countries relies on trational medicines. The government of India established the development of Indian system of Ayurvedic and Homeopathy more recently the medicinal plants Board to develop promote and regulate the sector for maximizing benefits to the people as well as to ensure sustainable growth Tamilnadu has been at the forefront of Ayurvedic revolution in the country. The plant derived medicines have made large contributions to human health and well being many evidences gathered from earlier report which confirmed that the presence of phytoconstitutente in plants contribute medicinal properties. So in this present investigation of silver and zinc synthesized nanoparticles in *Elettaria cardamomum* fruits extract were tested for their antibacterial activity of human microorganisms. **Methods:** Green synthesized silver and zinc nanoparticles in *Elettaria cardamomum* fruits extract were tested for their antibacterial activity of Agar well diffusion method was performed as follows. **Results:** The present investigation of silver and zinc synthesized nanoparticles in *Elettaria cardamomum* fruits extract were tested for their antibacterial activity. The synthesized silver and zinc nanopartcle against express zone of inhibition *Kilapsilla pineumoneae*. Such as moderate high zone of inhibition *Escherchia coli* and *Basilus subtilies*. Most of tested nanoparticles exhibited moderate zone of inhibition. Few nanoprticles were found to exhibit or no activity against the tested human microorganisms. **Conclusion:** The most needed outcome of this research work will be the development of value-added products from *Elettaria cardamomum* seed for biomedical based industries, value-added food products industries, and Pharmaceutical and Pharmacological development laboratories.

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Key words: *Elettaria cardamomum*, *Kilapsilla pineumoneae, Escherchia coli, Basilus subtilies,* inhibition and microorganisms.

Introduction

In recent years various findings it is estimated that about 80% of the world population rely on botanical preparation as medicines to meet their health need. Herbs and spices are generally considered safe and proved to be effective against certain ailments[1]. The plant of cardamom (Elettaria cardamomum) of the Zingiberacea family is one of the world's very ancient and expensive spices[2]. Our knowledge faced on the Black cardamom is widely used extensively in India, in foods, beverages, mouth fresheners, and native medicine[3]. Overall, it is very common to use tinctures of cardamom in medicines for windiness or stomachic. Powdered cardamom seeds are invariably mixed with ground ginger, cloves and caraway and used mainly for combating digestive ailments. It is used as a powerful pleasant aromatic stimulant, carminative, stomachic and diuretic. Use of cardamom checks nausea and vomiting. In the present day stress prone population cardamom is used invariably as cardiac stimulant. Powdered seeds of cardamom boiled with tea-water imparts very pleasant aroma to the tea and it can be used as medicine for scanty urination, diarrohea, decently, palpitation of the heart, exhaustion due to over work, depression etc. It is believed that eating cardamom capsule daily along with a tablespoon of honey improves eye site, strengthens the nervous system and thus improves health of the person[4].

Identified another research *E.cardomum* Leaf extract with distilled water revealed the presence of anthraquinones, flavonoids, alkaloids, terpenoids, saponlns, glycosides, cardiac- glycosides except tannins[5]. Another study investigated to examine the inhibitory effects of cardamom (*Elettaria cardamomum* Maton) seed extract of cardamom seed displayed a variable degree of antimicrobial activity on different microorganisms. *S. aureus* was found to be more sensitive strain then the others. On the other hand *P. aeruginosa* was found to be most resistant bacteria against the cardamom seed. Examining findings, the widest inhibition zone was formed

around *S. aureus* followed by *M. smegmatis*, *C. albicans*, *M. luteus* and *S. typhimurium*. The least inhibitory effects were observed for *E. coli*, *K. pneumoniae* and *E. faecalis* [6]. Reported that the other hand the antimicrobial activity assays indicated that coriander seed had inhibitory activity on *M. smegmatis, K. pneumoniae, S. aureus, E. coli, E. faecalis, M. luteus,* and *C. albicans*; however no inhibitory activity was observed against *P. aeruginosa*. *S. aureus* which is an important pathogen in food-poisoning has been identified as the most sensitive strain against cardamom. Antimicrobial characteristics of the herbs are due to various chemical compounds including volatile oils, alkaloids, tannins and lipids that are presented in their tissue. According to us, using coriander as antimicrobial additives in food may be useful [7].

In several studies conducted The antibacterial effects of seed extracts of cardamom (Eltttaria cardamomum) on more resistant isolates of both species were examined all extracts have antibacterial property but methanolic extract was better than ethanolic and aqueous extracts and used as curing agents to eliminate the antibiotic resistance genes and removing the swarming phenomenon[8].

We document analysis of the present data it is evident that the acetonic, methanolic and ethanolic extracts of *A.subulatum* showed antimicrobial inhibitory activity against two bacteria *S.mutans* and *S.aureus* and two fungi *C.albicans* and *S.cerevisiae*, the cold water extract of *E.cardomomum* showed antimicrobial activity against *S.mutans* and *S.aureus* while the hot water extract showed no activity at all[9].

Noticed that *Elettaria cardamomum* Maton (Chhoti elaichi) dry fruits. Minimum inhibitory concentrations of extracts were further evaluated against these bacteria. *E. cardamomum* seems to have significant antibacterial activity and to be very useful in the discovery of novel antibiotic [10].

Plant Material

The plant *Elettaria cardamomum* L. Maton,(Tamil vernacular name: Elakkai) belongs to the family Zingeberaceae was at moolathurai in western ghats hills of muunar town Idukky District, Kerala, India. Herbarium specimens were prepared and taxonomic identification of the plant was confirmed at the Rapinat Herbarium and Centre for Molecular Systematic, Tiruchirappalli, with the voucher number: SM001. A voucher specimen of plant was deposited to that the Rabinate Herbarium for future reference.

Green Bio-Synthesized Silver And Zic Nanoparticles

Chemical

Silver nitrate (AgNO3), Zinc sulphate ($ZnH_2SO_4.H_2O$) were purchased from Sigma-Aldrich Chemical Ltd. (St Louis, MO, USA) and another chemicals AR grade Hi Media, Mumbai, India.

Preparation Of Plant Extracts

The cardamomum fruits were washed thoroughly thrice with distilled water and were shade dried for 10 days. The fine powder was obtained from the dried plant materials by using kitchen blender. The plant powder was sterilized at 121 °C for 15 minutes. 50 g of powder was taken and mixed with 200 mL of Milli Q water and kept in boiling water bath at 60 °C for 10 minutes. The extracts were filtered with whatman filter paper No. 1. The filtered extract residue was removed by then centrifuged at 500g for 10 min. The supernatant was collected and used for further studies. Double-distilled de-ionized water was used in all experiments.

Biosynthesis Of Silver And Zinc Nanoparticles

For the biosynthesis silver nanoparticles, 1.5 ml of plant extracts is mixed with 30 ml of $AgsNO_3$ solution (1 mM) and incubated at 28 °C for 24 hours. Small aliquot of solution is used for the procedure is followed Agar well diffusion method was performed as follows: Muller –Hinton Agar (MHA) plates were swabbed (sterile cotton swabs) with 8 – 12 hours old broth cultures of the respective bacteria. A sterile cork borer was used to place four wells, each measuring 8 mm diameter, in each of the plates. About each of 50 mg/ml of different concentrations of the solvent extracts were added into the wells using sterilized dropping micropipettes and allowed for diffusion at room temperature for 2 hours. The plates were incubated at 37 °C for 24 hours. The solvent without extracts served as negative control. Standard antibiotics of DMSO 25 mg/ml ceftriaxone 10mg disc and were used as positive controls. After 24 hours of incubation, diameter of the inhibition zone was recorded in mm. The experiment was repeated thrice and the average values were calculated for antibacterial activity.

Antimicrobial Property In Bio-Synthesized Silver And Zinc Nanoparticles

Collection Of Micro Organisms

The microbial strains employed in the biological assays were bacteria strains: The microbial strains employed in the biological assays were bacteria strains: *Bacillus subtilis* (MTCC 441), *Pseudomonas aeruginosa* (MTCC 2474), *Escherichia coli* (MTCC 119), *Klebsiella pneumoniae* (MTCC 3040) and *Staphylococcus aureus* (MTCC 740), Obtained from Microbial type culture collection (MTCC) at the institute of Microbial Technology (IMTECH), Chandigarh, India.

Antimicrobial activity of synthesized nanoparticles

Antimicrobial activity was analyzed with synthesized silver and Zinc nanoparticles by well diffusion method against bacterial strains:

Pseudomonas aeruginosa (MTCC 2474), *Klebsiella pneumoniae* (MTCC 3040), *Escherichia coli* (MTCC 119), *Staphylococcus aureus* and *Bacillus subtilis* (MTCC 441), human microorganisms. The pathogenic cultures were cultured in broth for antibacterial assay. Approximately 8 mm diameter of well was made on Muller Hinton Agar plate with gel puncture. The cultures were swabbed on test media. Four agar wells were made on nutrient agar and each well was loaded with further, 20 µL, was spread onto 20ml of sterial agar plates by using cotton swab. The surface of the medium was allowed to dry for about 3 min. the well (10mm) were punched over the agent plates using sterile gel puncher. Different extract Silver and Zinc synthesized concentration were inoculated to the well and then the plates were incubated at 37 °C for 24 hours the zone of inhibition was formed around each discs were measured in mm and recorded.

Result

Green Biosynthesis Of Silver And Zinc Nanoparticle Using *Elatteria Cordamomum Maton L.* Fruits Extract

Silver nanoparticles (AgNPs) as a good result of their excellent optical properties are promising catalytic materials for various applications. In this investigation, we demonstrate a novel approach for using biosynthesized AgNPs and ZnNPs were synthesized through reduction of silver nitrate and Zinc sulphate by extracts of medicinal plants. Plays a very important role in the syntheses and the biological evaluation of various nanoparticles are also dependent relatively on the phenomenal techniques.

Antibacterial Activity Of Synthesized Silver And Zinc Nanoparticles

Antimicrobial activity of biosynthesized silver and zinc nanoparticle in *Elettaria cardamomum* seed extract. The *Pseudomonas aeruginosa,* and *Kilebsiella pineumoneae* and *Escherichia coli* and is highest zone of inhibition than that against *Staphylococcus aureus, Bacillus subtilis* and *Escherichia coli* in seed synthesized silver extract. The modarate activity of *Staphylococcus aureus, Bacillus subtilis* and *Escherichia coli* maximum activity in both samples. Where as in zinc nanoparticles showed antibacterial activity against *Bacillus subtilis* and *Escherichia coli* is higher zone of inhibition than that against *Pseudomonas aeruginosa,* and *Kilebsiella pineumoneae,* and *Staphylococcus aureus* in *Elettaria cardamomum* seed extract zinc extract. Table.1.

Table: 1 Antibacterial activity of silver and zinc synthesized nanoparticle in *Elettaria cardamomum* fruits extract.

S. No	Microorganisms	Silver Synthesized Extract		Zinc Synthesisedextract		Control	Disc
		1mM	2mM	1mM	2mM	DMSO25ml	CEFTRIAXONE (10mg)
1	*Pseudomonas aeruginosa*	12mm	10mm	12mm	11mm	NIL	9mm
2	*Kilebsiella pineumoneae*	13mm	10mm	13mm	NIL	NIL	12mm
3	*Staphylococcus aureus*	10mm	12mm	11mm	9mm	NIL	4mm
4	*Escherichia coli*	10mm	10mm	13mm	12mm	NIL	2mm
5	*Bacillus subtilis*	10mm	10mm	13mm	12mm	NIL	2mm

Discussion

Traditional medicine has been improved in developing countries as an alternative solution to health problems and costs of pharmaceutical products. It is one of the herbs mentioned in all ancient scriptures of Ayurveda. In the traditional system of medicine, the plant is used for various health problems and diseases. Therefore, the aim of this to present an investigation of pharmacognostical, traditional, pharmacological and nanotechnology investigations carried out on this plant. Similar observations were obtains in-*vitro* antimicrobial activity of the AgNPs was investigated against *Bacillus subtilis*, *Escherichia coli*, *Klebsiella pneumoniae* and *Staphylococcus aureus*.. The AgNPs synthesized from aqueous leaf extract of *Soymida febrifuga* showed effective antimicrobial and catalytic properties. The developed method can be used as substitute for the physical and chemical methods used for the synthesis of AgNPs[11]. The antimicrobial activities of the as synthesized AgNPs were investigated against gram negative bacteria *Pseudomonas Fluorescens* and gram positive bacteria *Staphylococcus Epidermidis*. It was observed that silver nanoparticles obtained from *Asiatic Pennywort* was more effective on gram positive bacteria *Staphylococcus Epidermidis* while AgNPs obtained from *Bryophyllum* was more effective on gram negative bacteria *Pseudomonas Fluorescens* indicating size dependent activity of AgNPs[12].

Reported that the other hand the *in vitro* antimicrobial activity of *Amomum subulatum* and *Elettaria cardamomum* fruits extracts were studied against *Streptococcus mutans, Staphylococcus aureus, Lactobacillus acidophilus, Candida albicans* and

Saccharomyces cerevisiae. The acetone, ethanol and methanol extracts of the selected plants exhibited antimicrobial activity against all tested microorganism except *L. acidophilus*. The most susceptible microorganism was *S.aureus* followed by *S.mutans, S.cerevisiae* and *C.albicans* in case of *Amomum subulatum* while in the case of *Elettaria cardamomum; S.aureus* was followed by *C.albicans*, *S. cerevisiae* and *S.mutans*. This depicts that ethanol and acetone extracts of fruits of *Amomum subulatum* and *Elettaria cardamomum* can be used as a potential source of novel antimicrobial agents used to cure dental caries[13].

Conclusion

It is effective to remove fats and as a cure for urinary and skin complaints in Ayurvedic, Siddha and Homeopathy medicine. The ancient Egyptians chewed it as a tooth cleaner and to aid in digestion. The seeds are regarded as carminative, stomachic, desiccant, resolvent, digestive and anti-emetic and ingested for the treatment of gastrointestinal disorders. Cardamom essential oil had inhibitory effects against fungus growth and marked antispasmodic, analgesic, and anti–inflammatory activities. The seeds are useful in spice mixtures like curries, beverages such as tea and coffee, baked foods, confectionaries, meat products, as flavors in biscuits, custards, wines and liqueurs. It is the third most expensive spice in the world by weight, with only saffron and vanilla being more expensive than it is. Due to the importance of this plant. The present investigation have determine the ability of *Elettaria cardamomum* Maton fruits extract on biosynthesis of silver and zinc nanoparticles in antimicrobial efficacy.

Both silver and zinc nanoparticles showed wide spectrum of antibacterial activity. The most needed outcome of this research work will be the development of value-added products from *Elettaria cardamomum* fruits for biomedical based industries, value-added food products industries, and Pharmaceutical, Pharmacological and Drugs development laboratories.

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Conflict Of Interest:

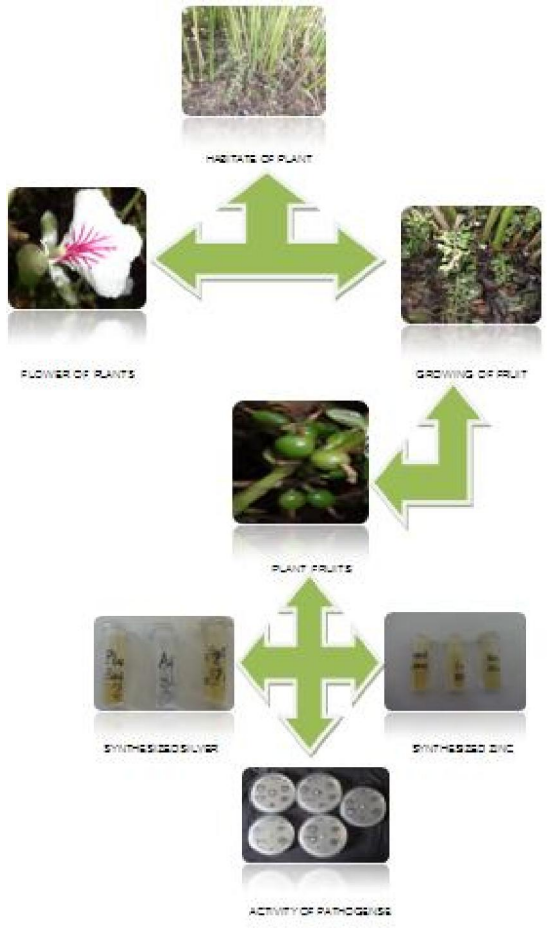
None.

Abbreviation Used:

AgNO3: Silver nitrate,
$ZnH_2SO_4.H_2O$: Zinc sulphate,
MTCC: Microbial Type Culture Collection.

Corresponding author:
Dr. A. Kalaiarasan
Centre for Bioscience and Nanoscience Research, Coimbature, Tamil Nadu, India.
Mobil no: +91 9943110536, 7092240630.
Email – myla_kalai@yahoo.com

Pictorial Abstract



Summary

☺ Traditional medicinal plants used in India.
☺ *Elettaria cardamomum* is one of the Indian export economically important roles of crops.
☺ The government of India established the development of Indian system of Ayurvedic, Siddha and Homeopathy more recently the medicinal plants.
☺ The present investigation of silver and zinc synthesized nanoparticles in *Elettaria cardamomum* fruits extract were tested for their antibacterial activity of human pathogens.
☺ The Cardamom fruits are useful in spice mixtures like curries, beverages such as tea and coffee, baked foods, confectionaries, meat products, as flavors in biscuits, custards, wines and liqueurs.

☺ It is the third most expensive spice in the world by weight, with only saffron and vanilla being more expensive.

About Authors

Dr. AKALAIARASAN M.Sc., M.Ed., M.Phil., Ph.D. Obtained his starting in Bachelor of Science in Bishop Heber College Tiruchirappalli During in 2001 to 2004. He stayed Master of Science in Kandaswami Kandar's College in 2004 to 2007. Did bachelor Education stated in St. Joseph's Educational Trust Tuticorin in 2007 to 2008. Research stated Master of Education in Varruvan Vadivelen College of Education in 2008 to 2009, Imprested in research Master of Philosophy in Vinayaka Mission's Annapoorna College of Education in 2009 to 2010. My achievement of research stated in Philosopher completed Jamal Mohamed College in 2010 to 2013. He has published more than 15 papers in reputed International Journals and obtained that attend the two international conference and five national conference. He is eleven presented papers on the conference. But in the still bright of research interests are focusing in nanotechnology, plant taxonomy, microbiology, biotechnology, biochemistry and molecular biology of center for bioscience and nanoscience research, Coimbatore, Tamilnadu, India.

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