



BLACK CARDAMOM (*AMOMUM SUBULATUM*): A REVIEW

* Shailja Choudhary, Madhusudan S, Bhawana Walia, Gitika Chaudhary

Shuddhi Ayurveda, Jeena Sikho Lifecare Pvt. Ltd. Zirakpur 140603, Punjab, India

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ABSTRACT

Amomum subulatum is also known as 'Badi Elaichi' is an aromatic and medicinal spice, used as a flavoring agent in various dishes. It is also known as Queen of spices. It is a native of the Eastern Himalayan region. Traditionally, black cardamom has been utilized as a preventive and remedial measure for throat problems, blockage of lungs, irritation of eyelids, stomach-related problems and in the treatment of aspiratory tuberculosis. It is considered as a conclusive drug in the traditional medicinal system like Unani and Ayurveda since ancient times. Its significance has been explained by Hakeem Kabiruddin in his book "Makhzanul-mufradat". Black cardamom extracts mainly the aqueous ones are known to possess biological activities like anti-inflammatory, anti-ulcer, anti-oxidant, anti-microbial and cardio-adaptogen.

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INTRODUCTION

Plants are considered as a natural source of shelter, clothing, food, flavors, scents, medicines\prescriptions from ancient times. Plants are used for traditional medicinal systems like Ayurveda, Unani, and Chinese medicinal system (1). Plants have been known as an extraordinary source of therapeutics or other human clinical focal points since ancient times. Plants are considered a significant source of medicines (2,3). The restorative utilization of plants is very old. The literature demonstrates that remedial utilization of plants is as old as 4000 - 5000 B.C (4). In India, the use of plants for medicines has been an old practice and is important in the medical care system (5). The use of therapeutic plants depends on the great experience of many therapists over hundreds of years, acquired from generation to generation, or created through their own experiences over time (6). Spices are utilized to enhance food flavors yet they may also consider as useful food to boost up health or immunity (7,8,9). Black Cardamom (figure 1) is also known as "Black gold" or "Queen of spices" is a high market value plant that is utilized as an enhancing agent in different food items.

Because of its pleasant fragrance, it has been utilized as a significant ingredient in blended flavors for seasoning vegetables, numerous food arrangements and pickles, in the world mainly in China, India, Nepal, Bhutan. The seed is used for commercial practice. It is also used in the treatment of teeth and gums infection, as medicine for stomach problems and in malaria, and also used as an antidote against snake and scorpion venom (10,11,12). Great cardamom is used in the Ayurveda and Unani medicinal systems to cure diseases including heartburn, vomiting, rectal infections, looseness of the bowels, liver blockage, gastrointestinal issues, and genitourinary grumblings. Black Cardamom helps in improving the metabolic conditions when added to the eating routine. Black cardamom helps to enhance the functioning of the liver (13,14,15,16). Taxonomical classification and vernacular names are shown in table no. 1 and table no. 2

Table 1. Taxonomical features of Black Cardamom (17)

Taxonomical Rank	Taxon
Kingdom:	Plantae
Class:	Liliopsida
Order:	Zingiberales
Family:	Zingiberaceae
Genus:	<i>Amomum</i>
Species:	<i>subulatum</i>

*Corresponding author: Shailja Choudhary,
Shuddhi Ayurveda, Jeena Sikho Lifecare Pvt. Ltd. Zirakpur 140603,
Punjab, India.



Fig. 1. *Amomum subulatum*

Table 2. Vernacular Names of *A. subulatum* (18)

English	Black/Greater/Nepal cardamom
Hindi	Bari elachi/bari illayaca
Urdu	Badi Elaichi, Heel Kalan; / poorbi elaichi
Kannada	Dodda Yalakki, Nepdi Elakki
Sanskrit	Bhadra, stulaila Bhadrail
Bengali	Baara aliach
Malayalam	Valiya Elam, Perelam
Gujrati	Elaicho, Mothi Elichi
Marathi	Mothi Elayachi
Oriya	Bada aleicha, Aleicha
Punjabi	Budi Eleichi
Tamil	Periya Elam, Beraelam, Kattu Elam
Telugu	Pedda Elakulu
French	Cardamome
German	Kardamom
Italian	Cardamomo, Cardamone
Spanish	Cardamomo
Burmese	Phalazee
Chinese	Ts"ao-k"ou
Indian	lachi, e(e)lachi, ela(i)chi, illaichi
Persian	Qakilahé kalan
Indonesian	Kapulaga

Botanical description of Black cardamom: It is tall evergreen, perennial, monocot herbaceous plant. The height of the plant reaches up to 1.5-3 meters. Fruits of *Amomum subulatum* are smooth anteroposterior having 15-20 sporadic, dentate-undulate wings which stretch out from the peak to base for 66% of its length (19). The matured natural fruit is red earthy colored, trilobular, and contains a pinkish cultivated capsule (20). Capsules are 20– 25 mm long and oval to globular, echinate, trilobular, dark red-earthly colored in shading, in every cell a few sweet-smelling seeds are available held together by a sticky sweet mash (21). Leaves are oblong and lanceolate, with length 30-60 cm, green glabrous on the two sides. Verdant shoots are molded by long sheath-like stalks encompassing each other. Globose, thick, and presently peduncle spikes are present. Calyx and corolla tube sections are more limited than the cylinder, sub-obtuse, and the upper one is cuspidate. Lip is emarginated, obovate-cuneate, yellowish-white, and to some degree longer than the corolla-part. Rhizomes are stretched and crawling, for certain erect leaf shoots and panicles. Its peduncle is short and buds are encased in close red bracts. The stem is around 90-120cm. Flowering starts mainly in the spring season. The single flower stays open for three days. Simultaneously, new flowers open progressively (22). Fruits and Seeds of *Amomum subulatum* show a slender membranous aril made out of a few layers of flattened cells containing oil globules and kaleidoscopic gems of calcium oxalate.

Testa comprises of the single-layered epidermis of rectangular cells followed by 1-2 layers of imploded, flimsy walled parenchymatous cells, underneath the solitary layer of enormous rectangular cells containing oil globules present that are encircled by few layers of straightened, thin-walled, parenchymatous cells, perisperm comprises of polygonal, dainty walled, parenchymatous cells containing round to oval starch grains estimating 2-5 μ in breadth, and a bunch of calcium oxalate gems perisperm encompassed remotely by slim walled, sclerenchymatous, radially prolonged dim earthy colored measuring glass-like cells, perisperm encase the endosperm and developing organism, both made out of polygonal, slight walled, parenchymatous cells, rich in protein (23).

Geographical Distribution of Black cardamom: It is Native to the Eastern Himalayan district. It is developed in south-east Asia to northern Australia, develops up to the central Pacific. It is distributed in south-east Asia. Assam slopes, Darjeeling, Sikkim, northern West Bengal, Nepal and Bhutan, generally distributed in south-east Asian nations like Thailand, Laos, and Indonesia (24,25,26). The significant manufacturer of this herb is Nepal (52%), India (37%) and Bhutan (11%) of absolute world manufacturing per annum (27). Black cardamom is cultivated in 53 regions of Nepal. Almost 84% of the black cardamom comes from the eastern district, including Islam, Taplejung, Sankhuwasabha, Dhankuta, Bhojpur, Tehrathum, and Panchthar regions. Ramsai, Dammersai, Jirmale, Saune, Bharlang, Golsai, Ramla, Chebese are generally discovered varieties of black cardamom in the nation. Among them, Dammersai is found in the Bhojpur region of Nepal (28,29,30). In India, Sikkim is the biggest manufacturer (after Nepal) with 23,500 ha of the zone under with 80 to 85% total manufacturing in India (31). It has a high retail price in Pakistan, Singapore, and the Middle East and is also shipped to UAE, US, UK, Afghanistan, Malaysia, South Africa, Japan, Argentina. The major domestic markets are Amritsar, Kolkata, Delhi, Mumbai, Guwahati and Kanpur. The financial outcome from this spice crop is substantially higher than that of other spices (32,33,34).

Phytochemical constituents of Badi Elaichi: The chemical constituents of various extracts of *A. subulatum* revealed the presence of carbohydrates, flavonoids, amino acids, steroids, triterpenoids, glycosides, tannins, (35) anthocyanin's, aurone, flavanone (36) alkaloids, fixed oil and fats (37). The chemical constituents of the Badi Elaichi are 1,8-cineole around (65–80%) and the other phytochemicals are Terpenyl acetate (traces to five percent), Monoterpene hydrocarbon (5-17%) of which limonene, sabinene, terpinenes pinenes and Terpeneols present in 5-7% of the oil, Starch 43.21%, Crude fiber 22.0% and Protein 6.0%. The distribution of the essential oil of black cardamom is 1,8-cineole (65 to 80%) and limonene (10.3%) as a significant constituent (38). The monoterpene hydrocarbon present is 5 to 17% of which limonene, sabinene, terpinenes and pinenes are major components. The terpinols contain around 5 to 7% of the oil. The high cineole and low terpenyl acetate derivatives are responsible for the aroma of this spice (39). The seed of cardamom contains primarily essential oil, flavonoids, carbohydrates and fats (40). All phenolic content in seed was discovered to be 0.00366% w/w (weight by weight) which has been accounted as gallic acid while total flavonoid in seed was seen to be 0.0361% w/w (41). The decoction of seeds also consists of some glycosides such as subulin, petunidin-3,5-diglucoside,

Table 3. Various therapeutic uses of Black Cardamom

Anti-inflammatory	The ethanolic and aqueous extract (100mg/ml and 200mg/ml dose) of black cardamom are good anti-inflammatory agent when tested in rat model (63).
Analgesic	The methanolic extract of seeds (more than 100 mg/kg) and ethyl extract (>200 mg/kg) show analgesic activity (64).
Antimicrobial	Secondary metabolites, for example, tannins, alkaloids and flavonoids, a few of these metabolites are known to have antimicrobial properties. The acetonic, methanolic and ethanolic concentrates of <i>A. subulatum</i> indicated antimicrobial inhibitory action against two microorganisms causing dental caries, <i>Streptococcus mutans</i> and <i>S. aureus</i> ; and two organisms <i>Candida albicans</i> and <i>Saccharomyces cerevisiae</i> (65,66). Petroleum ether concentrates of great cardamom demonstrated antimicrobial activities against <i>Staphylococcus aureus</i> , <i>Escherichia coli</i> , <i>Pseudomonas aeruginosa</i> , <i>Bacillus cereus</i> (67,68).
Anti-oxidant	The seed extract 1,8-cineole, alphaterpineol, protocatechualdehyde, protocatechuic acid show anti-oxidant property against lipid peroxidation (69,70). The phenolic compounds of essential oil are associated with the anti-oxidant activity (71). The polyphenolic content has strong lipid peroxidation inhibiting properties against rat liver homogenate (72).
Anti-ulcer	Crude extracts of fruit are associated with the anti-ulcer activity (73).
Hepatoprotectivity	Ethanol induced liver damage in rats was treated with the methanolic extract of seeds which showed the hepatoprotective potential of black Cardamom (74).
Anti-diabetic	<i>A. subulatum</i> has good impact on fructose induced insulin resistance. It decreases that insulin resistance (75).
Cardio-adaptogen activity	<i>A. subulatum</i> is utilized in treatment for patients with Ischemic Heart Disease (IHD), confronting ordinary distressing conditions on daily consumption (76).

leucocyanidin-3-O- β -D-glucopyranoside along with cardamom and alpine (42). Steam refining of seed consists of essential oil having cineole as a major constituent. Other chemical constituents are α and β -pinenes, sabinene, p-cymene, terpinene-4-ol, α - and β -terpineol, nerolidol, terpinene, terpinyl acetate and bisabolene. Protocatechualdehyde, 1,7-bis (3,4-dihydroxy phenyl) hepta-4E,6E-dien-3-one, Protocatechuic acid, and 2,3,7-trihydroxy-5-(3,4-dihydroxy-E-styryl) - 6,7,8,9-tetrahydro - 5H - benzocycloheptene, are separated from large cardamom (43). The structures of some major phytochemicals are shown in figure 2.

Folk uses: Traditionally, black cardamom has been utilized as a preventive and remedial measure for throat problems, blockage of lungs, irritation of eyelids, stomach-related problems and in the treatment of respiratory tuberculosis (44). From ancient times, black cardamom seeds have been utilized to fix dyspnoea, hack, thirst, vomiting, infection of the mouth, nausea, tingling, acid reflux, biliousness, stomach torments and rectal infections in rural areas and cities too (45). *A. subulatum* seeds and fruits are used in the preparation of food items as flavors consistently around the world and prevent gastrointestinal problems, respiratory issues. It increases the palatability and flavor to make food more edible. Residues of charred leaves are used with mustard oil and taken twice for sexually transmitted diseases and hack (46). "Alui" a formulation prepared from the combination of cumin and black cardamom is utilized for the treatment of malaria (47). The seed decoction is helpful as a gargle in infection of the teeth and gums while the pericarp is helpful in cerebral pain and stomatitis (48). The seeds are additionally helpful as an antidote against snake and scorpion venom (49). It is a significant constituent in Arabic coffee. They own coffeepots that can keep a few cardamom seeds in their spouts and use cardamom in blend form with different flavors in their dishes. Scandinavian nations utilize cardamom in biscuits and sweetbreads (50).

Black cardamom in Ayurveda: Badi-Elaychi is an herb that reduces Vata (air component) and Kapha (earth and water component) and increases pitta (digestion and metabolism)

component of human body. In the Ayurvedic medicinal system, it is utilized as a carminative, diuretic, stomachic and stomach related, and for colds and heart stimulation. Cardamom has been utilized in traditional medication against kidney and urinary problems, and as a gastrointestinal defensive. Cardamom oil has revealed calming and antibacterial uses. In India, black cardamom (*A. subulatum*) is comprehensively used to treat contaminations of the teeth and gums and to treat throat inconvenience, blockage of the lungs and pneumonic tuberculosis, asthma, coronary illness, aggravation of the eyelids and stomach related problems. At the point when mixed with neem and camphor, cardamom is utilized as a nasal readiness to treat colds. Implantation of cardamom can be utilized as a rinse to mitigate sore throats, which has prompted its utilization in hack desserts. Cardamom is also utilized as a remedy for the treatment of both snake and scorpion toxins and food contamination. In traditional Chinese medication, it is utilized to treat stomachache, stoppage, loose bowels, and other processing issues. Cardamom seeds when mixed with milk, are used for bladder related issues. The seeds are famously accepted to be a Spanish fly (51,52,53,54,55,56). Other properties of Badi- Elaichi (57)

Abhiyantar-Nadishansthan

-) Pachan-Shanstan: It is used to cure digestive problem.
-) Raktavah-shanstan: It is used to maintain blood circulation.
-) Svashan-shanstan: It is used to cure respiratory problems.
-) Mutrvah-shanstan: It act as a curative agent against various urinogenital disorders.
-) Taapkaram: It is used to maintain body temperature.

Modern View

Modern herbal formulations are usually an alteration of the native classical herbal formulations either by changing the main component and lack of standardization. Consequently, these altered forms in all probability get impaired because of

incongruence, uncertainty, and pollutants prompting some serious side effects because of the toxicity (58). Pollutants get into the modern herbal drug formulations at different phases of preparation including purposeful contamination of the herbal formulation details with manufactured drugs like synthetic chemicals (59,60,61). There is a negligible contribution towards the Global herbal business from the developed nations due to the absence of normalization measures and quality control. The absence of protection and viability information on herbal beauty care products renders it hard to meet the models required for supporting its utilization around the world (62).

Conclusion

Badi-Elaichi (Black cardamom) is an important remedial plant which hold a great position in Ayurvedic medicinal system for anticipation and medications of various human diseases. In the Ayurvedic medicinal system, it is utilized as a carminative, diuretic, stomachic and stomach related, and for colds and heart stimulation. Traditionally, black cardamom has been utilized as a preventive and remedial measure for throat problems, blockage of lungs, irritation of eyelids, stomach-related problems and in the treatment of aspiratory tuberculosis. Due to the presence of phytochemicals constituents, it possesses various therapeutical properties like hepatoprotective, anti-ulcer, anti-diabetic, anti-oxidant, anti-inflammatory.

REFERENCES

- Gurib-Fakim A. Medicinal plants: traditions of yesterday and drugs of tomorrow. Molecular aspects of Medicine. 2006.
- Pandey MM, Rastogi S, Rawat AK. Indian traditional ayurvedic system of medicine and nutritional supplementation. Evidence-Based Complementary and Alternative Medicine. 2013.
- Khan H. Medicinal plants in light of history: recognized therapeutic modality. Journal of evidence-based complementary & alternative medicine. 2014.
- Iyer A, Panchal S, Poudyal H, Brown L. Potential health benefits of Indian spices in the symptoms of the metabolic syndrome: a review. 2009.
- Tapsell LC, Hemphill I, Cobiac L, Sullivan DR, Fenech M, Patch CS, Roodenrys S, Keogh JB, Clifton PM, Williams PG, Fazio VA. Health benefits of herbs and spices: the past, the present, the future. 2006.
- Viuda-Martos M, Ruiz-Navajas Y, Fernández-López J, Pérez-Álvarez JA. Spices as functional foods. Critical Reviews in Food Science and Nutrition. 2010.
- Shrestha KP. Growth Trend Analysis of Large Cardamom in Nepal. Nepalese Horticulture. 2018.
- Belbase S, Paudel J, Bhusal R, Gautam S, Aryal A, Kumar S. Fungal diseases of large cardamom (*Amomum subulatum* Roxb.) and Its Integrated Management. Int. J. Curr. Microbiol. App. Sci. 2018;7(3):3316-21.
- Kaur G, Handa VG, Baranwal MG. *Studies on Antibacterial and Anticancer activities of Black Cardamom* (Doctoral dissertation). 2013.
- Bisht VK, Negi JS, Bh AK, Sundriyal RC. Amomum subulatum Roxb: Traditional, phytochemical and biological activities-An overview. African Journal of Agricultural Research. 2011.
- Bhaswant M, Poudyal H, Mathai ML, Ward LC, Mouatt P, Brown L. Green and black cardamom in a diet-induced rat model of metabolic syndrome. Nutrients. 2015.
- Parmar MY, Shah P, Thakkar V, Gandhi TR. Hepatoprotective activity of Amomum subulatum Roxb against ethanol-induced liver damage. International Journal of Green Pharmacy (IJGP). 2009.
- Parmar MY, Shah PA, Gao J, Gandhi TR. Hepatoprotection through regulation of voltage dependent anion channel expression by Amomum subulatum Roxb seeds extract. Indian journal of pharmacology. 2011.
- Parveen U, Maaz M, Mujeeb M, Jahangir U. BIOLOGICAL AND THERAPEUTIC USES OF AMOMUM SUBULATUM ROXB: A. European Journal of Biomedical. 2018.
- Uzma P, Mohd M, Mohd M, Umar J. Biological and therapeutic uses of Amomum Subulatum Roxb: A REVIEW. European Journal of Biomedical and Pharmaceutical Sciences. 2017.
- Gopal K, Baby R, Ali M. Amomum subulatum roxb: An overview in all aspects. International research journal of pharmacy, 2012; 3(7): 96-99
- Gautam N, Bhattarai RR, Khanal BKS, Oli P. Technology, Chemistry and Bioactive Properties of Large Cardamom (*Amomum subulatum* Roxb.): An Overview. Int J Appl Sci Biotechnol, 2016.
- Rahmatullah M, Noman A, Hossan MS, Rashid MHo, Rehman T, Chowdhury MH. A survey of medicinal plants in two areas of Dinajpur district, Bangladesh including plants which can be used as functional foods. American-Eurasian Journal of Sustainable Agriculture, 2009.
- Sharma E, Sharma R, Singh K. A boon for mountain populations: Large cardamom farming in the Sikkim Himalaya Mountain. Res. Dev, 2000.
- Anonymous, The Unani Pharmacopoeia of India. New Delhi, 2007.
- Kumar G, Chauhan B, Ali M. Anti-inflammatory effect of Amomum subulatum Roxb. fruits extract. International Journal of Pharmaceutical Sciences and Research. 2012.
- Pura Naik J, Jagan Mohan Rao L, Mohan Kumar TM, Sampathu SR. Chemical composition of the volatile oil from the pericarp (husk) of large cardamom (*Amomum subulatum* Roxb.). Flavour and Fragrance Journal. 2004.
- Smith RM. review of Bornean Zingiberaceae. 1.(Alpineae pp). Notes-Royal Botanic Garden Edinburgh. 1985.
- Singh AI, Pothula AK. Postharvest processing of large cardamom in the eastern Himalaya. Mountain Research and Development. 2013.
- Kalauni D, Joshi A. Production economics, marketing and critical success factors of Large Cardamom in Bhojpur, Nepal. Cogent Food & Agriculture. 2019.
- Singh AI, Pothula AK. Postharvest processing of large cardamom in the eastern Himalaya. Mountain Research and Development. 2013.
- Timilsina GP, Paudel K. Improved Cardamom cultivation technology.2016.

28. Pratap U, Śarmā G, Gurung MB, Chettri N, Sharma E. Large cardamom farming in changing climatic and socioeconomic conditions in the Sikkim Himalayas. 2014.
29. Divakar CC. Contribution of Indian spices in culinary history.
30. Gautam N, Bhattarai RR, Khanal BK, Oli P. Technology, chemistry and bioactive properties of large cardamom (*Amomum subulatum* Roxb.): An overview. *International Journal of Applied Sciences and Biotechnology*. 2016.
31. Gudade BA, Chhetri P, Deka TN, Gupta U, Vijayan AK. Large cardamom (*Amomum subulatum* Roxb): a spice crop with multiple uses. *Indian Journal of Arecanut, Spices and Medicinal Plants*. 2013.
32. Shivanand P, Mahalaxmi R. Identification and determination of protocatechuic acid present in greater cardamom fruit extracts by HPTLC technique. *International Journal of Pharmaceutical Sciences Review and Research*. 2010.
33. Sen S, Chakraborty R, De B, Mazumder J. Plants and phytochemicals for peptic ulcer: An overview. *Pharmacognosy Reviews*. 2009. Shukla SH, Mistry HA, Patel VG, Jogi BV. Pharmacognostical, preliminary phytochemical studies and analgesic activity of *Amomum subulatum* Roxb. *Pharma Science Monitor*. 2010.
34. Pura Naik J, Jagan Mohan Rao L, Mohan Kumar TM, Sampathu SR. Chemical composition of the volatile oil from the pericarp (husk) of large cardamom (*Amomum subulatum* Roxb.). *Flavour and Fragrance Journal*. 2004.
35. Pruthi JS. Major spices of India. Crop management and post-harvest technology. *Major spices of India. Crop management and post-harvest technology*. 1993.
36. Chatterjee A, Pakrashi SC. Treaties on Indian medicinal plants: national institute of science communication and information resources. New Delhi, India. 2003.
37. Lakshmi V, Chauhan JS. CHEMICAL EXAMINATION OF FLOWERS OF *GREWIA-ASIATICA* LINN. *Journal of the Indian Chemical Society*. 1976.
38. Husain A, Virmani OP, Popali SP, Mishra LN, Gupta MM, Srivastava GN, Abraham Z, Singh AK. *Dictionary of Indian medicinal plants Central Institute of Medicinal and Aromatic Plants (CIMAP)*. Lucknow, India. 1992.
39. Kikuzaki H, Kawai Y, Nakatani N. 1, 1-Diphenyl-2-picrylhydrazyl radical-scavenging active compounds from greater cardamom (*Amomum subulatum* Roxb.). *Journal of nutritional science and vitaminology*. 2001;47(2):167-71.
40. Verma SK, Rajeevan V, Bordia A, Jain V. Greater cardamom (*Amomum subulatum* Roxb.)—A cardio-adaptogen against physical stress. *J Herb Med Toxicol*. 2010.
41. Gautam N, Bhattarai RR, Khanal BK, Oli P. Technology, chemistry and bioactive properties of large cardamom (*Amomum subulatum* Roxb.): An overview. *International Journal of Applied Sciences and Biotechnology*. 2016.
42. Rahmatullah M, Noman A, Hossan MS, Rashid MH, Rahman T, Chowdhury MH, Jahan R. A survey of medicinal plants in two areas of Dinajpur district, Bangladesh including plants which can be used as functional foods. *American Eurasian Journal of Sustainable Agriculture*. 2009.
43. Thakur RS, Puri HS, Hussain A. Major medicinal plants of India. CIMAP, Lucknow, India. 1989.
44. Shukla SH, Mistry HA, Patel VG, Jogi BV. Pharmacognostical, preliminary phytochemical studies and analgesic activity of *Amomum subulatum* Roxb. *Pharma Science Monitor*. 2010.
45. Bisht VK, Purohit V, Negi JS, Bhandari AK. Introduction and advancement in cultivation of Large Cardamom (*Amomum subulatum* Roxb.) in Uttarakhand, India. *Res. J. Agri. Sci*. 2010.
46. Rajpur A, Samratha K. Cardamom: A Multipurpose Species in Food and Commercial Needs. In *Bioorganic Phase in Natural Food: An Overview 2018*.
47. Ballabh B, Chaurasia OP, Ahmed Z and Singh SB. Traditional medicinal plants of cold desert Ladakh-used against kidney and urinary disorders. *J. Ethnopharmacol*. 2018.
48. Jafri MA, Farah, Javed K and Singh S. Evaluation of the gastric antiulcerogenic effect of large cardamom (fruits of *Amomum subulatum* Roxb). *J. Ethnopharmacol*. 2001.
49. al-Zuhair H, el-Sayeh B, Ameen HA and al-Shoora H. Pharmacological studies of cardamom oil in animals. *Pharmacol*. 1996.
50. Elgayyar M, Draughon FA, Golden DA and Mount JR. Antimicrobial activity of essential oils from plants against selected pathogenic and saprophytic microorganisms. *J. Food Prot*. 2001.
51. Duke JA, Bogenschutz-Godwin MJ, deCellier J and Duke PK. *Elettaria cardamomum* (L.) Maton (Zingiberaceae) Cardamon, Malabar or Mysore cardamon, in *CRC Handbook of Medicinal Spices*, CRC Press, Washington DC. 2003.
52. Gopal K, Baby C, Mohammed A. *Amomum subulatum* Roxb: An overview in all aspects. *Int Res J Pharm*. 2012.
53. Muddgal D. *Dravyagun Vigyan. Ayurvedic Sanskrit Hindi Pushtak Bhandar*. 2019.
54. World Health Organization. WHO guidelines on good agricultural and collection practices (GACP) for medicinal plants. World Health Organization; 2003.
55. Zhang J, Wider B, Shang H, Li X, Ernst E. Quality of herbal medicines: challenges and solutions. *Complementary therapies in medicine*. 2012.
56. Wilson P, Masse C. Detection of Synthetic Drugs as Adulterants in Natural and Herbal Slimming Products by LC-ESI-MS/MS with Polarity Switching. *Journal of AOAC International*. 2016. Calahan J, Howard D, Almalki AJ, Gupta MP, Calderón AI. Chemical adulterants in herbal medicinal products: a review. *Planta Med*. 2016.
57. DK SS, JAIN V. CHALLENGES IN FORMULATING HERBAL COSMETICS. *Int J App Pharm*. 2018.
58. Alam K, Pathak D, Ansari SH. Evaluation of anti-inflammatory activity of *Amomum subulatum* fruit extract. *International Journal of Pharmaceutical Sciences and Drug Research*. 2011.
59. Shukla SH, Mistry HA, Patel VG, Jogi BV. Pharmacognostical, preliminary phytochemical studies and analgesic activity of *Amomum subulatum* Roxb. *Pharma Science Monitor*. 2010.
- 60.

61. Kumar U, Kumar B, Bhandari A, Kumar Y. Phytochemical investigation and comparison of antimicrobial screening of clove and cardamom. *Int J Pharm Sci Res.* 2010.
62. Hussain T, Arshad M, Khan S, Sattar H, Qureshi MS. In vitro screening of methanol plant extracts for their antibacterial activity. *Pak. J. Bot.* 2011.
63. Aneja KR, Joshi R. Antimicrobial activity of *Amomum subulatum* and *Elettaria cardamomum* against dental caries causing microorganisms. *Ethnobotanical Leaflets.* 2009.
64. Satyal P, Dosoky NS, Kincer BL, Setzer WN. Chemical compositions and biological activities of *Amomum subulatum* essential oils from Nepal. *Natural product communications.* 2012.
65. Kikuzaki H, Kawai Y, Nakatani N. 1, 1-Diphenyl-2-picrylhydrazyl radical-scavenging active compounds from greater cardamom (*Amomum subulatum* Roxb.). *Journal of nutritional science and vitaminology.* 2001.
66. Gautam N, Bhattarai RR, Khanal BK, Oli P. Technology, chemistry and bioactive properties of large cardamom (*Amomum subulatum* Roxb.): An overview. *International Journal of Applied Sciences and Biotechnology.* 2016.
67. Kapoor IP, Singh B, Singh G, Isidorov V, Szczepaniak L. Chemistry, antifungal and antioxidant activities of cardamom (*Amomum subulatum*) essential oil and oleoresins. *International Journal of Essential Oil Therapeutics.* 2008.
68. Yadav AS, Bhatnagar D. Modulatory effect of spice extracts on iron-induced lipid peroxidation in rat liver. *Biofactors.* 2007.
69. Jafri MA, Javed K, Singh S. Evaluation of the gastric antiulcerogenic effect of large cardamom (fruits of *Amomum subulatum* Roxb). *Journal of Ethnopharmacology.* 2001.
70. Parmar MY, Shah P, Thakkar V, Gandhi TR. Hepatoprotective activity of *Amomum subulatum* Roxb against ethanol-induced liver damage. *International Journal of Green Pharmacy (IJGP).* 2009.
71. Vavaiya RB, Patel A, Manek R. Anti-diabetic activity of *Amomum subulatum* Roxb. fruit constituents. *Int. J. Pharm. Innov.* 2010.
72. Verma SK, Rajeevan V, Bordia A, Jain V. Greater cardamom (*Amomum subulatum* Roxb.)—A cardio-adaptogen against physical stress. *J Herb Med Toxicol.* 2010
