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Monograph

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A Monographic Profile on Quality Specifications for a Herbal Drug and Spice of Commerce- *Cuminum cyminum* L.

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Abstract *Cuminum cyminum* L. commonly known as 'jeera' in Hindi and 'cumin' in English is used as drug in Ayurvedic and Siddha System of medicine and common spice in food commodities. Dried seeds have carminative, stimulant and analgesic effect. Cumin is used as a carminative for stomach disorders, diarrhea and colic. Cumin is therapeutically support in promoting digestion and it is a superb addition to any formula when there is a compromised digestive system so it has long history of use in well established systems of medicines viz. Ayurveda and Siddha. Present communication deals with detailed pharmacognostic studies on powdered drug and review on different aspects pertaining to quality aspects of cumin.
Keywords *Cuminum cyminum* L., Drug Standardization, Quality Specifications

1. Introduction

Cuminum cyminum L. is commonly known as cumin or jeera, the fruit of the cumin plant is a common ingredient in many recipes. The word cumin in English is derived from the Latin cuminum, which itself was derived from Greek 'kyminon'. *Cuminum cyminum* L. is an annual shrub up to 10 to 50 cm high, cumin initially came from the Mediterranean region, the plant is indigenous to Turkistan (Hager) or northern Egypt (Grieve), but is today widely cultivated. Major cumin seed producers include India, Pakistan, Egypt, Iraq, Morocco, Turkey, Syria, Sicily, Yugoslavia, Bulgaria, Malta, Sudan, Cyperus, Czechoslovakia, China and Indonesia (1).

Cumin had some reputation as a drug but its chief medicinal use now-a-days in veterinary medicine. The strong aroma of jeera or cumin seeds is due to the presence of compound cuminaldehyde. This spice is also used as a homeopathic treatment for a variety of conditions. Cumin is credited with a number of medicinal properties in different systems of medicine viz., Ayurveda and Siddha. The seeds of cumin have gained their place as main spice in Indian, African, Chinese, Cuban and Mexican cuisines; it is mainly used to spice and season variety of dishes like curries, chutneys, masalas etc. It is extensively used in India to season dishes. Due to its numerous medicinal properties, jeera is used as an ingredient in many home remedies and ayurvedic preparations.

2. Methods

Drug samples were collected from different places with a view to find out any significant difference present within the same species. For studying powder Jackson and Snodon (22) was followed. To determine physico-chemical constants, Indian Pharmacopoeia (2) was consulted and for fluorescence study schedules mentioned by Trease & Evans (3) was followed; colors were named by consulting Rayner (4). Standard prescribed procedures for histochemical studies (5-8) organic group detection (9); U.V. Spectrophotometry (10) and Chromatography (11-13) were adopted from relevant literature resource. The informatics is complied by reviewing the available literature.

3. Observation

A) Family: Apiaceae

B) Genus: Cuminum

Cuminum cyminum L., Sp. Pl., 245, 1753; C. B. Clarke in Hook. f., Fl. Brit. Ind., 2: 718.

A little annual herb leaves twice or thrice 3-partite, ultimate segments filiform, deep green in color. Inflorescence umbel compound, flowers are white or rose- colored, bracts and bracteoles several, linear, rigid; calyx-teeth small, subulate, unequal. Petals oblong or obovate, emarginated. The fruits are elongated-oval in shape and yellowish-brown in color, tip narrowed; primary ridges filiform, distinct, secondary usually hispidulous (Figure 1 A).

The plant native to Mediterranean region and is cultivated in Pakistan, Arabia, UAE, Israel, Iran, Iraq, Yugoslavia, Syria, Bulgaria, Malta, Sudan, Cyprus, China and Java. In India, it is cultivated mainly in Punjab, U.P., Bengal, Asam, Gujarat, Maharashtra, Haryana and Rajasthan.

C) Nomenclature

The plant is known by different vernacular names e.g. Safaid jeera (Bengali), Jeeru (Gujarati), Jira or Safed jira or Zeera (Hindi), Jeerkam (Malayalam), Jire (Marathi), Jeera (Oriya), Zeera (Punjabi), Zirgaum (Tamil), Jikaka (Telugu), Amla (Urdu) and Cumin (English), etc.

D) Cultivation, Collection and Storage Practices

It is drought-tolerant, and is mostly grown in Mediterranean climates. Cumin cultivated in semi-arid areas with moderate winter and light rain. It is grown from seed, sown in spring, and needs fertile, well-drained soil. The crop can be grown when the atmosphere is humid. The seed are sown during April-May and for each crop, sowing is done between middle November and December, they are transplanted. Cultivation of cumin requires a hot summer of 3 to 4 months, with daytime temperatures around 30°C. The total vegetative period of cumin is 100 to 110 days.

Seeds are usually collected and threshed by hand or cut by sickle. Seeds are ready 120 days after planting for harvesting when the seed become hard and the fruit change color. The plants are pulled out along with roots and dried in the Sun light. The seeds are separated by beating the plants with light slicks and cleaned by winnowing. The seeds should be dried in Sun before storage in gunny bags.

E) Chemical Constituents

The characteristic odour of cumin is attributed to the presence of sminaldehyde, 1, 3-p-menthadien-7al, 1-4-p-menthadien-7-al, 14 free amino acids, 18% protein, flavonoid glycosides, including apigenin-7-glucoside, luteolin-7-glucoside and luteolin-7-glcuronosyl glucoside, tannin, resin, gum. The other constituents are moisture, fat, crude fiber, carbohydrate, mineral matter, calcium, phosphorus, sodium, potassium, iron, vitamin A, B1, B2 & C, etc. (14, 15).

F) Medicinal Properties

Cumin seeds stimulant, antispasmodic, diuretic, aphrodisiac, emmenagogue, carminative, stomachic, astringent and useful in diarrhea, colic & dyspepsia, particularly in veterinary medicine. It is considered also very cooling, prescribed for whooping cough, the spitting up of blood, spasmodic cough and enters into most of the prescriptions for gonorrhoea. It is used in as a lactagogue. Cumin seed prescribed for snake-bite and scorpion–sting (16, 15).

G) Pharmacological Activities

Cumin helps in digesting food properly. It is one of the best herbs for digestive sluggishness; it also helps in the cure of digestion related problems. It is due to cuminaldehyde, that our salivary glands stimulate and this enables the primary digestion of food. Thymol is another compound present in cumin that stimulates the glands secreting digestive acids to bring about complete digestion of food. Moreover, it relieves for gas troubles, bloating and gurgling (1).

The essential oils present in cumin have anti fungal and disinfecting properties which prevent fungal and microbial infections from harming, the skin, it has also antibacterial properties and its decoction protects against hookworm infections too. The essential oils present in cumin also play an important role in strengthening the immunity. Cumin seed and oil is a great source of vitamins such as vitamin A, B, C, E and iron, its prevent the deficiency of iron (14).

H) Commercial Potentialities

The seeds of cumin are collected from cultural lands and open deserted places throughout India. *Cuminum cyminum* L. is marketed as ‘jeera’ are largely used as a condiment or spices. Its popularity spread from Latin America to Africa and all over Asia. In India, cumin has a good demand in export market its natural form as well in its powder form. Producing states are Gujarat, Rajasthan and Madhya Pradesh.

I) Important Formulations

Hingvidi Churna, Jirakidyarishta, Jirakidimodaka, Hinguvacidi Churna. Attatic Curanam, Cirakac Curanam, Cirakat Tailam, Kecari Ilakam, Mayilirakatic Curanam, Panca Tipakkinic Curanam, Pitta Curak Kutinir (17).

J) Adulterations and Substitute

There are various cumin alternatives, one of the most commonly used substitute for cumin are the coriander seeds, heavily adulterated with stem. Caraway seeds (Carum carvi), Anise seeds, black cumin (Bunium persicum or Nigella sativa) and white cumin etc. also make for great alternative to cumin seeds.

K) Other Uses

Cumin has a distinctive aroma, which adds spice to the dishes that are being cooked. The seed is used as a spice for flavoring food of various kinds like bread, cheese and curry powder. It is also used in other food products, backed food, meat and meat products, condiments, pickles, vegetables soups, gravies, snake food. The absolute is superior to the oil in flavoring. Cumaldehyde, the chief constituent of cumin oil, is used in perfumery. This will not only add taste in food, but will also act as one of the herbal remedies against many health disorders. The antiseptic, acts as a tonic benefiting the respiratory system, nervous system, excretory system and the circulatory system. In traditional medicine systems, cumin seeds are used extensively to stop morning sickness, jaundice, nausea, vomiting, colic etc.

L) Regulatory Status

An official drug under Drugs & Cosmetic Act 1940 and Rules and food commodity (spice) in Food Safety and Standards Act, 2006, Rules, 2011 and Regulations 2011:

i. Ayurvedic Pharmacopoeia of India, Part I, Vol. I. (18)
ii. Ayurvedic Formulary of India, Part I & II. (19)
iii. Siddha Pharmacopoeia of India, Part I, Vol. I. (17)
iv. Siddha Formulary of India, Part I. (20)
v. Indian Pharmacopoeia, 1955. (2)
vi. Food Safety and Standards Regulations 2011 (as food commodity). (21)

M) Organoleptic Characteristics

Fruit is light brown in color; schizacarp, ovoid-elongated, about 4-6 mm. It apex and base are thin and bear strip all over it (Figure 1 B, C). Powder yellowish-brown; odour aromatic, slightly camphoraceous and taste aromatic (Figure 1 D).

N) Micro-morphological Characteristics

Epicarp is a single layer colorless cell having stomata. The vittae are yellowish-brown, consisting of small, thin-walled, polygonal, tubular, cutinized cells. Mainly two type of the sclereids from the mesocarp, one is single layer longitudinally elongated cells with moderately thickened walls and numerous regular spaced and another one is small groups and are composed of considerably elongated cells; these sclereids have thickened walls and few pits. Endosperm is polygonal cells and containing microspheroidal crystals of calcium oxalate. Endocarp is large, thin-walled, elongated cell; found mostly attached with vittae and parenchymatous cells of mesocarp. The fibro-vascular tissue and testa is also present. (Figure 2).

O) Histochemistry

Micro-chemical tests and behavior of specific reagents towards plant/drug tissues: observations and results pertaining to micro-chemical tests and behavior of specific reagent towards plant tissues are presented in Table 1.

Table 1: *Micro-chemical tests and behavior of specific reagents towards plant tissues and cells contents*

Reagent	Test for	Inference	Histological Zone/Cell Contents Responded.
Dragendorff's Reagent	Alkaloid	-	Not Responded
Marme's Reagent	Alkaloid	-	Not Responded
Wagner's Reagent	Alkaloid	-	Not Responded
Potassium Hydroxide Solution (5% W/V)	Anthocynin	-	Not Responded
Sulphuric Acid (66% V/V)	Anthocynin	-	Not Responded
Acetic Acid	Calcium Oxalate	+	Calcium Oxalate Crystals in Mesocarp Region
Potassium Hydroxide Solution (5% V/V) + Hydrochloric Acid	Calcium Oxalate	+	Same as Above
Sulphuric Acid	Calcium Oxalate	+	Same as Above
Kedde Reagent	Cardiac Glycoside	-	Not Responded
Iodine Solution Followed By Sulphuric Acid	Cellulose	+	Epicarp, Mesocarp and Other Cellular Region
Sudan III	Fixed Oil and Fats	+	Endosperm Cells
Chlor-Zinc-Iodine Solution	Latex	-	Not Responded
Aniline Sulphate Solution Followed By Sulphuric Acid	Lignin	+	Vascular Strands Region
Phloroglucinol HCl	Lignin	-	Not Responded
Lugol's Solution	Protein	+	Endosperm Cells
Millon's Reagent	Protein	+	Same as Above
Picric Acid	Protein	+	Same as Above
Heating With KOH (5% W/V) + H_zSO_4	Suberin	-	Not Responded
Sudan III	Suberin	-	Not Responded
Weak Iodine Solution	Starch	-	Not Responded
Potassium Hydroxide Solution (5% W/V)	Starch	-	Not Responded
Sulphuric Acid	Starch	-	Not Responded

Indications: *'-' Absence and '+' presence of constituent.*

P) Organic Groups of Chemical Constituents

The extracts of the drug were tested for presence of different organic groups and results are presented in Table 2.

Table 2: *Major Group of Organic Chemical Constituents of Drug*

Organic Groups Of Chemical Constituents	Reagents / Tests	Inference
Alkaloid	Dragendorff's and Mayer's Reagents	-
Anthraquinone	Borntrager Reaction	-
Coumarin	Alcoholic Potassium Hydroxide	+
Flavonoid	Shinoda Reaction	+
Glycoside	Mollisch's Test	+
Protein	Xanthoprotein Test	+
Resin	Ferric Chloride Regent	-
Saponin	Libermann-Burchard Reaction	-
Steroid	Salkowski Reaction	-
Tannin	Gelation Test	+

Q) Identity, Purity and Strength

Physico-chemical constants

The analytical values in respect of physico-chemical constant of drug were established and results are reported in Table 3.

Table 3: *Analytical Values of Physico-chemical Constants*

Physico-Chemical Constants	Analytical Values
Moisture Content, % w/w	8.0
pH	7.3
Total Ash, % w/w	7.5
Acid Insoluble Ash, % w/w	1.0
Alcohol Soluble Extractive % w/w	6.5
Water Soluble Extractive % w/w	13.0
Essential Oil, %, v/w	-

R) Fluorescence and Spectroscopy

Fluorescence characteristic of powdered drug under UV light: Powdered drug was screened for fluorescence characteristic with or without chemical treatment. The observations pertaining to their color in daylight and under ultra-violet light were noticed and are presented in Table 4.

Table 4: *Fluorescence Characteristic of Powdered Drug under Ultra-Violet Light*

Treatments	Sample	
	Color In Day Light	**Nature Of Color In Fluorescence**
Powder as Such	Dark Peru	Brownish
Powder With		
Carbon Tetra Chloride	Brown	Dark brown
Ethyl Acetate	Brown	Brown
Hydrochloric Acid	Greenish Brown	Brown
Nitric Acid + Water	Yellowish Brown	Greenish Brown
Sodium Hydroxide + Methanol	Yellowish Brown	Brown
Sodium Hydroxide + Water	Greenish Brown	Brown
Sulphuric Acid + Water	Light Brown	Dark Brown
Buffer- Ph 5	Brown	Greenish Brown
Buffer- Ph 7	Brown	Reddish Brown
Buffer- Ph 9	Brown	Brown

Ultra-Violet Spectroscopy

The data of Ultra-Violet Spectrophotometric characteristics as computed in Table-5.

Table 5: *Ultra-Violet Spectrophotometer Characteristic of Drugs*

Specifications	Result
Tincture Dilution ml/ml	0.02
Maximum Absorption Peak	0.259
	0.212
	0.354
λ Maxima at, nm	340.45
	268.70
	215.00

S) Chromatographic Profile

Thin-Layer Chromatography: Best separations for TLC fingerprinting were obtained by using different layers and solvent systems. Inferences are shown in Table 6.

Table 6: *TLC Fingerprinting Data*

Drug	Mobile Phase/Solvent System	Derivatizing Reagents	Visualizations	No. of Spots	R_f Values of bands
Cuminum cyminum L.	Toluene: Ethyle acetate (9:1) v/v	Anisaldehyde-Sulphuric Acid	Under 254 nm	3	0.29, 0.42 and 0.60 (all grey)
			Under 366 nm	3	0.29 (red),0.36 (bright sky blue), and 0.42 (red)
			After derivatization	9	0.23 (violet), 0.29 (brown), 0.36 (violet), 0.42 (reddish brown), 0.53 (light blue), 0.60 (brown), 0.73 (light brown), 0.89 and 0.92 (both violet)

T) Regulatory Quality Specifications

Table 7 and 8 is showing the regulatory specifications for fruits of C. cyminum L. in different regulatory compendium.

Table 7: *Regulatory Specifications for Fruits of C. Cyminum* L. *In Different Regulatory Compendium*

S. No.	Quality Specification	Ayurvedica Pharmacopoeia of India (API)	Siddha Pharmacopoeia of India (SPI)	India Pharmacopoeia '55 (IP'55)	Prevention of Food Adulteration (PFA)
1.	**Official Title**	Svetajiraka	Cirakam	Cuminum, Cumin	Cumin (Safed Zeera)
2.	**Botanical Species**	*C. cyminum* L. (Fam. Apiaceae)	*C. cyminum* L. (Fam. Apiaceae)	*C. cyminum* L. (Fam. Apiaceae)	*C. cyminum* L. (Fam. Apiaceae)
3.	**Morphological Part/Official Part**	Ripe Fruits	Ripe Fruits	Ripe Fruits	Dried Mature Fruits
4.	**Description**	I. Macroscopic II. Microscopic	I. Macroscopic II. Microscopic III. Powder	Characters	_
5.	**Identity, Purity & Strength**				
	Foreign Matter	2.0 %, Not more than	2.0 %, Not more than	2.0 %, Not more than (other organic matter)	3.0 %, Not more than
	Total Ash	8.0 % Not more than	8.0%, Not more than	8.0%, Not more than	9.5%, Not more than
	Acid Insoluble Ash	1.0 %, Not more than	1.0%, Not more than	-	3.0%, Not more than
	Alcohol Soluble Extractive	7.0 %, Not less than	7.0%, Not less than	-	_
	Water Soluble Extractive	15.0 %, Not less than	15.0%, Not less than	-	_

S. No.	Quality Specification	Ayurvedica Pharmacopoeia of India (API)	Siddha Pharmacopoeia of India (SPI)	India Pharmacopoeia '55 (IP'55)	Prevention of Food Adulteration (PFA)
	Volatile Oil (Assay)	-	-	-	1.5 %,Not less than
6.	**Thin Layer Chromatography**	_	TLC profile	-	_
7.	**Extraneous Matter Including Dust Dirt, Stones, Lumps Of Earth, Chaff, Stalk, Stem Or Straw ,Edible Seeds Of Fruit Other Than Coriander And Insect Damaged Seeds**	_	_	_	5.0 %, w/w, Maximum
8.	**Insect Damaged Matter (Partially Or Wholly Bored By Insects)**	_	_	_	1.0 , w/w %, Not more than
9.	**Powder's Specification**	_	_	_	Rough or Fine Powder Obtained by Grinding Clean, Dried Cumin Fruits.
10	**Moisture Content In Powder**	_	_	_	10.0% ,w/w ,Not more than
11	**Total Ash In Powder**	_	_	_	9.5 % ,w/w, Not more than
12	**Acid Insoluble Ash In Powder**	_	_	_	1.5% ,w/w ,Not more than
13	**Added Coloring Matter In Powder**	_	_	_	Free From Added Coloring Matter

Table 8: *Regulatory Specification for oil of C. cyminum* L. *in Indian Pharmacopoeia and Indian Pharmacopoeial list.*

S. No.	Quality Specification	Indian Pharmacopoeia (1955)
1.	**Official Title**	Oleum Cumini, Oil of Cumin
2.	**Botanical Species**	*C. cyminum* L.
3.	**Official Product**	Oil Distilled from the Dried Fruit of *C. Cyminum* L.
4.	**Cumin Aldehyde**	16 %, Minimum
5.	**Specific Gravity**	$15.5^0/15.5^0$, 0.8900 to 0.935g
6.	**Refractive Index**	At 20^0, 1.490 to 1.509
7.	**Optical Rotational**	$+ 3^0$ to $+ 8^0$

4. Discussion

The cumin fruit is used in a number of classical and patent and proprietary formulations of Ayurveda and Siddha preparation. It is also most commonly used as a spice. Presented data in this communication may be utilized for the quality control and to check the adulteration of cumin available in commerce.

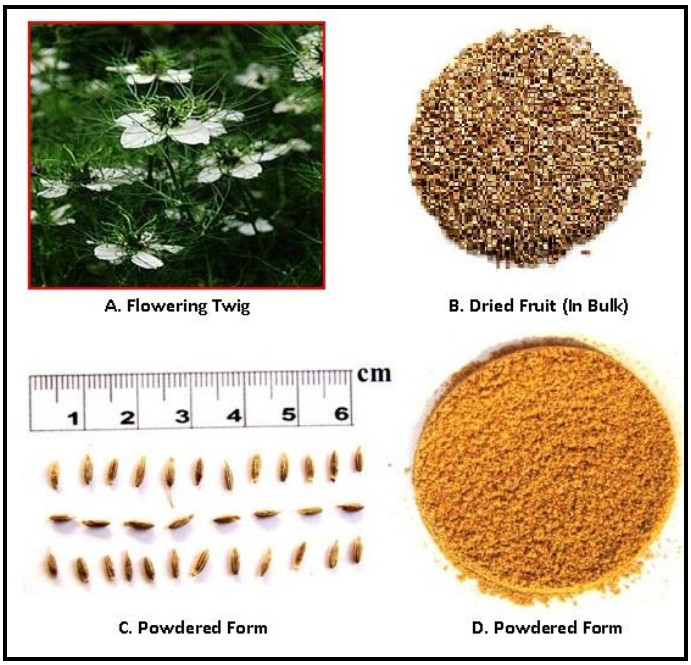

Figure 1: *Organoleptic Characteristics*

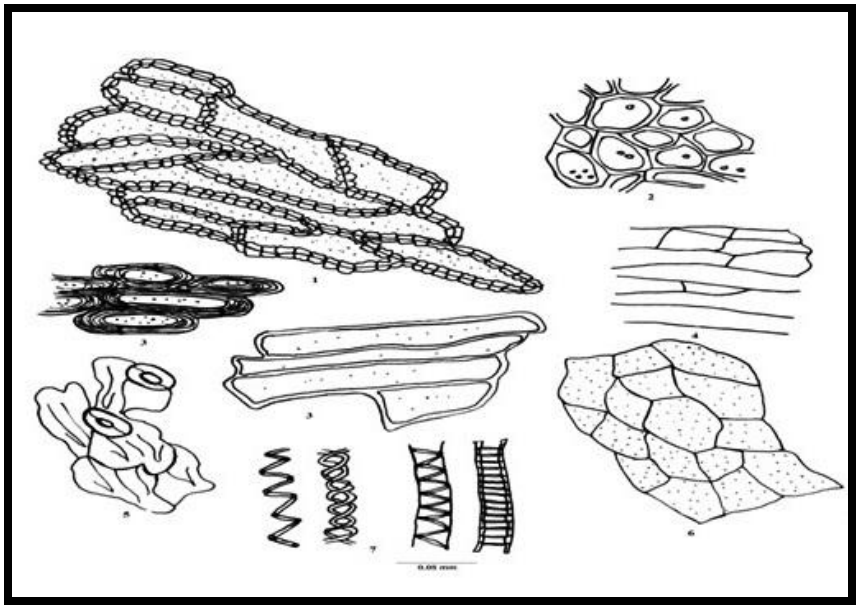

Figure 2: *Micro-morphological Characteristics*

1. Sclerenchymatous layer of the mesocarp; 2. Endosperms cells containing microsperoidaal crystals of calcium oxalate; 3. Group of sclereids from mesocarp cells; 4. Surface view of endocarp; 5. Fragment of epicarp in surface view with stomata; 6. Vitta cells; 7. Vascular tissue.

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