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REVIEW ARTICLE

Cumin(*Cuminum cyminum L.*): The Flavor of India (Cultivation, Nutrifacts, Pharmacological effect, Disease control and Economical value)

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ABSTRACT
Cumin (Cuminumcyminum) is noticeable seed spices crops delivered, devoured and traded from India and involves noteworthy spot in Indian agriculture. It is a yearly herbaceous blooming plant having a place with the family Apiaceae, otherwise called the Umbelliferae family. The little vessel formed seeds of Cumin (Cuminumcyminum) has been utilized for some medicinal and culinary purposes from the antiquated time in the different nations. Cumin is a mainstream spices on the planet from Latin America to Northern Africa and everywhere throughout the Asia and furthermore utilized as a flavouring agent. It is exported to many countries, so have global repute in world market and plays a crucial role in its economic development of India. The spotlight here is fairly on processing and harvesting of the developed species, in light of the fact that the nature of plant material and handling innovation lead to the high calibre of the last item. Reproducible quality is an objective, which is accomplished by the procedure of normalization. The nature of Cumin seeds and its basic oil must be surveyed with the scientific strategies. Cumin crop is generally attacked by some major diseases viz. wilt, blight and powdery mildew these are frequently attacking the crop and leading to heavy losses in yield and quality of seeds. Hence, for a good harvest plant protection measures should be adopted carefully and systematically. In this paper, the taxonomical order, Indian name ,phytochemistry, therapeutic properties and the gauges from the field cultivation, harvesting, storage, marketing ,conservative worth, dietary benefit, oil composition, varieties ,infection and control of cumin are reviewed.
KEY WORDS: Cuminum cyminum, export, Nutritional value, medicinal usage, variety, disease, control

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INTRODUCTION

Agriculture is the essential wellspring of employment for around 58 percent of India's populace. Agribusiness is a significant piece of India's economy and at present it is among the main two farm producer on the planet. This sector gives roughly 52 percent of the complete number of occupations accessible in India.

Seed spices are the yields having seed as primary efficient part, utilized in entire or worth included structure for conferring flavour fragrance and sharpness to food and also utilized in pharma. As aftereffect of various agro climatic conditions, India creates in excess of 20 seed flavours. Cumin, fenugreek, dill seeds, coriander and fennel are the significant seed flavours developed in the nation. Various states are known for different spices however seed spices are generally developed in Rajasthan and Gujarat with more than 80 percent contribution.[1]

India is the biggest maker, shopper and exporter of cumin so known as the land of spices. Cumin (*Cuminum cyminum L.*) which is generally known as Jeera is one of the most punctual seed spices utilized everywhere throughout the world. Cumin is an herbaceous yearly therapeutic plant which belongs to the Apiaceae family. The point by point taxonomical arrangement of cumin is appeared in Table 1.[2]

In India it is usually known as cumin or zeera and there are wide ranges of neighborhood name that are utilized for cumin in different state of India in various languages. The accessible name in various province of India are referenced in Table: 2

They grow tall and have slight, slim dull green leaves. Cumin is grown for its seeds, which are gone before by pink or white flowers. (Fig:1) More depiction of its physical attributes is recorded in Table 3. [3]

Cumin is local from the East Mediterranean to South Asia and today, grown everywhere throughout the world. It rely upon the seed source. Its seeds are utilized in the cooking styles of a wide range of societies. Among flavours, cumin (*Cuminum cyminum L.)* is a most conventional spice which has culinary just as therapeutic employments. Cumin put away for a considerable length of time together become a typical practice by the farmers, traders and processors during pointless creation just as lower showcase cost, so as to be bring significant expense in future. Effect of long time stock piling of cumin seed under encompassing condition were discover quality trait for oil, oleoresin and phytochemicals.[4]

CULTIVATION OF CUMIN

- **SOIL:**
  It tends to be developed in wide scope of soil, thus sandy topsoil to medium substantial soils with a pH from 6.8 to 8.3 and having a lot of organic matter with better fertility status are generally appropriate.
- **CLIMATE:**
  The harvest is effectively developed in respectably cool and dry atmosphere during Rabi season in territory liberated from serious ice during blossoming. It doesn't incline toward moistness in the climate during blossoming and seed setting stage. Shady climate is unfavourable during blossoming and fruiting stages.
- **SEED RATE:**
  Keeping optimum seed rate is an important technique for ensuring optimum plant population for realising higher yield of cumin. The seed rates depend upon type of variety and method of sowing. The optimum seed rate for cumin is 12 to 15 kg per hectare.
- **SEED TREATMENT:**
  For better and fast germination, seeds ought to be absorbed water for eight hours and afterward surface dried under conceal. The yield takes 10-12 days for germination and hence two light water systems are suggested for acceptable germination. Water soaked seeds should be kept in moist condition for six days for sprouting and saving cost of one irrigation. Researcher could acquire best germination (75.10%) by rewarding seeds with potassium nitrate 227 at 100 mg/litre, trailed by ammonium nitrate and urea, both at 1000 mg/litre, giving 67.55% and 61.59% germination individually.
- **TIME OF SOWING:**
  Time of sowing is a significant agro-method involving no cost yet chooses level and production, disease and pest frequency to a more noteworthy degree. Thusly, so as to shield cumin from rate of diseases and pests, it ought to be developed at fitting from to that basic time of blooming of cumin may get away from higher moistness content in climate. The temperature ought to be beneath $30^{o}C$ for better germination. The correct time for planting is from mid-November to first seven day stretch of December.
- **SOWING METHOD:**
  There are two types of methods i.e. line sowing and broad casting.
  Traditionally farmers sow cumin by broadcasting method but sowing done in lines facilitates intercultural operations and better environment and space to the plants. The seeds may be drilled at a spacing of 15 cm along the line. The line to line distance should be kept at 25 cm. The seed should not be sown deeper than 1.5 cm and the same should be covered with a thin layer of soil.
- **CROPPING SYSTEMS AND CROP ROTATION:**
  Cumin isn't suggested for developing as blended or intercrops. So as to deal with certain soil borne disease, it is important to follow crop rotation including distinctive yield in some season in succeeding year. A portion of the recommended cropping system for cumin developing zones are:
  pearl millet-cumin.
  dhaincha - cumin-green gram,
  dhaincha – cumin,
  maize - cumin - summer moong

- **MANURE AND FERTILIZERS:**
  The requirement of fertilizer depends upon the fertility status of the soil. Therefore, fertilizer should be applied based on soil testing report. Judicious application of manures and fertilizers in appropriate dose are important with respect to plant growth, seed development, yield and quality of produce.
  Application of FYM @10-15 tons/ha as basal dose was recommended during land preparation. In addition, application of 20 kg $P_2 O_5$ as basal dose and 30 kg N/ha through top dressing in the standing crop in single dose at 30 DAS or in two equal splits, one as basal and rest at 30 DAS, is sufficient to harvest good crop of cumin.
  Application of nitrogen and phosphorus each at 40 kg/ha was found significantly superior over 20 kg/ha of NP and control in increasing the growth and yield attributes of cumin. Uptake of nitrogen and phosphorus was also increased in seed and Stover of cumin at higher level of fertilization.
- **IRRIGATION:**
  Application of water at right time in required quantity is very much beneficial for the quality production of cumin. Contingent on the climatic conditions and soil water system is finished. For the most part, water system isn't required for the yield developed in dark cotton soils, yet for light soils, 3-4 water systems are given. First water system ought to be given soon after the planting and second water system ought to be given during seed germination, 8-10 days subsequent to planting. By and large cumin requires 4-6 water system dependent on soil type and yield ought to be inundated by giving the 20-25 days stretches. Sprinkler water system in cumin could essentially spare the water, it is gainful.
- **HARVESTING TIME AND METHOD:**
  Collecting of Cumin began from first seven day stretch of March contingent on planting date. (110-120 DAS) seed can be separated by beaten and trampled on clean threshing floor of by cumin threshing machine.
- **YIELD/ha :**
  Cumin crops take 110 -120 days to reach at maturity. Under logical administration condition 8-12 q/ha cumin seed of improved assortments can be acquired.
- **CUMIN BREEDING:**
  Cumin is a cross-pollinator, The in-vitro development of cumin permits the age of hereditarily accurate plants. One objective of cumin breeding is improved protection from biotic (contagious infections) and abiotic stresses**.**
- **PROCESSING AND POST HARVEST TECHNOLOGY:**
  The dried seed utilized for steam refining and it yields 2.5 - 4.5% of volatile oil contingent on assortment and area. The processed items incorporate fundamental oil, cumin force, oleoresins and fixed oil.
- **STORAGE AND VIABILITY:**
  The seeds can be held in cool, dry, dim spot and in impermeable compartments. Keep away from higher temperature**.**

NUTRITIONAL VALUE OF CUMIN:

Cumin seeds are nutritionally rich, they give high measures of fat (particularly monounsaturated fat), protein, dietary fibre, vitamins and a few dietary minerals, particularly iron, are likewise significant in cumin seeds. (Table: 4) [5, 6, 7]

Cumin has a particular solid flavour. Its warm smell is because of its basic oil content. It is a primary constituent of smell mixes are cuminaldehyde and cuminic alcohol. Other significant mixes of cumin and their structure are recorded in Table: 5 and 6. [3, 8, 9]

MEDICINAL IMPORTANCE OF CUMIN:

Nature has been a wellspring of medicinal agent for a long time and the utilization of therapeutic plants, particularly in customary medication, is all around recognized and established. [10]The World Health Organization (WHO) assesses those 4 billion individuals, 80 percent of the total populace, by and by utilize home grown medication for some part of essential wellbeing care.[11]

The seeds of cumin (*C. cyminum L.*) are broadly utilized as the spices for their distinctive aroma, they are likewise normally utilized in conventional medication to treat a variety of diseases including antimicrobial, cancer prevention agent, hypolipidemic, cardiovascular, focal anxious, respiratory, immunological, calming, pain relieving antipyretic and numerous other pharmacological effects. (Table: 7)The literature presents plentiful proof for the organic and biomedical exercises of cumin, which have for the most part been attributed to its bioactive constituents. [12, 13]

ECONOMICAL IMPORTANCE OF CUMIN

Agriculture export from a nation assumes a significant job in its financial turn of events. Spices trade assumes a significant job in agriculture export from India. According to 2017-18 evaluations, India exported 10.28 lakh tons absolute spices of worth 1792955 lakh rupees contributing 7.98% offer to add up to agrarian export from India. [14]

Differing agro-climatic conditions winning in the nation from Jammu to Kanyakumari and from Western Rajasthan to North-Eastern states gives enormous creation base to spices in India. The primary cumin developing regions are Rajasthan and Gujarat as well as parts of Madhya Pradesh and Uttar Pradesh. It is exported to numerous nations including Bangladesh, Japan, Malaysia, Nepal, Pakistan, Singapore, USA etc. [15]

Hence, India produces 63 out of 109 spices recorded by International Spice Organization. At present India is the biggest maker, purchaser and exporter of spices on the planet. Spices where seed is the fundamental prudent and consumable part is named as seed spices. Out of 63 spices delivered in India 20 are delegated seed spices, with significant seed spices (Cumin, Coriander, Fenugreek and Fennel) and minor seed spices (Ajwain, Aniseed, Caraway, Celery, Dill and Nigella).

Seed spices contributes in excess of 45 percent to national spices land and have a lion's share of more than 24 percent to spice export from the country in volume. In most recent three decades seed spices export from India has expanded more than 11 and 57 times as far as amount and worth individually.

Cumin, coriander and fenugreek export out rose to 92, 22 and 14 times in amount individually. Higher increment in esteem term shows steep increment in costs for seed spices in world market. Indian spices have worldwide notoriety in world market because of their particular fragrance and flavour. The investigation of development and shakiness of significant seed spices export out for the examination time from 2000-2001 to 2017-18 introduced in fig:2 uncovers that seed spice exports have brilliant possibilities and future in business as usual scenario.

According to Observatory of Economic Complexity (2017), seeds spices (incorporate cumin, coriander, anise, fennel, caraway, and so forth.) of worth $898M were exchanged world market (2017).(Fig: 3) India was the top exporters to the world market having a portion of 49.88% ($448M) to the world seed spices exchange. During 2017, cumin seed esteemed $486M was exchanged the global market, of that 71.8% was provided by India ($349M) alone, trailed by Syria ($62.8M), Turkey ($21.5M), Spain ($4.38M) and Egypt ($4.24M). The top merchants of cumin are Vietnam ($105M), the United States ($44.3M), Bangladesh ($37.1M), Egypt ($24.3M) and the United Arab Emirates ($23.4M).[16]

CUMIN DISEASES AND MANAGEMENT

These yields are influenced by dominant part of variables beginning from seed accessibility to creation and post-harvest the board. (Table:8)Seed spices crops are delicate to abiotic and biotic components making it a hazardous yield to get guaranteed reap by farmer.(Table:9)

IMPROVED VARIETIES

Crop improvement, production and protection technologies /recommendations which had a strong impact in changing the National seed spice scenario: In the country significant work was done at various centres, the basic aim of the scientists was only to develop effective production technologies to enhance the yield potential of these crops. The work done was more on applied aspects looking to the major problems in seed spice cultivation. (Table:10)

[Seed] [Leaves] [Flower]

Figure 1: Phenotype descriptors

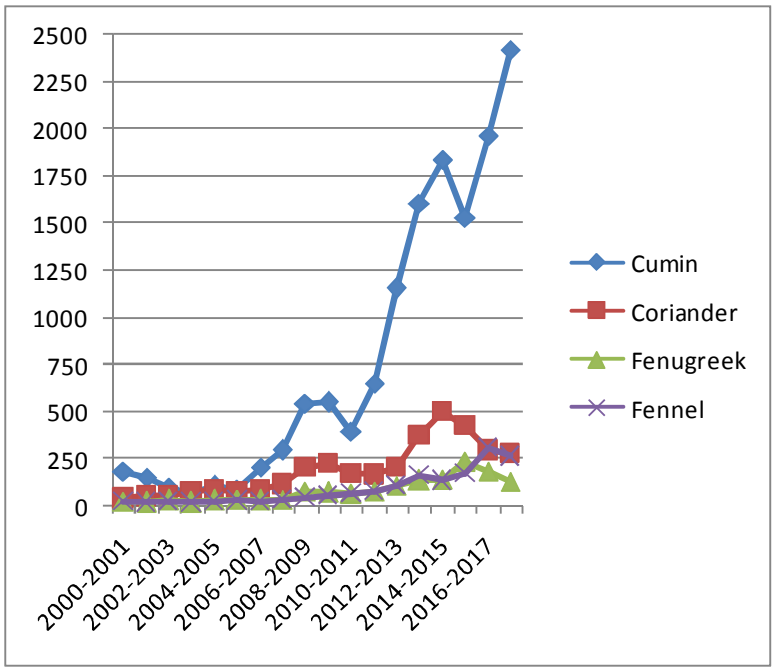


Figure 2: Major seed spice exports during 2000-2018 (Value in Rs.crore)

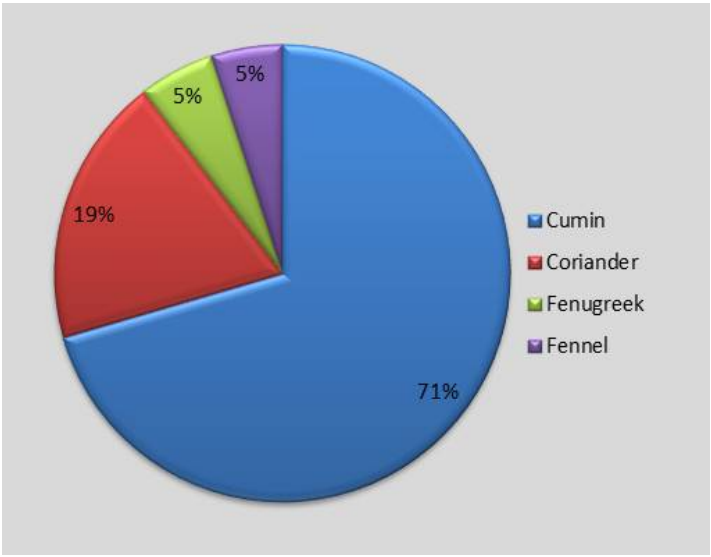


Figure:3 Export during 2017-2018

Table:1 Taxonomical Classification of Cumin

Kingdom	Plantae
Subkingdom	Tracheobionta
Super division	Spermatophyta
Division	Magnoliophyta
Class	Magnoliopsida
Sub class	Rosidae
Order	Apiales
Family	Apiaceae
Genus	*Cuminum* L.
Species	*Cuminumcyminum*L.

Table 2: Indian names of cumin

State/Region	Language	Names
Gujarat	Guajarati	Jeeru
North India	Hindi	Jira, SafaidJeera, Zeera
Punjab	Punjabi	Jira, SafaidJeera
Karnataka	Kannada	Jeerige
West Bengal	Bengali	Jeere
Kerla	Malayalam	Jeerakam
Maharashtra	Marathi	Jeregire
Odisha	Odia	Jeera
Tamil Nadu	Tamil	Ziragum
North-Eastern Bihar	Maithili	Jir
Jammu and Kashmir	Urdu	Jira

Table 3: Botanical description of cumin

Organoleptic characteristic	Colour	Stem Leaves Seed Flower	Inner core White and Outer core Grey or dark Yellowish green Yellowish brown White or pink
	Odour	Heavy aromatic,Strong and peculiar	
	Taste	Aromatic, disagreeable, bitter and Warm	
Macroscopic Characteristics	Stem	Not very tall : 20 to 50 cm an erect stem with little slender branched	
	Leaves	5 to 10 cm long, Pinnate or bipinnate with thread like leaflet.	
	Flower	The little flowers are radially balanced with 5 little sepals, 5 petals, and 5 stamens.	
	Fruit	Elliptical, flat on one side, convex, furrowed and rough on the other. Length: 5 to 6 mm Thickness: 1.5 mm colour.: light brown	
Microscopic characteristics	Epicarp	Single layer, Colourless cell having stomata	
	Vittae	Yellowish brown consisting of small , polygonal, thin-walled , tubular, cutinized cell.	
	Mesocarp	One sort sclereids are single layer longitudinally cells with respectably thickened wall and other sort sclereids are small group and are made out of significantly stretched cells.	
	Endosperm	Polygonal cells and containing microspherical crystals of calcium oxalate.	
	Fibro vascular tissue	Present	
	Testa	Present	

Table: 4 : Nutritional factors cumin seeds (Value per 100gm)

Nutritional Composition	Nutritional Information	Nutrient Value/Amount	% of RDA
PRINCIPLE	**Energy**	375 Kcal	19%
	Carbohydrate • Dietary Fibre • Sugar	44.24 g 10.5 g 2.25g	34% 26% -
	Protein	17.8 g	32%
	Total Fat • Saturated fat • Polyunsaturated fat • Monounsaturated fat	22.27g 1.535g 3.379g 14.04g	74% 8% - -
	Cholesterol	0.0mg	-
VITAMINS	Folates	10 µg	2.5%
	Niacin	4.58mg	28.5%
	Pyridoxine	0.435mg	33%
	Riboflavin	0.32mg	24.5%
	Thiamin	0.628mg	52%
	Vitamin A	1270mg	42%
	Vitamin C	7.7 mg	13%
	Vitamin E	3.3 mg	44%
	Vitamin K	5.4 µg	4.5%
MINERALS	Calcium	931 mg	93%
	Copper	0.867 mg	96%
	Iron	66.36 mg	829%
	Magnesium	366 mg	91%
	Manganese	3.3 mg	145%
	Phosphorus	499 mg	71%
	Zinc	4.8 mg	43.5%
ELECTROLYTE	Sodium	1788mg	38%
	Potassium	68 mg	11%
PHYTO-NUTRIENT	Carotene-ß	762 µg	-
	Crypto-xanthin-ß	0 µg	-
	Lutein-zeaxanthin	448 µg	-

Table 5: Essential oil composition of cumin seeds

COMPONENTS	PERCENTAGE %
β-Pinene	10.22
Camphene	0.01
Δ3-Carene	0.03
α-Phellandrene	1.6
Limonene	0.39
Ɣ-Terpinene	0.11
Terpinene	17.25
Trans-Sabinenehydrate	0.09
Linalool	0.04
β-Caryophllene	0.45
Terpinen-4-ol	0.13
α-Terpineol	0.05
p-Mentha-1,3-diene-7-al	15.18
p-Mentha-1,3-diene-7-ol	0.31
Cumin aldehyde	27.6
Cumin alcohol	0.36
p-Mentha-1,4-diene-7-al	9.48
(Z)-β-Farnesene	0.6
p-Mentha-3-en-7-al	2.91
Cis-Sabinenehydrate	0.19
p-Cymene	5.51
β-Phellandrene+1.8-cineole	0.49
α-Terpinene	0.11
Myrcene	0.83
Sabinene	0.58
α-Pinene	0.63

Table: 6 Compound Structure of Essential Oil constituents in Cumin Genotype

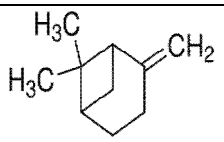
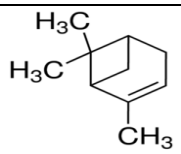
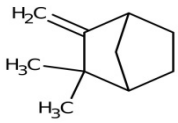
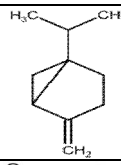
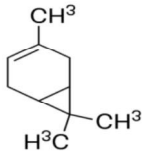
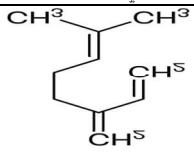
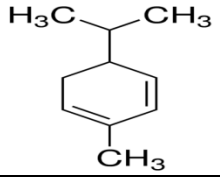
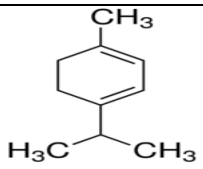
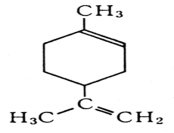
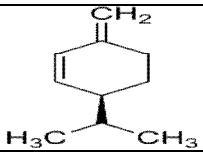
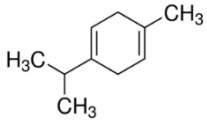
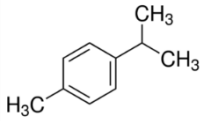
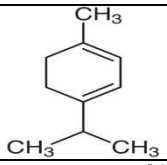
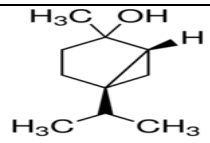
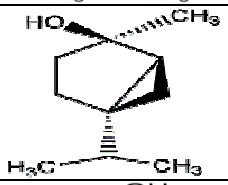
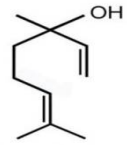
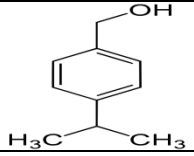
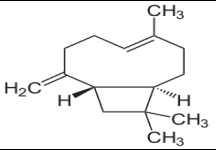
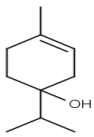
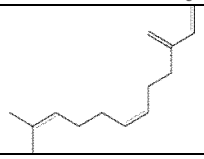
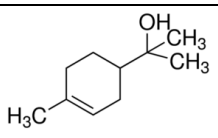
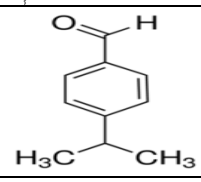
Name	Formula	Structure	Name	Formula	Structure
β-Pinene	$C_{10}H_{16}$		α-Pinene	$C_{10}H_{16}$	
Camphene	$C_{10}H_{16}$		Sabinene	$C_{10}H_{16}$	
Δ3-Carene	$C_{10}H_{16}$		Myrcene	$C_{10}H_{16}$	
α-Phellandrene	$C_{10}H_{16}$		α-Terpinene	$C_{10}H_{16}$	
Limonene	$C_{10}H_{16}$		β-Phellandrene	$C_{10}H_{16}$	
ϒ-Terpinene	$C_{10}H_{16}$		p-Cymene	$C_{10}H_{14}$	
Terpinene	$C_{10}H_{16}$		Trans-Sabinenehydrate	$C_{10}H_{18}O$	
Cis-Sabinenehydrate	$C_{10}H_{18}$		Linalool	$C_{10}H_{18}O$	
Cumin alcohol	$C_{10}H_{14}O$		β-Caryophllene	$C_{15}H_{24}$	
Terpinen-4-ol	$C_{10}H_{18}O$		(Z)-β-Farnesene	$C_{15}H_{24}$	
α-Terpineol	$C_{10}H_{18}O$		Cumin aldehyde	$C_{10}H_{12}O$	

Table: 7 Bioactive component of cumin and their effect[17- 29]

Sr.No	Phyto-component and Extract	Activity
1	Eugenol, limonene, monoterpene alcohols	Anti-oxidant
2	Cuminaldehyde, carvone, linalool, α- and β-pinenes, eugenol	Anti-microbial
3	Cuminaldehyde and flavonoids	Gastrointestinal Disorders
4	Cuminaldehyde	Anti-diabetic
5	vitamin-E	Skin Disorders and boils
6	Eugenol, limonene	Anti-cancer
7	Cumin alcoholic extract	Analgesic
8	Phytoestrogens	Anti-osteoporotic
9	Phytoestrogens	Anti-fertility
10	Cumin essential oil	Anti-inflammatory
11	Caffeine, aromatic essential oils	Antitussive
12	Cumin ether extract	Astringent
13	Caffeine, aromatic essential oils	Anti-asthmatics
14	Iron, essential oils, vitamin-C, vitamin-A	Immuno-Modulator
15	Cumin aqueous extract	Anti-hypertensive

Table: 8 Biotic stress

Insect pests	Aphid	*Myzuspersicae* Sulzer
		*Acyrthosiphonpisum*Harris
		Aphis gossypii
		A. craccivora Koch
	Thrips	*Thripstabaci*Lindeman
Nematode	Root-knot nematode	*Meloidogyne*spp.
Diseases	Wilt	*Fusariumoxysporum*f. sp. *cumini*Foc
	Blight	*Alternaria SP.*
	Powdery mildew	*Erysiphepolygoni*
	Damping off	*Pythiumaphanidermatum*(Edson) Fitzp.
Weeds	Broadleaf	Zeeri: *Plantagopumilla*L. (Plantaginaceae)
		Lambs quarters: *Chenopodium album* L. (Chenopodiaceae)
		Yellow sweet clover: *Melilotusindica*Medik. (Fabaceae)
		Wild onion: *Asphodelustenuifolius*Cav (Liliaceae)
		Scarlet: *Anagallisarvensis*L. (Primulaceae)
		Corn spurry: *Spergulaarvensis*L. (Caryophylliaceae)
		Fine leaf fumitory: *Fumariaparviflora*Lam (Fumariaceae)
		False daisy: *Eclipta alba* (L.) Hassk. (Asteraceae)
		Water primrose*: Ludwigia*sp. (Onagraceae)
		Toothed dock: *Rumex*sp. (Polygonaceae)
	Grasses	Canary grass: *Phalaris minor* Retz. (Poaceae)
		Goose grass: *Poannua*L. (Poaceae)
		Rabbits foot grass: *Polypogonmonspeliensis*(L.) Desf. (Poaceae)
		Burmuda grass: *Cynodondactylon*(L.) Pers. (Poaceae)
	Sedges	Purple nut sedge: *Cyperusrotundus*L. (Cyperaceae)
		Variable flatsedge: *Cyperus diff ormis*L. (Cyperaceae)
Virus	Potyvirus group	Vanilla distortion mosaic virus

TABLE:9 Major disease in cumin and their management[30- 35]

INSECT	Aphids	Time of infestation	Between December to March, During blossoming stage a populace of 55 - 70 aphids/5 plant could diminish yield by 50%
		Loss	Adults and nymphs suck the sap from plants and furthermore produce nectar dew emission on which the shootymolds are created which brings about disappointment of seed creation.
	Thrips	Time of infestation	At early vegetative growth of crop and found up to flowering stages.
		Loss	It sucks the leaves of plant causes yellowing and drying of leaves.
		Management	Neem oil or Dimethoate or Imidachloprid.
WILT	*Fusariumoxysporum f. sp. cumini*	Time of infestation	At all stages of growth but major infection at one month of plant.
		Loss	Leaves of the infected plant hang turn yellow and later on shrivel and evaporate.
		Management	Crop rotation, Healthy and disease free seeds should be used,Watering should be done in limited ways, Soil solarization + soil utilization of Trichoderma + FYM (5 t/ha) + splash with Mancozeb 0.25% (60 DAS)
BLIGHT	*Alternaria burn*.	Time of infestation	At blossoming stage, Temperature running from 23-28°C is ideal for infection.
		Loss	The disease appears in the form of small isolated whitish necrotic areas on the leaf and stem .In case of severe infection there may not be seed formation while under moderate infection, shrivelled, discoloured seeds having poor germination may be produced.
		Management	Crop rotation, chemical spray: Dithane M - 45, Dithane Z-78 or Carbendazim,Mancozeb, Copper oxychloride, Zineb.
POWDERY MILDEW	*Erysiphaepolygoni*	Time of infestation	February and March at the flowering time. The disease spreads fast under warm (27 - 35°C) and moist conditions.
		Loss	Small white or greyish specks appear on lower leaves and later on increases in size and coalesce, covering the entire surface with mycelial growth, reduction in yield with poor quality
		Management	Mostly Sulfur dust, Dinocap,Carbendazim,Tridemorph
ROOT KNOT DISEASE	*Meloidogyne*	Time of infestation	Significant yield losses at field level
		Loss	drying and yellowing
		Management	Carbofuran spray, *Azadirachtaindica*
WEED	*Cynodondactylon*, *Chenopodium spp*. and *Plantagopumila*	Loss	Loss of 80-90% in the seed yield of cumin because of weed
		Management	Herbicides :Terbutryn or Oxadiazone, Fluchloralin or pre-rising Pendamethalin

Table: 10 Varieties of Cumin

Developed by	Developed at	Name of varieties	Pest/disease	Quality of variety	year of release
Indigenous selection	Spice Research Centre (S.D.A.U), Jagudan	GC-1	Powdery mildew Blight Wilt	Maturation:105-110 days Yield: average 7.0q/ha.	1983
	SKN College of Agriculture (RAU), Jobner	RZ-19	Powdery mildew Blight Wilt	Growth behaviour: erect pink coloured flowers and bold pubescent grains Maturation:120-140 days Yield: average 5-6 q/ha.	1988
	SKN College of Agriculture (RAU), Jobner	RZ-209	Blight Wilt	Maturation:140-150 days Yield: average 6.5 q/ha.	1995
	Spice Research Centre (S.D.A.U), Jagudan	GC-4	Fusarium wilt	It gives an average yield of 8.75 q/ha	2006
	SKN College of Agriculture (RAU), Jobner	RZ-345	wilt, blight and powdery mildew	Attractive and Bold seeds Higher volatile oil Maturation:120-130 days Yield: average 6.07 q/ha.	2008
Exotic selection	Spice Research Centre (S.D.A.U), Jagudan	GC-3	wilt, blight and powdery mildew	Maturation: average 100 days Yield: average 7.0 q/ha. 3.5% essential oil.	2000
Mutation	Spice Research Centre (S.D.A.U), Jagudan	GC-2	-	Maturation: average 100 days Yield: average 7.0 q/ha.	1992
	SKN College of Agriculture (RAU), Jobner	RZ-223	Wilt	The seeds yield an oil content of 3.23 per cent and gives seed yield of 6.0q/ha.	2004

Source: www.seednet.gov.in

CONCLUSION

Cumin is a valuable spices crop in India as it is a significant piece of Indian cooking styles as it includes a generally excellent punch of flavor in it just as it is utilized in different medicinal purposes because of essence of volatile oil and aldehydes in it. Cumin covers a region of around seven lakh hectares in India with sufficient measure of production. The healthy benefits show that this spices contains generally excellent measure of protein, enhanced starches, diet filaments and nutrients like ribo-flavin, thiamin and niacin. It is viewed as enhanced wellspring of calcium and minerals. Cumin seriously experiences different contagious disease which confer negative impact on the yield because of which cumin producers face incredible misfortune and it at the same time prompts national financial misfortune. In this way, different endeavors are being made to handle these pathogens by making different synthetic compounds which control their development, by making pathogen safe and open minded assortments and multidisciplinary viewpoints are being made to improve the creation innovation of cumin.

REFERENCES

1. Gopal Lal, (2018). Scenario, Importance and Prospects of Seed Spices: A Review. Current Investigations in Agriculture and Current Research.vol. 4(2),491-498.
2. Abdolhossein Rezaei Nejad, (2011). Productivity of Cumin (Cuminum cyminum L.) As Affected by Irrigation Levels and Row Spacing. Australian Journal of Basic and Applied Sciences.vol. 5(3), 151-157.
3. NitinRai, SeemaYadav, AK Verma, Lalit Tiwari, Rajeev Kr Sharma,(2012).A monographic profile on quality specifications for a herbal drug and spice of commerce-*Cuminum cyminum* L. International Journal of Advanced Herbal Science and Technology.vol1(1),1-12.
4. . AK Verma, Ravindra Singh, Sharda Choudhary and Gopal Lal,(2018). Cultivation of Dollar Earning Cumin Crop for Higher Income. Acta Scientific Agriculture.vol2(3),46-48.
5. Emilie Deletre ,FabriceChandre,Livy Williams , Claire Duménil , Chantal Menut and Thibaud Martin,(2015). Electrophysiological and behavioral characterization of bioactive compounds of the Thymus vulgaris, Cymbopogonwinterianus, *Cuminum cyminum* and *Cinnamomum zeylanicum* essential oils against Anopheles gambiae and prospects for their use as bednet treatments. Parasites &Vectors.vol. 8:316,1-14.
6. Rihawy MS, Bakraji EH, Odeh A.,(2014). PIXE and GC-MS investigation for the determination of the chemical composition of Syrian *Cuminum cyminum* L. *Appl RadiatIsot.* Vol.86,118-125.

7. H Hajlaoui, H Mighri, E Noumi, M Snoussi, N Trabelsi, Riadh Ksouri, Amina Bakhrouf, (2010).Chemical Composition and Biological Activities of Tunisian Cuminum Cyminum L. Essential Oil: A High Effectiveness Against Vibrio Spp. Strains. *Food ChemToxicol.*Vol 48,2186-2192.
8. Wanner J, Bail S, Jirovetz L, et al, (2010). Chemical composition and antimicrobial activity of cumin oil (Cuminum cyminum, Apiaceae). *Nat Prod Commun*. Vol.5(9):1355-1358.
9. RongLi ,Zi-Tao Jiang. (2004). Chemical composition of the essential oil of *Cuminum cyminum* L. from China. FLAVOUR AND FRAGRANCE JOURNAL.vol. 19: 311–313
10. Hanif, C., Ayesha, T., Adila, S., Saeed, M., Tanveer, A. and Ashfaq, M. (2012). Physiochemical investigation and antimicrobial activity of essential oil of cumin. World Appl. Sci. J. 19 : 330-333.
11. Leporatti, M. L. and Ghedira, K. (2009). Comparative Cumin as bionutrient and its management 221 analysis of medicinal plants used in traditional medicines in Italy and Tunisia. J. Ethnobiol. Ethnomed.5 : 31-39.
12. Mnif S, Aifa S.,2015.Cumin (*Cuminum cyminum* L.) from traditional uses to potential biomedical applications. Chemistry & Biodiversity. Vol.12(5):733-742.
13. Chaudhary, n., husain, s.s., & Ali, M.Y., (2014). Chemical composition and antimicrobial activity of volatile oil of the seeds of *Cuminum cyminum* l. Conference proceedings.
14. Meena, M.D., Lal, G., Meena, S.S., Lal, S., Chaudhary, N., (2019). Seed spices export from India: Prospects and constraints. International J. Seed Spices.vol. 9(2), 12-20.
15. AshitaRana ,Vipul Kumar, AnisMirza,Anil Panghal, (2018). Efficacy of Cumin (*Cuminum cyminum* L.) as a Bionutrient and its Management. Annals of Biology .34 (2), 218-222.
16. M. D. Meena, G. Lal, S.S. Meena and N. K. Meena,2018. Production and export performances of major seed spices in India during pre and post-WTO period. International J. Seed Spices .vol.8(1), 21-30.
17. A Najda; J Dyduch; N Brzozowski. (2008). *Veg Crops Res Bull*. **2,** 68, 127-133.
18. Derakhshan S, Sattari M, Bigdeli M., (2008). Effect of subinhibitory concentrations of cumin (*Cuminum cyminum* L.) seed essential oil and alcoholic extract on the morphology, capsule expression and urease activity of *Klebsiella pneumoniae*. *Int J Antimicrob Agents*.vol.32(5),432-436.
19. DavideTagliazucchi, Elena Verzelloni, Angela Conte,2005. Effect of Some Phenolic Compounds and Beverages on Pepsin Activity during Simulated Gastric Digestion. *Journal of Agricultural and Food Chemistry*. Vol.***53*** (22), 8706-8713.
20. Kumar PA, Reddy PY, Srinivas PN, Reddy GB, (2009).Delay of diabetic cataract in rats by the antiglycating potential of cumin through modulation of alpha-crystallin chaperone activity. The Journal of Nutritional Biochemistry.vol.20(7),553-562.
21. United States Department of Agriculture. (2015). "Cumin Seed". Agricultural Research Service USDA.
22. Gagandeep, Sivanandhan Dhanalakshmi, Ester Mendiz, Agra Ramesha Rao, Raosaheb Kathalupant Kale, (2003). Chemopreventive effects of *Cuminum cyminum* in chemically induced fore stomach and uterine cervix tumors in murine model systems. Nutrition and cancer.vol.47(2), 171-180.
23. Sangeeta P. Bhat, WaseemRizvi, Anil Kumar, (2014). Effect of *Cuminum cyminum* L. Seed Extracts on Pain and Inflammation. JOURNAL OF NATURAL REMEDIES. Vol 14 (2),186-192.
24. DaljeetKaur, Ramica Sharma, (2012).An Update on Pharmacological Properties of Cumin, International Journal of Research in Pharmacy and Science. Vol.2(4),14-27.
25. Wei, J., Zhang, X., Bi, Y., Miao, R., Zhang, Z. and Su, H. (2015). Anti-inflammatory effects of cumin essential oil 264.7 cells. Evidence-based complement. Alternat. Med. 474-509.
26. Uma Agarwal, Dharam Pal Pathak, GarimaKapoor , RubinaBhutani , Ruchi Roper, Vikas Gupta ,Ravi Kant,(2017). Review on *Cuminum Cyminum* –Nature's Magical Seeds. Journal of Chemical and Pharmaceutical Research, vol. 9(9),180-187.
27. Johri RK. (2011*). Cuminum cyminum* ,Carum carvi: An update. Pharmacognosy Reviews. Vol.5(9),63-72
28. Ahmad Reza Gohari, Soodabeh Saeidnia,(2011). A Review on Phytochemistry of *Cuminum cyminum* seeds and its Standards from Field to Market. Pharmacognosy Journal.vol.3(25),1-5.
29. S.S.Lamba ,K.Y.BuchH,LewisIIIJ.Lamba,(2000). Phytochemicals as potential hypoglycemic agents. Studies in Natural Products Chemistry.vol,21, 457-496.
30. Gangopadhyay, S., Bhakar, B. R. and Godhar, S. L. (2010). Effects of botanicals on cumin blight caused by *Alternariaburnsii*. *J. Mycol. Pl. Pathol.* 40:570-574.
31. Gohil, V. P., Jani, S. M. and Dange, S. R. S. (1988). Assessment of yield losses due to powdery mildew in North Gujarat. *Indian Phytopath.* 41: 156-157.
32. Champawat, R. S. and Singh, V. (2008). Seed Spices. In Disease Management in Arid Land Crops. Eds. Lodha, S., Mawar, R and Rathore, B. S. Scientific Publishers (India) Jodhpur 197- 232
33. . Egunjobi, O. H. and Larinde, M. A. (1975). Nematodes and maize growth in Nigeria 11Effects of some amendments on the yield of maize (zea mays) in Nigeria. *Nematologica Mediternean,* 3:65-73
34. N Rai, P C Gupta, Rajeev Kumar Sharma,(2018).Studies on Microbiological Assessment of Some Commercial Herbal Drugs and Spices. Research & Reviews: Journal of Herbal Science.vol1(30), 39-43.
35. Ramchandra S., Bhatt P.N. (2012): First report of *Fusarium equiseti* causing vascular wilt of cumin in India. Plant Disease, 96: 1821.