

AN OVERVIEW OF MEDICINAL PLANT AS BLACK CUMIN SEED

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ABSTRACT

Black seed, also known as black cumin (*Nigella sativa*), plays a crucial role globally due to its importance in health, pharmaceuticals, culinary uses, and as a source of income. It is cultivated in many countries, including Ethiopia, where it has been used by households for generations. Despite its significance, the productivity of black cumin in Ethiopia remains low compared to other countries. Several factors contribute to this low productivity, including the lack of improved varieties, poor fertilizer management, limited knowledge of best cultural practices, and inadequate disease and pest management. Addressing these challenges requires focused research on fertilizer requirements, the adaptation of available varieties, recommendations for agronomic practices, and effective pest and disease control strategies.

1. INTRODUCTION

Spices are consumed and appreciated for unique flavor and aroma and entered the agricultural activity of humans around 6000 BC though their presence was recorded in Neolithic era or even earlier (Mehmood et al., 2018). Among the spices, seed spices are an important group that consists of around 20 spices. Black cumin (*Nigella sativa* L.) is considered as a miraculous spice having very important medicinal values apart from its intrinsic flavor (Naz, 2011). Historical records show that plants are being used from thousands of years for treatments of many diseases. The plant materials are either used directed or administered in the form of teas, powder etc. (Shahzad et al., 2020). The development and production of drugs by using medicinal plants started by isolating primary compounds directly from plants, these drugs include digitoxin, quinine, cocaine, and codeine, some are still in use for different purposes (Agarwal et al., 2019). Black cumin also known as Kalonji locally, is one of the most widely examined plant possessing wide range of

naturally occurring compounds (Mehmood et al., 2018). It is a field crop that belongs to Ranunculaceae, the butter cup family. In Islam, black cumin is considered as the best healing medicine available. Hence, it is appropriately known as seed of blessing (habbatul barakah) (Srivastava, 2014). The medicinal value of

black cumin is of immense importance and numerous workers appreciated its unique, varied and powerful pharmacological traits.

Origin and Distribution :-

Black cumin (*Nigella sativa*) has a long history in global crop cultivation. It is mentioned in the Holy Bible, where the sowing and reaping of black cu Muhammad also declared the medicinal benefits of black cumin in Islam, claiming that it could cure all diseases except death (Sahih Muslim: Book 26 Kitab As-Salam, Number 5489). The exact origin of black cumin remains unclear, though it is widely believed to have originated in the Mediterranean region (Yarnell and Abascal, 2011). Scholars have differing views on its origin; for instance, Sultana et al. (2015) suggest it is native to North Africa, Southwest Asia, and Southern Europe, while Kulloli (2016) and Lal (2018) argue that it is native to South and Southwest Asia. Mahr (2009) also notes that about 15 species in the *Nigella* genus are native to Southern Europe and Northern Africa.

Spice cultivation and consumption in Ethiopia have a rich history, with roots tracing back to the time of the Queen of Sheba (Habtewold et al., 2017). Spices such as korarima, cardamom, Ethiopian long pepper, black seed, bishop's herb, coriander, thyme, and fenugreek are associated with Ethiopia as a center of origin (Duns and Willems, 2015).

Ethiopian farmers have long used various herbs and spices to treat ailments. For example, black seed mixed with honey is traditionally used to alleviate stomach aches (Tiru et al., 2017), highlighting Ethiopia's role as one of the countries where black cumin is considered native. Furthermore, the Ethiopian Plant Genetic Resources Center (1996) recognizes black cumin as one of the important spice crops originating in Ethiopia.

While the date and place of domestication of black cumin are not firmly established, the plant has been in wild cultivation for over 3,000 years, with evidence of its presence in the tomb of the Egyptian Pharaoh Tutankhamun (Hammond, 2012). Historically, black cumin cultivation spread across North Africa, the Middle East, and South Asia, where it has been used in traditional medicine for centuries (Diwakar et al., 2018; Hammond, 2012). Although archaeological evidence is limited, black cumin seeds have been found in several ancient Egyptian sites, including Tutankhamun's tomb ("Genuine Black Seed Oil," 2019; Kulloli, 2016). Over time, the plant spread throughout Northern Africa, Eastern Asia, and Southern Europe, and more recently, it has made its way into Eastern Europe and North America (Kulloli, 2016). In Europe, black cumin became a significant spice used in the preparation of bread and

cakes (Heiss and Oegg, 2005), and its consumption is widespread across Europe, North Africa, Asia Minor, and the Mediterranean region, with minor use in Russia, Egypt, Turkey, and France (Aftab et al., 2018).

min and fenugreek are contrasted with that of wheat (Isaiah 28:25, 27). Prophet

Taxonomic Classification

The name *Nigella* is derived from the Latin word "niger," meaning "black," which refers to the color of the plant's seeds (Jansen, 1981; Mahr, 2009). Black cumin is a genus of annual plants in the *Ranunculaceae* family, which includes approximately 14 species. Common names for this genus include Devil-in-a-bush and Love-in-a-mist (Kulloli, 2016). The English common names of *Nigella sativa* include black cumin, fennel flower, nutmeg flower, black seed, black caraway, Roman coriander, damascena, devil-in-the-bush, and wild onion seed (Kulloli, 2016; Sultana et al., 2015). In Ethiopia, it is known by various names, including "Gurra" (Afan Oromo), "Tikur Azmud" (Amharic), and "Awoseta" (Tigrigna) (Habtewold et al., 2017). The hierarchical classification of black cumin is as follows:

- Kingdom: Plantae
- Subkingdom: Vascular Plants
- Superdivision: Seed Plants
- Division: Angiosperms (Flowering Plants)
- Class: Dicotyledons
- Subclass: Magnoliidae
- Order: Ranunculales
- Family: Ranunculaceae
- Genus: *Nigella*
- Species: *Nigella sativa* L. (Kartesz, 2019)

Morphology of Black Cumin

Black cumin is an erect annual plant that typically grows to a height of 20 to 60 cm, with a somewhat branching stem (Girma et al., 2016; Sultana et al., 2015). The plant has divided leaves and a straight taproot (Dubey et al., 2016). Its flowers are hermaphroditic and usually cross-pollinated, with solitary flowers appearing on the main stem (Shariq et al., 2015). Initially, the flowers have pale green petaloid sepals, which turn pigeon blue when fully bloomed (Perveen and Qaiser, 2006). The flowers lack involucres of bracts, and the peduncle is long and erect. The petaloid sepals are broad and ovate, arranged in a single whorl of 4 to 6. Typically, only about 10% of flowers are non-fertile (Mukherjee et al., 2013). The plant has 3 to 4 whorls of stamens, with 32 to 66 stamens in total.

The ripe fruit is a capsule consisting of 3 to 7 united follicles, each containing numerous tiny seeds (Diwakar et al., 2018). Black cumin seeds are triangular with a rough surface (Thilakarathna et al., 2018a). The seeds are flat on one side and convex on the other, with tapered curved ends (Margout et al., 2013). They are black on the outside and white on the inside, with a mild odor and a bitter taste (Jansen, 1981; Perveen and Qaiser, 2006). There is considerable diversity in the morphological and physiological characteristics of different black cumin cultivars (Jansen, 1981; Shariq et al., 2015).



Fig.1 Black Cumin

Importance of Black Cumin

Black cumin (*Nigella sativa*) has a long history of importance in human civilization, serving as a spice, traditional herb, food preservative, and flavor enhancer in baking (Ermumucu and Sanlier, 2017). The seeds of black cumin are used for local consumption and have a variety of other uses, including the extraction of oil and oleoresin for medicinal purposes, export markets, crop diversification, and income generation. These attributes make black cumin a valuable alternative crop for Ethiopia, where small land holdings are common (Dessalegn & Wubeshet, 2018). The historical and traditional uses of black cumin have been well-documented in ancient texts and historical records (Botnick et al., 2012).

Among its many uses, the medicinal value of black cumin is especially significant. It has been referred to as a “miracle herb,” “panacea,” “holy herb,” and “herb from heaven” by ancient herbalists (Aftab et al., 2018; Dubey et al., 2016; Tariq, 2008; Yarnell and Abascal, 2011). Studies have highlighted its effectiveness as a natural remedy for various ailments, treating both human and animal diseases. Black cumin is also recognized for its antimicrobial properties, as well as its antioxidant effects, which improve learning and memory (Abdallah, 2017; Paseban et al., 2020; Sahak et al., 2016; Tavakkoli et al., 2017).

Black cumin oil is particularly valuable for its nutritional and pharmaceutical applications. It contains several active components, including tocopherol, phenolic compounds, and thymoquinone, which are believed to contribute to its health benefits, including antioxidant properties (Rohman et al., 2019). Ebrahim et al. (2019) emphasize black cumin as an important natural remedy for a wide range of health conditions, with properties such as antioxidant activity, antidiabetic effects, antihypertensive effects, neuroprotection, antimicrobial activity (antibacterial, antifungal, antiviral, and antiparasitic), anticancer potential, and support for male infertility. Islam et al. (2017) further highlight the importance of black cumin for immune system health, pulmonary health, and conditions such as diabetes mellitus, breast cancer, dermatological issues, dyspepsia, osmotic balance, and dehydration. Studies also show that black cumin has gastro-protective effects, likely through its antioxidant activity and its role in stimulating gastric mucus secretion and increasing hexose levels in the gastric mucosa (Paseban et al., 2020).

In addition to its flavor, black cumin is well-known for its nutritional value. Research into the nutritional profile of black cumin essential oil has revealed significant amounts of carbohydrates, proteins, and lipids (Dubey et al., 2016). The fixed oil of black cumin contains fatty acids such as myristic acid, myristoleic acid, palmitic acid, stearic acid, oleic acid, linoleic acid, linolenic acid, eicosenoic acid, arachidonic acid, behenic acid, and dihomolinolenic acid, which include both saturated and unsaturated fatty acids (Margout et al., 2013; Sultan et al., 2009). Key active constituents in the essential oil include thymoquinone, dihydro-thymoquinone, α -anethole, α -thujene, and thymol, along with secondary constituents like α -pinene and β -pinene (Khalid, 2018). The most abundant nutrients in the seed oil are magnesium, phosphorus, calcium, and potassium, with smaller amounts of sodium, manganese, zinc, iron, and copper (Sultan et al., 2009).

Black cumin oil also plays a critical role in animal nutrition. Research has shown that sheep fed black cumin oil experience significant effects on blood cholesterol levels, high-density lipoprotein (HDL) cholesterol, triglycerides, and body weight (Maha et al., 2014). Azeem et al. (2014) demonstrated that black cumin seed oil promotes poultry health and production performance. When added to poultry diets, black cumin acts as a natural antioxidant and immune system stimulant. Additionally, studies on broiler chickens by Guler et al. (2006) found that including 1% black cumin seeds in broiler diets improved body weight, feed conversion ratios, and carcass production. Furthermore, black cumin seeds can serve as a natural growth promoter, replacing antibiotics in poultry diets.

2. PRODUCTION STATUS

Black cumin (*Nigella sativa*) is cultivated in various regions worldwide, including the Middle East, Europe, Asia, Syria, Turkey, and Saudi Arabia (Engels and Brinckmann, 2017; Thilakarathna et al., 2018b). In Ethiopia, black cumin has a long history in agricultural farming and is grown across the country (Herms, 2015; Merga et al., 2018). The production, processing, marketing, and improvement of black cumin involve collaboration between private partners, farmer organizations, government agencies, and sector development organizations in Ethiopia (Business Opportunities Report Spices #6, Ethiopian Netherlands Business Event, 2015). According to Habtewold et al. (2017), in 2007, black cumin was grown on approximately 21,550 hectares of agricultural land in Ethiopia, with an estimated annual production of 17,072 tons. Ethiopian black cumin is exported to countries such as Saudi Arabia, Israel, Malaysia, France, Pakistan, Austria, Tanzania, Germany, and Indonesia (Export Genius, 2016). Both dry seeds and essential oils are exported, contributing to foreign revenue. Therefore, black cumin plays a significant role in Ethiopia's economy through import substitution and export opportunities (Girma et al., 2016).

Ethiopian black cumin seeds have a higher concentration of thymol (up to 50%), a monocyclic phenolic compound, making them valuable for the healthcare and medicinal industries (Ebrahim et al., 2019). Additionally, the high thymoquinone content in the essential oil makes Ethiopian black cumin an attractive option for the cosmetics industry (Thilakarathna et al., 2018b).

3. ECOLOGICAL REQUIREMENTS

Ecological factors such as climate and soil conditions are critical for the growth, development, and synthesis of active compounds in plants, especially in medicinal and aromatic plants (Malhotra, 2008). For optimal growth and the production of high-quality essential oils, black cumin should be cultivated in areas that align with the local ecology (Girma et al., 2016).

In Ethiopia, black cumin is typically grown at elevations between 1,750 and 2,200 meters above sea level in mid- to highland areas (Gezahegn and Sintayehu, 2016). The crop thrives in semi-arid regions with well-drained black vertisols, which retain some residual moisture even during drought conditions (Ermias et al., 2015). To achieve maximum yield, black cumin requires a growing season with 120-400 millimeters of rainfall. The plant grows best at temperatures ranging from 0 to 25°C, with an ideal temperature range of 12-14°C (Malhotra, 2008). While it requires warm temperatures for rapid growth and full sunlight for optimal bloom production, black cumin can tolerate some shade, although this may reduce flower production (Killinger, 2018). Despite its relatively low water requirements, adequate water availability during the growing season is crucial for the timely onset of flowering and seed formation (Habtewold et al., 2017).

Black cumin grows best in well-drained, healthy soil, though it can also adapt to a range of soil types. Sandy loam with high microbiological activity is considered the most suitable (Killinger, 2018). Ideal soil conditions include areas with moderate rainfall and flat, well-drained soils, with a pH range of 7.0 to 7.5 (Shariq et al., 2015). Black cumin's germination is temperature-sensitive, with an optimal germination temperature of 23°C, and it can even grow in saline conditions, as it is a halophyte (Alshammari, 2017).

4. CULTURAL PRACTICES

Effective crop management practices are essential to increase yield and maximize farm profits (Willer and Youssefi, 2007). The key practices for black cumin cultivation include site preparation, land preparation, sowing, weeding, thinning, supplemental irrigation, fertilization, pest control, and general crop management (Zapotocny et al., 2019).

4.1 Land Preparation and Sowing

Land for black cumin should be prepared at least one month before sowing. The soil should be plowed 2-3 times, depending on soil type. Beds should be spaced 120-130 cm apart to allow for proper drainage and to reduce conditions favorable for diseases such as wilt and damping-off (Habtewold et al., 2017). Direct sowing is typically used, with sowing rates of 20 kg/ha recommended for areas receiving rainfall from May to October. For areas with bimodal rainfall, sowing from September to October is optimal for higher yields (Yemisrach et al., 2010; Habtewold et al., 2017). The sowing method can be broadcasting, row planting, or bed sowing, with the latter providing the highest yield (Mahmood et al., 2012). Soaking seeds overnight can enhance germination. Typically, black cumin seeds are drilled and later thinned to the recommended spacing (Zapotocny et al., 2019).

4.2 Irrigation

Black cumin is a low-water-demanding crop; however, water availability during the growing season is essential to support flower emergence, seed setting, and yield (Ariafar and Forouzandeh, 2017). Ceasing irrigation at the budding stage can increase the essential oil, carvone, and thymoquinone content in the seeds, but it may not significantly affect the overall seed yield. Therefore, full irrigation is important to achieve optimal yield (Hadi et al., 2016).

4.3 Fertilization

Although black cumin requires relatively low levels of fertilizer, the lack of fertilization can lead to reduced yields. Moderate fertilization is necessary for optimal production (Ali et al., 2015). In Ethiopia, nitrogen application at 60 kg/ha has been found to be effective in boosting yield potential. A combination of NPK fertilizers (50, 40, 20) and farmyard manure (10-15 tons/ha) is recommended to maximize yield (Habtewold et al., 2017). Black cumin responds positively to both organic and inorganic fertilizers, which improve various plant parameters such as height, number of branches, chlorophyll content, dry weight, seed yield, and essential oil content (Hadi et al., 2015; Mousa et al., 2012; Sen et al., 2019; Yousuf et al., 2018).

4.4 Weeding

Frequent weeding is crucial to reduce competition from weeds, which can significantly affect growth and development (Datta et al., 2012). Weeds can reduce yield by 60-85%, and regular weeding (3-5 times at 20-25-day intervals) is recommended, typically done by hand hoe (Habtewold et al., 2017). Weeding at 40 days after emergence is a critical period to prevent significant economic loss due to weed competition (Nadeem et al., 2013). Annual weeds, including *Phalaris minor*, *Chenopodium album*, *Vicia sativa*, *Anagalis arvensis*, *Solanum nigrum*, *Oxalis corniculata*, *Medicago denticulate*, *Cynodon dactylon*, and others, are serious threats to black cumin crops in Ethiopia (Merga et al., 2019).

5. DISEASES AND INSECT PESTS

Common diseases affecting black cumin in Ethiopia include wilt, blight, and powdery mildew, with potential yield losses of up to 72%, 88%, and 60%, respectively (Merga et al., 2018). Aphids and mites are the primary insect pests attacking the crop (Habtewold et al., 2017). Proper management of diseases and pests is essential to ensure optimal yield and quality of black cumin (Merga et al., 2019).

TABLE.1

Diseases	Reference
Fusarium wilt, Black Cumin blight (<i>Alternaria burnsii</i>), Powdery	mildew (Habtewold et al., 2017; Merga et al., 2018)
Insect Pests	
Aphids (<i>Myzus persicae</i>), Mites (<i>Petrobia latens</i>)	(Habtewold et al., 2017)

Harvesting and Postharvest Handling

Black cumin takes 58 to 62 days for initiation of flower bud and 78 to 87 days for flower opening from the day of seed sowing (Diwakar et al., 2018). To reach maturity, black cumin usually needs 135-150 days. Harvesting is done before shattering of the seed. One indicator of maturity is when the color of capsules is turned to brown (Habtewold et al., 2017). Black cumin has a

determinate type of maturity and harvesting is practiced by uprooting the plant and tying in bundles and then putting upward, until the plant has completely dried. Thereafter, the plant is threshed and winnowed to separate the seeds from impurities (Tiru et al., 2017). The seeds are dried and stored in cool and dry places (Datta et al., 2012).

6. CONCLUSION

Despite the black cumin importance, from this review it can be concluded that there is a research gaps for increasing the yield potential of this crop particularly for nutrient and weed 8 management, disease and insect pests. Therefore, it is important to improve the yield of black cumin crop to fulfill the need of the local consumers, the local market and export demand.

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