Available online on 15.05.2019 at http://jddtonline.info

Journal of Drug Delivery and Therapeutics

Open Access to Pharmaceutical and Medical Research



Open Access Review Article

# Ethnobotany and Unani Perspective of *Tukhme Soya (Anethum sowa Roxb.)*

**Khatoon Rizwana *, Aslam Mohd **, Chaudhary Shahid Shah*****

*M.D. Scholar, Dept of Ilmul Advia, SUMER, Jamia Hamdard, New Delhi, India

** Professor & Head Dept of Ilmul, Advia School of Unani Medical Education and Research (SUMER), Jamia Hamdard, New Delhi, India

***Assistant Professor Dept. of Saidla, SUMER, Jamia Hamdard, New Delhi, India

## ABSTRACT

People are using herbs as a medicine since ancient time. Herbal medicine has a valuable importance in the treatment of many chronic as well as life threatening diseases with minimal or about negligible side effects. In the classical Unani literature drug is classify in to dwae ghizayi and ghizae dwai. *Tukhme soya (Anethum sowa)* a Unani drug having dietary value as well as medicinal value also. *Tukhme soya* is a green crock herb which is commonly found in many parts of India and it is cooked with palak, so *Tukhme soya* is generally comes in the category of ghizae dwai. In classical Unani literature it is used in different diseases like Ehtebas e tams (amenorrhea), Ehtebase baul (retention of urine), Nafakhe Shikam (flatulence), Marod (spasmodic pain), Da'emi Qabz (chronic constipation), Bawasir (hemorrhoids), Hichki (hiccups), Ghisyan (yawning), Baul fil Farash (Bed wetting), Mufatite hisate kulliya wa Masana (Lithotripsic of kidney and bladder), Indemale Qrooh (Wound healing) specially those wound which are present on genitalia etc. so *Tukhme soya* used as carminative, stomachic, diuretic, aromatic stimulant, galactogogue, emmenagogue, anthelmintic (hookworm infestation) antiflatulence. The present review is exposed its pharmacology and Phytochemistry in scientifically manner.

**Keywords**: Tukhme soya, Umbellifereae (Apiaceae), Diuretic (Mudire baul), Ethnobotany

**Article Info:** Received 24 March 2019; Review Completed 26 April 2019; Accepted 30 April 2019; Available online 15 May 2019

**Cite this article as:**

Khatoon R, Aslam M, Chaudhary SS, Ethnobotany and Unani Perspective of *Tukhme Soya (Anethum sowa Roxb.)*, Journal of Drug Delivery and Therapeutics. 2019; 9(3):537-542 http://dx.doi.org/10.22270/jddt.v9i3.2823

***Address for Correspondence:**

Aslam Mohd, Professor, Dept of Ilmul Advia, SUMER, Jamia Hamdard, New Delhi, India

## Introduction

The family Apiaceae or umbellifereae is a well-known family for having a number of spices as well as medicinal herbs. This family comprises 434 genera and about 3700 species. The herbs and spices of this family play an important role in human health as well as dietary by giving valuable medicinal herbs and essence of eating [1]. This family has a great commercial and medicinal value due to presence of essential oil as secondary metabolites. Volatile oils and many others compounds like oleo-gum-resin present in the herbs of this family are medicinally important. Volatile oil is also responsible for a special fragrance which is a characteristic order of this family [2]. Volatile oils are secondary metabolites of the plants most of them are generally a mixture of hydrocarbons such as terpins (monoterpins like limonene, myrcene, ocimene, pinene) sesquiterpins and their derivatives (oxygenated) [3], [4], [5], [6]

*Tukhme soya (Seed of Anethum sowa*) belongs to the umbellifereae family [7] [8]. *Tukhme soya* (Seeds) is commonly known as Indian Dill. In India dill is cultivated as seed spice and vegetable crop. Tukhme soya is an important pungent herb which is used for pickles, sweetmeat and flavoring tea. *Tukhme soya* is useful in food as spice, vegetable and fragrant including medicinal value [9]. *Tukhme soya* inhibits the budding in stored potatoes [10]. Seed and herb of dill contains volatile oil and also used therapeutically [11] [12]. Carvone is one of the most important constituents, isolated from *Tukhme soya* having antimicrobial activity which have been reported [13]

Anethum is a Greek word, derivative of Norse Dilla meaning to soothe [14] [15], means dill or soya is a soothing herb which is used earlier as a healing herb for the treatment of diseases related to digestion, metabolism as well as excretion (16). In Charak Samhita (700 BC) it is mention that soya is an oldest medicinal herb. It is an old Egyptian medicine which is used as a remedy which gives analgesic effect so it is used as a pain killer as described in Ebers papyrus. It was chewed by the Romans to improve their digestion. They believed that it would prevent the distressed stomach so they hung the herb in their dining hall as wreaths. It fragrance would defuse the heavy food smell that's why it was used as flooring in the banquet hall. Nicolas Culpeper in seventeenth centaury disclosed dill as a brain tonic. The Puritans were put dill seeds in their Bibles to modestly chew so that their stomach would not rumble during the long church services [17] [18].

People of ancient and medieval periods was believed that the dill seed gives protection against black magic, they thought that if a occultist cursed then the treatment could be done by a cup of dill water [19], [20].

Genus Anethum is comprise of 100 species, out of these 100 species there are two varieties of soya plant have been known since ages that are as *Anethum graveolens* ***(European Dill)*** and *Anethum sowa Roxb*. ***(Indian Dill)*** [21] [22]**,** Soya plants which grows in Europe are called as *Anethum graveolens Linn*, described in almost all pharmacopoeias like British Pharmacopoeia, 1958; Indian Pharmacopoeia, 1966, is commonly distributed all over the world. Indian soya plant i.e. Anethum sowa Roxb is a cold weather crop cultivated in India [23]. These two verities differ with each other in their morphological characters and chemical properties [22]. *Anethum graveolens (European Dill)* is 3-4 feet in height having tri-pinnate leaves. Leaflets of leaves are linear with yellow flowers having compound (multiple) umbel [14]. *Anethum sowa (Indian Dill)* or plant of *Tukhme soya* is 2-2.5 ft. high and having tripinnate leaves, with long cylindrical and vaguely situated pinnae [17] [24]**.** Inflorescence of this plant is shortly pedunculated with short primary rays having less number of umbel. Every umbel has less number of flowers in comparison of European dill (25)**.** Indian Dill contains fruits so called seeds with narrow winged in comparison to European Dill (M.P. Singh Medicinal herbs with their formulations). These two varieties also vary in their chemical compositions such as Indian dill contains Apiol in more quantity while as European dill is rich in Caravone [26]

In classical Unani literature it is used in different diseases like Ehtebase tams (amenorrhea), Ehtebas e baul (retention of urine), Nafakhe Shikam (flatulence), Marod (spasmodic pain), Da'emi Qabz (chronic constipation), Bawasir (hemorrhoids), Hichki (hiccups), Ghisyan (yawning), Baul fil Farash (Bed wetting),Mufatite hisate kulliya wa Masana (Lithotripsic of kidney and bladder), Indemale Qrooh (Wound healing) specially those wound which are present on genitalia etc. Tukhm e soya was used very frequently by ancient Unani physician for the treatment of above diseases as according to Dioscorides sit'z bath by its decoction is beneficial for pain in uterus and piles has been treated by the sokhta (adust) of the Tukhm (seeds) applying as a paste. As Ave Senna said that extract of its seeds dry the excessive secretions from the ear and releaving the pain caused by Sauda (black bile) [27].

## Taxonomical Classification: [28], [29]

Kingdom - Plantae

Division - Magnoliophyta

Class - Magnoliopsida

Order - Apiales

Family - Apiaceae

Genus - Anethum

Species - Sowa

## Vernacular Names: [30] [31] [32] [33] [14] [28], [29]

Arabic Shibt, Shavit

Bengal Shulupa, sowa, sulpa, sulpha, suva

Burma Samyeit

Chines Shih Lo

Dutch Dille

English Anet, Dill, Dilly

French Anet, Aneth, Aneth fetide, Aneth odorant, Anethum, Ecarlate, Fenouil

German Dill

Greek Anithos

Gujarat Suah, Surva

Hindi Sowa, soya, sotupsha

Kashmir Soi

Kumaun Soya

Persian Shol

Punjab Soya

Russian Anit, Kopior,Ukrop

Sanskrit Ahichhatra, Atichhatra, Avakpushpi, Bahal, Chhatra,

Spanish Eneldo

Tamil Satakkuppi

Telugu Sompa

Urdu Soya

## Botanical Description

**Geographical distributions:** *Tukhme soya* (*Anethum sowa Roxb.*) is a member of family umbellifereae (Apiaceae), comes in the genus Anethum [34], [35] Soya is an annual (winter crop), glabrous, fragrant herb and grows in cooler environment. Plant of *Tukhme soya (Anethum sowa Roxb.)* is a native plant of India and cultivated throughout all parts of India such as Gujarat, Punjab, Orissa, M.P., Kashmir, Rajasthan etc. [36]**.** Besides, it is also dispersed all over the world such as Germany, Hungary, Netherlands, Pakistan and Netherlands.

**Cultivation and Collection:** In India, soya is cultivated as summer crop but it can also grow in hot areas. Climate should be cool and dry for cultivation of soya plant. It is a rabi crop of Northern Indian plains. Cold weather is required for early somatic growth and it needs warm sunny days for formation and maturity of seeds [37]. Temperatures above 30 °C and below 7 °C are not favorable for its growth and development. Climate should not be humid because it can promote the attack of disease and pests. It can tolerate higher rainfall, but growth is affected by the water dampening [38]**.** A variety of soils can be used for the cultivation of soya plant but a fertile sandy loam soil is more suitable for its cultivation [17]. A heavy black soil which contains high capacity of waterlogging is required for un-irrigated cultivation and light soils in place of an irrigated crop. Brackish soils are not good for cultivation of soya plant.

Plant growth and development is depends on seed sowing. Seed sowing is depends on environmental condition of the related areas. Seeds are sown in February-march (spring seasons) at temperate climate and October in tropical region [38] [39]. Seed should be sown about 1.5-2.0 cm deep. Seed should be sown in a row, gapping of a row should be 50-60 cm for European variety and 40-50 for Indian variety [40].

**Harvesting:** Harvesting of the crop should be done after complete maturation of the plant for better yielding. Crop is fully matured in 130-150 days [17], [39]. Maturity of the crop is also identified by the brown color of the umbel. Harvesting should also do when the earliest fruit is ripe [41].

**Macroscopic characters:** The plant of soya is 2-2.5 ft. in height with solitary, curved, sleek and single stem along with thin, delicate and tri pinnate leaves [17] [24], [23]. Inflorescence is a compound umbel and having yellow flowers **(Figure D)**. Soya fruit so called Seed is known as whole cremocarp and partly mericarp having pedicles **(Figure A).** Each mericarp is connected to each other by the carpophore and carpophore attached to the stalk **(Figure B)**. Mericarp is distinct, approximately oval and dorsally less compressed then European seed in shape. Size of the seed is 4mm long, 2-3 mm broad and 1 mm thick. Color of the seed is dark brown **(Figure E)**. Each mericarp contain two surfaces one is dorsal and another commissural surface **(Figure C)**. There are five primary crests (ridges) on dorsal surface, which are yellow in color. Out of the five ridges three are inconspicuous, slightly elevated and filliform, two ridges are lateral which are extended as wings. Stylopod is seen at the apex of each mericarp [42], [43]

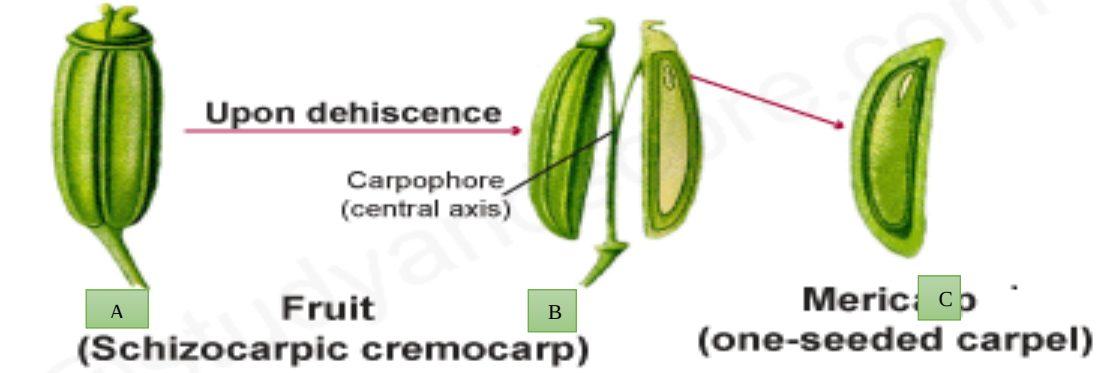



**Figure: A, B, C- Cremocarp and mericarp of fruit of A. sowa. D- Herb of A. sowa, E- seed of A. sowa**

**Microscopic features:** Whole mericarp contains pericarp and seed. Pericarp consists of outer epicarp, then mesocarp and endocarp. Pericarp is made up of epidermis which contains polygonal tabular cells with outer thick wall and striated cuticle. Mesocarp consist of parenchymatous tissue in which a part of cells are lignified, shows reticulate thickening. Endocarp is made up of flat cells, rarely these cells are found with twisting anticlinal walls. There are four vittae present on the dorsal surface and rest of two on the commissural surface, which extends up to the length of every mericarp. These vittae consist of endothelium with brown cells, which contains volatile oil. There are three dorsal costae, out of these three costae one is superior and rest of two is lateral and broadly winged. Vascular strands are present in each costa. Seed shows immense endosperm, which is more compressed and made up of parenchymatous cells with thick and cellulosic cell wall. Endosperm also contains oil granules of fixed oil, several aleurone grains and micro-rosette crystals of calcium oxalate. Carpophores divided, passing at the apex into the raphe of each mericarp containing a vascular strand of sclerenchymatous fibers and spiral vessels. [44], [45], [42]

**Mizaj (Temprament):** Hot in ending of two degree & starting of three degree and Dry in starting of two degree & ending of first degree [32].

Hot & Dry in three degree [46].

**Nafa-e-khas (Important function):** *Qai Awar* (Emetic) & *Mudir e baul wa Haiz* (Diuretic, Emmenagogue) [27], [32], [47].

**Muzir (Toxic):** Harmful for people with hot temperament and toxic for brain, eyesight and sexual power [46], [27],

**Musleh (Correctives):** For hot temperament people give with sikanjbeen and the things which have citric acid, for cold temperament people. Turnip/ honey/cinnamon/ clove should be used as corrective [27], [46].

**Badal (Alternative):** Dry or wet Soya herb [46]

**Miqdar-e-Khurak (Dose):** 7g [27], 2-3g [46].

**Af'aal (Pharmacological actions in Unani System of Medicine):**

1. Mudir e Baul (Diuretic) [47], [48], [27] [32], [49] [46]
2. Mudir e Haiz (Emmenagogue) [47], [49], [46], [31]
3. Mudir e Laban (Galactogogue) [31], [32], [27]

4. Mufatit e Hisat (Lithotripter) [31], [27], [47]
5. Kasir e Riyah (Carminative) [31], [46], [32], [27]
6. Hazim (Digestive) [27], [31]
7. Muqi (Emetic) [31], [46]
8. Musakkin e Alam (Analgesic) [31], [27], [46], [32],
9. Muhallil e Awram (Anti-inflammatory) [50],
10. Munzij e Balgham wa Safra (Phlegm & bile concoctive) [27], [32]
11. Mudammil e Qurooh (Cicatrizant) [27], [32]
12. Qabiz (Astringent) [27]
13. Daaf e Marod (Anti spasmodic) [27]
14. Mujafif wa Muharrik e Mani [27]
15. Mulyyan (Laxative) [27]
16. Munavvim (Hypnotic) [32], [27].
17. Muqawwi e Jigar (Liver Tonic) [49], [48]
18. Mujafif qurooh (wound Desiccative) [32] [47] [27], [49].

**Table: 1 Mawaq e Istaimal (Therapeutic uses) of Tukhme Soya (Anethum sowa Roxb.) in Classical and Ethnobotanical literature**

| Mawaq e Istemal (uses) | References (Unani) | References (Ethno medicinal) |
|---|---|---|
| Nafakh e Shikam (flatulence) | [31] [32] [47] | [30] |
| Ehtabas e Baul (Anuria or Retention of urine) and Dushwari Baul (Dysuria) | [48], [27], [50], [32] | [14] |
| Hisat e kulliya wa Masana (Renal & vesicular calculi) | [31], [27] | |
| indemal e Qurooh (wound healing) especially the lesions present on the genitalia | [27], [32] | |
| Favakeh (Hichki) & Ghisyan (Yawning) | [32] | [30], [33] |
| Aabzan (Sit'z Bath) with Joshanda (decoction) the seed of soya is beneficial in Dard e Reham (uterine pain) | [32] | [33] |
| Ash of the Tukhm as a zamad (gives relieve in the Bavaseer (piles) | [47],[32] | |
| Daimi Qabz (Chronic constipation) | [27] | |
| Grip water prepared from Tukhm e soya is good for children in flatulence | | [33], [17] |
| cystitis and bed wetting (Warm e Masana aur Baul fil Frash) | [50], [27] | |
| Tiryaq e Samoom (antidote for various poison) like snake venom | [27] | |
| (Aatshak) syphilis | [47] | |
| Dard e gurda wa Masana | [46], [50] | |
| Dard e Kamar (low backache) | [27] | |
| Mujaffife Ratoobat e Uzn (drying excessive ear secretions) | [32] | |
| zof e kabid, Tihal, Gurda wa Masana (weakening of liver, spleen, kidney & spleen) | [31] | |

## Pharmacological action:

1. **Anti-carcinogenic Activity:** Masamichi Fukuoka in his study "Characterization of mutagenic principles and carcinogenicity test of dill weed and seeds" which was carried out in ACI Rats, reported that hydro Alcoholic extract (aqueous methanolic extract) of Anethum sowa seed and Anethum graveolens weed which were fractionated by mutation assay of TA98 with S-9 Mix strains given to the ACI rats for 450 & 410 days, the study shown that carcinogenicity were not found in those rats who were containing 33% extracts of dill weed & dill seed in their diets. [51]
2. **Insecticidal activity:** Hnda & Deewan and Parmer & Tomer [52], [53] has been reported that dillapiol and its reduced derivatives which are present in *Tukhm e soya* (*Anethum sowa Roxb.)* as an active constituent (51%) having the insecticidal property and it synergise the natural pyrethrum, and pyrethroid, carbamate and organochlorine group of insecticides. A lot of synthetic and semisynthetic compounds are manufactured artificially having a wonderful insecticidal property which is based on dillopiol [54] [55]
3. **Antioxidant Activity:** An invitro study "Antioxidant activity of medicinal spices and aromatic herbs" has been done by M. Patel Riddhi and T. Jasrai Yogesh which revealed that hexane extract of fifteen medicinal spices and aromatic herbs such as *Anethum sowa* have potential antioxidant activity. Antioxidant potential screening assay has been employed by free radicle scavenging activity (% DPPH). The hexane extract all the crude drugs used in the study had shown occurrence of significant free radical scavenging activity [56]
4. **Anti-infertility Action:** A Clinical study has been done in stri rog & Prasutitantra OPD of M.A. Podar Ayurved Medical hospital. 60 patients were enrolled for the study and patients were divided in to two groups of 30 patients. Group A were treated with Shatpushpa (*Tukhm e soya or Anethum sowa*) [57] tail uttarbasti with herbal compound and group B treated with Stavari tail uttarbasti with herbal compound. The effect of both drugs on ovulation has been noted. The study concluded that both drugs are act on HPO axis that's why these both drugs prompted the ovulation as well as augmented the size of the follicle and treated the an-ovulatory cycle which is the main cause of infertility**)** [58] [59], [60], [61], [62]
5. **Estrogenic activity:** Bhagyashri Mahavir Khot et al has been reported in her clinical study which is done on 60 patients in the OPD that Shatpushpa (tukhm e soya) uttarbasti tail has natural phytoestrogen which helps in the abnormal and irregular menstrual flow by the increment in endometrial thickness and ultimately menstrual blood flow has been increased [58].
6. **Analgesic activity (as Dysmenorrhea):** "Evaluation of efficacy of shatapushpa phala churna in rajakrichrita with special reference to primary dysmenorrhea" a clinical study has been done by Nidhi Garg et al. In

which 30 patients were enrolled and divided in to two groups. Both groups were compared to evaluate the effect of Shatpusphpa (*Tukhm e soya or Anethum sowa*) [57] powder and placebo (Rice powder) for the treatment of primary dysmenorrhea. The study was concluded that powder of shatapushpa is more efficient for terminating the menorrhagia pain (Dysmenorrhea) in comparison to placebo (Rice powder) [63]

7. **Antimicrobial activity:** An in vitro Antimicrobial potential study of different extracts such ethanolic, aqueous, n-butanol and petroleum ether etc. of Anethum sowa (Tukhm e soya) has been carried out by Rashmi Mathur against human pathogenic bacteria like E.coli, pseudomonas aeroginosa, staphylococci, coagulase positive & negative staphylococci and pathogenic fungi such as candida albicans & parapsilosis etc. The antimicrobial potential of Anethum sowa has been evaluated by the phytoconstituents which were isolated from the extract. The study reveals that ethanolic & n-butanolic extract of the plant have good antimicrobial potential against all bacteria and fungi than other extracts [64]

## Phytochemistry:

**Volatile/ Essential oil (Dill oil):** Dill oil or essential oil is a very important constituent of dill seed. Dill oil obtained from fresh seeds of thukm e soya by hydro/steam distillation. **Monoterpenes** are present in high amount in dill oil about 93.6%. Out of seven monoterpenes four are hydrocarbons, two are alcohols and one is ketone. **Carvone** (30-60%), **Limonene** (33%) and **Grandisol** are the main components of monoterpenes. **Cyclohexane** is an **aliphatic** constituent while **bis-1, 2-benzendicarboxylic acid** the single **aromatic** constituents present in the volatile oil**)** [65]**.** Other constituents such as **dihydrocarvone** (7.2-14.3%), **α-pinene** (5.0-7.3 %), **terpinene** (3.6%), **caryophyllene** (3.6%), **eugenol** (3.0%), **myristicin** (1.0%), **apiol** (5.7-15.6%), **dill-apiol** (8.6%), **thymol** (2.4%) [17], [57]. Paramyrcene, l-Dphellandone (20.61%), Cineole, Bomyristian, Penene Myrcene, Myrystician, Furanocoumarin are also present in trace [66]**.**

**Fixed oil:** Thukm e soya also contain fixed oil, fatty acid oil consist of petroselinic (49.8%), oleic (31.2%), linoleic (9.2%), palmitoleic (4.9%), lenolenic (0.6%), lauric (1.4%) and arachidic (1.0%), Behenic acid (0.46%) trace (66)**,** [17]**.**

**Others:** Reducing sugar, Tannins, **Glycosides** such as: β-sitosterol **Glucosides**, **Saponins**, **Flavinoids** such as quercetine, kaemferol, isorhamnetin-3-glucoronides **Steroids**, Anthraquinone (Aromatic compound), Terpenoids, Flavonosides [66].

Tukhm e soya (Seeds) is also having rich nutritive value means Tukhm e soya have some macro & macro nutrients such as **carbohydrate** 35.7%, crude fiber 20.7%, **proteins** 13.1% . Lots of **amino acids** are found in protein of tukhm e soya for example therionine, alanine, thyrosine, leucine, and isoleucine etc**.** Tukhm e soya also rich in vitamins & minerals such as vitamin A, thiamin, riboflavin, ascorbic acid, niacin, vitamin B6 & calcium, potassium, zinc, magnesium, sodium, iron, phosphorus, chromium, nickel, cobalt, copper, titanium, molybdenum, vanadium respectively [66], [17], [57]**.**

**Conclusions:** Herbal medicine has a valuable importance in the treatment of many chronic as well as life threatening diseases. As the above review suggested that Tukhme soya has a valuable position in classical Unani literature as well as other traditional medicine and has proven efficacy against various disease. Although a lots of researches has been done to validate its pharmacological effects but more and more research are needed to prove its ethnobotanical properties to contribute the community.

## References


1. S.G., Aiyadurah. *review of research on spices and ceshew nut.* [ed.] Ernaculam-6. s.l. : ICAR, 1996. p. 225.

2. *Krishna, S. and Badhwar, R.L. . 12, 1952, J. Sci. Industr. Res., Vol. 11, p. 245.*

*3. Carson, C.F., Hammer, K.A. Chemistry and bioactivity of essential oils. In: Thormar, H. (Ed.) Lipids and Essential Oils as Antimicrobial Agents. s.l. : John Wiley & Sons, 2011. pp. 203–238.*

*4. Melaleuca alternifolia (Tea Tree) oil: a review of antimicrobial and other medicinal properties. Carson, C.F., Hammer, K.A., Riley, T.V. 1, 2006, Clin. Microbiol. Rev., Vol. 19, pp. 50-62.*

*5. Effects of irradiation on natural antioxidants of cinnamon (Cinnamomum zeylanicum N.). Kitazurua, E.R., et al. 7, s.l. : RadiationPhysics and Chemistry, (2004), Vol. 1, pp. 37 -39.*

*6. . Antioxidant properties of essential oils1;(6):. Misharina TA, Terenina MB, Krikunova NI. 6, s.l. : Applied Biochemistry and Microbiology, 2009 , Vol. 45, p. 642.*

*7. Malhotra SK, Vashishtha BB. Breeding objectives and strategies in seed spices crops. Production, Development, Quality and Export of Seed Spices. Ajmer : NRCSS, 2007. pp. 52-64.*

*8. (A. Husain, O. P. Virmani, A. Sharma and L. N. Misra. Major Essential Oil-Bearing Plants of India. Lucknow : CIMAP, 1988. pp. 87-95.*

*9. Sharma, R. Agro-techniques of medicinal plants. New Delhi, : Daya Publishing House, 2004. pp. pp. 3-10.*

*10. The effect of (S)-(+)-carvone treatments on seed potato tuber dormancy and sprouting. Score, C., R. Lorenzi and P. Ranall. s.l. : Potato Research, 1997, Vol. 40, pp. 155-161.*

*11. Composition and content of aroma compounds in dill, Anethum graveolens L., at three different growth stages. Huopalahti R, Linko RR. 2, s.l. : Journal of agricultural and food chemistry, 1983, Vol. 31, pp. 331-3.*

*12. Studies on chemical and technological aspects of Indian dill seed (Anethum sowa Roxb. Shankaracharya NB, Rao LJ, Puranaik J, Nagalakshmi S. 4, 2000, Journal of Food Science and Technology, Vol. 37, pp. 368-72.*

*13. Antimicrobial activity profiles of the two enantiomers of limonene and carvone isolated from the oils of Mentha spicata and Anethum sowa. Aggarwal KK, Khanuja SP, Ahmad A, Santha Kumar TR, Gupta VK, Kumar S. 1, s.l. : Flavour and Fragrance Journal., 2002, Vol. 17 , pp. 59-63.*

*14. Singh, M.P. Medicinal herbs with their formulations. Delhi : Daya Publishing house , 2005. pp. 97-98. Vol. 1.*

*15. Antimicrobial potential and phytochemical analysis of plant extracts of Anethum sowa. . R., Mathur. 20, 2012, International Journal of Current Research and Review, Vol. 4, p. 55.*

*16. M, William A.R and Thomson. Anethum graveolens L. Healing plants. U.k. : A Modren Herbal., M.C. Graw Hill Book co., 1978. p. pp 42.*

*17. Anonymous. The Wealth of India: A dictionary of Indian Raw Materials and Industrial Products. Delhi : CSIR, 1985. pp. 78-79.*

*18. Chevallier, A. The Encyclopedia of Medicinal Plants. London : Dorling Kindersley Limited, 1996. p. 166.*

*19. Le Strange, R. The History of herbal plants. New york : Acro Publishing company, 1977.*

*20. J., Wright. The Herb Society ofAmerica's Essential Guide to Dill. s.l. : The Herb Society of America, 2013. p. 18.*

*21. The carvone and dillapiole content of dill fruits by gas chromatography without preliminary distillation. TJ., Betts. 4, 1969, Journal of Pharmacy and Pharmacology, Vol. 21, pp. 259-62.*

*22. Constituents of two varieties of Indian dil. Shah CS, Qadry JS, Chauhan MG. 6, 1971, Journal of Pharmacy and Pharmacolog, Vol. 23, pp. 448-50.*

*23. Macro and Micro Elemental Analysis of Anethum Sowa L. (Dill). M. Moshfekus Saleh-e-in, Abida Sultanaa,Abul Hossainb, Mainul Ahsan and Sudhangshu Kumar Roy. 4, 2008, Bangladesh J. Sci. Ind. Res, Vol. 43, pp. 483-494.*

*24. R.N. Chopra, S.L Nayar, IC Chopra. Glossary of Indian Medicinal Plants. New Delhi : CSIR, 1956. pp. 68-69.*

*25. Adhikari, V. M. ). . D.Sc. Thesis (Pharmacognosy). West Germony : Saarland University, Saarbrucken, 1965.*

*26. Chemical composition of the volatile oil from different plant parts of Anethum graveolens L.(Umbelliferae) cultivated in Romania. . . Radulescu V, Popescu ML, Ilies DC. 5, 2010, Farmacia, Vol. 58, pp. 594-600.*

*27. Khan, Azam. Muhit e Azam. New Delhi : CCRUM, 2014. pp. 283-85. Vol. 3rd.*

*28. Pharmacognostical Study of Anethum sowa (Dill) Seed. Pathak V., Dwivedi R., Shukla P. 3, Lucknow : s.n., 2014, IJRB, Vol. 2, pp. 6-14.*

*29. Anonymous. s.l. : Govt. of India Ministry of Health and Family Welfare,, 2003. Vols. Part-01, Vol. II.*

*30. A.K., Nadkarni. Indian metreria Medica. Bombay : Bombay publishing House, 1989. pp. 935-936.*

*31. Anonymous. The Unani Pharmacopoeia of India. New Delhi : CCRUM, 2008. p. 97. Vol. VI.*

*32. Baitar, Ibn e. Aljamai ul Mufradat Al Aghdhiya wal Advia. New Delhi : CCRUM, YNM. pp. 113-14. Vol. III.*

*33. Basu, K.A. Indian medicinal Plants. Delhi : Shri Satguru Publications, 1999. pp. 1218-1220. Vol. II.*

*34. Husain A., Virmani OP, Sharma A., Kumar A., Mishra L.N. Major essential oil Bearing plants of India. Lucknow : CIMAP, 1988. pp. 87-95.*

*35. Analysis of oil extracted from Anethum sowa. Namrata V, Ragini P. 4, 2012, International Journal of Chemical Sciences, Vol. 10, pp. 2010-14.*

*36. R., Gupta. Handbook of Herbs and Spices. Cambridge : Woodhead Publishing Limited, 2001. p. 173. Vol. 1.*

*37. K.V, Peter. Handbook of herbs and spices. s.l. : Woodhead publishing, 2006. Vol. 3.*

*38. Guenther, E. The Essential Oils. [ed.] 1st Edn. New York : D.Van Nostrand Co. Inc, 1953. p. 633. Vols. Vol-IV.*

*39. Randhawa G.S., Kaur S., Chandha K.L. Gupta R. Medicinal and Aromatic plants . Delhi : Malhotra Publiations House, 1995. pp. 917-32.*

*40. Structural relaxation in vitreous materials. Moynihan CT, Macedo PB, Montrose CJ, Montrose CJ, Gupta PK, DeBolt MA, Dill JF, Dom BE, Drake PW, Easteal AJ, Elterman PB. 1, 1976, Annals of the New York Academy of Sciences, Vol. 279, pp. 15-35.*

*41. Influence of meteorological factors on the quantity and quality of the essential oil synthesized in Dill (Anethum graveolens Linn.). Zlatev, S.K. 4, 1976, Rastenien days Sciences,, Vol. 1, pp. 57-63.*

*42. Shah C.S., Qadri J.S. Textbook of Pharmacognosy. 11th. Delhi : B.S.Shah Prakashan, 1995-96. pp. 196-200.*

*43. (Kokate K. C., Purohit A.P., Gokhale S.B. Pharmacognosy. 53. Pune : Nirali Prakashan, 2013. p. 7.*

*44. Anonymous. (Database on medicinal plants used in Ayurveda and sidha. s.l. : Central Counsil for research in Ayurveda and sidha, YNM. p. 355. Vol. 8.*

*45. THERAPEUTIC AND MEDICINAL USES OF SHATAPUSHPA: A REVIEW. Akhil jain, Nidhi Garg. 2, 2017, world Journal of Pharmacy and pharmaceutical Science, Vol. 6, pp. 336-42.*

*46. Kabiruddin, Hakeem. Mukhzan ul Mufradat. New Delhi : Aijaz Publishing House, YNM. pp. 347-48.*

*47. Hakeem, Mohd. Bustan ul Mufradat. s.l. : Aiijaz Publishing house, YNM. p. 209.*

*48. Kabiruddin, Hakim. Al Iksir e Azam. New Delhi : Aijazublishing House, YNM. pp. 729-30.*

*49. Anonymous. The unani Pharmacopoeia of India. New Delhi : CCRUM, 2008. pp. 97-98. Vol. VI.*

*50. Majoosi, Ali Ibn e Abbas. Kamil us sana. [trans.] ghulam Hasnain Kantoori. New Delhi : Idara Kitabushifa, YNM. p. 471. Vol. 3rd.*

*51. Characterization of mutagenic principles and carcinogenicity test of dill weed and seeds. FUKUOKA M, YOSHIHIRA K, NATORI S, SAKAMOTO K, IWAHARA S, HOSAKA S, HIRONO I. 3, 1980, Journal of pharmacobio-dynamics, Vol. 5, pp. 236-44.*

*52. Evaluation of dillapiole and dihydrodillapiole as synergists for pyrethrins in dust formulations. 13: . Handa S. K., and R. S. Dewan. . 1, 1974, Pyreth. Post , Vol. 3, p. 45Ð 46.*

*53. Review of research on insecticide synergists in India-retrospect and prospect. Parmar, B. S., and S. S. Tomar. 1983, Int. J. Trop. Agric, Vol. 1, pp. 7-17.*

*54. New methylenedioxyphenyl synergists for pyrethrins. Mukerjee, S. K., V. S. Saxena, and S. S. Tomar. . 2, 1979, J. Agric Food Chem., Vol. 7, pp. 1209 -1211.*

*55. Synthesis and synergistic activity of dillapiole based pyrethrum synergists. . 27:. Tomar, S. S., M. L. Maheshwari, and S. K. Mukerjee. 2, 1979, J. Agric. Food Chem, Vol. 7, pp. 547-550.*

*56. Antioxidant activity of medicinal spices and aromatic herbs. Riddhi MP, Yogesh TJ. 1, 2012, Annals of Phytomedicine, Vol. 1, pp. 75-80.*

*57. Analytical Analysis of Shatapushpa Described in Kashyapasamhita: A Review. Dr. M.B. Pillewan, Dr. Sujata K. Shamkuwar and Dr. Pratibha Baghel. 5, 2018, International Journal of Agriculture Innovations and Research, Vol. 6, pp. 2319-1473.*

*58. A Clinical Study To Evaluate The Efficacy Of Shatapushpa Tail. Dr.Bhagyashri Mahavir Khot, Dr.Meenal Dipak Lad, Dr.Arun Jagannath. 1, 2013, IOSR Journal of Dental and Medical Sciences, Vol. 7, pp. 26-31.*

*59. Rajput Arti, ,. Comparative study on Shatpushpa and Mishreya on Beejotsarga. Gujarat Ayurved university Jamnagar : s.n., 2001.*

*60. SavaliyaHetal. Comparative study of Shatpushpachoorna and Shatpushpa taila uttarabasti in the management of Vandhyatvaw.s,r to ViphalaArtava (Anovulatory factor); . Gujarat Ayurved university, Jamnagar : s.n., 2005.*

*61. KrupaPatel. A clinical study on polycystic ovarian disease and its management by Shatpushpa tail Matrabasti and Pathadikwath. Gujarat Ayurved University, Jamnagar : s.n., 2011.*

*62. A Clinical Study –Shatpushpa in Artavnirmiti (Anovulatory Cycle). KuwarRekhaChhagan. 11, 2016, IOSR Journal of Dental and Medical Sciences (IOSR-JDMS), Vol. 15, pp. 77-81.*

*63. EVALUATION OF EFFICACY OF SHATAPUSHPA PHALA CHURNA IN RAJAKRICHRITA WITH SPECIAL REFERENCE TO PRIMARY DYSMENORRHOEA. Nidhi Garg, Akhil Jain. 12, 2016, International Ayurvedic Medical Journal, Vol. 4, pp. 3602-3608.*

*64. ANTIMICROBIAL POTENTIAL AND PHYTOCHEMICAL ANALYSIS OF PLANT EXTRACTS OF ANETHUM SOWA. Mathur, Rashmi. 20, 2012, IJCRR, Vol. 4, p. 55.*

*65. Chemical Constituents of Essential Oil from Anethum Sowa Kurz. Seed. Singh, Sumitra. 9, 2012, Journal of Chemical and Pharmaceutical Research , Vol. 4, pp. 4156-4160.*

*66. Utility of Shatapushpa (Indian Dill) in Kashyapa Samhita and its Critical Analysis- A Review. Pradhan, Snehalata. 3, 2016, Int J Ayu Pharm Chem, Vol. 4, pp. 44-51.*