

Seeds of *Hyoscyamus niger* Linn (Ajwain Khurasani): Pharmacognostical and Pharmacological Appraisal including Unani Medicine Perspective

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ABSTRACT

Hyoscyamus Niger (also known as Henbane) from Solanaceae family is used medicinally for its dried leaves and flowering tops, having not less than 0.05% alkaloids, calculated as hyoscyamine. Besides, there are other significant alkaloids are also found in other parts of the plant too, like seeds, roots, fruits contain a significant amount of atropine, scopolamine and hyoscyne. The plant has a magnificent medicinal value since ages, used as local anesthetic to relieve pain and insomnia. Historical records mentioned its association with black magic, too due to its anesthetic property in the Middle Ages.

Seeds of the plant are used in Unani medicine in the name of *Ajwain Khurasani* for its wide therapeutic value. Present paper discusses the detailed description of the pharmacognostical and pharmacological importance of the plant in addition to its details as mentioned in Unani literature. Seeds, used in Unani medicine are less explored, till now. So, the paper presents a description of the pharmacological value of its seeds, scientific studies done so far on its seeds, and provides a frame work for the researcher to explore more from it.

Keywords: *Hyoscyamus Niger*, Seeds, Ajwain Khurasani, Unani medicine

INTRODUCTION

Therapeutic description of the plant *Hyoscyamus* is first found during the period of Dioscorides in the first century A.D., who is said to use it to procure sleep and relieve the pain. Later, it was a frequently mentioned drug in Anglo Saxon works on medicine of the eleventh century, in which it was named as 'Henbell'. Later, due to its illusion like property its use was stopped and for some time it was removed from the London Pharmacopoeia of 1746 and 1788, but then after its significant efficacy of the extract found for epilepsy and other nervous and convulsive diseases through a series of studies by Baron Storch, it was restored in 1809.

Hyoscyamus Niger is a biennial 80 cm long herb that thrives well in the temperate climate and is propagated diversely in rocky, arid areas and along roads. It is distributed throughout western Himalaya of Kashmir to Garhwal, Agra, Western and Northern Asia, Europe, Siberia, Egypt, Khurasan, Iran and North Africa. It occurs throughout the year; flowering occurs during February to March and seeds get mature during April to May. The plant is an erect course, viscid herbs; seeds are called as 'the seeds of banj'. The plant has oval leaves, and yellow to dull green colored flowers with purple veins; its fruit have numerous seeds. It is considered as magic brewer, anodyne; prevent convulsions, neurologic

pain, psychosomatic disorder, tremor, and insomnia, anti-tumor. It is also used as abstinent therapy for opium addiction.

TAXONOMICAL CLASSIFICATION

Kingdom: Plantae

Phylum: Spermatophyta

Class: Dicotyledonae

Order: Solanales

Family: Solanaceae

Genus: *Hyoscyamus*

Species: *Niger* [1]

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VERNACULAR NAMES

Arabic: Bazulbanj, Saikran, Khadarijal; Greek: Khurasani, Afiqoon, Laisghramash, Bunk; Spanish: Azmaloo; Turkish: Batbata; Berberi: Aqtafeet, Asqiraas; Persian: Bang; Dalmi: Kabarjak; Sindi: Jaankhurashali; Urdu: Ajwain Khurasani; Hindi: khurasani ajwayan; Bengali: Kharasani ajawan; Kannada: Khurasani vadaki; Tamil: Khurasani yomam; Telugu: Khurasani vamam; Gujrati: Kharasaniajma, Barabang; Sanskrit: Madkarni, Parsaikyuwani; English name: Henbane, Hyocyamus [2]. Common names: Jupiter-bean, Syfonica, Cassilata, Cassilago, Caballinus, Henbell, Jusqiam, Bazrolbang, Masheatar, Ajavain khorasani, Devil's eye, Stinking nightshade Insane root, Poison tobacco, Benele, Chenilsenkeraut [3].

NOMENCLATURE

Henbane: The name Henbane is derived from Anglo-Saxon comprising of two words i.e., 'Hen' and 'Bane' means hen killer; when fowls eat their seeds, they got paralyzed and die. Therefore, it is named as Henbane.

Hyocyamous: It is Greek's root of Hyocyamus; hyos means "pig" and cymo means "bean". That means Hog's-bean the name of animal which is supposed to eat it with impunity [4].

DESCRIPTION

Stem: They are branched, slightly hairy.

Leaves: Radical leaves spreading, stalked, ovate, oblong, 15-20 cm, coarsely sinuate, toothed. Leaves on stem are small, ovate, irregularly pinnatifid passing into bracts.

Flowers: Sub sessile, yellowish green arranged on simple unilateral re-curved leafy terminal spikes; calyx tube ovoid, limb funnel shaped, 5-toothed; Funnel shaped corolla, slightly unequal and minutely reticulate; stamens protruding, exerted. Ovary is two celled styles longer than the stamens, capsule 1.3 cm diameter enclosed in a globose tube of enlarged calyx, lower part membranous, tip hard and rigid opening transversely along the constriction between the two portions; fruit is small two celled, containing numerous seed [5]. Dehiscence occurs longitudinally.

DESCRIPTION ACCORDING TO UNANI MEDICINE TEXTS

Hyocyamus niger are the seeds of herb named as *banj*, commonly found in Siberia, Egypt, Khurasan, and Iran. In India, it is cultivated in Agra, Kashmir, and Garhwal.

Nomenclature as 'Ajwain Khurasani' in Unani Medicine: The fresh herb smells as of *Trachyspermum ammi* (Ajwain), so it was named as Ajwain; and as its origin was found to be from Khorāsān (the northeast province of Greater Iran) it was named as Khurasani.

Types: It is mentioned to be of three types: *Hyocyamous alba* (Banj safaid), *H. muticus* (Banj surkh), and *H. niger* (Banj siyah).

Temperament: Their active constituents are cold and dry (*Yabis arzi*) which cause whiteness in cold body and blackness in dry body. Therefore, Zakariya Razi has mentioned it as *dawae muzmina* (medicine for chronic diseases) in his book. The variety of Ajwain Khurasani having cold and moist temperament in higher degree is considered as worst. Its best variety is white one which has lesser cold and moist temperament [6-8]. There is variation in the degree of coldness and dryness according to different thought Unani scholars, as follows:

Cold dry 3(3) or cold dry 4(1)^{7,9}

Cold dry 3(1),⁷

Cold 3, Dry³⁵

Cold dry 3⁸

MORPHOLOGICAL CHARACTERS

Leaves: It can be differentiated from *Nepeta hindostana* (Badranjboya) by leaves, which are wider, long, thick, and glabrous than *N. hindostana*. Further the leaves of *H. niger* are, light blackish green with dentate margin; ovate in shape with acute apex, glabrous with alternate phyllotaxy. They have strong taste and smell. They are collected carefully at the time when flower become three times of its size and get dried.

Stem: It is thick and glabrous.

Flowers: Blue/ white colored, pentamerous, having 2 capsules in which seeds are enclosed.

Fruit: It has berry like pomegranate but it is not round. They are arranged longitudinally with seeds inside.

Seeds: They look like mustard (ra'ai), but they are smaller than it and thin [9]. Seeds have a shelf life of less than a year (Figure 1).

Extract is considered better than its gum.

SEEDS

Macroscopic characters

The dark brown color seeds are of about 0.8×1-1×1.5 mm dimensions laterally compressed scrobiculate, exarillate, and albuminous, reticulate, seed coat having pungent tobacco like smell, bitter taste. Hundred seeds weights around 4-7 gm [5].

Microscopic characters

Longitudinal section of the seeds has circular outlines covered 0.14-0.21 mm seed coat, which comprised of single row of thick walled radially elongated and outer is thin-walled cells, laterally and interior cell are thick cell walled

epidermis, second layer of cell are tangentially arranged. Vascular bundle is short. Endosperm is thin cell walled

polyhedral parenchymatous, contain aleurone grains and oil globules. Cotyledons are thin walled [5].



Figure 1. Seeds of *Hyoscyamus Niger* (Ajwain Khurasani).

Procedure & time of collection of seed

The seeds are collected from ripe fruits. To collect them, the plant is uprooted before the fruit dehiscence and spreaded in sunlight for 2-3 days and racked with sticks so that fruits can open. A single plant can yield 10,000 seeds. The dry seeds are garbled, sieved and stored in cool and dry place, free from moisture.

Method of processing: As they constitute as a toxic drug, so they are detoxified by soaking into vinegar for three consecutive nights. The ratio of drug and vinegar is 1:4. After that they are dried and kept for further use [5].

Therapeutic actions

Sedative, Anesthetic, hypnotic, astringent, Aphrodisiac, vicscosify the semen [10], Repellant, Anti-inflammatory, cure phlegmatic cough, mydriatic, Hair remover, Haemostyptic, according to some its root amulet cure colitis patient [11].

Therapeutic uses

It is used with honey for cold, cough, melancholia, headache, fever, Dental carries, itching, insomnia, inflammation, rheumatism, Gout, Sciatica, Haemoptysis, insomnia, Liver infection, Uterine infection, tooth ache, ear ache, Menorrhagia, Haemorrhage, Furuncle, Eye, ear inflammation, Glaucoma, unconscious, Vertigo, diphtheria, mania, coma), memory disturbance, Glossal inflammation [7].

Adverse effects (Muzir): Mania, Drowsiness, Diphtheria⁹, Nerve and brain⁸

Corrective (Musleh): Honey^{9,8}, anisoon¹⁰⁹ Zafran⁸

Toxicity corrected by: Hot water, Honey, Cow's ghee (Roghan zard), Honey water (Ma'ul asl), *Ficus carica* (Anjeer decoction), Borax, Milk with *F. carica* (Anjeer) decoction, by inducing vomiting or through gastric lavage⁷.

Substitute (Badal): *Papaver somniferum* (Afiyun), *Trachyspermum ammi* (Ajwain desi)⁹; *Nardastachys jatamansi* (Sumbul), Poppy seeds (Khashkhash siyah)⁷

Dose (Miqdaar-e-khuraak): Kamil: 2 gm⁹, 1 gm⁷, 4.5 gm causes drowsiness, sleep for long hours, 200-500 mg/500 mg-1 gm⁶

Toxic dose: 7 gm, 7-14 gm⁷

Toxic effect

It is bronchodilator, anti-secretory, and urinary bladder relaxant, spasmolytic, and hypnotic, hallucinogenic, pupil dilating, sedative and bears anti-diarrheal properties like other anti-cholinergic drugs.

Clinical findings of acute henbane poisoning includes severe mydriasis, tachycardia, arrhythmia, agitation, convulsion and coma, dry mouth, thirst, slurred speech, difficulty speaking, dysphagia, warm flushed skin, pyrexia, nausea, vomiting, headache, blurred vision and photophobia, urinary retention, distension of the bladder, drowsiness, hyper reflexia, auditory, visual or tactile hallucinations, confusion, disorientation, delirium, aggressiveness, and combative behavior, amnesia, mania, cold and yellow body, dry tongue, Froth, red eyes, vision loss, hallucination, maniac episodes, restlessness, dyspnea stammering (Isa bin ali). If patient not get treated, then patient will die in 2 min (Ibn e jaraz) [7].

Compound formulation: *Jawarish muqawwi meda*, *Banadiqul buzoor*

Phytoconstituents

Hyocyanin, Atropine, Scopolamine fatty oil, tannin, protein, Other are as follows: Withanolide class steroids: 16 α -acetoxyhyoscyamilactol, daturalactone-4, hyoscyamilactol, Lignanamides: hyoscyamide, grossamide, cannabisin D & G; ferulic acid ester derivative: 24-tetracosanediol diferulate; glycerol fatty acid ester: 1-O-(9Z,12Z-octadecadienoyl)-3-O-nonadecanoyl glycerol; tyramine derivative: N-trans-feruloyl tyramine; Long chain glycerol: 1-O-octadecanoyl glycerol, 1-O-(9Z,12Z-octadecadienoyl) glycerol, 1-O-(9Z,12Z-octadecadienoyl)-2-O-(9Z,12Z-octadecadienoyl) glycerol, 1-O-(9Z,12Z-octadecadienoyl)-3-O-(9Z-octadecanoyl) glycerol; Steroidal saponins: hyoscyamoside B, hyoscyamoside C, hyoscyamoside C2, (25R)-5 α -spirostan-3 β -ol-3-O- β -D-glucopyranosyl- (1 $\rightarrow$ 3)- β -D-galactopyranoside, (25R)-5 α -spirostan-3 β -ol-3-O- β -D-glucopyranosyl- (1 $\rightarrow$ 3)-[β -D-glucopyranosyl-(1 $\rightarrow$ 2)]- β -D-galacto- pyranoside; Glycoside: hyoscyamoside A, hyoscyamoside B1, hyoscyamoside B2, hyoscyamoside B3, hyoscyamoside C1, hyoscyamoside E, hyoscyamoside F1, atroposide A, atroposide C, (25R)-5 α -spirostan-3 β -ol-3-O- α -L-rhamnopyranosyl(1 $\rightarrow$ 2)- β -D-glucopyranoside, (25R)-spirost-5-ene-3 β -ol-3-O- α -L-rhamnopyranosyl(1 $\rightarrow$ 2)- β -D-glucopyranoside, atroposide E, petunioside L pyranoside N, lignans: hyosmin, hyoscyamal, balanophonin, other compounds :rutin, vanillic acid, β -sitosterol, daucosterol, 3',5-dihydroxy-3,4',5',6,7-pentamethoxyflavone, ($\pm$)-pinoresinol, 5-hydroxymethylfurfural; Glucoside: pongamoside C, pongamoside D; Coumarinolignans: hyosgerin, venkatasin, cleomiscosin A, cleomiscosin B, cleomiscosin A methyl ether, cleomiscosin A-9'-acetate, cleomiscosin B-9'-acetate. If hyocyanin remain for some days, it itself converted into atropine, 3 alkaloid, fixed oil which have toxic effect [12].

SCIENTIFIC STUDIES

Antispasmodic activity: The crude extract of *H. niger* seeds caused a complete concentration dependent relaxation of spontaneous contractions of rabbit jejunum, similar to that caused by verapamil, whereas atropine produced partial inhibition. The test drug also inhibited the contractions induced by carbachol (1 μ m) and K⁺ (80 mm) in a pattern similar to that of dicyclomine, but different from verapamil and atropine. It indicates the Ca²⁺ channel ferpamyl mechanism in addition to an anticholinergic effect of the test drug. Antispasmodic effect of *H. niger* is mediated through a combination of anticholinergic and Ca²⁺ antagonist mechanisms. The relaxant effects occur at much lower concentrations in the trachea and bladder in guinea pig trachea and rabbit urinary bladder tissues, carbachol (1 μ m) and K⁺ (80 mm) induced contractions at around 10- and 25-times lower concentrations than in gut, respectively. Also have antidiarrheal and antisecretory effects against castor oil induced diarrhea and intestinal fluid accumulation in mice [13].

Hypotensive, Cardio suppressant and vasodilator activities:

The hypotensive activity of *H. niger* crude extract showed fall in the arterial blood pressure (BP) of rats under anesthesia in a dose-dependent manner. *H. niger* crude extract exhibited a cardio depressant effect on the rate and force of spontaneous atrial contractions in guinea-pig atria. In isolated rabbit aorta, *H. niger* crude extract (0.01-1.0 mg/ml) relaxed the phenylephrine and K⁺ (80 mM)-induced contractions and suppressed PE (1 microM) control peaks obtained in Ca⁺⁺-free medium similar to that caused by verapamil. The vasodilator effect was endothelium-independent as it was not opposed by N (omega)-nitro-L-arginine methyl ester in endothelium-intact rat aortic preparations and also occurred at a similar concentration in endothelium-denuded tissues. These data indicate that *H. niger* lowers BP through a Ca⁺⁺-antagonist mechanism [14].

Analgesic, anti-inflammatory and antipyretic activity:

The methanolic extract of seeds produced significant increase in hot plate reaction time, while decreasing writhing response in a dose-dependent manner indicating its analgesic activity. It was also effective in both acute and chronic inflammation evaluated through carrageenin-induced paw edema and cotton pellet granuloma methods. In addition to its analgesic and anti-inflammatory activity, it also exhibited antipyretic activity in yeast-induced pyrexia model [15].

Anticonvulsant activity: Effects of *H. niger* L on central nervous system have been known for many years. The effects of methanolic extract of *H. niger* L. on seizures induced by picrotoxin showed anticonvulsant activity against picrotoxin-induced seizures in mice [16].

Antiparkinson activity: The neuroprotective potential, of aqueous methanol extracts of *H. niger* seeds was evaluated in 1-methyl-4-phenyl-1, 2, 3, 6-tetrahydropyridine (MPTP) model of Parkinson disease in mice. The extract caused significant inhibition of monoamine oxidase activity and attenuated 1-methyl-4-phenyl pyridinium (MPP⁺)- induced hydroxyl radical (OH) generation in isolated mitochondria. Accordingly, the protective effect of the methanolic extract of *H. niger* seeds against Parkinsonism in mice could be attributed to its inhibitory effects on the increased $\cdot$ OH generated in the mitochondria [17].

Memory losing activity: Hydro-alcoholic extract of BH disarranges short-term memory of mice and reduces the learning of the water maze task [18].

Mydriatic and CNS depressant activity: Ophthalmic administration of scopolamine produces mydriasis more quickly than atropine with shorter duration. Scopolamine induces CNS depression, leading to drowsiness, amnesia and fatigue [19].

Organophosphate poisoning: Atropine is an effective antimuscarinic agent for the treatment organophosphate compounds intoxication [20].

Antioxidant activity: The methanolic extracts of *H. niger* showed antioxidant activity ($IC_{50}=1.64 \mu g$) compared to α -tocopherol ($IC_{50}=0.60 \mu g$), which was used as the positive control [21]. The antioxidant activity of the aerial parts of *H. niger* extracts was investigated with 2 methods DPPH (2, 2-diphenyl-1-picrylhydrazyl) and ferric reducing antioxidant power (FRAP) assays. The antioxidant (EC_{50}) for methanol extract was $377\pm1.21 \mu g/ml$ and it was 21 ± 0.68 and $4.8\pm0.32 \mu g/ml$ for butylated hydroxytoluene (BHT) and ascorbic acid [22].

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