

1 **Photochemistry and Therapeutic Properties of *Bunium persicum* (Boiss.): Review.**

2

3 **Abstract**

4 The seeds of *Bunium persicum* are commonly known as black cumin, black caraway,
5 shahi zeera, and sayah zeera. In many food systems, these are used not only as flavor enhancers
6 but also as a preservative. The main chemical components in seeds of *B. persicum* are, alpha-
7 terpinen , limonene, dillapiole, p-mentha-1, 4-dien-7-al, gamma-terpenene, beta-pinene, phenolic
8 compounds, fatty acids, carboxylic acids, and carbohydrates. *B. persicum* seeds possess multiple
9 biological activities i.e. acetylcholinesterase inhibitory, antimicrobial, anticancer, antidiabetic,
10 anticonvulsant, anti-inflammatory, analgesic, substances that are antihistamine, antidiarrheal,
11 antispasmodic, antihematoxic, and anti-pancreatic lipase.

12 **Keywords:** *Bunium persicum*, Anti-diabetic activity, Black cumin, Kala jeera, Spice

13 **Introduction –**

14 As natural items, herbs and spices differ from person to person in their chemical
15 composition, with uses ranging from energizing decoctions to the usage of herbal extracts in
16 accordance with standard Western medical procedures. The history of traditional medicine is
17 extensive. It encompasses all of the methods used preserve health, including illness prevention,
18 diagnosis, treatment, and enhancement that are grounded in numerous cultures' thoughts, beliefs,
19 and experiences. Although there are some differences Herbal therapy still has to be evaluated for
20 effectiveness using the traditional trial approach in comparison to conventional pharmaceutical
21 therapies. Numerous plant extracts have been shown to be effective for specific health issues.
22 Research in this area has to be stepped up, nevertheless, because the public is frequently
23 misinformed to think that herbal drugs are dangerous and that all-natural remedies are safe. An
24 key unresolved issue in evaluating the numerous purported health effects of herbs and their
25 extracts is the primary topic that has not been adequately addressed, which concerns the triad of
26 absorption, metabolism, and effectiveness. **Barkat et al (2011).**¹ The negative effects of anti-
27 obesity medications can be reduced by using herbal remedies or chemical compounds from these
28 remedies. Several clinical and animal studies were conducted using herbal remedies, and some of
29 them showed a notable improvement in body weight control without any discernible negative

30 effects (Gupta et al., 2012).² Ayurvedic and Unani medicines have been used for centuries to
31 treat obesity, but many of them have not been tested for safety and efficacy using contemporary
32 scientific methods. Zeera arq is Among the most well-known conventional herbal treatments
33 used to treat obesity. Zeera arq is aqueous decoction of four herbs and among which seeds of.
34 *Bunium persicum* is one among the four. *B. persicum* seeds are used to treat digestive and
35 urinary diseases, such as liver function, colic, diarrhea, dyspepsia, hysteria, heartburn, flatulent
36 indigestion, stomatitis stimulant, and dyspeptic headache. Some of its numerous uses include
37 anticonvulsant, anti-diabetic, anti-asthmatic, antispasmodic, antiepileptic, anti-obstruction,
38 diuretic, and breast milk flow enhancer. therapeutic applications. (Miraj and Kiani, 2016;
39 Gurpreet, et al .2002]. ³

40 *Bunium persicum* is herbaceous perennial geophyte. *Bunium persicum* (synonym:
41 *Carum carvi*) are commonly called as Black Cumin, Siyah Jeera, Kala Jeera. It belongs to family
42 Apiaceae or Umbelliferae which consists about 423 genus (Koul et al., 1979).⁴ The genus
43 *Bunium* has roughly 166 species. It naturally grows in alpine and sub-alpine environments.
44 Around the world, this plant is known by many distinct names, including " "Persian Cumin,"
45 "Zire Kuhn," "Shah zira," "Kala Zeera," "Jira," "Wild caraway," "Black caraway," "Black carvi,"
46 "Persian cumin," "Great pignut," and "Wild cumin." It is known as Kala Jira in Punjabi and
47 Krishna ji in Sanskrit. Its name is Shahijirige in Kannada. It is called Kalijira or Himali Jira in
48 Nepali. It is referred to as Kalazira in Urdu. Hassanzad et al., (2018) ⁵ .*B. persicum* is a
49 valuable plant herbaceous spice that is one of the treasures of aromatic plants. It is found
50 throughout regions with a Mediterranean climate, such as China, Iran, Turkey, Syria, Pakistan,
51 Tajikistan, Afghanistan, North India (including Kashmir and Pamir), and some regions of
52 Europe, Northern Africa, and South America. (Zahida et al., (2019) ⁶.

53 *B. persicum* is typically grown from subterranean tubers but occasionally it is also grown
54 from seeds. The plant of *B. persicum* generally attains a height of 40 to 80 cm. It may or may
55 not have one or more middle-branching stems. The inter-nodal area of the stem is hollow and has
56 secretary conduits for resins and oils *B. persicum* leaves are filiform, broadly pinnate, and
57 coarsely split (2–3).It features a umbel blossoming, a feature belong to umbelliferae family, with
58 an 8 to 20 flower cluster with a convex or flat top that arises from a single apex. *B. persicum*
59 flowers are zygomorphic, with five stamens that alternate with petals and five petals that are

60 purple, pink, or white. The plant's fruit is a schizocarp, which is made up of two falciform meri-
61 carps joined by a slender axial centre stalk. The petals are both bifid and free. 5 white, pink, or
62 purple petals and five stamens that rotate with the petals make up the blooms. The fruits, which
63 are more usually but incorrectly referred to as seeds, are brown to dark brown in colour, four to
64 five mm long, and 0.8 to 1 mm in diameter (Bansal et al., 2021).⁷ The plant is perennial and has
65 branches that can reach heights of 40 - 60 cm. The glandular root has an asymmetrical, spherical
66 form. The leaf have a filiform shape and are freely pinnate and finely divided. The flowers are
67 tiny, white, highly symmetrical, and have little sepals, petals, and stamens. They grow in tight
68 umbel (Baser et al., (1997; Abduganiev et al., 1994; Bansal et al. 2021).⁸

69



70

71 **Fig 1: *Bunium persicum* Seeds and Flower *Bunium persicum* Plant (a) (Mandegari et al.,**
72 **2012)**

73 **Penology :** Fruiting in September and October; flowering from late June to September. **Zahida**
74 **et al., (2019).⁸**



Fig 1 *Bunium persicum*

75
76

77 **Geographical distribution –**

78 **B.P.** is a valuable herbaceous spice found in many aromatic plant treasures. It is a perennial herb
79 with a pleasant odor that grows throughout the Mediterranean region, including parts of Europe,
80 North Africa, South America, China, Iran, Turkey, Syria, Pakistan, Tajikistan, s

81 **Phytochemistry -**

82 Phytochemical compounds from distinct *B. persicum* sections have been found . The main
83 phytoconstituents found in *B. persicum* E.O. included Methatriene, p-cymene, limonene,
84 caryophyllene, Crithmene , cuminyl acetate, cuminal , gammaterpene-7-al, trans-3-carene-2-ol,
85 and ethanolic acid. (Zahida et al 2019).¹⁰ The dehydrated fruits of different *Bunium persicum*
86 populations produced an average range.

87 of 1.92-9.1% v/w in volatile oil .pinene , monoterpenes ethers , phenyl propenes, and
88 sesquiterpenes are primary constituents of B. Persicum E.oil. Key components found in volatile
89 oils include terpenoids (0.8–46.1%), cuminal (5.96–40.66%), and terpinene-7-al (0.4–37.2%).

90 **Amin et al (2011); Dehkordi et al., (2016).** ¹¹ The formic extract of *B. persicum* contains a
91 variety of phenolic components, comprises flavonoids (kaempferol) and phenolic acids
92 (coumaric acid, caffeic acid, etc).**Rakhimov et al., (1984).**¹²

93

S. no	Compounds	Mas s	RT	% area
1.		136	4.65	7.32
2.		136	5.30	89.82
3.		136	5.679	75.3
4.		154	6.491	8.75
5.		232	7.141	18.5
6.		154	7.344	11.6

7.		154	7.520	5.68
8.		148	8.373	81.6 7
9.		148	8.400	85.9
10.		148	8.470	96.7
11.		150	8.910	51.6
12.		152	9.160	12.6

13.		166	9.28	7.64
14.		166	9.78	4.75
15.		164	10.70	9.45
16.		152	19.41	4.52
17.		148	19.84	3.49

96 (Fatma et al 2025.) *Bunium persicum* fruits have contain calcium oxalate, polysaccharides,
97 volatile and fixed oils, and flavonoids. Khare .et al.,¹³ This species has a number of isolated
98 compounds that have use in the pharmacopeial and antifungal industries. The goal of this
99 research was to assess the level of variation in the essential oil components of *Bunium persicum*
100 accessions that came from three different areas. Pulwama, Bandipora, and Kishtwar. The study
101 populations' essential component of *B. persicum* essential oil were discovered to be γ -terpinene
102 (26–28%) and cuminaldehyde (40–41%). As shown by the Pearson correlation coefficient, there
103 was a highly significant positive association between p-Cymene and cuminaldehyde in the
104 essential oil content of the different samples tested. Based on the essential oil content, the
105 accessions were divided into three main categories. While the Kishtwar population had 81.99%
106 activity with an overall average of 82.94%, the Pulwama and Bandipora populations showed
107 minimal variance in antioxidant properties, ranging from 79.14% to 87.70%. The results of this
108 study can be utilized to develop effective breeding plans for this species.

109 **Lipids:** lipids (10.5%) were separated from seeds, the following substances were found:
110 petroselinic acid, both free and esterified; Sterols (0.4), free alcohols (tr.), free fatty acids (5.1),
111 organic compounds (0.2), TAG.(66.0), Grease (0.1), and chlorophyll (0.1%). The roots held
112 scopoletin, phytofluene, β -sitosterol, umbelliferone, and Glycerol esters of fatty acids, both
113 saturated and unsaturated. (Khan et al., 2016) 14.

114 **Vitamins:** Vitamin B6 0.360 mg, total reduce ascorbic acid 21.0 mg, thiamin 0.3606 mg,
115 vitamin B2 0.379 mg, Nicotinic acid 3.606 mg, folate 10 μ g, vitamin A (RAE) 18 μ g, v (IU) 363
116 IU, and tocopherols 2.50 mg (Khan et al., 2016).15

117 **Flavonoids:** *Bunium persicum* fruits contain traces like Flavonoids including quercetin,
118 kaempferol, and their glycosides. It has also been discovered that the flavonoids Quercetin 3-
119 ocaffeoylglucoside, kaempferol-3-glucoside, iso-quercitrin, and quercetin-3-glucuronides
120 are present in the roots of *Carum carvi* (Khan, et al 2016) 16

121 **Carbohydrate** - The ethanolic extract of kala zeera present variety of carbohydrates, including
122 Pectin compounds, water-soluble polysaccharides, and mono- and oligosaccharides, and
123 hemicellulose. Glucose, fructose, mannitol, sucrose, and raffinose were among the mono- and
124 oligosaccharides.(Rakhimov et al 1984).17

125 **Medicinal uses of *Bunium persicum* -**

126 Traditional remedies for menstruation aches, spasms, and flatulence include *B. persicum* fruits.
127 They are also used as antimicrobials. Kala zeera is used as medicine an antibacterial, stomachic,
128 and carminative. According to a study on information from elderly people in Malakand,
129 Pakistan, where the Unani system of medicine is more common. Low quantities (0.05, 0.1
130 mg/ml) of aqueous and hydro-alcoholic extracts from *B. persicum* fruits considerably stimulated
131 the release of insulin from the isolated mouse Langerhans. This impact was similar to how
132 glyburide 1 M and 10 M affected insulin secretion at 2.8 mM and 16.7 mM of glucose,
133 respectively. 1 μ M and 10 μ M of glyburide had comparable effects on insulin secretion in
134 glucose 2.8 mM and glucose 16.7 mM, respectively. According to a different study, α -amylase
135 activity was significantly inhibited by the methanolic, ethyl acetate, and n-hexane extracts from
136 *B. persicum* fruits (range of 40–72.3% percent inhibition at 250 μ). According to a different
137 study, *B. persicum*' methanolic, ethyl acetate, and n-hexane extracts. **(Giancarlo et al 2006).**¹⁸
138 Natural substances, including medicinal plants, are increasingly being used in food to improve
139 safety and shelf life. **(Iacobellis et al., 2005).**¹⁹ *Bunium persicum* seeds are well recognized for
140 their Iranian traditional medicine's GIT , anti repertory , anti-convulsive, anthelmintic, anti-
141 dyspnea, and antinociceptive properties. They have also long been used to treat urinary and
142 intestinal diseases. As a carminative, the plant leaves and flower heads are used to cure
143 headaches, stomach colds, joint discomfort, TB, fever, and other ailments can all be treated with
144 fruit decoction in water, according to **Zaman. et al., 2013; 20 Majidi et al., 2020.**²¹ *B. persicum*
145 demonstrates anti-diabetic efficacy by drastically lowering total Triglycerides, low-density
146 lipoproteins, and cholesterol in an aqueous ethanolic extract. with regard, it exhibits antimicrobial
147 activity. Additionally, *Aspergillus* spp., *S. cerevisiae*, *C. albicans*, *P. chrysogenum*, and *A. mali*
148 have been documented to exhibit antifungal activity. Using the DPPH assay, -carotene bleaching,
149 and ammonium thiocyanate. *Anopheles stephensi*, the malaria vector, was tested for larvicidal
150 efficacy against essential oil, extract and fractions of *B. persicum*. The essential oil, whole
151 extract, petroleum ether fraction, and methanol fraction all demonstrated exceptional
152 effectiveness against *Anopheles stephensi* larvae. The maximum inhibitory concentration (IC₅₀)
153 of *B. persicum*'s methanolic extract was found to be around 45.7 g/ml when antioxidant activity
154 was evaluated. **(Sharifi-far et al 2010).**²² In the Unani system of medicine (USM), the popular
155 culinary spice kala zeera is an important therapeutic plant. , Hazim (digestive), Muqawli-e-Meda
156 (stomachic), Kasir-i-Riyah (carminative), Qabiz (astringent), Muqawli-i-Jigar (hepatotonic), etc.

157 are some of the pharmacological effects of Zeera siyah in USM . (Naquibuddin et al., 2021).23
158 It has been employed as a medicinal substance to treat a variety of illnesses. Due to its strong
159 medicinal and antioxidant qualities, this plant has a lot of potential for usage in the food and
160 medical industries. A thorough evaluation of the literature was carried out by looking for
161 research in all pertinent, reliable scientific databases. *B. persicum*, Persian cumin, Zire kuhi, Shah
162 zira, Kala Zeera, Jira, wild cumin, and wild caraway were all searched for in databases without
163 restriction up to **10 November 2017**. Based on the study to investigations, this plant and its
164 derivatives are important substances with analgesic, antibacterial, anti-inflammatory, anti-
165 diabetic, anti-hyperlipid, and antioxidant properties. High quantities of oxygenated monoterpenes
166 with potent antibacterial and antioxidant qualities, such as limonene, γ -terpinene,
167 cuminaldehyde, and p -cymene, are found in B.P.essential oil. The harmful consequences of
168 *Bunium persicum* are not a serious issue because the plant is frequently utilized as a flavoring
169 ingredient in people's diets. **Hassanzadazar et al (2018). 24.** Numerous isolated compounds
170 from this species have potential use in the pharmaceutical sector and as antifungals. (**Kareshk et**
171 **al., 2015).**25

172 **Antihistamine activity** - The antihistamine action was assessed using the Accumulative
173 Accumulative log concentration-response curves of histamine of aqueous and macerated extracts
174 and essential oil at 20 nM chlorpheniramine and saline. caused the solitary guinea pigs' tracheal
175 chains to constrict. There has been an improvement in both maximal reaction and EC50
176 (effective histamine concentration causing 50% of maximum response). The results
177 demonstrated that *B. persicum* exhibited a competitive antagonistic impact on histamine H1
178 receptors, an inhibitory effect on muscarinic receptors, and an activation of β -adrenergic
179 receptors. (**Boskabady 2004) 26**

180 **Anti-parasitic effects** -The ethanolic extract of BP may have antiparasitic qualities, according
181 to research. The results imply that BP could have significant antitoxoplasmosis properties. BP
182 oil can be given orally as natural toxoplasmosis preventative treatment, according to a study
183 done on mice with acute toxoplasmosis. (**Kareshk et al.,2015 Results of Mahmoudvand et al.**
184 **(2016) 27.**

185 **Anticancerous property** - One of the most prevalent cancers worldwide is colon cancer. Diets
186 rich in cumin have been shown to lower the histopathologic lesions brought on by 1,2-

187 dimethylhydrazine and prevent colon cancer in rats. Alkaline phosphatase activity, neutral
188 sterols, fecal bile acid, and aberrant crypt foci growth are also decreased. (**Deeptha et al., 2006;**
189 **Kamaleeswari and Nalini, 2006**)**28** Monoterpenes with anticarcinogenic properties, including
190 limonene, carvone, and anethofuran, are found in cumin essential oil. (**Agrahari and Singh,**
191 **2014**). **28 of Mahmoudvand et al. (2016) 29.**

192 **Anti-hyperglycaemic Activity** –The extract of *B. perscium* may cause hypoglycaemia in insulin
193 in type 1 diabetes in individuals because they either prevent glucose from being produced or
194 promote its use in peripheral organs, particularly Both muscle and fat, these plants may have a
195 hypoglycaemic impact. (**Eddouks et al., 2003**)**30** Study based on diabetic rats, extracts of BP
196 seed at different dosages significantly lowered insulin and glucose levels in comparison to
197 animals in good condition. Oral administration of cumin extract significantly decrease blood
198 glucose levels in diabetic rats without influencing plasma insulin levels, suggesting that its
199 mechanism of action is not dependent on insulin production. (**Eddouks et al., 2004**) **31.** The
200 components of Strong antioxidant activity and protection against diabetes and its consequences
201 are provided by black zeera, particularly flavonoids and carvone when taken as an aqueous
202 extract. It has been discovered that BP water extract shields rats against kidney damage brought
203 on by diabetes. (**Sadiq et al., 2010**).**32**

204 **Gastrointestinal problems** - Ninety-three patients with breast cancer underwent high
205 emetogenic therapy participated in a randomized, double-blind, crossover clinical investigation.
206 and experienced nausea and vomiting that was resistant to chemotherapy. Persumac, a
207 combination of *Rhus Coriaria* and semi-ground zeera fruits, was given to the patients for seven
208 days .They found that Persumac dramatically reduced the frequency and severity of nausea and
209 vomiting. (**Nazari et al 2017**) **33**

210 **Toxicity** -Various applications for *B. persicum* fruits and essential oil, and there have been no
211 reports of any adverse effects from this plant. On the other hand, the literature on traditional
212 medicine has linked long-term fruit intake to skin discoloration and weight loss. pregnant women
213 should be cautious of *B. persicum* emmenagogue effects. The volatile oil of kala zeera has a
214 substantial margin of safeness. Based on a study on poisoning that is acute. The harmful effects
215 of BP essential oil and extract on mice was evaluated using intraperitoneal (I.P) injections of
216 0.75, 1, 1.25, and 1.75 ml/kg and 4 and 5 g/kg, respectively. Mortality and morbidity were

217 determined after 24 hours. The results revealed that While the EO had no mortality up to 2.5
218 ml/kg, the extract had no mortality at a dosage of 4 g/kg but 16% at a dose of 5 g/kg.(**Showraki**
219 **et al., 2016**).³⁴

220 **Cytotoxicity assay**

221 The effect of ethanolic extract of *B.persicum* seeds on L6 myc cell lines was evaluated by
222 MTT (3-(4, 5-dimethylthiazol-2-yl)-2, 5- diphenyl tetrazolium bromide) assay. L6 myc
223 cells were seeded at 1×10^4 cells/well in a 96-well culture plate and allowed to get
224 confluence. Cells were treated with different concentrations i.e. 10 µg/ml, 25 µg/ml, and
225 50µg/ml of plant extract (*Black cumin*), and incubated at 37°C for 24 h. after incubation, 10
226 µl of MTT solution (5 mg/mL in PBS) was added into each well, covered with aluminum
227 foil, and incubated at 37°C for 4 h. Culture medium was aspirated and 100µl DMSO was
228 added to each well and incubated to dissolve the formazan crystals. The absorbance was
229 measured at 570 nm using an ELISA plate reader. presents the effect of ethanolic extract of
230 *B. persicum* seeds on L6 myc cell lines. The cytotoxic effect was monitored by uptake of
231 MTT by L6 myc cells. . The cells were incubated for 24 hours with various concentrations
232 of ethanolic extract i.e. 10 µg/ml, 25 µg/ml, and 50 µg/ml in the wells . As evident from the
233 figure 1 that treatment of the ethanolic extract of *B.persicum* seeds at the concentrations
234 ranging from 10 µg/ml to 50 µg/ml did not show any adverse effect on the viability of L6
235 myc cell and considered to be safe 50 ug concentrations. (**Fatma et .al. 2025**)

236 **Conclusion -**

237 The phytoconstituents present in Cuminaldehyde, α -pinene beta myrcen, 3-carene,
238 benzenemethanamine, dl-limonene,1,8-cineole, gamma-terpinene , alpha-thujone,
239 camphene, alpha terpinene, and 1,3,3-trimethylbicyclo(2.2.1) -heptan-2-ol,p-menth-2-en-1-
240 ol. i.e. that, in addition to being affordable and free of adverse consequences, it can assist
241 alleviate chronic diseases such as diabetes, cancer,gastrointestinal and autoimmune disorder
242 , etc. The use of phytomedicine has attracted enormous scientific interest. In order to
243 develop *Bunium persicum* as a potential herbal therapeutic candidate, additional research is
244 required to identify the precise phytoconstituents that will target the particular Chronic
245 condition.

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