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Chemical Constituents and Biological Activities of Genus Nepeta (Lamiaceae) from India and Western Himalaya: A Review

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Abstract

A literature-based survey of Nepeta species essential oil composition found in India and the Western Himalayan region was carried out. A concise review of the scientific literature pertaining to constituents of Nepeta essential oils and volatile fractions is presented in this mini review article. Labiatae (Mint) family (Genus Nepeta) remains quite important. Essential oils extracted from various parts of species of above mentioned genus have been a vital source of terpenoid and oxygenated terpenoid hydrocarbons especially sesquiterpene hydrocarbons and their oxygenated derivatives. These compounds have been known for their inherent biological activities viz. sedative, diaphoretic, febrifuge, expectorant, diuretic, stomach tonic, antispasmodic, antipyretics, antiviral, anti-inflammatory, antimicrobial, fungicidal, insecticidal, insect repellent and antidote against snakes and scorpion bites etc.

Keywords: Lamiaceae; Nepeta; Essential Oil; Nepetalactones; Antioxidant Activity

Introduction

The forests of India have been the source of traditional medicines for millennia. Total of the 17,000 species of higher plants described in India, 7500 are known for their medicinal uses [1]. The Charak Samhita, a document on herbal therapy written about 300 BC, reports on the production of 340 herbal drugs and their indigenous uses [2]. The Himalayan range in the northern part of India harbours a great diversity of medicinal plants of the approximately 8000 species of angiosperms, 44 species of gymnosperms and 600 species of pteridophytes that have been reported in the Indian Himalaya [3], 1748 species are known for their medicinal properties [4]. The state of Uttarakhand is a part of northwestern Himalaya and still maintains a dense vegetation cover (65%). The maximum species of medicinal plants have been reported from Uttarakhand [5,6] followed by Sikkim and North Bengal [4]. The trans-Himalaya in contrast, sustains about 337 species of medicinal plants [4], which are low compared to other areas of the Himalaya due to the distinct geography and ecological marginal ecological conditions [7]. Recent years have seen a sudden rise in the demand for herbal products and plant-based drugs across the world resulting in the heavy exploitation of medicinal plants. Habitat degradation, unsustainable harvesting and over-exploitation to meet the demands of the most illegal

trade in medicinal plants have already led to the extinction of more than 150 plant species in the wild [8]. More than 90% of plant species used in the herbal industries is extracted from the wild, and about 70% of the medicinal plants of Indian Himalaya are subject to destructive harvesting. The majority of these plants stems from sub-alpine and alpine regions of the Himalayas [9,10]. The genus Nepeta, one of the largest genera of the Lamiaceae family, belongs to the subfamily Nepetoideae and tribe Mentheae. It comprises ca. 300 herbaceous perennial, rarely annual species most of which are spread out over the larger part of central and southern Europe, the Near East, central and southern Asia, and some areas of Africa. The plants of this genus have beautiful flowers with a pleasant odor the pollen grains are hexacolpate [11]. Nepeta is the second largest genus of the Indian labiates, with 41 species in all, 37 of which occur in the Western Himalaya [12].

N. campestris and *N. eriostachya* were observed to be endemic to India [13]. Literature survey revealed that several Nepeta spp. are used in folk medicine as diuretic, diaphoretic, antitussive, antispasmodic, anti-asthmatic, febrifuge, and sedative agents, and for the antiseptic and astringent properties as topical remedy in children with cutaneous eruptions, and for snake and scorpion bites. Some species are used as medicinal herbs in Iran, for example, *N. ispahanica, N. binaloudensis, N. bracteata, N. pogonosperma*, and *N. pungens*, while *N. crispa* is used as a culinary herb. *N. caesarea*, an endemic species in Turkey, has folkloric uses in southern Anatolia and is used as a herbal tea to treat gastric disorders [14]. Fresh leaves of some endemic species of Southern Greece, such as *N. parnassica* and *N. troodi*, are chewed to alleviate toothache. An alcoholic macerate of leaves is efficacious for treatment of contusions and rheumatic pains [15,16] . *N. cataria*, the most intensively studied species, is found in the Eastern Mediterranean, Southern Asia, and China, and is commonly known as Catnip or Catmint because of its irresistible action on cats. In the early 17th century, the plant was used as a tonic and/or a disinfectant for rhinitis. More recently, catnip has been used in medicinal preparations as an antispasmodic, carminative, diaphoretic, emmenagogue, nerving, stomachic, stimulant, and mild sedative component. Its use in the treatment of gastrointestinal and respiratory hyperactive disorders, such as colic, diarrhea, cough, asthma, and bronchitis, was also reported [17]. Among the various medicinal properties, Nepeta species are famous for treating cardiovascular complaints, such as angina pectoris, cardiac thrombosis, and tachycardia and heart muscle weakness [18]. Several Iranian Nepeta species have been of great interest for use in Iranian folk and traditional medicines, and are used in the treatment of various diseases [19] including *Nepeta hindostana* for sore throat [20] and its decoction for fever and pain, such as ear and toothaches [21]. A literature survey shows that Nepeta members are rich with fatty acids, flavones, flavone glycosides, coumarins, steroids, monoterpenic lactones and eudesmane diterpenoids [22].

Indian Nepeta species [23,24]

S. N0.	Indian *Nepeta* species	Reported sites	Ref.
1	*Nepeta annua* Pallas.	Kashmir Himalaya	[24]
2	*Nepeta cataria* L.	Kashmir Himalaya	[24]
3	*Nepeta campestris* Benth.	Kashmir Himalaya	[24]
4	*Nepeta clarkei* Hook.	Kashmir Himalaya, Nainital, Malari, Chamoli	[23,24]
5	*Nepeta coerulescens* Maxim.	Kashmir Himalaya	[24]
6	*Nepeta connata* Royle ex Benth. Hook	Kashmir Himalaya	[24]
7	*Nepeta discolor* Royle ex Benth.	Kashmir Himalaya, Nainital, Malari, Chamoli	[23,24]
8	*Nepeta elliptica* Royle ex Benth.	Kashmir Himalaya,Clips, Subash Peak, Nainital	[23,24]
9	*Nepeta eriostachya* Benth.	Kashmir Himalaya	[24]
10	*Nepeta kokanica* Regel.	Kashmir Himalaya	[24]
11	*Nepeta laevigata* (D. Don) Hand.-Mazz	Kashmir Himalaya & Kumaun Himalaya	[23,24]

12	*Nepeta linearis* Royle ex Benth.	Kashmir Himalaya	[24]
13	*Nepeta nervosa* Royle ex Benth.	Kashmir Himalaya	[24]
14	*Nepeta paulsenii* Briquet in Bot.	Kashmir Himalaya	[24]
15	*Nepeta podostachys* Benth in DC.	Kashmir Himalaya	[24]
16	*Nepeta raphanorhiza* Benth.	Kashmir Himalaya	[24]
17	*Nepeta loccose* (Benth.)	Kashmir Himalaya	[24]
18	*Nepeta longibracteata* (Benth)	Kashmir Himalaya	[24]
19	*Nepeta glutinosa* (Benth.)	Kashmir Himalaya	[24]
20	*Nepeta govaniana* (Wall. ex Benth.)	Kashmir Himalaya,	[23,24]
		Nainital, Chamoli,	
21	*Nepeta erecta* (Royle ex Benth.)	Kashmir Himalaya, Hemkund Uttrakahnd	[23,24]
22	*Nepeta salviaefolia* (Royle ex Benth.)	Kashmir Himalaya	[24]
23	*Nepeta mollis* (Benth.)	Nainital,	[23]
24	*Nepeta distans* (Royle ex Benth.)	Nainital,	[23]
25	*Nepeta. graciflora* (Bentth)	Jeolikote, Nainital	[23]
26	*Nepeta gracilis* (Benth.)	Nainital,	[23]
27	*Nepeta rudelaris* (Bueh-Ham.)	Nainital,	[23]
28	*Nepeta ciliaris* (Benth.)	China Peak, Nainital	[25,26]

Chemistry of Genus Nepeta

Various types of chemical constituents within the genus have been reported, such as monoterpene derivatives, sesquiterpenes, diterpenes, triterpenes, flavonoids, phenolic compounds, essential oils, and some others. Some common constituents are listed here (Table 1 & Figure 1).

S. No.	*Nepeta species*	Major constituents from Essential Oils/ Isolates	Ref.
1	*N. clarkei* (Hook. f)	iridodial β-monoenol acetate B-sesquiphellandrene,	[27-29]
		germacrene D, α-guaiene, actinidine,	
		kaur-16-ene, pimara-7, 15-dien-3-one, caryophyllene oxide, methyl abietate, manoyl oxide	[40]
2	*N. leucophylla* (Benth.)	Iridodial β-monoenol acetate, dihydroiridodial diacetate, iridodial dienol diacetate,	[27-29]
		cyclopentanomonoterpene enol acetates,	[41]
		12-O-Methylcoleon U, ursolic acid	[43,44]
3	*N. discolor* (Royle.ex Benth.)	1,8-cineole, β-caryophyllene, p-cymene, pregeijerene, geijerene, cis-iridolactone	[27,30]
		α-pinene, β-pinene, myrcene, linalyl acetate sabinene,	[37]
4	*N. govaniana* (Benth.)	isoiridomyrmecin, pregeijerene, (+)-isoiridom , 4aα, 7α, 7aα-nepetalactone, germacrene D , β elemene , myrmecin , β-caryophyllene, 4b-dihydronepetalactone, 2a,3b,23-trihydroxyurs-12-en-28-oic acid	[20,27, 31-33, 39,46]
5	*N. elliptica* (Royle ex Benth.)	(7R)-trans,trans-Nepetalactone, 4aα, 7α, 7aβ-nepetalactone ,12-O-Methylcoleon U, dehydro-12-O-methylcoleon U	[27,42,45]

6	*N. erecta* (Benth.)	isoiridomyrmecin, caryophyllene oxide, β-bourbonene, humulene epoxide II, linalool	[38]
7	*N. spicata* (Benth.)	b-caryophyllene, linalool, germacrene D, caryophyllene oxide	[48]
8	*N. floccosa*	neral, geraniol	[31]
9	*N. royleana*	1, 8-cineole,	[31]
		4aα, 7α, 7aα-nepetalactone	[32]
10	*N. raphanorhiza* (Benth.)	(Z)-β-farnesene, Î-3-carene, Î±-bisabolene, and germacrene-d-4-ol	[34]
11	*N. coerulescens*	caryophyllene oxide, 4-(1, 5-dimethylhex-4enyl) cyclohex-2-enone, 1-butanone, 1-(2-furanyl)	[35]
12	*N.nervosa* (Royle ex)	camphene, bornyl acetate and β-bisabolene	[40]
13	*N. eriostachia*	Ursane triterpenoids	[45]
14	*N. laevigata (D.Don)* Hand.-Mazz	1, 8-cineole, caryophyllene oxide	[49]
		manool, pimaradiene, linalool, citronellal, geraniol, α-copaene, δ-cadinene, (Z)-3-hexen-1-ol,	[49]
		4aα,7a,7aα-nepetalactone, α-bisabolol oxide A, kaur-16-ene	[36]

Table 1: Chemical constituents characterized in Indian Nepeta genus.

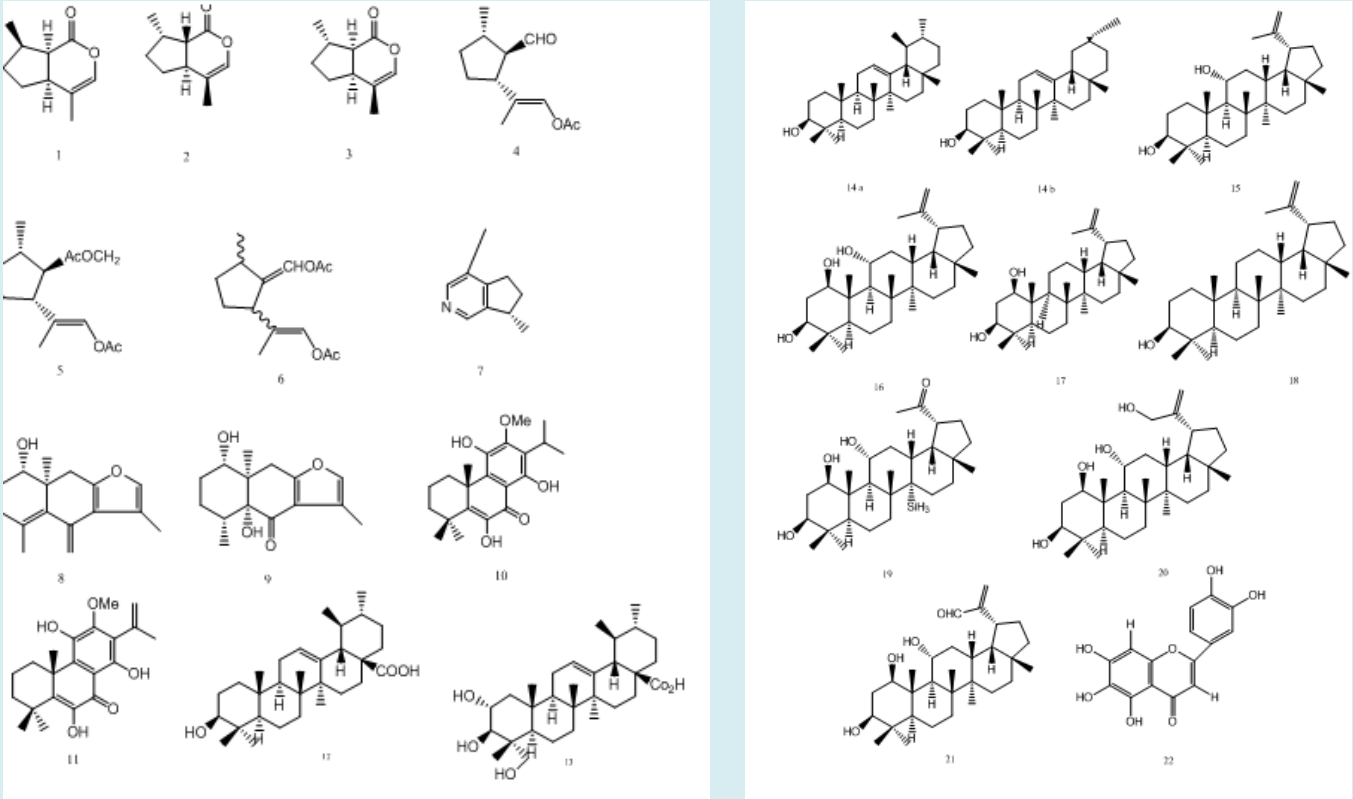

Figure 1: Structure of some common isolates from different Nepeta species.
4aα,7α,7aα-nepetalactone, 4aα,7α,7aβ- nepetalactone, 4aβ,7α,7aβ-nepetalactone, iridodial β-monoenol acetate, Iridodial dienol diacetate, Actinidine, Nehipetol, Nehipediol, 12-O-Methylcoleon U, Dehydro-12-O-methylcoleon U

Essential Oils from Some Nepeta Species from Uttrakhand and India

The essential oils obtained from different parts of plants viz. roots, stem, leaves, flowering parts etc. Genus Nepeta has been found to be rich in terpenoid hydrocarbons, sesquiterpene hydrocarbons including their oxygenated analogues [50,51]. Depending upon the composition of major compounds in the essential oils, Nepeta species contained different isomers of nepetalactone and some species contained that compounds other than isomers of nepetalactone like 1,8-cineole, β-caryophyllene, caryophyllene oxide, β-farnesene, α-citral, β-citronellol etc as their major constituents [52]. Maximum species of contains 4aα, 7α, 7aα-nepetalactone, 4aα, 7α, 7aβ-nepetalactone, 4aβ, 7α, 7aβ-nepetalactone, 4aβ, 7α, 7aα-nepetalactone as their key compounds. These species also contained isomers 4aα, 7β, 7aβ-nepetalactone, 4aα, 7β, 7aα-nepetalactone, 4α- dihydronepetalactone, 4β-dihydronepetalactone and 5, 9-dihydronepetalactone. 4aα, 7α, 7aα-nepetalactone has found as major ingredient in species like N. govaniana (Benth.) [31], *N. royleana* [32] *N. laevigata* (D.Don) Hand.-Mazz [36] 4aα,7α,7aβ-nepetalactone was reported in *N. elliptica* (Royle ex Benth.) [27]. Volatile constituents of *Nepeta ciliaris* Benth. Roots were reported from Kumaun Himalaya, major components are α-ylangene (32.1%) β-caryophyllene (16.1%), guaiacol, etc [53]. Bisht et al. [54], examined chemical composition of essential oil isolated with steam distillation from fresh flowering aerial parts of six Himalayan Nepeta species viz. *Nepeta clarkei* Hook. F., Nepeta discolor Royle ex Benth. (Collected from Malari, Chamoli), *Nepeta elliptica* Royle ex Benth. (Collected from Nainital), Nepeta erecta Benth. (Collected from Hemkund), Nepeta govaniana Benth. (Collected from Bhundiar, Chamoli and Nepeta leucophylla Benth (Collected from Nainital). The oils have been analysed by using GC and GC-MS technique. The major compounds present in six Himalayan Nepeta species have been given below in the Table 2.

Species	Compounds
N. clarkei	α-guaiene (10.0%); germacrene D (13.0%); *β*-sesquiphellandrene (22.0%) iridodial β-monoenol acetate diastereomers (25.3%)
N. discolor	*ρ*-cymene (9.8%); *β*-caryophyllene (18.6%); 1,8-cineole (25.5%)
N. elliptica	(7*R*)-*trans,trans*-nepetalactone (83.4%)
N. erecta	isoiridomyrmecin (66.7%)
N. govaniana	pregeijerene (20.7%); isoiridomyrmecin (35.2%)
N. leucophylla	iridodial dienol diacetate (7.8%); dihydroiridodial diacetate (18.2%) iridodial β-monoenol acetate (25.4%)

Table 2: Major compounds of in Himalayan Nepeta genus.

GC-MS and GC-FID analysis of oil extracted with Clevenger-type apparatus from the fresh plant material (aerial parts) of *Nepeta govaniana* from Gulmarg region of Kashmir Valley showed the presence of β-bourbonene (3.6%), β-caryophyllene (6.1%), germacrene D (9.4%) and pregeijerene (56.9%) have been the major constituents of sesquiterpene hydrocarbon present in the oil [39]. Caryophyllene oxide (25.14%) was reported from *Nepeta coerulescens* from Kargil, Jammu and Kashmir [35]. The essential oils of aerial parts of *Nepeta laevigata* from Milam glacier led to the identifying of 64 constituents accounting for 83.82% of the total oil composition. The 1, 8-cineole (9.08%), caryophyllene oxide (11.16%), manool (7.91%) and pimaradiene (4.60%) were the principal components [49].

Biological Activities

Literature survey revealed that a number of species showed different biological activities like *N. cataria* oil, nepetalic acid, and nepetalactone were evaluated for toxicological and behavioral effects in mice and rats. Catnip oil (500 mg/kg) and nepetalic acid (62.5 mg/kg) increased hexobarbital sleeping time in mice [55]. About antibacterial, antifungal, and antiviral activities, the first report on the antibacterial activity of a Nepeta species dates back to 1974, when Goutam and Purohit showed the effectiveness of N. hindostana against *Bacillus subtilis*, *Corynebacterium pyogenes, Pasteurella multocida*, and *Sarcina lutea* [56]. The volatile oil from *N. hindostana* showed also good in vitro antifungal activity against several species of Penicillium and Aspergillus [57]. Essential oils of *N. cataria* var. citriodora (lemon catnip) and N. cataria (catnip) were studied also later for their activity against some bacteria that play a role in respiratory tract and skin infections, with both reference strains being from culture collections and clinical isolates with different susceptibility to standard antibiotics. All Gram-positive strains were susceptible to the essential oils tested, exhibiting MIC values of 0.016 to 0.50% (v/v). The most susceptible one was Streptococcus pneumoniae (MIC 0.016–

0.03%). The Gram-negative respiratory tract pathogens, H. influenzae and M. catarrhalis (MIC 0.03–0.06%), were among the most sensitive, and also Acinetobacter lwoffi was remarkably susceptible (MIC 0.06–0.250%). The clinical isolates of *S. aureus, S. pyogenes, S. pneumoniae*, *H. influenzae*, and *M. catarrhalis* were all sensitive to the oils [58]. The antimicrobial activity of the essential oil and MeOH extract from *N. cataria* was also studied later. The essential oil with 4aa, 7a, 7ab- nepetalactone, 4aa, 7a, 7aa-nepetalactone and 4aa, 7b, 7aa- nepetalactone as main components exhibited activity against eleven bacteria, twelve fungi, and a yeast, *C. albicans*, with MIC values ranging from 12.50 to 250 ml/ml. The MeOH extract showed weaker activity, being active only against five bacteria and seven fungi [59]. Iridodial b-monoenol acetate, isolated from the essential oil of *N. leucophylla*, and actinidine from N. clarkei were screened for antifungal activities against *Aspergillus flavus, Aspergillus ochraceus*, *Penicillium citrinum*, and *Penicillium viridicatum*, all mycotoxin-producing taxa, and *Sclerotium rolfsii* and *Macrophomina phaseolina*, potential soybean pathogens. Iridodial b-monoenol acetate was most active against *Aspergillus ochraceus*. Both were moderately active against Bacillus anthracis and *Streptococcus pyogenes* [60,29]. Also reported that essential oils from *N.ciliaris* oil displayed maximum DPPH activity, and N.leucophylla essential oil exhibited high TAG (6.6 mg AAE/g). Iridodial ester and actinidine containing oil were from Lamiaceae was a more effective antioxidant in this studies from Kumaun region [61] in (Table 3).

Plant Species	Ethnopharmacology	Bioactivity	Major Essential Oil Components
Nepeta ciliaris Benth.	Local people in the Kedarnath Wildlife Sanctuary of Uttarakhand use a decoction of the leaves to reduce fever [62]	None reported	None reported
Nepeta clarkei Hook. f.	None reported	Aerial parts essential oil from Uttarakhand, antimicrobial *(Pseudomonas aeruginosa)* [54]	Aerial parts essential oil from Malari, Chamoli, Uttarakhand: iridodial-monoenol acetate (25.3%),sesquiphellandrene (22.0%), germacrene-D (13.0%),guaiene (10.0%) [54]. Aerial parts essential oil from Gulmarg, Kashmir: kaur-16-ene (36.6%), pimara-7,15-dien-3-one (19.7%), caryophyllene oxide (14.1%) [40]
Nepeta discolor Royle ex Benth.	In the Bhotiya tribal communities of Niti valley, Uttarakhand, India, a leaf decoction, mixed with honey, is used to treat tuberculosis [63]. In the Nubra valley [64] and the Leh-Ladakh region [65] of Kashmir, a decoction of the leaves is used to treat coughs, colds, and fever.	Essential oil from Uttarakhand, not antimicrobial [54]	Aerial parts essential oil from Malari, Chamoli, Uttarakhand: 1,8-cineole (25.5%), caryophyllene (18.6%), p-cymene (9.8%) [54]
Nepeta elliptica Royle ex Benth.	In Utturakhand, [66] and Jammu and Kashmir [67], an infusion of the seeds is used for digestive disorders.	Aerial parts essential oil from Uttarakhand, antimicrobial *(Pseudomonas aeruginosa, Serratia marcescens, Candida albicans, Trichophyton rubrum)* [54]	Aerial parts essential oil from Clips, Nainital, Uttarakhand: (7R)-trans,trans-nepetalactone (83.4%) [54]. Aerial parts essential oil from Jammu and Kashmir: elemene (23.4%), humulene (11.8%), bicyclogermacrene (13.1%) [68]

Nepeta erecta (Royle ex Benth.)	People of the Deosai Plateau of Pakistani Kashmir use the leaves of N. erecta to cure cough, cold, fever [69]	Aerial parts essential oil from Uttarakhand, antimicrobial *(Pseudomonas aeruginosa)* [54]	Aerial parts essential oil from Hemkund, Uttarakhand: isoiridomyrmecin (66.7%) [54]
Nepeta eriostachys Benth.	People in the Devikund, Bageshwar [70], and Sundardhunga Valley [71], Uttrakhand, give an extract of the leaves for fever. The whole plant is used in the Kullu district of Himachal Pradesh for eye complaints [46]	None reported.	None reported.
Nepeta floccosa Benth.	People in the cold desert of Ladakh, Kashmir prepare a decoction of the leaves as a remedy for colds, coughs, and fever [72]	None reported.	None reported.
Nepeta glutinosa Benth.	In the Nubra valley of Kashmir, a decoction of the leaves is taken to treat diarrhea, pneumonia, and fever [73]	None reported.	None reported.
Nepeta govaniana (Wall. ex Benth.)	In Murari Devi, Himachal Pradesh, a decoction of whole plant taken for colds, influenza, diarrhea, colic, insomnia, mentrual cramps [70]. In Pakistani Kashmir, a decoction of whole plant taken for sore throat, and as a cardiac tonic [71].	Aerial parts essential oil from Uttarakhand, antimicrobial *(Pseudomonas aeruginosa)* [54]	Aerial parts essential oil from Bhundiar, Chamoli, Uttarakhand: isoiridomymecin (35.2%), pregeijerene (20.7%) [54]. Aerial parts essential oil from Uttarakhand: prejeijerene (38%), geijerene (6.8%) [46]. Aerial parts essential oil from Jammu and Kashmir: pregeijerene (56.9%), germacrene D (9.4%), caryophyllene (6.1%), torreyol (5.1%) [39]
Nepeta juncea Benth.	None reported.	Aerial parts essential oil from Jammu and Kashmir, antifungal *(Aspergillus umigatus, Trichophyton mentagrophytes, Trichophyton rubrum)* [76].	Aerial parts essential oil from Jammu and Kashmir: nepetalactone (71.8%) [74].
Nepeta laevigata (D. Don) Hand.-Mazz.	In Pakistani Kashmir, an infusion of seeds used to treat dysentery [75]. In the Naran valley, Khyber Pakhtunkhwa, Pakistan, powders of the dried plants used to treat colds, fevers, and headaches [76].	Aerial parts essential oil from Kumaun, Uttarakhand, radical-scavenging (DPPH) [77].	Aerial parts essential oil from Jammu and Kashmir: citronellol (16.5%), caryophyllene (10.8%), germacrene D (19.4%), bisabolol oxide B (12.4%) [68]. Aerial parts essential oil from Kumaun, Uttarakhand: 1,8-cineole (11.1%), caryophyllene (5.7%), caryophyllene oxide (15.2%), manool (7.9%) [49].

Nepeta leucophylla Benth.	Local healers in the Baglund district, Nepal, recommend using the root juice for fever [78]. In Utturakhand, a leaf paste used to treat malaria [66].	Aerial parts essential oil from Uttarakhand, antimicrobial (Pseudomonas aeruginosa, Trichophyton rubrum) [54]	Aerial parts essential oil from Nainital, Uttarakhand: iridodial monoenol acetate (25.4%), dihydroiridodial diacetate (18.2%), iridodial dienol diacetate (7.8%) [54].
Nepeta longibracteata Benth.	In the Nubra valley of Kashmir, the whole plant is used for stomach [64]	None reported.	None reported.
Nepeta raphanorhiza Benth.	None reported.	None reported.	Aerial parts essential oil from Kashmir: (Z)-farnesene (49.2%), 3-carene (12.3%), bisabolene (9.4%), germacrene D-4-ol (5.8%) [34].
Nepeta royleana R.R. Stewart	None reported.	None reported.	Aerial parts essential oil from Himachal Pradesh: 1,8-cineole (75%) [31].

Table 3: Summary of Ethnopharmacology, biological activities and essential oil compositions of Himalayan aromatic medicinal plants.

Conclusion

Nepeta is the second largest genus of the Indian labiates, with 41 species in all, 37 of which occur in the Western Himalaya, and many of them have been used as traditional herbal medicines. Nevertheless, there are still many Nepeta species that have received no or only a little attention; in the future, to search for more potential bioactive components, much more phytochemical and biological studies should be carried out on this genus. It has been found from the literature that the most of species growing in the Himalayas region have been contained compounds other than nepetalactone as major constituents in their essential oils as compare to the species growing in other part of the world (Iran, Tehran, Serbia, Egypt, Turkey, Brazil, USA), which have both nepetalactone along with its derivatives and other than nepetalactone compounds as the major ingredient of their essential oils. Active ingredients isolated from genus Nepeta has been reported to show wide array of biological activity in medicinal and agriculture field. The present review is prepared with the help of previously published articles and literature review [79-81]. In Uttrakhand plenty of medicinally important plants are present, in which Nepeta genus is one of them. But the more analysis is required of this genus to make pharmaceutically important compounds and useful products from this species.

Conflict of Interest

There is no conflict of interest.

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