

The Genus *Lagochilus* (Lamiaceae)

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The genus *Lagochilus* (Lamiaceae) is native to Central, South-Central, and Eastern Asia.

Lagochilus

Lamiaceae

diversity

traditional medicine

phytochemistry

secondary metabolites

pharmacology

biological properties

1. Introduction

Terrestrial plants have been used for centuries as an endless well for supplying many medicinally important secondary metabolites that are used effectively in curing various ailments. They are considered as the milestone of all the traditional medicinal systems used throughout the whole world since antiquity. This fact attracted researchers in drug discovery to explore these plants frequently with the aim of finding new secondary metabolites or to validate the claimed ethnopharmacological uses.

Family Lamiaceae (the mint family) is among the largest family that contains about 236 genera and 6900 to 7200 species. The family is famous for many of its widely used genera including *Salvia*, *Scutellaria*, *Stachys*, *Plectranthus*, *Hyptis*, *Teucrium*, *Vitex*, *Thymus*, and *Nepeta*. Members from the Lamiaceae are important ornamental, medicinal, and aromatic plants and have been used as traditional herbal medicines for thousands of years^[1]. They are also used as culinary herbs, spices, and vegetables and as ingredients in cosmetics, hygienic products, and perfumes^[2].

The genus *Lagochilus* is a small genus that comprises about 44 species that are native to Central, South-Central, and Eastern Asia^{[3][4]}. It is highly drought-tolerant and is considered a typical mountain plant. Most of these species have been commonly used as herbal medicines for the treatment of various ailments for thousands of years, especially in Asian countries. Species of this genus exhibit various pharmacological effects, such as hemostatic, antispasmodic, and anti-edemic properties, and can be used against bleeding, coronary heart disease, chest pain, skin conditions, stomach pain, and as a tranquilizer. The most reported properties include relaxation, insomnia, dementia, euphoria, and subtle perceptual changes. *Lagochilus* is also used for the treatment of allergies and skin diseases^{[5][6][7][8][9]}. Pharmacological studies indicated that mainly diterpenoids have hemostatic abilities^{[10][11]}.

Previous chemical investigations on the genus are limited due to the fact that many species are classified endangered, and the collection of these plants is not easy. However, this effort on the chemical profiling of the plants belonging to the genus led to the isolation and characterization of many diterpenes, flavonoids, iridoids,

triterpenes, and polysaccharides. The diterpene lagochiline and its derivatives are among the promising hemostatic agents [5][7][10][11].

2. Taxonomy and Botany

Within the Lamiaceae family, *Lagochilus* belongs to the subfamily Lamioideae and tribe Leonureae Dumort[12]. Species of *Lagochilus* are subshrubs or perennial herbs (Figure 1). Rootstocks are woody. Stems are green-white, rigid, and sparsely hirsute. The leaf blade is rhombic, palmatipartite, or pinnatipartite, with lobes spinescent, sometimes subtending sterile spinescent bracteoles. Normally, 2–10 flowers grow vertically. The calyx is campanulate to tubular-campanulate, 5-veined; throat oblique, straight; teeth five, subequal or three posterior teeth longer, triangular to oblong or broadly ovate, usually longer than the tube, apex spinescent. Corolla is villous outside, pilose annulate inside, 2-lipped; upper lip oblong, straight, slightly concave, 2-lobed or 4-toothed; lower lip obliquely spreading, 3-lobed; middle lobe largest, obcordate, 2-lobulate; lateral lobes straight, acute, or emarginate. Stamens are four, exserted or sub included, anterior two longer; with filaments complanate; anther cells two, parallel or divergent, ciliate. Style is filiform, apex subequally 2-cleft. Nutlets are flattened-obconical, oblong–obovoid or oblong–ovoid, apex truncate or rounded, glandular, dusty hairy, scaly, or glabrous, smooth.



Figure 1. Photograph for some *Lagochilus* species from Uzbekistan Flora (A): *L. inebrians* Bunge, (B): *L. nevskii* Knorring, (C): *L. occultiflorus* Rupr., (D): *L. olgae* Kamelin, (E): *L. platycalyx* Schrenk, (F): *L. proskorjakovii* Ikramov, (G): *L. seravschanicus* Knorring, (H): *L. setulosus* Vved., (I): *L. vvedenskyi* R. Kam. (Photos A, B, D, G are taken by Natalya Beshko, photos C, H are taken by Alim Gaziev, photo E is taken by Tulkin Tillaev, photos F, I are taken by Akbar Akhmedov).

3. Diversity

The genus *Lagochilus* is mostly distributed on dry slopes, in valleys, and deserts from Iran to Mongolia, Russia (south Siberia), northwest China, north Pakistan^[4] and has a distributional center in Tianshan Mountains and Central Asia. The results of the studies of Zhang et al. ^[3] showed that the Tianshan Mountains, especially the western Ili-Kirghizia Tianshan, as well as Sunggar and Kaschgar, were the ancestral area. The ancestral biome was mainly in the montane steppe zone of valley and slope at altitudes of 1700 ± 2700 m above sea level, and the montane desert zone of foothill and front-hill at 800 ± 1700 m. The main center of diversity lies in Central Asia. According to Tskervanik^[12], in world flora, there are 44 species that can be distinguished in *Lagochilus*. According to the taxonomy of this author, 34 species grow in the territory of the CIS (Commonwealth of Independent States).

In the flora of Uzbekistan, this genus is represented by 18 species (Table 1)^[13]. Taxa of the genus *Lagochilus* basically occur throughout the territory of Uzbekistan, starting from the deserts to Tian-Shan and Pamir-Alay mountain systems. The majority of species can be found in the Pamir-Alai Mountain, south-west of Tian-Shan and Turanian lowland^[13]. Species from the genus *Lagochilus* belong to the most vulnerable plant species from the Lamiaceae family. Out of the existing 18 *Lagochilus* species in the flora of Uzbekistan, four are included in the Red Book of the Republic of Uzbekistan^[14]: *L. vvedenskyi*, *L. olgae*, *L. proskorjakovii*, and *L. inebrians*. The main population of these species grows in Nuratau and Kyzylkum deserts. On the basis of occurrence, these Red List plant species belong to category I (disappearing) and II (rare species). In addition, the natural distribution of other species from this genus, such as *L. gypsaceus* and *L. acutilobus*, are also limited across the country^[15]. In the territory of South Kazakhstan, 10 species of *Lagochilus* were found, and the areas of these species are located in Karatau, Karzhantau, and Aksu-Zhabagly^[16]. In the Flora of China, there are 14 *Lagochilus* species distributed wildly in the northwest region. One of the species, *L. ilicifolius*, grows in the desert (sandy land) and steppe in northwestern China (Neimeng, Gansu, Shanxi, and Ningxia provinces), whereas the other 13 species are distributed mainly in the Xinjiang region^{[3][10][17]}. The Flora of Iran comprises six species, and four of them (*L. macranthus* Fisch and C.A. Mey., *L. quadridentatus* Jamzad, *L. lasiocalyx* (Stapf) Jamzad, and *L. aucheri* Boiss.) are endemic to Iran^{[4][18][19]}. Three species of *Lagochilus* are found in Mongolian flora, and they are widely distributed in the Khangai, Mongolian Altai, Middle Khalkha, Depression of Great Lakes, Valley of Lakes, East Gobi, Gobi-Altai, Transaltai Gobi, Alashan Gobi regions (Table 1)^{[20][21]}.

Table 1. Diversity and distribution of different *Lagochilus* species in Asia.

Distribution	Region	Species	Reference
Afghanistan	western Himalaya	<i>L. cabulicus</i> Benth., <i>L. cuneatus</i> Benth., <i>L. hindukushi</i> Kamelin and Gubanov, <i>L. schugnanicus</i> Knorring	https://wcsp.science.kew.org/
China	northwestern China, Xinjiang region (Ili Valley, the Karakoram	<i>L. ilicifolius</i> Bunge ex Benth., <i>L. grandiflorus</i> C. Y. Wu and Hsuan, <i>L. platyacanthus</i> Rupr., <i>L. kaschgaricus</i> Ruprecht, <i>L. diacanthophyllus</i> (Pall.) Benth, <i>L.</i>	^{[3][10][17]} https://wcsp.science.kew.org/

Distribution	Region	Species	Reference
	and Altai Mountains)	<i>hirtus</i> Fisch. and C.A. Mey., <i>L. bungei</i> Benth., <i>L. macrodontus</i> Knorring, <i>L. kaschgaricus</i> Rupr., <i>L. lanatonodus</i> C.Y. Wu and S.J. Hsuan, <i>L. leiacanthus</i> Fisch. and C.A. Mey., <i>L. pungens</i> Schrenk, <i>L. xianjiangensis</i> G.J. Liu	
Iran		<i>L. alutaceus</i> Bunge., <i>L. cabulicus</i> Benth., <i>L. macranthus</i> Fisch and C.A. Mey., <i>L. quadridentatus</i> Jamzad, <i>L. lasiocalyx</i> (Stapf) Jamzad, <i>L. aucheri</i> Boiss.	[4][18][19]
Kazakhstan	Karatau, Karzhantau, Aksu-Zhabagly	<i>L. acutilobus</i> (Ledeb.) Fisch. and C.A. Mey., <i>L. bungei</i> Benth., <i>L. longidentatus</i> Knorr., <i>L. pulcher</i> Knorr., <i>L. taucumensis</i> Zucker., <i>L. inebrians</i> Bunge, <i>L. androsswii</i> Knorr., <i>L. leiacanthus</i> Fisch. et Mey, <i>L. pungens</i> Schrenk, <i>L. hirtus</i> Fisch. et Mey, <i>L. diacanthophyllus</i> Benth., <i>L. kaschgaricus</i> Rupr., <i>L. knorringianus</i> Pavlov, <i>L. occultiflorus</i> Rupr., <i>L. platyacanthus</i> Rupr., <i>L. platycalyx</i> Schrenk ex Fisch. and C.A. Mey, <i>L. seravschanicus</i> Knorring, <i>L. setulosus</i> Vved., <i>L. subhispidus</i> Knorring	[16] https://wcsp.science.kew.org/
Kyrgyzstan	Tian-Shan and Pamir Alai Mountains	<i>L. diacanthophyllus</i> (Pall.) Benth, <i>L. drobovii</i> Kamelin and Tzukerv., <i>L. hirsutissimus</i> Vved, <i>L. kaschgaricus</i> Rupr., <i>L. knorringianus</i> Pavlov, <i>L. occultiflorus</i> Rupr., <i>L. paulsenii</i> Briq., <i>L. platyacanthus</i> Rupr., <i>L. platycalyx</i> Schrenk ex Fisch. and C.A. Mey, <i>L. pubescens</i> Vved., <i>L. pulcher</i> Knorring, <i>L. schugnanicus</i> Knorring, <i>L. turkestanicus</i> Knorring	https://wcsp.science.kew.org/
Mongolia	Mongolian Altai and Khangai Mountains, Gobi regions	<i>L. bungei</i> Benth., <i>L. diacanthophyllus</i> , <i>L. ilicifolius</i> Bge	[20][21]
Pakistan	Western Pakistan	<i>L. cabulicus</i> Benth., <i>L. cuneatus</i> Benth., <i>L. schugnanicus</i> Knorring	https://wcsp.science.kew.org/
Tajikistan	Pamir-Alay Mountains	<i>L. botschantzevii</i> Kamelin and Tzukerv., <i>L. gypsaceus</i> Vved., <i>L. hirsutissimus</i> Vved, <i>L.</i>	https://wcsp.science.kew.org/

Distribution	Region	Species	Reference
		<i>inebrians</i> Bunge, <i>L. knorringianus</i> Pavlov, <i>L. kschtutensis</i> Knorring, <i>L. nevskii</i> Knorring, <i>L. paulsenii</i> Briq., <i>L. platyacanthus</i> Rupr, <i>L. platycalyx</i> Schrenk ex Fisch. and C.A. Mey, <i>L. pubescens</i> Vved, <i>L. schugnanicus</i> Knorring, <i>L. seravschanicus</i> Knorring, <i>L. turkestanicus</i> Knorring	
Turkmenistan		<i>L. balchanicus</i> Czerniak., <i>L. gypsaceus</i> Vved., <i>L. inebrians</i> Bunge, <i>L. cabulicus</i> Benth.	https://wcsp.science.kew.org/
Uzbekistan	Nuratau and Kyzylkum deserts, Tian-Shan and Pamir-Alay Mountains	<i>L. acutilobus</i> (Ledeb.) Fisch. et C. A. Mey., <i>L. botschantzevii</i> Kamelin et Zukerv., <i>L. diacanthophyllus</i> (Pall.) Benth., <i>L. gypsaceus</i> Vved., <i>L. hirsutissimus</i> Vved., <i>L. inebrians</i> Bunge, <i>L. knorringianus</i> Pavlov, <i>L. kschtutensis</i> Knorr., <i>L. nevskii</i> Knorr., <i>L. occultiflorus</i> Rupr., <i>L. olgae</i> R. Kamelin, <i>L. paulsenii</i> Briq., <i>L. pubescens</i> Vved., <i>L. platyacanthus</i> Rupr., <i>L. setulosus</i> Vved., <i>L. platycalyx</i> Schrenk, <i>L. seravschanicus</i> Knorr., <i>L. vvedenskyi</i> R. Kam. et Zucker.	[13][15]

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