

Medical Benefit of *Lallemantia Iberica*- A Review

Ali Esmail Al-Snafi

Department of Pharmacology, College of Medicine, Thi qar University, Nasiriyah P O Box 42, Iraq. Cell: aboahmad61@yahoo.com

Abstract

Lallemantia iberica (Family: Lamiaceae) is used traditionally as stimulant, diuretic, expectorant, in the treatment of common cold, coughing, stomach, and abdominal pain. It produced many secondary metabolites such as phenolic acids, flavonoids, tannins, triterpen, mucilage, and oil. It possessed many pharmacological effects included analgesic, antibacterial, and antioxidant effects. The current review discussed the chemical constituents and pharmacological effects of *Lallemantia iberica*.

Keywords: Constituents, Pharmacology, *Lallemantia Iberica*.

Introduction

As a result of accumulated experience from the past generations, today, all the world's cultures have an extensive knowledge of herbal medicine. Two-thirds of the new chemicals identified yearly are extracted from higher plants. 75% of the world's population used plants for therapy and prevention. In the US, where chemical synthesis dominates the pharmaceutical industry, 25% of the pharmaceuticals are based on plant-derived chemicals⁽¹⁾. Recent reviews revealed that the medicinal plants possessed a wide range of pharmacological effects⁽²⁻¹³⁾. *Lallemantia iberica* (Family: Lamiaceae) is used traditionally as stimulant, diuretic, expectorant, in the treatment of common cold, coughing, stomach, and abdominal pain. It produced many secondary metabolites such as phenolic acids, flavonoids, tannins, triterpen, mucilage, and oil. It possessed many pharmacological effects included analgesic, antibacterial, and antioxidant effects. The current review discussed the chemical constituents and pharmacological effects of *Lallemantia iberica*.

Plant profile:

Synonyms: *Dracocephalum aristatum*, *Dracocephalum ibericum*, *Lallemantia kopetdaghensis*, *Lallemantia sulphurea*⁽¹⁴⁾.

Taxonomic classification:

Kingdom: Plantae, **Phylum:** Spermatophyta, **Subphylum:** Angiospermae, **Class:** Dicotyledonae, **Order:** Lamiales, **Family:** Lamiaceae, **Genus:** *Lallemantia*, **Species:** *Lallemantia iberica*⁽¹⁴⁻¹⁵⁾.

Common names:

Arabic: Simsim Bari; **English:** Dragon's head; **German:** kaukasischer Ölziest, **Persian:** Balangooshahri; **Swedish:** småblommigazurläpp; **Turkish:** ajdarbaşı⁽¹⁵⁻¹⁶⁾.

Distribution:

It is native to Asia; Armenia; Azerbaijan; Russian Federation-Ciscaucasia, Turkmenistan, Iran, Iraq, Palestine, Jordan, Lebanon, Syria, and Turkey. In Europe, it is recorded in Belgium, France, Romania, and Russian Federation^(14, 17)



Description:

It is an annual or perennial herb, or dwarf shrub, at maturity stage, the plant high is of 40.8 cm. The leaves are disposed in pairs on each stem node (opposite leaves), the average number of pair leaves on the main stem been 16. The leaf length on the main stem increases from the bottom up to the leaf four then decreases upwards. Each leaf has tow bracts, one on each side of the leaf, each bract having a stalk of 2 mm length and the edge with awns. The branching process takes place at the first six nodes on the main stem, the branches developing from each leaf axils (opposite branches). The inflorescence starts to develop in verticillus from the seventh node upwards the stem, once the seventh pair of leaves is fully unfolded. Calyx presents five triangular teethe, among which two are inferiors, two lateral, and one superior; corolla has white color and presents two lips, the upper lip with two lobes, and the lower lip with three lobes; there are four stamens, two of them longer and two of them shorter⁽¹⁸⁾.

Traditional uses:

Lallemantia iberica seeds are traditionally used as reconstitute, stimulant, diuretic, and expectorant, for the treatment of common cold, coughing, stomach and abdominal pain⁽¹⁹⁻²⁰⁾. Its seed contained mucilage which used in the treatment of nervous, hepatic, and renal diseases and as a general tonic⁽²¹⁾. Oil is used for lighting, as a varnish, in paints, and as a lubricant. The oil may also be used for oil-foods and as a tanning agent. It is considered as a linseed substitute in a number of applications including: wood preservative, ingredient of oil-based paints, furniture polishes, printing inks and soap making. It is also used in the manufacture of linoleum⁽²²⁻²³⁾.

Chemical constituents:

Lallemantia iberica produced a number of secondary metabolites such as phenolic acids, flavonoids, tannins and triterpen^(19, 24). The seed of Lallemantia iberica contained up to 30% (even 35-38%) of dryingoil^(18, 25). Lallemantia oil content of fatty acid is the following: 6.5% palmitic acid, 1.8% stearic acid, 10.3% oleic acid, 10.8% linoleic acid, and 68.0% linolenic acid⁽²⁰⁾.

The lipid composition of the seed oil of three varieties (L-74, VIR-11, and BGR-455) of Lallemantia iberica from Bulgaria is studied. Triacylglycerols (>90%), phospholipids (<3%), sterol esters (~0.2%), with accompanying compounds [sterols (~0.3%) and tocopherols (336-499 mg/kg)] are determined. Nineteen triacylglycerols species are identified, of these the highly unsaturated trilinolenin, dilinolenyllinoleate and dilinolenylpalmitate comprised 59% of the total triacylglycerols. Phosphatidylcholine, phosphatidylinositol, and phosphatidyl ethanolamine are the main phospholipids. Beta-sitosterol is the main sterol component, followed by campesterol and stigmasterol. Gamma-tocopherol predominated (>90%) in the tocopherol fraction. Palmitic acid is the major fatty acid of the phospholipids and oleic acid dominated in the sterol ester fraction. The three varieties showed similar lipid compositions with BGR-455 being slightly more saturated²⁶.

The volatile oil analysis of the aerial parts of Lallemantia iberica growing wild in Iran showed that the oil of the aerial parts contained 11 compounds. It mainly consisted of germacrene-D (33.7%), delta-3-carene (19.0%), isocaryophyllene (12.8%), sabinene (11.1%), alpha-terpinene acetate (6.5%) and limonene (4.4%)⁽²⁷⁾.

The essential oil analysis of wild-growing Lallemantia iberica in Turkey revealed identifying of 40 components. Germacrene-D (36.0 %), β -caryophyllene (18.3 %) and bicyclogermacrene (9.7 %) represented the main constituents⁽²⁸⁾.

The chemical components of the essential oils of the arial parts of Lallemantia iberica, collected in 2 stages (flowering and post-flowering) in Hashtgerd of Iran are examined by GC and GC-MS. 36 components are characterized in flowering stage, β -cubeben (19.55%), linalool (18.71%), spathulenol (18.04%), β -caryophyllene (11.11%), geraniol (3.50%) and bicyclogermacrene (3.46%) are the major constituents. Constituents represented monoterpenes (33.85%) and sesquiterpens (63.54%). About 39 components of essential oil of post-flowering

stage are detected, caryophyllene oxide (38.77%), linalool (15.15%), Germacrene-D (7.03%), Trans-caryophyllene (5.61%), β -bourbonene (4.96%) and Trans-geraniol (4.34%) as the major constituents. Components represented monoterpenes (26.51%) and sesquiterpenes (69.23%)⁽²⁹⁾.

The analysis of essential oils of the dried flowering aerial parts of *Lallemantia iberica* from the suburb of Larijan, north of Iran, showed that the main constituents are, p-cymene (22.1%), isophytol (19.8%), T-cadinol (11.1%), 3-octanol (8.1%), caryophyllene oxide (7.4%) and terpinen-4-ol (5.7%)⁽³⁰⁾.

The hydrodistillation of *Lallemantia iberica* callus provided colorless oil with a yield of 0.1% (v/w). The GC-MS analysis of the essential oil revealed nine components representing 97.52% of the oil. The oil mainly consisted of thymol (53.03%), octane (19.90%), decane (5.73%), and carvacrol (5.63%). The oil is characterized by oxygenated monoterpenes (58.68%) and hydrocarbones (35.13%)⁽³¹⁾.

Two sterols, β -sitosterol acetate, β -sitosterol, one triterpenoic acid, ursolic acid, one polyphenol, rosmarinic acid and six flavonoides: luteolin-7-O-glucoside, 4'-methoxy-luteolin-7-O-glucoside, apigenin-7-O-glucoside, luteolin, diosmetin and apigenin are isolated from the ethyl acetate and methanol extracts of *Lallemantia iberica* aerial parts⁽³²⁾.

A putrescine bisamide phenolic glycoside, N-(trans-feruloyl)-N'-(para-hydroxybenzoyl) putrescine bisamide-4'-O- α -l-rhamnopyranoside and phenolic glycoside, cucurbitoside D, are isolated from the seeds of *Lallemantia iberica*⁽³³⁾.

Analysis of *Lallemantia iberica* seed gum showed that the seed gum is a high molecular weight polysaccharide (5.74×10^6 g/mol) containing, 89.60% carbohydrate, 2.98% protein, 8.95% ash, 0.2% fat and 6.52% moisture⁽³⁴⁾.

The dried mucilage of *Lallemantia iberica* had average 4.93% moisture, 95.06% dry weight and 0.28% ash⁽²²⁾. It composed of galacturonic acid, galactose, mannose, arabinose, xylose, glucose and rhamnose monosaccharide⁽²⁵⁾.

Pharmacological effects:

Analgesic effect:

The antinociceptive effect of methanolic extract of (80, 100 and 300 mg/kg, ip) of *Lallemantia iberica* is evaluated in rats. *Lallemantia iberica* leaf extract significantly inhibited the number of contractions induced by acetic acid. All doses showed antinociceptive activity in the tail flick model. In formalin test, the highest effect is observed at dose of 300 mg/kg ($p < 0.01$)⁽³⁶⁾.

Antibacterial effect:

The antibacterial effect of *Lallemantia iberica* seed extracts is studied against *Pseudomonas aeruginosa*, *P. fluorescens*, *Bacillus subtilis*, *B. anthracoid*, *B. coagulans*, *B. cereus*, *B. sphaericus*, *Escherchia coli* O157, *Salmonella typhimorium* ATCC3598, using disk-diffusion antibiotic sensitivity testing. The seed hydroalcoholic extract of *Lallemantia iberica* possessed high antibacterial effect against *Pseudomonas aeruginosa* (18.3 ± 6.5 mm), *Bacillus subtilis* (16.6 ± 4.1 mm) and *Bacillus sphaericus* (15.3 ± 3 mm). This extract also exerted moderate effect against *Salmonella typhimorium* ATCC3598 (14.6 ± 2.3 mm), *Bacillus cereus* (11.3 ± 2.5 mm) and *Escherchia coli* O157 (9.6 ± 1.5 mm). Other bacteria are not affected by *Lallemantia iberica* seed extract⁽³⁷⁾.

Antioxidant effect:

The antioxidant activity of the ethyl acetate (IC_{50} 189.95 ± 2.8 μ g/ml) and the methanol extracts (IC_{50} 140 ± 1.2 μ g/ml) are compared to the standard antioxidant, BHA (IC_{50} 100 ± 1.6 μ g/ml) in DPPH method. The reducing

power of the ethyl acetate (300.28 $\mu\text{mol Eq FeSO}_4 \cdot 7\text{H}_2\text{O}/\text{mg DW}$), and methanol extract (553.14 $\mu\text{mol Eq FeSO}_4 \cdot 7\text{H}_2\text{O}/\text{mg DW}$) and BHA (558.36 $\mu\text{mol Eq FeSO}_4 \cdot 7\text{H}_2\text{O}/\text{mg}$ of standard) are elucidated in FRAP assay⁽³²⁾.

The essential oils from the arial parts of *Lallemantia iberica* showed antioxidant activities as calculated by two in vitro assays; DPPH radical scavenging and ferric reducing power assay (FRAP). All samples possessed inhibitory activity, essential oils in post-flowering exhibited the highest radicals scavenging potential ($\text{IC}_{50}=70\mu\text{g}/\text{ml}$) following by essential oils in flowering stage ($\text{IC}_{50}=100\mu\text{g}/\text{ml}$). The greatest activity is obtained by essential oils in post-flowering stage ($\text{IC}_{50}=70\mu\text{g}/\text{ml}$), it is more effective than BHA ($\text{IC}_{50}=100\mu\text{g}/\text{ml}$), and less effective than α -tocopherol ($\text{IC}_{50}=40\mu\text{g}/\text{ml}$)⁽²¹⁾.

Conclusion:

Lallemantia iberica (Family: Lamiaceae) is used traditionally as stimulant, diuretic, expectorant, in the treatment of common cold, coughing, stomach, and abdominal pain. It produced many secondary metabolites and possessed many pharmacological effects. The current review discussed the chemical constituents and pharmacological effects of *Lallemantia iberica* as a promising therapeutic agent because of its efficacy and safety.

References:

1. Orhan IE. Biotechnological production of plant secondary metabolites. Bentham ebook, 2012: 107.
2. Al-Snafi AE. Arabian medicinal plants with antiurolithiatic and diuretic effects - plant-based review (Part 1). IOSR Journal of Pharmacy 2018; 8(6): 67-80.
3. Al-Snafi AE. Arabian medicinal plants affected female fertility- plant-based review (part 1). IOSR Journal of Pharmacy 2018; 8(7): 46-62.
4. Al-Snafi AE. Arabian medicinal plants for the treatment of intestinal disorders- plant-based review (part 1). IOSR Journal of Pharmacy 2018; 8(6): 53-66.
5. Al-Snafi AE. Medicinal plants affected contractility of smooth muscles- A review. IOSR Journal of Pharmacy 2018; 8(11): 22-35.
6. Al-Snafi AE. Arabian medicinal plants possessed gastroprotective effects- plant-based review (part 1). IOSR Journal of Pharmacy 2018; 8(7): 77-95.
7. Al-Snafi AE. Arabian medicinal plants with analgesic and antipyretic effects- plant-based review (part 1). IOSR Journal of Pharmacy 2018; 8(6): 81-102.
8. Al-Snafi AE. Arabian medicinal plants with antiinflammatory effects- plant-based review (part 1). IOSR Journal of Pharmacy 2018; 8 (7): 55-100.
9. Al-Snafi AE and Thwaini MM. Nephro- protective effects of Arabian medicinal plants (part 1). Research Journal of Pharmaceutical, Biological and Chemical Sciences 2018; 9(5): 1504-1511.
10. Al-Snafi AE and Thwaini MM. Arabian medicinal plants with hepatoprotective activity (part 1). Research Journal of Pharmaceutical, Biological and Chemical Sciences 2018; 9(5): 1469-1497.
11. Al-Snafi AE. Arabian medicinal plants with dermatological effects- plant-based review (part 1). IOSR Journal of Pharmacy 2018; 8(10): 44-73.
12. Al-Snafi AE, Majid WJ, and Talab TA. Medicinal plants with antidiabetic effects - An overview (Part 1). IOSR Journal of pharmacy 2019; 9(3): 9-46.

13. Al-Snafi AE, Talab TA, and Majid WJ. Medicinal plants with central nervous activity - An overview (Part 1). IOSR Journal of pharmacy 2019; 9(3): 52-102.
14. The Plant List, *Lallemantia iberica*. <http://www.theplantlist.org/tpl1.1/record/kew-107339>
15. U.S. National plant germplasm system, *Lallemantia iberica*, <http://tn-grin.nat.tn/gringlobal/taxonomydetail.aspx?id=21413>
16. EPPO Global Database, *Lallemantia iberica*, <https://gd.eppo.int/taxon/LALIB>
17. CABI, Invasive Species Compendium, *Lallemantia iberica*, <https://www.cabi.org/isc/datasheet/115106>
18. Ion V, Basa AGh, Sandoiu DI, Obrisca M. Results regarding biological characteristics of the species *Lallemantia iberica* in the specific conditions from South Romania. Scientific Papers UASVM Bucharest, Series A 2011; I(LIV): 275-280.
19. Asghari G, Akbari M and Asadi-Samani M. Phytochemical analysis of some plants from Lamiaceae family frequently used in folk medicine in Aligudarz region of Lorestan province. Marmara Pharmaceutical Journal 2017; 21(3): 506-514.
20. Samadi S, Khaiyamiand M, and Tappe AHG. A Comparison of important physical and chemical characteristics of six *Lallemantia iberica* (Bieb.) Fisch. and Mey. varieties. Pakistan Journal of Nutrition 2007; 6 (4): 387-390.
21. Amanzadeh Y, , KhosraviDehaghi N, Gohari AR, Monsef-Esfehani HR, and Amanzadeh Ebrahimi ES. Antioxidant activity of essential oil of *Lallemantia iberica* in flowering stage and post-flowering stage. Research Journal of Biological Sciences 2011; 6(3): 114-117.
22. Shafiee S, ModaresMotlagh A, Minaee S and Haidarbigi K. Moisture dependent physical properties of dragons head seeds (*Lallemantia iberica*). Agricultural Engineering International: The CIGR E-Journal. 2009; Vol. XI: Manuscript 1192.
23. Abdoli S and Shafagh-Kolvanagh J. Relationship between biological yield and some agronomic traits of common ecotypes of *Lallemantia* (*Lallemantia iberica* Fisch. et C.A. Mey) from Iran. J Bio & Env Sci 2017; 10(5): 267-274.
24. Khosravidehagi, N. Phytochemical investigation of *Lallemantia iberica*. Ph.D. thesis, Tehran University of Medical Sciences, Tehran, Iran 2012.
25. Fekri N, Khayami M, Heyderi R, and Jaadi A. Isolation and identification of monosaccharide of mucilage in dragon's head by thin-layer chromatography. Iranian J Medicinal and Aromatic Plants 2008; 2 (40):207-216.
26. Zlatanov M, Antova G, Angelova-Romova M, Momchilova S, Taneva S and Nikolova-Damyanova B. Lipid structure of *Lallemantia* seed oil: A potential source of omega-3 and omega-6 fatty acids for nutritional supplements. Journal of the American Oil Chemists' Society 2012; 89(8): 1393-1401.
27. Nori-Shargh D, Kiaei SM, Deyhimi F, Mozaffarian V and Yahyaei H. The volatile constituents analysis of *Lallemantia iberica* (M.B.) Fischer & Meyer from Iran. Nat Prod Res 2009; 23(6):546-548.
28. Yucebabacan E and Bagci E. Study of the essential oil composition of *Lallemantia iberica* (M. Bieb.) Fisch. and C.A. Mey. (Lamiaceae) from Turkey.

29. Amanzadeh Y, KhosraviDehaghi N, Gohari AR, Monsef-Esfehani HR, and Ebrahimi ES. Antioxidant activity of essential oil of *Lallemantia iberica* in flowering stage and post-flowering stage. *Research Journal of Biological Sciences* 2011; 6(3): 114-117.
30. Moteza-Semnani K. Essential oil composition of *Lallemantia iberica* Fisch. et C.A. Mey. *Journal of Essential Oil Research* 2006;18(2):164-165.
31. Razavi SM, Arshneshin H and Ghasemian A. In vitro callus induction and isolation of volatile compounds in callus culture of *Lallemantia iberica* (M. Bieb.) Fisch. & C. A. Mey. *Journal of Plant Process and Function* 2017; 5(18): 65-68.
32. KhosraviDehaghi N, Gohari AR, Sadat-Ebrahimi SS, Naghdi Badi H, and Amanzadeh Y. Phytochemistry and antioxidant activity of *Lallemantia iberica* aerial parts. *Res J Pharmacog.* 2016; 3(3):27-34.
33. Khosravidehaghi N, Lai D, Amanzadeh Y, and Chaidir C. A new putrescine bisamide phenolic glycoside from the seeds of *Lallemantia iberica* (M. Bieb.) Fisch. & C. A. Mey. *Phytochemistry Letters* 2012; 5(3):643–646.
34. Fathi M, Emam-Djomeh Z, and Sadeghi A. Extraction, characterization and rheological study of the purified polysaccharide from *Lallemantia iberica* seeds. *International Journal of Biological Macromolecules* 2018; 120 (Pt A), DOI:10.1016/j.ijbiomac.2018.08.159
35. Fekri N, Khaami M, Heidari R and Jamee R. Chemical analysis of flaxseed, sweet basil, dragon head, and quince seed mucilage. *Research J Biol Sci* 2008; 3(2): 166-170
36. Golshani Y and Mohammadi S. Evaluation of antinociceptive effect of methanolic extract of *Lallemantia iberica* in adult male rats. *Armaghane-danesh, Yasuj University of Medical Sciences Journal* 2015; 19(12): 1058-1068.
37. Karami L, Ghahtan N and Habibi H. Antibacterial effect of *Plantago ovate* and *Lallemantia iberica* seed extracts against some bacteria. *Res Mol Med*, 2017; 5 (3): 32-36.