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Phenolic Substances and Biological Activities of *Verbana officinalis* L.: A Mini-Review

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Abstract

The published data related to the identification of the major phenolic compounds as well as its biological activities present in *Verbana officinalis* L. This plant has received a great interest in the worldwide for its diuretic, expectorant and anti-rheumatic, anti-inflammatory, antifungal, antibacterial, analgesic and antioxidant activities.

Keywords: *Verbana officinalis* L; Phenolic substances; Biological activities

Introduction

Verbena officinalis or commonly referred as vervain belongs to the verbenaceae family (Table 1) which can be found in West Asia, North Africa and throughout Europe [1]. It is listed in the Chinese Pharmacopoeia and the British Herbal Pharmacopoeia [2]. Verbana is a medicinally used herb, where most people still depend on the folk medicine, despite the great progress in all opathic medicines, particularly to all eviateanxiety, insomnia, depression [3]. Verbena officinalis has been widely used for amenorrhea, insufficient lactation (lactogogue plant), assisting contractions duringlabor, promoting wound healing and for disorders of menstruation [4].

Table 1: Taxonomical Classification.

Kingdom	Plantae
Subkingdom	Tracheobionta – Vascular plants
Super division	Spermatophyta – Seed plants
Division	Magnoliophyta – Flowering plants
Class	Magnoliopsida – Dicotyledons
Sub class	Asteridae
Order	Lamiales
Family	Verbenaceae – Verbena family
Genus	Verbena L. – vervain
Species	Verbena officinalis L.

Botanical Characteristics

Figure 1: *Verbana officinalis* L. plant.

Verbena officinalis is a perennial herb. It is erect, 25–100 cm tall and branched above. Its leaves are 3.5–8 cm long and 1.5–3.5 cm broad. It has pale pink or purplish color flowers about 4 mm across [5] (Figures 1 & 2).

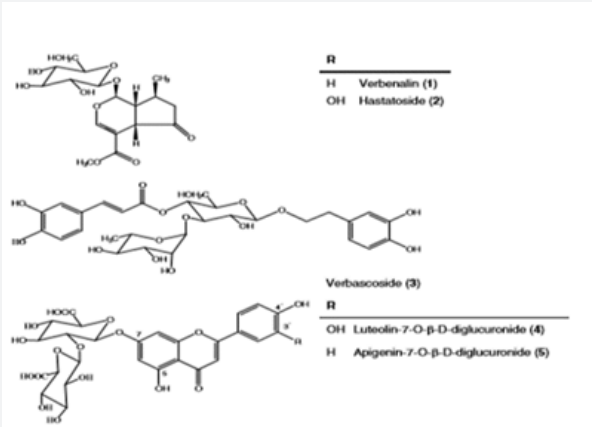

Figure 2: Chemical structure of some major constituents of *Verbana officinalis*.

The Chemical Composition of *Verbana officinalis*

Table 2: Phenolic compounds analysis techniques of *Verbana officinalis* L.

Phenolic Compounds Analysis Techniques of *Verbana officinalis*	Conditions	Major component	References
LC-MS	Gas temperature of 350°C, nitrogen flow rate of 10 L min^{-1}, nebulizer pressure 30 psis, Quadrupole temperature 30°C, Capillary voltage 3500 V. The applied fragmentors were in the range 80–180 V.	Verbenalin	[6]
		Hastatoside	
		Verbascoside	
		Isoverbascoside	
		Eukovoside or isomer	
A micellar electrokinetic capillary chromatography: MECC	The compounds were detected either at 205 or 235 nm. Calibration data confirmed linearity of the detector response within the concentration range injected (R2 from 0.997 to 0.999), and revealed detection limits ranging from 5.0 lg mL)1 (verbascoside) to 13.6 lg mL)1 (hastatoside). The five markers were readily	Verbenalin	[10]
		Hastatoside	
		Verbascoside	
		Luteolin-7-O-β-D-diglucuronide	
		Apigenin-7-O-β-D-diglucuronide	
LC-MS/MS	UPLC separation was achieved using a Waters Acquity BHE C18 Column (150 3.9 mm i.d. 1.7 mm particle size maintained at 25°C), with a mobile phase flow rate of 0.4 mL/min. The mobile phase contained acetonitrile-ammonium acetate 5 mmol/L (A) and water-ammonium acetate (B) in different proportions. The elution system was : 0-5 min, 93-90% of B ; 5-8 min, 90-80% of B ; 8-13 min, 80% of B ; 13-30 min, 80-40% of B and 30-40 min, 40% of B.	Verbascoside	[8]
		Isoverbascoside	
		campneoside II or b-hydroxyverbascoside	
		isocampneoside II or b-hydroxy-isoverbascoside	
UHPLC-DAD	Capillary energy, 3500 V; nebulizer gas, 34.8 psi; dry gas, 10.0 L/min at a temperature of 280°C; scan range, m/z 100–1000 with a scan rate of 2 Hz; quadrupole, ion energy 5 eV; low mass m/z 300.00; collision cell, collision energy 10 eV; transfer time, 60 µs; collision RF, 266.7Vpp; prepulsestorage, 10 µs; transfer, funnel 1 RF 250.0 Vpp, funnel 2 RF 300.0 Vpp, hexapole RF 454.8 Vpp.	Verbenalin	[9]
		Luteolin 7-O-diglucuronide	
		Verbascoside	
		Luteolin 7-O-diglucuronide	
		Apigenina 7-O-diglucuronide	

The main class of compounds of these plants were phenylpropanoids, being verbascoside the most abundant in all the preparations up to 97 % of the total phenylpropanoids. In addition, iridoids, has hastato side and verbenalin together with flavonoids, mono- and di-glucuronidic derivatives of luteolin and apigenin were found [6] (Table 2).

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Several analytical techniques were used in order to identify and quantify the phenolic composition of Verbena officinalis, these techniques included high-performance liquid chromatography-mass spectrometry (LC-MS) [6,7], high-performance liquid chromatography-mass spectrometry/mass spectrometry LC-MS/MS [8], ultra-high performance liquid chromatography diode array detector UHPLC-DAD [9], Micellar electro kinetic chromatography MECC [10] and High-performance liquid chromatography with diode-array detection HPLC-DAD [7] (Table 3).

Table 3: Screening of important essential oil isolated from *Verbana officinalis* L.

S.No	Name of compounds	Types	Article
1	Hastatoside	Iridoid glucoside	[9]
2	Verbenalin	Iridoid glucoside	[9]
3	Luteolin 7-O-diglucuronide	Flavonoid	[9]
4	Pedalitin 6-O-(2-O-feruloyl) -diglucuronide	Flavonoid	[7]
5	Scutellarein 7-O-(2-O-feruloyl) -diglucuronide	Flavonoid	[7]
6	Pedalitin 6-O-diglucuronide	Flavonoid	[7]
7	Apigenin 7-O-diglucuronide	Flavonoid	[7]
8	Aucubin	Iridoid	[7]
9	Scutellarein 7-O-diglucuronide	Flavonoid	[7]
10	1,5-O-dicaffeoylquinic acid	Phenolic acid	[7]
11	4,5-O-dicaffeoylquinic acid	Phenolic acid	[7]
12	Luteolin 7-O-glucuronide	Flavonoid	[7]
13	Scutellarein 7-O-glucuronide	Flavonoid	[7]
14	Luteolin 7-O-glucoside	Flavonoid	[7]
15	Pedalitin 6-O-galactoside	Flavonoid	[7]
16	Pedalitin 6-O-glucoside	Flavonoid	[7]
17	Apigenin 7-O-galactoside	Flavonoid	[7]
18	Apigenin 7-O-glucoside	Flavonoid	[7]
19	Scutellarein 7-O-glucoside	Flavonoid	[7]
20	Verbascoside	Phenolic acid	[9]
21	Isoverbascoside	Phenolic acid	[8]
22	Apigenin	Flavonoid	[7]
23	Campneoside II	Phenylethanoid	[8]
24	Isocampnenoide II	Phenylethanoid	[8]
25	4‴-acetyl-O-isoverbascoside	Phenylethanoid	[8]
26	2″,4″-diacetyl-O-verbascoside	Phenylethanoid	[8]
27	3‴,4‴-diacetyl-O-isoverbascoside	Phenylethanoid	[8]
28	4‴,6″-diacetyl-O-betonyoside A	Phenylethanoid	[8]
29	3‴,4‴-diacetyl-O-betonyoside A	Phenylethanoid	[8]
30	Betonyoside A	Phenylethanoid	[8]
31	6″-acetyl-O-isoverbascoside	Phenylethanoid	[8]
32	4‴-O-acetyl-O-isoverbascoside	Phenylethanoid	[8]

The Biological Activities of *Verbana officinalis*

The famous properties of vervain herb are sedative, antispasmodic and diaphoretic [11]. Verbena officinalis L. has been traditionally used as nervine tonic, antidepressant, and anticonvulsant; prescribed in liver and gall bladder complaints (spasm of the bladder and strangury), nervous and menstrual disorders; also, for bronchitis, asthma and febrile affections [12].

In addition to that, *Verbana officinalis* can be utilized to treat enteritis, acute dysentery, depression and amenorrhea [13]. The scavenging activity against DPPH (1,1diphenil-2-picrylhydrazyl) radical and the antifungal effect against chloroform, ethylacetate and 50% methanolic extracts of Verbena officinalis leaves were investigated. The activity of different fractions of 50% methanolic extract and some isolated compounds were also investigated. The

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results suggest that 50% methanolic extract and caffeoyl derivatives could potentially be considered as excellent and readily available sources of natural antifungal and antioxidant compounds [2].

The antimicrobial potential of verbana herb leaves, and roots was evaluated against 24 strains of Gram-positive and Gram-negative bacteria by Dildar [5]. Ethanolic extracts of stems, leaves, and roots of Verbena officinalis and their fractions in various solvents were assessed. The stems proved to be most potent against all the strains. Its activity against Staphylococcus aureus and Pseudomonas aeruginos a was higher than the antibiotic Amoxicillin.

The leaves also showed considerable activity against Pseudomonas aeruginosa, Citrobacter freundii, and Staphylococcus aureus. The roots turned out to be highly effective against Bacillus subtilis, Staphylococcus aureus, and Pseudomonas aeruginosa. The study confirmed the efficacy of Verbena officinalis against infectious diseases. While all the three parts of the plant were active against the test micro-organisms, stems were most powerful. The plant has great potential to provide exploitable leads for new antimicrobial drugs [5].

Conclusion

The biological activities of *Verbana officinalis* L., including antioxidant, anti-microbial, anti-inflammatory and anti-cancer, were due to the presence of bio-active compounds in the leaves such as: Verbenalin, Hastatoside, Verbascoside, Luteolin-7-O-β-D-diglucuronide, Apigenin-7-O-β-D-diglucuronide.

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