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Review

Pharmacological activity of *Althaea officinalis* L.

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Althaea officinalis **belongs to family Malvaceae. It is one of the medicinal plants used therapeutically since ancient time. The leaves of the** ***A. officinalis*** **plant as well as the root are used as medicine. Roots of** ***A. officinalis*** **contain mucilage, flavonoids and glycosides, additionally the leaves contain the coumarin scopoletin. Due to having valuable secondary metabolites it exert potential therapeutic effect.** ***In vitro*** **and** ***in vivo*** **study of** ***A. officinalis*** **indicates significant pharmacological activity in the cough, irritation of the throat, gastric inflammation, anti-tumor, antiviral and immunostimulant. Anti-bacterial and anti-inflammatory activities, effects on mucociliary transport, adhesion of polysaccharide to buccal membranes and reduction of cough are reported.**

Key words: Pharmacological activity, *Althaea officinalis*, pectin.

INTRODUCTION

Scientific name: *Althaea officinalis* L. (Malvaceae)
Synonym(s): Althaea, Marshmallow
Part(s) used: Leaf, root, flowers.
Geographical distribution: Native to Asia, Europe and United States of America. At least 2 years old roots are obtained from commercially cultivated plants that are harvested in the autumn (Leung, 1980).

Description

Flower and fruit: Axillary reddish-white flowers and 6 to 9 sepals of the epicalyx are bind at the base 8 to 10 mm long. Heart-shaped petals and sepals are five in number and many stamens fused with each other to anthers in a column. The ovaries are in a ring. There are numerous styles. The mericarps are smooth and downy. Fruit is disc-like and open up into the mericarps. Compressed dark brown kidney-shaped seeds are glabrous (Gruenwald, 2000).

Leaves, stem and root: *Althaea officinalis* is a perennial herb 60 to 120 cm high. Stem is erect and have short petioled leaves (Gruenwald, 2000). Harvesting: *A. officinalis* root is usually harvested from October to November. After cleaning and drying at a maximum temperature of 35°C (Gruenwald, 2000) (Figures 1 and 2).

Folk use: *A. officinalis* is widely used in the irritation of oral, pharyngeal mucosa and associated dry cough. Mild gastritis, skin burns and for insect bites. It is also used as a catarrh of the mouth, throat, gastrointestinal tract and urinary tract, as well as for inflammation, ulcers, abscesses, burns, constipation and diarrhea (Gruenwald, 2000).

PHARMACOLOGY

Experimental pharmacology

Due to high content of polysaccharide *A. officinalis* is effective in the oral and pharyngeal mucosa irritation and inflammation (Franz, 1989).

Anti-complement activity

In vitro study on polysaccharide showed anti-complement

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Figure 1. Marshmallow.

Figure 2. Marshmallow root.

activity in human serum (Yamada, 1985).

Anti-Inflammatory and immunostimulant activity

Aqueous extracts of the roots stimulated phagocytosis, and the release of oxygen radicals and leukotrienes from human neutrophils *in vitro.* The aqueous extract also induced the release of cytokines, interleukin-6 and tumour necrosis factor from human monocytes *in vitro*, thereby exhibiting anti-inflammatory and immune-stimulant activity (Scheffer, 1991).

Antitussive activity

Polysaccharide fraction of *A. officinalis* mimics the intensity and frequency of cough by aqueous extract of its root. The anti-tussive activity is more effective than prenoxdiazine (Nosal'ova, 1992).

Pregnancy and lactation

During pregnancy and lactation no known problems seen if taken orally.

Antiviral activity

Ethanolic extract of dried whole plant, in cell culture at variable concentrations is inactive on adenovirus, coxsackie B2 virus, Herpes virus type 1, measles virus, poliovirus 1 and Semlicki-Forest virus vs plaque inhibition (Berghe, 1978). Water extract of the dried leaf, in cell culture at a concentration of 10.0%, was inactive on Herpes virus type 2, influenza virus A2 (Manheim 57), poliovirus 11 and vaccinia virus A (May, 1985).

Free radical scavenging activity

Ethanol/water f(1:1) extract of the dried entire plant, at a concentration of 5.0 mcg/ml, produced weak activity vs superoxide anion when estimated by the neotetrazolium method (Masaki, 1995).

Antimicrobial activity

Ethanol and water extracts of the flower, leaf and root on agar plate were inactive on *Escherichia coli* and *Staphylococcus aureus*. Ethanol, hexane and water extracts of the dried seed, at a concentration of 10.0 mg/ml, were inactive on *Corynebacterium diphtheriae, Diplococcus pneumoniae, Staphylococcus aureus, Streptococcus pyogenes* and *Streptococcus viridans (*Naovi, 1991).

Antifungal activity

Ethanol, water and hexane extracts of the dried seed on agar plate at a concentration of 10.0 mg/ml, were inactive on *Candida albicans* and *Candida tropicalis*

Table 1. Chemical constituents of the various polymers.

Chemical constituents		References
Pectin	Pectins 11%	(Blumenthal, 2000)
Starch	Starch 25-35%	
	Mono-, Di-saccharide saccharose 10%	(Gudej, 1991)
Mucilage	5% glucose in spring and 20% glucose in winter.	(Franz, 1966)
Flavonoids	Hypolaetin-8-glucoside, Isoquercitrin, kaempferol, caffeic, *p*-coumaric acid, ferulic acid, *p*-hydroxybenzoic acid, salicylic acid, p-hydroxyphenylacetic aicd, vanillic acid.	(Gudej, 1991)
Coumarins		(Gudej, 1991)
Phytosterols		(Wichtl, 1994)
Tannins	Scopoletin	(Bradley, 1992)
Asparagine		
Amino acids		(Rosík, 1984)

(Naovi, 1991).

Cytotoxic activity

Water extract of the flower, leaf and root, in cell culture at a concentration of 10%, was inactive on Hela cells (May, 1985).

Antitubercular activity

Ethanol (95%) extract of the flower, leaf and root, on agar plate, was inactive on *Mycobacterium tuberculosis* (Gottshall, 1949).

Hypoglycemic effect

Polysaccharide from the root of *A. officinalis* (Althaea-mucilage-O) administered intraperitoneally to non-diabetic mice to reduce significantly blood glucose (Tomoda, 1987).

Drug interactions

Simultaneous administration of with other drugs may delay the absorption of other drugs (Hänsel, 1994).

Precautions and adverse reactions

No adverse effect is known when taken with therapeutic dosages.

Chemical constituents

Chemical constituents of the various polymers are shown in Table 1, and their structures are shown in Figures 3 to 11.

Pharmacological activity of pectin

Pectin belongs to family of galacturonic acid polymers present in the all plant cell walls (Figure 10). Pectin is the major part of dietary fibre. It decreases the blood cholesterol level markedly by restricting its absorption (Keys et al., 1961; Palmer and Dixon, 1966; Jenkins et al., 1975; Kay and Truswell, 1977). Pectin has mild effect on bowel habit (Durrington et al., 1976; Kay and Truswell, 1977). Pectin reduces the symptoms of dumping syndrome thus producing pharmacological activity (Jenkins et al., 1977).

Pectin has a high amount of uronic acid and form complex with calcium so restrict absorption of calcium in the intestine (Rees, 1975; Tanaka and Skoryna, 1970).

Pharmacological activities of pectins include immune-stimulating activity, anti-metastasis activity, anti-ulcer activity, anti-nephrosis activity and cholesterol decreasing effect. It can also be used for drug delivery for the vaccine of typhoid fever (Yamada, 1996).

Pharmacological activity of scopoletin

Anti-thyroid, anti-oxidative and anti-hyperglycemic activity of scopoletin

Scopoletin (7-hydroxy-6-methoxy coumarin) is thera-peutically evaluated in rats for hyperthyroidism, lipid peroxidation and hyperglycemia. Scopoletin (1.00 mg/kg, p.o.) administered daily for 7 days decreased the levels of serum thyroid hormones and glucose as well as hepatic glucose-6-phosphatase activity. Scopoletin also

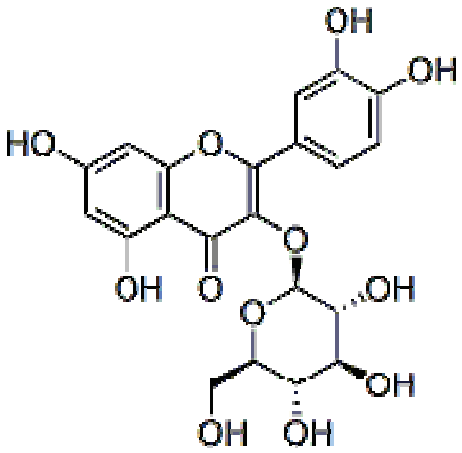

Figure 3. Isoquercitrin.

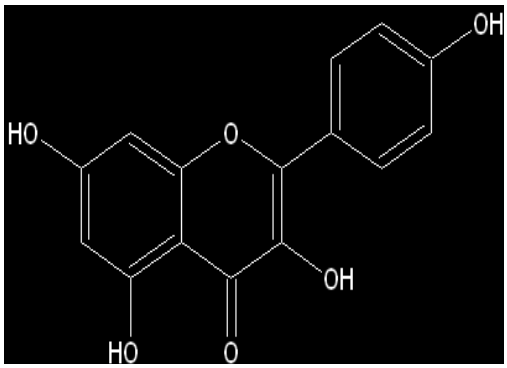

Figure 4. Kaempferol.

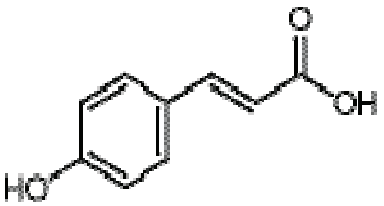

Figure 5. p-coumaric acid.

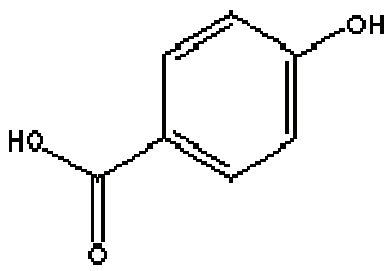

Figure 6. p-hydroxybenzoic aicd.

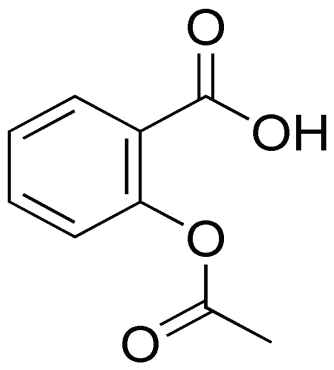

Figure 7. Salicylic acid.

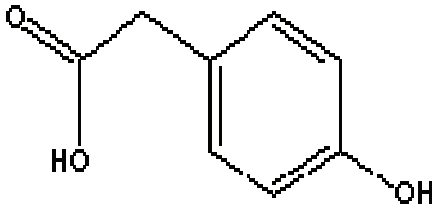

Figure 8. p-hydroxyphenylacetic acid.

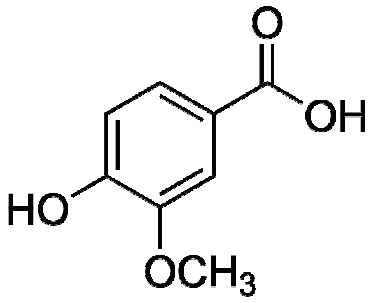

Figure 9. Vanillic acid.

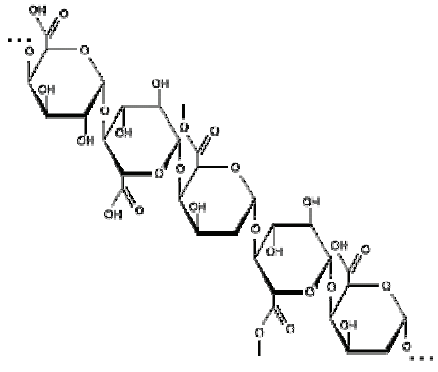

Figure 10. Structure of pectin (Family of galacturonic acid polymers).

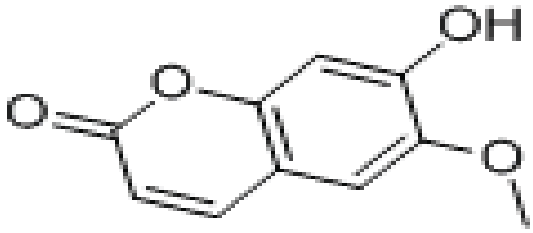

Figure 11. Scopoletin (7-hydroxy-6-methoxy coumarin).

mimic hepatic lipid peroxidation and promote antioxidants activity, superoxide dismutase and catalase. It indicate that scopoletin produce anti-thyroid activity and hyperglycemia without hepatotoxicity (Panda, 2006).

Hepatoprotective activity of scopoletin

Scopoletin hepatoprotective activity is seen in carbon tetrachloride-intoxicated primary cultured rat hepatocytes by measuring the release of glutamic pyruvic transaminase and sorbitol dehydrogenase from carbon tetrachloride-intoxicated rat hepatocytes into the culture medium. Scopoletin markedly decrease the releases of glutamic pyruvic transaminase and sorbitol dehydrogenase from the carbon tetrachloride-intoxicated primary cultured rat hepatocytes by 53 and 58%, respectively at dose of 1 to 50 µM (Kang, 1998).

Immunomodulatory effect of scopoletin on tumoral and normal lymphocytes

Scopoletin produced dual action on tumoral lymphocytes exhibiting both a cytostatic and a cytotoxic effect on cell incubation and also exert apoptosis. Proliferation of normal T lymphocytes was found due to the interaction with kinase C (PKC) protein. It indicates that scopoletin may be a potential anti-tumoral compound therapeutically used in cancer treatment.

Anti-inflammatory effects of scopoletin

Scopoletin exert anti-inflammatory activity by croton oil-induced mouse ear edema (Ding, 2009).

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