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## INDO AMERICAN JOURNAL OF PHARMACEUTICAL RESEARCH



### A COMPREHENSIVE REVIEW ON *ALTHAEA ROSEA* LINN

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#### ABSTRACT

*Althaea rosea* is a stately ornamental plant, producing large single, semi-double, double or frilled flowers of many colours belongs to the family Malvaceae. It is commonly known as Hollyhock. The aim of this review is to reveal the comprehensive information about *Althaea rosea*, to highlight the areas of research have been carried out in this drug and to promote further studies in this particular plant. Data were gathered from ethnobotanical books, traditional texts books, monographs, scientific journals and databases such as PubMed, Google Scholar, etc. The herbs can best be grown during the winter in the plains, but where the monsoon is not heavy; it also grows during the rains. Under moderate climatic conditions, it has been grown throughout the year in the plains. Propagation is generally through seeds. The main parts used in medicine are roots, leaves, seeds and flowers. The fruits and leaves contain primary alcohols, cyclohexanol, limonene, phellandrene,  $\beta$ -sitosterol, sucrose, glucose and mannose. Linoleic acid is the major constituent of the seed oil. The plant is having mucilaginous, demulcent, emollient, analgesic, anti-inflammatory, diuretic and febrifugal property. This is beneficial for chest complains, gastrointestinal disorders, boils, abscesses, skin cuts, ulcers, burns, peptic ulceration, renal calculi, kidney disorders, cough, arthritis, inflammatory conditions, asthma, bronchitis and many more. Though, it is evident that the *Althaea rosea* possesses various medicinal properties, very few studies have been carried out to prove its effects scientifically, such as antimicrobial, anti-inflammatory, cytotoxic, analgesic, antibiotic, antioxidant, antiurolithiatic, immunomodulatory, etc. Hence, it is suggested that relevant studies should be carried out in this particular plant to utilize its maximum benefits.

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## INTRODUCTION

*Althaea rosea* belongs to the family Malvaceae. The name *Althaea* (generic) is originated from the Greek word, *altho* means to cure. Malvaceae (order) is derived from the Greek word, *malake* (soft) from the special qualities of the mallows in softening and healing<sup>[1]</sup>. The derivation of the common name Hollyhock is obscure. It may probably come from holy plus the Anglo-saxon word hoc for Mallon<sup>[2]</sup>. *Althaea rosea* is a stately ornamental plant, producing large single, semi-double, double or frilled flowers of many colours<sup>[3,4]</sup>. All parts of this plant contain mucilage and are used in medicine. This herb is beneficial for number of diseases, such as chest complains, gastrointestinal disorders, boils, abscesses, skin cuts, ulcers, burns, peptic ulceration, renal calculi, kidney disorders, cough, arthritis, inflammatory conditions, asthma, bronchitis and many more. However, very few studies have been carried out to prove its effects. Therefore, it is a need of hour to have a proper documentation of medicinal plants and to validate its properties and uses scientifically through effective strategy for the discovery of useful medicines for the promotion of the traditional knowledge of this plant. Hence, the objective of this review is to provide comprehensive information about *Althaea rosea* in order to know its characteristic feature, to identify its phytochemistry, pharmacology and recent advancement, and to promote further studies in this particular plant.

### Plant taxonomy

Kingdom - Plantae plants  
 Division - Magnoliophyta  
 Class - Magnoliopsida  
 Order - Malvales  
 Family - Malvaceae (mallow family)  
 Genus - *Althaea* L  
 Species - *Althaea rosea* Linn  
 Synonyms - *Alcea rosea* Linn

### Vernacular names<sup>[3-6]</sup>

*Arabic* - Khatma wardi  
*Chinese* - Shu k'ui  
*English* - Hock Herb, Hollyhock, Round Dock  
*French* - Alcee, Alcee rose, Althee rose, Mauve rose, Pass rose  
*German* - Augenpappel, Baummalve, Baumrose, Gartenmalve, Rosenpappel  
*Greek* - Altaia  
*Italian* - Malvarose, Malvoni  
*Malta* - Hollyhock, Malvarose  
*Roumanian* - Nalba de gardina  
*Russian* - Chernaya roja, Shtok rosa  
*Spanish* - Malva arborea, Malva loca  
*Kannad* - Doddabindigaegidda  
*Tamil* - Simaithuthi  
*Punjab* - Gul-khaira, Khatmi, Rishak hatmi

### Habitat

A genus of herbs, distributed from the east Mediterranean region to Central Asia. Native to China and Greece, very commonly cultivated in Indian gardens. Sometimes found as an escape in waste places and along roadsides<sup>[2-5]</sup>.

### Cultivation, propagation and collection

The herbs can best be grown during the winter in the plains, but where the monsoon is not heavy; it also grows during the rains. Under moderate climatic conditions, it has been grown throughout the year in the plains. The flowering seasons vary in the plains and on the hills. Normally, the plant flowers in 4-5 months, but the early ones may take less time. They grow on both clayey and sandy soils, fortified with organic manure. Besides good spacing of 60 cm x 60 cm, adequate irrigation is needed<sup>[3,4]</sup>.

Propagation is generally through seeds in the plains. The seeds are sown in well prepared and manured beds, and periodically irrigated. In 30 days, the seedlings are transplanted to well prepared, rich, friable soils. The herbs can be propagated on the hills from the division of roots, each piece having crown buds, and shoot-cuttings. As *Althaea rosea* is highly cross-pollinated, true colours and forms may not appear in all hybrids<sup>[3]</sup>.

### Plant Description

*Althaea rosea* is an erect, simple or sparingly branched, stellately hairy, annual or biennial herb and 0.5-2.0 m in height. Stem of this plant is often reaching 2.4 – 3 m, erect, stout, simple, and more or less hispid with fascicled branched hairs. Leaves are large, 7.5 – 12.5 cm diam., long petioled, cordate-ovate and acutely 5 -7 lobed. Flowers are large, often exceeding 10 cm across, purple, rose, or white, short-pedicelled and forming long terminal racemes. Involucres are monophyllous, large, cup-shaped, segments 6 -9, obtuse and often bifid. Calyx is large, 5 cleft, downy and acute segments. Petals are very broad, waxy and obcordate. Stamen tube is short and anthers are pale yellow coloured. Ovary is many-celled with one ovule in each cell<sup>[5]</sup>. Disc shaped fruit separated into one seeded nut-lets when ripe<sup>[2]</sup>. The brownish black coloured, kidney shape seeds are about 6 mm with rugose and hair at margin. The seeds turn into mucilaginous when soaked in water.

### Parts Used

Roots, leaves, seeds and flowers<sup>[4-6]</sup>.



**Fig: 1** *Althaea rosea* plant

From <https://www.pinterest.com>



**Fig: 2** *Althaea rosea* seed

### Properties and uses

The seeds of *Althaea rosea* are mucilaginous, demulcent, emollient, analgesic, anti-inflammatory, diuretic and febrifugal<sup>[3, 5, 12, 13]</sup>. They are beneficial for chest complaints, asthma, boils and abscesses, diarrhea, skin cuts and burns, haemoptysis, constipation, intestinal colic, peptic ulceration, renal calculi, burning micturition, cough, dysphagia, dysuria, thirst, arthritis, skin inflammation and ulcers, enteritis, cystitis, gastritis, proctitis, mastitis, metritis and bronchitis<sup>[2-7, 13-16]</sup>.

The root of *Althaea rosea* is having demulcent and astringent properties<sup>[3, 5, 6]</sup>. It is used in the treatment of diarrhoea, dysentery, constipation, loss of appetite, ulcers, severe coughs, fever, bronchitis and inflammation<sup>[3, 5, 6, 12, 13, 17]</sup>. The flowers of *Althaea rosea* are having properties like, diuretic, cooling, demulcent, emollient, anti-inflammatory, febrifuge, astringent, etc.<sup>[5, 6]</sup> and they are useful in the treatment of constipation, chest complaints, dysmenorrhoea, haemorrhage, rheumatism and to improve blood circulation<sup>[3, 5, 6, 17]</sup>. The flowers and roots are beneficial for inflammations of the kidneys and uterus, as well as vaginal and seminal discharge<sup>[6]</sup>. Whole plant is beneficial in asthma, jaundice, cough and irritated stomach, throat pain and its swelling, kidney pain, urinary irritation and dandruff<sup>[18, 19]</sup>.

### Morphology

Epidermal cells in *Alcea rosea* were smooth walled. Leaves amphistomatic and amphitrichomic but generally the stomata and trichomes were more concentrated on the abaxial surface. Diacytic stomata and stellate trichomes were found in *Alcea rosea*. Leaves are thin but appeared thick due to the presence of a thick cover of eglandular trichomes<sup>[20]</sup>. Pollen grains are spherical in polar view with pollen diameter of about 115(132)142  $\mu\text{m}$ , oval to elliptic in equatorial view, monocolpate and polyporate. Pores are distinct, rounded in shape with pore diameter of about 2(4)5  $\mu\text{m}$  and scattered on entire pollen surface. Exine is 3.4–5  $\mu\text{m}$  thick and differentiated into sexine and nexine. Tectum is perforated, echinate and sub psilate. Spine is 140 (145)150 in number, dimorphic, larger one with acute apex while shorter one with blunt apex, arranged regularly and are resistant to acetolysis<sup>[21]</sup>.

Seeds of the *Althaea rosea* are approximately 6 mm in size, generally brownish black colour, kidney shaped with rugose and hairy at margin. Microscopic study of T.S. of seed revealed, thin and pulpy testa with thick inner epidermis and an outer multicellular layer comprising of outer most thick walled epidermis followed by several layers of parenchymatous cells. Two layered tegmen contains outer 4-5 cells and inner row of palisade like malpighian cells followed by two layered hypodermis of cells (a slightly thick walled and nonlignified). Polygonal to round, 5 to 20  $\mu\text{m}$  in size endosperm cells are filled with starch grains.<sup>[22]</sup>

Pentamerous, hermaphrodite, hypogynous and infundibuliform flowers are produced either in the end of the central stems in a raceme or as axillary solitary flowers from the axils of the upper leaves. Flowers are having 6-9 bracts and epicalyx is under the 5 sepals which are light green, hairy, ovate, and much smaller than the petals. White, pink, or purplish red funnel shape overlapping petals are 5 with a columnar structure in the center with the reproductive organs<sup>[23]</sup>. There are  $9.8 \pm 0.66$  fruits per raceme. The fruit is divided into 15-20 sections with a black seed in each mericarp<sup>[23]</sup>.

### Physicochemical

Physicochemical values such as extractive values, ash values, loss on drying, pH value, and swelling index of *Althaea rosea* seeds were determined by Fahamiya et al.<sup>[22]</sup>. The results showed individual extractive values (hot) of petroleum ether, chloroform, methanolic and aqueous extracts were  $8.42 \pm 0.63$ ,  $8.08 \pm 0.30$ ,  $9.83 \pm 0.23$  and  $16.0 \pm 0.95$  % respectively and successive extractive values were  $8.18 \pm 0.85$ ,  $2.76 \pm 0.12$ ,  $3.63 \pm 0.32$  and  $11.24 \pm 0.14$  % respectively. Total, acid insoluble and water soluble ash values were  $7.3 \pm 0.32$ ,  $1.48 \pm 0.16$  and  $3.33 \pm 0.24$  % respectively. Moisture content was  $8.2 \pm 0.38$  % and swelling index was  $5.3 \pm 0.16$  ml<sup>[22]</sup>.

### Phytochemicals

The flowers contain mucilage, starch and tannins. They yield a flavonoid, altheanin (aromadendrin-3-glucoside, 0.06%) and an anthocyanin dye (altheain). The purple portion of the flowers from Pondicherry contains cyaniding, glucose and rhamnose, whereas the yellow portion has quercetin, kaempferol, isoquercitrin and kaempferol-3-glucoside. The total anthocyanidin content of the flowers is 13.5% (dry basis) in term of cyaniding. The yellow coloured flowers from Srinagar contain a new flavonol glycoside, herbacin, which, on hydrolysis, gives herbacetin. The presence of kaempferol is reported from all the varieties of flowers. Besides kaempferol, pink and orange coloured flowers contain herbacetin, mauve and red contain quercetin; white and yellow contain herbacetin and an unidentified pigment. The yellow variety is rich in anthoxanthins and contains herbacetin as the major pigment. Nudiflorin, identified as apigenin-7- $\beta$ -(6- $\beta$ -L-rhamnifuranosido)-D-glucufuranosid, isolated from flowers<sup>[3, 5, 7, 8]</sup>.

The fruits and leaves contain primary alcohols, cyclohexanol, limonene, phellandrene, and  $\beta$ -sitosterol, besides sucrose, glucose, galactose and mannose. The leaves also contain *p*-tolualdehyde and  $\alpha$ -terpenyl acetate. The rind and pith of stalks contain, respectively, 1.8- 2.0 and 12.0 percent of polysaccharide; the pith also contains 1.0- 1.3 percent of starch. Dioxane lignins (low weight polydisperse) are also present<sup>[8, 9]</sup>.

Seeds contain a drying oil (9- 13%, dry basis) having the following constants: sp gr<sup>15°</sup>, 0.9275; n<sub>D</sub><sup>25°</sup>, 1.4722; sap val, 197; and iod val, 119- 25. Linoleic acid is the major constituents of the oil. Protein (3.9%), isobutyl alcohol, limonene, phellandrene, *p*-tolualdehyde, citral, terpenol, *p*-sitosterol, besides glucose, mannose and lactose are present. Lipid extract of seeds contain hydrocarbons, acids, esters, glycerides and alcohols. The basic fraction of extract gave positive reaction to alkaloids.<sup>[2, 5-7, 8]</sup>

Seeds, flowers and leaves of Egyptian plant contain palmitic, myristic, stearic, oleic, linoleic limonene, phellandrene, citral,  $\alpha$ -terpenyl-OAc, and lauric, *p*-tolualdehyde,  $\beta$ -sitosterol and stgmasterol<sup>[3, 6, 7, 11]</sup>. Root is substitute of *Althaea officinalis* root which contains mucilage polysaccharides (galacturonorhamnans, arabinans, glucans, arabinogalactans, carbohydrates), flavonoid glycosides (kaempferol, quercetin), coumarins, caffeic, calcium oxalate, fat and sterols<sup>[3, 5, 12, 13]</sup>.

Three new dihydroflavonol glycosides, named as roseaflavanonosides A (1), B (2), and C (3), together with two known ones were obtained from ethanolic extract of hollyhock flower. Their structures were elucidated by chemical and spectroscopic methods<sup>[24]</sup>. Nine anthocyanins such as delphinidin 3-O-rutinoside, delphinidin 3-O-glucoside, cyanidin 3-O-rutinoside, cyanidin 3-O-glucoside, petunidin 3-O-rhamnosylglucoside, petunidin 3-O-glucoside, malvidin 3-O-malonylglucoside, malvidin 3-O-glucoside, malvidin 3-O-rhamnosylglucoside and three flavonols, myricetin 3-O-glucoside, kaempferol 3-O-glucoside, kaempferol 3-O-rutinoside, and a flavone, luteolin 4'-O-glucoside were isolated from the black flowers of *Alcea rosea* b Nigra,<sup>[25]</sup>

Methanolic extracts of the seeds of *Althaea rosea* L, contains alkaloids, glycosides, carbohydrates, phenolic and flavonoids compound whereas in aqueous extract except glycosides all the other compounds present but in chloroform extract only carbohydrate was present<sup>[22]</sup>. Five flavonoid compounds recognized as kaempferol-3-O- $\beta$ -d-rutinoside, quercetin 3-O- $\beta$ -d-glucuronopyranoside-8-C- $\beta$ -d-glucopyranoside, kaempferol-3-O- $\beta$ -d-glucoside, kaempferol-4'-O- $\beta$ -d-glucoside and kaempferol were isolated from the aerial parts of *A. rosea* Cav. The IC<sub>50</sub> and TPCs values of the methanolic extracts of the aerial parts and flowers were 11 and 1 mg/ml, respectively and 48 and 73  $\mu$ g/ml, respectively<sup>[26]</sup>.

A selective extraction method was developed for rutin, quercetin and kaempferol in *Althaea rosea* (L) Gavan by Muhetaer and three active species were determined by high performance liquid chromatography (HPLC) with HC-C18 column (250 mm x 4.6 mm, 5  $\mu$ m) and the mobile phase of CH<sub>3</sub>OH-0.4% H<sub>3</sub>PO<sub>4</sub> (50 :50, v/v)<sup>[27]</sup>. Dry extracts from roots and stems of *Althaea rosea* were prepared and their chemical composition was studied by Azizov et al., (2007) by characterizing the carbohydrate, protein, and elemental compositions<sup>[28]</sup>.

The phenolic acids have been identified in the flowers of *Althaea rosea* var. nigra as ferulic, vanillic, syringic, *p*-coumaric, *p*-hydroxybenzoic, *p*-hydroxyphenylacetic and caffeic acids. Among the phenolic acids analyzed, the syringic, *p*-hydroxybenzoic and *p*-coumaric acids are dominant<sup>[29]</sup>. A rich source of ricinoleic acid (61.7%) has been found by Daulatabad and Jamkhandi (2000) in *Althaea rosea* (Malvaceae) seed oil<sup>[30]</sup>. Identification was based on chemical and spectroscopic methods. The other fatty acids are myristic (1.1%), palmitic (25.3%), stearic (2.6%) and oleic (9.3%).

From the mucilage of leaves and flowers of species *Althaea*, high molecular weight (from 1.3 to 1.6 x 10<sup>6</sup> D) acidic polysaccharides (HMWAPs) were isolated. Flowers of *Alcea* contain highest HMWAP when compared to leaves or flowers from Malva. Glucuronic acid, galacturonic acid, galactose and rhamnose were mainly present in HMWAPs<sup>[31]</sup>.



## Pharmacological studies

Ethanollic extract of hollyhock flower (HFE) was found to decrease serum triglyceride and glucose levels significantly in KK-A(y) mice after oral administration for 8 weeks. Meanwhile, gene expressions on AMPK, IRS2, PI3K, AKT and GLUT4 in liver were remarkably up-regulated. Hepatic cell glucose uptake experiment was performed using 2-NBDG as a glucose uptake indicator. At the dosage of 20 µg/mL for 1-5, the glucose uptake increasing level was nearly 30% -40% in HepG2 cells<sup>[24]</sup>. Water extract of *Alcea rosea* (ARE) had boosted the antibody response to egg albumin but no effect on interleukin-4 and gamma-interferon gene transcription. Further the results showed that ARE is a B-lymphocyte polyclonal activator<sup>[32]</sup>.

An aqueous extract from hollyhock flowers (*Althaea rosea* Cav. varietas nigra) induces weak metabolic changes in rat testes. The insignificant changes in testicular testosterone and estradiol content suggest that the extract does not disturb steroidogenesis<sup>[33]</sup>. Papiez et al. (2002) found that after administration of hollyhock extract, both in testicular sections and cultured Leydig cells, the immunoreactivities for aromatase and estrogen receptor beta were weaker when compared to the controls, whereas the intensity of immunoreaction for estrogen receptor alpha remained unchanged<sup>[34]</sup>.

Analgesic and anti-inflammatory activities of ethanolic extract of the flower of *Althaea rosea* proved by significant inhibition of the heat induced (tail) flicking of rats, through acetic acid-induced twisting of mice, the edema of the rat paw induced by carrageenin or dextran, the acetic acid-induced increase in permeability of abdominal blood capillaries and the release of PGE from inflammatory tissue<sup>[35]</sup>. Compound Muniziqi granule (MNZQ), a traditional Uighur medicinal preparation, comprises 13 species of medicinal plants including seeds of *Althaea rosea*. MNZQ exerted analgesic activities with a significant dose-dependent increase in latency in the hot plate test. Meanwhile, MNZQ at 0.8, 2.4, and 7.2 g/kg strongly inhibited the acetic acid-induced writhing response by 25.22% ( $p < 0.01$ ), 44.60% ( $p < 0.001$ ), and 49.41% ( $p < 0.001$ ), respectively. Moreover, MNZQ was demonstrated a significant anti-inflammatory effect against xylene-induced edema in a dose-dependent manner. MNZQ also exerted a significant anti-inflammatory effect against cotton pellet-induced granuloma formation. MNZQ at 1.62 and 4.86 g/kg could inhibit granuloma formation by 17.07% and 17.60%, respectively, whereas the percentage inhibition of diclofenac was 33.12%<sup>[36]</sup>.

Alcoholic extract of the flower of *Althaea rosea* (L.) showed a transient hypotensive effect on anesthetic cats and it inhibited the platelet aggregation induced by ADP and the experimental thrombosis formation. Further, the extract increased the outflow of coronary artery of isolated guinea pig's heart and markedly dilated the blood vessels in the hind limbs of rats<sup>[37]</sup>.

Volatile oil of *A. rosea* obtained by using the chemical distillation and extraction method showed better antibiotic activity for common microorganisms, with a wide antibacterial spectrum by the filter paper diffusion method<sup>[38]</sup>. Green synthesis of silver nanoparticles (AgNPs) was developed by treating Ag ions with *Alcea rosea* flower extract. The minimum inhibitory concentration of AgNPs against a Gram positive (*Staphylococcus aureus*) and Gram negative (*Escherichia coli*) bacteria was found to be 37.5 µg/ml<sup>[39]</sup>. Antibacterial activity of ethanolic extracts of leaf and flower of *Alcea rosea* (*A. rosea*) L. showed inhibitory effects at 0.20 g/mL concentration against some Gram-positive and Gram-negative bacteria by agar disc diffusion method<sup>[40]</sup>. Antibacterial activity of the hydro alcoholic extracts of *Alcea rosea*, in Baku, was evaluated by the disk diffusion susceptibility test method and the broth dilution test method on bacteria. The rate of MIC of *A. rosea* extracts of *S. pneumoniae* and *K. pneumoniae* were 375 J<sub>3</sub>L-1 and 680 J<sub>3</sub>L-1 respectively. The maximum amount of inhibition zone diameter in 500 J<sub>3</sub>L-1 concentration of *A. rosea* extracts for *S. pneumoniae* was 6.9 mm and for *K. pneumoniae* 3.2 mm<sup>[41]</sup>.

Methanol, n-hexane, ethanol, ethyl acetate and water extracts of *Alcea rosea* L. flowers were showed antimicrobial activities by disc diffusion method against bacteria *Escherichia coli*, *Staphylococcus aureus*, *Staphylococcus epidermidis*, *Salmonella thyphimurium*, *Enterobacter cloacae*, *Enterococcus faecalis*, *Pseudomonas aeruginosa* and yeast like fungi *Candida albicans*. In addition, ethyl acetate extract showed cytotoxic activity against brine shrimp<sup>[42]</sup>. Neoplastic cell transformation by inhibiting the kinase activity of the epidermal growth factor (EGF) receptor (EGFR) was significantly suppressed by methanol extracts of *Althaea rosea* (MPML). MARC treatment suppressed the activation of EGFR by EGF in EGFR (+/+) cells, but not in EGFR (-/-) cells. Further in EGFR-expressing murine embryonic fibroblasts, the MARC inhibited the EGF-induced cell proliferation<sup>[43]</sup>.

Hydroalcoholic extract of *Alcea rosea* roots significantly reduced the number of kidney calcium oxalate deposits in ethylene glycol-induced kidney calculi in rats when compared to ethylene glycol group in both preventive and curative protocols. Moreover, administration of *Alcea rosea* extract reduced the elevated urinary oxalate due to ethylene glycol<sup>[44]</sup>.

## Conclusion

It is very essential to have a proper documentation of medicinal plants and to know their potential to provide a very effective strategy for the discovery of useful medicines and for the promotion of the traditional knowledge of the herbal medicinal plants in a scientific base. The present review reveals that the *Althaea rosea* plant is used traditionally in treating various ailments and it is found to attribute to a number of medicinal properties such as antimicrobial, anti-inflammatory, cytotoxic, analgesic, antibiotic, antioxidant, antiulcerogenic, immunomodulatory and other biological properties. The plant contain mucilage and other compounds such as anthocyanin, quercetin, kaempferol, isoquercitrin, phellandrene, β-sitosterol, stgmasterol, linoleic, limonene, palmitic, myristic, stearic, oleic, citral, α-terpenyl-OAc, and lauric, p-tolualdehyde, etc. and also various polyphenolic compounds which are responsible for its pharmacological activity. From the above review, it is evident that the *Althaea rosea* is a versatile plant due to its various medicinal properties. Hence, it is suggested that relevant studies may be carried out to prove its effects in conditions like asthma, diarrhea, haemoptysis, intestinal colic, peptic ulceration, burning micturition, dysuria, arthritis, cystitis, gastritis, proctitis, mastitis, metritis, etc., in order to utilize its maximum benefits.

**Conflict of interest** - None

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