International Journal of Science and Research (IJSR)
ISSN: 2319-7064
ResearchGate Impact Factor (2018): 0.28 | SJIF (2019): 7.583

Medicinal Values of *Rhododendron arboretum*: A Comprehensive Review

Swamidasan R[1], Sanil Kumar R[2], Manasa Deepa R[3]

[1]Noori College of Pharmacy, Andersonpet, KGF, Kolar District, Karnataka, India

[2]Department of Pharmacy, Annamalai University, Annamalai Nagar-608 002, India

[3]East West College of Pharmacy, Yelahanka, Bengaluru, Karnataka, India

Abstract: ***Rhododendron arboretum is a woody plants with a showy display of bright red flowers belongs to Ericaceae normally grows on North Temperate Zone especially in the moist acid soil of the Himalayas, South EastAsia. The plant is found in the Himalayas from Kashmir eastwards to Nagaland and widely grows in Bhutan, China, Myanmar, Nepal, Sri Lanka, Pakistan and Thailand. Commonly it is used in gardens, plantations due to its aesthetic value of attractive flower tree plant. It plays a major role in Traditional remedies for different diseases due to its phytochemical potential. This review focus on medicinal properties of different parts of Rhododendron arboretum.***

Keywords: *Rhododendron arboretum*, red flowers, phytochemical constituents, Medicinal Value

1. Introduction

Rhododendron, a most popularornamental plant in the gardens and as avenue trees and widely cultivated in different parts of the world for to its aesthetic, commercial and medicinal values[1].*Rhododendron arboretum* is commonly known as Buransh an evergreen tree growing up to 20 m tall, having rough and pinkish brown bark with oblong-lanceolate and narrowed at ends Leaves crowded towards end of branches. Rhododendron is derived from Greek word: "rhodo" means "rose" and "dendron" means "tree." *Rhododendron arboreum* belongs to the family Ericaceae and are mainly inhabited in the Himalayas between1200 and 4000 meters. It have large, globose, compact corymbs attractive flowers have deep red or pink colour. They have capsular, cylindric, curved, longitudinally ribbed fruits and seeds ellipsoid in shape. It is a seasonal tree normally Flowering & Fruiting will occurs on the month of March – April and September – October. The flower is entitled as the national flower of Nepal and state flower of Himachal Pradesh (India) due to the aesthetic beauty of the fully blossomed flowers in the flowering season. All these places account for more than 90% of the world's natural population of Rhododendrons[2,3,4].Rhododendron is possessing numerous medicinal properties in the treatment of dysentery, diarrhea, detoxification, inflammation, fever, constipation, bronchitis and asthma and also used as processors in food sector[5].The Various parts (leaves, flowers and roots) of the plant have been reported to possess several medicinal properties and are used in the treatment of traditional and modern system of medicines[6]. This review mainly focuses on the medicinal properties of the Rhododendron arboretum.

a) Systemic classification of the plant

Kingdom	Plantae
Phylum	Magnolliophyta
Class	Angiospermae
Order	Ericales
Family	Ericaceae
Genus	*Rhododendron*
Species	*R. arboretum*

b) Vernacularnames

Sanskrit	Kurvak
Tamil	Billi
Kannnada	Pu
Malayalam	Kattupoovarasu
Punjabi	Adrawal
Nepal	Laligurans
Kumaoun	Eras
Garhwal	Burans

Distribution in India

Rhododendrons of India are widely distributed in different regions and altitudes mainly in the Himalayas and majority of them are in the greater Himalayas. Besides this, a good number of species are found in northeastern India particularly in Naga and Khasi hills. Only one species occurs in Trans-Himalayan region located in extreme north-west of India (including the cold deserts of Jammu and Kashmir and Himachal Pradesh. One subspecies nilagiricum of Rhododendron arboreum occurs in Western Ghats. State-wise, Arunachal Pradesh harbours the maximum number of species (67 species) followed by Sikkim (36 species). 19 species are recognized from Darjeeling district of West Bengal, 7 from Nagaland, 5 from Manipur, 2 from Mizoram and Meghalaya each, 6 species from Uttaranchal and 4 from Himachal Pradesh and Jammu & Kashmir each. Only one subspecies is found in Tamil Nadu and, Kerala[7].

Chemical Constituents

The plant contains large amount of secondary metabolites such as alkaloids, flavonoids, glycosides, saponins, tannins, steroids and phlobatannins. The quantified the amount of phytoconstitutents such as rutin, quercetin and coumaric acid, -3-o-galactoside, epicatechin, syringic acid terpenoid, anthraquinones, xanthoproteins, hyperin , 3-heptenocacid methyl ester, 5-heptenoic acid, methyl ester methyl butanoate, butanoic acid, methyl ester and pentanoic acid, 4-methyl-methyl ester 4-heptenoic acid methyl ester, 8-nonynoic acid methyl of phenols, flavonoids, gallic acid ursolic acid, β-sitosterol , lupeol Pyrogoll and catechol were prsent in leaf, flower , bark of and stem R. Rhododendron arboreum . It also contains minerals such as manganese, iron, zinc, copper, sodium, chromium, cobalt, cadmium, molybdenum, nickel, lead and arsenic[8,9]. The leaves of Rhododendron arboreum were reported to contain Quercetin 3-O- beta -D-glucopyranosyl [1- >6]-O- alpha -L-rhamnopyranoside, pectolinarigenin 7-Orutinoside, 7,2'-dimethoxy-4',5-methylene dioxyflavanone[24].

Traditional Practices

Rhododendron arboreum's nectar is brewed to make wine and is effective in diarrhoea and dysentery. Its Corolla is administered in case of fishbone stuck in the gullet. Snuff made from the bark of the tree is excellent cold reliever. Young leaves can be processed into paste and applied on the forehead to alleviate headaches. Action and Uses Juices of petals is good drink for summer and heart tonic. It has anti-inflammatory, anti-nociceptive activity, hepatoprotective activity and anti-diarrhoeal activity. The young leaves are astringent and poultice. They are made into a paste and then applied to the forehead in the treatment of headaches. The juice of the bark is used in the treatment of coughs, diarrhoea and dysentery. A decoction of the flowers is used to check a tendency to vomit, especially if there is also a loss of appetite. The juice of the flowers is used in the treatment of menstrual disorders. The petals are eaten to assist the removal of any animal bones that have become stuck in the throat. The petroleum ether extract decreases the rate of heartbeat and contraction in isolated heart of frog. An alcoholic (50%) extract of the flowers lowered blood pressure in dogs and albino rats[10].

Acute toxicity studies

Based on toxicity study Based on OECD guidelines No. 423 (OECD, 1996)three oral doses of ethanolic extract of *R. Arboreum* 100, 250,500 mg kg $^{-1}$ were selected using acute toxic class method.[11]

Medicinal properties of Rhododendron plant

Flavonoids, isolated from the leaves of Rhododendron arboreum were found to have potent antioxidant property, the plant Rhododendron arboreum have been reported for anti-inflammatory. There are various medicinal properties of *R. arboretum* were reported.

The hepatoprotective activity

Hepatoprotective activity of *R. arboretum*ethanolic leaf extracts was evaluated in wistar rat model by assay of serum marker enzyme like SGOT, SGPT, ALP, direct and total billirubin, triglycerides, cholesterol and estimation of ascorbic acid in urine. The results showed significant hepato protective activity[12].The acetate fraction of R. arboreum flower extract is also shown efficient activity against hepatic damage[13].

The anti-diabetic activity

Anti-diabetic activity was studied using aqueous methanolic extract of *Rhododendron arboreum* by *in vivo* rat intestinal glucosidase method. The extract was found to inhibit rat intestinal α-glucisidase. The aqueous methanolic extract showed inhibitory activities on glucosidase proved the anti-diabetic activity[14].

The anti-inflammatory anti-nociceptive activity

Ethyl acetate extract of *Rhododendron arboreum*flowers was investigated for its anti-inflammatory and anti-nociceptive potential in animal modelsby anti-inflammatory activity in arachidonic induced hind paw edema ($p<0.01$), cotton pellet granuloma model of inflammation ($p<0.01$) and Freund's adjuvant-induced paw arthritis ($p<0.01$ and anti-nociceptive activity in mice by protection in acetic acid-induced writhing justified the anti-inflammatory and anti-nociceptive potential of Rhododendron arboreum[15].anti-inflammatory activity of ethanolic, aqueous and methanolic extracts from *R. arboretum* flowers were investigated by producing paw oedema using various phlogistic agents. The decrease in paw volume showed maximum anti-inflammatory activity of Extracts[16].

The immunomodulatory activity

Alcoholic leaf extract of *R. arboreum* is evaluated for immunomodulatory activity and related hepatotoxicity inswiss albino mice model. The parameters like, humoral immune response, cell mediated immune response and total leukocyte counts (TLC) were assessed in the antigenically challenged mice with sheep RBC (SRBC). Liver function tests like total bilirubin, SGPT and SGOT were also evaluated. The orally administered alcoholic extract of the leaves showed a significant suppression of the immune responses, in a dose dependent manner. The extract at the maximum dose (100 mg/kg) was found to possess higher immunosuppressant effect in comparison with control and levamisole ($p<0.001$. Thus, it can be concluded that the alcoholic extract of R. arboreum is an effective and safe immunosuppressive agent[17].

The anti-diarrheal activity

The anti-diarrheal property of ethyl acetate extract of flower of *R. arboreum* studied on animal model and the extract was orally administered at the concentration of 100 mg kg^{-1}, 200 mg kg^{-1} and 400 mg kg^{-1} body weight. The result showed that ethyl acetate flower extract possess significant anti-diarrheal activity against magnesium sulfate and castor oil induced diarrhea by reducing both weight and volume of intestinal content significantly thus justifying its traditional use in diarrhea and have great potential as a source for natural health products[18].

The antimicrobial activity

The antimicrobial activity of aqueous and ethanolic extract of flower of *R. arboreum* was studied against *Escherichia coli, Staphylococcus aureus, Candida albicans, Pseudomonas aeruginosa, Agrobacterium tumefaciens, Bacillus subtilis* and *Aspergillusniger*. The results showed

that aqueous and ethanolic flower extracts are effective against *E. coli* and *S. aureus*. Aqueous extract showed antimicrobial activity at 50 mg ml^{-1} and 100 mg ml^{-1} of concentration against *E. coli* and *S. aureus*, respectively. Whereas methanolic extract showed activity against *E. coli* at the concentration of 12.5 mg ml^{-1} and above and against *S. aureus* at the concentration of 25 mg ml^{-1} and above. However, both the extracts did not show inhibitory activities against rest of the strains[19].

The antioxidant property

The antioxidant activity of hydro-methanolic leaf extract of *R. arboreum* by auto-oxidation of linoleic acid coupled reaction and β carotene.DPPH assay revealed the radical scavenging activity (IC_{50}-0.47) of leaf extract of *R. arboreum*[20]. Hot water, cold water and ethanolic flower extracts of R. arboreum were studied for Antioxidant property by superoxide radical scavenging assay, hydroxyl radical scavenging assay and lipid peroxidation assay. The half maximal effective concentration (EC_{50}) values for hydroxyl radical scavenging assay indicated antioxidant property hot water, cold water and ethanolic flower extract[21].

The cardioprotective activity

The ethanolic extract of Rhododendron arboretum (ERA) against isoproterenol-induced myocardial ischemia in rat myocardium using Wister rats showed significant elevation in serum cardiac marker enzymes like lactate dehydrogenase (LDH), aspartate transaminase (AST) and alanine transaminase (ALT). Pretreatment with ERA to ISO-treated rats caused a significant cardioprotective effect and Histopathological examination also confirmed the cardioprotective effect of Ethanolic extract of Rhododendron arboretum.[11]

The ethanolic extract of *Rhododendron arboreum* (ERA) leaves can prevent isoproterenol-induced myocardial ischemia in rat myocardium[22].

The flavonoids present in Rhododendron not only protect the cardiac muscles from negative effect of oxidants but also improve cardiac function and ameliorate ventricular remodeling through blocking UTR-mediated activation of RhoA-ROCK pathways in myocardial infarction rats[23].

2. Conclusion

Rhododendron plants possess health benefits along with various medicinal properties which were effectively utilized by the traditional practitioners and tribes.The authors have tried to review the medicinal properties and hoping that this review will attract the researchers to conduct research in this field for the value addition which may help in the enhancement of employment and economy for the upcoming generation. *R. arboretum*is a plant with assorted chemical constituents which exerted many pharmacological effects. There is agreat possibility for development of novel drugs from *R. arboreum* to treat numerous human diseases.

References

[1] Chamberlain, DF., 1982. A Revision of Rhododendrons, II subgenus Hymenanthes, Notes Roy. Bot. Garden, Edinburgh, 39: 1-480.
[2] Anpin Raja RD, Prakash JW, Jeeva S. Antibacterial activity of some medicinal plantsused by Kani tribe, southern Western Ghats, Tamilnadu, India. In: Trivedi PC, Editor.Ethnic Tribes and Medicinal Plans. Jaipur: Pointer Publishers, 2010; 28-45.
[3] Pradhan UC, Lachungpa ST. Sikkim-Himalayan Rhododendrons. Darjeeling:Primulaceae Books, 1990.
[4] Paul A, Khan ML, Arunachalam A, Arunachalam K. Biodiversity and conservation ofRhododendrons in Arunachal Pradesh in the Indo-Burma biodiversity hotspot. CurrSci,2005; 89(4): 623-634.
[5] Laloo, R.C., L. Kharlukhi, S. Jeeva and BP. Mishra, 2006. Status of medicinal plants in the disturbed and the undisturbed sacred forests of Meghalaya, northeast India: population structure and regeneration efficacy of some important species. Curr. Sci., 90: 225-232.
[6] Swaroop, A., A. Prakash Gupta and A. Kumar Sinha, 2005. Simultaneous determination of quercetin, rutin and coumaric acid in flowers of Rhododendron arboreum by HPTLC. Chromatographia, 62(12): 649-652.
[7] Debjyoti Bhattacharyya and M. Sanjappa, "Rhododendron Habitats in India", Journal American Rhododendron Society.,2009. Vol. 63 No. 4
[8] Sharma, N., U.K. Sharma and A.P. Gupta, 2010.Simultaneous determination of epicatechin, syringicacid, quercetin-3-Ogalactoside and quercitrin in the leaves of Rhododendron species by using avalidated HPTLC method. J. F. Comp and Analysis,23: 214-219.
[9] Mohammad Nisar, Sajid Ali and Muhammad Qaisar Preliminary Phytochemical Screening of Flowers, Leaves, Bark, Stem and Roots of *Rhododendron arboretum* , Middle-East Journal of Scientific Research 10 (4): 472-476, 2011.
[10] Srivastava P., Rhododendron arboreum an overview. Journal of applied pharmaceutical Sciences. 2012.02 (01); 152-162.
[11] Manjunatha P. Mudagal, SandipKaria and DivakarGoli, Preventive effect of Rhododendron arboreum on cardiac markers, lipid peroxides and antioxidants in normal and isoproterenol-induced myocardial necrosis in rats African Journal of Pharmacy and Pharmacology Vol. 5(6), pp. June 2011, 755-763.
[12] Prakash Tigari, SnehalDayalalFadadu, uday Raj Sharma, VenkataSurendra, "Hepatoprotective activity of leaves of Rhododendron arboreum in CCl4 induced hepatotoxicity in rats", Journal of medicinal plant research 2(11) · November 2008.
[13] NeerajVerma, Anil P. Singh,G. Amresh, P. K. Sahu, and Ch. V. Rao, "Protective effect of ethyl acetate fraction of flowers against carbon tetrachloride-induced hepatotoxicity in experimental models", Indian J Pharmacol. 2011 May-Jun; 43(3): 291–295.
[14] Bhandary MR, Kawabata J. Antidiabetic activity of Laligurans (Rhododendron arboreum Sm.) flower. J Food Sci Technol. 2008; 4:61–63.

[15] NeerajVerma, Anil Pratap Singh, G. Amresh, P. K. Sahu, Ch. V. Rao, "Anti-inflammatory and anti-nociceptive activity of *Rhododendron arboretum* Journal of Pharmacy Research 2010, 3(6),1376-1380.
[16] Shyam S. Agrawal. &Kalpana Sharma ,Anti-Inflammatory Activity Of Flowers Of *Rhododendron arboreum* (Smith) In Rat's Hind Paw Oedema Induced By Various Phlogistic Agents , Indian J. Pharmac (1988) 20 : 86-89.
[17] Pankaj Kumar Sonar, Ranjit Singh, AnjuVerma, Shailendra K. Saraf, Rhododendron arboreum(Ericaceae): Immunomodulatory and related toxicity studies, Oriental Pharmacy and Experimental Medicine, 2013;13(2).
[18] NeerajVerma, Anil Pratap Singh, G. Amresh, P. K. Sahu, Ch. V. Rao, Antidiarrheal potential of standardized extract of Rhododendron arboreum Smith flowers in experimental animals, Indian J. Pharmac., 2011; 43(6): 689-693.
[19] Sonar KP, Singh R, Bansal P, Balapure KA, Saraf KS. R. arboreum flower and leaf extracts: RP-HPTLC screening, isolation, characterization and biological activity. Rasayan J Chem., 2012;5:165-72.
[20] Prakash D, Upadhyay G, Singh BN, Dhakarey R, Kumar S, Singh KK. Free radical scavenging activities of Himalayan Rhododendrons. Curr Sci., 2007;92:526-32.
[21] Krishnendu Acharya, SubrataGiri, Gunjan Biswas, Comparative study of antioxidant activity and nitric oxide synthase activation property of different extracts from Rhododendron arboreum flower, International Journal of PharmTech Research., 2011; 3(2):757-762.
[22] Neeru Bhatt, Cardio Protective Property of *Rhododendron arboretum*, The Canadian Journal of Clinical Nutrition, 2018; 6(1).
[23] Nisar M, Ali S, Qaisar M. Preliminary phytochemical screening of flowers, leaves, bark, stem and roots of *Rhododendroarboreum.* Middle-East J SciRes., 2011; 10(4):472-476.