



PHARMACOPHYTOCHEMICAL ACTIVITY OF RHODODENDRON ARBOREUM

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Abstract

We are living in the growing world where nature opens their door for the world and Ayurveda provide a lot of essential fauna which connects us with the nature. In India, 23.39% area is covered with plants & forest and we are using different variety of plant but everyone is going away from the beautiful nature so it is extremely important to change the routine or lifestyle otherwise the nature shows their adverse effect. In this study, Rhododendron arboreum concentrate on the pharmacological activities, phytochemical activities, traditional use and medicinal use of the plant. Also in recent study, it shows antiviral activity which shows activity against COVID-19 targets like the SARS-CoV-2 and Human Angiotensin Converting Enzyme 2 (ACE2) receptor and their petals shows significant amount of secondary metabolites.

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INTRODUCTION

India is a country which has a huge diversity and is rich in biodiversity where so many plants are less explored for medicinal purpose but they are very popular in some of the state. There is a plant *Rhododendron arboreum* (state tree of Uttarakhand & national flower of Nepal) which is dispersed in many regions mainly in stature areas in Himalayas at 1500-5500m altitude. It is originally discovered in north central India & found in the Himalayas from Kashmir to Bhutan & in the hills of Assam & Manipur at altitudes of 1200-1400 m (Chauhan, 1999). The genus *Rhododendron* originates from a Greek word where 'rhodon' means rose & 'dendron' means tree. It belongs to Ericaceae family. There are so many species of *Rhododendron* (80 species, 10 subspecies & 14 varieties) which is particularly useful for the people and generally spread in different parts of the Himalayas. (Verma K et.al 2020). *Rhododendron* is a small tree having bright red flowers with bright red and green color leaves. Generally, plant shows best growth in moist soil. In Ayurveda, it is called as kurabaka which is kept in the kashaya group. In Nepal, it is known by the "Rohitaka" name. In Uttarakhand, it is commonly known as 'buransh' & it has large amount of mineral & secondary metabolite which have essential role in the health of human being including glycosides, flavonoids, alkaloids, betulinic. Betulinic acid, lupeol, ursolic acid, β – sitosterol, saponins, gallic acid, amyirin, phenols, epifriedelanol, friedelin, quercetin, tannins, steroids, phlobatannins, anthraquinones, terpenoids, phlobatanins, reducing sugars, picen-3-yl acetate, 22-stigmasten-3-one, beta-amyirin, and linoleyl alcohol (Rawat et al., 2018; Painuli et al., 2016; Roy et al., 2014; Nisar et al., 2013; Nisar et al., 2011; Sharma et al., 2010). It has evergreen leaves that are glabrous on the dorsal surface and have silvery scales on the ventral surface, are about 8.5cm long, oblong-lanceolate, leathery, and collected at the ends of the branches. The blooms are in a corymb with a terminal inflorescence, with a calyx that is 5-8 lobed and a campanulate, tubular corolla that is 5-8 lobed. At the base of the corolla, stamens are inserted. The ovary is superior and multilocular, and the capsules are cylindrical, scaly, and curved, containing many winged seeds. The bark is flaky and pale brown. The tree blooms from March to May and bears fruit from April to November. Propagation is done via cuttings and seeds. It grows best in damp loam without lime, although it can also thrive on rocky ground provided sufficient soil moisture and humus are available (Madhvi et.al 2019).

TRADITIONAL USE

Stem wood of *Rhododendron arboreum* often used as a fuel for making variety of wooden goods such as handles, packsaddles, and gift boxes and the sweet-sour flavour of the flower used for making juice (sharbat), jams, jellies, pickle(chutney). It is useful for decoration purposes. Traditionally the juice of *R. arboreum* locally utilised to reduce headache, diarrhoea, fever, stomach-ache, nasal bleeding, and mental retardation (Madhvi et.al 2019). Fresh flowers were used to treat diarrhoea, dysentery, and dyspepsia, while dried flower petals were occasionally fried in ghee and used as a dysentery medication. Flowers' juice or squash is particularly effective in the treatment of diabetes, several heart illnesses, and menstrual issues. To get rid of stuck fish bones in the gullet, use fresh or dried flower petals. The dried flower powder is used as a treatment for bloody dysentery. The bark paste is thought to aid in the healing of cuts, but aside from these ethnomedicinal effects, the nectar of flowers is deadly if taken in excess (Verma et.al 2020). To get rid of bed lice, the leaves' juice is sprayed on cots and beds. The plant's wood is used to generate charcoal and fuel and it's grained wood is utilised for 'khukri' handles, packsaddles, gift-boxes, gunstocks, and posts. Flowers and leaves are hung around the houses, including temples, in long ropes made of munja grass as ornaments (Srivastava 2012).

MEDICINAL USE

Rhododendron has wide range of therapeutic benefits and low risk of side effects like phenolic acids extracted from its leaves and twigs have been shown to have anti-HIV, anti-inflammatory, and anti-nociceptive properties, and its leaves and blooms are used to cure sickness, headaches, diabetes, and rheumatism, among other conditions (Kumar et.al 2019).

Oxidative stress has also been linked to cognitive degradation in older people and also neurological diseases like Alzheimer's and Parkinson's disease. Failure of immunological tolerance to protein self-antigens is thought to be the cause of autoimmune disorders like type 1 diabetes mellitus (DM1). Alterations in self-antigens have been suggested as a possible trigger for autoimmunity (Moniruzzaman et.al 2020). Gout and rheumatism have been treated with a tincture of dried leaves of *Rhododendron arboreum*, according to Homeopathic Materia Medica. The Ayurvedic preparation "Asoka Arishta," which contains *R. arboreum*, has anti-oxytocic, anti-estrogenic, and anti-prostaglandin synthetase properties. *R. arboreum*'s dried flowers are said to be particularly

effective in preventing diarrhoea and bleeding dysentery (Pallavi srivastava 2012).

DESCRIPTION

Kingdom-Plantae
Phylum-Magnoliophyta
Class-Angiospermae
Order- Ericales
Family- Ericaceae
Genus- *Rhododendron*
Sub-genus- *Hymenanthes*
Species- *Rhododendron arboreum*

VERNACULAR NAMES

Burans or Lalburansh - Hindi/Garhwali
Laligurans - Nepali
Adrawal - Punjabi
Kamri and Cham - Kashmiri
Dieng-tiw-saw - Khasi
Baras - Bengali
Eras - Kumaoni
Billi or Allingi - Tamil
Kattupoovarasu - Malayalam Pu Kannada



PHARMACOLOGICAL ACTIVITY:

1. Antiviral activity:

(Lingwan et.al 2020) used dried petal of *R. arboreum* with acetone extract and assess antiviral activity against COVID-19 targets like the SARS-CoV-2 main protease and the Human Angiotensin Converting Enzyme 2 (ACE2) receptor, which facilitate viral replication and entry into the host and secondary metabolites are investigated which are Quinic acid, 3-Caffeoyl-quinic acid, 5-O-Coumaroyl-D-quinic acid, 5-O-Feruloylquinic acid, 71 2,4-Quinolinediamine, Coumaric acid, Caffeic acid, Epicatechin, Catechin, 3-Hydroxy benzoic acid, 72 Shikimic acid, Protocatechuic acid, Epicatechin gallate, Quercetin, Quercetin-O-pentoside, Quercetin 73 O-rhamnoside, Kaempferol-O-pentoside and Kaempferol.

2. Antimicrobial activity:

The plant *Rhododendron arboreum* used whole plant (200mg) of methanolic extract used antimicrobial activity into 5 different pathogenic microorganism (*Bacillus subtilis*, *Pseudomonas*, *K pneumonia*, *Streptococci*, *Candida albicans*) and measure zone of inhibition i.e. 14mm with *Bacillus subtilis* (Sharma et.al 2020).

Sonar et.al 2012 used antimicrobial activity by making extract of flower of *R. arboreum* (100g) having stock solution of ERA (ethanol) and ARA (chloroform) isolated quercetin (1.5625-50 mg/ml) and tested against 7 microorganisms. But only *S. aureus* and *E. coli* found active. Other is (*B. subtilis*, *P. aeruginosa*, *A. tumefaciens*, *C. albicans* and *A. niger*).

Dried flower of *arboreum* of ethanolic extract (350ml) is used to study 6 bacterial species (3 Gram positive i.e. *Bacillus subtilis*, *Bacillus cereus*, *Staphylococcus aureus* and 3 Gram negative i.e. *E. coli*, *Salmonella enteric*, *Shigella flexineri*) and show very good antimicrobial activity against *E. coli* (17mm zone at 50mg/ml concentration) (Kashyap et.al 2017).

The flower extract of *R. arboreum* study antimicrobial activity of aqueous and ethanolic extract examined against *E. coli*, *Staphylococcus aureus*, *Candida albicans*, *Pseudomonas aeruginosa*, *Agrobacterium tumefaciens*, *Bacillus subtilis* and *Aspergillus niger* which shows effective result against *E. coli* and *S. aureus* (Swamidasan et.al 2019).

Agarwal and Awasthi (2021) reported the antimicrobial activity of dried leaves of

Rhododendron arboreum to treat gout and rheumatism.

3. Antioxidant activity:

The chloroform, hexane, ethyl acetate and petroleum ether extract of flower investigated for chemical composition using GC-MS. Chloroform extract shows 34 metabolites, hexane show 23 metabolites, ethyl acetate show 31 metabolites, petroleum ether show 20 metabolites. Also its ethanolic extract of flower possesses antioxidant activity against hydroxyl radical, superoxide radical and lipid peroxidation (Bhardwaj et.al 2016).

Dried flower of *R. arboreum* were extracted with ethanol (350ml) and shows good scavenging activity. DPPH scavenging assay is based on ability of reducing violet colour as sign of antioxidant activity (Kashyap et.al 2017).

(Agarwal and Awasthi 2021) reported that *Rhododendron arboreum* shows presence of ascorbic acid and major pigment like anthocyanins and flavonols that use flower part and shows the antioxidant property also in flower the anthocyanin content was found to be around 208-212 mg/100g. Kumar et.al 2014 used leaves extract with different solvents i.e. petroleum ether, chloroform, acetone extract of *Rhododendron arboreum* show maximum antioxidant activity i.e. 78.60% at 500µg/ml.

The leaves of *R. arboreum* are used and analysed the antioxidant activity by using solvent of hexane, chloroform and ethyl acetate fraction. In this chemical composition are found i.e. nitric oxide quenching assay and lipid peroxidation assay, site

specific deoxiribose deprivation assay (Gautam V et.al 2018).

4. Antidiabetic activity:

(Gautam et.al 2020) analysed antidiabetic activity by using bark of *R. arboreum* and extracted in ethanol at 200mg/kg which reduced blood glucose level also 100mg/kg reduced blood glucose level in diabetic rats.

(Bhandary et.al 2009) reported the antidiabetic activity by using methanolic extract of flower *R. arboreum* and indicate inhibitory activity on rat intestinal α -glucosidase. The antidiabetic potential of *Laligurans* flower was discovered in this study, which could be useful in the development of pharmaceutical formulations, nutraceuticals, or functional foods for diabetes and its consequences.

5. Anticancer activity:

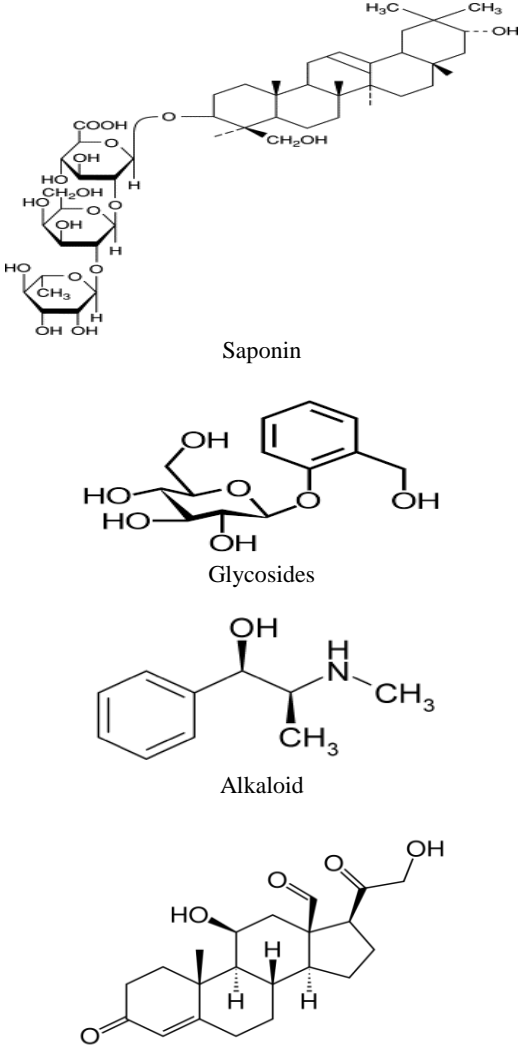
Leaves and flower of *R. arboreum* of ethanolic extract shows anticancer activity and used to treat crown gall also against crown gall tumour, alcoholic extract was tested in vitro for anticancer property and yields found to be 4.01%w/w and 6.9% w/w (Sonar et.al 2012). Pianuli et.al 2018 reported that the plant *Rhododendron arboreum* used fresh leaves of aqueous extract. By performing antipro life rativeassay through ,3-bis-(2-methoxy-4-nitro-5-sulfophenyl)-2H-tetrazolium-5-carboxy anilide salt (XTT) assay against cancer cell lines HeLa. Aqueous extract of *R. arboreum* (RAA), at a concentration of 31.25µg/ml, inhibited 60.12% and 25.41% proliferation of HeLa and Vero cell lines.

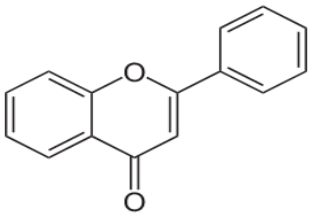
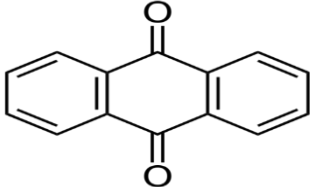
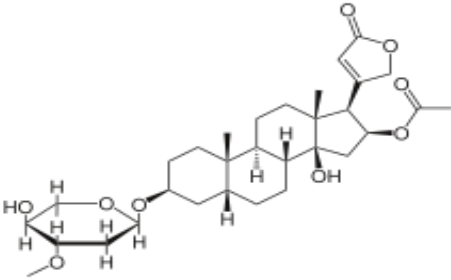
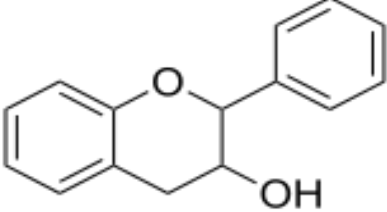
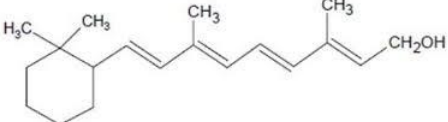
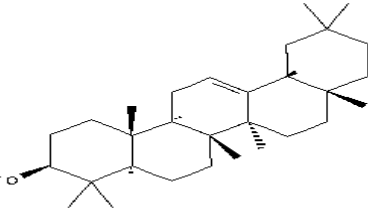

Table-1. Pharmacological activity

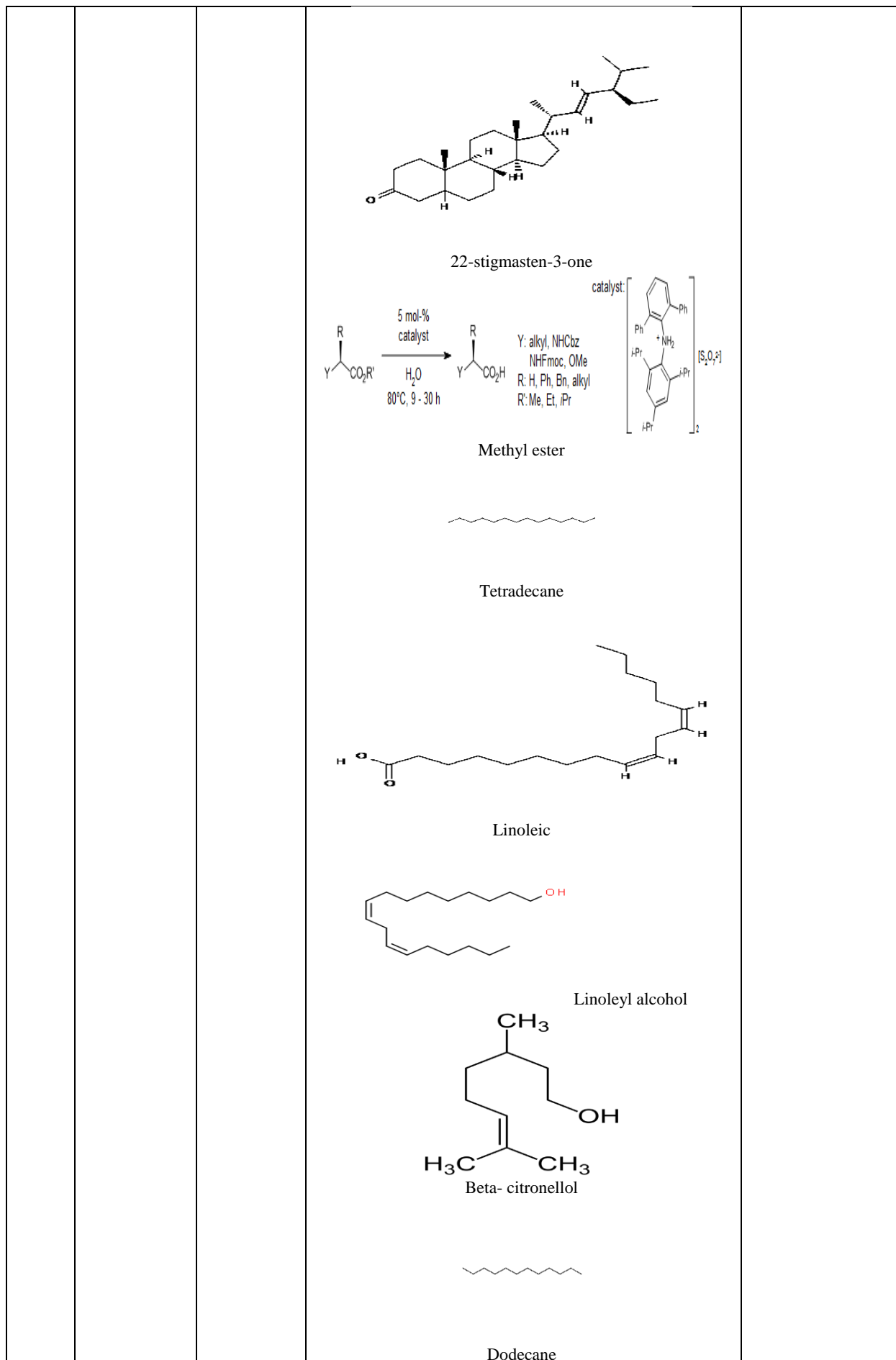
S. No.	ACTIVITY	PLANT PART	CRITICAL ANALYSIS	REFERENCES
1.	Antiviral activity	(a) Petals	It is used to analyse antiviral activity against COVID-19 targets like the SARS-CoV-2 main protease and the Human Angiotensin Converting Enzyme 2 (ACE2) receptor and secondary metabolites were found like Quinic acid, 3-Caffeoyl-quinic acid, 5-O-Coumaroyl-D-quinic acid, 5-O-Feruloylquinic acid, 71 2,4-Quinolinediamine, Coumaric acid, Caffeic acid, Epicatechin, Catechin, 3-Hydroxybenzoic acid, 72 Shikimic acid, Protocatechuic acid, Epicatechin gallate, Quercetin, Quercetin-O-pentoside, Quercetin73 O-rhamnoside, Kaempferol-O-pentoside and Kaempferol.	Lingwan et.al 2020

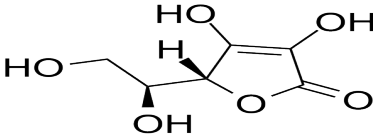
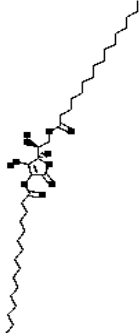
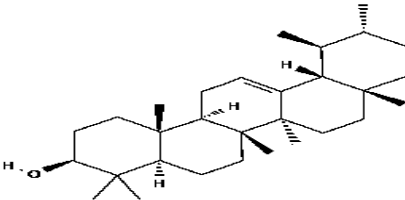
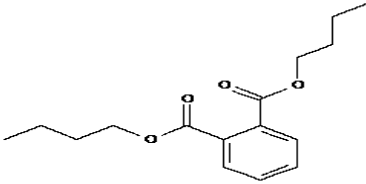
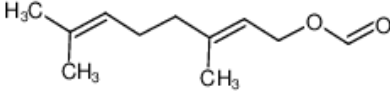
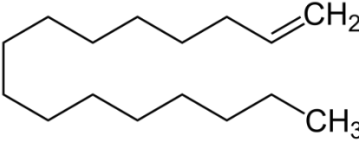
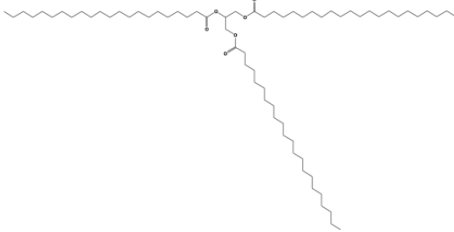
sections. Fresh flower petals yielded the maximum extraction yield (19.22%), while dried flower petals and dried leaves yielded lower extraction yields (16.76 percent and 8.50 percent, respectively). By performing phytochemical screening saponins and tannins were the two most abundant components found in flower and leaf samples, whereas terpenoids were only found in leaves and anthraquinones were only found in flowers. In another study, different phytochemical activity have been isolated and identified from various parts of *R. arboreum* and nearly 34 compounds are identified. In GC-MS study, methanolic leaf extract are determined the following main components which are beta-amyrin, heptadecane, 22-stigmasten3-one, tetradecane, methyl ester, linoleic, linoleyl alcohol, beta-citronellol, dodecane, L-ascorbic acid, 2, 6-dihexadecanoate, alpha-amyrin and dibutyl

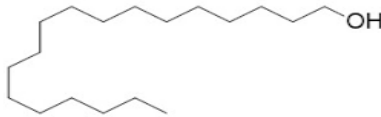
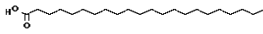
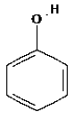
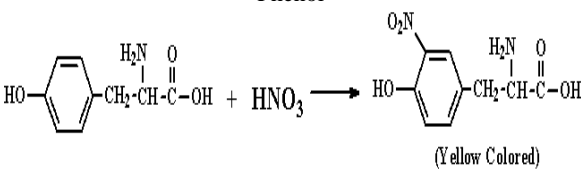
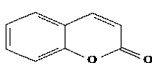
phthalate (Painuli et.al 2016). One study reported that 13 compounds were found in ethanolic leaf extract, with geraniol formate, 1-hexadecene, 1, 2, 3, propanetriyl ester, 1-octadecanol, and docosanoic acid being the most important compounds (Madhvi et.al 2019). (Mohammad et.al 2020) reported that phytochemical activity of dried leaves of methanolic extract of *R. arboreum* shows the presence of Saponin, Glycoside, Flavonoids, and Alkaloids. Fresh flower of *R. arboreum* together with the presence of aleovera and ginseng used different solvents (acetone, benzene, chloroform, ethanol, petroleum ether and distilled water) and shows phytochemical activity which are rich in bioactive secondary metabolites. The bioactive compound which shows their presence is phenols, saponins, steroids, tannin, xanthoprotein and coumarin (Bhaskar et.al 2020).

S.No	Plant parts	Solvents	Bioreactive compounds	Reference
1.	Whole plant	Methanol	 <p>Saponin</p> <p>Glycosides</p> <p>Alkaloid</p> <p>Steroid</p>	Sharma et.al 2020

			 <p>Flavonoid</p>	
2.	Fresh flower petal, dried flower petal, dried leaves	Ethanol	 <p>Amthraquinones</p>  <p>Cardiac glycosides</p>  <p>Tannins</p>  <p>Terpenoids Alkaloid, flavonoid, saponins</p>	Winitchai et.al 2021
3.	Leaf	Methanol	 <p>Beta- amyryn</p>  <p>Heptadecane</p>	Painuli et.al 2016



			 <p>L-ascorbic acid</p>  <p>2,6-dihexadecanoate</p>  <p>Alpha-amyrin</p>  <p>Dibutyl phthalate</p>	
4.	Leaf	Ethanol	 <p>Geraniol formate</p>  <p>1-hexadecane</p>  <p>1,2,3-propanetriyl ester</p>	Madhvi et.al 2019

			 <p>1-octadecanol</p>  <p>Docosonoic acid</p>	
5.	Dried leaves	Methanol	Saponin, glycoside, flavonoid, alkaloid	Mohammad et.al 2020
6.	Fresh flower	Acetone, benzene, chloroform, ethanol, petroleum ether and distilled water	 <p>Phenol</p>  <p>Xanthoprotein</p>  <p>Coumarin</p>	Bhaskar et.al 2020

CONCLUSION AND FUTURE PROSPECTIVE:

The purpose of this review is to study the information of about different activities (pharmacological, phytochemical) and different parts of the plant show different functions. *Rhododendron* is useful in treating different disease such as headache, diarrhoea, fever, stomach-ache, nasal bleeding, mental retardation, diarrhoea, dysentery, and dyspepsia and their flowers' juice or squash is effective to treat diabetes, heart illnesses, and menstrual issues. In this review, the phytochemical activities also used to produce several secondary metabolites such as Alkaloids, Flavonoids, Anthraquinones, Saponins, Cardiac glycosides, Tannins, Terpenoids along with pharmacological activities like antimicrobial, antioxidant, anticancer, antidiabetic and antiviral

activities are very effective to diagnose the disease. More research will be done in future as the first report found as antiviral activity which is found in *Rhododendron* petals that shows results against COVID-19 like SARS-CoV-2 and Human Angiotensin Converting Enzyme 2 (ACE2) receptor further will be done in future and it is the only Uttarakhand plant *Rhododendron* that shows positive results against COVID-19.

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