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A COMPREHENSIVE REVIEW OF THE TRADITIONAL AND PHYTOPHARMACOLOGICAL USES OF *ROSA DAMASCENA* MILL.

Chandani Prasad, Rachana Punjabi and Pratima Tatke *

C. U. Shah College of Pharmacy, S.N.D.T. Women's University, Juhu Campus, Santacruz (West), Mumbai- 400049, Maharashtra, India.

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Correspondence to Author:
Dr. Pratima Tatke

Principal and Professor of Pharm. Chemistry, C. U. Shah College of Pharmacy, S.N.D.T. Women's University, Juhu Campus, Santacruz (West), Mumbai- 400049, Maharashtra, India.

E-mail: drpratimatatke@gmail.com

ABSTRACT: Mother nature has gifted with many herbs that have been found to have various pharmacological and therapeutic activities. One among them is the Rose plant which is available everywhere easily and has been used for ages. There are at least 200 species of rose flowers, amongst them *Rosa damascena* Mill. species is widely utilized in many industries for different purposes. *Rosa damascena* well-known as Rose, king of flowers, also known for its sweet smell and beauty, has numerous pharmacological properties, including antioxidant, antidiabetic, antitussive, anti-inflammatory, relaxant effect on tracheal chains, hypnotic, antibacterial, and anti-HIV. The petals, hips, stems, leaves and roots of rose plants have medicinal values and contain various secondary metabolites, including vitamins and minerals. Extracts from different parts of the rose plant have also been reported to show antibacterial and anti-fungal activity. *Rosa damascena* is cultivated and produced in Bulgaria, some regions of Turkey, and Tunisia, China, and India. This article is a comprehensive review of the traditional and pharmacological uses of *Rosa damascena*.

INTRODUCTION: Herbal medicine is one of the most used ancient ways of treating ailments and has come under scientific investigations. Rose (*Rosa damascena*) is most famous than any other flower throughout the world. It belongs to the family Rosaceae. Its actual place is India, but because of its beauty and fragrance, it is cultivated throughout the world [1]. This plant is called Damask rose because it was originated in Damascus. It is a perennial shrub of 1 or 2 meters in height and cultivated in Turkey, Bulgaria, Iran, India, Morocco, South France, China, South Italy, Libya, South Russia, and Ukraine [2, 3].

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Roses have been used for ages in rituals, cosmetics, perfumes, medicines, and aromatherapy [2, 3]. From ancient times, it is in our culture not only as a symbol of love and beauty but as an ethnomedicine. It has been used in the Ayurveda and Unani systems of medicines since the ancient era. The use of *Rosa damascena* is increasing day by day worldwide for its medicinal properties and health-promoting benefits [4]. Various species of Rose have been utilized for several important pharmacological properties such as astringent, mild laxative, antibacterial, anti-fungal, anti-HIV, antidiabetic, anti-depressant, analgesics, hypnotics, anti-hepatitis, anticancer, anti-aging, antioxidant, antitussive, anti-inflammatory, neuroprotective, respiratory effects, *etc*. [4, 5].

Pharmacological and phytochemical studies have revealed that the various health benefits of *Rose* plant can mainly be because of the presence of

polyphenolic compounds, essential oils, flavonoids, glycosides, terpenes, and anthocyanins [6, 7].

1. Origin and Distribution: From the ancient ages, petals were used to cover floors, baths were filled with rose petals, and roses were scattered at feasts and beneath chariot wheels. *Rosa damascena* is the hybrid between *Rosa gallica* and *Rosa Phoenicia* and is the most important species [8].

This plant is cultivated all over the world including, Bulgaria, Turkey, and India. The major cultivated areas of *Rosa damascena* in Iran are Kashan, Fars, and Azerbaijan [9]. There are many pieces of evidence that the cultivation of Rose in Iran has a long history and Iran is one of the originators. In the 16th century, Iran was found to be the main producer of rose oil [9, 10].

Vernacular Names: [9, 10, 11]

Sanskrit : Taruni, Shatapatri
Hindi : Gulab
Marathi : Gulab
Gujarati : Gulab
Bengal : Golap
Tamil : Irasha
Telugu : Gulabi
English : Rose
Afghanistan : Gulab, Gulal,Gul
Arabic : Warde ahmar

2. Botanical Description: *Rosa damascena* is a shrubby, perennial plant, with unequal strong prickles [10] and approximately 1 to 2 meters in height with large and colorful flowers. The leaves are imparipinnate with 5-7 leaflets [10], sepals deflexed after flower have open pulpy calyx and peduncles. Fruits are oval and become red on ripening [11]. Stems are generally with many stout and hooked prickles, sometimes mixed with glandular bristles. Flowers are generally corymbose, double, red, pink, or white, sometimes striped; pedicels and receptacles glandular-hispid [11, 12].

FIG. 1: PLANT OF *ROSA DAMASCENA*

3. Traditional Uses: In ancient medicine, the most therapeutic effects of *Rosa damascena* are in the treatment of abdominal and chest pain, strengthening the heart, treatment of menstrual bleeding and digestive problems, and reduction of inflammation, especially of the neck [12]. Rose oils help in healing depression, stress, and tension. It also helps in healing old cough, special complaints of women, wound healing, and skin health [12]. Rose oil helps in treating some allergies, headaches, and migraines [12, 13].

In Indian tradition, *Rosa damascena* is traditionally used in Ayurvedic medicine as gulk and in the treatment of gastric problems and blood disorders. It elevates mood and prevents depressive effects. It helps in digestion and increases bile production [13, 14]. Rose tea helps to prevent infection of the digestive system. It is used to cure painful and irregular periods. It relieves pain and heavy bleeding caused by uterine congestion, *Rosa damascena* is also used in cosmetics, creams, hand lotions, and perfumes [14, 50]. Rose water was used for mouth disinfectant and for eye washing because it is an antiseptic agent, also used for bronchial and chest congestions because of its antispasmodic activity.

In Unani medicine, the flowers of *Rosa damascena* are used as chief ingredient in compound formulations; Gulqand Gulab, Majun Dabeedulvard and Sherbat Vard Mukarrer, Jawarish Tabasheer,

Jawarish Tamer Hindi, Anooshdaru Sada [15]. The uses of Unani formulation are remove palpitation (khafqan), syncope (ghashi), and cardiac debility (zof-e-qalb) and to strengthen the liver (muqawwi-e- jigar), stomach and intestines (ama). It is also used as vital organ tonic (muqawi-e-aza-e-raeesa) and General tonic (muqawi-e-badan) [15].

4. Phytochemistry: The chemical constituents found in the *Rosa damascena* Mill. throughout the research papers are essential oils such as citronellol, geraniol and nerol [15, 16]. Apart from these, phenyl ethyl alcohol, eugenol, geranyl-acetate, α-pinene, β-pinene and linalool are also present [15, 16]. In addition to these oxygenated terpenes, hydrocarbons such as Tricosane, Pentacosane, Heptacosane, Heneicosane, Eicosane, Heptadecane and Nonadecane were also present in *Rosa damascena*. These hydrocarbons are responsible for the waxy structure of rose oil. Citronellol, geraniol and Phenyl-ethyl alcohol are considered to be the chief constituents in the rose oil [16].

The rose oil contains minute quantities of damascenone, ketone with a powerful fragrance [17]. Other constituents include methanol, ethanol, hexanol, heptanol, octanol, nonanol, linalool, terpinen-4-ol,farnesol, acetaldehyde, cinnam aldehyde, salicylaldehyde, hexylactate, linalyl acetate, carvone, tran-damascenone, methyl-heptenone, eugenol, methyl-eugenol, alpha, and beta-pinene, camphene, myrcene and propionic, butyric, valeric and caproic acids are also present. Numerous constituents were isolated from flowers, petals, hips (seed-pot), leaves, stems, roots of *Rosa damascena* [18].

Flavouring compounds that are present in the *R. damascena* essential oil are beta-damascone, beta-ionone and beta-damascenone, usually obtained from carotenoid degradation. Phosphorus, calcium, sodium, potassium, magnesium, iron, manganese, boron, and zinc are the mineral contents of *R. damascena*. Phenolic compounds are mostly responsible for the medicinal functions of Rosaceae, which are present in large amount [18].

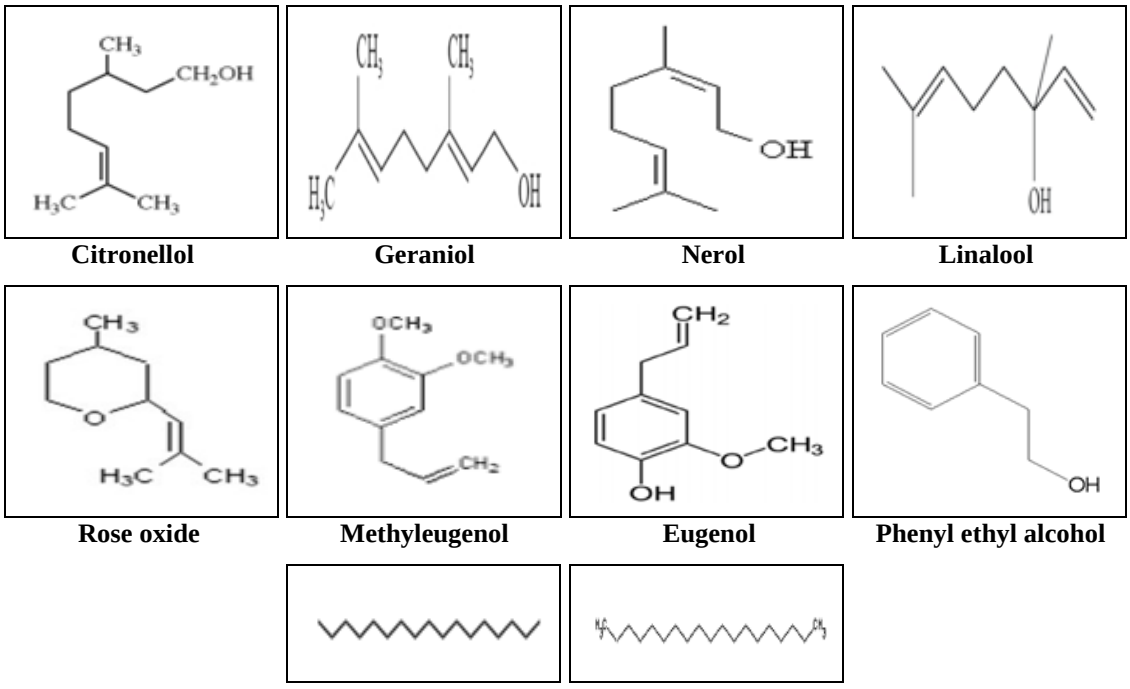

FIG. 2: PHYTOCONSTITUENTS PRESENT IN *ROSA DAMASCENA*

5. Pharmacological Activities:

5.1. Antimicrobial Effects: It has been shown that *Rosa damascena* has wide spectrum antimicrobial activities. Essential oil, absolute, and hydrosol are important products that showed antimicrobial activity against *Escherichia coli, Staphyloccocus aureus, Bacillus subtilis, and Pseudomonas aeruginosa strains. Escherichia coli* were the most sensitive bacteria to rose essential oils [19]. Rose absolute showed antibacterial activity against both gram-positive and gram-negative bacteria but rose hydrosol had no antimicrobial activity against any

of the microorganisms. Antibacterial activity of fresh flowers and spent/used flower extracts of *Rosa damascena* were observed against *B. cereus, Enterobacter aerogenes, Enterococcus feacalis, Escherichia coli, Klebsiella pneumoniae, Mycobacterium smegmatis, Proteus vulgaris, Pseudomonas aeruginosa, Pseudomonas fluorescens, Salmonella enteritidis, Salmonella typhimurium,* and *Staphyloccocus aureus*. Extracts of fresh flowers were more effective than the spent or dried flowers [20, 21].

5.2. Antioxidant Activity: The *Rosa damascena,* similar to many aromatic and medicinal plants, exhibits antioxidant properties. Sources of natural antioxidants are phenolic compound that is found in all parts of plants such as the fruits, vegetables, seeds, leaves, roots and barks [22, 23]. It is found that the phenolic content obtained from fresh flower extracts of *Rosa damascena* has more potent antioxidant property than the spent or used flowers. The effect may be due to the presence of quercetin and flavonoid compounds in the extract [23, 24].

5.3. Neuroprotective Activity: Pharmacological studies have been performed on *Rosa damascena* to evaluate their effects on the central nervous system (CNS). It has been reported that *Rosa damascena* has extensive effects on CNS [25, 26]. Ethanolic extracts of fresh flowers has been shown a potent depressant activity in mice [26]. Some of the other effects which were exhibited by this plant are hypnotic, anticonvulsant, anti-anxiety and analgesic effects [26].

5.4. Anti-diabetic Effect: It has been shown that *Rosa damascena* has an anti-diabetic effect. Oral administration of methanolic extract of *Rosa damascena* showed a significant decrease in blood glucose levels in normal and diabetic rats [26]. Antidiabetic effect of this plant maybe mediated by inhibition of α-glucosidase that suppressed carbohydrate absorption from the small intestine and can reduce the postprandial glucose level [27].

5.5. Anti-inflammatory Effect: This plant has also been shown to have an anti-inflammatory effect [27]. Hydro-alcoholic extract of *Rosa damascena* shows a significant reduction of edema. Essential oils had no anti-inflammatory activity, but extracts of flowers have the potential to reduce edema [28, 49].

5.6. Anticancer Activity: Many studies presented the prominent anti-cancer effects of *R. damascena* methanolic extract and rose oils. Extract as well as oils showed an effect against cancer cell lines [28, 29]. It also reported that a low concentration of oils and extracts showed an effective anti-cancer activity, and it is safe for human lymphocyte cells [29, 30, 49].

5.7. Gastrointestinal Effects: It has been identified that hydro-alcoholic extracts of *R. damascena* showed effects on the GI tract. Hydro-alcoholic extracts showed a stimulatory effect on ileum smooth muscle contraction [31]. It was also observed that the isolated geraniol and citronellol showed strong ileum relaxation activity. Hydro-alcoholic extracts also showed the stimulation of β-adrenergic and opioids receptors for ileum contractions inhibition in guinea pigs and muscarinic receptors for ileum movements stimulation in rats.

5.8. Effect on Respiratory System: *Rosa damascena* has an effect on the respiratory system. Researchers showed that ethanolic and aqueous extracts of *R. damascena* significantly reduce cough induced by citric acid in guinea pigs [31]. In another study, the effect of ethanolic extract and essential oil on tracheal smooth muscle of guinea pigs contracted by KCl and methacholine was studied. The results showed a potent relaxant effect of extract and essential oil that was comparable to that of theophylline. The mechanism behind the relaxant activity is unknown [32].

5.9. The Laxative Effect: In the traditional medicine system of Ayurveda, the boiled extract of *Rosa damascena* showed a significant laxative effect. It increases the feces water content and the frequency of defecation [32].

5.10. Anti-HIV Activity: Researchers showed, aqueous and methanolic extract of *R. damascena* has an anti-HIV effect. They showed that *Rosa damascena* has new compounds 2-phenylethanol-O-(6-O-galloyl)-β-D-glucopyranoside, which are responsible for the anti-HIV activity. Kaempferol has immense action against C8166 cells of HIV infection. It reduces the maturation of infectious progeny virus by slowing down the viral protease. Derivatives of kaempferol avoid the binding of gp120 to CD4 to inhibit HIV infection [31, 32].

5.11. Anti-depression and Sexual Effects: In one research, it was shown that daily oral intake of 2ml of rose oil for two months reduces depression symptoms and significantly improved sexual function in depressed men suffering from sexual dysfunction [31]. It was also shown that rose oil has no effect on depression in women but moderately increased sexual function in their body [33, 34].

5.12. Analgesics and Antinociceptive Activity: The analgesic property of *Rosa damascena* Mill. was investigated in six studies and observed an inhalation therapy of essential oils on 50 patients with deep burn wounds.

It was reported considerable pain relief after 15-30 min of wound dressing when patients received aromatherapy [35].

5.13. Anti-hyperlipidemic Effect: In Joukar's study, 45 days of oral intake of the methanol extract of *Rosa damascena* showed the effective result in hyperlipidemic rabbits [36].

5.14. Hypnotic Effect: Both the ethanolic and aqueous extracts of *Rosa damascena* increase a sleeping time compared to diazepam [37].

5.15. Anti-aging Effect: In an experimental trial that was performed, rose flower extract of *Rosa damascena* showed an anti-aging effect. The results showed a significant decrease in mortality [38].

5.16. Cosmetic Properties: Hydro-alcoholic and ethyl acetate extracts of *Rosa damascena* have effective absorption of UV radiation [38, 39]. The anti-acne effect of essential oils and antibacterial effects against *Propioni bacteriumacnes* has been reported [34, 35].

5.17. Culinary Uses: Damask roses are used in cooking as a flavoring ingredient or spice. Rosewater and powdered roses are used in Middle Eastern cuisines. Rosewater is mostly sprinkled on meat dishes, while rose powder is added to sauces. In other countries of the Middle East, the most popular use is in the flavoring of desserts such as ice cream, jam, Turkish delights, rice pudding, and yogurt. It was most commonly used in desserts and still is a flavor in traditional desserts [39].

TABLE 1: PHARMACOLOGICAL ACTIVITY OF BIOACTIVE OF FLOWERS OF *ROSA DAMASCENA*

Extracts	Pharmacological Activity
Polyphenolic fraction from rose oil	Significant decrease in gene and cellular protein [40]
Methanolic extract	Anticancer activity [41]
Essential oils	H_2O_2 induced neuronal death reduction [42]
Concentrated methanol extract	Antibacterial activity against *S. aureas, B. subtilis, P. aeruginosa* [43]
Essential oils	Anticonvulsant, Antimicrobial [42]
Flavonoid compounds	Anti-HIV [42, 44]
Methanol extract	Anti-diabetic [44]
Hydro alcohol, essential oils, methanol extracts and ethanol extracts	Antioxidant [44, 45]
Ethanol extract	Anti-solar, Anti-ageing, Constipation laxative, Bronchodilator [31, 44]
Aqueous or ethanol extract	Potentiating of contractility and heart rate [44]
Absolute rose oils	Anticancer activity [46]

6. Recent Studies on *Rosa damascena:*

6.1. Reducing Oxidative Toxicity of L-dopa in Combination with Two Different Antioxidants-an Essential Oil isolated from *Rosa Damascena* Mill, and Vitamin C: Parkinson's disease (PD) is a multifactorial disease that takes a leading place among contemporary frequent diseases of the central nervous system (CNS) with not well-established mechanism. One of the most popular and effective therapy for patients with PD is Levodopa (L-dopa), but the clinical effect of the drug diminished by motor complications resulting from prolonged treatment. Due to the L-dopa neurotoxic effect in the disease treatment, the L-dopa administration is delayed as long as possible in order to avoid side effects. L-dopa therapy with antioxidants may decrease side effects and provide symptomatic relief. The oxidative stress (OS) induced by the L-dopa was reduced after combining two different antioxidants, an essential oil isolated from *Rosa damascena* Mill, and vitamin C. In this study, combinations of L-dopa

and Ascorbic acid and L-dopa and Rose oil show levels commensurate with the controls and statistically decreased from the L-dopa group [47].

6.2. The Effect of Aromatherapy with *Rosa damascena* Essence on Postoperative Pain in Inguinal Hernia Repair: The advances in surgical technology, postoperative pain are still a challenge for both patients and nurses. A study conducted in educational hospitals of Kerman, Iran, also reported that almost all patients were dissatisfied with postoperative pain relief. Aromatherapy is the science of using aromatic materials, including essential oils, to promote health and well-being. Some studies suggest that olfactory stimulation and changes in brain activity and the limbic system through aromatherapy can result in immediate pain reduction. Aromatherapy also reduces pain sensation by inducing slow and deep breathing. It may also have a placebo effect as the third mechanism for pain reduction. Essential oil of *Rosa damascena* was examined for the effect of aromatherapy on the intensity of postoperative pain in patients undergoing inguinal hernia repair surgery. The study showed that aromatherapy with *R. damascena* essence was effective in reducing postoperative pain. Its effect was significantly greater in the 8th and 12th postoperative hours [48].

7. Marketed products of Damask Rose (*Rosa damascena*): There are different extracts and more than 200 aromatic products of *Rosa damascena* such as essential oils, floral water, scented water, absolute, concrete, *etc*. are available which are used for formulating various other marketed products such cosmetics, medicines, *etc*. Some of them are mentioned in below table:

TABLE 2: MARKETED PRODUCTS OF *ROSA DAMASCENA*

S. no.	Products of Rose	Uses
1	**Gulkand (Rose petal jam)** 	**Active ingredients:** Rose petals It helps to reduce acidity Powerful antioxidant Protects from sunstroke Purifies blood
2	**Rosewater** 	**Active ingredients:** Rose petals Act as a skin toner Acne fighter Makeup remover It has antiseptic, anti-ageing, antioxidant properties.
3	**Rose syrup (Rooh Afza)** 	**Active ingredients:** Rose petal, Tulsi extract, *etc*. It regulate heart rate, smooth supply of blood It provides instant energy, revitalizes mind and body. It eliminates toxins from the body and also protects the liver Rich in vitamin A & C
4	Herbal eye drop (Ophtha Care) 	**Active ingredients:** Honey and Rose petal It provides relief from eyestrain and computer vision syndrome and exhibits antibacterial activity
5	Himalaya Kajal 	**Active ingredients:** Damask rose and triphala almond oil It cools, soothe and nourish eyes
6	**Rose oil soft capsule** 	**Active ingredients:** Rose oil Rose oil is a stomach tonic It treats digestive wounds and eliminates waste from the digestive tract

CONCLUSION: *Rosa damascena* is the vital species of the Rosaceae family, mainly famous for its perfumery properties. The flowers of Rose are used since ancient times immemorial to treat a wide range of diseases. The whole review has focused on knowing the importance of *Rosa damascena* as not only an ornamental plant or its beauty, but it also has various medicinal benefits. Its major products are essential oils and rose water which is used to serve a cosmetics and medicinal formulation in the market. This plant contains several compounds such as terpenes, glycosides, flavonoids, anthocyanins, polyphenols, tannins, *etc*., that are responsible for its pharmacological activities. The literature reveals that plant has antibacterial, antifungal and antioxidant activities with a rich source of vitamins and minerals. The respiratory, gastrointestinal tract infection, laxative, neuroprotective, anti-inflammatory, hepatoprotective, anti-diabetic are the other effects of this plant. Scientific studies have proved most of the claims of traditional medicines. However, further, detailed clinical trials appear necessary to explore the full therapeutic potential of this plant in order to establish it as a standard drug.

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