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A Complete Evaluation on *Bougainvillea Glabra*: Ethnomedical Information, Active Constituents and Pharmacological Actions

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ABSTRACT

Indian medicinal plants are gaining popularity in treating several diseases. Due to the plants availability and less side effects people are showing more interest in Indian medicinal plants than other source of medications. The current review is a latest and wide-ranging analysis of ethnomedical information, pharmacological uses and phytoconstituents of *Bougainvillea glabra*. Traditionally, the plant is conveyed for the management of helminthiasis, diabetes and respiratory tract illnesses such as cough, cold & bronchitis. It has been proved several pharmacological activities like analgesic, antipyretic, anti-inflammatory, antibacterial, antidiabetic, antiulcer, antidiarrhoea and antilipidemic. Major phytoconstituents like terpenoid, carbohydrate, fatty acids and flavonoids have been reported in this plant. This helps in supporting the plant for future studies and uses on different disorders faced due to various reasons. Further investigation and research is still required for the plant to explore various medicinal properties.

Keywords: *Bougainvillea glabra*, medicinal properties, phytoconstituents, antibacterial activity, uses.

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INTRODUCTION

Bougainvillea glabra is an ornamental plant with several medicinal properties. It is distributed everywhere, mostly in warm climatic regions. The plants are native of South America from Brazil west, Peru and south to southern Argentina (Chubut Province). *Bougainvillea* is also called as *Buganvillea* in Spain and *bugambilia* in Mexico, Guatemala, Cuba and Philippines. *Bougainvillea glabra* is an evergreen, climbing shrub with thorny stems. The plant actually grows 3-4m (10–12feet). They have a propensity to flower all year round in equatorial regions¹. *Bougainvillea glabra* is a vigorous climbing species, which flowers at an earlier age than most kinds. It is a subtropical woody plant armed with spines. *Bougainvillea glabra* is having colorful flowers and the plant is seen in front of houses and in office and on walls and fences¹. Taxonomical classification of *Bougainvillea glabra* was mentioned in Table 1.

Taxonomical classification of *Bougainvillea glabra*

| Kingdom | Plantae |
|------------|----------------------|
| Subkingdom | Viridiae plantae |
| Class | Magnoliopsida |
| Order | Caryophyllales |
| Family | Nyctaginaceae |
| Genus | <i>Bougainvillea</i> |
| Species | <i>glabra</i> |

Ethnomedical information

- In Mexican traditional medicine, leaves and bunch of flowers of *Bougainvillea glabra* has been used as a remedy for minor upper and lower respiratory tract illnesses, such as cold, cough and bronchitis²⁻⁴.
 - Leaf juice of *Bougainvillea glabra* is orally taken with rhizome juice of *Curcuma caesia* for a few days to treat helminthiasis in Bangladesh⁵.
 - Herbal combination of *Bougainvillea spectabilis* is used in for the treatment of diabetes⁶
 - Flowers, bark and leaves of *Bougainvillea glabra* are used for variety of disorders like diarrhea, acidity, cough, leucorrhoea, hepatitis and sore throat by the traditional practitioner of Mandsaur⁷.
 - *Bougainvillea* stems are dried & made into powder and used as main ingredient in popular herbal combinations used in the executive of diabetes mellitus in Chattisgarh⁸.
- Ethnomedical information of *Bougainvillea glabra* was illustrated in Table 2.

Ethnomedical information of *Bougainvillea glabra*

| Country | Part of the plant used | Uses | References |
|-------------|--------------------------|--|------------|
| Mexico | Leaves and inflorescence | Used to treat cough, cold and bronchitis | 2 |
| Bangladesh | Leaves | Anthelmintic | 5 |
| Mexico | Leaves | Used to treat respiratory illness | 4 |
| Mandsaur | Flowers | Used to treat diarrhoea, acidity, cough and sore throat. | 7 |
| Mandsaur | Flowers and bark | Used to treat leucorrhoea and hepatitis | 7 |
| Chattisgarh | bark | Used to treat diabetes mellitus | 8 |

Pharmacological activities of *Bougainvillea glabra***Anti-inflammatory, antipyretic and analgesic activities**

Pretreatment of rats with the *Bougainvillea glabra* extract (50-200) mg/kg considerably inhibited the rat paw oedema induced by carrageenan when matched with the control group ⁹. Methanol extract of *Bougainvillea glabra* has shown a substantial analgesic effect on tail immersion model experiment on mice ⁹. Methanol extract of *Bougainvillea glabra* caused a better hypothermal activity against yeast-induced pyrexia in rats ⁹. *Bougainvillea glabra* has steroidal compounds with anti-inflammatory activity ¹⁰

Antibacterial activity

Ethanol extract of diverse parts of *Bougainvillea glabra* resulted to be effective against two gram positive bacteria, *Bacillus subtilis* and *Staphylococcus aureus* and two gram negative bacteria, *Escherichia coli* and *Pseudomonas auriginosa* ¹¹.

Antidiabetic and antilipidemic activity

The antidiabetic test displays that the 100 mg/kg extract of *Bougainvillea glabra* pointedly (p<0.05) reduced the blood glucose level in the diabetic animals (alloxan induced) ¹². The study has also revealed that the aqueous *Bougainvillea glabra* leaves extract has antilipidemic effects ¹².

Thrombolytic activity

Leaves part of methanol extract of *Bougainvillea glabra* at the concentration of 800µg/ml for three days exhibited hundred percentage clot lysis. The methanol extract of *Bougainvillea glabra* stayed to have substantial thrombolytic activity at a dose of 800µg/ml ¹³.

Antihyperlipidemic activity

Different extracts (chloroform/ethyl acetate/methanol) of leaves *Bougainvillea glabra* caused a significant reduce in the total cholesterol, triglyceride and LDL-cholesterol level followed by an raise in HDL-cholesterol level in triton wr-1339 induced hyperlipidemic rats ¹⁴.

Anthelmintic activity

The *in-vitro* studies performed using hydroalcoholic extract of *Bougainvillea glabra* discovered a impeccable anthelmintic activity on helminth worms *Eudrilus eugeniae* and *Eisenia foetida* ¹⁵. Anthelmintic activity of ethanol-water extract of *Bougainvillea glabra* is high when connected to the standard drug Metronidazole (10mg/ml).

Antimicrobial activity

Hydroalcoholic extract (500 g/disc) from leaves of *Bougainvillea glabra* was active against some pathogenic microorganisms ¹⁶. *Bougainvillea glabra* is used for curing ulcers, diarrhoea and the plant is having antimicrobial activities ¹⁷. The antimicrobial effect of *Bougainvillea glabra* can be associated with the presence of betalains pigments ¹⁸. The pharmacological information of *Bougainvillea glabra* was mentioned in Table 3.

Pharmacological information of *Bougainvillea glabra*

| S.No | Plant part used | Solvent used for extraction | Uses of the plant | References |
|------|-----------------|-----------------------------|---|------------|
| 1 | Leaves | Methanol | Analgesic, antipyretic and anti-inflammatory activities | 9 |
| 2 | Leaves | Ethanol | Antibacterial activity | 11 |
| 3 | Leaves | Water (aqueous extract) | Antidiabetic and antilipidemic activities | 12 |
| 4 | ----- | Methanol | Thrombolytic activity | 13 |
| 5 | Leaves | Ethanol | Antihyperlipidemic activity | 14 |
| 7 | Leaves | Hydroalcoholic extract | Anthelmintic activity | 15 |

Phytoconstituents of *Bougainvillea glabra*

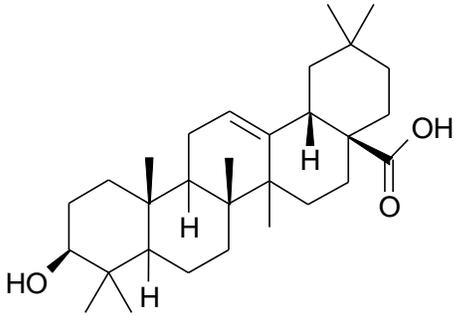
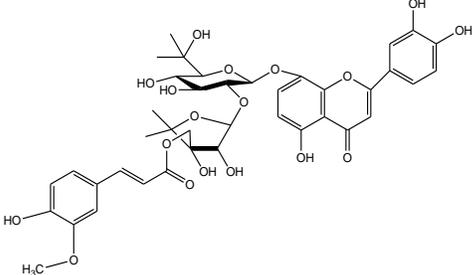
The preliminary qualitative and quantitative tests were performed in *Bougainvillea glabra* leaves and found out the presence some bioactive compounds like alkaloids, tannins, phlobatannins, saponin, flavonoids, steroids, terpenoids and cardiac glycosides ¹⁹. The phytoconstituents of *Bougainvillea glabra* were shown in Table 4. Oleananoic acid acetate was isolated from ethanol extract of *Bougainvillea glabra* by using simple chromatographic technique ²⁰. Luteolin-7-O-[2"-O-(5'''-O-feruloyl)- b-Dapiofuranosyl]- b-D-glucopyranoside (novel flavone) was isolated from the methanolic extract of the aerial part of *Bougainvillea glabra*. In addition to five flavonoids like vitexin, isovitexin, chrysoeriol, apigenin & luteolin were also isolated & identified from the methanol extract of *Bougainvillea glabra* ²¹. The GC-MS study of *Bougainvillea glabra* has shown many phytochemicals which contributes to the medicinal activity of the plant. The major components in the plant are 3-O-methyl-d-glucose; tetradecanoic acid; phytol; 9, 12, 15-

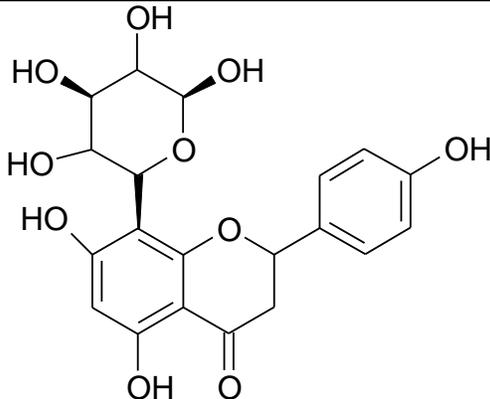
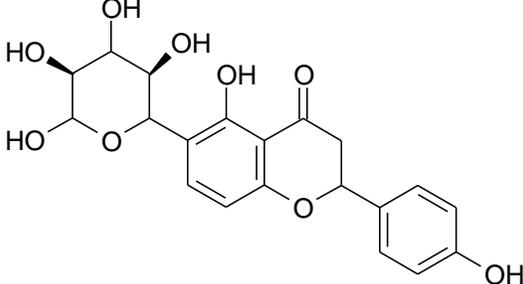
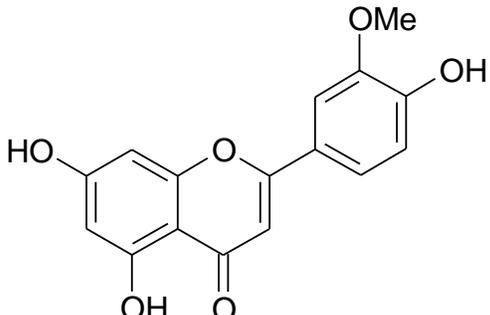
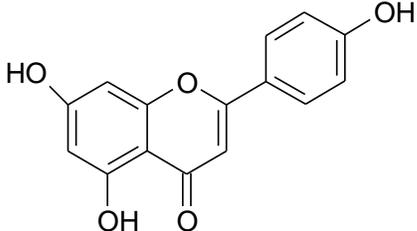
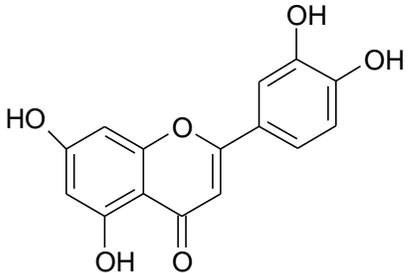
octadecatrienoic acid; and squalene.¹⁹ The IUPAC names and structures of phytoconstituents of *Bougainvillea glabra* were illustrated in Table 5.

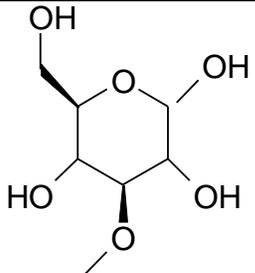
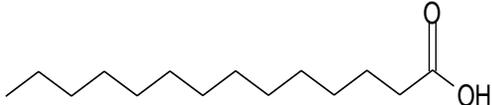
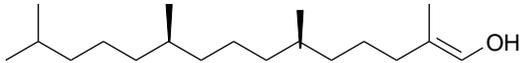
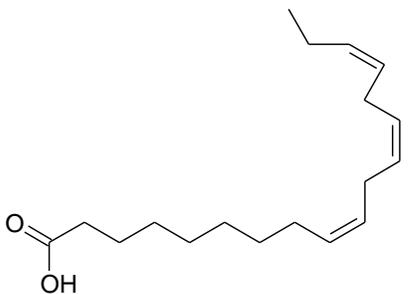
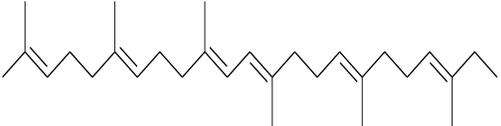
Information of active constituents for *Bougainvillea glabra*

| Plant part | Solvent used for extraction | Active constituent | References |
|------------|-----------------------------|--|------------|
| Leaves | Ethyl acetate and Methanol | Oleanic acid acetate | 20 |
| Aerial | Methanol | Luteolin-7-O-[2"-O-(5'''-O-feruloyl)- b-Dapiofuranosyl]- b-D-glucopyranoside | 21 |
| Aerial | Methanol | Vitexdin | 21 |
| Aerial | Methanol | Isovitexin | 21 |
| Aerial | Methanol | Chrysoeriol | 21 |
| Aerial | Methanol | Apigenin | 21 |
| Aerial | Methanol | Luteolin | 21 |
| Leaves | Ethanol | 3-O-Methyl-d-glucose | 19 |
| Leaves | Ethanol | Tetradecanoic acid | 19 |
| Leaves | Ethanol | Phytol | 19 |
| Leaves | Ethanol | 9, 12, 15-Octadecatrienoic acid, | 19 |
| Leaves | Ethanol | Squalene | 19 |

Phytoconstituents with IUPAC names and structures

| Category | Name | IUPAC name | Structure |
|------------|--------------|---|---|
| Fatty acid | Oleanic acid | (4a <i>S</i> ,6a <i>R</i> ,6a <i>S</i> ,6b <i>R</i> ,8a <i>R</i> ,10 <i>S</i> ,12a <i>R</i> ,14b <i>S</i>)-10-hydroxy-2,2,6a,6b,9,9,12a-heptamethyl-1,3,4,5,6,6a,7,8,8a,10,11,12,13,14b-tetradecahydricene-4a-carboxylic acid. |  |
| Flavonoid | ----- | luteolin-7-O-[2"-O-(5'''-O-feruloyl)- b-Dapiofuranosyl]- b-D-glucopyranoside |  |

| | | | |
|-----------|-------------|---|---|
| Flavonoid | Vitexin | (1S)-1,5-Anhydro-1-[5,7-dihydroxy-2-(4-hydroxyphenyl)-4-oxo-4H-chromen-8-yl]-D-glucitol |  |
| Flavonoid | Isovitexin | 5,7-dihydroxy-2-(4-hydroxyphenyl)-6-[(2S,3R,4R,5S,6R)-3,4,5-trihydroxy-6-(hydroxymethyl)oxan-2-yl]chromen-4-one |  |
| Flavonoid | Chrysoeriol | 5,7-dihydroxy-2-(4-hydroxy-3-methoxyphenyl)chromen-4-one |  |
| Flavonoid | Apigenin | 5,7-Dihydroxy-2-(4-hydroxyphenyl)-4H-1-benzopyran-4-one |  |
| Flavonoid | Luteolin | 2-(3,4-Dihydroxyphenyl)-5,7-dihydroxy-4-chromenone. |  |

| | | | |
|--------------|--------------------------------|---|--|
| Carbohydrate | 3-O-Methylglucose | 3-O-methyl-D-glucopyranose |  |
| Fatty acid | Myristic acid | n-tetradecanoic acid |  |
| Terpenoid | Phytol | (2 <i>E</i> ,7 <i>R</i> ,11 <i>R</i>)-3,7,11,15-tetramethyl-2-hexadecen-1-ol |  |
| Fatty acid | 9,12,15-Octadecatrienoic acid, | 9 <i>Z</i> ,12 <i>Z</i> ,15 <i>Z</i>)-9,12,15-Octadecatrienoic acid |  |
| Terpenoid | Squalene | 2,6,10,15,19,23-Hexamethyltetracosane |  |

CONCLUSION

The present work deals with an up-to-date review on the ethnomedical, active constituents and pharmacological information of *Bougainvillea glabra*, a useful medicinal plant from Nyctaginaceae family finding applications in indigenous systems of medicine. The isolated phytoconstituents and various extracts of the plant possess various properties like analgesic, antipyretic, anti-inflammatory, antidiabetic, thrombolytic and antibacterial activities. Hence, the objective of this review is to progress the present day researchers in the direction to undertake further studies of this plant.

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