Antifertility Effect of *Bougainvillea spectabilis* or Paper Flower

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**ABSTRACT**

*Bougainvillea spectabilis* (Family: Nyctaginaceae), commonly referred to as Great *Bougainvillea* or Paper Flower, is one of the traditional medicinal plants with potential antifertility activity. The aqueous extract and decoction of this plant have been used as fertility control among the tribal people in many countries. Furthermore, it has been shown to possess anticancer, anti-diabetic, antihematoxic, anti-inflammatory, antihyperlipidemic, antimicrobial, antioxidants, and antilucre properties. Its phytoconstituents such as alkaloids, essential oils, flavonoids, glycosides, oxalates, phenolics, philobotannins, quinones, saponins, tannins, and terpenoids were reported as the basis of its efficacious therapeutic properties. The other important constituents which contribute to the remedial properties are bougainvinones, pinitol, quercetagetin, quercetin, and terpinolene. Published information on the antifertility property of *B. spectabilis* was gathered by the use of different database platforms including Google Scholar, ScienceDirect, PubMed, SciFinder, and Scopus. These database platforms were used to provide an up-to-date review on its importance.

**Key words:** Antifertility, *Bougainvillea spectabilis*, paper flower, phytochemical substance, plant

**INTRODUCTION**

In 2016, the world population is estimated at 7.4 billion; the number is expected to increase to 9.6 billion in 2050 and 11.2 billion in 2100.[1] Fertility control is a significant issue of the global and the national public health.[2] Several effective approaches for the induction of infertility have been investigated over a long period including hormonal, chemical, and immunological approaches.[3,4] However, these approaches possess various side effects such as obesity,[5] thromboembolism,[6] and carcinogenic effects.[7] Therefore, they are interested in natural products such as plants to be used as abortifacient and as contraceptive. An ethno-botanical survey of fertility conditions among the tribal people in many countries was reported, for example, Kamrup District, Assam in India,[8] Tswapong North in Eastern Botswana,[9] Ebonji State in Nigeria,[10] and Ibadan in Southwest Nigeria.[11] Medicinal plants with potential of antifertility activity are bladder cherry, *Physalis alkekengi* [12] crab’s eye creeper, *Atris precatorius* [13] abuta, *Cissampelos pareira* [14] turmeric, *Carcuma longa* [15] climbing milkweed, *Sarcostemma secamone* [16] bellacyshe, and *Jatropha gossypifolia*.[17] The present review is to provide an up-to-date information of the properties of *Bougainvillea spectabilis*, one of the plants that are being investigated for diverse health benefits.

**PLANT DESCRIPTION**

*B. spectabilis* is sometimes referred to as “Paper Flower” because its bracts are thin and papery. The most common *Bougainvillea* color is purple or magenta, the others are range from white to orange. It also has two colors on the same tree, for example, pink and white or pink and orange that is called rainbow paper flower [Figure 1].[18] Stem is a woody perennial vine, with multi-trunked and large clumping stems which spread up to 2–4 m. The clumping stem uses thinning branches which spread up to 2–4 m. The clumping stem uses thinning branches which attached the curved thorns. The color of growing stems is from green to dark green. The bark is pale and corky. Branching is close and short, giving rise to a very dense plant. The leaf is 5–10 cm long and 2–6 cm wide, with ovate to rounded shapes. Leaves are deep green, leathery in texture, and hairy underneath. The flowers arise in leaf axils, in clusters of three. The color of the flower is white, it is small-slimmer size with hairy tubes, and surrounded by showy, colorful petaloid bracts. The bracts are crinkled, fairly large, egg-shaped, and possess colors in the rose, rusty-red, magenta, and purple. The elongated five-lobed achene fruit is 1–2 cm long, has a dry, hard fruit cover.[19]

**TAXONOMICAL CLASSIFICATION**

The taxonomy of *B. spectabilis* is in the Kingdom: Plantae; Subkingdom: Viridiplantae; Infrakingdom: Streptophyta; Superdivision: Embryophyta; Division: Tracheophyta; Subdivision: Spermatophyta; Class: Magnoliopsida; Superorder: Caryophyllales; Order: Caryophyllales; Family: Nyctaginaceae; Genus: *Bougainvillea*; Species: *B. spectabilis*.[20] Genus: *Bougainvillea* was first discovered in Brazil by a French navigator named Louis Antoine de Bougainville, in 1786.[19,21] This genus has 18 species: *Bougainvillea berberidifolia*, *Bougainvillea buttiana*, *Bougainvillea campanulata*, *Bougainvillea glabra*, *Bougainvillea herzogiana*, *Bougainvillea infesta*, *Bougainvillea lehmanniana*, *Bougainvillea lehmannii*, *Bougainvillea malmeana*, *Bougainvillea modesta*, *Bougainvillea pachyphylla*, *Bougainvillea peruviana*, *Bougainvillea pomaccia*, *Bougainvillea praceox*, *B. spectabilis*, *Bougainvillea spinosa*, *B. spectabilis*, *Bougainvillea spinosa*,...
**Bougainvillea stiptata**, and *Bougainvillea trollii*. The important species in horticulture are *B. spectabilis*, *B. glabra*, and *B. peruviana*. [22,25]

**NOMENCLATURE**

*B. spectabilis* is a native plant of South America, and it is popular in South America, Asia, Africa, and other areas that spread throughout the tropical and warm climates. [24] The vernacular name of *B. spectabilis* is known as Great *Bougainvillea*, paper flower (English); Bagan Bilash (Bengali); mao bao jin, jiu chong ge, san jiao hua, ye zi hua (Chinese); bougainvillier (French), booganbel (Hindi); buganvillia (Italian); buganvil, kembang kertas, bunga kertas (Indonesian); felila (Japanese); bougainvillea (Konkani); buganvil, buginvia, pokok bunga kertas (Malay); Cherei (Manipur); buganvilia, veranera (Spanish); bugambilia, bogambilya (Tagalog); kagithala puvvu (Telugu); fuang fah (Thai); and hoa giay, bong giay (Vietnamese). [14]

**PHYTOCHEMICAL SUBSTANCES**

The phytochemical substances that are extracted from stem, flowers, and leaves of *B. spectabilis* are alkaloid, flavonoids, furanoids, glycosides, phenols, phlobatannins, quinones, saponins, steroids, tannins, and terpenoids. [24] The other active constituents are bougainvinones peltogynoids, tannins, and terpenoids. [24] The antifertility property of this plant was not only reported in research studies but also in the several review articles. [23,24]

**CONCLUSION**

The antifertility property of *B. spectabilis* has inhibited the spermatogenic pathways that lead to decrease the number, motility, and viability of sperm. It also affects female by disrupting the estrous cycle. This plant also decreases both the sex hormones: testosterone and estrogen. This review article has attempted to compile the new medicinal plant *B. spectabilis*, to be one of the choices in the fertility regulation.

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There are no conflicts of interest.

**REFERENCES**

1. United Nations 2015. World Population Prospects: The 2015 Revision, Key Findings and Advance Tables. Working Paper No. ESA/P/WP 241. Department of Economic and Social Affairs, Population Division, United Nations; 2015.
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2. Devi P, Kumar P, Nithi Dhamija I. Antifertility activity of medicinal plants on male and female reproduction. Int J Pharm Sci Res 2015;6:988-1001.

3. Campbell M, Sahin-Hodogluglu GN, Potts M. Barriers to fertility regulation: A review of the literature. Stud Fam Plan 2008;37:87-98.

4. Gill-Sharma MK. Prolactin and male fertility: The long and short feedback regulation. Int J Endocrinol 2009;2009:687:259.

5. Pandey S, Pandey S, Maheshwari A, Bhattacharya S. The impact of female obesity on the outcome of fertility treatment. J Hum Reprod Sci 2010;3:62-7.

6. Somigliana E, Peccatini FA, Filippi F, Martinelli F, Raspagliesi F, Martinelli I. Risk of thrombosis in women with malignancies undergoing ovarian stimulation for fertility preservation. Hum Reprod Update 2014;20:944-61.

7. Kort JD, Eisenberg ML, Milheiser LS, Westphal LM. Fertility issues in cancer survivorship. CA Cancer J Clin 2014;64:119-34.

8. Deka J, Kalita JC. Ethnobotanically important medicinal plants of Kamrup district, Assam, India, used in fertility treatment. Int Res J Pharm 2013;4:229-32.

9. Mothina DM, Nithiu GP. Ethnobotanical survey of medicinal plants of Tsawong North, in Eastern Bhutna: A case of plants from Mosuoew and Seloivane villages. Eur J Med Plants 2013;3:10-24.

10. Niduue MU, Omosum G, Okvulueh IC. Ethnobotanical survey of plants used as remedy for fertility conditions in Ebonyi State of Nigeria. Ssh Acad J Biosci 2016;3:3:214-21.

11. Fasola TR. An ethnobotanical survey of plants used in the management and treatment of female reproductive health problems in Ibadan, Southwestern Nigeria. J Biol Agric Health 2015;5:7-11.

12. Montaserti A, Pourheydar M, Khazaei M, Ghorbani R. Anti-fertility effects of Phyllais alkekengi/añjalinn alcohol extract in male rat. Iran J Reprod Med 2007;5:13-6.

13. Jahan S, Rasool S, Khan MA, Ahmad M, Zafar M, Arshad M, et al. Antifertility effects of ethanolic seed extract of Abrus precatorius L on sperm production and DNA integrity in adult male mice. J Reprod Med 2009;3:8-09.14.

14. Jhumta S, Bhatthachary S. Cissampelos parenoides: A promising antifertility agent. Int J Ayurveda Pharm 2011;2:439-42.

15. Ghosh AK, Das AK, Patra KK. Studies on antifertility effect of rizhome of Curcuma longa Linn. Asian J Pharm Life Sci 2011;1:3:49-53.

16. Thanga KK, Sathidivge I, Muthukumarnawamy S, Mohan VR. Anti-fertility activity of whole plant extract of Sarcostemma secamone (L) Bennett on male albino rats. Int Res J Pharm 2012;3:139-44.

17. Jain S, Choudhary GP, Jain DK. Pharmacological evaluation and antifertility activity of Jatropha gossypifolia in rats. Biomed Res Int 2013;2013:125980.

18. Warren W. Handry Pocket Guide to Tropical Flowers. Singapore: Tuttle Publishing; 2013. p. 64.

19. Kobayashi KD, McConnell J, Grifffis J. Bougainvillea. Ornamentals and Flowers. OF-38, Cooperative Extension Service, College of Tropical Agriculture and Human Resources, University of Hawaii at Manoa; 2007.

20. Integrated Taxonomic Information System (ITIS). Bougainvillea spectabilis Wild. Taxonomic Serial No.-895413. Geological Survey, USA; 2016.

21. Fawad SA, Khalid N, Asghar W, Suleria HA. Effect of Bougainvillea spectabilis on some liver and kidney function indices in rats. Phytochem 2017;135:8-13.

22. The Plant List. Bougainvillea. The Plant List: A Working List of All Plant Species. Ver. 1; 2010.

23. Saikia H, Das S. Antidiabetic action of Bougainvillea spectabilis (leaves) in normal and alloxan induced diabetic albino rats. Indian Drugs 2009;46:391-7.

24. Jahan S, Kumar Y, Khan MS. Hypoglycemia activity of Bougainvillea spectabilis stem bark in normal and alloxan induced diabetic rats. Asian Pac J Trop Biomed 2012;2:2:919-23.

25. Mishra N, Singh H, Tandon VL, Munjal A. Evaluation of antifertility potential of aqueous extract of Bougainvillea spectabilis leaves in swiss albino mice. Int J Pharm Sci Drug Res 2012;3(10):19-23.

26. Hembrom AR, Pragya S, Kumar J, Singh VN. Effects of aqueous leaf extract of Bougainvillea spectabilis on seminal quality of mice. J Adv Zootech 2011;2:119-22.

27. Hembrom AR, Pragya S, Singh VN. Selective and directional influence of Bougainvillea spectabilis on anodic electrophoretic proteins and m-isozymes of LDH in semen of mice in relation to fertility control. Int Res J Pharm 2014;5:5:36-7.

28. Ali MS, Ibrahim SA, Ahmad F, Perez MK. Colour versus bioactivity in the flowers of Bougainvillea spectabilis (Nyctaginaceae). Nat Prod Res 2005;2005:19-1.

29. Joshi DD, Mijumdar AM, Narayanan CR. Anti-inflammatory activity of Bougainvillea spectabilis leaves. Indian J Pharm Sci 1984;46:167-8.

30. Mandal G, Chatterjee C, Chatterjee M. Evaluation of anti-inflammatory activity of methanolic extract of leaves of Bougainvillea spectabilis in experimental animal models. Pharmacogn Res 2015;7:18-22.

31. Adebowo YB, Adesokan AA, Otunji LA, Buoro DO, Aolasayo AD. Effect of ethanolic extract of Bougainvillea spectabilis leaves on haematological and serum lipid variables in rats. Biochemistry 2005;17:4:3-5.

32. Chairs-Martinez L, Munro-Reyes E, Bautista-Bingas A, Jimenez-Avalos HA, Seqvulva-Jimenez M. Determination of radical scavenging activity of hydroalcoholic and aqueous extracts from Bauhinia divaricata and Bougainvillea spectabilis using the DPPH assay. Pharmacognosy Res 2009;1:2:38-44.

33. Venkatachalam RN, Singh K, Marar T. Bougainvillea spectabilis, a good source of antioxidant phychothemicals. Res J Pharm Biol Chem Sci 2012,3:605-13.

34. Dhankhar S, Sharma M, Ruhl S, Balhara M, Kumar M, Chhillar AK. Evaluation of antimicrobial and antitoxin activities of Bougainvillea spectabilis. Int J Pharm Sci 2013;3:1:78-82.

35. Malirajan P, Gopalakrishnan G, Narasimhan S, Jessi KV. Antiulcer activity of crude alcoholic extracts of Bougainvillea spectabilis Wild. Jundishahap J Nat Pharm Prod 2007;2:1-6.

36. Bolognesi A, Polito L, Olivieri E, Valbonesi P, Barbieri L, Battelli MG, et al. New ribosome-inactivating proteins with polynucleotide:adenosine glycosidase and antiviral activities from Basella rubra L. and Bougainvillea spectabilis Wild. Panta 1997;2:2:422-9.

37. Balasaraswathi R, Sadasivam S, Ward M, Walker JM. An antiviral protein from Bougainvillea spectabilis roots: Purification and characterization. Phytochemistry 1998;5:1:156-1.

38. Malomo SO, Adebowo YB, Arous RD, Olorunmiu UF, Egunwe EC. Effects of ethanolic extract of Bougainvillea spectabilis leaves on some liver and kidney function indices in rants. Phytotherm Pharmacol 2005;17:261-72.

39. Sherwani SK, Khan MM, Zubair A, Shri MA, Kazmi SU. Evaluation of in vitro thrombolytic activity of Bougainvillea spectabilis leaf extract. Int J Pharm Sci Rev Res 2013;2:1-9.

40. Francis G, Kerem Z, Makkar HP, Becker K. The biological action of saponins in animal systems: A review. Br J Nut 2002;98:5:605-605.

41. Kumar CR, Sachin J. Pharmacological action of plant alkaloids in female reproductive system of test animals and/or human beings: A review. Int J Pharm Sci Rev Res 2013;2:3:98-107.

42. Joshi SC, Sharma A, Chaturved M. Antifertility potential of some medicinal plants in males:
An overview. Int J Pharm Pharm Sci 2011;3:204-17.

56. Sharma RK, Goyal AK, Bhat RA. Antifertility activity of plants extracts on female reproduction: A review. Int J Pharm Biol Sci 2013;3:493-514.

57. Singh G, Mali PC. A review on antifertility effects of Indian plants used traditional for contraception. Int J Pharm Bio Sci 2015;6:209-17.

58. Dutta S. A review of plants used as contraceptives. Int J Innov Pharm Sci Res 2015;3:655-62.

59. Meerwal P, Jain GC. Male fertility regulation with plant products: A review. Int J Pharm Chem Biol Sci 2015;5:146-62.

60. Azamthulla M, Balasubramanian R, Kavimani S. A review on medicinal plants exhibiting antifertility activity. World J Pharm Pharm Sci 2015;4:243-72.