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# A Review on Antifungal Potential of *Hibiscus rosa-sinensis* and *Bougainvillea spectabilis*

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**ABSTRACT:** Fungal Infections are a rising challenge in global health because of the increasing number of immuno-compromised patients, shortage of antifungal drugs, and increased resistance. Medicinal plants have been investigated as alternative sources of antifungal agents because of their diversity, bioactivities, and safety. Among these, *Hibiscus rosa-sinensis* and *Bougainvillea spectabilis* have been scientifically studied because of their various phytochemical constituents and broad-spectrum antimicrobial properties. Several *in vitro* and *in vivo* studies have demonstrated the antifungal efficacy of different parts of these plants, such as leaves, flowers, stems, and roots, against fungi, Candida, dermatophytes, and filamentous fungi. This review summarizes the antifungal activities of *Hibiscus rosa-sinensis* and *Bougainvillea spectabilis*.

**KEYWORDS:** Fungal infections, Flavonoids, Terpenoids, phenolic acids, *Hibiscus rosa-sinensis, Bougainvillea spectabilis*

## INTRODUCTION

Fungal infections have become a serious global health concern because many people have weak immune systems, patients live longer due to medical treatments, immunosuppressive drugs are widely used, the number of elderly patients with cancer has increased, and HIV/AIDS is more common [1]. The rate of both superficial and invasive fungal infections has significantly increased, leading to high morbidity and mortality rates [2]. Although fungi can seriously harm human health, only a few types of antifungal drugs are available, and they are known for their toxicity, drug interactions, and resistance [3]. The development of new antifungal medicines has been slow because fungal cells are similar to human cells, making it difficult to create drugs that are safe for humans [4]. The increase in antifungal resistance, especially in Candida species and dermatophytes, has decreased the efficacy of current therapies [2]. Consequently, researchers have turned their attention to medicinal plants as potential sources of new antifungal agents [5]. Phytochemistry of different plant species has revealed that phytochemicals are a better source of medicine than artificially made drugs [6]. The plants *Hibiscus rosa-sinensis* and *Bougainvillea spectabilis,* which have been traditionally used in treating various cutaneous infections, have been highly reinforced by scientific studies in past two decades, particularly with respect to their antimicrobial and antifungal effects [7-8].

### Types Of Fungal Infections

Fungal infections can be classified as superficial, cutaneous, subcutaneous, mucosal or systemic, depending on the depth of tissue involvement [1]. Superficial and cutaneous mycoses primarily affect skin, hair, and

nails. They are caused by dermatophyte species such as *Trichophyton*, *Microsporum*, and *Epidermophyton* [9]. Mucosal fungal infections affect mucous membranes, such as the mouth, stomach, and genital regions, and are caused by *Candida species* [10]. Systemic or invasive fungal infections occur when fungi enter the bloodstream or deep tissues and have a high mortality rate [2]. The rising incidence of non-albicans Candida species, such as *Candida parapsilosis* and *Candida glabrata,* has increased the complexity of antifungal therapy because non-albicans species are naturally resistant to commonly used antifungal medicines [11].

**Botanical Description And Traditional Uses Of *Hibiscus Rosa-sinensis* And *Bougainvillea Spectabilis***

***Hibiscus rosa-sinensis*** belongs to the family Malvaceae. It is cultivated as a decorative shrub in many tropical regions [12]. In traditional medicine, leaves and flowers are used to treat wounds, fever, infections, and inflammation [12]. In addition, the plant has antimicrobial and antioxidant activities [13].

**Figure 1: Flower of *Hibiscus rosa-sinensis***

***Bougainvillea spectabilis*** belongs to the family Nyctaginaceae. It is an evergreen perennial climbing shrub found in tropical or subtropical regions [14]. The leaves as well as the flowers are applied for the treatment of inflammation, ulcers, cough, and diarrhea [14]. Furthermore, it treats disorders of metabolism together with microbial infections [15].

**Figure 2: Flower of *Bougainvillea spectabilis***

**ANTIFUNGAL POTENTIAL**

- ***Hibiscus rosa-sinensis***

The antifungal potential of various parts and components of *Hibiscus rosa-sinensis* has been extensively explored, and many researchers have documented its substantial antifungal inhibitory potential. In this regard, *Hibiscus rosa-sinensis* flower, leaf, and root extracts obtained by employing various organic solvents have manifested varying degrees of antifungal potential, thus suggesting that both the plant and solvent play a role in exhibiting antifungal activity [16]. The antifungal activity of *Hibiscus rosa-sinensis* flowers is relatively high. The ethanolic extract of the flowers showed complete inhibition of fungal growth, while the methanolic extract exhibited a significant level of antifungal activity [17-18]. This antifungal property of flowers has been attributed to the wide range of phytoconstituents present, such as flavonoids and, tannins. Some of these

bioactive constituents identified in these flowers include alkaloids and terpenoids, whose antifungal properties are already known to be effective. Another plant part showing antifungal activity, in this case, is *Hibiscus rosa-sinensis* leaf extracts. Both methanolic and ethanolic extracts, when prepared from their main constituents, show potential antifungal activity against some of the fungal species [19]. Phytochemical tests performed on leaf extracts showed that these extracts contained bioactive compounds such as phenols, tannins, alkaloids, steroids, glycosides, and flavonoids, which contribute to their antifungal properties [18].

In addition to flowers and leaves, *Hibiscus rosa-sinensis* roots have also shown antifungal activity. The ethanolic root extract of *Hibiscus rosa-sinensis* has shown inhibitory effects on fungal growth, which have been linked to the sterol, cardenoglycoside, and tannin constituents present in the roots [17-18]. The antifungal efficacy of *Hibiscus rosa-sinensis* extract was evaluated against a range of fungal pathogens. The growth of *Candida parapsilosis* was inhibited by ethanolic extracts obtained from the leaves, flowers, and roots [17]. *Aspergillus niger* is susceptible to ethanolic flower extract [17]. Methanolic leaf extracts have been reported to inhibit the growth of *Candida glabrata*, although ethanolic extracts of *Hibiscus rosa-sinensis* exhibited greater potency against this species than methanolic extracts [20]. Furthermore, methanolic leaf extracts showed inhibitory activity against *Aspergillus flavus*, whereas flower extracts were ineffective against this fungus [17]. The growth of *Candida albicans* was significantly inhibited by methanolic leaf and flower extracts, and ethanolic extracts also demonstrated strong anti-candidal activity [19-20].

Overall, the available evidence indicates that *Hibiscus rosa-sinensis* possesses broad-spectrum antifungal potential. The antifungal activity varies depending on the plant part used and the solvent employed for extraction, highlighting the importance of extraction methods in maximizing the therapeutic potential of this medicinal plant for treating fungal infections.

- ***Bougainvillea spectabilis***

Various plant parts of *Bougainvillea spectabilis* have been tested for antifungal activity, and several studies have documented remarkable antifungal inhibitory activities against a wide spectrum of fungal pathogens. Plant extracts obtained from different plant parts using different organic solvents have varying antifungal potencies, indicating that both plant parts and solvents significantly affect antifungal potential [14]. *Bougainvillea spectabilis* flowers exhibit significant antifungal activity. Ethanolic flower extracts have shown marked inhibition potential against the growth of fungal strains, and methanolic extracts have shown appreciable *in vitro* antifungal activity [21]. The antifungal potential of flower extracts could be attributed to the presence of various bioactive phytoconstituents, such as flavonoids, alkaloids, tannins, and terpenoids, which are recognized for their excellent antimicrobial potential [22].

In addition, *Bougainvillea spectabilis* leaf extracts possess notable antifungal potential. Methanol and ethanol leaf extracts of *Bougainvillea spectabilis have been* reported to show notable antifungal potential against different fungal strains [23]. Phytochemical investigation of leaf extracts revealed the presence of phenolic constituents, flavonoids, alkaloids, glycosides, and steroids, which may act together to exert potential antifungal effects [23]. Although fewer reports are available on the antifungal potential of *Bougainvillea spectabilis* roots compared to flowers and leaves, several reports suggest that the roots of *Bougainvillea spectabilis*, when subjected to alcohol, show moderate antifungal potential against some fungal pathogens. This may be ascribed to the presence of phytochemicals, including tannins, in their roots. The antifungal activity of *Bougainvillea spectabilis* extracts was screened against various fungal pathogens. The growth of *Candida albicans* was considerably inhibited by the ethanolic and methanolic flower and leaf extracts, and the antifungal activity of ethanol flower extracts was high, especially at high extract concentrations [24]. *Aspergillus niger* was found to be susceptible to ethanolic and chloroform flower extracts, indicating solvent-dependent antifungal effects [21]. Inhibition of the growth of *Aspergillus flavus* by methanolic leaf extracts

has been shown, although relatively low activity of the flower extracts was observed against the fungus [25]. In addition to crude plant extracts, antifungal proteins derived from *Bougainvillea spectabilis*, such as ribosome inhibiting proteins, which target phytopathogenic fungi such as *Rhizoctonia solani* and *Trichoderma harzianum*, have shown appreciable inhibitory activity, supporting the antifungal activity of *Bougainvillea spectabilis* [26]. From the above findings, it is evident that *Bougainvillea spectabilis* has appreciable antifungal activity relative to other parts of the plant. Furthermore, varying antifungal activities have been exhibited depending on the part of the plant that is used and the solvent employed during the extraction of the relevant plant parts, emphasizing the significance of plant parts and components in enhancing the therapeutic activity of *Bougainvillea spectabilis* [14].

## MECHANISM OF ACTION

The antifungal properties of *Hibiscus rosa-sinensis* are mediated through interactions with ergosterol and the inhibition of chitin formation. The bioactive compounds identified in this plant include flavonoids, phenolic acids, and tannins. These have been demonstrated to be interrelated with cell wall synthesis enzymes, especially those that synthesize key structural fungal cell wall polymers such as β-glucan and chitin [27-28]. Inhibition of these important structural components compensates for weakened fungal cell walls by increasing permeability. As a result, the essential cell content leaks out of the cell membrane, creating an osmotic imbalance. This results in cell lysis. This mechanism contributes to the broad-spectrum antifungal potential of *Hibiscus rosa-sinensis* [4][29].

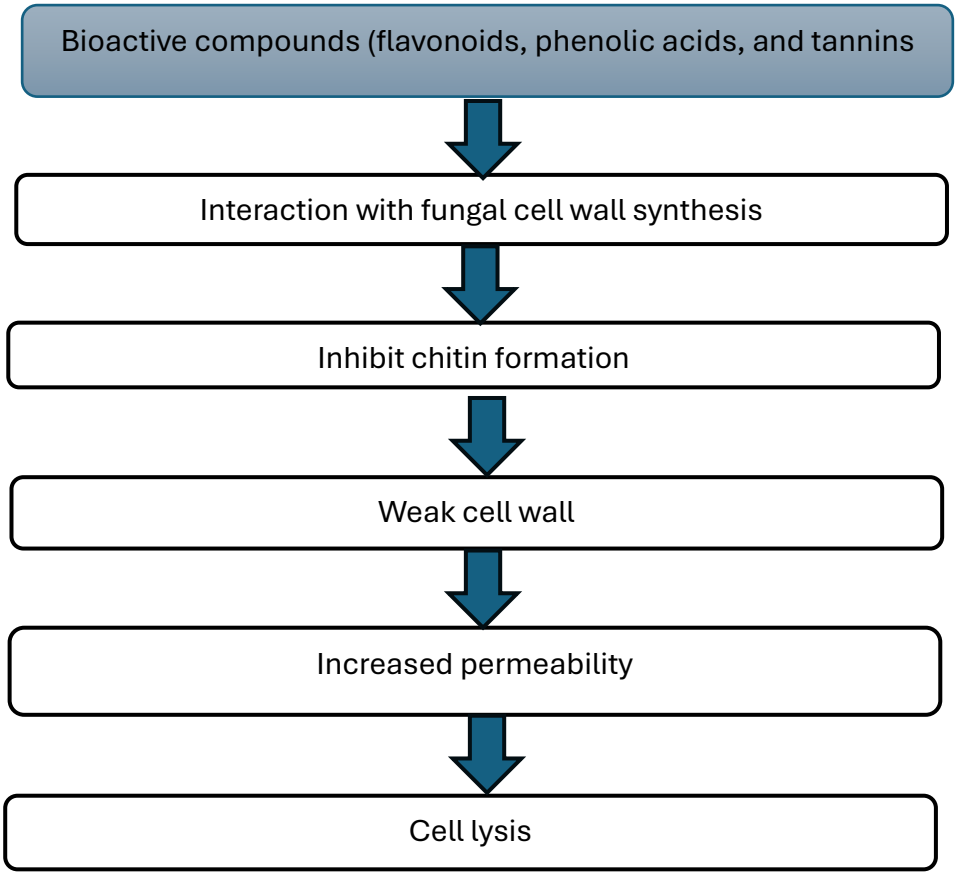


**Figure 2: Basic mechanism of action of Hibiscus rosa-sinensis**

***Bougainvillea spectabilis***–The antifungal mechanism of *Bougainvillea spectabilis* involves inhibition of protein synthesis by ribosome-inactivating proteins such as bouganin [30]. Flavonoids and phenolic

compounds interfere with fungal enzyme systems and induce oxidative stress, resulting in cellular damage and fungal cell death [4][31].

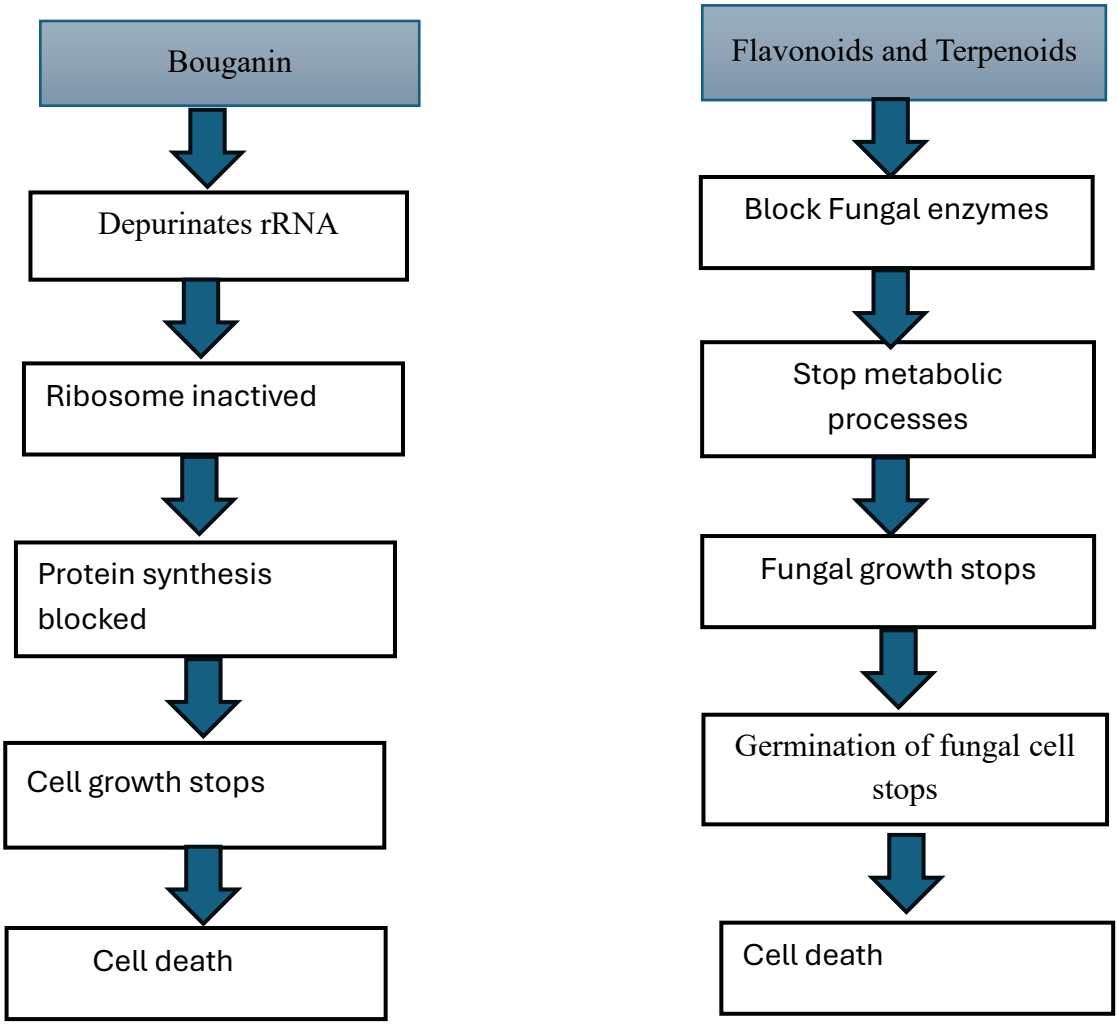


**Figure 4: Basic mechanism of action of *Bougainvillea spectabilis***

## RESEARCH GAPS AND FUTURE PERSPECTIVES

***Hibiscus rosa-sinensis:*** Although this plant has demonstrated antifungal activity, the available literature indicates that current research is still incomplete. Many studies on the antifungal potential of *Hibiscus rosa-sinensis* have used the crude form of the plant, and it is difficult to ascertain the exact compounds within the plant responsible for its antifungal activity [18][32]. The mechanism of the antifungal action of *Hibiscus rosa-sinensis* is another area which remains to be sufficiently clarified. Although some studies have provided initial hints regarding the interference of phytochemicals in the cell walls and membranes of pathogens, these findings are based on assumptions. However, further investigation is required to clearly explain how the phytoconstituents are influencing the pathogen [33].

The domain of safety assessment could be considered a major drawback in the present literature, as the majority of the antifungal studies conducted on *Hibiscus rosa-sinensis* were done under laboratory conditions, while there is scarce information on toxicity, dosage, and side effects of these extracts. In vivo studies must be conducted on herbal plants to evaluate the pharmacological effects of the drug before its therapeutic application [34]. In addition, only a small number of studies have dealt with the preparation of *Hibiscus rosa-sinensis* extracts in easily employable antifungal forms. The development of such forms is vital for the

employment of the antifungal activity, even if some unreliable results have been obtained due to differences in the extraction procedures applied in the individual studies[18][35].

***Bougainvillea spectabilis***: The antifungal potential of *Bougainvillea spectabilis* is less explored and characterized by inconsistency. However, these studies have shown conflicting results. On one hand, some reports have demonstrated good antifungal properties of the drug, while on the other hand, the efficacy of the drug is not demonstrated in some studies; hence, there is a degree of ambiguity in the antifungal potential of the drug [36-37]. Another significant gap in the research is the identification of the bioactive compounds responsible for the antifungal activity of *Bougainvillea spectabilis*. Although various phytochemicals have been identified, evidence regarding their individual contributions to antifungal activity is lacking. Thus, studies validating these activities should be conducted [38].

In addition, most studies provide qualitative data that cannot be compared to other studies because of the absence of quantitative data, such as the minimum inhibitory concentrations of the antifungal agent. Similar to *Hibiscus rosa-sinensis*, most of the literature related to *Bougainvillea spectabilis* is based on in vitro experiments, and the need to conduct in vivo experiments to establish its biological significance is high[39].

## CONCLUSION

The emergence of fungal infections and the limitations of currently used synthetic antifungal drugs indicate that alternative drugs need to be found which are not only safe and effective, but can also act rapidly. Medicinal plants like *Hibiscus rosa-sinensis* and *Bougainvillea spectabilis* have proved effective as alternatives to synthetic antifungal drugs. Several studies have indicated that the medicinal plants have various types of compounds that can damage fungal cell membranes, inhibit protein synthesis, and interfere with fungal biochemical processes. Because of this, the chance of resistance is much lower. In addition, the medicinal plants have no to little side effects. Synthetic drugs have a number of side effects and can interact with other drugs.

## REFERENCES

1. Reddy G, Kiran K, Padmavathi AR, Nancharaiah YV. Fungal infections: Pathogenesis, antifungals and alternate treatment approaches. Current Research in Microbial Sciences. 2022; 3(3): 100137.
2. Sui Ting Hui, Gifford H, Rhodes J. Emerging Antifungal Resistance in Fungal Pathogens. Current Clinical Microbiology Reports. 2024; 11: 43–50.
3. Revie NM, Iyer KR, Robbins N, Cowen LE. Antifungal drug resistance: evolution, mechanisms and impact. Current Opinion in Microbiology. 2018; 45: 70–76.
4. Lee Y, Puumala E, Robbins N, Cowen LE. Antifungal Drug Resistance: Molecular Mechanisms in Candida albicans and Beyond. Chemical Reviews. 2020; 121(6): 3390–3411.
5. Zhou X, Zeng M, Huang FP, Qin G, Song Z, Liu F. The potential role of plant secondary metabolites on antifungal and immunomodulatory effect. Applied Microbiology and Biotechnology. 2023; 107(14): 4471–4492.
6. Kaur N, Bains A, Kaushik R, Dhull SB, Melinda F, Chawla P. A Review on Antifungal Efficiency of Plant Extracts Entrenched Polysaccharide-Based Nanohydrogels. Nutrients. 2021; 13(6): 2055.
7. Raza H, Sultan MT, Ahmad K, Maaz M, Zafar S, Noman AM. Hibiscus rosa-sinensis: A Multifunctional Flower Bridging Nutrition, Medicine, and Molecular Therapeutics. Food Science and Nutrition. 2025; 13(12): e71254.
8. Ghogar A, Jiraungkoorskul K, Jiraungkoorskul W. Paper Flower, Bougainvillea spectabilis: Update Properties of Traditional Medicinal Plant. Journal of Natural Remedies. 2016; 16(3): 82.

9. Konkay K, Golajapu R, Chaganti PD, Janani B, Haque MZ. Cytopathological study of cutaneous and subcutaneous mycosis presenting as soft-tissue swellings: A 5-year retrospective study from a tertiary care center in South India. Cytojournal. 2022; 19: 54.
10. Richardson J, Naglik J. Special Issue: Mucosal Fungal Infections. Journal of Fungi. 2018; 4(2): 43.
11. Kaur R, Dhakad MS, Goyal R, Kumar R. Emergence of non-albicans Candida species and antifungal resistance in intensive care unit patients. Asian Pacific Journal of Tropical Biomedicine. 2016; 6(5): 455–460.
12. Patel R, Patel A, Vaghasiya D, Nagee A. Antimicrobial Evaluation of Hibiscus rosa-sinensis plant extracts against Some Pathogenic Bacteria. Bulletin of Environmental and Scientific Research. 2025; 1(3-4): 14–7.
13. Garg D, Shaikh A, Muley A, Marar T. In-vitro antioxidant activity and phytochemical analysis in extracts of Hibiscus rosa-sinensis stem and leaves. Free Radicals and Antioxidants. 2012 Jul;2(3):41–6.
14. Swamy MK, Sudipta Km, Prakash L, Kashyap S. Phytochemical screening and in vitro antimicrobial activity of Bougainvillea spectabilis flower extracts. International Journal of Phytomedicine. 2012; 4(3): 375–379.
15. Chauhan P, Mahajan S, Kulshrestha A, Shrivastava S, Sharma B, Goswamy HM. Bougainvillea spectabilis Exhibits Antihyperglycemic and Antioxidant Activities in Experimental Diabetes. Journal of Evidence-Based Complementary and Alternative Medicine. 2015; 21(3): 177–185.
16. Khadiga G. Abd Elaleem EAS, Abd Elaleem HG. Potential Antibacterial Activity of Hibiscus rosasinensis Linn Flowers Extracts. International Journal of Current Microbiology and Applied Sciences. 2017; 6(4): 1066–1072.
17. Missoum A. An update review on Hibiscus rosa sinensis phytochemistry and medicinal uses. Journal of Ayurvedic and Herbal Medicine. 2018; 4(3): 135–146.
18. Zulkurnain EI, Ramli S, Ali AA, James RJ, Kamarazaman IS, Halim H. The Phytochemical and Pharmacological Effects of Hibiscus rosa-sinensis: A Review. International Journal of Pharmaceutical Investigation. 2023; 13(3): 422–431.
19. Zuhaira S, Naz S, Ridzuan PM. The efficacy of hibiscus rosa-sinensis leaf extracts against candida SPP, causing candidiasis. Journal of Science and Mathematics Letters. 2019; 8(1): 1–5.
20. Palande V, Jaitly P, Bipinraj NK. Plants with anti-Candida activity and their mechanism of action: a review. Journal of Environmental Research And Development. 2015; 9(04): 1189–1196.
21. Shaiq Ali M, Amir Ibrahim S, Ahmed F, Kashif Pervez M. Color versus bioactivity in the flowers of Bougainvillea spectabilis (Nyctaginaceae). Natural Product Research. 2005; 19(1): 1–5.
22. Saxena N, Chudasama Y, Hardik Chawada, Kumar C, Sanyal D, Dasgupta S. Antibacterial And Antifungal Properties Of Bougainvillea Spectabilis And tecoma Stans Plant Extracts Against Human Pathogens. Journal of Survey in Fisheries Sciences. 2023; 10(3): 1917-1927.
23. Hajare CN, Inamdar FR, Patil RV, Shete CS, Wadkar SS, Patil KS, Ghosh JS. Antibacterial Activity of the Leaves of Bougainvillea spectabilis against E. coli NCIM 2832 and M. aureus NCIM 5021. International Journal of Pharmaceutical Sciences Review and Research. 2015: 34(1): 194-196.
24. Apriliani T, Pratiwi RH, Noer S. Activity of Ethanol Extract of Paper Flower (Bougainvillea spectabilis) against the Growth of Candida albicans. Biosphere: Journal of Biology and Biology Education. 2024; 9(2): 199–205.

25. Fawad SA, Khalid N, Asghar W, Suleria HAR. In vitro comparative study of Bougainvillea spectabilis "stand" leaves and Bougainvillea variegata leaves in terms of phytochemicals and antimicrobial activity. Chinese Journal of Natural Medicines. 2012; 10(6): 441–447.
26. Girbes T, Ferreras JM, Arias FJ, Stirpe F. Description, Distribution, Activity and Phylogenetic Relationship of Ribosome-Inactivating Proteins in Plants, Fungi and Bacteria. Mini Reviews in Medicinal Chemistry. 2004; 4(5): 461–476.
27. Mohana P, Singh A, Rashid F, Singh S, Kaur K, Rana R, Bedi PMS, Bedi N, Kaur R, Arora S. Inhibition of Virulence Associated Traits by β-Sitosterol Isolated from Hibiscus rosa-sinensis Flowers Against Candida albicans: Mechanistic Insight and Molecular Docking Studies. Journal of Microbiology. 2024; 62(12): 1165-1175.
28. Coyago-Cruz E, Alarcon A, Guachamin A, Mendez G, Osorio E, Heredia-Moya J. Functional, Antioxidant, Antibacterial, and Antifungal Activity of Edible Flowers. Antioxidants. 2024; 13(11):1297–1307.
29. Alharbi AE, AlHussaini AM, Alshami I. A Comprehensive Review of the Antimicrobial Effects of Hibiscus Species. Cureus. 2024; 16(11): e73062.
30. Iglesias R, Lucia Citores, Gay CC, Ferreras JM. Antifungal Activity of Ribosome-Inactivating Proteins. Toxins. 2024; 16(4):192–202.
31. Al Aboody MS, Mickymaray S. Anti-Fungal Efficacy and Mechanisms of Flavonoids. Antibiotics. 2020; 9(2): 45.
32. Arullappan S, Zakaria Z, Basri DF. Preliminary Screening of Antibacterial Activity Using Crude Extracts of Hibiscus rosa sinensis. Tropical Life Sciences Research. 2009; 20(2):109-118.
33. Bala R, Kaur R, Kaur B, Kaur P. Hibiscus Rosa Sinensis Linn. International journal of health sciences. 2022; 6(S3): 5165–5193.
34. Saha R, Manipal V, Sandhuja M, Mittal C. A comprehensive overview of Hibiscus-rosa-sinensis and its uses: A review. International Journal of Advanced Biochemistry Research. 2025; 9(5): 644–657.
35. Bijauliya RK, Shashi A, Chanchal DK, Kumar M. A Comprehensive Review On Standardization Of Herbal Drugs. International Journal of Pharmaceutical Sciences and Research. 2017; 8(9): 3663-3677.
36. Kenari RE, Razavi R. Encapsulation of bougainvillea (Bougainvillea spectabilis) flower extract in Urtica dioica L. seed gum: Characterization, antioxidant/antimicrobial properties, and in vitro digestion. Food Science & Nutrition. 2022; 10(10): 3436-3443.
37. Umamaheswari A, Shreevidya R, Nuni A. In vitro Antibacterial Activity of Bougainvillea spectabilis Leaves Extracts. Advances in Biological Research. 2008; 2(1-2): 1-05.
38. Das PK, Vaghela JS, Badore N. Pharmacognostical, Phytochemical and Fluorescence analysis of the plant Bougainvillea spectabilis (Willd.). Research Journal of Pharmacy and Technology. 2021; 14(7): 3733-3738.
39. Sowmiya B, Fauzia A. Phytochemical Analysis of Bougainvillea spectabilis by Using GCMS. International Journal of Zoological Investigations. 2021;7(2):751–755.