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# INTRODUCTION TO HOLOPTELEA INTEGRIFOLIA PLANT

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## ABSTRACT

In order to find new medications, the herbal sciences of today do an enormous amount of research on a wide range of plants, with Holoptelea integrifolia Roxb. (Indian elm) being one of the most analysed species. Old medicinal traditions including Siddha, Ayurvedic, and Unani literature acknowledge the traditional knowledge and ethnopharmacological value attributed to this tree, especially its stem, bark, and leaves. The core of present research is encapsulated in this abstract, which highlights the connection between advanced scientific investigation and centuries-old wisdom upheld by conventional medical institutions. Holoptelea integrifolia research has the potential for uncovering medicinal substances and close the gap between traditional herbal medicine methods and modern drug discovery attempts. Holoptelea integrifolia Roxb., or Indian elm, has a rich ethnopharmacological legacy that is documented in traditional medical literature, especially in the systems of Siddha, Ayurveda, and Unani. The stem, bark, and leaves of the plant are frequently employed for its many health benefits, which include digestive, carminative, laxative, depurative, astringent, and diuretic effects. Antiviral, antimicrobial, antifungal, anti-arthritic, antioxidant, wound healing, anti-helminthic, anti-diabetic, anti-diarrheal, antiulcer, antitumor, adaptogenic, analgesic, hepatoprotective, and larvicidal properties are just a few of the many therapeutic principles that Holoptelea integrifolia is known for. This wide range of pharmacological effects highlights the plant's potential to treat a variety of ailments, from digestive disorders to infectious infections, among other conditions. The existence of important chemical ingredients in Holoptelea integrifolia Roxb.

(Indian Elm) has been conclusively demonstrated by phytochemical research. Several bioactive substances, such as terpenoids, alkaloids, glycosides, carbohydrates, steroids, sterols, saponins, tannins, proteins, and flavonoids, are revealed by this thorough investigation. Each of these substances adds to the pharmacological profile of the plant, giving it an extensive variety of possible uses in medicine.

## INTRODUCTION

The historical reliance upon medications produced from plants, especially in the context of Ayurveda, stresses the continuing importance of natural medicine. Approximately 75% of modern medications still have their roots in Vedic therapy. The advent of novel and difficult infectious illnesses such as Ebola, Swine Flu, Bird Flu, HIV II, and antibiotic-resistant strains, along with the evolution of multi-drug resistance bacterial strains, represent a serious danger. These major developments demonstrate how urgently novel infection-fighting approaches are needed.[1] We should reconsider how we fight bacterial illnesses in light of the growing issue of antibiotic resistance. The current situation shows the need to quickly explore new directions in the quest for efficient treatment approaches since it raises worries about the potential emergence of incurable bacterial diseases. This puts pressure on academics and the pharmaceutical sector to look into a variety of sources, such as modern scientific research and conventional medical expertise, in order to create creative and adaptable plans to combat infectious illnesses in the face of emerging pathogenic threats.[2] Herbal medicines have been receiving a lot of attention as viable sources of medicinal agents for treating and preventing a wide range of illnesses. The wayside tree Holoptelea integrifolia has gained recognised as a notable medicinal plant with a wide variety of biological activity. Its importance comes from the many kinds of phytochemicals it contains, which render it an invaluable tool for treating a broad range of disorders in both people and animals. Holoptelea integrifolia's multifaceted phytochemical make up is thought to contribute to its therapeutic potential.[3] These compounds that are bioactive support the plant's ability to effectively cure a range of illnesses. The phytochemicals in this tree have a wide range of programmes, which increases their therapeutic flexibility due and enables them to treat a variety of illnesses in various species.[4]

The above-mentioned plant species arose in the Pacific Islands. Its distribution pattern encompasses both tropical and temperate regions in the northern hemisphere. The particular species may be found in the outer Himalayan area of India, which reaches an altitude of 2000

feet. It like a big deciduous tree and grows to a spectacular height of thirty to thirty-five metres.[5] This tree's bark has a grey hue and a texture that tends to peel off in scales that are faintly corky. The leaves are elliptic-ovate, ranging in length from 5 to 13 cm, and are placed alternately. They are sub-coriaceous in texture, with a finished edge, acuminate concludes and pinnate veining. When the plant is in blossom, it grows greenish-yellow flowers that can be either hermaphrodite or male. The floral structure is classified as monochlamydeous, while cases of polygamy are uncommon. The onset of flowering primarily takes place in January and February, which gives the plant's life cycle a temporal component.[6] All things thought out, these botanical traits support the plant's identity and ecological function, especially in the designated parts of the Indian subcontinent. The penultimate stage of this plant's reproductive cycle is the production of suborbicular samara fruits, which have one tiny kidney-shaped seed within and are identifiable by their membrane-covered wings. These unusual fruits, which add to the plant's life cycle and potential for propagation, typically occur in April and May.[7]

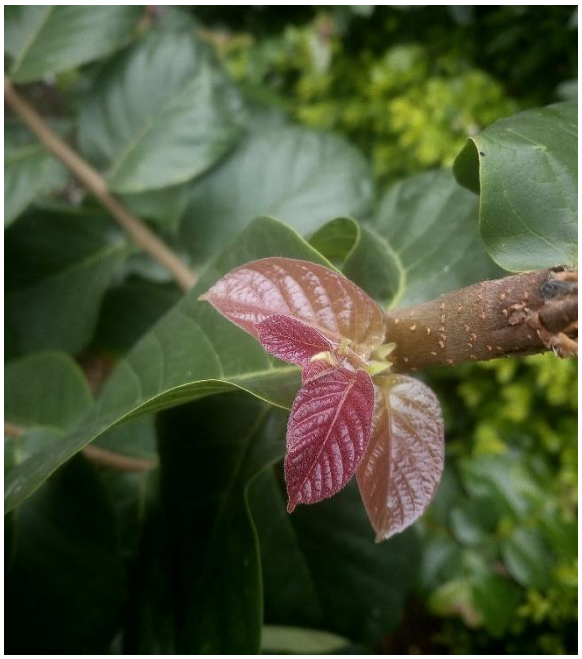


**Fig. 01: Holoptelea integrifolia plant.**

## PHYTOCHEMICAL CONSTITUENTS

**a number of reports, the plant Holoptelea integrifolia contains a wide range of chemical elements, with certain plant portions acting as primary sources of distinct phytochemicals with potential medical applications:**

1. **Stem Bark**

- Holoptelin-A and B

- 2-amino napthoquinone
- Friedlin
- Epifriedlin
- β-sitosterol
- β-D-glucose
- β-amyrin
- Betulin
- Betulinic acid

**2. Heartwood**

- 2,3-dihydroxyolean-12-en-28 oic acid
- Hederagenin

**3. Leaf**

- Hexacosanol
- Octacosanol
- 1,4-napthalenidione
- α-amyrin
- A newly invented phytosterol: 17-(6-diethylamino) decan-3-yl)-10, 13-dimethyl-12, 13-dihydro-10H-cyclopenta[a] phenanthren-3-ol

**4. Seeds**

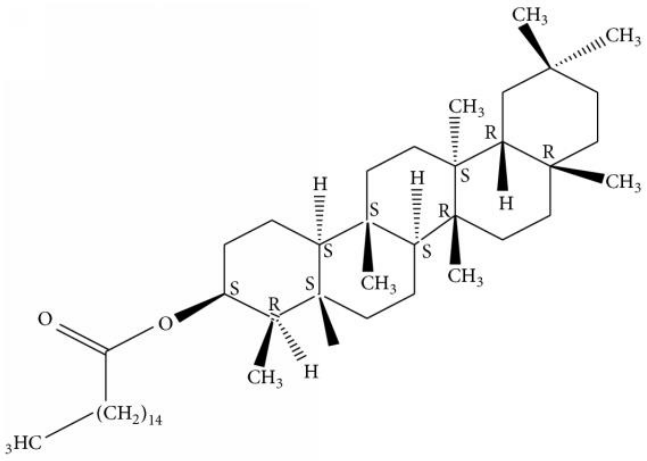
- Fatty acids: Palmitic acid, Myristic acid, Stearic acid, Linoleic acid, Linolenic acid
- Steroids: Stigmasterol, α and β-sitosterol, β-amyrin, Friedel-1-en-3-one, Lupeol, β-sitosterol-D-glucoside

**5. Pollen Grains**

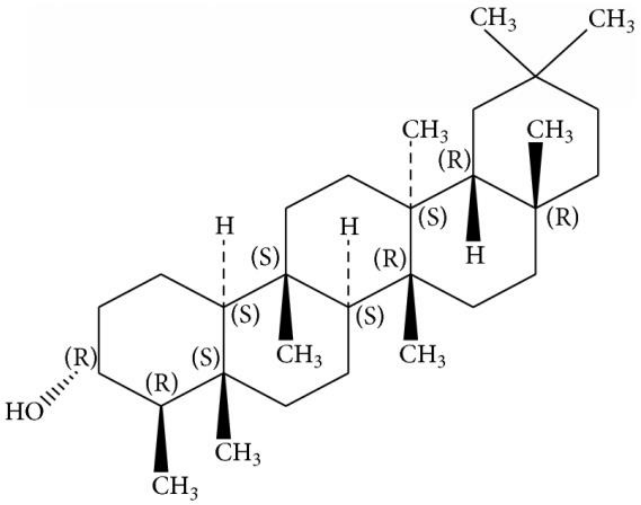
- Histamine
- 5-hydroxy tryptamine

**6. Roots**

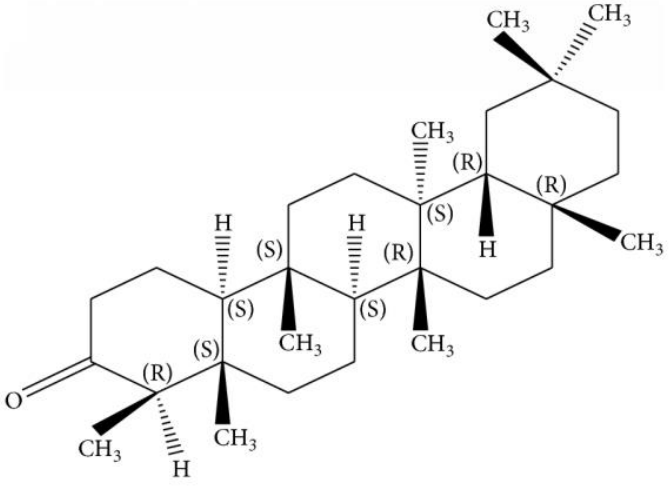
- 24-ethyl-cholest-22-en-3α-ol



**HOLOPTELIN – A**



**HOLOPTELIN –B**



**FRIEDLIN**

**Ethnomedicinal Uses**

The fact that different sections of the plant are used to cure a variety of health concerns highlights the importance of Holoptelea integrifolia in traditional medicine. These are a few examples of customary uses:

**Treatment of Inflammation:** Holoptelea integrifolia has long been used as an inflammatory therapy, which demonstrates the plant's potential as a natural treatment for inflammatory disorders. A complicated biological reaction to various stimuli, inflammation is frequently accompanied by discomfort, redness, swelling, and heat.[8] Holoptelea integrifolia is said to have anti-inflammatory characteristics, which implies that the plant's constituents may aid in regulating the inflammatory response. The inclusion of bioactive substances like flavonoids, terpenoids, or other phytochemicals with anti-inflammatory qualities may be the reason why conventional methods like Holoptelea integrifolia are successful at treating inflammation.[9] By interfering with inflammatory pathways, these substances may lessen the severity of the inflammatory response and reduce related symptoms.[10]

**Gastritis and Dyspepsia**: Holoptelea integrifolia has long been used to treat dyspepsia and gastritis, which demonstrates the plant's ability to support digestive health. Gastritis and dyspepsia are disorders that cause pain or discomfort in the stomach and are frequently connected to problems like inflammation of the stomach lining or poor digestion.[11] The fact that Holoptelea integrifolia is employed in traditional medicine to treat various digestive disorders suggests that the plant might have bioactive substances that have beneficial effects on the digestive tract. The symptoms of gastritis and dyspepsia may be decreased by these qualities, which may have anti-inflammatory, gastroprotective, or digestive-enhancing benefits.[12]

**Colic and Intestinal Worms:** Holoptelea integrifolia has been historically utilised to treat intestinal worms and colic, which implies that it may have anthelmintic qualities. Colic is a term used to describe excruciating, frequently varying gastrointestinal pain brought on by spasms, obstructions, or distension of the digestive tract.[13] Conversely, intestinal worms are parasitic organisms that can infect the digestive tract and cause a number of health problems. Because Holoptelea integrifolia is used for these reasons in traditional medicine, it is possible that the plant contains bioactive chemicals that have anti-intestinal parasitic activities. The capacity to drive out or eliminate parasitic worms is an indication of anthelmintic qualities, which are caused by certain phytochemicals produced by the plant.[14]

**Wound Healing:** Holoptelea integrifolia has been utilised for years to treat wounds, which suggests that it may help with tissue restitution. The biological process of wound healing is intricate and includes several phases, such as inflammation, tissue creation, and tissue remodelling. Bioactive components included in natural remedies like Holoptelea integrifolia may aid in these procedures and promote the general healing of wounds.[15] Holoptelea integrifolia is used in traditional medicine to treat wounds, which suggests that its ingredients include antibacterial, anti-inflammatory, and tissue-regenerating capabilities. These characteristics are essential for stopping infections, lowering inflammation, and hastening the healing process for injured tissues.[16]

**Diabetes:** Holoptelea integrifolia has been used traditionally to treat diabetes, which shows that it may have antidiabetic qualities. Blood glucose regulation therapies are often used in the therapy of diabetes, a metabolic disease characterised by increased blood sugar levels.[17] The plant Holoptelea integrifolia is used in traditional medicine to treat diabetes, which shows that it contains bioactive chemicals that have glycemic-controlling characteristics. These characteristics can include improving insulin sensitivity, encouraging the breakdown of glucose, or adjusting other elements related to the metabolism of glucose.[18]

**Pharmacology**

Holoptelea integrifolia is linked to a wide range of pharmacological characteristics and is recognised for its efficacy as a remedy in traditional systems. Even if there are acknowledged to be a number of traditional applications, it is crucial to emphasize that commercial exploitation requires scientific confirmation and supporting data.

**1. Antibacterial Activity:** antibacterial effect of different extracts from the leaves of Holoptelea integrifolia against a lactam-resistant strain of Staphylococcus aureus. The study examined hexane, diethyl ether, acetone, and aqueous extracts, with a particular focus on their antibacterial properties.[19]

**Various Extracts Examined**: Hexane, diethyl ether, acetone, and aqueous extracts made from Holoptelea integrifolia leaves were tested for their antibacterial activities.

**Notable Antimicrobial Action**: The antibacterial properties of the extracts showed that they might be able to stop the lactam-resistant strain of Staphylococcus aureus from growing or remaining viable.[20,21]

**Increased Diethyl Ether Extract Activity**: The diethyl ether extract showed the most potent antibacterial activity of all the studied extracts. This implies that the chemicals that were extracted using diethyl ether had a special ability to combat the strain that was resistant.[22,23]

**Finding the Active Principle:** The antibacterial activity that was detected was attributed to 1,4-naphthalenedione as the active principle. The chemical most likely had a significant role in the inhibitory actions against Staphylococcus aureus that were seen.[24]

**MIC stands for minimum inhibitory concentration:** The active ingredient 1,4-naphthalenedione was found to have a Minimum Inhibitory Concentration (MIC) of 4 mg/mL. The minimum inhibitory concentration (MIC) of an antibiotic agent is the concentration at which the bacterium cannot grow visibly.[25]

**2. ANTIHELMINTIC ACTIVITY**

**Antihelmintic Activity Against Pheretima posthuma:** Significant antihelmintic action against Pheretima posthuma was shown by the methanolic extract (80 mg/ml) and the aqueous extracts (10, 20, 50, and 100 mg/ml) from the stem bark of H. integrifolia.[26]

The duration needed for the helminths to become paralysed and die was used to evaluate this activity.

**Effectiveness Against Eisenia foetida Worm:** In a similar vein, it was discovered that the stem bark's ethanolic extract proved fatal to the Eisenia foetida worm, especially at a dosage of 100 mg/ml.

**3. Antioxidant activity:** One of the primary processes in biological systems, oxidation is essential to many physiological processes. However, oxidation can have negative consequences if left unchecked, including oxidative stress start, lipid, protein, and DNA damage, all of which can contribute to the development of different illnesses.[27] Antioxidants, which are chemicals that can stop or postpone oxidative damage brought on by reactive oxygen species (ROS), are necessary to offset these possible risks. The in vitro antioxidant activity of several stem bark extracts was examined in relation to Holoptelea integrifolia. A variety of techniques were used to assess the ethanolic stem bark extract as well as the methanolic and aqueous extracts.[28] These included the Thiobarbituric Acid (TBA) and Ferric Thiocyanate (FTC) methods, which shed light on the extracts' potential as antioxidants. In addition, the reducing power ability assay and the inhibiting capacity of nitric oxide,

superoxide, and 1,1-diphenyl-2-picrylhydrazyl (DPPH) radicals were used to evaluate the extracts' antioxidant potential in-depth.[29]

**4. Anti cancer activity:** With its unrelenting growth of cells, lack of differentiation, and propensity for metastasis, cancer continues to be a very difficult disease to treat. One popular method of treating cancers is the use of anticancer or anti-neoplastic medication.[30] In this regard, the possible anticancer effects of Holoptelea integrifolia leaf ethanolic extract have been explored. In one research, mice with cancer were given the ethanolic extract at doses of 250 and 500 mg/kg. Notable results showed a dose-dependent effect on certain metrics. The extract was able to increase the treated mice's lifetime, suggesting that it could have a beneficial effect on overall survival. Moreover, it demonstrated effectiveness in regaining haematological parameters, indicating a positive effect on blood-related markers impacted by the cancer.[31] The beneficial benefits also extended to the treated mice's mean survival time, an important metric for evaluating a possible treatment's overall efficacy. Tumour volume count also showed a significant dose-dependent reduction. An important finding is the decrease in tumour volume, which suggests that the Holoptelea integrifolia extract may be able to prevent or lessen the growth of cancer in the experimental model. Oral administration of the ethanolic extract from Holoptelea integrifolia bark had significant anticancer effects in experimental experiments.[32,33] The dosages that were given were 250 and 500 mg per kilogramme of body weight. The findings showed a dose-dependent and statistically significant ($P<0.05$, 0.01) suppression of the development of breast cancer. This indicates that the ethanolic extract, when taken orally, demonstrated a significant effect in preventing the growth of breast cancer.

**5. Antiulcer activity:** The hallmark of peptic ulcer disease (PUD) is a rupture in the stomach lining, the lower oesophagus, or the first section of the small intestine. In relation to treating this illness, it has been recorded that rats given 500 mg/kg of the methanolic leaf extract of Holoptelea integrifolia orally showed a substantial ($P<0.01$) decrease in ulcers.[34] This implies that the methanolic leaf extract might offer a therapeutic benefit in the animal setting by reducing or avoiding peptic ulcers. The mechanisms behind this found anti-ulcer action would need to be clarified and verified by more research and clinical investigations.

**6. Antidiarrheal activity:** The major causes of diarrhoea, which is characterised by irregular watery bowel movements, include bacterial, viral, or parasite diseases. Diarrhoea increases the risk of dehydration. The ethanolic leaf extract of Holoptelea integrifolia showed notable

antidiarrheal action in experimental animals in the context of treating this disease.[35] The ethanolic leaf extract, given at 250 and 500 mg/kg, had significant ($P<0.01$) antidiarrheal effects in mice caused by magnesium sulphate (2 mg/kg) and castor oil (0.5 ml). The Holoptelea integrifolia extract may have a medicinal use in the treatment of diarrhoea based on its capacity to lessen its symptoms.

**Phytochemistry:** The adapt medicinal plant Holoptelea integrifolia is notable for being a singular source of a wide range of chemicals with different chemical structures. The plant species has a high concentration of several phytochemicals, which suggests that it may have medicinal benefits.[36] The following substances have been found to be present in Holoptelea integrifolia:

**Terpenoids:** These substances have substantial biological activity and are produced from isoprene units.

**Sterols:** Are a family of organic compounds that have a particular kind of chemical structure and are crucial to many different physiological functions.[37]

**Saponins:** Saponins are glycosides that resemble soap and are recognised for a wide range of pharmacological actions.

**Tannins:** Tannins are polyphenolic substances that have antioxidant qualities and are frequently tasted harsh.[37,38]

**Protins:** fundamental components of a variety of biological systems and structures of living things.

**Carbohydrates:** Important for energy storage and as structural components in living organisms**.**

## CONCLUSION

The body of study on Holoptelea integrifolia's potential as a medicine is highlighted in the literature, with a focus on the plant's leaves. The stem bark and leaves have shown promise in the treatment of eczema, ringworm, leucoderma, and scabies, among other skin disorders. Studies on biological agents have demonstrated the presence of noteworthy antibacterial, antihelminthic, antidiabetic, anti-inflammatory, and antioxidant properties in crude extracts

derived from various plant sections. These results are consistent with the isolated pure chemical 1,4-naphthalenedione's notable antibacterial activity, especially against the Staphylococcus aureus strain that is resistant to N-lactam antibiotics." The purpose of this study is to present a current overview of Holoptelea integrifolia with a special focus on its phytomedicines and clinical research. Extensive and critical study is presently being conducted by the scientific community worldwide to discover new medications from plants that have not been previously looked at, especially those that are found in tropical and sub-tropical climates. These novel medications show promise as prospective treatments for illnesses including malaria, Ebola, different flu strains, AIDS, and cancer, given the rise of new aggressive mutations and the reappearance of virulent infections. The continuous investigation into the therapeutic potential of plants such as Holoptelea integrifolia highlights the significance of natural resources in the pursuit of novel treatment approaches to tackle present and upcoming health issues.

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**CONFLICT OF INTEREST**

All authors declare that no conflict of interest.

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**REFRENCE**


1. S. Singha, U. Adhikari, A. Ghosh, and G. Chandra, “Mosquito larvicidal potentiality of Holoptelea integrifolia leaf extract against Japanese Encephalitis Vector, Culex vishuni,” Journal of Mosquito Research, 2012; 2: 25–31.
2. S. Shrinivas, K. Ravindra, M. Aradhana, and B. Kailash, “Ethanolic leaf extract of Holoptelea integrifolia Planch. decreases cisplatin-induced pica in rats,” Journal of Pharmacognosy, 2008; 7(16): 293–297.
3. H. Guo, D. S. Wang, G. H. Rizwani et al., “Antineoplastic activity of Holoptelea integrifolia (Roxb.) Planch bark extracts (in vitro),” Pakistan Journal of Pharmaceutical Sciences, 2013; 26: 1151–1156.
4. A. Saraswathy, D. S. Nandini, and D. Ramasamy, “Antioxidant, heavy metals and elemental analysis of Holoptelea integrifolia Planch,” Indian Journal of Pharmaceutical Sciences, 2008; 70(5): 683–686.
5. J. Srivastava, K. N. Dwivedi, and H. P. Pandey, “Assessment of antioxidant activity and total phenolic content of aqueous stem bark extract of Holoptelea integrifolia Planch,” International Journal of Pharmacy and Pharmaceutical Sciences, 2013; 5: 357–361.
6. M. K. Mamatha, Phytochemical investigation and antidiabetic activity of Holoptelea integrifolia Planch [M.S. thesis], KLE University, Karnataka, India, 2009.
7. S. Sharma, P. Khatri, A. Pandey, V. Jakhetia, L. Chaturvedi, and N. Dwivedi, “Anti-diabetic screening of leaves extract of Holoptelea integrifolia Roxb,” International Journal of Pharmaceutical Research and Development, 2010; 2: 66–71.
8. J. Sharma, S. C. Sharma, Y. S. Sarangdevot, and B. Vyas, “Study of antidiabetic activity of the stem bark extract of Holoptelea integrifolia (Roxb.),” Research Journal of Pharmacology and Pharmacodynamics, 2012; 4: 181–184.
9. S. Shrinivas, K. S. Lakshmi, and T. Rajesh, “Evaluation of antidiarrhoeal potentials of ethanolic extract of leaves of Holoptelea integrifolia in mice model,” International Journal of Pharmaceutical Research, 2009; 1(3): 832–836.
10. Sharma J, Sharma SC, Sarangdevot YS, Vyas B. Study of antidiabetic activity of the stem bark extract of Holoptelea integrifolia (Roxb.). Res J Pharmacol Pharm., 2012; 4: 181-4.
11. Shrinivas S, Lakshmi KS, Rajesh T. Evaluation of antidiarrhoeal potentials of ethanolic extract of leaves of Holoptelea integrifolia in mice model. Int J Pharm Res., 2009; 1: 832-6.

12. Kumar B, Puri S, Debnath J, Salhan M, kaur M, Mittal A. Comparative pharmacological evaluation of adaptogenic activity of Holoptelea integrifolia and Withania somnifera. Int J Drug Dev Res., 2011; 3: 84–98.
13. Rizwani GH, Mahmud S, Shareef H, Perveen R, Ahmed M. Analgesic activity of various extracts of Holopteleaintegrifolia (Roxb) planch leaves. Pak J Pharm Sci., 2012; 25: 629-32.
14. Subhash AK, Augustine A. Hypolipidaemic effects of methanolic extract of Holoptelea integrifolia (Roxb.) planchon bark in diet-induced obese rats. Appl Biochem Biotechnol, 2013; 169: 546-53.
15. Hemamalini K, Sathya SB. Hepatoprotective activityof Sophara interrupta and Holoptelea integrifolia against carbontetrachloride induced hepatotoxicity in rats. Int J Biol Pharm Allied Sci., 2013; 2: 80-9.
16. Shrinivas S, Ravindra K, Aradhana M, Kailash B. Ethanolic leaf extract of Holoptelea integrifolia Planch decreases cisplatininduced pica in rats. J Pharmacogn, 2008; 7: 293-7.
17. Singha S, Adhikari U, Ghosh A, Chandra G. Mosquito larvicidal potentiality of Holoptelea integrifolia leaf extract against Japanese Encephalitis Vector, Culex vishuni. J Mosque Res., 2012; 2: 25–31.
18. Hemamalini K, Soujanya LG, Vasireedy U, Pavani P. CNS activity of the methanolic leaf extracts of Sophora interrupta Bedd, Kigelia pinnata Dc, Holoptelea integrifolia plants in experimental animal models. Int J Pharm Technol., 2011; 3: 3785-91.
19. S. H. Samsam and F. Moatar, Natural Medicines and Plants, Mashal Publications, Tehran, Iran, 1991.
20. R. P. Borris, “Natural products research: perspectives from a major pharmaceutical company,” Journal of Ethnopharmacology, 1996; 51(1–3): 29–38.
21. A. Singh, “Exotic floristic diversity of the Varanasi district of Uttar Pradesh, India,” Indian Journal of Plant Sciences, 2012; 1: 73–84.
22. V. D. Bambhole and G. G. Jiddewar, “Antiobesity effect of Iris versicolor and Holoptelea integrifolia in rats,” Sachitra Ayurveda, 1985; 37: 557–561.
23. P. K. Warrier, V. P. K. Nambiar, and C. Ramakutty, Indian Medicinal Plants: A Compendium of 500 Species, Orient Longman, 1995.
24. D. K. Mishra, G. Somanta, and T. K. Mishra, “Ethnomedicine of the tribe Kharia of Midnapore district, West Bengal,” in Ethnobotany in South Asia, J. K. Mahalakshmi, Ed., Scientific Publishers, Jodhpur, India, 1996.

25. S. Pawar and D. A. Patil, “Ethnomedicinal uses of barks in Jalgaon district,” Natural Product Radiance, 2007; 6(4): 341–346.
26. H. Singh, Medicinal Plants and Their Local Uses in SubHimalayan Tract of Uttaranchal, Medicinal Plants: Ethnobotanical Approach, Agrobios, Jodhpur, India, 2006, edited by P. C. Trivedi.
27. Saraswathy A, Nandini DS, Ramasamy D. Antioxidant, heavy metals and elemental analysis of Holoptelea integrifolia Planch. Indian J Pharm Sci., 2008; 70: 683-6.
28. Srivastava J, Dwivedi KN, Pandey HP. Antioxidant activity of methanolic extract from stem bark of the Holoptelea integrifolia planch. Int J Pharm Sci Rev Res., 2014; 24: 104-9.
29. Sutar RC, Kalaichelvan VK. Evaluation of antioxidant activity of leaf extract of Holoptelea integrifolia (Roxb) Planch. Int J Appl Pharm., 2014; 6: 6-8.
30. Lakshmi KS, Sharma SS, Rajesh T, Chitra V. Antitumour activity of ethanolic extract of leaves of Holoptelea integrifolia on Dalton’s ascitic lymphoma in Swiss albino mice. Int J Green Pharm., 2010; 4: 44-7.
31. Soujanya J, Silambujanaki P, Leela Krishna V. Anticancer efficacy of Holoptelea integrifolia, planch. against 7, 12- dimethyl benz(a)anthracene induced breast carcinoma in experimental rats. Int J Pharm Pharm Sci., 2011; 3: 103-6.
32. Guo H, Wang DS, Rizwani GH. Antineoplastic activity of Holoptelea integrifolia (Roxb.) planch bark extracts (in vitro). Pak J Pharm Sci., 2013; 26: 1151-6.
33. Hemamalini K, Suvidha S, Bhargav A, Vasireddy U. Evaluation of anti-ulcer activity of methanolic extracts of Kigelia africana, Sophara interrupta and Holoptelea integrifolia leaves in experimental rats. Int J Curr Pharm Res., 2012; 4: 61-6.
34. Mamatha MK. Phytochemical investigation and antidiabetic activity of Holoptelea integrifolia planch [M. S. thesis], KLE University, Karnataka, India, 2009.
35. Reddy BS, Reddy RKK, Naidu VGM. Evaluation of antimicrobial, antioxidant and wound-healing potentials of Holoptele integrifolia. J Ethnopharmacol, 2008; 115: 249-56.
36. Sahoo KK, Yadav VK, Saxena AR. Antifungal properties of Holoptelea integrifolia (Roxb.) Planch. Ann Plant Protection Sci., 2010; 18: 438-42.
37. Ishnava KB, Chauhan KH, Bhatt CA. Screening of antifungal activity of various plant leaves extracts from Indian plants. Arch Phytopathol Plant Prot., 2012; 45: 152-60.
38. Nadella N, Paarakh PM. Evaluation of anthelmintic activity of Holoptelea integrifolia (Roxb.) planch. Int J Res Ayurveda Pharm., 2011; 1: 637-41.