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A BOON TO HUMAN HEALTH-*BAUHINIA VARIEGATA*

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ABSTRACT: The plant *Bauhinia variegata* is a medium-sized tree found throughout India, ascending to an altitude 1350 m in the Himalayas. It is a species of flowering plant belonging to the family Fabaceae. Kanchnar, Mountain Ebony, Rakta Kanchnar are the common name of *Bauhinia variegata*. The various parts of the plant like flower buds, flowers, stem, stem bark, leaves, seeds, and roots are used in various indigenous systems of medicine. For the last many years, this plant is very popular among the various ethnic groups in India for the curing of a number of diseases. Traditionally, it is used in the treatment of diarrhea, dysentery, Goiter, Tumor and Kapha- Pitta dosha disorders while flowers have Pittaghna (Pacify pitta dosha), piles, constipation, and leprosy. There are a number of phytochemicals isolated from the various part of kanchnar such as flavonoids, kaempferol, ombuin, hesperidine, triterpenecaffeate, flavonol glycosides, flavanone, stigmateroles, octacosanol, Phenanthraquinone, protein, calcium and phosphorous, volatile oil, germacrene D, quercetin, rutin, etc. Upon medicinal and biological studies, anti-inflammatory & analgesic activity, chelation action, anticarcinogenic activity, anti-diabetic action, haemagglutinating activity, hypolipidaemic activity, haematinic activity, immunomodulatory activity, anti-microbial activity, nephroprotective activity, neural activity, antioxidant effects, anti-tumor activity, and antiulcer activity have been reported. Along with medicinal uses, the various non-medicinal uses of kachanar are also reported, such as timber, food, fuel, apiculture, and in production of gum resin. There is the various product of kanchnar available in the market, such as kanchnar guggulu, kanchnar juice, kanchanr ki chaal, orchid flower seed, kanchnar kashaya, kanchnar gomutra ark kanchnar churna, kanchnar herbal extract, and thyroid capsule. This review represents a detailed survey of the literature and review highlights the current status of researches on the advancement of pharmacognosy, phytochemistry, traditional, medicinal, non-medicinal uses, pharmacological activities, and marketed products of *Bauhinia variegata* Linn.

INTRODUCTION: The Plant *Bauhinia variegata* is a member of the Fabaceae family, known as Kachnar (in Hindi), kanchan (in Bangla), Rakta Kanchan (in Sanskrit) and Mountain Ebony (in English). Kachnar plants very often found in garden, park, and roadsides as an ornamental plant in warm temperate and subtropical regions.

This plant is native to Southeast Asia and grows well in a tropical and subtropical climate. *Bauhinia variegata* is distributed in subhimalayan and outer Himalayan region of the Punjab and Sikkim state of India.

Kachnar is also found in some other countries such as Burma and China and in tropical countries such as Africa and South America. *Bauhinia variegata* consists of more than 300 species of medium-sized, deciduous tree which remain leafless in the month of January to April. In this period, the flowering of the tree gets starts. The genus includes trees, vines, and shrubs. *Bauhinia variegata* leaves are bifoliate.

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It is known to restore fertility to acid and degraded soils because of its capacity to fix nitrogen in soil. The various parts of the plant like flower buds, flowers, stem, stem bark, leaves, seeds, and roots are used in various indigenous systems of medicine. Since last many years this plant becomes very popular among the various ethnic groups in India for the curing of a number of diseases that's why in Veda, it is called kanchan (gold) ¹.

Morphology: It is a deciduous tree having height up to 15 -20 m, Colour of bark is dark brown, branches are grey, leaves are 5-9 × 7-11 cm in size, broadly ovate shape, Flower buds are fusiform, smooth, sessile. Petioles are 2.5-3.5 cm; Petals are white or with pink spots possessing shape obovate or lanceolate ²⁻⁵.

Traditional Uses: Kachnar is well described in ancient Indian science of life known as Ayurveda, and its stem bark & flowers are used as medicine in various formulations. Its bark uses in many disorders like Gandamala (Lymphadenopathy), Galaganda (Goitre), Arbuda (Tumor), Ashthila and Kapha-Pitta dosha disorders whereas flowers possess Pittaghna (Pacify pitta dosha), Rakta Pradaraghna (treats dysfunctional uterine bleeding), Kaasghna (cough treatment) and Kshyaghna (Anti tubercular) properties. However, it is also practiced in the treatment of various carcinomas. Kachnar i.e., *Bauhinia variegata* is a very popular plant species occurs in Himachal Pradesh. The buds of Kachnar are cooked and eaten as a delicious food known as "Karalen Ki Sabji". People eat Kachnar buds seasonally when available with the celebration and happiness. Kachnar buds are also taken by

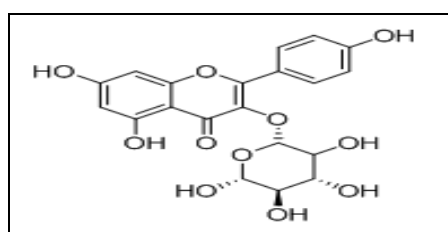
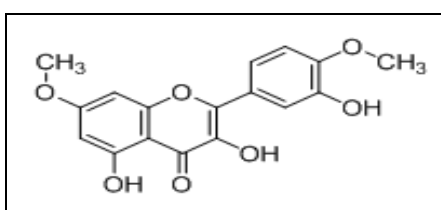
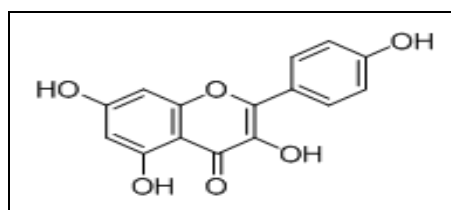
peoples as vegetables in the North-eastern part of the country ^{3, 4}. A systematic review of the medicinal importance of Kachnar plant is missing despite its wide use in Ayurveda and cultural importance.

Taxonomic Hierarchy: ⁶

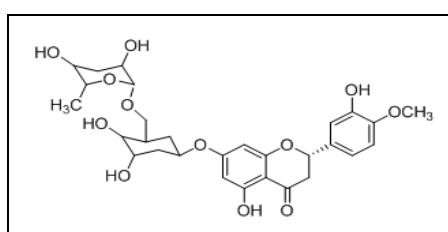
Kingdom : Plantae
Divison : Tracheophyta
Class : Magnoliopsida
Order : Fabales
Family : Fabaceae
Genus : Bauhinia
Species : variegata

Ecology: Kachnar is a plant that requires tropical and subtropical climates and grows in summer and mild winter season. It requires a lot of light and good drainage. Extreme cold conditions destroyed the leaves of seedlings, but the seedlings recover during the summer season. It grows well at an altitude of about 1700-2000 meters, temperature range 10-45 °C and rainfall 400-2200 mm. Kachnar can grow in a wide range of soil, but it mainly required rocky soil and sandy, loamy soil with good drainage.

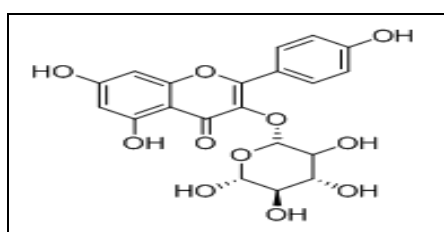
Phytochemical Constituents: The main constituent of *B. variegata* parts are- 1. Aerial part 7 contains 6 flavonoids, namely - 1. Kaempferol 2. Ombuin 3. Kaempferol-3-o-β-D-gluco-pyranoside 4. Hesperidine 5. Kaempferol, 7, 4'-dimethylether-3-o-β- Dglucopyranoside 6. isorhamnetin-3-o-β-D glucopyranoside 7. triterpene caffeate (3 beta)-3-Hydroxyolean-12-en-28-oic acid.



KAEMPFEROL-3-O--B-D-GLUCO
-PYRANOSIDE

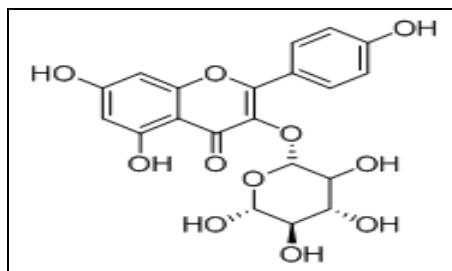


HESPERIDIN

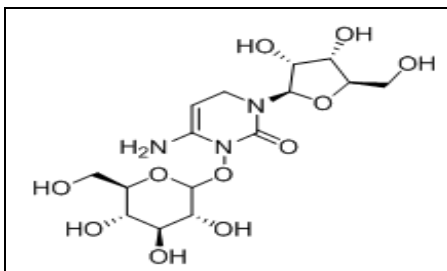


TRITERPENE CAFFEATE (3 BETA)-
3-HYDROXYOLEAN-12-EN-28-OIC ACID

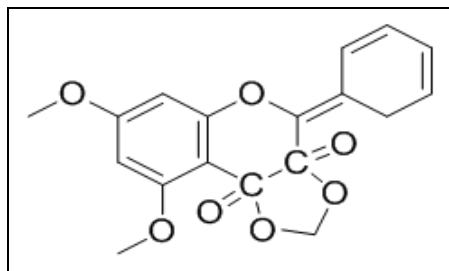
2. Root ⁸ contains flavonol glycosides viz. Kaempferol-3-O-- β -D-glucopyranoside, cytidine-3-glucoside, flavonone - 5, 7-dimethoxy-3, 4 methylenedioxyflavonone



KAEMPFEROL-3-O--B-D-GLUCOPYRANOSIDE

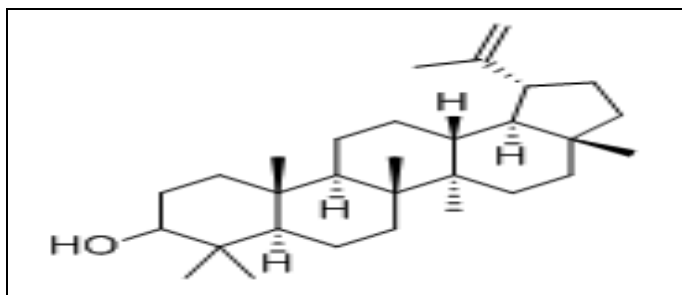


CYTIDINE-3-GLUCOSIDE

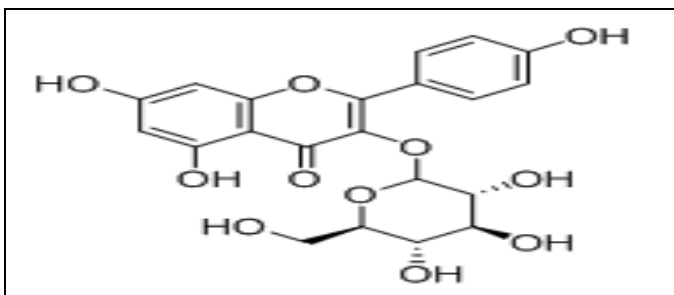


5, 7-DIMETHOXY-3, 4 METHYLENEDIOXYFLAVONONE

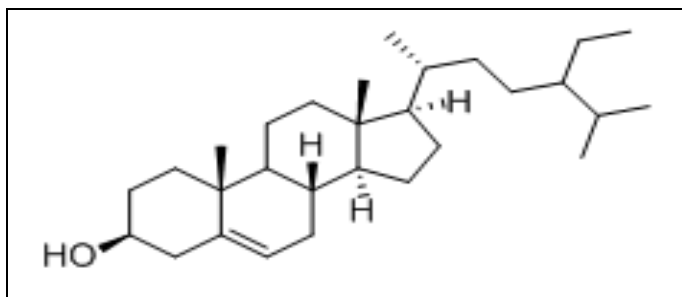
3. Stem bark ^{9, 10, 11} on preliminary phytochemical screening the *B. variegata* gave reducing sugar, stigmasteroles, octacosanol and nitrogenous substances, Flavonone glycoside, Phenanthra-quinone 5, 7-dihydroxyflavanone-4'- O-a-L-rhamnopyranosylb-glucopyranosides.



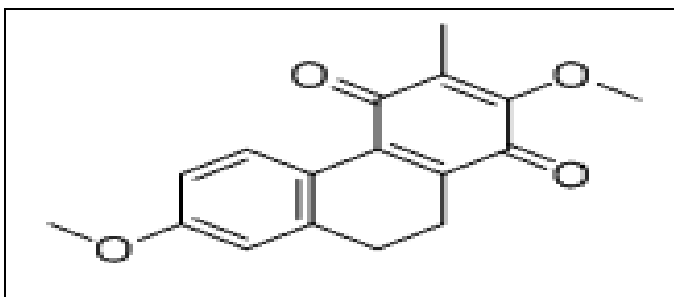
LUPEOL



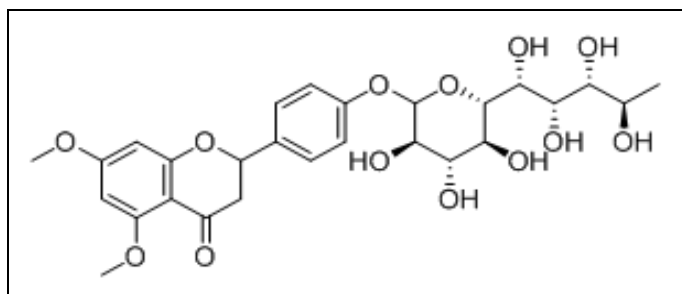
KAEMPFEROL-3- GLUCOSIDE



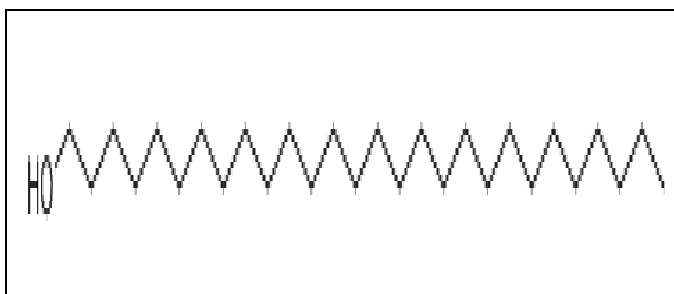
β -SITOSTEROL



BAUHINIONE

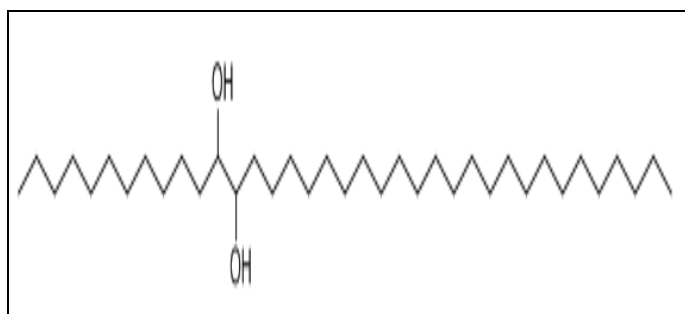


NERINGENIN-5, 7-DIMETHYLETHER-4'- RHAMNOGLUCOSIDE 9, 10-DIHYDROPHENANTHRENE-1, 4-DIONE

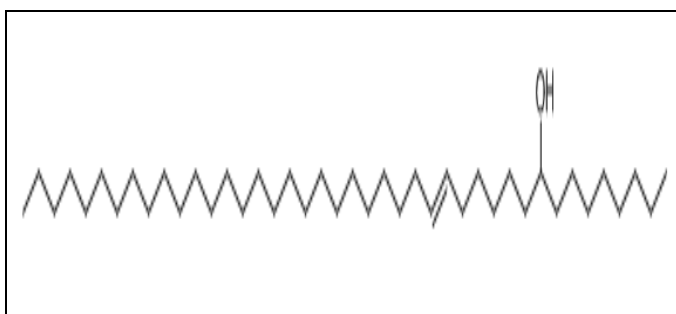


OCTACOSANOL

4. Leaves ¹² the leaves of *B. variegata* mainly contain heptatriacontan- 12, 13-diol, dotetracont-15-en-9-ol, crude protein, calcium and phosphorous, volatile oil, germacrene D, spathulenol, δ - and γ - cadinene, flavonoids quercetin, rutin, kaempferol etc.



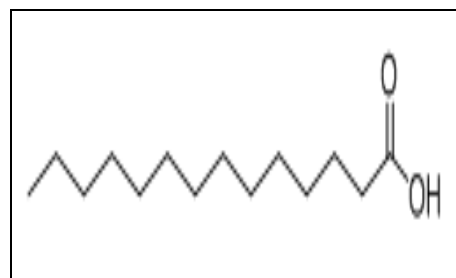
HEPTATRIACONTAN- 12, 13-DIOL



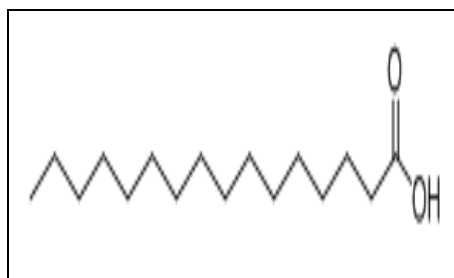
DOTETRACONT-15-EN-9-OL

5. Seeds the petroleum ether extract of the seed yields 17 percent fatty oil¹³. Seed also contain the essential amino acids such as lysine, methionine,

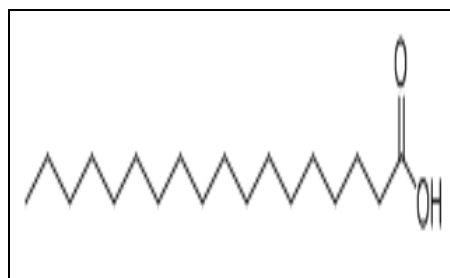
isoleucine, valine, threonine, leucine and phenylalanine. The colour of the fatty acid oil is yellow and the composition is as follows



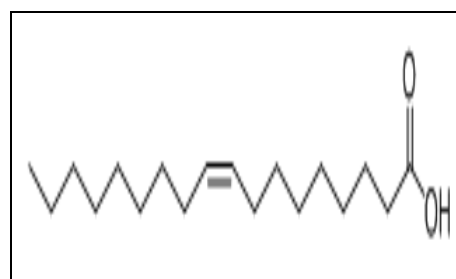
MYRISTIC ACID (1%)



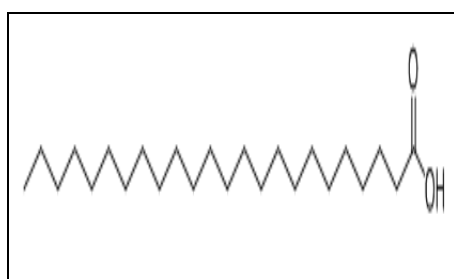
PALMITIC ACID (17%)



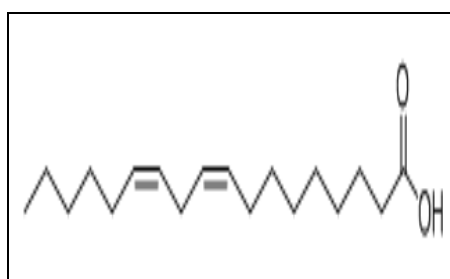
STEARIC ACID (13.4%)



OLEIC ACID (31.8%)



LIGNOCERIC ACID



LINOLEIC ACID (35.9%)

Pharmacological Studies:

1. Anti-inflammatory & Analgesic Activity:

Mohammed MA *et al.*, 2009 identified analgesic and anti-inflammatory activity and reported new triterpene saponins (Compound 9) from *Bauhinia variegata* leaves which reduces edema accompanied by significant reduction in PGE2 (Prostaglandin E2) level in serum, liver homogenate, and granuloma. Reduction in hepatic and pulmonary granuloma diameter was observed after treatment with compound⁹ was suggested may be due to its anti-inflammatory activity. Furthermore, compound shown analgesic effects both in visceral and central nociceptive mouse models¹⁴.

2. Chelation Action: G. Uddin *et al.*, 2012 examined the chelation action of Kachnar and found dose-dependent effect in metal ion chelating

ability of the extracts of different concentrations. The aqueous extract of *B. variegata* has more chelation property than the non-polar extract. The decreasing order of chelation action of extracts was acetone, water, ethyl alcohol, benzene, chloroform, petroleum ether, and ethyl acetate¹⁵.

3. Anticarcinogenic Activity: Sonam Panday & R. C. Agrawal 2009 investigated the anticarcinogenic activity of *B. variegata* and reported that methanolic extract of stem bark of *B. variegata* shows anticarcinogenic activity using two-stage protocol in skin papilloma model in Swiss albino mice against 7, 12- dimethylbenz anthracene (DMBA) and croton oil-induced skin carcinogenesis in mice¹⁶.

4. Anti-diabetic Action: Syeda shahana *et al.*, 2017 investigated anti diabetic activity on strepto-

zotocin induce diabetes model and found that insulin can effectively use to reduce the blood glucose level in hyperglycemia because Kachnar also contain the domain structure which has the same amino acid sequence as Insulin.

In streptozotocin-induced and alloxan-induced diabetic rats, the elevated blood glucose level is reduced when the alcoholic and hydroalcoholic extract of Kachnar leaves administered by oral route at 200 mg/kg dose^{17, 18}.

5. Haemagglutinating Activity: Wassel et al., 1989 studied the haemagglutinating activity of kachnar and reported that the protein obtained from the crude seed of *B. variegata* shows the haemagglutinating activity. Haemagglutination is used for the detection of the presence of viral particles¹⁹.

6. Hypolipidaemic Activity: Rajani GP & Ashok P. 2009 recognized the hypolipidaemic activity and reported the ethanolic and aqueous extracts of the stem bark and root of Kachnar effectively lowered the levels of plasma lipids and lipoprotein, e.g., cholesterol, low-density lipid, triglyceride, and very-low-density lipid and increased the level of high-density lipid in Triton WR-1339 (iso-octyl poly-oxyethylene phenol) induced hyperlipidemic albino rat²⁰.

7. Haematinic Activity: Nabu Raj Pokhrel et al., 2002 identified the haematinic activity and reported the ethanolic, and aqueous extract of stem bark of *B. variegata* increases the hemoglobin content of blood in hemolytic anemic rats²¹.

8. Immuno-modulatory Activity: P.K. Gupta & G. Sahu 2012 identified immunomodulatory activity and reported an ethanolic extract of the stem bark of *B. variegata* shows the immunomodulatory activity on the primary and secondary antibody responses by humoral antibody response for specific immune response²².

9. Anti-Microbial Activity: Mishra A et al., 2013 identified antimicrobial activity and found Kachnar has antimicrobial activity against Gram-negative bacteria. The leaf extract of the *B. Variegata* inhibited the growth of bacteria. The antimicrobial

spectrum of kachnar is relatively narrow. Sensitive organisms are *E. coli*, *Pseudomonas* species, *Klebsiella pneumoniae*. The polar extract was effective against the *E. coli* & *Pseudomonas* species and the polar extract were effective against *K. pneumoniae*²³.

In *Staphylococcus aureus B. variegata* bark powder administration shows antibacterial, bio enhancing, and anti-inflammatory properties²⁴.

10. Nephroprotective Activity: SR Pani et al., 2011 recognized nephroprotective activity in *in-vivo* cisplatin-induced nephropathy model in rats. The administered ethanolic extract of *B. variegata* stems for 14 days attenuated the various histological and biochemical symptoms of cisplatin nephrotoxicity. The decrease in creatinine serum level and urea and an increase in urine output and body weight was observed²⁵.

11. Neural Activity: Kamilla Monteiro dos Santos et al., 2011 identified the neural activity in Kachnar and found acetylcholinesterase inhibition activity through Thin Layer Chromatography (TLC). Enzyme inhibition was observed mainly in flowers. However, inhibition found in lower intensity on branches and leaves showed no inhibition at all²⁶.

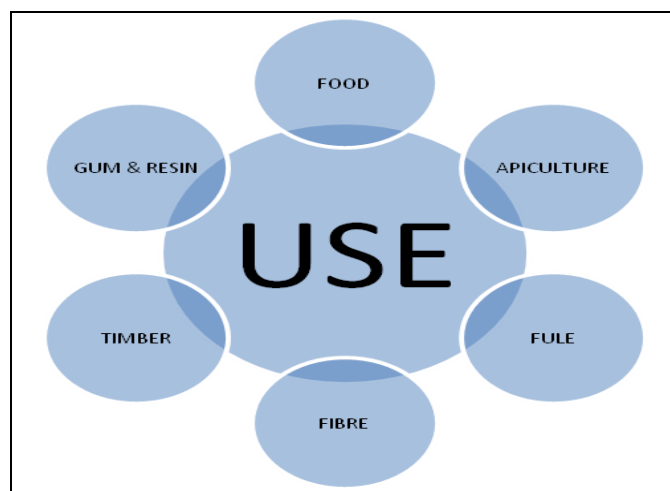
12. Antioxidant Effects: Rajni G P et al., 2009 examined antioxidant activity. The crude extracts and fractions of *B. variegata* were evaluated for their antioxidant potential. The antioxidant activity was performed by DPPH radical scavenging assay. The ethyl acetate, methanol, and n-hexane fractions showed moderate scavenging activity as compared to the standard Quercetin. The presence of Phyto-constituents such as oleic acid, β -sitosterol is reported to reduce the hyperlipidemic states, and such components have been previously reported in *B. variegata*. Anti-obesity effect of *Bauhinia variegata* bark extract on female rats fed on a hypercaloric diet had been observed. In another study, methanolic extract of *B. variegata* bark and its fractions were evaluated for antioxidant and DNA protective activity. The results concluded it has significant antioxidant activity and the potential to prevent H₂O₂-induced oxidative damage to pBR322 DNA. The potent antioxidative activity and DNA protection ability of *B. variegata* bark extract/fractions may be attributed to their richness

in phenolic/flavonoid compounds. Moreover, there was a significant correlation between antioxidant activity and the total phenolic/flavonoid content ²⁷.

13. Anti-tumor Activity: B. Raj Kapoor *et al.*, 2003 investigated the anti-tumor activity of Kachnar and reported the ethanolic and aqueous extract of stem of the *B. variegata* showed an anti-tumour effect on swiss albino mice against dalton's ascetic lymphoma (DAL) ²⁸.

14. Antiulcer Activity: B. Raj Kapoor *et al.*, 2003 recognized the antiulcer effect of Kachnar and reported that the ethanolic extract of the stem of *B. variegata* showed the antiulcer activity against gastric ulcer induced by pyloric ligation and aspirin-induced ulcer model in rats. Ethanolic extract decreases the volume of gastric secretion, total, free acidity, and ulcer index with respect to control, which increases during ulcer ²⁹.

Other uses of Kachnar: ³⁰



1. Food: The various part of kachnar like flowers, leaves, and flower buds are used as vegetables in many regions of India.

2. Apiculture: It blooms in early winter and spring in India. The buds being consumed as a vegetable, bees have little chance of taking proper advantage of the bloom.

3. Fuel: The woody part of the plant has a high calorific value of about 4800 kcal/kg. It uses as fuel in many places.

4. Fibre: The stem of *B. variegata* also produces a fibre.

5. Timber: The various agricultural equipment and agricultural machine are prepared by using the wood of *B. variegata*.

6. Gum or Resin: *B. variegata* also produce a type of gum.

Marketed Products:

Product name	Manufactured / Marketed By		
Kachnar guggulu	Baidyanath		
	Shriji herbal products		
	Amar pharmaceuticals		
	Ashtang herbals		
	Zandu Ayurveda		
	Amrita drugs		
	Dabur India limited		
	Dhootapapeshwar limited		
	Patanjali Ayurved Limited		
	Banyan herbs		
Kachnar juice Kachnar ki chhaal	SUMERU HERBS		
	Shubh supplies JJW & Brothers Pvt. Ltd. Indianjadibooti LIFERR Herbs		
B. variegata / Kachnar Ornamental mixed Flowering orchid trees Seeds	SHOP 360 GARDEN®		
	Kachnar kashaya Kachnar gomutra ark Kachnar Churna Kachanara Guggulu capsules	Nagarjun pharmaceutical P.ltd. Goseva Planet Ayurveda Cosmveda Organics	
		Kachnar Herbal Extracts Bio Mountain Ebony Vitalizing Serum for falling hair Thyroid Capsules	Flower Perfumes Biotique Botanicals Zoic Pharmaceuticals

CONCLUSION: In this article, authors reviewed the relevant properties such as pharmacognostical, phytochemical, and pharmacological information of *B. variegata*. A critical analysis of the literature revealed that this plant contains different constituents that are responsible for various activities.

The present review of the literature revealed that the plant is having anti-diabetic, anti-inflammatory, immunomodulatory, anti-tumour, hepatoprotective, antibacterial, haemagglutinating, haematinic, anti-microbial, antiulcer, antioxidant, anti-carcinogenic, hypolipidemic and antitumour activities. This review study will help the Industrialists, researchers, students, and scientists for further studies on this plant.

ACKNOWLEDGEMENT: Nil

CONFLICTS OF INTEREST: Nil

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