INTRODUCTION

The genus Bauhinia contains more than 200 species of flowering plants belonging to the family Fabaceae (subfamily Cesalpinioideae). It is an erect, branched shrub up to 2-4m contains hairy branches, leaves and pods. Leaves are 4-7cm long, wide and split about one third to the base into two, oval, rounded lobes. Flowers are bell shaped, pendulous, solitary, grow up to 7cm long. They usually appeared in pairs. Pods are slender, pale brown, velvety, pointed10-11x1.5-2cm, splitting on the tree to release 6-12 seeds. Seeds are 7-8.5x5.5-7x2-3mm, ovate compressed, reddish brown in color with v-shaped marginal hilum [1].

Seed acts as tonic and aphrodisiac. Fruit is used as diuretic. Leaf is used as a main ingredient in preparing plaster to treat abscesses. Root and bark decoction is used for curing abdominal troubles and as an anthelmintic. Root bark infusion is used as an external application to treat inflamed glands and abscesses. Bark is used externally to treat wounds and tumours. Combination of seed paste with vinegar is used as a local application to the wounds produced by venomous animals. Leaves have anti diabetic action. The whole plant is used for treatment of snake bite and scorpion sting. Buds and flowers are used in dysentery. Root bark is internally used for treating large intestine problems. Flower is used for curing diarrhoea and dysentery. A decoction of root bark is applied as vermifuge and stem bark infusion is used as astringent. Seed acts as tonic and aphrodisiac [2].

Whole plant yields tannins. Leaves contain kaempferol-7-rhamnose, kaempferol-3-0-glucoside, quercetin-3-0-glucoside and quercetin-3-0-rutinoside. Flowers contain glycosides, tannins, alkaloids, phytosteroids, flavonoids, saponins, carbohydrates, phenolic compounds and tannins. Seeds contain fatty oils, proteins, water soluble mucilage and saponins. Bark yields fiber. Roots contain carbohydrates, reducing sugars, saponins, tannins, phenolics and flavonoids [1].

PHARMACOLOGICAL ACTIONS

Antibacterial activity

The antibacterial activity [3] of aqueous and ethanolic extracts of leaves of Bauhinia tomentosa have been evaluated against human pathogenic bacteria such as Escherichia coli, Salmonella typhi, Streptococcus...
pyrogens, Enterobacter aerogens, Pseudomonas aeruginosa, Streptococcus faecalis, Staphylococcus aureus, Bacillus subtilis, Bacillus cereus, Proteus vulgaris. The anti bacterial assay was performed by disc- diffusion technique. Antibacterial activity was evaluated based on zone of inhibition appeared around the discs. Ethanol extract shows higher anti bacterial activity than aqueous extract. Ethanol extract shows maximum inhibitory activity against Streptococcus faecalis and minimum inhibitory activity for Enterobacter aerogens. Aqueous extract shows maximum inhibitory activity against Streptococcus faecalis and minimum activity against Bacillus cereus.

**Anti bacterial activity**

The anti bacterial activity [4] of n-butanol, chloroform, aqueous extracts of Bauhinia tomentosa flower have been evaluated against Bacillus subtilis, Enterobacter aerogens, klebsiella pneumonia, Salmonella typhi, Staphylococcus aureus using agar well diffusion assay. n-butanol extract showed maximum anti bacterial activity against Salmonella typhi and Enterobacter aerogens when compared to chloroform and aqueous extracts.

**Anti microbial activity**

Methanol, ethanol, chloroform, petroleum ether, ethyl acetate and aqueous extract of Bauhinia tomentosa leaves were evaluated for anti microbial activity [5] against Bacilus cereus, Bacillus subtilis, Escherichia coli, Pseudomonas aeruginosa, Candida albicans and Aspergillus niger by cup-plate method. Methanol, ethanol, chloroform extract shows maximum antimicrobial activity against tested microorganisms when compared to other extracts.

**Anti-ulcer activity**

Aqueous extract of leaves of Bauhinia tomentosa was evaluated for anti-ulcer activity [6] using Alcohol-induced and Aspirin-induced ulcer model in rats. The aqueous extract shows anti-ulcer activity against alcohol induced and aspirin induced ulcer in rats.

**Anti-hyperglycemic &Anti-lipidemic activity**

The anti-hyperglycemic & anti-lipidemic activity [7] of Ethanolic extract of Bauhinia tomentosa flower was evaluated for the management of streptozotocin-induced diabetes in rats. Ethanolic extract was administered intra peritoneally for 7days at dose of 100mg/Hg & 200mg/Hg for 48hrs after streptozotocin injection (100mg/Hg). There will be decreased plasma glucose, plasma insulin, total cholesterol, triglycerides, low density lipoproteins, very low density lipoproteins, and increased high density lipoproteins were observed in of streptozotocin-induced diabetic rats. The Ethanolic extract shows potent anti-hyperglycemic & anti-hyper lipidemic effects in streptozotocin-induced diabetic rats.

**Anti-hyperglycemic activity**

Anti-hyperglycemic activity [8] of aqueous extract of Bauhinia tomentosa leaf was evaluated against oral glucose tolerance test in overnight fasted as well as in alloxan induced diabetic rats. The hypoglycemic activity is mainly because of active compounds like phenols and flavonoids. The significant blood glucose lowering effect of Bauhinia tomentosa leaf extract in alloxan induced diabetic rats are more helpful in maintaining the blood sugar level in patients with diabetes.

**Anti-diabetic activity**

The anti-diabetic activity [9] of aqueous extract of Bauhinia tomentosa leaf was evaluated against Alloxan-induced albino Wistar rats. Diabetes was induced with alloxan monohydrate (150mg/kg body weight) in rats. Aqueous extract is administered at the dose of 300mg/kg orally for 30 days. The aqueous extract significantly reduces the glycemic parameters, lipid parameters and serum enzymes and increases high density lipoproteins, total proteins, and glycogen levels. These results confirmed the potent anti-diabetic activity of Bauhinia tomentosa.

**Anti-diabetic activity**

The anti-diabetic activity [10] of ethanolic extract of roots of Bauhinia tomentosa were tested against glucose tolerance test in normal rats and alloxan induced diabetic rats. Ethanolic extract was administered for 14 days at the doses of 250 & 500mg/kg i.p 5 days after alloxan injection (120mg/kg). These doses shows potent anti-diabetic activity when compared to glibenclamide (10mg/kg).

**Anti-diarrhoeal activity**

The anti-diarrhoeal activity [11] of aqueous extract of Bauhinia tomentosa was evaluated in castor oil induced diarrhoea, prostaglandin induced enteropooling and charcoal meal test at doses of 5, 50,100&200mg/kg using albino rats. The aqueous extract of Bauhinia tomentosa reduces diarrhea at dose of 200mg/kg i.p by inhibiting gastrointestinal motility and prostaglandin E2 induced enteropooling.

**In vitro anticancer activity of gold nano particles**

Green synthesis of gold nano particles (AuNP) using leaves extract of Bauhinia tomentosa will be evaluated for its anti cancer activity. The in-vitro anti-cancer activity confirmed by Methylthiazolyl Diphenyl–Tetrazolium Bromide (MTT) assay on the cell lines of Human laryngeal epithelial carcinoma (HEp-2) cells show IC₅₀ values of extract at 53.125µg/ml and
AuNP’s at 34.375 µg/ml. The AuNP’s inhibited the proliferation of (HEp-2) cells in dose and time dependent manner. IC50 values of AuNP showed that the concentration required to inhibit 50% of HEp-2 cells was less than that of Bauhinia tomentosa [12].

**Anti inflammatory activity**

The anti-inflammatory activity [13] of ethyl acetate and methanol extracts of Bauhinia tomentosa (stem bark & roots) was evaluated against 5-lipoxygenase enzyme. Ethyl acetate extract of Bauhinia tomentosa (yields complete inhibition at 100µg/ml & an IC50 value of 18.47± 0.67 µg/ml) shows potent anti-inflammatory activity by inhibiting 5-lipoxygenase enzyme.

**Anti-oxidant activity**

Free radical scavenging potential of Bauhinia tomentosa was assessed using various in vitro anti-oxidant models. Reactive oxygen species like super oxide anions, hydroxyl, nitric oxide and peroxinitrite radicals play important role in oxidative stress related to pathogenesis of various diseases. The anti-oxidant activity of ethanolic extract of Bauhinia tomentosa was evaluated with total phenolic content. Ethanolic extract of Bauhinia tomentosa shows potent anti-oxidant properties, serve as free radical inhibitor [14].

**Anti-nociceptive &Anti-oxidant activity**

The analgesic & anti-oxidant potential of ethanol, methanol & aqueous extract of Bauhinia tomentosa against Eddy’s hot plate, acetic acid induced writhing test & 1.1-di phenyl-2-picrylhydrazyl (DPPH) radical scavenging and nitric oxide scavenging assays [15]. Methanol and aqueous extract at doses of 200, 400mg/kg and ethanol extract at maximum dose (400mg/kg) inhibits number of writhing’s as well as increases mean latency time. In case of acetic acid induced writhing test ethanol, methanol and aqueous extract at the dose of 400mg/kg shows maximum inhibition. DPPH radical scavenging activity has been observed with IC50 values of methanol, ethanol and aqueous extracts was found to be 81.21%, 79.18% & 72.5% inhibition compared to standard indomethacin shows maximum inhibition of 79.26%. These extracts also possess potent nitric oxide scavenging activity with IC50 values of 220.43, 150.45 & 310.25µg/ml of ethanol, methanol & aqueous extracts respectively when compared to standard IC50 value of ascorbic acid value of 125.10 µg/ml.

**Anti-oxidant/ immunomodulatory/ anti-inflammatory**

The methanolic extract of Bauhinia tomentosa was evaluated for its immunomodulatory, anti-oxidant and anti-inflammatory activity [16] in BALB/c mice. Methanolic extract of Bauhinia tomentosa is administered intra peritoneally and observed for total leukocyte count, bone marrow cellularity and α-esterase positive cells and compared with control groups. Anti-oxidant activity was confirmed by observing the inhibition of non-enzymatic lipid peroxidation and nitric oxide radical scavenging activity. Anti-inflammatory activity was evaluated against inflammation induced by carrageenan and formalin. Methanolic extracts shows reduced acute inflammation of paw edema induced by carrageenan and formalin.

**DNA cleavage studies**

DNA cleavage studies of ethanolic extracts of bark of Bauhinia tomentosa and the whole plant of Mussaenda frondosa have been performed. The cleavage of rCU18 DNA was estimated using agarose gel electrophoresis. Ethanolic extract of Bauhinia tomentosa shows more cleavage activity than Mussaenda frondosa. These results are compared with standard DNA cleavage agent FeSO4 [17].

**Inflammatory bowel disease**

Protective activity [18] of Bauhinia tomentosa was evaluated against acetic acid induced ulcerative colitis. Animals are treated with Bauhinia tomentosa (5, 10, 20mg/kg body weight) for 5 days before inducing ulcerative colitis. Reduced levels of glutathione nitric oxide, glutathione peroxidase, superoxide dismutase results in inhibition of ulcerative colitis in a dose dependent manner. The extract obtained from Bauhinia tomentosa will exhibit protective effect in experimentally induced ulcerative colitis possibly by regulating the anti oxidant and inflammatory mediators.

**CONCLUSION**

The present review concludes that survey of Bauhinia tomentosa was reported to contain proteins, amino acids, fatty acids, minerals, alkaloids, flavonoids, phyto steroids, saponins, tannins, phenolic compounds, fixed oils and fats. Pharmacological studies such as anti-oxidant, anti-bacterial, anti-hyperglycemic, anti-lipidemic, anti-ulcer, immunomodulatory, anti-diarrhoeal, anti-microbial and anti-diabetic activities has been proved by using different animal models.

**REFERENCES**

1. Grace RAN, Santhi SM, Vijaya LN. A review on Bauhinia tomentosa Linn. Int J Uni Pharm Bio Sci 2014;3(4):296-304.
2. Manodeep C, Anju J, Jagdish KV. Bauhinia tomentosa: A phytopharmacological review. Int Res J Pharm 2011;2(12):128-131.
3. Rhma S, Madhavan S. In vitro antibacterial activity of Bauhinia tomentosa Linn. leaf extracts. J Drug Deliv Ther 2012;2(6):83-85.

4. Sathy V, Bharathidasan R, Tamil SS, Sophia RN, Ilakkiya R, Prabakaram M. Quantitative, qualitative phytochemical analysis and in vitro anti bacterial activity of Bauhinia tomentosa L. In Nat Prod Plant Resour 2013;3(2):31-36.

5. Mythreyi R, Murugan M, Muthusamy P, Venkatesh S. Anti microbial activity of the leaves of Bauhinia tomentosa Linn. leaves. Advance Research in Pharmaceuticals And Biologicals 2011;1(1):51-55.

6. Patidar LN, Bhargava P, Bhadaura RS, Ravichandran N. Anti ulcer activity of aqueous extract of Bauhinia tomentosa Linn. leaves. Advance Research in Pharmaceuticals And Biologicals 2011;1(1):51-55.

7. Rangasamy M, Mannangatti V, Ayyasamy B, Emir B, Natesan S.K. Anti-hyperglycemic and anti-lipidemic activity of ethanolic extract of Bauhinia tomentosa (Linn) flower in normal and streptozotocin – induced diabetic rats. Journal of Global Pharma Technology 2010;2(3):71-76.

8. Gopalakrishnan VK, Devaki K, Beulah U, Akila G, Sunitha M, Narmadha R. Effect of aqueous extract of Bauhinia tomentosa on GTT normal and diabetic rats. Pharmacologyonline 2011;3:195-202.

9. Devaki K, Beulah U, Akila G, Narmadha R, Gopalakrishnan VK. Glucose lowering effect of aqueous extract of Bauhinia tomentosa on alloxan induced type 2 diabetes mellitus in wistar albino rats. J Basic Clin Pharm 2011;2(4):167-174.

10. Ajit KK, Jain SK, Gupta A, Shiv KG, Bansal M, Sharma PK. Anti diabetic activity of Bauhinia tomentosa Linn. roots extract in alloxan induced diabetic rats. Der Pharmacia Lettre 2011;3(2):456-459.

11. Mythreyi R, Sasikala E, Muthusamy P. Anti diarrhoeal evaluation of Bauhinia tomentosa Linn. leaf extracts. Int J Pharmacol Ther 2012;2(1):43-48.

12. Mukundan D, Mohankumar R, Vasantakumari R. Green synthesis of gold nano particles using leaves extract of Bauhinia tomentosa Linn and in-vitro anti cancer activity. International Journal of Innovative Research In Science And Engineering 2014;2(1):375-380.

13. Swarnalatha D, Satyanarayana T. Anti inflammatory activity of Bauhinia tomentosa (stem bark and roots) and Bauhinia vahlii roots. Journal of Global Trends in Pharmaceutical Sciences 2011;2(1):108-116.

14. Muthukrishnan S, Jayaraman A. Free radical scavenging activity of ethanolic extract of Bauhinia tomentosa leaves collected from kolli hills (Tamilnadu). World Journal of Pharmaceutical Research 2014;3(3):4188-4199.

15. Tiwari V, Anita S. Elucidation of possible mechanism of anti-nociceptive and anti-oxidant potential of Bauhinia tomentosa extracts in experimental animal models. The Natural Products Journal 2013;3(4):309-316.

16. Kannan N, Renitta RE, Guruvayoorappan C. Bauhinia tomentosa stimulates the immune system and scavenges free radical generation in vitro and in vivo. Journal of Basic And Clinical Physiology And Pharmacology 2010;21(2):157-168.

17. Gopalakrishnan S, Vadivel E. DNA cleavage studies of the ethanolic extracts of the bark of Bauhinia tomentosa L. and the whole plant of Mussaenda Frongosa L. International Research Journal Of Pharmacy 2011;2(9):153-154.

18. Guruvayoorappan C, Kannan N. Protective effect of Bauhinia tomentosa on acetic acid induced ulcerative colitis by regulating anti oxidant and inflammatory smediators. International Immunopharmacology 2013;16:57-66.

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