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### Phytopharmacological study and Ethnobotany of plant *Ficus benghalensis* Linn.

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**Abstract:** There are 400 different tribal and other ethnic groups in India which constitute about 7.5% of India's population. Tribal, rural and primitive societies have discovered solution for treatment of disease to almost all their needs and their problems from the natural resources around them. Hence in recent years, ethno medicinal studies received much attention as this brings to light the numerous little known and unknown medicinal virtues especially of plant origin which needs evaluation on modern scientific lines such as phytochemical analysis, pharmacological screening and clinical trials. The present work describes the various pharmacological activities done on *Ficus benghalensis*.

**Keywords:** *Ficus benghalensis*, Phytochemical, Hypoglycemic, Hypolipidemic, Antioxidant

**Introduction:** Medicinal plants constitute a source of raw materials for both traditional systems of medicine (e.g. Ayurvedic, Chinese, Unani, Homeopathy, and Siddha) and modern medicine. Nowadays, plant materials are employed throughout the industrialized and developing

world as home remedies, over-the-counter drugs, and ingredients for the pharmaceutical industry. As such, they represent a substantial proportion of the global drug market. Most rural populations, especially in the developing world, depend on medicinal herbs as their main source of

primary health care. Although most medicinal herbs are not, in their natural state, fit for administration, preparations suitable for administration are made according to pharmacopeia directions. The therapeutic potential of a herbal drug depends on its form: whether parts of a plant, or simple extracts, or isolated active constituents. Herbal remedies consist of portions of plants or unpurified plant extracts containing several constituents, which often work together synergistically.<sup>1</sup>

India has an ancient heritage of traditional medicine. The materia medica of India provides a great deal of information on the folklore practices and traditional aspects of therapeutically important natural products. Indian traditional medicines based on various systems including Ayurveda, Siddha, Unani and Homeopathy. The evaluation of these drugs is primarily based on phytochemical, pharmacological and allied approaches including various instrumental techniques such as chromatography, microscopy and others. With the emerging worldwide interest in adopting and studying traditional systems and exploiting their potential based on different health care systems, the evaluation

of the rich heritage of traditional medicine is essential. In this regard, one such plant is *Ficus bengalensis* Linn. syn. *Ficus banyana* Oken. (Family-Moraceae). The plant is a large evergreen tree distributed all over India from sub Himalayan region and in the deciduous forest of Deccan and south India. It is grown in gardens and road sides for shades.<sup>2,3</sup>

The tree is commonly found all over India from sea level to an elevation of about 3,000 ft. it is also reported from Sri Lanka, Pakistan now widely cultivated.<sup>4</sup> It is commonly known as Vada in Marathi, Banyan tree in English, Bar in Hindi and as Avaroha in Sanskrit.<sup>5</sup>

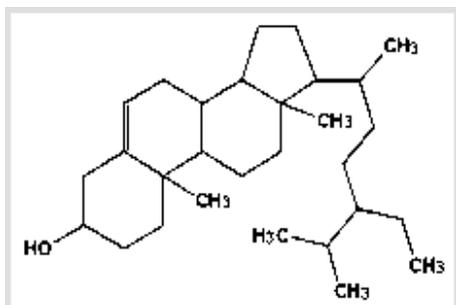
It is a member of four sacred trees Nalpamara (*Ksirivrkas*) meant to be planted around the home and temples. It is found throughout the year, grows in evergreen except in dry localities where it is leafless for a short time. It is hardy and drought-resistant; it withstands mild frost. It is epiphytic when young. It develops from seeds dropped by birds on old walls or on other trees and is therefore, considered destructive to forest trees, walls and buildings.<sup>2,6-8</sup>

**Pharmacognostical Study:**

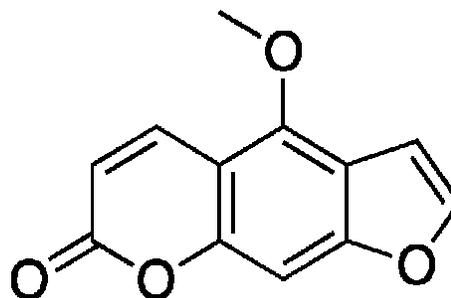
A very large evergreen tree, extending laterally by sending down aerial roots. Large ariel roots many some developing in to accessory trunks and assisting the lateral spread of the tree indefinitely.<sup>9</sup> Leaves are green spirally arranged on branch lets, up to 10-30cm long and 7-20cm wide, coriaceous, ellipticto ovate, apex obtuse, base rounded, with 5-7 basal nerves; petioles 2.5-5 cm long; stipules stout opposite arrangement and reticularly pinnate venation. Fruits (figs) in red color receptacles sessile, axillry in pairs 1.3-1.9 cm in diameter globose. Bark smooth grey hard surface and uneven 0.5-1.9 cm thick, on rubbing white papery flakes come out from the outer surface inner surface light brown fracture fibrous taste mucilaginous without any characteristics odour.<sup>3, 10, 11</sup>

**Phytochemical Constituents:**

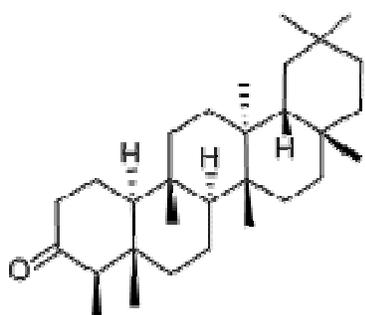
Leaves yield quercetin-3-galactoside, rutin, friedelin, taraxosterol, lupeol,  $\beta$ -amyrin along with psoralen, bergapten and  $\beta$ -sisterol<sup>14</sup>.<sup>9</sup> The bark of *Ficus bengalensis* presence of 5,7 Dimethyl ether of leucopelargonidin-3-0- $\alpha$ -L rhamnoside and 5,3 dimethyl ether of leucocynidin 3-0- $\alpha$ -D galactosyl cellobioside, glucoside,<sup>20</sup>-tetratriacontene-2-one,<sup>6</sup>- heptatriacontene-10-one,<sup>pentatriacontan-5-one,</sup> beta sitosterol- $\alpha$ -Dglucose, and meso-inositol Earlier, glucoside, <sup>20</sup> tetratriacontene-2-one,<sup>6</sup>- heptatriacontene-10-one, pentatriacontan-5-one,  $\beta$ sitosterol- $\alpha$ -Dglucose,<sup>and meso-inositol</sup> <sup>12-17</sup>, Leucodelphinidinderivative <sup>18</sup>,bengalenoside:Agglucosi <sup>de</sup> <sup>19</sup>, Leucopelargonin <sup>derivative</sup> <sup>20,</sup> <sup>21</sup>, leucocynidin <sup>derivative</sup> <sup>22</sup>, glycoside of leucopelargonidin <sup>23</sup> have been isolated from the bark of the *Ficus bengalensis* (Figure 1).



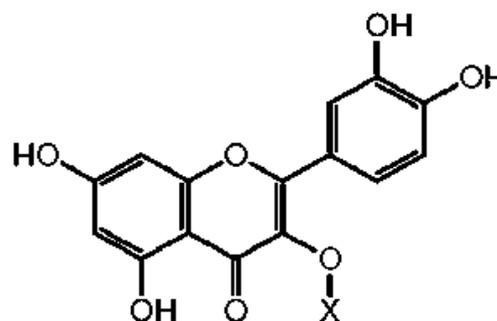
$\beta$ -sisterol



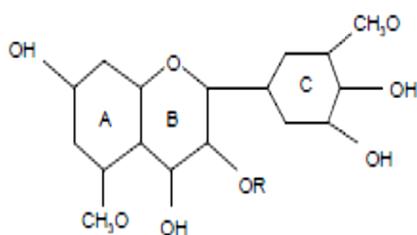
Bergapten



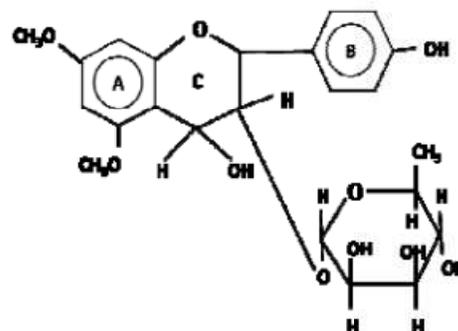
Friedelin



$\beta$ -amyryl



Leucopelargonidin



5,7 Dimethyl ether of leucopelargonidin-3-O- $\alpha$ -L rhamnoside

**Figure 1:** Structure of different phytoconstituents present in the plant.

## **Pharmacological Action:**

### **1. Hypolipidemic Effect-**

Hypolipidemic effect of the water extract of the bark of *Ficus bengalensis* was investigated in alloxan induced diabetes mellitus in rabbits showing a good glycemic control also corrects the abnormalities in serum lipid profile associated with diabetes mellitus. In view of the ability of the water extract of *Ficus bengalensis* to improve carbohydrate and lipid metabolism<sup>47</sup>. Dietary fibre content of foods namely, khejri (*Prosopis cineraria*), peepalbanti (*Ficus religiosa*), barbanti (*Ficus bengalensis*), gullar (*Ficus glomerata*) and teent (*Capparis decidua*) varied from 38.5% to 55.7% fibre from all these plant foods, fed at the 10% dietary level to rats, induced a greater resistance to hyperlipidemia than cellulose. The dietary fibre influenced total lipids, cholesterol, triglycerides and phospholipids of the liver to varying extents.<sup>24</sup>

### **2. Hypoglycemic effect-**

According to Ayurvedic system of medicine *Ficus bengalensis* Linn (Banyan tree) is well known to be useful in diabetes. This attracted the attention of many earlier workers who studied the hypoglycemic

effect of extracts from the bark of *Ficus bengalensis* and tried to isolate active compounds. Bark of this plant has antidiabetic properties. The hypoglycemic effect of extract of bark was demonstrated in alloxan diabetic rabbits, rats and in humans. Potent hypoglycemic water insoluble principle was isolated (Patent applied) from the bark in our lab by Babu *et. al.*. A water soluble hypoglycemic principle was also isolated from the bark (patent applied) in our lab by Shukla *et. al.* which was effective at a low dose of 10 mg/kg, bw/day. Both the banyan bark principles were effective in mild as well as severe alloxan induced diabetes in rabbits, and improved lipid profile. Mechanism of action of water soluble and insoluble hypoglycemic compounds was investigated.<sup>25-29</sup>

### **3. Wound healing effect-**

Some of these plants have been screened scientifically for the evaluation of their wound healing activity in different pharmacological models and patients, but the potential of most remains unexplored. In a few cases, active chemical constituents were identified. Some Ayurvedic medicinal plants, namely *Ficus bengalensis*, *Cynodon dactylon*, *Symplocos racemosa*, *Rubia*

cordifolia, Pterocarpus santalinus, Ficus racemosa, Glycyrrhiza glabra, Berberis aristata, Curcuma longa, Centella asiatica, Euphorbia nerifolia, and Aloe vera, were found to be effective in experimental models. This paper presents a limited review of plants used in Ayurvedic medicine.<sup>30</sup>

#### **4. Antidiarrhoeal effect-**

Ethanol extract of four different plants of the Khatra region of the Bankura district of West Bengal, India were evaluated for anti-diarrhoeal activity against different experimental models of diarrhoea in rats. The extracts of Ficus bengalensis Linn. (hanging roots), Eugenia jambolana Lam. (bark), Ficus racemosa Linn. (bark) and Leucas lavandulaefolia Rees (aerial parts) showed significant inhibitory activity against castor oil induced diarrhoea and PGE<sub>2</sub> induced enter pooling in rats. These extracts also showed a significant reduction in gastrointestinal motility in charcoal meal tests in rats. The results obtained establish the efficacy of all these plant materials as anti-diarrhoeal agents.<sup>30</sup>

#### **5. Antidiabetic and Ameliorative effect-**

The aqueous extract of Ficus bengalensis at a dose of 500mg/kg/day exhibits significant

antidiabetic and ameliorative activity as evidenced by histological studies in normal and Ficus bengalensis treated streptozotocin induced diabetic rats. On the basis of our findings, it could be used as an Antidiabetic and Ameliorative agent for better management of diabetes mellitus.<sup>31</sup>

#### **6. Antioxidant effect-**

Ficus compound showed significant antioxidant effects which may be attributed to their polyphenolic nature. The antioxidant effect of aqueous extract of the bark of Ficus bengalensis has been evaluated in hypercholesterolemia rabbits. Rabbits were divided into three groups, Group I served as healthy control; groups II and III were made hypercholesterolemia by feeding cholesterol suspended in groundnut oil (100 mg/kg body weight per day) for 6 weeks. Rabbits of Group III received water extract of the bark of Ficus bengalensis at a dose of 50 mg/kg body weight per day in addition to cholesterol suspended in oil.

Feeding cholesterol increased serum cholesterol, triacylglycerol and LDL + VLDL-cholesterol significantly in Group II as compared to Group I (P = 0.001). Treatment with water extract decreased the

serum cholesterol level by 59%, triacylglycerol by 54% and LDL + VLDL-cholesterol by 60% in Group III as compared to Group II. In addition, treatment with this extract led to a decrease in lipid peroxidation as evidenced by fall in thiobarbituric acid reactive substances with a corresponding increase in blood glutathione content ( $P = 0.001$ ). Further, there was significant increase in the activities of antioxidant enzymes; superoxide dismutase ( $P < 0.001$ ), catalase ( $P < 0.03$ ), glutathione peroxidase ( $P = 0.03$ ) and glutathione reductase ( $P < 0.01$ ); which were depressed in Group II rabbits after cholesterol feeding. Thus, our results show that the water extract of the bark of *Ficus bengalensis* has significant antioxidant effect.<sup>32</sup> The stem bark and fruits of *Ficus bengalensis* L. and *Ficus racemosa* L. are used in India for the treatment of diabetes and a number of other diseases. Since these effects may be correlated with the presence of antioxidant compounds, methanol and 70% acetone (acetone: water, 70:30) extracts of *Ficus bengalensis* (aerial root) and *Ficus racemosa* (stem bark) were evaluated for their antioxidant activity and radical scavenging capacity in comparison with

*Camellia sinensis* (L.) O. Kuntz (green tea).<sup>33</sup>

### **7. Antis tress and ant allergic effect-**

Various extracts of *Ficus bengalensis* bark was screened for it's ant allergic and antis tress potential in asthma by milk-induced leucocytosis and milkinduced eosinophilia. Aqueous, ethanol, and ethyl acetate extracts showed significant decrease in leucocytes and eosinophils in the order given while petroleum ether and chloroform extracts were inactive. This shows the application of polar constituents of *F. bengalensis* bark as antis tress and ant allergic agents in asthma.<sup>34</sup>

### **8. Immunomodulatory effect-**

To evaluate the Immunomodulatory activity of the aerial roots of *Ficus bengalensis* (Family Moraceae).The successive methanol and water extracts exhibited a significant increase in the percentage phagocytosis versus the control. In the in vivo studies, the successive methanol extract was found to exhibit a dose related increase in the hypersensitivity reaction, to the SRBC antigen, at concentrations of 100 and 200 mg/kg. It also resulted in a significant increase in the antibody titer value, to

SRBC, at doses of 100 and 200 mg/kg in animal studies.<sup>35</sup>

### **9. Antiatherogenic effect-**

One month treatment of alloxan diabetic dogs with glycoside, viz. leucopelargonin derivative (100mg/kg/day) isolated from the bark of *Ficus bengalensis* decreased fasting blood sugar and glycosylated haemoglobin by 34% and 28% respectively. Body weight was maintained in both the treated groups while the same was decreased significantly by 10% in the control group. In cholesterol diet fed rats, as the atherogenic index and the hepatic bile acid level and the faecal excretion of bile acids and neutral sterols increased, the HMGCOA reductase and lipogenic enzyme activities in liver and lipoprotein lipase activity in heart and adipose tissue and plasma LCAT activity and the incorporation of labeled acetate in to free and ester cholesterol in liver decreased significantly.<sup>36</sup>

### **10. Anti-inflammatory effect-**

The anti-inflammatory effect of ethanolic and petroleum ether extracts of the bark of *Ficus bengalensis* were evaluated in

experimental animals. We have determined the anti-inflammatory activity of ethanolic and petroleum ether extracts of the bark of *Ficus bengalensis* by oral administration of doses of 300 and 600 mg/kg/day of body weight to healthy animals. The extracts were studied for their anti-inflammatory activity in carrageenan-induced hind paw edema in rats and the paw volume was measured plethysmometrically at 0 to 3h after injection. The present results indicated the ethanolic extract of *Ficus bengalensis* exhibited more significant activity than petroleum ether in the treatment of inflammation compared with the standard drug Indomethacin.<sup>10</sup>

### **11. Anthelmintic effect-**

The methanolic, chloroform, and petroleum ether extracts of the roots of *Ficus bengalensis* have potent Anthelmintic activity when compared with conventionally used drug and is equipotent to standard Anthelmintic drug.<sup>37</sup>

### **12. Antitumor effect-**

Fruit extracts exhibited anti-tumor activity in the potato disc bioassay. None of the tested extracts showed any marked inhibition on the uptake of calcium in to rat

pituitary cells GH4C1. The extracts of the four tested *Ficus* species had significant antibacterial activity, but no antifungal activity. The results of this preliminary investigation support the traditional use of these plants in folk medicine for respiratory disorders and certain skin diseases.<sup>38</sup>

### Conclusion:

From the above work it is concluded that *Ficus bengalensis* possesses various pharmacological activities. However, it is imperative that more clinical and pharmacological studies should be conducted to investigate the unexploited potential of this plant.

### Reference:

1. Bandaranayake W.M., "quality control, screening, toxicity and regulation of herbal drugs", *modern phytyomedicines*, 2006; pp 25-55.
2. The Wealth of India, Volume-(F-G). In: A Dictionary of Indian Raw Materials and industrial products. Vol. 4. New Delhi: Council of Scientific and Industrial Research: 1999; p. 24- 26.

3. Parrotta John A, *Healing Plants of Peninsular India*. USA: CABI publishing; 2001; p. 517.
4. V.V. Shivrajan *Ayurvedic drugs and their Plant sources*, oxford and IBH Publishing company Pvt. Ltd. New Delhi, 2002; pp.333.
5. Kirtikar KR and Basu BD *Indian medicinal plants* Eds. E Blatter, Caius J. F., Lalit Maohan Basu, Allahabad, 2nd edn, 1989; vol. II, 2389.
6. Warriar P.K. *Indian medicinal plants-A compendium of 500 species*, Orient Longman Ltd, Chennai, vol.III, 1989; PP.33-35.
7. Chopra R. N., Chopra I.C. Handa K.L. and Kapur L.D. *Indigenous drugs of India*, U.N. Dhur and sons Pvt. Ltd. Calcutta: 1958; pp.673-675.
8. *Medicinal plants of India*, ICMR, New Delhi, 1956; vol.I, pp.415-416.
9. A. Chatterjee *The treaties of Indian medicinal plants*: 1997; Vol.I pp. 39.
10. Patil V.V., Pimprikar R.B., Patil V.R. *Pharmacognostical Studies and Evaluation of Anti-inflammatory Activity of Ficus bengalensis Linn* JYP. 2009; Vol 1, Issue 1.

11. Duthie JF flora of upper genetic plains and adjacent siwalik and sub-Himalayan Tract, reprinted edition Botanical survey of India, Calcutta, 1960; vol.III, pp 248.
12. Subramanian PM, Misra GS. Chemical constituents of *Ficus bengalensis* Indian J chemistry. 1997; 15B; 762.
13. Sheeja Cherian, Kumar RV, Augusti KT, Kidwai JR, Indian J Biochem biophys Antidiabetic effect of glycoside of Pelargonidin isolated from the bark of *Ficus bengalensis* linn: 1992; 29:380-382.
14. Kumar R.V., Augusti K.T. Antidiabetic effect of a leucocynidin derivative isolated from the bark of *Ficus bengalensis* Linn. Indian J Biochem Biophys. 1989; 26: (6):400-4.
15. Subramanian PM, Misra GS. Chemical constituents of *Ficus bengalensis* (Part II) Pol J Pharmacol Pharm:1978; 30(4):559-62.
16. The Wealth of India, Volume-(F-G). In: A Dictionary of Indian Raw Materials and industrial products. Vol. 4. New Delhi: Council of Scientific and Industrial Research: 1999; p. 24- 6.
17. Daniel RS, Devi KS, Augusti KT Mechanism of action of Antiatherogenic and related effects of *Ficus bengalensis* Linn. Flavonoids in experimental animals Indian Journal of Experimental Biology:2003; 41,296-303.
18. Geetha BS, Mathew BC, Augusti KT, Hypoglycemic effects of Leucodelphinidin derivative isolated from *Ficus bengalensis* Indian J Physiol. Pharmacol.:1994; 38(3):220.
19. Augusti KT Hypoglycemic action of bengalenoside: Aglucoside isolated from *Ficus Bengalensis* Linn, in normal and Alloxan diabetic rabbits. Indian J Physiol Pharmacol:1975; 19:218-20.
20. Augusti K T, Daniel RS, Cherian S, Sheela CG, Nair CR Effect of Leucopelargonin derivative from *Ficus bengalensis* Linn on diabetic dogs Indian J Med Res:1994; 82-86.
21. Cherian S, Sheela and Augusti K T Insulin sparing action of Leucopelargonin derivative isolated from *Ficus bengalensis* Linn Indian

- Journal of Experimental Biology. 1995;33:608- 611.
22. Kumar RV, Augusti KT, Insulin sparing action of a leucocynidin derivative isolated from *Ficus bengalensis* Linn Indian Journal of Biochemistry and Biophysics: 1994; 31:73-76.
23. Cherian S, Augusti K.T. To study the Antidiabetic effects of a glycoside of leucopelargonidin isolated from *Ficus bengalensis* Linn Indian J Exp Biol: 1993; 31(1):26- 29.
24. Agrawal V. Chauhan BM a study on composition and Hypolipidemic effect of dietary fibre from some plant foods Plant foods hum Nutr:1988; 38(2):189-97.
25. Vohra, S.B. and Parasar, G.C. Antidiabetic studies on *Ficus bengalensis* Linn. Ind. J. Pharmacy:1970; 32, 68-69.
26. Shukla, R., Anand, K., Prabhu, K.M. and Murthy, P.S. Hypoglycemic effect of the water extract of *Ficus bengalensis* in alloxan recovered mildly diabetic and severely diabetic rabbits. International. J. Dia. Dev. Countries: 1994; 14, 78-81.
27. Joglekar, J.C., Shrotri, D.S., Aiman, R. and Balwani, J.H. (1963) A study on *Ficus bengalensis* Lin. J. Ind. Med. Assoc: 1963; 40, 11-12.
28. Sheeja Cherian, Vinod Kumar, R. and Augusti, K.T. (1992) Antidiabetic effect of glycoside from Pelargonidin isolated from the bark of *Ficus bengalensis* Linn. Ind. J. Biochem. Biophys: 1992; 29,380-382.
29. Babu, B.V. Studies on Hypoglycemic action of *Ficus bengalensis* (PhD Thesis, Delhi University, Delhi); 25b. Patent applied by P.S. Murthy, B.V. Babu and K.M Prabhu for active hypoglycemic compound isolated from *Ficus bengalensis*,1985.
30. Pulok K. Mukherjee, Kakali Saha, T. Murugesan, S.C. Mandal, M. Pal, B.P. Saha Screening of anti-diarrhoeal profile of some plant extracts of a specific region of West Bengal, India Journal of Ethnopharmacology.1998 ;60: 85–89.
31. Mahalingam G, Krishnan K antidiabetic and ameliorative potential of *Ficus bengalensis* bark

- extract in streptozotocin induced diabetic rats Indian Journal of Biochemistry. 2008; 23(4):394- 400.
32. Rimi Shukla, Shweta Gupta , J.K. Gambhir , K.M. Prabhu , P.S. Murthy Antioxidant effect of aqueous extract of the bark of *Ficus bengalensis* in hypercholesterolaemic rabbits Journal of Ethnopharmacology 2004; 92: 47– 51.
33. Rajesh Manian, Nagarajan Anusuya, Perumal Siddhuraju, Sellamuthu Manian The antioxidant activity and free radical scavenging potential of two different solvent extracts of *Camellia sinensis* (L.) O. Kuntz, *Ficus bengalensis* L. and *Ficus racemosa* L.; Food Chemistry 2008; 107:1000– 1007.
34. DJ Taur, SA Nirmal ,RY Patil, MD Kharya Antitress and ant allergic effects of *Ficus bengalensis* bark in asthma Nat Prod Res:2007; 21,14:1266-70.
35. Gabhe S.Y., P.A. Tatke, T.A. Khan Evaluation of the Immunomodulatory activity of the methanol extract of *Ficus bengalensis* roots in rats Indian J Pharmacol: 2006; 38, 4:271-275.
36. Daniel RS, Devi KS, Augusti KT, Nair CR Mechanism of action of Antiatherogenic and related effects of *Ficus bengalensis* Linn flavonoids in experimental animals. 2003; 41:296- 303.
37. Aswar M, Aswar U, Watkar B, Vyas M, Wagh A., Gujar KN Anthelmintic activity of *Ficus bengalensis* 2008; IJGP;2:3.
38. Mousa O, Vuorela P, Kiviranta J, Wahab SA, Hiltohen R, Vuorela H Bioactivity of certain Egyptian *Ficus* species J Ethnopharmacol: 1994; 41:71- 6.