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A PHARMACOLOGICAL REVIEW ON *BAUHINIA RACEMOSA*

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ABSTRACT

The plant *Bauhinia racemosa* (L) belong to the Leguminosae family it is popularly known as "Apta" in Marathi, kanchnal" in hindi other common name include mountain ebony & kachnar (India & Pakistan). The bark and leaves are known to cure skin disease, throat troubles tumors chronic, dysentery, headache &malaria. The tree is demonstrated to have anti-oxidant & hepato-protective effect the extract of leaves to show analgesic, antipyretic anti-inflammatory, antispasmodic, anthelmintic & Anti-microbial activity as well the tree has antitumor qualities and is widely used in ayurveda to treat first stage cancer. Chemical constituents such as ß-sitosterol and ß-amyrin were isolated from stem bark of this plant. Also Five flavonols (kaempferol&quercetin) to cumarins (scopoletin & scopolin) were isolated from leaves of the plant stilbene (resveratrol)was isolated from the heartwood of *Bauhinia racemosa*.

KEYWORD: *Bauhinia racemosa*, Analgesic activity, Antimicrobial Activity.

INTRODUCTION[1]

In spite of convincing progress in synthetic chemistry and Biotechnology, plants are the most important sources for preventive and curative medicinal formulations. Large scale use of medicinal plants and herbs in preparation of such formulations is increasing both in the developed as well as developing countries due to growing concern about the adverse effects of chemical and synthetic substances. The plant based drugs have the added advantage of being simple, effective, and offering a broad spectrum activity with an emphasis on the preventive action of drugs. Because of these factors, the demand for phyto pharmaceuticals is increasing worldwide. The plant under review is a valuable Indian medicinal plant, which enjoys ethno botanical and ethno pharmacological importance.

Bauhinia racemosa Lam (The Sonpatta Tree) is a small, crooked, bushy, deciduous tree with drooping branches, which can grow in poor and very harsh climatic conditions. The deciduous tree is propagated easily from seed.

Bauhinia is a genus of more than 200 species of flowering plants of subfamily, Caesalpiniaceae. Many species are widely planted in the tropics as orchid trees, particularly in northern India, Vietnam and southeastern China. This particular species racemosa is widely distributed throughout India, ascending to an altitude of 1,650 m from sea level in the western Himalayas, and in Ceylon, China and Timor. It is a useful species for filling blanks in forest plantings and helps in preventing soil erosion. In the United States of America, the trees grow in Hawaii, coastal California, Texas, Louisiana, and Florida.[2]

The plant is popularly known as Sittacha (Tamil), Banraj (Bengali), Ashta, Jhinjeri, Katmauli, Kachnal (Hindi), Aapta, Aralukadumandara, Vana samtige (Kannada), Apto (Konkani), Omboroda (Odia), Kosundra (Punjabi), Arampaali, Kutabuli, Malayaththi (Malayalam), Asundro (Gujrati), Apta, Sona (Marathi), Yamalapatrakah, Yugmapatra, Ashmantaka, Kanchini (Sanskrit), Atti, Tataki, Kokku mandarai, (Tamil), Arechettu (Telugu), Kachnaar (Unani). Other common names include Mountain Ebony and Kachnar (India and Pakistan).

The bark and leaves of *B. racemosa* are sweetish and acrid, refrigerant, astringent and is used in the treatment of headache, fever, skin diseases, blood diseases, dysentery and diarrhea.

A decoction of the bark is recommended as a useful wash for ulcers. The tree is demonstrated to have anti-oxidant and hepato-protective effects. An extract of the leaves has been proved to show analgesic, anti-pyretic, antiinflammatory, anti-spasmodic, anthelmintic and antimicrobial activity. The tree has anti-tumor qualities and is widely used in Ayurveda to treat first stage cancer.[3,4] The root of B. racemosa contains a new tetra cyclic lupeol, betulin, β-sitosterol, and tetracyclic 2, 2-dimethyl chroman.[5,6] The seed contains flavonoids, crude protein, and lipid.[7,8] The bark of the plant contains ß-sitosterol and ß-amyrin and the leaves contain

flavonols (kaempferol, quercetin) and coumarins (scopoletin and scopolin). Stilbene (resveratrol) was isolated from the heartwood of *B. racemosa*.

Botanical Description[2]

Bauhinia racemosa is a small crooked tree with dark scabrous bark, containing numerous drooping branches. The trees typically reach a height of 6–12 m and their branches spread 3–6 m outwards. The other important associated species under this genus Bauhinia include B. tomentosa Linn, B. retusa Roxb. B. vahlii Wight, B. purpurea Linn, B. variegate Linn, B. malabarica Roxb, B.macrostachya Wall. The bark of B. racemosa is bluish black, rough, pinkish red inside, which turns brown on exposure. The leaves are broader than long, having size 2-5 cm by 2.56.3 cm, divided a little less than half way down into two rounded lobes. The upper surface of leaf being green and glabrous, rigidly coriaceous, slightly cordate, clothed more or less densely beneath with grey pubescence and base is usually cordate. The five-petaled flowers are 7.5– 12.5 cm diameter, generally in shades of red, pink, purple, orange, or yellow, and are often fragrant. The tree begins flowering in late winter and often continues to flower into early summer. The flowers are in short peduncle, lax, terminal and leaf-opposed racemes. The calyx being pubescent, contain very short tube, limbs are of 6-8 mm long and the petals are narrowly oblanceolate, acute,[10-15] mm long. The flowers contain 10 fertile stamens with densely hairy filaments at the base and ovary is pubescent with sessile stigma. The pods are stalked,[15-25] in number having size of 1.3-2.2 cm, blunt at the apex and tapering to the base, somewhat falcate, glabrous, turgid, scarcely veined. Each pod contains 12-20 dark reddish brown, oblong, compressed, rounded at the apex, seeds. The bark of *B. racemosa* is bluish black, rough, pinkish red inside, which turns brown on exposure.

Economic Importance

The leaves of *B. racemosa* are used for making bidis, thus the plant is commonly known as bidi leaf tree. Also the plant makes good fodder for sheep, goats and cattle. The flowers are of much importance in apiculture and also as a pot herb in curries and made into pickle (chutni). The tree yields a useful gum and fibers. The bark is used for tanning and dyeing. Almost each and every part of this tree possesses some medicinal values. It is planted for its value as well as for its extreme beauty. It is one of the loveliest of Indian trees. The tree is staggeringly beautiful when in bloom and it blooms for several months. Its flowers can be found in shades of magenta, lavender, purplish blue or even white. The wood is hard and heavy, thus used for making plough and yokes and also used as fuel.

Pharmacological investigation

Analgesic activity [11]

The ethyl acetate extract was evaluated for its analgesic activity by acetic acid induced writing model and hot plate method. In acetic acid induced writhing method albino mice (20-25g)were divided into three group each consisting of six animals. One group served as negative control (received5%gum acacia 5ml/gm),while third group received ethyl acetate extract of *bauhinia racemosa* (400mg/gm body weight)orally. The writhing movement were observed and counted for 30 minutes after acetic acid administration.

Analgesic activity evaluation through abdominal writhing test

Analgesic activity of MEFV was examined as previously described.[24] Mice were divided into seven groups of five mice each. Group 1 served as control and was administered vehicle only. Groups 2 and 3 were orally administered the standard analgesic drug aspirin at doses of 200 and 400 mg per kg body weight, respectively. Groups 4-7 were administered MEFV at doses of 50, 100, 200 and 400 mg per kg body weight, respectively. Following a period of 60 minutes after oral administration of standard drug or MEFV, all mice were intraperitoneally injected with 1% acetic acid at a dose of 10 ml per kg body weight. A period of 5 minutes was given to each animal to ensure bioavailability and onset of chemically induced irritation of acetic acid.[25] following which period, the number of abdominal constrictions (writhings) was counted for 10 min. The percent inhibitions of abdominal constrictions were calculated according to the formula given below.

Percent inhibition = (1 – We/Wc) X 100, where We and Wc represents the number of writhings in aspirin or MEFV administered mice (Groups 2-7), and control mice (Group 1), respectively.

Acute toxicity test

Acute toxicity test was conducted as previously described.[26] Mice were divided into nine groups, each group consisting of six animals. Group 1 was given 1% Tween 80 in normal saline (2 ml per kg body weight). The other eight groups (Groups 2-9) were administered, respectively, 100, 200, 300, 600, 800, 1000, 2000 and 3000 mg of MEFV per kg body weight. All animals were closely observed for the next 8 hours to notice any behavioral changes or mortality and were kept under close observation for the next two weeks.

Antitumor activity[7]

Male Swiss albino mice were divided into 6 groups (n=12). All the groups were injected with EAC cells (0.2mL of 2×106 cells/mouse) intraperitoneally except the normal group. This was taken as day zero. From the first day normal saline 5 mL·kg-1·mouse-1·d-1 and propylene glycol 5 mL·kg-1· mouse-1·d-1 were administered to normal and EAC control groups respectively for 14 d intraperitoneally. Similarly MEBR at different doses (50, 100, and 200 mg·kg-1· mouse-1·d-1) and standard drug 5-flurouracil (20 mg/ kg)[17] were administered in groups 3, 4, 5, and 6, respectively. After the administration of last dose followed by 18 h fasting 6 mice from each group were sacrificed for the

study of antitumor activity, hematological and liver biochemical parameters. The remaining animals in each of the groups were kept to check the mean survival time (MST) of the tumor bearing hosts. Antitumor effect of MEBR was assessed by observation of changes with respect to body weight, ascetics tumor volume, packed cell volume, viable & nonviable tumor cell count, MST and percentage increase in life span (% ILS). MST of each group containing six mice were monitored by recording the mortality daily for 6 weeks and % ILS was calculated using following equation[18,19] MST=(Day of first death+ Day of last death)/2. ILS (%) =[(Mean survival time of treated group/mean survival time of control group)–1]×100.

Anthelmintic Activity [11]

Aqueous, ethanolic and petroleum ether extracts from the whole plant of *B. Racemosa* were investigated for their anthelmintic activity against Pheretima posthuma. Various concentrations (50, 75 and 100 mg/ml) of each extracts were tested in the bioassay, which involved determination of time of paralysis and time of death of the worms. Albenzadole was included as standard reference and saline water as control. The anthelmintic assay was carried as per the method of (Ajaiyeoba et al. 2001) with minor modifications. The assay was performed on adult Indian earthworm, Pheretima posthuma due to its anatomical and physiological resemblance with the intestinal roundworm parasite of human beings (Sollmann 1918; Vidyarthi 1967; Thorn et al.1988). Because of easy availability, earthworms have been used widely for the initial evaluation of anthelmintic compounds in vitro (Jain et al.1972; Martin 1997; Suresh et al.2002). In the first set of experiment, six groups of six earthworms were released in to 25 ml of solutions of Albenzadole, aqueous, ethanolic and petroleum ether extracts of whole plant of *B. Racemosa* in distilled water. The remaining groups were treated for different concentrations. All drug and extract solutions were freshly prepared before starting the experiment. Albenzadole was used as reference standard while saline water as control. Observations were made for the time taken to paralysis and death of individual worms. Time for paralysis was noted when no movement of any sort could be observed except when the worms were shaken vigorously. Death was concluded when the worms lost their motility followed with fading away of their body colors.

Anxiolytic Activity[26]

This study was performed to investigate the anxiolytic like effects of methanolic extract of *B. racemosa* (MEBR) in mice using the elevated plus-maze model (EPM), light dark model, hole board test, foot shock induced freezing behavior. Furthermore, the anxiolytic-like effects of MEBR were compared to a known active anxiolytic drug (Diazepam).

The extract administered orally in two different doses of 150mg/kg and 300mg/kg, was able to increase the time spent and the number of arm entries in the open arms of the elevated plus-maze. The increase in time spent by mice in the illuminated side of the light–dark test, showed significant increase in nose poking and decrease locomotion in hole board test, as well as caused significant reduction in freezing time in comparison with control animals. This effect was comparable to that of the benzodiazepine diazepam (2.0mg/kg p.o.). These results indicate that methanolic extract of *B. racemosa* is an effective anxiolytic agent.

Anti-HIV Activity[13]

The effect of *B. racemosa* extracts on acute HIV-1 infectivity was measured by the syncytia formation assay. In the presence or absence of various concentrations of samples, 4×104 C8166 cells were infected with HIV-1 at a multiplicity of infection (MOI) of 0.015, and cultured in 96-well plates at 37°C in 5% CO2 for 3 days. AZT was used as a positive control. After 3 days post-infection, the cytopathic effect (CPE) was measured by counting the number of syncytia (multinucleated giant cell) in each well of 96-well plates under an inverted microscope (100×).

The inhibitory percentage of syncytia formation was calculated by the percentage of syncytia number in sample-treated culture compared to that in infected control culture 50% effective concentration (EC50) was calculated, 50% cytotoxic concentration (CC50) and 50% effective concentration (EC50) was also determined.

Antimicrobial Activity[17]

The antimicrobial activity of the leaves of the *B. racemosa* was evaluated by using the aqueous and methanol extract against standard bacterial and fungal cultures. In vitro antimicrobial test was performed by agar well diffusion method on Mueller hinton agar and Sabouraud dextrose agar for bacterial and fungal cultures respectively. Minimum inhibitory concentration test was performed by modified agar well diffusion method. Methanol extract showed significantly higher inhibitory effect compared to aqueous extract on tested organisms. The methanol extract showed a broad spectrum of antimicrobial activity as it inhibited Gram negative bacteria (Escherichia coli, Micrococcus luteus, and Pseudomonas aeruginosa), Gram positive bacteria (Bacillus subtilis) and fungi (Candida albicans and Aspergillus niger). Both extracts showed maximum relative percentage inhibition against A. niger. MIC values for methanol extract varied from 1.5-25 mg/ml.28

The petroleum ether extract, chloroform extract, ethyl acetate extract and methanol extracts of leaves of B. racemosa Linn. were prepared and antibacterial activity were studied by disc diffusion method against certain enteric bacterial pathogens such as Escherichia coli, Staphylococcus aureus, Klebsiella pneumonia, Enterobacter aerogenes, Pseudomonas aeruginosa, Salmonella typhimurium, Salmonella typhi,

Staphylococcus epidermidis and Proteus vulgaris. The Methanol extracts had wide range of antibacterial activity against enteric bacterial pathogens than the petroleum ether extract, where as ethyl acetate extract were slightly higher antibacterial activity than chloroform extract.

Antipyretic activity[12]

Antipyretic activity was evaluated by yeast-induced hyperpyrexia in rats using alcoholic extract of the stem bark of *B. racemosa*. The pyrexia was induced by injecting a suspension of 15% of brewer's yeast and 2% gum acacia in normal saline sub-cutaneously below the neck at the dose of 1ml/100gm of animal weight. The difference in temperature between 0 hour and respective time interval was found out by statistical method. The potency of extract to bring down the temperature was compared with that of the control group. Treatment with the extract showed a significant dose-dependent reduction in pyrexia in rats.

Table1: Ethno medicinal uses and pharmacological activities of *Bauhinia racemosa.*

Plant part	Chemical constituents	Method of preparation	Uses/properties	Reference
Seed	Flavonoids, Crude protein, and lipid		Antibacterial	[7,17]
Leaf	Flavonols (Kaempferol, Quercetin) and Coumarins (Scopoletin and Scopolin	Decoction with onion unspecified extract	Anti-microbial	[4]
			Diarrhoea	
			Anthelmintic	[11]
			Analgesic	[12]
			Anti-pyretic	[12,21]
			Malaria	[16,17]
			Antihyperglycaemic	[13]
			Antihistaminic	[24]
			Antifilarial	[27]
			Antibacterial	[18,19,20,21,22]
			Nutritive	[5,6,7]
Flower		Infusion	Laxative	
			Cough	
			Haemorrhages	
Bark	Octacosane B-amyrin B-sitosterol	Extract decoction methanol extract	Dysentery	[10]
			Anti-inflammatory	
			Analgesic	
			Antipyretic	
			cholagogue	
			Skin diseases	[20]
			Antimicrobial	
			Wash of ulcer	
			Antitumor	[7,8,9]
			Antioxidant	[16,17]
			Hepatoprotective	[14,15]
			Antianxiety	[25]
			Antiulcer	[23]
Fruit		Alcoholic extraction	Antiulcer	[29]
Root	Tetracyclic lupeol, Betulin, β-sitosterol, and tetracyclic 2, 2-Dimethyl chroman.			[28]
Heart wood	Stilbene(resveratol)			[18]

Table 2: Pharmacological studies of *B. racemosa.*

Pharmacological activity	Tested substance	Model	Dose range (route of administration)	Reported dose	Reference
Antitumor activity	Methanolic extract of stem bark	Injected with EAC cells (0.2 mL of 2×106 cells/mouse) intraperitoneally (in vivo, 14 days, 5-flurouracil (20 mg/kg))	50,100,200,400mg/kg	200mg/kg	[7,14]
Analgesic effect	Aqueous and alcoholic extract of stem bark	Acetic acid-induced writhing, hot plate test and tail immersion method (in vivo, Aspirin (100 mg/kg))	100,200mg/kg	Both 100&200mg/kg, Aqueous extract 200mg/kg	[12]
Anti–HIV activity	Ethyl acetate n-butalol, methanol and aqueous extract of stem	Syncytia formation assay (4×104 C8166 cells were infected with HIV-1) (in vitro, 3 days, AZT(4000µg/ml))		Methanol extract (1000ug/ml)	[13]
Antimicrobial activity	Methanolic extract of stem bark	Disc diffusion method (in vitro, 24 hr, Ofloxacin (5µg/ml), Miconazole (40 µg/ml))	25,50,100,200ug/ml	200ug/ml	[19]
Anthelmintic activity	Ethanol and petroleum ether extract	In vitro (Albenzadole (Glaxo Smithkline25ml)	50,75,100mg/ml		
Anxiolytic activity	Methanolic extract of stem	Elevated plus-maze model (EPM), light dark model, hole board test, foot shock induced freezing behavior (in vivo, diazepam (2mg/kg))	150mg/kg,300mg/kg		[26]
Anti pyretic	Methanolic extract of stem bark	Yeast-induced hyperpyrexia (15% aqueous suspension) (in vivo, 24hr, paracetamol(150 mg/kg))	50,100,200mg/kg	200mg/kg	[12]

REFERENCES

1. Kirtikar KR, Basu BD. Indian Medicinal Plants, Bishen Mahendra Pal Singh, Dehradun, India, 1975; 2: 842.
2. Nadkarni KM, Indian materia medica, Bombay Popular Prakashan, 1982; 3(1): 183–844
3. Wealth of India, Raw Materials. Council of Scientific and Industrial Research, Publication and Information Directorate, New Delhi, 1952; 54–55.
4. Anonymo1us, The Wealth of India, New Delhi: Council of Scientific Research and Industrial Research, 1991; 54-55.
5. Rajaram N, Janardhanan K, Chemical-composition and nutritional potential of the tribal Pulses Bauhinia purpurea, B. racemosa and B. Vahlii. Journal of Agricultural and food chemistry, 1991; 55: 423-431..
6. Dhore RN, Bhinge SD, Udar SA, Nutritive value of Apta (Bauhinia racemosa) leaves for goat, Indian Journal of Small Ruminants, 2003; 9: 69-70.
7. Gupta M, Mazumder UK, Sambath KR, Siva KT, Antitumor effect of Bauhinia racemosa against Ehrlich ascites carcinoma with reference to lipid peroxidation and antioxidant system in Swiss albino mice, Acta Pharmacologica Sinica, 2004; 25: 1070-1076.
8. Mohamad RH, El-Bastawesy AM, Hegazi AG, Anticancer activity of Bauhinia racemosa Lam on mice bearing ehrlich ascites carcinoma. Egypt J Vet Sci., 2006; 40: 49-59.
9. Kumar RS, Sunderam RS, Thangavel SK, Effect of Bauhinia racemosa stem bark on N-nitrosodiethylamine-induced hepatocarcinogenesis in rats, American Journal of Chinese Medicine, 2007; 35: 103-114.
10. Gupta M, Anti-inflammatory, analgesic and antipyreticeffects of methanol extract from Bauhinia racemosa stem bark in animal models. Journal of Ethnopharmacology, 2005; 98: 267–273.

11. Borikar VI, Jangde CR, Rekhe DS, Philip P, Study of analgesic activity of Bauhinia racemosa lam in rats. Veterinary World, 2009; 2: 135-136.
12. Borikar VI, Jangde CR, Philip P, Study of antipyretic activity of Bauhinia racemosa Lam in rats, Veterinary World, 2009; 2: 217-218.
13. Prusty KB, Rao JV, Subudhi SK, Reddy PA, Raj KJ, Anti hyperglycemic activity of extracts of leaves of Bauhinia racemosa Lamk (Family-Caesalpineaceae) on normal and alloxan-induced diabetic rats, International journal of Pharmaceutical Research and Allied Sciences, 2012; 1: 9499.
14. Gupta M, Mazumdar UK, Siva KT, Gomathi P, Kumar RS, Antioxidant and Hepatoprotective Effects of Bauhinia racemosa against Paracetamol and Carbon Tetrachloride Induced Liver Damage in rats, International Journal of Pharmacy and Technology, 2004; 3: 12-20.
15. Kumar RS, Gupta M, Mazumdar UK, Effects of methanol extracts of Caesalpinia bonducella and Bauhinia racemosa on hematology and hepato-renal function in mice, Journal of Toxicology and Sciences, 2005; 30: 265-27.
16. Kumar RS, Sunderam RS, Sivakumar T, Effect of Bauhinia racemosa stem bark on N-nitrosodiethylamine-induced hepatocarcinogenesis in rats, American Journal of Chinese Medicine, 2007; 35: 103-114.
17. Kumar RS, Sivakumar T, Sunderam RS, Gupta M, Mazumdar UK, Gomathi P, Rajeshwar Y, Saravanan S, Kumar MS, Murugesh K and Kumar KA, Antioxidant and antimicrobial activities of Bauhinia racemosa L. stem bark. Brazilian Journal of Medical and Biological Research, 2005; 38: 10151024
18. Gupta M, Mazumder UK, Siva KT, Gomathi P, Kumar RS, Antioxidant and Hepatoprotective Effects of Bauhinia racemosa against Paracetamol and Carbon Tetrachloride Induced Liver Damage in Rats, International Journal of Pharmacy and Technology, 2004; 3: 12-20.
19. Kumar G, Karthik L, Rao KVB, Phytochemical composition and in vitro antimicrobial activity of Bauhinia racemosa lamk (caesalpiniaceae), International Journal of Pharmaceutical Sciences and Research, 2010; 1: 51-58.
20. Dahikar SB, Bhutada SA, Tambekar DH, In-vitro antibacterial efficacy of solvent extracts of leaves of Bauhinia racemosa Lam. (Caesalpiniaceae) against enteric bacterial pathogens, International Journal of Pharmaceutical Sciences and Drug Research, 2011; 3: 3234.
21. Kumar RS, Sivakumar T, Sunderam RS, Gupta M, Mazumdar UK, Gomathi P, Rajeshwar Y, Saravanan S, Kumar MS, Murugesh K Kumar KA, Antioxidant and antimicrobial activities of Bauhinia racemosa L. stem bark, Brazilian Journal of Medical and Biological Research, 2005; 38: 10151024
22. Ali MS, Azhar I, Amtula Z, Ahmada VU, Usmanghanib K, Antimicrobial screening of some Caesalpiniaceae, Fitoterapia, 1999; 70: 299–304.
23. Ravikumar A, Rathinam KMS, Antibacterial activity of hexane and acetone extracts of Peltophorum pterocarpum, Calvillea racemosa and Bauhinia purpurea, International Journal of ChemicalSciences, 2009; 7: 1751-1756.
24. Borikar VI, Jangde CR, Philip P, Rekhe DS, Study of Antiulcer Activity of Bauhinia racemosa Lam in rats, Veterinary World, 2009; 2: 215-221.
25. Nirmal SA, Laware RB, Rathi RA, Dhasade VV, Kuchekar BS, Antihistaminic effect of Bauhinia racemosa leaves, Journal of Young Pharmacists, 2011; 3: 129–131.
26. Davey MS, Atlee WC, Bharathi SRSA, Farook M, Antianxiety effect of methanolic extract of Bauhinia racemosa (Lamk) stem bark in mice, International Journal Pharmacy and Biological Sciences, 2011; 2: 224.
27. Jain R, Saxena U, Rathore K, Jain SC, Bioactivities of Polyphenolics from the Roots of Bauhinia racemosa, Archives of Pharmacal Research, 2008; 31: 1525-1529.
28. Jain R, Alam S, Saxena UA, A new teteacyclic phenol and other constituents from the roots of Bauhinia racemosa, Indian Journal of Chemistry, 2002; 41: 1321-1332.
29. Harbone JB. Phytochemical Method –A Guide to modern techniques of plant Analysis. Chapman and Hall, London, 1998; 182-90.
30. Pitripadma panda, Debajyoti Das, Priyanka Dash, Goutam Ghosh, Therapeutic Potenial of *Bauhinia racemosa*, A mini review, international Journal Pharmaceutical science rev.res, May–June, 2015; 32(2): 28: 169-179.