Review Article **www.ijcps.com**

International Journal of
Chemical and Pharmaceutical Sciences
2020, Aug, Vol. 11 (2)

ISSN: 0976-9390
IJCPS

Review on *Caesalpinia bonducella* [Linn]

[2] Annadurai Thenmozhi, [1] Cyril Jane Shammah* and [1] NarayananVenkateshan.

[1] Department of Pharmaceutical Chemistry, Arulmigu Kalasalingam College of Pharmacy, Anand Nagar, Krishnankoil, Srivilliputtur, Tamil Nadu, India.

[2] Department of Pharmaceutical Analysis, ArulmiguKalasalingam College of Pharmacy, Anand Nagar, Krishnankoil, Srivilliputtur, Tamil Nadu, India.

* **Corresponding Author:** E-Mail**:** shammahcj@gmail.com

Received: 13th Mar 2020, Revised and Accepted: April 22nd Apr 2020

ABSTRACT

The focus on medicinal plant research has been increased worldwide because of the belief that "green medicine" is safe and cheaper than synthetic drugs. Many herbal remedies have been employed in various medical systems for the treatment and management of different diseases. '*Caesalpinia bonducella*' is a prickly shrub belonging to the family 'Caesalpiniaceae' which is used to cure number of diseases in ayurveda. It is distributed all over the world specially found in India, Sri Lanka and Andaman and Nicobar Islands. In India, specially found in tropical regions. It is popular in indigenous system of medicine like Ayurveda, Siddha, Unani and Homoeopathy. The phytochemical screening conducted on various parts of *Caesalpinia bonducella* revealed the presence of several bioactive molecules that include oils, steroids, saponins, alkaloids, glycosides, carbohydrates, phenols, tannins, flavonoids and resins. This review attempts to encompass the available literature of *Caesalpinia bonducella* with respect to its traditional uses, phytochemical constituents, GC-MS analysis of various extracts and pharmacological activities. The evaluation of various pharmacological activities justifies the folkloric claim of *Caesalpinia bonducella*. Therefore, this information may be helpful in developing new formulations.

Keywords: *Caesalpinia bonducella*; GC-MS; Pharmacological activities; Phytochemical constituents.

1. INTRODUCTION

Medicinal plant has attained a significant role in health system all over the world for both humans and animals not only in diseased condition but also as potential material for maintaining proper health. *Caesalpinia bonducella* L. is an herb reported in ayurveda, an ancient traditional system of medicine in India. "Bonducella" the name of the species is derived from the Arabic word "Bonduce" meaning a "little ball" which indicates the globular shape of the seed. The seeds contain an alkaloid caesalpinine, bitter principles such as bonducin, saponins and other oils. These compounds render the herb its therapeutic properties.

1.1. Plant description

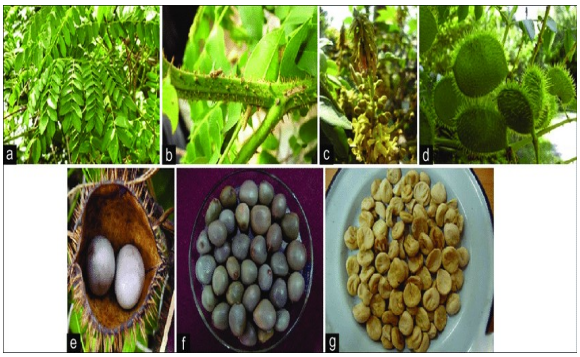

Figure -1: Caesalpinia *bonducella* (a) leaves (b) stem (c) flower (d) fruits (e) fruit with seed (f) seeds (g) seed kernels

Kingdom : Plantae
Phylum : Magnoliophyta
Division : Magnoliopsida
Class : Angiospermae
Order : Fabales
Family : Caesalpiniaceae
Genus : Caesalpinia
Species : Bonducella

1.2. Vernacular name

Tamil : Kalarcip paruppu, Kazharchikkaai, Kalachikai, Kalichikai, Kazarci

English : Fever nut, bonduc nut, nicker nut, nicker seed

Hindi : Kantkarej, Kantikaranja, Sagar Gota

Sanskrit : Kakachika, Kantakikaranja, Kantakini, Latakaranja, karanja, Krakachika

Urdu : Akitmakit

Persian : Khayahe-i-iblas

Kannada : Gajjiga, Kiri gejjuga, Gajikekayi

Malayalam : Ban-karetti, Kaka-moullou, Kazhanji,Kalanci, Kajanchikkur

Telugu : Mulluthige,Gaccakayai

1.3. Habit and Habitat

C.bonducella is growing in shade as well as in open condition. Generally found up to an altitude of 1,000 m in Himalaya and wild throughout the plains on waste lands or coastal areas of India. It is also found in deltaic region of western, eastern and southern India. Found particularly in the seacoast throughout the hotter parts of India, Burma and Sri Lanka.

1.4. Traditional uses

- It is used in vast range of diseases. The seed powder given with milk controls the diarrhea.
- The skin of the seed being astringent is beneficial as a medicament for diarrhea, dysentery and colitis.
- The seed is claimed to be styptic, purgative, anthelmintic and controls inflammations, useful in colic, malaria, hydrocele, skin diseases and leprosy.
- The seeds are considered as tonic, febrifuge, anthelmintic, antiblennorrhagic and specific in the treatment of hydrocele.
- The powdered seeds were mixed with equal part of pepper powder and given to malarial patients and was found to possess feeble antiperiodic properties.
- The seeds are ground in water and given internally in snakebite.
- *C. bonducella* seed along with long pepper powder act as a good expectorant.
- Burnt seeds with alum and burnt areca nut are used as a good dentifrice and useful in spongy gums, gum boils, etc.
- The oil prepared from the leaves, is a valuable nervine tonic.
- Leaves and twigs are traditionally used for the treatment of tumors, inflammation and liver disorder.
- They have also been applied for treatment of toothache.
- Leaves and juices have been used traditionally for elephantiasis and smallpox.

1.5. Phytochemical investigation

Various parts of *Caesalpinia bonducella* extracts reveals the presence of phytochemical substances such as alkaloids, carbohydrates, glycosides, flavonoids, steroids, saponins, tannins and phenols depending on the solubility of the compound and the solvent used.

Table - 1: Phytochemical investigation of various solvent extracts from *C.bonducella* seeds

Constituents	Hexane	Pet.ether	Chloroform	Ethyl acetate	Ethanol	Aqueous
Alkaloids	-	-	-	+	+	+
Carbohydrates	+	-	+	+	+	+
Glycosides	-	-	-	+	+	+
Flavonoids	-	-	+	-	+	+
Steroids	-	+	-	-	-	-
Saponins	+	+	+	+	-	+
Tannins	-	-	-	-	+	+
Phenolic compounds	+	-	-	-	-	-
Proteins	-	-	-	-	+	-

Table - 2: Phytochemical investigation of various solvent extracts from *C.bonducella* seed kernels

Constituents	Pet. Ether	Ethanol
Alkaloids	-	+
Carbohydrates	+	+
Glycosides	+	+
Steroids	+	-
Saponins	+	+
Tannins	+	+
Phenolic compounds	+	+
Proteins	+	+
Phytosterol	+	+

Table - 3: Phytochemical investigation of various solvent extracts from *C.bonducella* leaves

Constituents	Ethanol	Aqueous
Alkaloids	+	+
Carbohydrates	+	+
Saponins	-	+
Tannins	+	+
Phenolic compounds	+	+
Proteins	+	+
Flavonoids	+	+
Quinine	+	+

1.6. GC-MS Analysis

Gas Chromatography-Mass Spectroscopy analysis of various solvent extracts were identified whereas hydroethanolic extract of *C.bonducella* seeds showed 31 active compounds and ethyl acetate fraction of *C.bonducella* seeds revealed 2 active compounds. GC-MS analysis of ethanolic extract of *C.bonducella* seed kernel showed 7 bioactive compounds and methanolic extract of *C.bonducella* seed kernel revealed the existence of 11 bioactive compounds.

Table - 4: Hydroethanolic extract of *C.bonducella* seeds

Retention time (min)	Compound Name	Chemical formula	Molecular weight (gm/mol)
4.54	2,3, dihydro-3, 5-dihydroxy-6-methyl-4H-Pyran-4-one	$C_6H_8O_4$	144.12
4.90	Pentanoic acid	$C_5H_{10}O_2$	102.13
5.08	2-Pyrazoline	$C_3H_6N_2$	70.09
6.23	2-Propanol	C_3H_8O	60.1
6.96	1-Piperidineethanol 2-Propenoic acid	$C_{10}H_{17}O_2N$	183
7.5	1-Propanamine	C_3H_9N	59.11
10.59	Ethyl. beta -d-riboside	$C_7H_{14}O_5$	178.18
12.76	3-O-Methyl-d-glucose.alpha.-D-Xylofuranoside	$C_{15}H_{10}O_5$	150.13
13.09	2-[2-(2-Ethoxyethoxy)ethoxy]ethyl acetate	$C_{10}H_{20}O_5$	220.26
13.20	Hydrazine	N_2H_4	32.04
25.51	n-Hexadecanoic acid	$C_{16}H_{32}O_2$	256.43
26.91	Hexadecanoic acid ethyl ester	$C_{18}H_{36}O_2$	284.5
34.85	9,12-Octadecadienoic acid (Z,Z)	$C_{18}H_{32}O_2$	280.44
66.86	Trimethylsilyl ether	$C_{10}H_{24}OSi$	188.38
69.68	9-Octadecene	$C_{18}H_{36}$	252.5
70.83	1-(4-Nitrophenyl)-3-phenyl-3,4-di(carboxyethyl)-pyrazolin Acetic acid	-	-
71.15	2,3-Dihydroinden-2-one	C_9H_80	132.16
71.86	1H-Imidazole	$C_3H_4N_2$	68.07
72.45	Dichotine	$C_{22}H_{24}N_2O_6$	412.4
72.92	Ethanone	C_2H_3O	47.03

73.16	2,2'-(Alpha-methylbenzylidene) bis(6-methoxy-3-methylbenzofuran)	$C_{28}H_{26}O_4$	426.5
73.37	1,1-dimethoxy Ethanone	$C_5H_{10}O_3$	118.13
73.82	2,3-Dihydroinden-2-one	C_9H_80	132.16
75.45	2-Furanmethanamine	C_5H_7NO	97.11
75.86	Tetrahydro-Nalmefene	$C_{12}H_{25}N0_3$	375.89
77.28	o-(3-methylbutyl)-9-octadecene	$C_{23}H_{14}O_2$	352
77.95	Hydroxylamine	NH_2OH	33.03
79.45	Tetrahydro- Dichotine	-	-
79.84	1-(Trihexylsilyloxy) tetradecane Boron	$C_{32}H_{68}OSiB$	507
80.23	1,2,3-Thiadiazole	$C_2H_2N_2S$	86.12
82.55	Tetrahydro-Quinoline	$C_9H_{11}N$	133.19

Table - 5: Ethyl acetate fraction of *C.bonducella* seeds

Retention time (min)	Compound Name	Chemical formula	Molecular weight (gm/mol)
8.9	Carotene,3,3',4,4-tetrahydro-1,1,2,2-tetrahydro-1,1-dimethoxy-2,2-dioxo	$C_{42}H_{56}O_4$	624.9
10.5	2-Hexadecanol	$C_{16}H_{34}O$	242.44

Table - 6: Ethanolic extract of *C.bonducella* seed kernel

Retention time (min)	Compound Name	Chemical formula	Molecular weight (gm/mol)
16.57	Flavone	$C_{15}H_{10}O_2$	222.24
17.58	Estra-1,3,5(10)trien-17 a-ol	$C_{20}H_{26}O_3$	314.42
19.1	Oleic Acid	$C_{18}H_{34}O_2$	282.47
26.07	Coumarine,3[2-[1-methyl-2-imidazolylthio]-1-oxoethyl]	$C_{15}H_{12}N_2O_3S$	300.3323
26.88	Isopropyl stearate	$C_{21}H_{42}O_2$	326.565
30.4	Benzoic acid, 4-hydroxy-3,5-dimethoxy-, octyl ester	$C_{17}H_{26}O_5$	310.39
35	2-Secoandrosta-1,4,6-triene-17,19-diol,2-cyano-4,methyl- diacetate	$C_{25}H_{33}NO_4$	411.542

Table - 7: Methanol extract of *Caesalpinia bonducella* seed kernel

Retention time (mins)	Compound Name	Chemical formula	Molecular weight (gm/mol)
12.68	2,4{1H,3H}-pyrimidinedione, dihydro-3-methyl	$C_5H_8N_2O_2$	128
14.17	Benzene { 1- methylenebutyl}	$C_{11}H_{14}$	146
15.82	Benzidine	$C_{12}H_{12}N_2$	184
17.02	á-neoclovene	$C_{15}H_{24}$	204
17.75	Flavone	$C_{15}H_{10}O_2$	222
18.7	3,6-Non-adienedioic acid,5,5-dimethyl dimethyl ester	$C_{14}H_{22}O_3$	238
19.67	9,12-octadecadienoic acid {Z, Z}	$C_{18}H_{32}O_2$	280

21.28	Octadecanoic acid, 3-oxo, methyl ester	$C_{19}H_{36}O_3$	312
22.92	Isopropyl stearate	$C_{21}H_{42}O_2$	324
24.35	9,12-octadecadienoic acid {Z, Z}-, 2,3-dihydroxypropyl ester	$C_{21}H_{38}O_2$	354
25.3	9,12,15-octadecatrienoic acid, 2,3-dihydroxypropyl ester {Z, Z, Z}	$C_{21}H_{36}O_4$	352

1.7. Pharmacological activities

Table - 8: Pharmcological activities of various parts of *C.bonducella*

Parts of *Caesalpinia bonducella*	Solvent used for extraction	Pharmacological activity	Author name
Seed	Ethanol	Anticancer	Deepika KSN et al.
	Ethanol	Immunomodulatory	Shukla S et al.
	Aqueous	Antispermatogenic	Kanerkar UR et al.
	Ethanol	Abortifacient	Liliram et al.
	Hydro-ethanolic	Anti-inflammatory	Jagdale RA et al.
	Chloroform	Antioxidant	Nikhil kumar sachan et al.
	Ethanol	Analgesic and anti-inflammatory	Manoj Kumar Sagar et al.
	Aqueous and methanol	Diuretic	Ajay Khedkar et al.
	Petroleum ether and ethanol	Antiasthmatic	Prakash D. Khandagale et al.
	Hydro-methanolic	Antihyperglycemic and Antihyperlipidemic	Debidas Ghosh et al.
Seed coat	Ethanol	Anti-inflammatory and analgesic	Kannur et al.
	Aqueous and ethanol	Antimycobacterial	Sonvane SM et al.
Seed kernel	Alcohol	Antifilarial	Gaur et al.
	Petroleum ether	Anticonvulsant	Altaf et al.
	Methanol	Antimicrobial	Alrabie et al.
	Ethanol	Antihyperlipidemic	Gayatri Sarma et al.
Leaves	Aqueous and ethanol	Antimicrobial	Shirish S. Pingale et al.
	Methanol	Antidiarrhoeal	Billah MM et al.
	Methanol, ethanol, hexane and aqueous	Anthelmintic	Wadkar GH et al.
	Hydro- alcoholic	Antipsoriasis	Muruganantham N et al.
	Methanol	Antiulcer	Ansari JA et al.
Root-bark	Ethanol	Antifertility	Khedkar AS et al.
Stem-bark	Ethanol	Anti-inflammatory and Anticancer	Sandhia KG et al.

2. CONCLUSION

Ethno botanical and traditional uses of natural compounds, especially of plant origin received much attention in recent years as they are well tested for their efficacy and general believed to be safe for human use. Traditionally, plants are used in the treatment of many infections and systemic disorders. *Caesalpinia bonducella* are widely distributed and easily available in India. Thorough screening of literature available on *Caesalpinia bonducella* will hopefully help the researchers working in this area.

3. REFERENCES

1. Vibha Singh and PramodRaghav K. Review on pharmacological properties of *Caesalpiniabonduc*L. **Int. J. Med. Arom. Plants**, 2012; 2(3):514-530.
2. KalyaniPathak and RatnaJyotiDas.Herbal Medicine- A Rational Approach in Health Care System. **International Journal of Herbal Medicine,** 2013; 1(3):86-89.
3. Sivakrishnan S. Traditional Herbal Medicine – A review. **IJRAR,** 2018; 5(4):611-614.
4. SambasivamManikandaselvi,VellingiriVadivel andPemaiahBrindha. *Caesalpiniabonducella*L.: A nutraceutical plant. **Journal of Chemical and Pharmaceutical Research,** 2015; 7(12): 137-142.
5. PethaniSavaji, SavaliyaNavanit and Abdul Nayeem. Phytochemical Extraction and Antibacterial Studies of *Caesalpiniabonducella* Seed Extracts. **Mapana J Sci,** 2014; 13(4): 47-54.
6. Khan Nazeerullah, Kumar Sunil, Singh Rishi Pal and DhankharNeelam. A Pharmacognostic and Pharmacological Overview on *Caesalpiniabonducella*. **RJPBCS,** 2012; 3(1): 480-496.
7. Desh Deepak Pandey,Alok Pal Jain and Abhay Kumar.*Caesalpiniabonducella*: A pharmacological important plant. **The Pharma Innovation Journal,** 2018; 7(12): 190-193.
8. Prakash Khandagale D, AbhijeetPuri V, Yunus N, Ansari and RavindraPatil. Pharmacognistic, Physicochemical and Phytochemical Investigation of *Caesalpiniabonducella* [L.] Roxb. Seed. **International Journal of Pharmacy and Biological Sciences,** 2018: 8(3): 461-468.
9. Shruti Shukla, Pradeep Mehta, Archana Mehta, Suresh Prasad Vyas and VyasVivek K. Preliminary phytochemical and antifungal screening of various organic extracts of *Caesalpiniabonducella* seeds. **Romanian Biotechnological Letter,** 2011; 16(4):6384-6389.
10. Nikhil Kumar Sachan,ShikharVerma, AnupamSachan K andHussainArshad. An investigation to antioxidant activity of *Caesalpiniabonducella* seeds. **Ann. Pharm. & Pharm. Sci,** 2010; 2(10):88-9.
11. Lilaram and Nazeer Ahmed Raichur. Abortifacient potential of ethanolic seed extract of *Caesalpiniabonducella* in female albino rats. **J Basic ClinPhysiolPharmacol.** 2014; 25(4): 445–451.
12. Kanerkar UR,Bhogaonkar PY and Indurwade NH.Antispermatogenic Effect of Caesalpiniabonduc (L.) Roxb. Seeds. **Int. Res. J. of Science & Engineering,** 2015; 3(4):173-178.
13. Manoj Kumar Sagar,Praveen Kumar Ashok, Himansu Chopra, Manmohan Singh and KumudUpadhyaya. Analgesic and anti-inflammatory properties of caesalpinia (bonduc) seeds. **The Pharma Research,** 2009; 3(7): 54-59.
14. Dayanand Kannur M, MuktaParanjpe P, LalitSonavane V, PreranaDongre P and KishanchandKhandelwal R. Evaluation of Caesalpiniabonduc seed coat extract for anti-inflammatory and analgesic activity. **Journal of Advanced Pharmaceutical Technology & Research,** 2012; 3(3):171-175.
15. Ali A, VenkatRao N, Shaam MD, Shivaraj Gouda T and Shantakumar SM. Anticonvulsive effect of seed extract of *Caesalpiniabonducella* (Roxb.). **Iranian Journal of Pharmacology & Therapeutics,** 2009; 8(2): 51-55.
16. Khandagale PD and Puri AV. Evaluation of antiasthmatic activity of *Caesalpiniabonducella* [L.] Roxb. Seed. **Journal of Drug Delivery and Therapeutics,** 2019; 9(2):144-149.
17. Ajay Khedkar,YuvarajMandavkar D, GulabShinde, PallaviKhalure and PravinDere. Diuretic effect of Caesalpiniabonduc in rats. **Bangladesh J Pharmacol,** 2011; 6(2):61-63.
18. Sonvane SM, Deshpande AN, Shaikh RA, Gadgul AB, Choutmahal SA and Bhosale PV. Evaluation of IN-VITRO Antimycobacterial Activity of Caesalpiniabonduc Seed Coat Extracts. **International Journal of Pharma Research & Review,** 2016; 5(10):7-11.
19. Deepika KSN, Rama Navya K, Meenakshi Sundaram Muthuraman, Ravichandran Natesan C David Raj C and Brindha Pemaiah.

Evaluation of Invitro Anticancer potential of ethanolic extract and its different fractions of Caesalpiniabonduc (L) Roxb. Seeds. **International Journal of Pharmacy and Pharmaceutical Sciences,** 2014; 6(8): 311-314.

20. Gaur RL, Sahoo MK, Dixit S, Fatma N, Rastogi S, Kulshreshtha DK and Chatterjee RK.Antifilarial activity of *Caesalpiniabonducella* against experimental filarial infections. **Indian J Med Res,** 2008; 7(5): 65-70.
21. Ali alrabie, Ola basaARand Mazahar Farooqui, GC –MS Analysis, Inductively Coupled Plasma Mass Spectrometry Investigation, and Antimicrobial Screening of *Caesalpinia Bonducella* (L.) Roxb Seed Kernel. **Asian Journal of Pharmaceutical and Clinical Research,** 2019; 12(4): 315-319.
22. Jagdale RA,Somkuwar AP, Bhoye SK, Sarode KG and Limsay RP. In vivo anti-inflammatory activity and GC-MS analysis of hydroethanolic extract of *Caesalpiniabonducella*seeds. **Journal of Pharmacognosy and Phytochemistry,** 2019; 8(3): 929-934.
23. Sunayana Vikhe and Pravara Nirmal. Evaluation Isolation and Characterization of Chemical constituents from *C. bonducella* L. seed. **Pravara Journal of Science & Technology,** 2017; 1(1): 20-28.
24. Subramani V, Kamaraj M, Ramachandran B and Jerome Jeyakumar. Phytochemical investigation and antimicrobial activity of Caesalpiniabonduc (linn) Roxb seeds. **International Journal of Phytopharmacy,** 2014; 4 (3): 92-95.
25. VigasiniSubbiah, PannagaNagaraja, Priya Narayan and GunduRaoNagendra. Evaluation of Pharmacological Properties of *Caesalpiniabonducella* Seed and Shell Extract. **Pharmacogn J,** 2019; 11(1):150-154.
26. Banupriya R, Jayaseelan K, Saranya R and Elumalai S. Studies on Phytochemicals and Anti-Inflammatory Activity of *CaesalpiniaBonducella* (Linn). **Journal of Pharma Research,** 2012; 7(5): 63-69.
27. Komal Moon, Khadabadi SS, Deokate UA and Deore SL. *Caesalpiniabonducella* F - An **Overview. Report and Opinion.** 2010; 2(3): 83-90.
28. KanchanSalunke R, Nazeer Ahmed R, Shambanagouda Marigoudar R and Lilaram. Effect of graded doses of *Caesalpiniabonducella* seed extract on ovary and uterus in albino rats**. J Basic Clin Physiol Pharmacol,** 2011; 22(1-2):49–53.
29. Shirish Pingale S, Manohar Chaskar G and Nirmala Kakade R. Phyto chemical and Pharmacological Review of *Caesalpiniabonducella*. **International Research Journal of Pharmacy,** 2016; 7(12):12-17.
30. Bhavana Mehra, Santosh Kumar Maurya and Dwivedi KN. Pharmacognostic evaluation of Latakaranja (Caesalpiniabonduc [L.] Roxb.). **International Journal of Green Pharmacy,** 2015; 9 (4):63-69.
31. Biswas TK. Oral hypoglycemic effect of *Caesalpiniabonducella*. **Int J Pharmacog,** 1997; 3(4): 261-264.
32. Jayakrishnan BM. In vitro antioxidant studies and phytochemical screening on the seeds of Caesalpiniabonduc. **European Journal of Experimental Biology,** 2014; 4(6):47-51.
33. Kurmi P. In-vitro anticataract activity of ethanolic extract of seed kernel of *Caesalpiniabonducella* (L.) Fleming on goat. **International Journal of Pharmaceutical Sciences,** 2015; 6(1): 244-253.
34. ShirishPingale S. Phytochemical Analysis and Antimicrobial Activity of ***Caesalpiniabonducella*** **Leaves,** 2017; 42(2): 217-220.
35. Jana K. Antioxidant potential of hydro methanolic extract of seed of Caesalpiniabonduc: **An In-vitro study. J Adv Pharm Technol Res.** 2011; 2(1): 260-265.
36. Billah MM. Antibacterial, antidiarrhoeal and cytotoxic activities of methanol extract and its fractions of CaesalpiniaBonducella (L.) Roxb leaves. **BMC Complementary and Alternative Medicine,** 2013; 13:101
37. Wadkar GH. In- vitro anthelmintic activity of Caesalpiniabonducella (Linn). Flem. Leaves. **Journal of Pharmacy Research,** 2010; 3(5): 926-927.
38. Muruganantham N,Basavaraj KH, Dhanabal SP, Praveen TK, Shamasundar NM and Rao KS. Screening of Caesalpiniabonduc leaves for antipsoriatic activity. **Journal of Ethnopharmacology,** 2011; 133(2): 897-901.
39. Ansari JA. Effect of CaesalpiniaBonducella L. on ulcer and gastric secretions in pylorus legated rat model. **Journal of Drug Delivery & therapeutics,** 2012; 2(5):102-104.