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A PANORAMIC REVIEW OF *HOLARRHENA ANTIDYSENTERICA* (ROXB. EX FLEM.)WALL. WITH SPECIAL REFERENCE TO NIGHANTUS

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ABSTRACT

Medicinal plants have been used for the benefit of mankind since time immemorial. Various studies have been carried out to verify their efficacy which have led to the discovery of many lifesaving medicines. The global market value of medicinal plant products exceeds $100 billion per annum. *Holarrhena Antidysenterica* (Roxb. Ex Flem.)Wall. is one such well known plant otherwise known Kutaja or Kurchi. It is a small tree growing wild and gregariously in hilly regions. Its stem bark, leaves, seeds are used traditionally for various medicinal purposes. It has many proven medicinal properties like antidysentric, anthelminthic, anti-diabetic, hypolipidaemic activities. It is used for the treatment of dysentery, diarrhea, bleeding piles, malaria and various other diseases. It is reported to contain various alkaloids, flavonoids which gives it immense medicinal potential. Its uses are mentioned in classical ayurvedic texts and samhitas like Charak Samhita, Susruta Samhita etc and in nighantus like Dhanvantari Nighantu, Raj Nighantu, Madanpal Nighantu, Shaligram Nighantu, Kaiyadeva Nighantu, Bhavprakash Nighantu in great detail. *Holarrhena* antidysenterica (Roxb. Ex Flem.) Wall. has shown positive results in hyperglycaemia, also as an anti-diarrheal agent, hypolipidaemic agent and anthelminthic agent. This review also quotes various medicinal properties of Kutaja as found in various experimental studies.

KEYWORDS: Samhitas, Nighantus, Anti-diabetic, hypolipidaemic.

INTRODUCTION

Herbal remedies represent some of the most ancient medicines in healthcare and are historically considered among the most powerful means of maintaining human health and homeostasis.[1] The field of herbal medicines' research has been gaining significant importance in the last few decades and the demand to use natural products in the treatment of various diseases is increasing worldwide.

Kutaja, otherwise known as "Indrajav", "Coneru" in English and "Vatsaka" in Sanskrit is a shrub which is distributed all over India up to an altitude of 4000ft. In traditional system of medicine, it is considered a good medicine for the treatment of dysentery, diarrhea, hyperglycaemia and intestinal worms. Its seeds and stem bark have been in use in traditional medicine since centuries.

Taxonomic Classification[2]

Kingdom: Plantae – Plants

Subkingdom: Tracheobionta - Vascular plants

Superdivision: Spermatophyta - Seed plants

Division: Magnoliophyta - Flowering plants

Class: Magnoliopsida - Dicotyledons

Subclass: Asteridae

Order: Gentianales

Family: Apocynaceae - Dogbane family

Genus: Holarrhena R. Br. - holarrhena

Species: Holarrhena antidysenterica (Roxb. ex Fleming) Wall. ex A. DC. - tellicherry bark

Classical names[3]

Kutaja, *Kootaja, Kauta, Vatsaka, Girimallika, Kalinga, Shakrashakhi, Mallikapushpa, Indra, Indravriksha, Yavaphala, Vrikshaka, Panduradruma.*

Vernacular name

Eng- Kurchi, Conessi or Tellicherry bark

Hindi- *Kurci, Kuda, Karchi, Kura, Karra, Kurchi, Kureya, Karva-indarjou, Kora.*

Beng. -*Kurchi, Kureya, Tita-indarjou*

Guj. -*Indrajavanu, Dhowda, Kuda, Kari.*

Kan.-*Beppale, Koodsaloo, Korchie, Kodagasana.*

Mal.-*Kutakappala, Kodagapala, Kaipa-kutakap-palavitta.*

Mar.-*Kuda, Pandhara Kuda, Kodaga, Dola-kuda.*

Punj. -*Keor, Kewar.*

Tam. -*Kutasappalai, Veppalai, Kodagapalei, Indrobam, Kashappu-vetpa-larishi, Kulap-palai-virai.*

Tel.-kodisapala-vittulu, Pala, Kodaga, Istaraka palu, Vistaraku pala, Amkuduvittum, Palakodsa.

Assam- Dhutkhuri, Dudhkhuri.

Oriya- Kherwa, Pitakorwa, Patrukurwa.

Namrupa Vijnana[4]

1. **कुटजः**-कुटे वने प्रावृषि च जायते इति; यथा प्रियनिघण्टौ 'कुटजः कुटजातत्वात् कुटोऽरण्येऽथ प्रावृषि' इति ।कूटे गिरिशृङ्गे जायते इति रामाश्रमी।
2. **इन्द्रवृक्षः (सो०)**–कालिङ्गे महेन्द्रपर्वतक्षेत्रे बहुशो जायमानत्वात् । अष्टाङ्गनिघण्टुस्तु शक्रवृक्ष' इति पठति ।
3. **कालिङ्गः (भा०)**-कलिङ्गदेशे भवः ।
4. **गिरिमल्लिका (भा०)**-गिरिषु मल्लिकावच्छुभ्रपुष्पधारकः। गिरिशब्दः स्थलमल्लिकाव्यवच्छेदार्थः
5. **चक्रशाखी (भा०)**-चक्रे समूहे जायमानः शाखी वृक्षः ।
6. **पाण्डुरद्रुमः (भा०)**—पाण्डुत्वग् वृक्षः ।
7. **प्रावृषेण्यः (रा०)**-प्रावृषि पुष्पोद्गमात् ।
8. **मल्लिकापुष्पः (भा०)**-मल्लिकाया इव शुभ्रपुष्पाण्यस्य ।
9. **महागन्धः (रा०)**-सगन्धपुष्पयुक्तः ।
10. **यवफलः (सो०)**–यवाकारबीजसहितं फलमस्य । बीजानि हि 'इन्द्रयव' इति नाम्ना प्रसिद्धानि, अत एव भावप्रकाशः'इन्द्रयवफल' इति पठति ।
11. **वत्सकः (भा०)**-वत्सदेशे जायमानः ।
12. **वरतिक्तः (सो०)**–तिक्तेषु श्रेष्ठः ।
13. **वृक्षकः (अ०)**-ह्रस्ववृक्षः ।

14. शक्रः (रा०)-शक्नोति रोगानपनेतुमिति, वीर्यसंपन्न इत्यर्थः ।

15. संग्राही (रा०)-पुरीषं संगृह्णातीति ।

Kutaja (Holarrhena antidysenterica Linn. Wall.) is a small tree (Vrksaka) growing wild (kutaja) and gregariously (cakraśākhi) in hilly regions of Kalinga and Vatsa (kālinga, indravrksa, vatsaka) with pale bark (panduradruma). It bears fragrant (mahāgandha) jasmine-like flowers (mallikāpuspa, girimallika) in early rainy season (prāvrsenya). Fruits have barley-shaped seeds. (yavaphala). It is a potent (Sakra) bitter drug (varatikta) efficacious in diarrhoea and dysentery (sangrahi).

LITERATURE REVIEW

A) Samhitakala

In **Charaka Samhita** totally 112 references were found in 42 different Adhyayas of 5 different Sthanas. In Sutra Sthana 21, Vimana Sthana 4, Chikitsa Sthana 76, Kalpa sthana 9, and in Siddhi Sthana 2 references were mentioned.

The drug kutaja has been widely and often described in Samhita period. Caraka described it by the names of Vatsaka, Kutaja, Sakra, Vriksaka, Giri-mallika (C.K.5/4). Its seeds are called Indrayava and Kallingaka. It has been used in various skin disorders including leprosy (C.S.3/14) in lepa form along with other drugs. It has been mentioned among 600 emetic and purgative preparations (C.S.4/4). It has been mentioned in Arshaghna mahakasaya (C.S.4/12), Kandughna mahakasaya (C.S.4/14).

The bark of Kutaja helps in alleviating Kapha, Pitta and Rakta, also it is sangrahik, upasoshan (C.S.25/40). It is used for counter-acting the factors responsible for the production of parasites. (C.V.7/21). It is mentioned under the drug used in emesis (C.V.8/135). The bark of kutaja is used for preparation of taila along with other drugs for treatment of kustha, kandu (C.C.7/109)., as a haemostatic (C.C.14/185).

In **Sushruta Samhita** total 67 references are scattered in 35 Adhyayas of 4 Sthanas. In Sutra Sthana 13, Chikitsa Sthana 16, Kalpa Sthana 2, Uttaratantra 36 references are quoted.

In **Asthanga Hridaya** total 52 numbers of references are divided into 26 different Adhyayas of 4 different Sthanas. Maximum 25 references are found in Chikitsasthana, followed by 22 in Uttaratantra, 4 in Sutrasthana and Kalpasthana states 2 references.[5]

Table 1: Showing the Classical categorization of Kutaja in samhitas.

Drug	C.S	S.S	Ast.Sam	Ast.Hr
Kutaja	Arsoghna Kandughna Stanyosodhana Asthapanopaga	Aragvadhadi Pippalyadi Haridradi Laksadi	Aragvadhadi Pippalyadi	Sodhonadi

(C.S- Charak samhita; S.S- Susruta samhita; Ast. Sam- Astanga Samgraha; Ast.Hr- Astanga Hridaya)

B) Nighantu Kala

Table 2: Showing the Classical categorization of Kutaja in nighantus.

S.N.	TEXTS	VARGA/GANA
1.	**Dhanwantari Nighantu**	Shatapuspadi varga
2.	**Madanapala Nighantu**	Abhayadi varga
3.	**Raja Nighantu**	Prabhadradi varga
4.	**Kaiyadeva Nighantu**	Ousadhi varga
5.	**Bhavprakash Nighantu**	Guduchyadi varga
6.	**Shaligrama Nighantu**	Astavarga
7.	**Nighantu Adarsha**	Kutajadi varga
8.	**Priya Nighantu**	Harityakadi varga
9.	**Sushruta Nighantu**	Aragvadhadi Pippalyadi vrihatyadi
10.	**Siddha Mantra**	Kaphapittaghna Dravya Kaphapittaghna vatakara Dravya
11.	**Sarasvati Nighantu**	Mahavriksha varga
12.	**Shabda Candrika**	Vrukshadi varga
13.	**Nighantu Shesha**	Vrikshakaanda
14.	**Dravyaguna Sangraha**	Shakvarga
15.	**Amarakosha**	Vanausadhi varga
16.	**Abhidhana Ratnamaala**	Tiktaskandha
17.	**Astanga Nighantu**	Vatsakadi gana

Table 3: Showing synonyms as per different nighantu.

S.N.	SYNONYMS	DN	MNP	RN	KN	BPN	SGN	NA	PN
1	Kutaja	+	—	+	+	+	+	+	+
2	Kautaja	+	—	+	—	—	—	—	—
3	Sakra	—	—	+	—	—	+	+	—
4	Vatsaka	+	+	+	+	+	—	+	+
5	Girimallika	+	+	+	+	+	—	+	+
6	Kalinga	+	+	+	+	+	+	+	—
7	Mallika-puspa	+	+	+	+	+	+	—	—
8	Pravrsya	—	—	+	—	—	+	—	—
9	Sakrapada	—	—	+	—	—	+	—	—
10	Varatikta	—	—	+	+	—	+	—	—
11	Yavaphala	—	—	+	—	+	+	—	—
12	Sangrahi	—	—	+	—	—	+	—	—
13	Panduradruma	—	—	+	—	—	—	—	—

14	Pravrsenya	—	—	+	—	—	—	—	—
15	Mahagandha	—	—	+	—	—	—	—	—
16	Kohi	—	—	—	+	—	—	—	—
17	Utsak	—	—	—	+	—	—	—	—
18	Vrikshak	+	—	—	+	+	+	+	—
19	Kotivriksha	—	+	—	—	—	—	—	—
20	Sakraburuha	—	+	—	—	—	—	—	—
21	Pandura	—	—	—	—	—	+	—	—
22	Kutak	—	—	—	—	—	+	—	—
23	Sakradyay	—	—	—	—	—	+	—	—
24	Yavaphala	—	—	—	—	+	+	—	—
25	Indradu	—	—	—	—	—	+	—	—
26	Sakrasakhi	—	—	—	—	+	+	—	—
27	Indrayabphal	—	—	—	—	—	+	—	—
28	Indravriksha	+	—	—	—	—	—	+	+
29	Kauta	+	—	—	—	—	—	—	—

"+" denotes same name was mentioned in various Nighantu. "-" denotes this name was not mentioned.

(DN- Dhanvantari Nighantu, MPN- Madanpal Nighantu, RN- Raj Nighantu, KN- Kaiyadev Nighantu, BN-Bhav Prakash Nighantu, SN- Saligram Nighantu, NA- Nighantu Adarsh, PN- Priyo Nighantu).

The study in the "Table 3" represents the various synonyms given by different Acharyas in different Nighantus belonging to different time periods. Some of the most common synonyms of Kutaja used by the Acharyas are – Vatsaka, Girimallika, Kalinga and Mallika Pushpa respectively. Most number of Synonyms was mentioned by **"Raj Nighantu".**

Table 4: Showing Rasa, Guna, Virya and Vipaka of Kutaja according to Various Nighantus.

RASAPANCHAK		**TEXTS**						
		BN	**MPN**	**KN**	**RN**	**DN**	**SGN**	**PN**
RASA	**MADHURA**	—	—	—	—	—	—	—
	AMLA	—	—	—	—	—	—	—
	KATU	+	+	+	+	+	+	—
	TIKTA	—	—	—	+	+	+	+
	KASAYA	+	+	+	+	+	+	+
GUNA	**USHNA**	—	—	—	+	—	+	—
	SITA	—	—	—	—	—	—	—
	RUKSHA	+	+	+	—	+	—	—
	LAGHU	—	+	—	—	—	—	—
VIRYA	**SITA**	+	—	+	—	+	—	—
VIPAKA	**MADHURA**	—	—	—	—	—	—	—

"+'' denotes same Rasa, Guna, Virya & Vipak was mentioned in various Nighantu. "-" denotes this Rasa, Guna, Virya & Vipak was not mentioned.

(DN- Dhanvantari Nighantu, MPN- Madanpal Nighantu, RN- Raj Nighantu, KN- Kaiyadev Nighantu, BN-Bhav Prakash Nighantu, SGN- Saligram Nighantu, PN- Priyo Nighantu.)

Most of the acharyas believe that, Kutaja has Katu, Tikta and Kasaya rasa, Ushna and Ruksha guna and Sita virya respectively.

Botanical description

Holarrhena antidysenterica is a short-term tree with a small to a huge height up to 30 to 40 feet producing milky white, thick and less profuse latex.

Leaves are ovate, simple, large, smooth or hairy and opposite to each other. Leaves are 15–30 cm × 4–12cm in size. Its base is obtuse, generally rounded or acute. Leaves nerves are 10 to 14 pairs, opposite and sessile. Its petioles are 1.5cm in length and cymes are 3 to 6cm in diameter.

Seeds are 1-2cm long, linear or oblong with long coma shaped or boat-shaped which is light brown to brownish in color and shows epigeal germination. Hairs are present at the apex of the seeds and short-lived.

The stem bark of the plant is smooth or rough, pale brown to greyish brown in color which peels off in irregular patches with bitter in taste. The root bark is reddish-brown in color.

Plant flowers in the month of April to July which is white, small and arranged in a cluster and glimpse like a flattened top. Petals are disc-shaped and overlay at the right side and corolla 3-4 times longer than calyx; anthers are present inside the corolla tube.

It fruits from August to October. The fruits have small, long follicles having white spots on the surface. Dried fruits when busted it releases numerous flat seeds with brown hairs.[6-11]



FIG. 1: Showing Leaves and flowers. FIG. 2: Showing bark. FIG. 3: Showing fruits.

FIG-1- https://i.pinimg.com/564x/db/4d/9e/db4d9e6163589cd93a37285031bd411f.jpg
FIG-2-https://upload.wikimedia.org/wikipedia/commons/e/eb/Holarrhena-antidysenterica_05.jpg

Distribution

The plant is found throughout the drier or deciduous forest areas of India at low elevations and ascending to 1100m in the tropical Himalayan tract from Chenab eastwards.

Parts used

Stem bark, leaf, seed.

Pharmagnosy[12]

a) Macroscopic

Dried bark occurs in form of small recurved pieces of varying sizes and thickness; outer surface buff to brownish, longitudinally wrinkled and bearing horizontal lenticels; inner surface brownish, rough and scaly. Fracture is short and granular; taste acrid and bitter.

Powder

It is dark brown in colour, coarse, tastes bitter, odour- astringent.

FIG. 4: Showing Bark powder.

FIG. 5: Showing bark.

b) Microscopic

Transverse section of dried stem bark shows cork consisting of 4-12 rows of tangentially elongated cells, radial 15- 45 µ tangential 30-60 µ cork cambium consists of a row of thin walled tangentially elongated cells, secondary cortex usually wide, parenchymatous, interspersed with strands of stone cells, stone cell rectangular to oval, with numerous pits often containing prismatic crystals of calcium oxalate, non-lignified pericyclic fibres upto 52 mm thick, present in bark, secondary phloem wide consisting of sieve-tubes, companion cells, phloem parenchyma and stone cells, stone cells arranged in tangential rows in concentric manner associated with crystal sheath containing prisms of calcium oxalate, medullary rays mostly bi or triseriate rarely uniseriate becoming wide toward, outer part and consist of thin-walled, radially elongated, parenchymatous cells, medullary ray cells near stone cells become sclerosed.

Powder

Light brown, taste bitter; thin-walled cork cells, groups of stone cells of different sizes and shapes, prisms of calcium oxalate crystals in parenchymatous cells and in stone cells and also scattered all over.

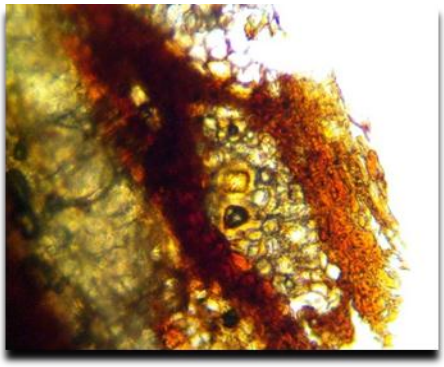


Fig. 6: Showing cross section of stem bark of Kutaja.

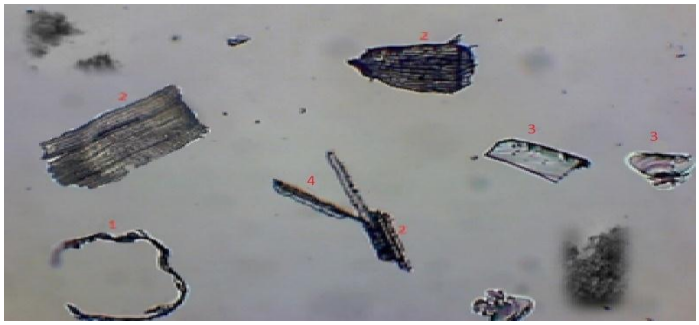
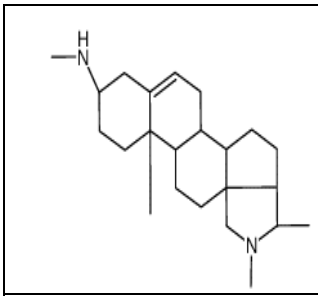
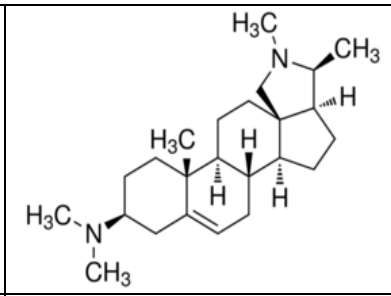
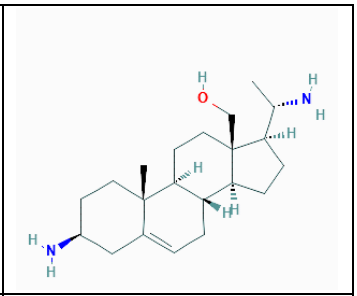


Fig. 7: Showing Powder microscopy of Kutaja stem bark; 1. Tracheid, 2. Vessel with scalariform orientation and vessels with parenchymal patches, 3. Crystal, 4. Trichome.

Chemical constituents

Alkaloids- kurchine, kurchicine, conessine, nor conessine, holarrhimine, hollarhine, conarrhimine, conamine, conimine, conessimine, isoconessimine, conessidine, conkurchine, holarrhenine lettocine and alkaloid holarricine (bark).[11]

		
Kurchine	**Conessine**	**Holarrhimine**

A triterpene characterised as 5,20 (29)- lupadein- 3β- ol- together with known steroid sitosta- 5, 23-dien- 3β-ol, two alkaloids named holacine and holacimine (bark extract).[13]

Action and uses

The bark and seeds are bitter, constipating, astringent, powerful antidysenteric, acrid, refrigerant, anthelminthic, antiperiodic, aphrodisiac, carminative, digestive, expectorant, febrifuge and tonic. Both are useful in amoebic dysentery, diarrhoea, asthma, bronchopneumonia, hepatic and gastric disorder, flatulence, hepato-splenomegaly, internal haemorrhages, bleeding piles, rheumatism, fever, malaria, vomiting, worm infestation, urological disorders (calculus and gravels), wounds, leprosy and skin diseases. The bark is rubbed over body in dropsy. Seeds are carminative, astringent, lithontriptic and aphrodisiac. Leaves are used in chronic bronchitis, dysentery, locally for boils and ulcers.[13]

Ayurvedic Properties[14]

Rasa: tikta, kashaya

Guna: laghu, ruksha

Veerya: katu

Vipaka: Sheeta

Doshaghnata -Kaphapittashamaka

Rogaghnata- Kaphapittajavikara, Vrana, Visphota, Agnimandya, Atisara, Pravahika, Jwaratisara, Arsha, Raktarsha, Udarashoola, Krimi, Raktavikara, Vatarakta, Kushtha, Raktapitta, Jwara, Vishamajwara, Sthaulya

Karma- Vranaropana, Vamaka, Deepana, Stambhana, Arshoghna, Krimighna, Upashoshana (Ama, Rakta and Jala), Samgrahi, Raktashodhaka, Raktastambhana, Jwaraghna, Dhatushoshana.[13]

Doses- Drug for decoction- 20-30gm; Powder- 3-6gm.

Formulation and Preparations - Kutajarishta, kutajavaleha, vridhagangadhara churna, laghugangadhara churna, jirakadya churna, Brihanmarichadya taila, panchanimba churna, Palashabijadi churna.[15]

Pharmacological activities

Some important pharmacological activities with references

Anti-diabetic activity, Hypolipidaemic activity-Plant Extracts contains a potential anti-diabetic effect.[16,17] Ethanolic extract of plant moderately decreased plasma glucose levels 30mins after administration to rats which has normal glucose level. The total cholesterol, triglyceride, AST, ALT, urea and serum creatinine and blood glucose level was decreased by both ethanolic and methanolic extract of the plant.[18]

Anti-inflammatory and Analgesic Activity-Carrageenan induced rat paw edema was inhibited by the methanolic leaf extract of the plant. Furthermore, it also suppressed the writhing response in a dose-dependent manner induced by acetic acid and demonstrated the analgesic efficacy by improving tail-flick latency.[19,20] Ethanolic plant extract showed an analgesic effect by suppressing writhing response in albino mice.[21,22] *H. antidysenterica* treatment also prevented rupture of goblet cells, inflammatory cellular infiltration and inflammation in mucosal layer.[23]

Other important pharmacological activities are as follows

Antitubercular, hypotensive, antiprotozoal, hypoglycaemic, antispasmodic, antigiardiastic, antifungal, antiamoebicidal, antidiarrhoeal, anticancer, antispirochetal.

REFERENCES

1. Peterson CT, Denniston K, Chopra D. Therapeutic Uses of *Triphala* in Ayurvedic Medicine. J Altern Complement Med, 2017 Aug 1; 23(8): 607–614.
2. https://plants.usda.gov/home/plantProfile?symbol=HOAN3.

3. Sharma P.C. , Yelne M.B., Dennis T.J.; Database on Medicinal Plants Used in Ayurveda, vol. II, Central Council for Research in Ayurveda & Siddha, Department of Indian system of medicine, Govt. of India, New Delhi, 2001; 347-368.
4. Sharma PV, Namrupajnanam, Characterization of Medicinal Plants based on etymological derivation of names and synonyms, Chaukhambha Visvabharati, 60-62.
5. Dr. Chunekar K.C., Singh T.B., Glossary of Vegetable Drugs in Brihattrayi, Chaukhamba Amarabharati Prakashan, 1972.
6. Jamadagni PS, Pawar SD, Jamadagni SB, Chougule S, Gaidhani SN and Murthy SN. Review of Holarrhena Antidysenterica (L.) Wall. Ex A. DC. Pharmacognostic, Pharmacological, and Toxicological Perspective. Pharmacognosy Review, 2017; 11(22): 141–144.
7. Ganapathy PS, Ramachandra YL, Rai SP. In vitro antioxidant activity of Holarrhena antidysenterica Wall. Methanolic leaf extract. Journal of Basic and Clinical Pharmacy, 2011 Nov; 2(4): 175-178.
8. Sharma DK, Gupta VK, Kumar S, Joshi V, Mandal RSK, Prakash AGB, Singh M. Evaluation of antidiarrhoeal activity of ethanolic extract of Holarrhena antidysenterica seeds in rats. Veterinary World, 2015 Dec; 8(12): 1392-1395.
9. Dictionary of Indian Medicinal Plants, CIMAP, Lucknow, 1992.
10. Ali Shah SM, Khan Usmanghani, Naveed Akhtar, Asif HM, Akram M, Khalil Ahmed, Ghazala Shaheen, Tahira shamim, Riazur Rehman, Ashfaq Ahmad, Laila Sumreen. Monograph of Holarrhena antidysenterica (Linn.) Wall. International Journal of Phytomedicine, 2010; 2: 345-348.
11. Mohammed Rahmatullah, Baharul Islam, Arif Khan Md, Shoma JF, Taufiq Rahman. "Holarrhena antidysenterica (Linn.) Wall. (Apocynaceae) – A Plant for Gastrointestinal Disorders". EC Gastroenterology and Digestive System, 2018; 5.6: 437-443.
12. The Ayurvedic Pharmacopoeia of India. Ministry of health and family welfare, department of Indian system of medicine & homoeopathy, Govt. of India, New Delhi, 2001; I: 107-108.
13. Sharma P.C. , Yelne M.B., Dennis T.J.; Database on Medicinal Plants Used in Ayurveda, vol. II, Central Council for Research in Ayurveda & Siddha, Department of Indian system of medicine, Govt. of India, New Delhi, 2001; 347-368.
14. Sharma, P.V.; Dravyaguna Vijnana; Vol. 2. Chaukhamba Bharati Academy, Varanasi, India; 2015; 463-466.

15. Sharma P.C. , Yelne M.B., Dennis T.J.; Database on Medicinal Plants Used in Ayurveda, vol. II, Central Council for Research in Ayurveda & Siddha, Department of Indian system of medicine, Govt. of India, New Delhi, 2001; 347-368.
16. Kazi MA, Tushar KB, Suvra M, Bikash RB, Debidas G. Attenuation of diabetic disorders in experimentally induced diabetic rat by methanol extract of seed of Holarrhena antidysenterica. International Journal of Pharma Tech Research, 2010; 1: 1205-1211.
17. Pradeep Sahu, Anindh Sharma, Tanushree Chatterjee. Natural Products with Potent Hypoglycemic Activity. Research J. Pharm. and Tech, 2010; 3(3): 650-656.
18. Mana S, Singhal S, Sharma NK, Singh D. Hypoglycemic Effect of Holarrhena antidysenterica Seeds on Streptozotocin induced Diabetic Rats. International Journal of Pharma Tech Research, 2010; 2(2): 1325-1329.
19. Ganapathy PS, Ramachandra YL, Rai SP. In vitro antioxidant activity of Holarrhena antidysenterica Wall. Methanolic leaf extract. Journal of Basic and Clinical Pharmacy, 2011 Nov; 2(4): 175-178.
20. Pankaj Rakha, Manju Nagpal, Sunil Sharma, Milind Parle. Anti-Inflammatory Activity of Petroleum Ether Extract of Seeds of Ocimum Basilicum Linn. Research J. Pharm. and Tech, 2009; 2(3): 589-591.
21. Shwetha C, Latha KP, Asha K. Study on analgesic activity of Holarrhena antidysenterica leaves. International Journal of Herbal Medicine, 2014; 2(3): 14-16.
22. Manpreet Kaur, Harinder Kaur. Analgesic Activity of Roots of Aralia racemosa. Research J. Pharm. and Tech, 2011; 4(12): 1896-1897.
23. Umashanker KPD, Chandra S, Sharma J. Antidiabetic Efficacy of Ethanolic Extract of Holarrhena antidysenterica Seeds in Streptozotocin – Induced Diabetic Rats and Its influence on certain Biochemical Parameters. Journal of Drug Delivery and Therapeutics, 2012 Jun; 2(4): 159-162.