

A Comprehensive Review of *Ikshu* – *Saccharum officinarum* Linn.

Author: Abishek Bharadwaj B.U¹

Co Authors: Himani Rani², Prakash L.Hegde³ and Pradeep⁴

¹⁻⁴Department of Dravyaguna Vijnana, Sri Dharmasthala Manjunatheshwara College of Ayurveda and Hospital Hassan, Karnataka, India

ABSTRACT

Ikshu (*Saccharum officinarum* Linn.) is a very popular and widely grown crop. *Ikshu* is considered as one of the important *Dravyas* in *Ayurveda* which is used as both *Aushadha* and *Ahara*. A separate *varga* has been dedicated to *Ikshu* by *Acharya Bhavamishra* in his *Bhavaprakasha Nighantu*. *Ikshu* is used in its raw form as a juice and also its *vikaras* are used for its therapeutic values as a main drug or as an *Anupana* along with other drugs. *Ikshu* has *Madhura rasa* (Sweet taste), *Guru* (Heavy) *Snigdha* (Unctuous) *Guna*, *Sheeta* (Cold) *virya* and *Madhura* (Sweet) *Vipaka*. *Ikshu* is enriched with *karmas* like *Mutrala* (Diuretic), *Dahaprashamana* (Reduces burning sensation), *Vrishya* (Aphrodisiac) etc. *Ikshu* mainly is a *Pittahara* and acts on *Mutravahasrotas*. *Ikshu* is found to have many phytochemicals like Vitamin D, Phenolic compounds, Plant sterols and many more which are discovered in recent research studies. According to All India Co-ordinated Research Projects on Sugarcane [AICRP(S)] 116 varieties has been identified. Agricultural research has to be encouraged in order to develop more species with high therapeutically active principles.

Key Words *Ikshu*, *Mutrala*, *Vrishya*, *Anupana*, *Aushadha*

Received 05th February 22 Accepted 29th March 22 Published 10th May 2022

INTRODUCTION

Ikshu (Sugarcane) botanically identified as *Saccharum officinarum* Linn. belonging to the family of *Poaceae* is one of the most popular and widely cultivated crops.

Sugarcane juice is also a popular drink consumed worldwide and known by different names (table 1), like in English Sugarcane, *Hindi* - *Ganna*, *Kannada* - *Kabbu*, *Telugu* - *Chereku*, *Tamil* - *karumbu*, *Malayalam* - *Kariumbu*, *Bengali* - *Aak*, *Gujarati* - *Shiradi*, *Punjabi* - *Shakir*, *Burmese* -

Kyan, *French* - *Canamelle*, *German* - *Echtes zuckerrcha*¹.

Ikshu is known to mankind since time immemorial. *Ikshu* is given the prime importance in *Ayurveda* as a *Dravya* for its therapeutic and dietic potentials that a separate *Varga* has been dedicated for varieties of *Ikshu* and its *Vikaras* (by-products), by *Acharya Bhavamishra* and has described 13 varieties of *Ikshu*². In *Ayurveda*, it is well known for its *Mutrala* (diuretic), *Vrishya* (Aphrodisiac), *Trishnahara* (Quenches thirst), *Balya* (Strengthening) *karmas*³. *Ikshu* is also

REVIEW ARTICLE

exchanged among the people as a part of ritual during Indian festivals like *Makara Sankranti* in South India. Sugarcane crop occupies a very prominent share in the agricultural sector of India covering large areas in subtropical as well as tropical regions. Sugarcane is the prime source for the production of co-products like sugar,

jaggery, bagasse, molasses etc. According to AICRP(S) 116 varieties has been identified⁴. *Ikshu*, apart from its industrial utility, is also of high therapeutic value. *Ikshu* is also of high nutritive value with rich content of Phosphorus, Calcium, Iron, Magnesium, and Potassium¹.

Table 1 Synonyms of *Ikshu*

NAME	B.P.Ni	R.Ni	K.D.Ni	M.P Ni, A. Ni, D.Ni
<i>Deerghachada</i>	+	-	-	<i>Madhutrina</i>
<i>Bhurirasa</i>	+	-	+	<i>Gandiri</i>
<i>Gudamoola</i>	+	-	+	<i>Venu</i>
<i>Asipatra</i>	+	+	+	<i>Trinaraja</i>
<i>Madhutrana</i>	+	+	-	<i>Nisruta</i>
<i>Tula</i>	-	-	+	<i>Gudapatraka</i>
<i>Gandiri</i>	-	-	+	<i>Amritapuspaka</i>
<i>Gandaki</i>	-	-	+	<i>Hruswamoola</i>
<i>Venu</i>	-	-	+	<i>lohitekshu</i>
<i>Gudadaaru</i>	-	-	+	<i>Pundrika</i>
<i>Trinaraja</i>	-	-	+	<i>Rasala</i>
<i>Maharasa</i>	-	-	+	<i>Khadakapatraka</i>
<i>Kantara</i>	-	+	-	<i>Mriyupushpa</i>
<i>Vrushya</i>	-	+	-	<i>Naatiushna</i>
<i>Sukumaraka</i>	-	+	-	-
<i>Gudatrana</i>	-	+	-	-
<i>Karankekshu</i>	-	+	-	-

AIMS AND OBJECTIVES

To review, compile and analyse the literature regarding classical, phytochemical and agricultural references.

MATERIALS AND METHODS

A thorough review of literature on *Ikshu* has been done by reviewing *Brihatrayee*, *Nighantus* and other sources.

CLASSICAL CATEGORIZATION

Ch.Su - *Kanthya, Shramahara,*

Shukrashodhana, Vamanopaga,

Su.su - *Ikshuvarga*

A.H - *Ikshuvarga, Trinapanchamula*

A.Ni - *TrinadiVarga*

K.D.Ni- *AushadhiVarga*

D.Ni - *KaraveeradiVarga*

R.Ni - *PaniyadiVarga*

P.Ni - *DravaVarga*

SYSTEMIC CLASSIFICATION¹¹-

Kingdom - Plantae

REVIEW ARTICLE

Sub kingdom - Phanerogamia
Division - Angiospermia
Class - Monocortyledons
Subclass - Glumiferaet
Family - Poaceae
Genus - Saccharum
Species - Officinarum

HABITAT¹¹ -

Ikshu is cultivated in major parts of India, but mainly in Uttarpradesh, Maharastra, Tamilnadu and Karnataka.

MORPHOLOGY OF *Saccharum officinarum* Linn¹².

Stem - Jointed, 3-5 m tall, 2-3 cm thick, shild juicy, upto 6m, glabrous below the panicle more or less coated with wax below the nodes. The lower internodes short, swollen; sheaths greatly overlapping (fig 1).

Leaf- leaf sheaths tight, smooth, glabrous except when young, midrib very stout, rounded on the back more or less flat above. Leaf blades, elongate, mostly 4-6 cm wide with a very thick midrib (fig 2).

panicle pyramidal upto 1 m long, dense, silvery; primary branches verticillate or semi verticillate, very slender, glabrous or hairy.

Inflorescence- Racemes upto 10cm long, very fragile, joints and pedicels filiform. The joints variable in length. The pedicels much shorter. involucral glumes sub equal, lanceolate, firm towards the base. The lower acute, 2 nerved to sub 4- nerved. glabrous. Lower floral glume oblong, acute, or subacute, hyaline, nerveless ciliate about 3.3mm long upper floral glume - subacute, ciliate. Varieties of *Ikshu* are given in Table 2^{5,6,7,8,9,10}

Table 2 Varieties according to different Acharyas

B.P. Ni	R.Ni	K.D.Ni	D.Ni	M.P.Ni	A.Ni
<i>Pundarika</i>	<i>Shwetekshu</i>	<i>Ikshu</i>	<i>Ikshu</i>	<i>Ikshu</i>	<i>Ikshu</i>
<i>Bhiruka</i>	<i>Pundriekshu</i>	<i>Lohitekshu</i>	<i>Pundriekshu</i>	<i>Pundrika</i>	<i>Kandekshu</i>
<i>Vamshaka</i>	<i>Karanekshu</i>	<i>Paundrika</i>	<i>Kharakashali</i>	<i>Rasala</i>	<i>Tapasekshu</i>
<i>Shataporaka</i>	<i>Krishnekshu</i>	<i>Kharakashali</i>	<i>Ikshugandha</i>	<i>Sukumara</i>	<i>Shataparvi</i>
<i>Kantara</i>	<i>Raktekshu</i>	<i>Naipala</i>	-	<i>Krishnekshu</i>	<i>Kantarekshu</i>
<i>Tapasekshu</i>	-	<i>Vamshika</i>	-	<i>Bhiruka</i>	<i>Vamshakekshu</i>
<i>Kandekshu</i>	-	<i>Kantara</i>	-	-	-
<i>Suchipatraka</i>	-	-	-	-	-
<i>Naipala</i>	-	-	-	-	-
<i>Dirghapatra</i>	-	-	-	-	-
<i>Nilapora</i>	-	-	-	-	-
<i>Koshakrita</i>	-	-	-	-	-
<i>Manogupta</i>	-	-	-	-	-

PHYTOCONSTITUENTS¹³

Stem-Mainly contains sugar.

Leaves- 5-7-0 dimethyl-apigenin, 4-0-glycopyranoside

Flowers - 5-0-methyl apiganin and 3',4',5,7-tetrahydroxy-3-6-dimethoxyflavone. Also contains fibre, nitrogenous substance, fats, waxes, gums, pectins chlorophyll, saccharetin, gylcans, saccharans A, B, C, D, E and F. vicenin-

REVIEW ARTICLE

2, ferulic carbohydrate, hemicelluloses, starch, pectins, protiens, albuminoses, peptoses, carboxylic acid, inorganic salts, silica, amino acids, argenin, vitamins-thymine, riboflavin, niacin, pantothenic acid, biotin, phenols, hemicellulose and vitamin-D.

RASAPANCHAKA^{5,7,8,9,10}- *Rasapanchaka* is the collection of five parameters by which the

Pharmacokinetics and Pharmacodynamics of a given drug is estimated in Ayurveda. They are *Rasa* (Taste/Chemical attributes), *Guna* (Quality/Physical attributes), *Virya* (Potency/Exothermic or Endothermic reaction), *Vipaka* (End product of digestion) and *Prabhava* (Pharmacologically unexplained effect) (table no 3).

Table 3 Rasapanchaka according to different acharyas

Name	B.P.Ni	K.D. Ni	D. Ni	M.P.Ni	A.Ni
<i>Rasa</i>	<i>Madhura</i>	<i>Madhura</i>	<i>Madhura</i>	<i>Madhura</i>	<i>Madhura</i>
<i>Guna</i>	<i>Sheeta</i>	<i>Snigdha,</i> <i>Guru</i>	<i>Sara</i> <i>Guru</i> <i>Snigdha</i>	<i>Guru,</i> <i>Snigdha</i>	<i>Sara</i> <i>Guru</i> <i>Snigdha</i>
<i>Virya</i>	<i>Sheeta</i>	<i>Sheeta</i>	<i>Sheeta</i>	<i>Sheeta</i>	<i>Sheeta</i>
<i>Vipaka</i>	-	<i>Madhura</i>	-	-	<i>Madhura</i>
<i>Doshagnata</i>	<i>Vata-Kapha</i> <i>vardhaka</i>	<i>Vatanashaka</i> <i>Kaphakara</i>	<i>Kaphakara</i> <i>Vatahara</i>	<i>Vataghna</i> <i>pittaghna</i>	<i>Vataghna</i> <i>pittaghna</i>
<i>Karma</i>	<i>Mutrala</i> <i>Balya</i> <i>Kanthya</i> <i>Shramahara</i> <i>Shukrashodhaka</i>	<i>Ayukara</i> <i>Jeevaniya</i> <i>Sukrajanana</i> <i>Ojovardhaka</i> <i>Raktapittashamaka</i>	<i>Vrishya</i> <i>Krimikara</i>	<i>Mutrakara</i> <i>Kaphakara</i> <i>Krimikara</i>	<i>Brimhana</i> <i>Vrishya</i> <i>kaphamutrajit</i> <i>h</i>

RASA BASED ON PART^{5,6,7,8,10} -

Moola (Root) - *Atyanta Madhura*
(Excessively sweet)

Madyamabhaaga (Stem)- *Madhura* (Sweet)

Agrabhaga (Terminal part)- *Lavana* (Salty)

GUNA KARMA BASED ON TYPE OF JUICE^{5,7,8}-

- Juice extracted by chewing is *Pittaraktavikarahara* (cures diseases of *Pitta* and *Rakta* origin), *Virya* (potency), similar to *Sharkara* (sugar), *Avidahi* (doesn't cause burning sensation), and *Kaphaprada* (increases *Kaphadosha*).

- Juice extracted by machine –*Vidahi* (causes burning sensation), *Vishtambhajanaka* (causes constipation), *Guru* (heavy for digestion),

Amlarasa (sour) and *Dahakaraka* (causes burning sensation).

- Stored juice – *Ahitakara* (unconducive), *Amlarasayukta* (sour), *Vatanashaka* (pacifies *Vata*), *Guru* (heavy for digestion), *Kaphapittakaraka* (aggravates *Kapha* and *Pitta dosha*), *Shosharogakara* (causes emaciation), *Malabhedaka* (cathartic) and *Atyantamutrajana* (diuretic).

- PakvaRasa* (cooked juice)- *Guru* (heavy for digestion), *Singdha* (unctuous), *Atyantatikshna* (intense), *Kaphavatanashaka* (alleviates *Kapha* and *Vata dosha*), *KinchitPittakara* (increases *pitta*), *Gulmahara* (cures tumour) and *Anahahara* (reduces abdominal distention).

REVIEW ARTICLE

GUNAKARMA WITH RESPECT TO TIME OF INTAKE⁶ -

When *Ikshu Rasa* is consumed before food, it will act as *Pittahara* (Alleviate *Pittadosha*) and when consumed after food it increases *Vata*. If *Ikshu rasa* is consumed with food, it will become *Durjara* (Hard to digest). PRAYOGA⁻¹⁴,

Prayoga is the application or usage of the given *Dravya*. Therapeutic utility of *Ikshu* in various conditions has been mentioned in the classics of Ayurveda by different Acharyas. *Ikshu* is used extensively in Ayurveda as a dietary drink as well as therapeutic agent. It is used as single drug or in combination with other *Dravyas* some of the *Prayogas* are selected and discussed are as follows

Fresh *Ikshu Rasa* with *Madhudaka* (honey water) taken internally as *Pathya* (diet) helps in relieving *Raktapitta* and when *Ikshu rasa* alone given as *Nasya* (nasal medication) it cures *Trishna* (thirst) and *Urdhvaraktapitta* (bleeding from upper orifices). *Ikshu asava* taken internally cures *Grahani* (Irritable bowel syndrome). If *Ikshu rasa* given as *Kavala* (gargling) is useful in *Mukhavairasya* (bad taste in mouth) and *Atikarsya* (emaciation). when *Ikshu rasa* taken with *Haritaki* (*Terminalia chebula*) and *Ghrita* (ghee) it acts as *Gulmaghna* (anti-tumour). *Acharya Sushruta* has mentioned various preparations of *Ikshu* which he has used to treat various ailments; some of them are *Mantha* prepared out of *Amalaki* and *Ikshu rasa* is advised to take internally in case of *Pandu* (anemia). *Shweta Ikshu* peeled and cut into small

pieces is put into cold water filled in a mud pot which is subjected to moon light, The next day it is filtered, mixed with *utpalachurna*, *masha*, honey than taken internally relieves *Raktapitta* (bleeding disorder). 4 *Prastha* (2160ml) of *Ikshu* mixed with 1 *Prastha* (540ml) of *Ghrita* (ghee) is cooked, added 6 *Masha* (5.8gms) to 1 *Tola* (11.6grms) of milk then added water, taken internally cures *Vataja*, *Pittaja* and *Kaphajakasa*.

RECENT RESEARCH ADVANCES -

This study aimed to investigate if *Saccharum officinarum* L. Juice had protective effect in acute liver toxicity with paracetamol.¹⁵

Results: Experimental findings revealed that the fresh juice at dose level of 20 ml/kg b.w. showed dose dependant hepatoprotective effect against PCM induced hepatotoxicity by significantly restoring the levels of serum enzymes to normal that was comparable to that of Clofibrate, but the fresh juice at dose level of 20 ml/kg was found to be potency when compared to that of 50 mg/kg standard. Besides, the result of the histopathological studies also supports the study.

Anti-inflammatory Activity of *Saccharum Officinarum* Linn (Poaceae) Juice in Animal Models¹⁶

This study was carried out to explore the anti-inflammatory effects of the juice of *Saccharum officinarum* in doses of 2.5, 5.0, 10.0 and 20.0 mL/kg using the following models in rats - carrageenan, histamine, serotonin, formalin-induced paw oedema, and cotton-pellet granuloma. Oral administration of SOC juice significantly ($p < 0.001$) reduced the right hind

REVIEW ARTICLE

paw circumference induced by carrageen- an, histamine, serotonin and formalin compared to control group. Furthermore, it inhibited xylene-induced ear oedema with peak effect at 20 mL/kg, as well as castor oil-induced diarrhea and cotton pellet granuloma with peak effect at 10 mL/kg. The **anti**-inflammatory activities of SOC were significant ($p < 0.05$) when compared with aspirin, cyproheptadine and dexamethasone. The study revealed the potent anti-inflammatory activities of the juice of *S. officinarum*.

NUTRITIONAL VALUE OF *Saccharum officinarum* Linn-(Per serving 28.35gm)¹⁷

Energy- 111.13KJ (26.56 K Cal)

Carbohydrates- 27.51 gm

Protein - 0.27 gm

Calcium - 11.23 mg(1%)

Iron - 0.37 mg (3%)

Potassium - 41.96 mg (1%)

Sodium - 17.01 mg (1%)

AGRICULTURE⁴ - Sugarcane is one of the important commercial crop of tropical and subtropical regions. Production of sugarcane depends on variety of factors and adoption of new promising genotypes. Since inception of AICRP(S), 116 sugarcane varieties have been identified out of which 55 varieties have been released and notified for cultivation in India.

Few sugarcane varieties have been widely adopted and occupied larger share in sugarcane area viz., Co 86032 (70%) in peninsular zone, Co 0238 (55%) in north western and north central zones, CoLk, 94184 (28.25%) in north central

zone, CoM 0265 (18%) in Karnataka and CoOr 03151 (18%) in Odisha state.

DISCUSSION

Ikshu with its properties is a very good dietary and therapeutically useful drug. It is widely consumed in India during *Sankranti* festival which is celebrated during the *Shishiraritu* (Jan-Feb) and this helps to balance *Vata* aggravation by virtue of its *Madhura rasa* (Sweet) and *Guru* (heavy), *Snigdha* (unctuous) *guna*. *Ikshu* is one among the *Trinapanchamoolas* and acts best in Urinary tract infections, mainly of *Pitta* origin due to its *Sheetavirya* (cold potency), *Madhura rasa* (sweet) and *Mutrala* (diuretic) *karma*. It is considered best in liver disorders and hence given as *Anupana* (vehicle) with other drugs like *Aragwadha* (*Cassia fistula*) in *kamala* (Jaundice). *Ikshu* is indicated in *Raktapitta* (bleeding disorder) as *Nasya* (Nasal medication) and for internal consumption which acts by its *Madhura rasa* and *Sheetavirya*. By the phytochemical study various phytochemicals including phenolic compounds, plant sterols and policosanols have been discovered. Ethanolic extract of fresh leaves administered intra-gastrically, showed diuretic activity the ethanolic leaf extracts were active against benzalperoxide induced writhing and tail flick response, hence proven to have analgesic activity. Ayurveda and agricultural science has to go hand in hand in order to progress and provide more potent and suitable drugs to produce better formulations. *Vaidyas* and agriculturists has to work together to find out more therapeutically

REVIEW ARTICLE

useful species by which sugarcane market also gets a leap with demand from Ayurvedic pharma companies.

CONCLUSION

- Ikshu, with its rich nutritional and therapeutic values, and easy availability, can be used as a dietary agent, as Anupana with other medications, and also as a single drug therapy in various diseases in day-to-day practice.
- Ikshu is inexpensive and thus affordable to patients of all socio-economic groups. when used as Anupana (vehicle) it increases the palatability of the given Yoga.
- Agricultural research has to be encouraged in order to develop more species with high therapeutically active principles.

-

ABBREVIATIONS

AICRP(S) - All India Co-ordinated Research Projects on Sugarcane.

B.P.Ni - Bhavaprakasha Nighantu.

R.Ni - Raja Nighantu.

K.D.Ni - Kaiyadeva Nighantu.

M.P Ni - Madanapala Nighantu.

A. Ni - Nighantu Adarsha.

D.Ni - Dhanvantari Nighantu.

REVIEW ARTICLE

REFERENCES

1. <https://www.easyayurveda.com/2010/12/01/sugar-cane-juice-benefits/>.
2. Bhavaprakasha of Bhavamishra, by Chunekar K. C, Pandey G, Edited with Bhavaprakasha Nighantu (Indian materia medica), Chaukhamba Bharati Academy, Gopal Mandir Lane, Varanasi-221001. 2018. Ikshuvarga, shloka no. 3-4, p-776.
3. Hegde P L, Harini A, A text book of Dravyagunavijnana. Vol 3, Chapter 43, p-236.
4. Shukla S K, Zubair. A, Awasthi. S. K, Pathak. A D, Sugarcane varieties identified by AICRP(S) in India, ICAR All India co-ordinated Research Project on Sugarcane, IISR Lacknow, 2018. p-7.
5. Bhavaprakasha of Bhavamishra, by Chunekar K. C, Pandey G, Edited with Bhavaprakasha Nighantu (Indian materia medica), Chaukhamba Bharati Academy, Gopal Mandir Lane, Varanasi-221001. 2018. Ikshuvarga, shloka no.1-20. p-776-780.
6. Raj nighantu of Sri Narhari pandit, by Sankhyadhar S C, Sankhyadhar D, with english translation and critical commentary, Chaukhamba Orientalia, Varanasi, edition 1, 2012, Chapter 14, shloka no. 81-107. P-805-810.
7. Kaiyadeva Nighantu of Pandith Kaiyadeva, by Sharma P V, Sharma G S, with Hindi commentary Pathyapathyavibhodakaha, Chaukhamba Orientalia, Varanasi, 2009; Oshadivarga, Shloka no. 137-142. P- 29.
8. Madanapalanighantu of Nrupamadanapala, KhemarajSrikrishnadasPrakashan Bombay.1990.
9. Nighnatu Adarsha of Bapalal G Vaidya, Chaukhamba Bharathi academy, Varanasi. 1985; Thrunadivarga; p-725-726.
10. Dr.Kamat.S.D.Studies on Medicinal Plants & Drugs in Dhanvantari-nighantu, Chaukhambasanskrit Pratishthan. 38U.A. Bungalow road, Jawahar Nagar, Delhi-110007:2002. Chapter 4 Karaveeradivarga, shloka no. 117-121; p-357-358.
11. Hegde P L, Harini A, A text book of Dravyagunavijnana. Vol 3, Chaukhamba publications New Delhi, 2020, Chapter 43, p-234.
12. Kirtikar K R, Basu B D. Indian Medicinal Plants, vol-4, International book distributors Dehradun, 1987; edition 2, p-2662.
13. Sharma P. C, Yelne M. B, Dennis T. J. Database on medicinal plants used in Ayurveda vol 4, Documentation and publication division central council for research in Ayurveda and siddha, New Delhi. 2002; p-189
14. Sharma P V, Classical uses of medicinal plants, Chaukhambhaviswabharati, Varanasi, 1996; 37th Chapter, p-53-54.
15. Singh R, Shukla R. Protective effect of Saccharum officinarum Linn juice in paracetamol induced acute hepatotoxicity in albina rats. Asian J. pharm. Res. 2021;11(1):17-22.
16. Agbaje Esther Oluwatoin, Ayinla Adebola Christina, **UjomoTejumade. Anti-inflammatory activity of saccharum officinarum

REVIEW ARTICLE

Linn (poaceae) juice in animal models, Research journal of pharmacology and pharmacy, 2019;3:7
17. WH Foods. 2011. Cane juice nutrition information.