

## SUGARCANE IN THERAPEUTICS

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**Abstract:** *Sugarcane (Saccharum spp.) is generally popular as a major cash crop, from the view point of yielding white sugar. For the natives and traditional healers of the world, sugarcane (Ganna) is a valuable medicinal herb finding a significant place in alternative healing methods. In India, Ayurveda and Unani systems of medicine recognize the invaluable medicinal properties of sugarcane and its derivatives. According to Ayurveda, it is oleaginous, diuretic, tonic, cooling, aphrodisiac and useful in fatigue, thirst, anaemia, ulcers etc., while according to the Unani system it is a laxative, diuretic, aphrodisiac and good for lungs. The sugarcane plant in its entirety is known to possess great therapeutic utility, the details of which are furnished in this paper. The recent researches on the by-products of sugarcane in medicine / therapeutics are highlighted.*

Key words: sugarcane, curative properties, traditional medicine,

### INTRODUCTION

The Science of Ethnobotany which is broadly defined as the study of the multiple roles of plants in a society – the dynamic inter-relationships between humans and plants. Since prehistoric times, in all ages, in all civilizations and in all quadrants of the globe, plants have been proven to have or have been thought to have medicinal properties. There are more than one thousand four hundred plants including trees, shrubs, and groundcovers in the plant kingdom that are considered to be medicinal plants. In the Linneal binomial system of plant taxonomy, more than sixty diverse group of plants have been given the species name *officinalis*, *officinale* or *officinarum*. *Officinalis*, *officinale*, *officinarum*, all adjectives, are the same word with different endings and they all mean used in medicine. The word ending changes because in Latin the adjective modifying the noun must agree with the noun in gender, case and number. All three forms, *officinalis*, *officinale*, and *officinarum* are in the genitive case. If the noun is singular and the gender is either masculine or feminine, the modifying adjective is *officinalis*. If the noun is

neuter, the modifying adjective is *officinale*. If the noun is feminine and plural and belongs to the first declension, the modifying adjective is *officinarum*. *Medicinalis* is an adjective. In botanical Latin, it means currently used in medicine in the sense of used in the practice of medicine. Table 1 shows a list of these medicinal plants and the linked names can be found in the medicinal herb garden, *Hortus Medicus*.

### SUGARCANE IN TRADITIONAL MEDICINE

Sugarcane (*Saccharum officinarum*, the Noble cane, and other *Saccharum* spp.) is an easy-to-grow plant that produces high yields of valuable products. *S. Officinarum* is known as *Ganna* while

*S. spontaneum* is known as *Kans*, *Kansi*, *Kas* in Hindi. Both these types of sugarcane plants are considered as valuable medicinal herbs in the traditional systems of medicine viz., ayurveda and unani in India. For the native and traditional healers of Chattisgarh, *Ganna* is sweet, oleaginous, diuretic, tonic, cooling, aphrodisiac and useful in fatigue, thirst,

leprosy, intestinal trouble, anaemia, erysipelas, inflammations, ulcers etc. According to Unani system of medicine, *Ganna* is sweet, laxative, diuretic, fattening, aphrodisiac and good for lungs. It is considered beneficial to liver and the patients having Jaundice are advised by the healers to consume large quantities of *Ganna* juice. The juice is also used in the treatment of Renal Calculi (Pathri) very frequently, since its consumption helps in flushing out the Pathri efficiently in very short time. In general, healers suggest the patients to use and extract the juice, with the help of mouth directly. The juice extracted with the help of machine is not preferred. According to the healers, the sucked juice is coolest in nature, machine extracted is relatively hotter whereas stored juice (changes black in colour) is hottest in nature, relatively. The farmers are aware about the styptic properties of *Ganna* and in case of injuries during field work, they never miss the chance to utilize this traditional knowledge. The traditional healers of Chhattisgarh, suggest the patients having skin troubles to take more and more *Ganna*. It is considered as a promising blood purifier.

*Saccharum spontaneum*, a wild relative of Sugarcane, is a common rainy season weed. The roots of this weed are collected to prepare oil useful for alleviating joint pains common in old age. With the help of fresh roots, dried ginger and sesamum oil, a special oil is prepared and used externally. For paddy farmers, who spend many hours in water logged fields, this oil is reported to be of help in the treatment of skin problems on the feet resulting due to constant contact with moisture.

### **SUGARCANE IN FOLK MEDICINE**

Not only in India but in several parts of the world such as Hawaii, China etc., the use of sugarcane in folk medicine is well documented. It is reported to be an antidote, antiseptic, antivinous, bactericide, cardiogenic, demulcent, diuretic, intoxicant, laxative, pectoral, piscicide, refrigerant and stomachic.

It is a folk remedy for arthritis, bedsores, boils, cancer, colds, cough, diarrhea, dysentery, eyes, fever, hiccups, inflammation, laryngitis, opacity, skin, sores, sore throat, spleen, tumors, and wounds [1]. Powdered sugar is used as a 'drawing' agent for granulations and 'proud flesh' [2] and in a 1:3 solution in water, for gonorrhoea and vaginal discharges [3]. The pulped

sugarcane is used to dress wounds, and the cane for splints for broken bones; the Malay women use it in childbirth. A decoction of the root of the race of '*tebu lanjong*' is used for whooping cough. It is used in elephant medicine; the juice is used to 'make an elephant sagacious', and in a poultice for sprains [4]. In India, the plant as well as its juices are used for abdominal tumors and several other pathogenic conditions.

### **MEDICINE AND CURATIVE PROPERTIES OF SUGARCANE JUICE**

Sugarcane juice is great for recharging energy because it contains rich carbohydrate and iron. The Tropical sugarcane is sweet and the juiciest. Being a nutritious product containing natural sugars, minerals and organic acids, sugarcane juice has many medicinal properties. It strengthens the stomach, kidneys, heart, eyes, brain and sex organs. The juice is beneficial in fevers. In febrile disorders which cause fever, where there is a great protein loss, liberal intake of sugarcane juice supplies the body with necessary protein and other food elements. Sugarcane is very useful in scanty urination. It keeps the urinary flow clear and helps the kidneys to perform their functions properly.

It is also valuable in burning micturation due to high acidity, gonorrhoea, enlarged prostate, cystitis and nephritis. For better results, it should be mixed with lime juice, ginger juice and coconut water. Mixed with lime juice, it can hasten recovery from jaundice. It is, however, very essential that the juice, must be clean, preferably prepared at home. Resistance is low in hepatitis and any infected beverage could make matters worse. The juice sucked from the sugarcane can prove highly valuable in case of weak teeth due to lack of proper exercise resulting from excessive use of soft foods.

It gives a form of exercise to the teeth and makes them strong. It also keeps the teeth clean and increases their life. Sugarcane juice is a fattening food. It is thus an effective remedy for thinness. Rapid gain in weight can be achieved by its regular use. The dew which collects on the long leaves of sugarcane is useful in several eye disorders. When instilled in the eyes, it is an effective medicine in defective vision, cataract, conjunctivitis, burning of the eyes and eye-strain after excessive reading.

## SUGARCANE JUICE DERIVATIVES IN MEDICINE

White sugar and jaggery are the two well known derivatives of sugarcane juice. Manufacture of sugar from cane juice employs a potpourri of chemicals as sulphur dioxide, lime, phosphoric acid, bleaching agents & viscosity reducers. This white sugar which does not possess therapeutical uses is largely employed as a sweetening agent in bitter medicines.

Jaggery is processed the natural way and no chemicals are added at any stage of its processing. Jaggery is often called the 'medicinal sugar and very useful in health problems like – Dry cough, Cough with Sputum, Indigestion, Constipation etc., Ancient medical scriptures dating back to 2500 years state how it purifies the blood, prevents rheumatic afflictions and disorders of bile and possesses nutritive properties of high order (Sushruta samhita, Chapter 45, sloka 146). The preventive action of jaggery on smoke-induced lung lesions suggest the potential of jaggery as protective agent for workers in dusty and smoky environments - paper presented by scientists of Industrial Toxicology Research Centre at the Workshop held in Lyon, France [5]. According to an experiment, Turbinade Sugar treated rats showed enhanced translocation of coal particles from lungs to tracheobronchial lymph nodes.

### Health facts of jaggery

Jaggery (Panela) contains proteins, minerals and vitamins, which are essential constituents for the body. It is also a potent source of Iron and has a higher Iron and Copper contents than white sugar.

It is also a superior product among natural sweeteners with regards to the vitamin contents. It is an energy food that is said to 'purify' blood, regulate the liver function and keep the body healthy.

### Nutrition facts of jaggery

Calories 19 Cal/tbsp; Vitamin B complex ñ 1g/kg; folic acid ñ 1mg / kg; Iron ñ 1mg / g; Calcium ñ 5g / 100g

### Importance of Folic acid

Folic acid is active in the most basic life process that we know, the synthesis of the building blocks of life, DNA. People found to have various types of precancerous cells have also been found folic acid deficient. Other symptoms of too little folic acid are

slowed metabolism, constipation, and tiredness at inappropriate times of the day.

## RECENT STRIDES IN SUGARCANE THERAPEUTICAL RESEARCH

### RESEARCH IN CUBA

The cane sugar industry is analogous to an oil refinery, a biorefinery that can produce many

value-added products from sugarcane, such as glycerol, bioethanol, inositol, carbon dioxide, succinic acid, aconitic acid and an animal feed ingredient under pressure because of global competition to diversity into value-added products. Glycerol has numerous applications, such as toothpastes, shampoos, skin care products, polyurethane, cellophane and pharmaceuticals. Inositol is used in baby formula and specially animal feeds for salmon and shrimp. Succinic acid is used in photographic and pharmaceutical applications. Aconitic acid is used in rubber and paints. The recent researchers in Cuba, the sugar bowl of the world pertaining to utilizing sugarcane for therapeutical use is reproduced below:

Cuba is stepping up efforts to make use of sugarcane derivatives for such things as medications and plastics at a time when the island's sugar industry is undergoing restructuring due to the low sugar prices on the international market. Cuban scientists are saying that sugarcane is a raw material with as much potential as petroleum. The conversion policy for this sector, launched two years ago, includes a push for utilization of sugarcane derivatives in the food, chemical, pharmaceutical and biotechnology industries.

Local experts are unanimous in touting 'alternative' uses for sugarcane (*Saccharum officinarum*): to make sweets and alcohol, medicines, animal feed, resins, preservatives, plastics and manufactured products like paper or furniture. "Currently, in the production and commercialization (of sugar) it is not essential to head towards broad diversification", Luis Galvez, director of the Havana-based ICIDCA, the Cuban sugarcane research institute, told Tierramerica. Founded more than 40 years ago, ICIDCA is at the forefront of Cuban technological endeavours to take full advantage of this crop, one that is deeply rooted in the island's history and culture. ICIDCA research covers agriculture, animal feed and human food as

well as environmental, biotech and pharmacological studies. Among the novelties in the pharmaceutical line are extracts of cane wax and organic acids. "In sugarcane derivatives there is ongoing potential in the technological knowledge achieved by Cuba", said Galvez, adding that through chemical and biotechnology, sugarcane can generate as wide a variety of products as petrochemicals produce. Of the surprising variety of sugarcane derivatives, the product that achieved perhaps the greatest international popularity in the late 20<sup>th</sup> century was policosanol, or PPG, discovered and developed in Cuban laboratories. PPG is applauded as a regulator of the metabolism for fats, including cholesterol, and as a food supplement for people in situations of great physical exertion. This "natural" medication does not have harmful side effects and is believed even to enhance sexual function. The product (Lesstanol ®, Policosanol 60) has customers in Europe and Australia, among other points of the globe, and is sought by many of the tourists visiting this socialist-run island (<http://www.ncbi.nlm.nih.gov/entrez/query.fcgi>). This is derived solely from pure sugarcane wax the only source of fatty alcohols having a typical profile as follows: 1-Octocosanol 55-70%; 1-triacontanol 5-20%; 1-hexacosanol 2-15%; 1-heptacosanol 0-0.5%. In pilot human clinical trials conducted at the University of California, San Diego, PPG has demonstrated a 23% reduction of LSL cholesterol and a 14% increase in HDL cholesterol over an eight week period, thus indicating its valuable role in cardiovascular health.

The Dalmer labs of Havana, where PPG is produced, have spent years searching for other natural derivatives of Cuban plants, and of sugarcane in particular. Just a few weeks ago, Cuban experts announced a new family of antibiotics for treating animals. These drugs were produced from sugarcane by the Chemical Bioactives Centre at the Central University of Las Villas, in Santa Clara, 300 km east of the capital. The research centre uses furfural, from sugarcane waste, to produce what is known as G-1, a strong adversary against bacteria and fungus that were resistant to previously known antibiotics. The product is used as a veterinary drug to treat diseases in nine animal species, according to the experts. The centre has developed new active drug ingredients from furfural for use in agricultural biotech and in human and animal medicine.

Also in Cuba, scientists have utilized sugarcane pulp to produce anti-diarrhoea drugs Ligmed-A and Ligmed-H, for animals and humans, respectively. The first has a powerful anti-microbe effect and a great capacity to absorb toxins and pathogenic microorganisms in the digestive tract of pigs. Its use for livestock is made simple by the fact that it does not have a strong taste or smell, nor does it have adverse side effects. Ligmed-H has been used successfully in hospitals for digestive illnesses, and even as a palliative for symptoms of colon cancer. For decades, Cuba invested heavily in infrastructure and research for a sector that focused mostly on sugar production. The aim now is to take greatest advantage of that investment, say officials. Among the projects underway is the creation of the Development Centre for Industrial Fermentation and Nutrition, which will have three pilot plants for semi-commercial production of biotech derivatives of sugarcane. The Centre has the financial support of the United Nations Development Programme and implementation support from the

U.N. Programme and implementation support from the U.N. Industrial Development Organization (Patricia Grogg, 2004)

## **RESEARCH IN TEXAS**

Scientifically produced proteins, called recombinant proteins, are poised to be the medical magic bullets of tomorrow, with the potential to successfully treat hundreds of human diseases and ailments. Recombinant proteins are already used extensively in the food and paper processing industries. Millions of diabetics use a life saving protein, insulin, every day. And more than 300 therapeutic proteins are in various stages of clinical trials for approval to treat ailments ranging from cancer to cystic fibrosis one day. But among the many challenges, is developing methods of producing recombinant proteins that are less expensive and safer than those available today. Recombinant proteins are produced by splicing a gene, or combination of genes, into an organism to induce that organism to produce the desired proteins.

WESLACO, Texas – Texas A&M University System has signed a license agreement with ProCANE LLC, a subsidiary of ECOR Corp. of Sedona, Ariz., to produce pharmaceutical-grade proteins in sugarcane plants (Rod Santa Ana III and Jay Cockrell, 2003).



**Table 1: List of medicinal plants ending with *Officinalis*, *officinale*, *officinarum***

<i>Alpinia officinarum</i> Galangal	<i>Althaea officinalis</i> Marsh mallow	<i>Anchusa officinalis</i> Alkanet	<i>Archangelica officinalis</i> Garden Angelica
<i>Aricennia officinalis</i> Indian Mangrove	<i>Asparagus officinalis</i> Asparagus	<i>Borago officinalis</i> Borage	<i>Calendula officinalis</i> Pot Marigold
<i>Ceterach officinarum</i> Rustyback Fern	<i>Cinchona officinalis</i> Cinchona	<i>Cochlearia officinale</i> Scurvy Grass	<i>Copaifera officinalis</i> Copaiba
<i>Cornus officinalis</i> Shan Zhu Yu	<i>Cynoglossum officinale</i> Hound's Tongue	<i>Emblica officinalis</i> Indian Gooseberry	<i>Euphrasia officinalis</i> Eyebright
<i>Euphorbia officinarum</i> Spurge	<i>Fumaria officinalis</i> Fumitory	<i>Galega officinalis</i> Goat's Rue	<i>Galipea officinalis</i> Angostura
<i>Guaiacum officinale</i> Lignum Vitae	<i>Hyssopus officinalis</i> Hyssop	<i>Jasminum officinale</i> Common Jasmine	<i>Lavendula officinalis</i> Lavender
<i>Levisticum officinale</i> Lovage	<i>Lithospermum officinale</i> Gromwell	<i>Magnolia officinalis</i> Magnolia	<i>Mandragora officinalis</i> Arum Mandrake
<i>Melissa officinalis</i> Lemon Balm	<i>Melilotus officinalis</i> Melilot sweet clover	<i>Morinda officinalis</i> Ba Ji Tan	<i>Nasturtium officinale</i> Watercress
<i>Paeonia officinalis</i> 'Mollis'	<i>Paeonia officinalis</i> 'Alba Plena'	<i>Paeonia officinalis</i> 'Rosea Plena'	<i>Paeonia officinalis</i> 'Rubra Plena' Peony BAI SHAO YAO (Chinese)
<i>Pilosella officinarum</i> Mouse-ear Hawkweed	<i>Pimenta officinalis</i> Allspice	<i>Polyporus officinalis</i> White Agaric	<i>Pulmonaria officinalis</i> Lungwort
<i>Rosa gallica officinalis</i> Apothecary Rose	<i>Rosmarinus officinalis</i> Rosemary	<i>Saccharum officinarum</i> Sugarcane	<i>Salvia Officinalis</i> 'Aurea', 'Icterina', 'Tricolor' Sage
<i>Sanguisorbia officinalis</i> Greater Burnet	<i>Saponaria officinalis</i> Soapwort	<i>Sassafras officinale</i> Sassafras	<i>Schoenocaulon officinale</i> Cevadilla
<i>Sisymbrium officinale</i> Hedge Mustard	<i>Smilax officinalis</i> Sarsaparilla	<i>Stachys officinalis</i> Betony	<i>Styrax officinale</i> Snow Bush
<i>Symphytum officinale</i> Comfrey	<i>Taraxacum officinale</i> Dandelion	<i>Valeriana officinalis</i> Garden Heliotrope	<i>Verbena officinalis</i> Vervaine
<i>Veronica officinalis</i> Speedwell	<i>Zingiber officinale</i> Ginger	<i>Alkekengi officinale</i> Cape Gooseberry	<i>Foeniculum</i> <i>capillaceum/officinale</i> Common Garden Fennel
<i>Marjorana officinale</i> Sweat Marjoram	<i>Peucedanum officinale</i> Hog's Fennel	<i>Rhubarb officinale</i> English Rhubarb	<i>Vincetoxicum officinale</i> Pecacuanha

Switching from animals to plants as the protein factors has been the focus of Mirkov's research for years, his research being supported to a great extent by the

Lower Rio Grande Valley Sugar Growers, Inc. To produce the proteins in sugarcane, the genes are introduced at the cellular level to sugarcane callus,

thereby transforming the transgenic cane to produce both sugar and the high-value proteins in the cane's stems. Mirkov and others at the Weslaco Centre have been working for several years on producing recombinant proteins in sugarcane which thrives commercially in deep South Texas, Louisiana, Florida and Hawaii.

Mirkov's research showed that producing and recovering proteins from sugarcane are scientifically and economically feasible. He has developed a transgenic sugarcane plant that besides producing sweeteners, also produces snowdrop lectin, a potent insecticidal protein found in the snowdrop lily. Mirkov and Texas A&M currently have seven patents, either issued or pending, for the process he developed to use sugarcane as a bio-factory for recombinant proteins.

#### **RESEARCH IN AUSTRALIA**

Australian research workers, Prof. David Leach and Michael O'Shea are currently pursuing work on Bioactive molecular discovery of medicinal natural products from sugarcane. They envisage obtaining information on sugar industry by-products for commercially interesting bioactive flavonoids, and to investigate the potential for developing these flavonoids for nutraceutical and pharmaceutical companies.

The major requirements of commercial production of pharmaceuticals by Biotechnology are two viz., the large amount of crop required to produce the compound in sufficient quantity and ensuring that the plants do not cross pollinate with other plants and transfer the new gene to other species. One way to ensure that this does not occur is by creating sterile male plants. With respect to sugarcane since it is a crop that produces a very large biomass and also can be grown as a sterile crop, it offers tremendous scope and promise in the pharmaceutical industry.

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