

**RASA SINDURA YOGA: A PANACEA FOR URINARY TRACT INFECTIONS.****Sanchit Joshi¹, Shuchi Mitra², Usha Sharma³, Khem Chand Sharma⁴.**

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**ABSTRACT**

Urinary tract infection is one of the most common bacterial infections, with about 150 million people diagnosed yearly. *E. coli* is the primary causative organism, followed by *Staphylococcus saprophyticus*, *Klebsiella*, *Proteus mirabilis* & *Enterococci*. Dysuria, burning micturition, increased frequency, urgency and urinary incontinence are significant symptoms of UTI with the treatment centers around Antibiotics. The symptoms of UTI closely resemble the symptoms of *Mutrakricchhra*, so these can be correlated. With Antimicrobial resistance on the rise nowadays, the need for safer alternatives is the need of the hour. In *Rasa Tarangini*, a formulation of *Rasa Sindura* with equal parts of *Shilajit*, *Elaichi*, and *Sitopala* has been mentioned, called *Rasa Sindura Yoga*. Since it is a Herbo-mineral preparation, it is required in lesser doses, can work at the cellular level, and exhibits higher efficacy. The drugs in this formulation are proven to have antimicrobial, anti-inflammatory, antioxidant, and Anti-analgesic properties, which can help alleviate the symptoms of UTI. The present study aims to critically review the individual drugs' formulation and probable mode of action in UTI.

Keywords: *Rasa Sindura*, UTI, *Shilajit*, *Ela*.

INTRODUCTION

Every year, about 150 million people are diagnosed with Urinary Tract Infections (UTIs) worldwide.¹ UTI is one of the most common bacterial infections, and it can be described as an inflammatory response of urothelium to bacterial invasion.² It is caused by bacteria from the digestive tract, which can ascend to the urethral opening and cause infection. *E. coli* is responsible for more than 80% of UTI infections³, followed by *Staphylococcus saprophyticus*, *Klebsiella*, *Enterobacter*, *Proteus mirabilis* and *Enterococci*. Antibiotics are the standard treatment for UTIs, with Amoxicillin, Doxycycline, Ciprofloxacin, Ceftriaxone, and Nitrofurantoin being some of the most commonly used drugs. In India, antibiotics are frequently misused, which might cause bacterial strains to become resistant.

Mutrakricchra is a broad term that covers the conditions described in modern medical science as Urinary Tract Infections. It can be defined as *Shoola (Ruja) Yukta Daha Pradhana Pakwashaya Sammutha Samanya Vyadhi* affecting the Urinary System. The

symptoms of UTI, viz., increased frequency, urgency, burning micturition, dysuria, and urinary incontinence, resemble those described for *Mutrakricchra*. Since Antibiotic resistance is on the rise today and is recognised by WHO as one of the ten major global public health threats, safer and more effective treatments for infectious illnesses in humans to limit the emergence of antibiotic-resistant microbes are the need of the hour.⁴

In the classical text *Rasa Tarangini*, a formulation, *Rasa Sindura Yoga*, is mentioned. It consists of equal parts of *Rasa Sindura*, *Shilajit*, *Ela*, and *Sitopala*. The ingredients of this formulation exhibit antimicrobial, anti-inflammatory, antioxidant, and analgesic properties, which can be useful for managing UTIs.

DRUG REVIEW:

The *Rasa Sindura Yoga* mentioned in the classical text *Rasa Tarangini*, as in the *Amayika Prayoga* of *Rasa Sindura* for *Mutrakricchra*, is to be consumed with *Sheeta Dhugdha* as the *Anupana*.⁵

Table no.1: Ingredients of Rasa Sindura Yoga

S. No.	Drug Name	Scientific Name	Part
1.	<i>Rasa Sindura</i>	Mercury Sulphide	1
2.	<i>Shilajatu</i>	<i>Asphaltum panjabinum</i>	1
3.	<i>Ela</i>	<i>Elettaria cardamomum</i>	1
4.	<i>Sitopala</i>	-	1

RASA SINDURA:

Rasa Sindura is a Herbo-mineral preparation and is one of the foremost *Kupipakva Rasayana*. Several references to *Parad Bhasma* and *Jarana* are mentioned in the ancient texts of *Rasa Shastra*, and several formulations that resemble *Rasa Sindura* are present, but they are not termed *Rasa Sindura*. The word *Rasa Sindura* was first described in *Rasendra Chintamani*. *Kajjali* is prepared by giving *Bhavana* of *Vatankura Swarasa* to *Shuddha Parada* and *Shuddha Gandhaka* in equal quantity. The *Kajjali* is then put into a glass bottle (*kacha kupi*) and is subjected to

heat in *Valuka Yantra* by a graded heating pattern (*Kramagni*) over a stipulated time. After sufficient cooling, a red-coloured sublimate is collected from the neck of the glass bottle. The juice of aerial roots of *Ficus benghalensis* Linn (*Vatankura Swarasa*) serves as an acidic medium, which helps form Mercury sulphide.⁶ On chemical analysis of *Rasa Sindura*, the structure is similar to meta cinnabar and identified as Red Sulphide of Mercury (HgS).⁷ On XRD analysis, it is confirmed that the phase of *Rasa Sindura* is tri/hexagonal (alpha form) of Mercury sulphide.⁸ Mercurial sulphide (crystallite size ranging from 25 to 50 nm) is associated with organic mac-

romolecules obtained from the plant extracts during drug processing and several other trace elements that were bioavailable, enhancing its medicinal properties.⁹

PROBABLE MODE OF ACTION:

In an experimental study conducted on gastrointestinal gram-negative bacteria in poultry, *Rasa Sindura* was reported to be effective against gram-negative bacteria in the digestive system and to reduce the amount of ileocaecal and faecal coliform count¹⁰. Modi et al.'s bactericidal activity of *Rasa Sindura* demonstrated that *E. coli* and *Staphylococcus aureus* are more sensitive at a 0.50 mg/ml concentration of sample¹¹. According to a study by Gokarn et al., samples with concentrations of 250µg/ml for *S. aureus* and 25µg/ml for *E. coli* show sensitivity.¹²

It was discovered that the finished *Ras-Sindura* product had notable amounts of Mg, Ca and Fe, which support a healthy metabolism and act as preventives against stomach lesions. The finished product also contained Zn, necessary for healthy growth and immunity, and Na and K, required to preserve an average fluid balance. These elements—Mg, Ca, Fe, Na, K, and Zn—are extra supplements to enhance the medication's therapeutic qualities. Additionally, since the drug's macroparticle size and the colloidal size match well, the particles may adhere to the human intestine and expand its surface area, which improves the absorption of additional nutrients and medications added to it during preparation or prescribed to the patient alongside them.¹³

SHILAJATU:

Often regarded as a *Rasayana*, *Shilajatu* is a rock exudate found in sedimentary rocks of the Himalayan region. As per *Sushruta*, the mountain rocks became warm in the months of *Shukra-Shuchi* (Summer months), and a mineral pitch with a semisolid consistency like *Laksha* oozes out of it, hence named *Shilajatu* (*Shila* = originates from rock, *jatu*: consistency like *Laksha*).¹⁴ *Charaka* has described its origin from the mountain rocks housing the ore for *Swarnadi Dhatu*, hence four types of *Shilajatu*: *Swarna*, *Rajata*, *Tamra* and *Lauha*. *Lauha Shilajit* is said to be best and to be used for *Rasayana Karma*.

Sushruta added two more, *Naga Garbha* and *Vanga Garbha*, to the above to explain six types.¹⁵ *Sushruta* has mentioned *Shilajit* in *Usakadi Gana*, with properties like *Kapha Shamana*, *Medonashana*, *Ashmari-Sharkara Hara*, and *Mutrakricchhra Nashana*.¹⁶ In *Rasa Granthas*, *Shilajit* is said to be of 2 types: *Gomutrakandhi* and *Karpurakandhi*.

About 60% to 80% of the total nutritional content in *Shilajit* is made up of humic compounds, such as fulvic acid, along with a few oligo-elements with anti-aging qualities like Selenium. The breakdown of organic matter - primarily vegetal compounds - caused by the action of many microbes results in humic chemicals. Ellagic acid, some fatty acids, resins, latex, gums, albumins, triterpenes, sterols, aromatic carboxylic acids, 3,4-benzo coumarins, amino acids, polyphenols, and phenolic lipids are additional compounds found in *Shilajit* formulations.¹⁷ Studies have proven the antimicrobial and antifungal efficacy of Fulvic acid.¹⁸ Another study affirms the Nephroprotective potential of *Shilajit* in cisplatin-induced nephrotoxicity; the action was attributed to fulvic acid and humic acid having a vital role in anti-oxidation and a biological function.

PROBABLE MODE OF ACTION:

Studies showed that the interaction of fulvic acid and benzoic acid in *Shilajit* with bacterial membranes leads to cell lysis.¹⁹ They increase the permeability of the bacterial cell membrane, which disturbs the cell osmolarity, leading to cell lysis. 2D-difference gel electrophoresis (2D-DIGE) was employed to assess protein changes in *E. coli* treated with *Shilajit* extract. It was found that the expression of all outer membrane porins was downregulated in the *Shilajit* extract-treated group, which indicates the instability of the cell membrane. The downregulation of the expression enzymes involved in protein, lipid and DNA synthesis, proteins involved in ATP synthesis, and Malate dehydrogenase, which is vital for controlling oxidative stress, was also observed in the microbe treated with *Shilajit* extract. Other downregulated enzymes were glycerol kinase, which is involved in energy metabolism, and some 30s & 50s ribosomal

proteins, indicating suppression of protein synthesis as a response to *Shilajit* extract.²⁰

Shilajit also shows an effect on serum superoxide dismutases (SODs), one of the antioxidant enzymes which helps in front-line defense against oxidative stress by removing superoxide free radicals, Vitamin C & E, which prevents lipid peroxidation. This antioxidant property of *Shilajit* is attributed to Fulvic acid and humic contents.²¹

Several other studies showed a decrease in the production of TNF- α in differentiated human monocytes after exposure to the endotoxin lipopolysaccharide. Furthermore, Fulvic Acid has been proven to decrease the release of prostaglandin E2 (PGE2) and cyclooxygenase 2 (COX2) in primary human monocytes upon homocysteine stimulation.²²

ELA:

Elettaria cardamomum, also known as "green or true cardamom," is a Zingiberaceae family perineal herb commercially cultivated in Southern India. *Ela* is traditionally used in several disorders, including GI, neural, Cardiovascular, Respiratory, Urinary, and general debility. Research further supports its efficacy as an antimicrobial, anti-ulcerogenic, and anti-carcinogenic agent, as well as its ability to improve specific actives for skin penetration.²³

In *Ayurveda*, it is a critical medicine and is used for various disorders. *Charaka* has categorized *Ela* under *Swasahara Mahakashaya*²⁴, *Angamarda Prashamana Mahakashaya*²⁵, *Shirovirechanopaga Mahakashaya*²⁶, *Katuka Skanda Dravya*²⁷ while *Sushruta*²⁸ and *Vagbhata*²⁹ under *Eladi Gana* and *Mustadi Gana*. Having *Katu-Madhura Rasa*, *Laghu Ruksha Guna*, *Sheeta Virya* and *Madhura Vipaka*, it has pacifying action on *Tridoshas*, with *Mutrajana*, *Mutrakricchrahara* and *Daha Shamaka* actions.³⁰

The essential oil content of the seeds is around 4% of their dry weight. With lower levels of α -terpineol, borneol, camphor, limonene, α -terphenyl acetate, and α -pinene, the primary constituent is 1,8-cineole (approximately 50% or more). The study shows the antimicrobial efficacy of aqueous extract of *E. cardamomum* against test bacteria, with *Staphylococcus aureus* being the most sensitive to extract.³¹

Another study determined the anti-inflammatory activity of aqueous extract of *E. cardamomum*, which is justified by the compound 1,8-cineole. Also, it has been discovered that α -terpineol can block pro-inflammatory mediators, which results in a suppression of IL-6.³² A different research showed that cardamom extracts had an anti-inflammatory impact by preventing macrophages from generating pro-inflammatory cytokines, including TNF- α , IL-1 β , and IL-8 when they are exposed to Lipopolysaccharides from *Actinobacillus actinomycetemcomitans*.³³

PROBABLE MODE OF ACTION:

Studies showed that the Cardamomum extracts inhibit the swarming phenomenon in the *Proteus mirabilis*, which may be due to a phenolic group which binds to the proteins and phospholipids of the outer membrane of the cell wall.³⁴

By lowering inflammatory cytokines like IL-6 and TNF- α and downregulating the production of COX-2 and iNOS, green cardamom may be able to alleviate inflammation. Additionally, cardamom reduces oxidative stress by promoting the regeneration of antioxidant enzymes such as reduced glutathione (GSH), catalase (CAT), and superoxide dismutase (SOD). Inhibiting NF- κ B phosphorylation and its translocation into the nucleus, 1,8-cineole controls the production of critical transcription factors, including Nrf2 and NF- κ B, which may prevent the inflammatory response.³⁵

Other studies indicated the diuretic potential of Cardamomum extract, which increased urinary output in doses of 1, 3, and 10 mg/kg body weight and enhanced Na⁺ and K⁺ excretion.³⁶

SITOPALA:

Sitopala, or *Mishri* or *Rock Sugar*, is one of the essential ingredients in *Ayurvedic* formulations, employed as a single ingredient or a component of compound formulations in medicinal preparations. It is made by processing Sugarcane juice (*Ikshu*). *Ikshu* and its *Vikaras* are mentioned in *Mutra Kricchra*, *Shoolahara*, *Udavarta*, *Yonishoola* and *Udara Roga* and are also said to have *Mutrala* property.³⁷ *Charaka* have mentioned *Sharkara* in *Ikshuvarga*³⁸, *Jwarahara Mahakashaya*³⁹, *Dahaprashamana Maha-*

*kashaya*⁴⁰, *Sushruta* and *Vagbhata* have mentioned *Sharkara* in *Ikshuvarga*. Medicinal properties are *Madhura Rasa*, *Guru-Snigdha-Saraka Guna*, *Sheeta Virya* and *Madhura Vipaka*.

Rock Sugar is made using either molasses or sugarcane juice. It is an unrefined, non-centrifuged sugar containing minerals, vitamins, and vital amino acids. It also has excellent concentrations of Vitamin B₁₂, an essential Vitamin.⁴¹

Natural absorption enhancers, including fructose, sulphur, and copper, are found in raw sugar and molasses high in iron. Numerous substances, such as long-chain aldehydes and policosanols, as well as antioxidants and volatile aroma profiles, are found in sugarcane juice. Among the active ingredients in sugarcane juice are apigenin, tricetin, and luteoline glycosides, which include orientin, vitexin, schaftoside, and swertisin. These substances have analgesic, diuretic, anti-inflammatory, hepatoprotective properties.⁴²

PROBABLE MODE OF ACTION:

In animal models and in-vitro test systems, the administration of unrefined sugar has been shown to decrease inflammation, as demonstrated by different inflammatory biomarkers, such as IL-6, IL-10, IL-1 β , TNF- α , IF- γ , and NF- κ B. Various studies have shown that the phytochemicals and polyphenol components in unprocessed sugarcane products provide them with antioxidant potential. Phytochemicals and phenolics may suppress free radical activity via multiple mechanisms, such as scavenging free radicals, binding to metals that trigger the production of free radicals and preventing the formation of new free radicals.⁴³

Caffeic acid, p-coumaric acid, ferulic acid, syringic acid, vanillic acid, and chlorogenic acid are the phenolic acids in non-centrifuged sugar that show antioxidant activity. Consequently, non-centrifuged sugar may be used to treat chronic illnesses associated with oxidative stress on its own or in conjunction with conventional treatment.⁴⁴

A study on rats observed that both genders had higher liquid intake and diuresis after drinking water containing sucrose.⁴⁵

DISCUSSION

Urinary Tract Infections are common nowadays, with about 150 million people affected by them worldwide. It refers to inflammation of the urethra and urinary bladder, with symptoms like painful micturition with a burning sensation, hematuria, and incomplete voiding of urine with increased frequency and urgency. In *Ayurveda*, it can be correlated with *Pittaja Mutrakricchra*, which has symptoms such as *Shoolayukta*, *Dahayukta*, and *Muhurmuhu Mutra Pravritti*. *Rasa Sindura Yoga* is mentioned in *Rasa Tarangini* as an *Amayika prayoga* of *Rasa Sindura* with *Rasa Sindura* taken with equal parts of *Sitopala*, *Ela* and *Shilajatu* as *Anupana/Sehpana*. Most of the ingredients having *Sheeta Virya* and *Madhura Vipaka*, have pacifying action on *Tridoshas* and help alleviate various *Mutravaha Srotas Vikaras*, *Jwara*, *Daha*, *Shoola*, etc. *Sharkara* also increases the palatability of the drug.

Rasa Sindura is the foremost *Kupipakva Rasayana* and is widely used therapeutically in various diseases. *Rasa Sindura*, being the herbo-mineral preparation, is required in smaller doses and of great medicinal use. The particles of the *Rasa Sindura* adhere to the gut and increase the surface area, enhancing the absorption of the nutrients and other drugs taken along with it. The organic molecules of the *Vata (Ficus benghalensis)*, which are used for processing the medication, are also carried by *Rasa Sindura*. The macro, micro, and trace chemicals associated with *Rasa Sindura* are responsible for its therapeutic qualities.

Being a *Rasayana*, *Shilajit* helps boost the body's immunity and cellular regeneration. It also exhibits antimicrobial, antioxidant, and anti-inflammatory properties. These properties, along with the nephroprotective nature of *Shilajit*, make it helpful in combating any urinary infection. *Shilajit* contains organic contents and some minerals, which are transported into cells by fulvic acid, which keeps them from deteriorating and dying by preserving and restoring their electrical potency. *Shilajit* facilitates the body's production of energy and aids in metabolism. It improves the body's ability to absorb nutrients and rid

itself of toxins, supports healthy blood production and stimulates the immune system. It also keeps the balance between anabolism and catabolism.⁴⁶ *Shilajit* has been proven to reduce TNF- α in monocytes and decrease PGE2 and COX2, proving its anti-inflammatory potential.

1,8-cineole and α -terpineol lower inflammatory cytokines and reduce oxidative stress by promoting antioxidants' regeneration. They also exhibit anti-inflammatory activity. Acting as a diuretic, they help flush out toxins by increasing urinary output, hence alleviating symptoms.

Sitopala has also been proven to have anti-inflammatory and antioxidant effects. It also has a coolant effect, which may help treat the burning sensation observed in UTIs.

The formulation's ingredients show antimicrobial, anti-inflammatory, analgesic, and diuretic activity, making it a potential drug for treating UTIs. Assessing medications' pharmacological activities is essential as they may lead to the discovery of therapeutically beneficial antibacterial agents that target uropathogens.

CONCLUSION

Rasa Sindura Yoga is a Herbo-mineral preparation with equal quantities of *Rasa Sindura*, *Shilajit*, *Ela*, and *Sitopala*. Most of the drugs have *Madhura Vipaka* and *Sheeta Virya*. *Rasa Sindura* boosts the absorption of nutrients and medications added to it. Fulvic Acid and humic substances in *Shilajit* show nephroprotective potential. The fulvic acid in *Shilajit* and 1,8- cineole in *Ela* show anti-microbial and anti-inflammatory activity that may help eliminate uropathogens. *Sitopala* (*Mishri/ Sharkara*) acts as a natural coolant and increases the palatability of the medication. Since the medication has a combination of antibacterial, anti-inflammatory, diuretic, and analgesic properties, it can be used therapeutically to manage UTIs.

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