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Review Article

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LITERARY REVIEW OF PARADA (MERCURY) IN RASASHASTRA

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ABSRACT

Ayurveda, the first medical science of the world emphasizes on maintaining equilibrium of physical, physiological, psychological, spiritual, and social health in a comprehensive way. The concepts and approaches of Ayurveda are unique and provide a health promotive, disease preventive and curative guidelines. The science utilizes naturally occurring animal sources, plants, metals and minerals in a systematic way to maintain the health. Use of metals and minerals in Ayurvedic drugs remains an unique identity for Ayurveda and at the same time became controversial issue for the followers of western medicine. However since time immemorial metals and minerals are being used in Ayurvedic medicine without causing any harm to the human body. The art of use of metals and minerals in different formulations is familiar as 'Rasashastra'. Though, in the medieval period, methods of preparation of metal and mineral drugs were refined to such an extent that it became an independent science; roots of this science were deeply buried in treatises like 'Caraka Samhita' and 'Susruta Samhita'.

KEYWORDS: Ayurveda, Rasashastra, Parada (Mercury).

INTRODUCTION

Ayurveda, the science of life emphasizes on three basic pursuits for healthy longevity of human beings, viz., Praneshana (desire to live), Dhaneshana (desire to earn) and Paralokeshana (desire to attain happiness after life). For these one has to follow four Chaturtartha e.g. Dharma (moral values), Artha (prosperity), Kama (pleasure) and Moksha (liberation). First by succeeding personal ethics and economic policies, one has to work for the development of constituency and after that the endure object of human being comes i.e. to get happy and healthy life for liberation. [1]

Rasa Shastra is a unique branch of Ayurveda, explaining pharmaceutical aspects of conversion of metals and minerals into therapeutically potent drugs. Rasa Shastra deals with different types of preparations namely Khalviya Rasayana, Parpati Rasayana, Pottali Rasayana, Kupipakwa Rasayana.

The main aim of *Rasa Shastra* is to attain *Jivan Mukti* (liberation from the cycle of re-birth by means of *Dehavadha* i.e. healthy physique with *Rasaushadhis* along with *Lohavadha* i.e. (converting lower metals to higher metals). Thus it is evident that the science of herbs along with the mineralogy and gemmology were at its zenith during that period.

Herbo-mineral formulations are one of them which have drawn attention of the world. These formulations have been more popular because of their smaller dose, palatability, shelf life and efficacy. Through various pharmaceutical processes these metals and minerals are converted into non-toxic forms suitable for the treatment of various diseases. Herbal drugs are also used in pharmaceutical processes which may act as a chelating agent and provide organic constituents.

Rasa shastra, *Parada* has miraculous and I mythical importance as the whole branch is named after *Parada*. It is believed to be the semen of Lord Shiva and he is the procreate of this treatise. Accordingly, this treatise is known as Rasa shastra (the science of mercury). In modern science, it is known as 'Quicksilver' and 'Liquid silver' due to its liquidity, shining and silver like appearance.^[2]

Parada (Mercury)

Parada is one of the main components of Rasaushadhi preparation, which has specific properties like Rasayana and Yogavahi etc. It is inseparable component in most of the metallic and herbo-mineral preparations.

It is commonly known as quicksilver and was formerly named hydrargyrum ("hydrargyrum" Random house webster's unabridged dictionary) Mercury occurs in deposits throughout the world mostly as cinnabar (mercuric sulphide).^[3]

यथा रसस्तथा हयात्मा यथा हयात्मा तथा रसः। आत्मविद रसविच्चैव द्वाविमौ सूक्ष्मदर्शिनौ।।(रसोपनिषद् सू. 15/20)

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Rasopanisad quotes that as soul plays an important role in the body, like wise Parada is the soul of Rasa Shastra and without Parada, existence of Rasa Shastra could not be imagined.

History

There is no such direct evidence of *Parada* in *Vedic* age. But in *Atharva Veda* the reference:

पक्षी जायान्य पतित स आविशति पुरुषम्।

तदक्षितस्य भेषजमुपयोः सुक्षतस्य च ।।

(ਰ.ਟ.7 / 50)

The word 'पक्षी जायान्य' could be inferred as *Parada*, like wise in *Yajur Veda* the word "यो वः शिवतमो रसः तस्य माजयते ह नः।" can be interpreted as *Parada*. In *Smruti* text also indirect evidence of *Parada* could be traced. The commentator of *Smruti* opines that "dqV Lo.kZ O;ogkjh" could be the preparation of gold artificially by *Parada*.

In Samhita like Charaka, Sushruta and Ashtanga there are ample evidences of Parada. Therapeutic use of Parada for external purpose have been recommended by Charaka, whereas Sushruta and Vagbhatta have indicated its use for both internal as well as for external use. But the proper utilization of Parada for Dehavada and Lohavada started from 8th Century A.D. onwards. Thereafter, Parada has become an impeccable or inseparable part of Rasa Shastra.

Mythological Origin^[4,5]

The mythology reflects that when Lord *Shiva* was in cohabitation with Goddess *Parvati*, whatever drops of the seminal fluid fell on the earth got converted into *Parada* and as such *Parada* is also known as *Shiva Virya*, *Shiva Retasa*, *Shiva Teja* etc.

शैलेऽरिमन् तद्रेतः पंचधाऽभवत्।। र.र.स. 1/60–66) साधु पृष्टं....... पारदः कीर्तितो महः।। (रसार्णव 1/33–35)

Occurrence^[14]

In "Rasa Ratna Samucchaya", it has been mentioned that, in ancient times Parada was found mainly in "Darada Desha" and in the ranges of Himalaya in small amounts. But now a day, it is obtained mainly from the mines of Spain, America, Italy, Australia, China, Russia, Japan and Africa etc.

In Native form: Procured from the mines in liquid form. Native mercury is found in mines of California called sonema and rattle snake.

In Combined form: Brazil, Peru, New Almaden, Almader (Spain), etc.

In combined form

- Native Calomel: Available in India and Almaden.
 Only a little amount of Mercury is available in this form
- b) Cinnabar or Meta cinnabar.

Synonyms of Parada^[6]

These are few synonyms. All the names of Lord *Shiva* have been specified as synonyms for *Parada*:

1. Rasa: The word which has the capability of liquifying and eating *Swarna*, *Loha* etc. *Dhatus* is *Rasa*. रसनात् सर्वधातूनां रस इत्यभिधीयते। (र.र.स. 1)

2. *Rasendra*: *Parada* is considered as the king among *Rasa* and *Uprasa*.

रसोपरसराजत्वाद रसेन्द्र इति कीर्तितः। (र.र.स. 1)

3. *Suta*: As it brings about the *Dehasiddhi* (making the body healthy and strong) and *Lohasiddhi* (converting the lower metals into higher) it is named as *Suta*. देहलोहमयीं सिद्धिं सूते सुतस्ततः स्मृतः। (र.र.स. 1)

4. *Raseshwara*: Mythologically, *Parada* has its origin from the semen of Lord *Shiva*.

म्म देह रसोय स्मात् रसस्तेनायमुच्चते। (रसेश्वरदर्शन)

5. *Parada*: It is called as *Parada* because it rescues the person who is trapped in the swamp of diseases.

रोगपङ्काब्धिमग्नानां पारदानाच्च पारदः। (र.र.स. 1)

Synonyms of Parada^[7,8,9,10,11]

- 1) Dehavadatmaka Rasayana, Amrtam, Mrtyunasana
- 2) Dhatuvadatmaka Maharasa, Rasottama, Suta
- 3) Vishista Gynantmaka Ananta, Suksma, Saubhagya
- 4) Darshana Rupatmaka Jivah, Divya, Achintyah
- 5) Swarupatmaka Galad, Raupyanibhama, Mahateja, Shivavirya
- **6) Devatmaka** Harabija, Shivabijam, Hararet, Shiva Rudraja, Trilochanama
- 7) Gatyatmaka Chapala, Khechara

Types

- श्वेतारूणहरिद्राभकृष्णाःसूताद्विजादयः |देहेलोहेगदेपिष्टयांयोज्यावास्वस्व जातिषु । ।
 ब्राह्मणः कल्प्यतेकल्पेगुटिकायां च वाहुजः । धातुवादे तथा वैश्यः शुद्रश्चेतरकर्मणि । । (पा. स. 1/41.42)
- रसो विप्रः सितो रक्तः क्षत्रियः पीत ऊरूजः।शुद्रः कृष्ण इति प्रोक्ता वर्णभेदाचतुर्विधः।।
 ब्राह्मणः कल्प्यते कल्पे गुटिकायां च बाहुजः।धातुवादे तथा वैश्यः शुद्रश्चेतरकर्मणि।।
 (यो. र. shalok 1.2)

Table No. 1.1: Table Showing Types of Parada according to Varna (o.kZ)^[12,13]

Sr. No.	Name of <i>Parada</i> (acc. to <i>Varna</i>)	Colour	Uses (as per <i>Parada</i> Samhita)	Uses (as per <i>Parada</i> Samhita & Yogratnakar)
1	Brahman	Sita	Dehavaada	Roga Nasha
2	Kshatriya	Rakta	Lohavaada	Rasayana
3	Vaishya	Pita	Gadvaad (for diseases)	Dhatubaada
4	Kshudra	Krishan	Pishti (medicine preparation)	Khechar Gati

On the basis of place origin, *Parada* is of five types- *Rasa*, *Rasendra*, *Suta*, *Parada*, *Mishraka* have been explained in *Rasa* classics. [14,15]

Table No. 1.2: Table showing types of Parada according to place origin.

No.	Type	Colour	Use
1	Rasa	Rakta (red)	Rasayana
2	Rasendra	Shyava (black)	Rasayana
3	Suta	Isatpita (light yellow)	Deha Lohakara
4	Parada	Shweta (white)	Sarvarogahara
5	Mishraka	Mayura Chandrika	Sarva Siddhi Prad

Vernacular Names^[16]

Sanskrit - Parada Hindi - Parada Gujarati - Paro Marathi - Para Latin - Hydrargyrum

Doshas of Parada^[17]

English

Parada (Mercury) procured from its original sources or from the market may contain various types of admixtures. Sometimes, the Parada is found associated

Mercury, Quick silver

with some metallic elements in nature while it is deliberately adulterated for commercial purposes by the profiteers. This fact was known to the ancient chemists very well and as such most of the authorities have described impurities of *Parada* which run as follows.

There are mainly three types of *Doshas* of *Parada*:

- 1. Naisargika Doshas (Natural)
- 2. Yougika Doshas (Artificial)
- 3. Aupadhika Dhoshas (due to exposure into many atmospheric factors)

Table No.1.3: Table showing *Doshas* of *Parada*^[18,19,20,21,22,23,24,25,26,27]

1. Naisargika	2.Yougika	3. Aupadhika	
Doshas	Doshas ^[28,29]	Doshas ^[26,28,29,30,31]	
(Natural impurities)	(Artificial impurities)	(Chemical impurities)	
		Parpati	
	Naga Vanga	Patani	
Visha		Bhedi	
Vahni		Dravi	
Mala		Malakari	
		Andhakari	
		Dhwankshi	

Different authors have described different type of *Parada Doshas*

These references are as follows

- ightharpoonup [18]विषं विह्नर्मलश्चेति हेतवः क्रमात्।। (र. र. स. 11/17)
- > [19] नागवंगी विहनमली चापल्यं गरलं गिरिः।असह्याग्निश्च विज्ञेया दोषा नैसर्गिका रसे।।(र. तं. 5/7)
- [20] नागो वंगो
 स्थिता: । (रसे. सा. स. 1/10)
- [21] नागोवंगो मलो विह्नश्चापल्यं च विषं गिरिः।..... निसर्गात्पारदे
 स्थिता।।(आ. प्र. 1 / 16)
- [22] मलशिखिविषनामनो रसस्य नैसर्गिकास्त्रयो दोषाः ।
 (यो. र. श्लोक 5 / 141)
- [23]पारदस्य त्रयो दोषा विषं वर्हिनर्मलस्तथा। रसायने।।
 (रस. 10/30–31)
- > ^[24]स्वाभाविकां:सत्यऽगुणरसेस्मिन्नागाग्निवंगादिकनामधेयाः।.... चलत्वात्।। (यो.तं.17/3)
- [25] दोषो मलो विषं विह्नर्मदो दर्पश्च तत्फलम्। मूर्च्छा मृत्यु सदादाहो विस्फोटश्च शिरो भ्रमः।। (रसे. चुडामणि 15/23)
- [26] मलं विषं विह्न गुरुत्वं चापलं चापलं नैसर्गिकं दोषमुशन्ति तज्ज्ञाः।
 औपाधिको द्वौ त्रपु नाग सम्भवौ रसेन्द्रराजे कथयन्ति वैद्याः।।
 (रसे. मंगल 1/18)
- ightarrow $\stackrel{(27)}{}$ यौगिको नागवंगो द्वौ तौ जाऽ्याध्मानकुष्ठदौ।। (र. र. स. 11 / 18)
- > [28]यौगिको नागवंगो द्वौ तौ जाऽ्याध्मानकुष्ठदौ।। औपाधिका पुनश्चान्ये...... नागवंगजौ।। (आ. प्र. 1/20)

- [29] औपाधिका पुनश्चान्ये.....नागवंगजौ |.....।
 (र. र. स. 11/19.21)
- > ^[30]भेदी द्रावी मलकारी ध्वाडक्षी.....पाटनिका कंचुका सप्त कीर्तिता।। (र. त. 5 / 10)
- [31]नागो वंगो मलं विह्नश्चाचल्यं च गिरिर्विषम्।। (यो. र. 2/141)

Effect of Ashuddha Parada. [32,33,34]

Parada associated with impurities is considered as poison; it may cause diseases so we should use *Shuddha Parada*.

It is mentioned that on internal administration of *Ashuddha Parada* the *Vidaha, Kushtha, Agnimandya, Krimi, Aruchi, Vamana, Jadya* etc. like symptoms will develop and it may even lead to *Mrityu*. [34]

Prati Visha

Any one of *Draksha*, *Kushmanda Khanda*, *Tulasi*, *Shata Pushpika*, *Lavanga*, *Twaka* with one *Karsha* (12 g) of *Gandhaka* and *Kshira*.(*Anupana Manjari*)

Grahya Parada^[35,36,37,38]

The inside colour should be bluish, and externally it should be bright as similar to the brightness of the midday sun, such a *Parada* is of very good quality.

Agrahya Parada,[35,36,37,38]

Parada having grayish to whitish colour, visible foreign particles floating over its surface, having mixture of colours, such a Parada should not be used for therapeutic purposes.

Properties of Shudha Parada^[39,40,41]

Rasa - Shada Rasa Guna - Snigdha, Sara, Guru

Virya - Ushna Vipaka - Madhura Prabhava - Yogavahi Doshghnta - Tridoshghana

Mercury

Mercury is a chemical element with the symbol Hg and atomic number 80. It is commonly known as quick silver and was formerly named Hydragyrum. A heavy, silver d-block element, mercury is the only metallic element that is known to be liquid at standard conditions for temperature and pressure; the only other element that is liquid under these conditions is the halogen bromine, though metals such as gallium and rubidium melt just above room temperature.

Mercury occurs in deposits throughout the world mostly as cinnabar (mercuric sulphide). Mercury is used in thermometers, barometers, manometers, sphygmomanometers, float valves, mercury switches, fluorescent lamp. Mercury remains in use in scientific research applications and in amalgam for dental restoration in some locales.

Mercury poisoning can result from exposure to watersoluble forms of mercury (such as mercuric chloride or methyl mercury), by inhalation of mercury vapour, or by ingesting any form of mercury.

Ores of Mercury^[42]

The most important ore of mercury is 'Cinnabar or meta cinnabar' in which it is in sulphide form, the other

important ore is 'Calomel' in which it is in chloride form (Hg_2Cl_2) . It is also found mixed with Antimony and Sulphur. The important ores of this group are living stonite and worsenite. It is found in the form of oxide also. The important ore of this group is Montrodite (HgO).

$Mercuric\ Compounds^{[43]}$

*	Mercuric chlorides	-	$Hg CI_2$
*	Mercuric Fluorides	-	$\operatorname{Hg} F_2$
*	Mercuric Bromide	-	$Hg Br_2$
*	Mercuric Iodide	-	$Hg I_2$
*	Mercuric Sulphide	-	Hg S
*	Mercuric Oxide	-	Hg O
*	Mercuric Nitrate	-	2 Hg (NO ₃), H ₂ O
*	Mercuric Nitride	-	$Hg_3 N_2$
*	Mercuric Carbonate	-	Hg CO ₃ , 3 HgO
*	Mercuric Peroxide	-	$Hg O_2$
*	Mercuric Iodide	-	$Hg I_2$
*	Mercuric Flulminate	-	$Hg (ONC)_2$
*	Mercuric Cynide	-	$Hg(N)_2$
*	Mercuric sulphate	-	$Hg SO_4$
*	Hydro-chloro Mercuric acid	-	H-HgCl ₂

Mercurous Compound^[44]

★ Mercurous Chloride
 → Mercurous Fluoride
 → Mercurous Bromide
 → Hg F
 → Hg Br
 → Mercurous Nitrate
 → Hg NO₃ H₂O
 → Mercurous Carbonate
 - Hg₂CO₃

$A malgams^{[45]} \\$

- Amalgam with Gold
- ❖ Amalgam with Zinc
- Amalgam with Silver
- Amalgam with Lead
- ❖ Amalgam with Tin
- Amalgam with Copper

Table No.1.4: Table Showing Physical properties of Mercury^[55]

hysical properties of wich cary			
Phase	Liquid		
Symbol	Hg		
Colour	Shining silvery white		
Atomic number	80		
Atomic weight	200.6		
Sp. Gravity	13.6		
Melting point	-38.83c		
Boiling point	356.73		
Valency	+1:+2		
Heat of fusion	2.29kj.mol-1		
Heat of vaporization	59.11kj.mol-1		
Specific heat capacity 25°C	27.983j.mol-1.k-1		

Chemical properties^[46,47]

• Mercury is the only metal which is liquid at ordinary temperatures. It has a melting point of -38.9°C and a

boiling point of 356.7°C. Droplets of liquid mercury are shiny and silvery white. It is a rather poor

conductor of heat if compared with other metals but it is fair conductor of electricity.

- It does not undergo oxidation in air. At ordinary temperature, it tarnishes in air containing traces of H₂S.
- It is used in barometers and manometers because of its high rate of thermal expansion i.e. fairly constant over a wide temperature range.
- It dissolves in hot concentration H₂SO₄ to form mercuric sulphate.
- Mercury compounds such as mercurous chloride, Hg₂Cl₂ is used as a standard in electrochemical measurements and in medicine as a Purgative.
- Mercuric chloride (corrosive sublimate, HgCl₂) is used as an insecticide, in rat poison, and as disinfectant.
- It has no action on alkalies.
- It easily reacts with organic matters to produce complex compound.
- It forms amalgam with metals.

Pharmaco-therapeutic properties of *Parada*^[48] Therapeutic action of *Shuddha Parada*

Yogavahi, Rasayana, Vrishya, Vajikarana, Dipana, Pushtikara, Ayushkara, Drishtibalaprada, Dehasiddhikara, Lohasiddhikara, Purusartha Chatusthayakara, Krimighna, Shodhana and Ropana.

Therapeutic indication of Shuddha Parada

Jwara, Raktapitta, Kasa, Pandu, Atisara, Pravahika, Visucika, Ajirana, Arsha, Hikka, Vamana, Mutrakriccha, Amajanya Shoola, Parinama Shoola, Shotha, Kamala, Vatarakta, Gridhrasi, Krimi, Kustha, Kilasa, Apasmara, Undmada and Prameha etc.

Therapeutic uses of Mercury^[3]

Mercury and its compounds are used in medicine, although they are less common. The element mercury is an ingredient in dental amalgams.

Mercury compound Merbromin is a topical antiseptic used for minor cuts.

Extraction of Parada by Satva Patna of Hingula [49,50]

Distillation procedure of *Hingula* with the help of *Adhaha Patana*, *Urdhva Patana* or *Tiryak Patana Yantra* is explained in *Rasa* classics. The *Satva*, which is collected in the *Adhaha Patana Yantra* is considered as purest form and it does not require any further process like *Ashta Samskara*. It is free from all the seven *Kanchuki Doshas* and can be used for all purposes. Properties of such *Parada* resembles with *Ashta Samskarita Parada*.

Boiling point of *Parada* is 357° C, but when it is extracted from *Hingula*, it needs $600 - 650^{\circ}$ C temperature, because *Hingula* dissociates at temperature around $600 - 650^{\circ}$ C.

Extraction^[3,51]

Mercury is extracted by heating cinnabar in a current of air and condensing the vapour. The equation for this extraction is $HgS + O_2 \rightarrow Hg + SO_2$.

In 2005, China was the top producer of mercury with almost two-thirds of global share followed by Kyrgyzstan. Mercury is readily obtained by roasting the mineral cinnabar in air. The cinnabar is oxidized to mercury oxide which decomposes at the temperature of 356°C, yielding mercury, which distil off.

 $2\text{HgS} + 3\text{O}_2 \rightarrow 2\text{HgO} + 2\text{SO}_2$

 $2HgO \rightarrow 2Hg + O_2$

Mercury is a silvery white transition metal with a bluish tinge; it is the only metal which is liquid at the ordinary temperature. It has a slight vapour pressure, even at ordinary temperatures and the vapour is poisonous.

Mercury dissolves many other metals such as gold and silver to form amalgams. Iron is an exception, and iron flasks have traditionally been used to trade mercury. Several other first row transition metals with the exception of manganese, copper and zinc are reluctant to form amalgams. Other element like platinum do not readily forms amalgams with mercury. Sodium amalgam is a common reducing agent in organic synthesis, and is also used in high- pressure sodium lamps.

$\mathbf{Absorption}^{[52,53]}$

Mercury vapour is quickly absorbed through the lungs due to the ease with which HgO penetrates alveolar membranes into the blood. Volatility, solubility and particle size are the main factors influencing the pulmonary absorption of inorganic and organo-mercuric compounds. The gastrointestinal absorption of inorganic mercury Hg²⁺ is approximately 7% in human.

Tissue distribution

Organic mercurial salts are more uniformly distributed to the various tissues rather than the inorganic salt. A significant portion of the body burden of organic mercurial is in the red blood cells. The highest concentration of mercury following exposure to inorganic mercury is found in the kidney, particularly in the distal parts of the proximal tubules. Lower concentration is also found in the wide part of Henle's loop and the collecting ducts and in the liver, spleen and thyroid gland. Within the kidney mercury is bound primarily to proteins, including the low molecular weight metal binding protein metal lothionein. Also kidney lysosomes tend to accumulate mercury. [53]

Biochemical mechanism of toxicity

Mercury can be shown to inhibit nearly any enzyme mediated bio-chemical reaction in vitro generally due to its high affinity for active sulfhydryl group. Methyl mercury and mercury vapors are lipid soluble and can therefore more easily crosses the cell membranes to get into the brain than inorganic forms of mercury. [53]

Treatment

Currently available drugs for acute mercurial poisoning include chelators N - acetyl - D, L - penicillamine (NAP), British Anti Lewisite (BAL), 2,3 - dimercapto - 1 - propane sulfonic acid (DMPS) and diimercaptosuccinic acid (DMSA). [53]

Parada Sevana Pathya-Apathya Pathyas^[54,55,56]

Ahara

Mudga, Dugdha, Shali, Punarnava, Saindhava, Shunthi, Musta, Roots of lotus etc. have been recommended as Pathya during Rasa Sevana.

Vihara^[56]

External application of *Tila, Kumkum* and *Kasturi;* to inhale fresh fragrance of flowers, to sleep on comfortable beds, to consume tasty foods and to enjoy the pleasures of life. (Rn.18 *Patala* / 134-136).

$Apathya^{[57,58,59]}$

Ahara

During administration of *Parada* the following *Ahara Dravyas* have been mentioned as *Apathya: Kulattha, Atasi, Tila Tailam, Masa, Masura, Takra, Kanji, Katu-Amla, Tiksna- Lavana- Picchila- Pittakaraka Dravvyas, Dadhi, Kshira, Draksha, Naranga, Bilva etc.*

Vihara^[60]

During the administration of *Parada* one must not remain hungry. Don't take food even during *Ajirna*, *Diwaswapana*. Avoid excessive walking etc.

Anupana: (Therapeutic property of Parada along with various Anupana Dravyas)

- 1. Along with *Tamra*, *Parada* cures *Jwara*, *Kustha* and other *Amadoshas*.
- 2. With *Kantaloha*, it is a good *Rasayana* and *Tridoshahara*.
- 3. *Prameha Roga* is eliminated if *Vanga* is used along with *Parada*. [61]
- 4. Along with *Gandhaka*, it can eradicate any disease and act as a *Rasayana*.
- 5. Parada mixed with Kasisa and Kanksi is used for Vranasuddhi.

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