

# Potential of *Vataadi Varga* from *Bhavaprakasha Nighantu* and Its Role in Trouncing SARS-CoV-19 - A Comprehensive Review

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DOI: <https://doi.org/10.52403/ijhsr.20221014>

## ABSTRACT

The coronavirus disease 19 (SARS CoV-19) pandemic is a unique and unprecedented in several aspects and has challenged the health care systems across the globe. The Covid pandemic has turned the world's attention to the immune system, the body's defence force against disease-causing bacteria, viruses and other organisms that we touch, ingest and inhale. Ayurveda has a specific approach towards treatment. According to Ayurveda, the disease should be treated as early as possible. The same concept applies to diseases of infection origin as the prevention of spread of infection is a critical step in the treatment of infectious diseases. The drugs of *Vataadi Varga* of *Bhavaprakasha Nighantu* were reviewed for *Jwarahara*, *Kaasahara*, *Shwaasahara*, *Pratishyaayahara*, *Rasayana*, *Krimighna*, *Vishagna* Karmas and recent pharmacological activities related to Covid-19. Botanical Name, Family and *Rasapanchaka* of all the *dravyas* were noted and tabulated. Among Forty-three *dravyas* mentioned in *Vataadi Varga* of *Bhavaprakasha Nighantu*, one *Dravya* was found to have *Jwarahara*, four *Dravyas* have *Kaasahara* action, two *Dravyas* *Shwaasahara*, none of them had *Pratishyaayahara* action, ten *Dravyas* have *Krimighna* action, fifteen *Dravyas* have *Vishagna* action and two *Dravyas* have been told to possess *Rasayana* activity individually or in permutation and combination.

**Keywords:** SARS Cov-19, *Nighantu*, *Vishagna*, *Krimighna*, *Kaasa*.

## 1. INTRODUCTION

The coronavirus disease 19 (SARS CoV-19) pandemic is a unique and unprecedented in several aspects and has challenged the health care systems across the globe. The coronavirus pandemic has turned the world's attention to the immune system, the body's defence force against disease-causing bacteria, viruses and other organisms that we touch, ingest and inhale.<sup>[1]</sup> Along with the investigations into the virology of SARS CoV-19,

understanding the fundamental physiological and immunological processes underlying the clinical manifestations of SARS CoV-19 is vital for the identification and rational design of effective therapies.<sup>[2]</sup> The transmission of SARS CoV-19 virus is directly through respiratory droplet/saliva and indirectly by contact with contaminated substances. Comorbid conditions, respiratory diseases like Asthma/COPD as well as old age persons and children appear to be the risk factors at the individual level.

According to World Health Organisation, most common symptoms are fever, dry cough, and tiredness. Less commonly seen symptoms are aches and pains, sore throat, diarrhoea, conjunctivitis, headache, loss of taste or smell, a rash on the skin, or discoloration of fingers or toes. Serious symptoms include difficulty in breathing (dyspnoea), chest pain, loss of speech or movement.

In Ayurvedic literature, the communicable diseases are mentioned under *Janapadoddhvamsa Vyadhi* caused due to impairment of *Vayu, Udaka, Desha* and *Kala*. *Adharma* is the root cause of vitiation of all these factors and is led by *Pragyaparadha*. *Sansargaja* and *Upasargaja* are also mentioned in Ayurveda. Ayurvedic management of such infectious diseases can be preventive and curative.<sup>[3]</sup>

Ayurveda has a specific approach towards treatment. According to Ayurveda, the disease should be treated as early as possible. The same concept applies to infectious diseases as the prevention of spread of infection is a critical step in the treatment of infectious diseases.<sup>[4]</sup>

In *Bhavaprakasha Nighantu*, *Dravyas* have been classified into 23 *Vargas* among which *Vataadi Varga* is the 5<sup>th</sup> one. This *Varga* deals with 43 *Dravyas* which are trees, like *Vata, Parisha, Udumbara, Shirisha, Shala, Shallaki, Shimshapa, Kakubha, Khadira* and so on. Many *dravyas* which have *Kaasahara, Vishamajvarahara, Shwaashahara, Krimighna, Vishagna*

actions have been mentioned in this *varga*. In this Present article, the *Dravyas* mentioned in *Vataadi Varga* have been reviewed for their action in combating SARS CoV-19.

## 2. AIMS AND OBJECTIVES

To review the drugs of *Vataadi Varga* of *Bhavaprakasha Nighantu* for *Jwarahara, Kaasahara, Shwaasahara, Pratishyayahara, Rasayana, Krimighna, Vishagna* activities.

To review the recent pharmacological activities related to SARS CoV-19 of *Vataadi Varga dravyas* in *Bhavaprakasha Nighantu*.

## 3. METHODOLOGY

Source of data – *Vataadi Varga* of *Bhavaprakasha Nighantu* and modern literatures including textbooks, websites, reputed journals were referred to gather information about the drugs and their pharmacological activities.

Method of collection of data – The drugs of *Vataadi Varga* were screened to see if they had *Jwarahara, Kaasahara, Shwaasahara, Pratishyayahara, Rasayana, Krimighna, Vishagna* Karmas individually or in combination

Botanical Name and Family of all the *Dravyas* were noted and tabulated *Rasapanchaka* of all the *Dravyas* were noted

Pharmacological Activity related to SARS CoV-19 were noted.

## 4. OBSERVATION AND RESULTS

Table No 1: Botanical Name, Family and Rasapanchaka of Vataadi Varga Dravyas<sup>[15]</sup>

Sl No.	Dravya	Botanical Name Family	Rasa	Guna	Virya	Vipaka	Doshakarma
1	Vata	<i>Ficus bengalensis</i> Linn. Moraceae	Kashaya	Shita, Guru, Grahi	Shita	Katu	Kaphapittahara
2	Ashwatha	<i>Ficus religiosa</i> Linn. Moraceae	Kashaya	Guru, Ruksha	Ushna	Katu	Kaphapittahara
3	Parisha	<i>Thespesia populnea</i> Soland ex Correa Malvaceae	Phala – Amla Moola – Madhura Majja – Kashaya, Madhura	Snigdha	Shita	Madhura	Kaphakara

Table 1 To Be Continued...							
4	Nandivruksha (Ashwatha Bheda)	<i>Ficus retusa</i> Linn. Moraceae	Madhura, Tikta, Kashaya	Laghu, Graahi, Ushna	Ushna	Katu	Kaphapittahara
5	Udumbara	<i>Ficus glomerata</i> Roxb. Moraceae	Madhura, Kashaya	Shita, Ruksha, Guru	Shita	Katu	Kaphapittahara
6	Kakodumbarika	<i>Ficus hispida</i> Linn. Moraceae	Tikta, Kashaya	Shita	Shita	Katu	Kaphapittahara
7	Plaksha	<i>Ficus infectoria</i> Roxb. Moraceae	Kashaya	Shita	Shita	Katu	Pittakaphahara
8	Shirisha	<i>Albizzia lebbeck</i> Benth. Fabaceae	Madhura, Tikta, Kashaya	Laghu, Ushna	Ushna	Katu	Tridoshahara
9	Shaala	<i>Shorea robusta</i> Gaertn. Dipterocarpaceae	Kashaya	Ushna	Ushna	Katu	Kaphahara
10	Sarjaka	<i>Vateria indica</i> Linn. Dipterocarpaceae	Katu, Tikta, Kashaya	Ushna	Ushna	Katu	Kaphahara
11	Shallaki	<i>Boswellia serrata</i> Roxb. Burseraceae	Kashaya	Shita	Shita	Katu	Pittakaphahara
12	Shimshapa	<i>Dalbergia sissoo</i> Roxb. Fabaceae	Katu, Tikta, Kashaya	Ushna	Ushna	Katu	Kaphahara
13	Kakubha	<i>Terminalia arjuna</i> W. & A. Combretaceae	Kashaya	Shita, Graahi	Shita	Katu	Pittakaphahara
14	Bijaka	<i>Pterocarpus marsupium</i> Roxb. Fabaceae	Kashaya	Shita	Shita	Katu	Pittakaphahara
15	Khadira	<i>Acacia catechu</i> Willd. Mimosaceae	Tikta, Kashaya	Shita	Shita	Katu	Pittakaphahara
16	Shwetha Khadira	<i>Acacia suma</i> Buch. Ham Mimosaceae	Tikta, Kashaya	Shita	Shita	Katu	Kaphahara
17	Irimeda	<i>Acacia farnesiana</i> Willd. Mimosaceae	Kashaya	Ushna	Ushna	Katu	Kaphahara
18	Rohitaka	<i>Tecomella undulata</i> Seem. Bignoniaceae	Tikta, Kashaya	Shita	Shita	Katu	Kaphapitta Shamaka
19	Babbula	<i>Acacia arabica</i> Willd. Mimosaceae	Tikta, Kashaya	Ushna	Ushna	Katu	Kaphahara
20	Arishtaka	<i>Sapindus mukorossi</i> Gaertn. Sapindaceae	Tikta	Ushna, Snigdha	Ushna	Katu	Kaphahara
21	Putranjiva	<i>Putranjiva roxburghii</i> Wall. Euphorbiaceae	Madhura, Lavana, Katu	Guru, Shita	Shita	Katu	Shleshmavaatahruth
22	Ingudi	<i>Balanites roxburghii</i> Planch. Simaroubaceae	Tikta	Ushna	Ushna	Katu	Kaphaghna
23	Jingini	<i>Lannea coromandelica</i> Roxb. Anacardiaceae	Madhura, Katu, Kashaya, Lavana	Ushna, Graahi	Ushna	Katu	Kaphavata Shamaka
24	Tamala	<i>Garcinia morella</i> Desr. Guttiferae	Tikta, Kashaya	Ushna	Ushna	Katu	Kaphapitta Shamaka
25	Tooni	<i>Cedrela toona</i> Roxb. Meliaceae	Kashaya, Madhura, Tikta	Laghu, Graahi	Shita	Katu	Kaphapitta Shamaka
26	Bhurja	<i>Betula utilis</i> D. Don. Betulaceae	Kashaya	Ushna	Ushna	Katu	Kaphapitta Shamaka
27	Palasha	<i>Butea frondosa</i> Koen. Ex Roxb. Fabaceae	Kashaya, Katu, Tikta	Ushna, Sara, Snigdha, Laghu	Ushna	Katu	Kaphavaatahara
28	Shalmali	<i>Bombax malabaricum</i> DC. Bombacaceae	Madhura	Shita	Shita	Madhura	Vaatapittahara
29	Mocharasa	Gum of Silk Cotton Tree	Kashaya	Shita, Graahi, Snigdha	Shita	Katu	Kaphapittahara
30	Koota Shalmali	<i>Ceiba pentandra</i> Linn. Bombacaceae	Tikta, Katu	Ushna	Ushna	Katu	Kaphavaata Nashaka
31	Dhava	<i>Anogeissus latifolia</i> Wall. Combretaceae	Madhura, Kashaya	Shita	Shita	Katu	Pittakaphaapaha
32	Dhavanga	<i>Grewia tiliaefolia</i> Vahl. Tiliaceae	Kashaya	Laghu, Ruksha	Ushna	Katu	Kaphapittahara

Table 1 To Be Continued...							
33	Karira	<i>Capparis aphylla</i> Roth. Capparidaceae	Katu, Tikta	Ushna	Ushna	Katu	Kaphavaatahara
34	Shakota	<i>Streblus asper</i> Lour. Moraceae	Kashaya	Ushna	Ushna	Katu	Vaataashleshmahara
35	Varuna	<i>Crataeva nurvala</i> Buch. Ham. Capparidaceae	Kashaya, Madhura, Tikta, Katu	Ruksha, Laghu, Ushna	Ushna	Katu	Pittajanaka, Kaphahara
36	Katabhi	<i>Careya arborea</i> Roxb. Lecythidaceae	Katu	Ruksha, Ushna	Ushna	Katu	Kaphahara
37	Mokshaka	<i>Schrebera swietenoides</i> Roxb. Oleaceae	Katu, Tikta	Graahi, Ushna	Ushna	Katu	Kaphavaatahruth
38	Jala Shirishika	<i>Trichodesma zeylanicum</i> R. BR. Boraginaceae	Madhura, Tikta, Kashaya	Laghu, Ushna	Ushna	Katu	Tridoshahara
39	Shami	<i>Prosopis spicigera</i> Linn. Mimosaceae	Tikta, Katu, Kashaya	Shita, Laghu	Shita	Katu	Kaphahara
40	Saptaparna	<i>Alstonia scholaris</i> R. Br. Apocynaceae	Kashaya	Snigdha, Ushna, Sara	Ushna	Katu	Shleshma Vaatahara
41	Tinisha	<i>Ougeinia dalbergioides</i> Benth. Fabaceae	Kashaya	Shita	Shita	Katu	Kaphapittahara
42	Jaarula	<i>Lagerstroemia flos-reginae</i> Retz. Lythraceae	Kashaya	Shita	Shita	Katu	
43	Bhumisaha	<i>Tectona grandis</i> Linn. Verbenaceae	Kashaya	Shita, Graahi	Shita	Katu	Pittakaphahara

Table No 2: Karmas of Vataadi Varga Dravyas related to SARS CoV-19 <sup>[15]</sup>

Sl no	Drugs	Jwara	Kaasa	Shwaasa	Prathishyaaya	Rasayana	Krimighna	Vishagna
1	Vata							
2	Ashwatha							
3	Parisha							
4	Nandivruksha (Ashwatha Bheda)							+
5	Udumbara							
6	Kakodumbarika							
7	Plaksha							
8	Shirisha		+					+
9	Shaala							+
10	Sarjaka							+
11	Shallaki							
12	Shimshapa							+
13	Kakubha							+
14	Bijaka					+		+
15	Khadira	+	+					+
16	Shwetha Khadira						+	
17	Irimeda							
18	Rohitaka							
19	Babbula						+	+
20	Arishtaka							
21	Putranjiva							
22	Ingudi						+	+
23	Jingini							
24	Tamala							
25	Tooni							
26	Bhurja							+
27	Palasha						+	
28	Shalmali					+		
29	Mocharasa							
30	Koota Shalmali							+
31	Dhava							
32	Dhavanga		+					
33	Karira							
34	Shakota							
35	Varuna						+	

36	Katabhi						+	+
37	Mokshaka						+	+
38	Jala Shirishika							+
39	Shami		+	+			+	
40	Saptaparna			+			+	
41	Tinisha						+	
42	Jaarula							
43	Bhumisaha							

Table No 3: Pharmacological Activities of Vataadi Varga Dravyas related to SARS CoV-19

Sl No.	Dravya	Antiviral	Anti pyretic	Anti inflammatory	Anti-microbial	Immunomodulatory
1	Vata		+	+	+	+
2	Ashwatha	+		+	+	+
3	Parisha	+	+	+	+	+
4	Nandivruksha (Ashwatha Bheda)				+	
5	Udumbara		+	+	+	+
6	Kakodumbarika		+	+	+	
7	Plaksha				+	
8	Shirisha		+	+	+	+
9	Shaala		+	+	+	+
10	Sarjaka			+	+	
11	Shallaki	+		+	+	+
12	Shimshapa	+	+	+	+	+
13	Kakubha	+	+	+	+	+
14	Bijaka			+	+	+
15	Khadira	+	+	+	+	+
16	Shwetha Khadira		+	+		
17	Irimeda			+	+	
18	Rohitaka		+		+	
19	Babbula	+			+	
20	Arishtaka		+	+	+	
21	Putranjiva		+	+	+	+
22	Ingudi	+		+	+	+
23	Jingini		+	+	+	
24	Tamala			+	+	+
25	Tooni			+	+	
26	Bhurja	+		+	+	
27	Palasha			+	+	+
28	Shalmali	+	+	+	+	
29	Mocharasa					
30	Koota Shalmali	+	+	+	+	
31	Dhava		+	+	+	
32	Dhavanga		+	+	+	
33	Karira					
34	Shakota	+		+	+	
35	Varuna		+	+	+	
36	Katabhi				+	
37	Mokshaka		+	+	+	
38	Jala Shirishika			+	+	
39	Shami	+		+	+	+
40	Saptaparna	+	+	+	+	+
41	Tinisha				+	
42	Jaarula	+		+	+	
43	Bhumisaha	+	+	+	+	

Among the above mentioned 43 Dravyas, none of the Dravyas had all the seven Karmas ie Jwarahara, Kaasahara, Shwaasahara, Prathishyaayahara, Rasayana, Krimighna and Vishagna. When we look into the modern pharmacological

activities, five Dravyas i.e. Parisha, Shimshapa, Kakubha, Khadira and Saptaparna all have the stated activities like Antiviral, Antipyretic, Anti-inflammatory, Antimicrobial and Immunomodulatory activity.

Table No 4: Dravyas with their Karmas

Sl No.	Karma	No. of Dravyas	Dravyas
1	Jwarahara	1	Khadira
2	Kaasahara	4	Shirisha, Khadira, Dhanvanga, Shami
3	Shwaasahara	2	Shami, Saptaparna
4	Prathishyaayahara	0	NIL
5	Rasayana	2	Beejaka, Shalmali
6	Krimighna	10	Shweta Khadira, Babbula, Ingudi, Palasha, Varuna, Katabhi, Mokshaka, Shami, Saptaparna, Tinisha
7	Vishagna	15	Nandivruksha, Shirisha, Shaala, Sarjaka, Shimshapa, Kakubha, Beejaka, Khadira, Babbula, Ingudi, Bhurja, Kootashalmali, Katabhi, Mokshaka, Jala Shirisha

## 5. DISCUSSION

### 5.1. Probable mode of action through Rasapanchaka

The majority of the *Dravyas* in this *Varga* have *Katu-Tikta- Kashaya Rasa*, *Ushna Virya*, *Katu Vipaka* and *Kaphahara* action. *Agnimandya* leads to *Jwara* which is one of the symptom in SARS CoV-19 patients. According to *Acharya Charaka*, *Tikta Rasa* is the only *Rasa* advised during *Taruna Jwara* as it does *Aama Pachana* and acts as *Agni Deepaka* in addition to *Katu* rasa owing to their *Panchamahabhuta* constitution (*Tikta – Vayu* and *Akasha*, *Katu – Vayu* and *Agni*). None of the other *Rasa* can be perceived once *Tikta Rasa* is consumed but *Tikta Rasa* is said to be *Arochakaghna* and hence can be indicated in SARS CoV-19 patients with Anorexia. *Acharya Vagbhata* says *Katu Rasa* as *Ruchya* in addition to *Tikta Rasa*. *Ama* also leads to *Srotorodha* due to its *Picchila Guna* which can be seen in patients suffering from SARS CoV-19 and *Katu Rasa* has been told to possess *Dosha Sanghata* action by which it does *Vivarana* of the *Srotas*. This also correlates with the high titres of inflammatory markers like Serum ferritin and CRP which are usually associated with *Amavastha*. Hence necessitating the use of *Katu Rasa* for its *Shonitha Sanghatam Bhinatti* action and *Amapachaka* effect due to its *Laghu*, *Ushna* and *Ruksha Guna*.<sup>[5]</sup> Assuming virus as *Visha* and *Krimi*, *Tikta Rasa* which has been told as *Krimighna*, *Vishagna* can be recommended in this condition.

The initial stage of COVID-19 is exogenous (*Agantu*) which later on converts into systemic (*Nija*) disorder.

*Chakrapanidatta* specifies

that *Bhuta* means *Vishakrimi* or a virulent organism; *Krimi* may be *Sahaja* (natural) or *Vaikarika* (pathogenic) organisms which is visible (macroscopic) or invisible to the naked eye (microscopic). Therefore, SARS CoV-19 comes under *Vaikarika Krimi*. *Abhishangaja Jwara* (which is one of the forms of *Agantuja Jwara*) is the term for those caused by the contact of the poisonous air or toxic plants or other toxins (*Visha*).<sup>[4]</sup> *Agantuja* type of disease may later turn into *Sannipatika* state with severe prognosis. The viral, bacterial fevers, along with malignancy, auto immune diseases, etc. can be considered as *Sannipatika* state. In COVID-19 Primary expressions are seen at *Pranavaha Srotas* as virus enters through nasal passage. In Ayurveda *Vyavayi Guna* (the important Guna of *Visha*) makes pathogenesis rapid. *Gara Visha* is the Ayurvedic concept of toxins where *Gara* means the one digluted. *Ashtanga Sangraha* has stated that *Gara Visha* (A group of poisons where one can find ‘Combination of parts of the body and excreta of different animals enlisted) is fast acting. Thus *Visha* is an important consideration as there is speedy and lethal pathogenesis that affects the organs which can be fatal. The speediness is an important virtue in pathogenesis of SARS CoV-19.<sup>[13]</sup> However, this *Abhishangaja Jwara* later on involves multiple tissues and organs. Thus, *Abhishangaja Jwara* can be corelated with Covid-19.

Hence the *Dravyas* of *Vataadi Varga* which have been mentioned as *Jwarahara* (*Khadira*), *Krimighna* (*Shweta Khadira*, *Babbula*, *Palasha* etc) and *Vishaghna*

(*Shirisha, Shaala, Kakubha, Bijaka* etc) can be used in this purview.

## 5.2. Probable mechanism through which immunity prevents infections

SARS CoV-19 mainly alters the immune regulatory mechanism and also damages the immune homeostasis [9]. The immune response of SARS CoV-19 infection occurs in two phases: one of which is Defence phase - When a virus infects a person (host), it invades the cells of its host in order to survive and replicate. The cells of the immune system cannot visualise the virus and therefore do not know that the host cell is infected. To overcome this situation, cells employ a system which allows them to show other cells what is inside them - they use molecules which are called as class I major histocompatibility complex proteins (or MHC class I) to display pieces of protein from within the cell upon the cell surface. If the cell is infected with the virus, these pieces of peptide will include fragments of proteins made by the virus. A special type of cell of the immune system called as T cell circulates looking for infections. One of its type of T cell is called a cytotoxic T cell because it kills cells which are infected with viruses with toxic mediators. Cytotoxic T cells also have specialised proteins on their surface that help them recognise virally-infected cells. These proteins are called as T cell receptors (TCRs). Each cytotoxic T cell has a TCR protein which specifically recognise a particular antigenic peptide bound to an MHC molecule. If the T cell receptor detects a peptide from the virus, it warns T cell of an infection. The T cell then releases a cytotoxic factor to kill the infected cell and, therefore, prevents the survival of the invading virus [7]

*Rasayana* botanicals may inhibit viral replication through inhibition of coronavirus main protease (Mpro) and RNA-dependent RNA-polymerase (RdRp) thereby inhibiting RNA synthesis of SARS-CoV-2. This may lead to its life cycle arrest. The multi-targeted immunomodulatory and adaptogenic potential of *Rasayana*

botanicals are predicted by network pharmacology approach. The *Rasayana* botanicals affect physiological inflammatory response by downregulating pro inflammatory mediators [8]

Wahab S et al., (2013) reported that *Bombax ceiba* has the ability to modulate humoral immune responses by acting at different levels in immune mechanism such as antibody production, release of mediators of hypersensitivity reactions, and the tissue responses to these mediators in the target organs. In their study, foot volume was enhanced after *Bombax ceiba* treatment, suggesting cell-mediated immune enhancement. Cell-mediated immunity (CMI) involves effector mechanisms carried out by the T lymphocytes and their products (lymphokines). The CMI responses are critical to act against infectious organisms, infection of foreign grafts, tumour immunity and delayed type hypersensitivity reactions. In the present study, *Bombax ceiba* exhibited a beneficial action on the specific and nonspecific immunity of immune suppressed mice at the optimal dose level. [10]

Thus *Rasayana Dravyas* mentioned in this *Varga* like *Beejaka* and *Shalmali* can act as immunomodulator, by strengthening the immunity.

## 5.3. Cytokine storm and inflammation

Damage phase - If the body's defence system or prophylactic treatment fails to regulate the viral entry and its clearance, the body activates strong inflammatory response resulting in cytokine storm in which there is uncontrolled release of cytokine that causing cytokine release syndrome (CRS), or 'cytokine storm' characterized by increased Interleukin2 (IL-2), Interleukin7 (IL-7), IFN-gamma, tumour necrosis factor (TNF)-alpha4 etc. Cytokine release syndrome (CRS) damages tissues of the lungs, kidney and heart which leads to severe complication like acute respiratory distress syndrome (ARDS), respiratory failure and death [9]. Briefly, the internalization of SARS CoV-2 eventually

ends up in secretion of enormous quantities of pro inflammatory cytokines. This gives rise to engagement of immune cells at the infected site. The current data indicates the potential of the *Dravyas* mentioned in this *Varga* to interfere with this signalling pathway which are proved to be anti-inflammatory.<sup>[8]</sup>

Zhao YL et al., (2013) stated that, *Alstonia scholaris* (Apocynaceae) has been traditionally used for the treatment of respiratory diseases in "dai" ethnopharmacy for hundreds years, especially for cough, asthma, phlegm, chronic obstructive pulmonary disease and so on. They investigated the protective activity of total alkaloids (TA), extracted from the leaves of *Alstonia scholaris*, against lipopolysaccharide (LPS)-induced airway inflammation (AI) in rats. It was found that Total alkaloids decreased the percentage of neutrophil, number of WBC, levels of ALB (albumin), AKP (alkaline phosphatase) and LDH (lactate dehydrogenase) within the BALF (Broncho alveolar lavage fluid), while increased the content of ALB in serum. It also improved SOD (superoxide dismutase) activity and increased NO (Nitric oxide) level within the lungs, serum and BALF, and reduced the concentration of MDA (malondialdehyde) in the lungs. Total alkaloids also inhibited the production of inflammatory cytokines TNF- $\alpha$  and IL-8 in the BALF and lung. Finally, histopathological examination indicated that total alkaloids attenuated tissue injury of the lungs in LPS-induced AI.<sup>[11]</sup>

#### 5.4. Increased vascular permeability

The macrophage-mediated inflammatory cytokines usually causes the contraction of endothelial cells of blood vessels which leads to increase in vascular permeability. This increases migration of immune cells to occupy alveolar space.<sup>8</sup> The *Vivarana* property of the *Katu Rasa* due to its *Ushna Guna* thus may act at the level of endothelial cells leading to their normalcy by dilating them or at the alveolar level by

letting out the immune cells out of the alveolar space.

P Mishra et al., (2022) stated that, Acute inflammation, micro vascular damage, and increased lung vascular and epithelial permeability are all characteristics of ARDS (Acute Respiratory Distress Syndrome). Combination of alveolar epithelial cells and capillary vascular cells is also involved in the condition. Endothelial injury, on the opposite hand, is more common. There is a leakage of fluids and proteins into the interstitium in ARDS condition due to increased permeability of the capillaries. Fluids, red blood cells, and neutrophils enter the alveolar space through the injured epithelial cells subsequently. In the exudative phase of ARDS, interstitial and alveolar edema are more common. Pharmacologically *Albizia lebeck* is employed in treatment of various respiratory ailments including bronchial asthma. In the current study, phytoconstituents of *Albizia lebeck* were analyzed using molecular docking software and the best docked compounds were further processed for drug-likeness and ADMET profile analysis using Lipinski Rule of Five and ADMET SAR studies. Molecular docking study revealed that 19 out of 59 phytochemicals from *Albizia lebeck* showed significant binding affinity with TLR-4, Nf-kB IL-6, TNF-alpha, of inflammatory cascade. ALI (Acute Lung Infection) is a clinical condition of respiratory distress which involves deregulated inflammatory system. It begins with accumulation of fluid within the alveolar region because of infiltration of neutrophil. Neutrophils serve as the defense mechanism regulated by macrophage polarization in normal situation. However, under the influence of endotoxins the toll like receptors (TLR-4) are activated and that they secrete chemokine to flush out the invading pathogens. In ALI/ARDS this mechanism goes out of control especially in cases of septicemia influenced ARDS and creates storm of inflammatory cytokines. From the molecular docking study, it was found that phytoconstituents from *Albizia*



lebbeck such as Globularicitrin (9.94 kcal) and Vicenin-2 (9.64 kcal) showed significant binding energy suggesting that they will down regulate TLR-4 receptors in ARDS condition and may save the patient from deleterious effects. [12]

### 5.5. Alveolar consolidation

The engagement of immune cells and the extent of cytokine secretion consolidate the alveolar spaces. Production of surfactants by pneumocytes defines the severity leading to dyspnea or shortness of breath [8]. *Ushna, Ruksha, Laghu Guna* of the *Dravyas* mentioned in this *Varga* causes *Upashoshana* of *Sneha, Kleda, Puya* which can be related to the clearance of surplus fluid in alveoli and keeps alveolar space dry<sup>6</sup>. Hence the *Dravyas* of this *Varga* can be considered as the drug lead/candidates due to such *Gunas* to overcome symptoms of dyspnea thus preventing the progression of the disease to Pneumonia, Pulmonary edema, Pleural effusion and so on.

Thus, the *Dravyas* of this *Varga* may act as lead candidate in tackling the Covid-19 virus right from the entry of the virus up to the arresting of the virus replication. These *Dravyas* may also have a synergistic action with treatment from other system in case of advanced stages of Covid-19.

In addition to this, the *Panchavalkala* (*Nyagrodha, Udumbara, Ashwatha, Plaksha* and *Parisha*) has been said to possess Anti-inflammatory, Antimicrobial and Immunomodulatory activity. [16], [17], [18]

A study on *Ashwatha* tree which releases oxygen even during night hours has been done to evaluate the oxygen molecule by Spectrophotometer. Tahakik RR et al., (2017) quoted that Oxygen plays important role in cellular metabolism. It acts as a catalyst for all cell when sufficient oxygen and nutrient available cell performs optimum level with less energy. It stimulates cell division, Immune response, decrease level of stress hormone. This study shows, ficus plant contains high amount of oxygen, which is 203 mg/dl. When leaf extract consume this oxygen entered in cell

and helps in smooth functioning and performs optimum level of cell metabolism with less energy. Oxygen molecule plays an important role in photosynthesis. This process also consumes carbon-dioxide from atmosphere and ends up with carbohydrate and oxygen. By this method amount of oxygen released in photosynthesis can be calculated and also carbon-dioxide consumption by RQ (Respiratory Quotient). Thus respiration and photosynthesis are interlinked and feed reactant to each other. Oxygen also destroys the harmful bacteria in our bodies without affecting the homeostasis. Hence determining oxygen value beneficial in areas of plant physiology and environmental biology, medical pharmacology. [19]

Though many of the *Dravyas* mentioned in this *Varga* do not have all the *Karmas* like *Jwarahara, Kaasahara, Shwaasahara, Prathishyaayahara, Rasayana, Krimighna and Vishagna*, they have been found to have Antiviral, Anti pyretic, Anti-inflammatory, Anti-microbial and Immunomodulatory activity either in permutation and combination which may have impact in restoring the physiological state of SARS CoV-19 patients. Hence such *Dravyas* can be considered as drugs of choice to treat SARS CoV-19 related signs and symptoms.

### 5.6. Correlation of Loka-purusha Samya Vada

*Acharya Charaka* has mentioned “*Purushoayam loka sammitah*” in *Sharirasthana* which means that human body and the universe or the nature are similar to each other. Whatever is enclosed in the universe is present in the human body as organs or the structures. Similar relation can be seen between the trees and the alveoli of the lungs. *Vataadi varga* of *Bhavaprakasha* deals only with the trees whereas in SARS CoV-19 the virus directly impacts the lungs as 83% of ACE2 cells are available at alveolar epithelial type II cells (ACE II) and thus damages the alveoli. Hence the *Dravyas* mentioned in this *Varga* may have direct action on the primary target

of the disease.

## 6. CONCLUSION

Among Forty-three *Dravyas* mentioned in *Vataadi Varga* of *Bhavaprakasha Nighantu*, one *Dravya* was found to have *Jwarahara*, four *Dravyas* have *Kaasahara* action, two *Dravyas* *Shwaasahara*, none of them had *Pratishyaayahara* action, ten *Dravyas* have *Krimighna* action, fifteen *Dravyas* have *Vishagna* action and two *Dravyas* have been told to possess *Rasayana* activity individually or in permutation and combination. Certain pharmacological activities related to SARS CoV-19 like Antiviral, Anti pyretic, Anti-inflammatory, Anti-microbial and Immunomodulatory were screened for the *Dravyas* of *Vataadi Varga*.

Further research needs to be done to validate the action of *Vataadi Varga Dravyas* on SARS CoV-19 and other related viral disorders.

**Conflict of Interest:** None

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How to cite this article: Ramya Rao, Naveen V, Seema Pradeep. Potential of Vatadi Varga from Bhavaprakasha Nighantu and its role in trouncing SARS-CoV-19 – a comprehensive review. *Int J Health Sci Res*. 2022; 12(10):105-115.

DOI: <https://doi.org/10.52403/ijhsr.20221014>

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