

## INDIAN COSTUS IN ISLAMIC, AYURVEDA, TCM AND MODERN MEDICINE, A REVIEW ON ANTIMICROBIAL ACTION

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### ABSTRACT

Indian Costus species has been mentioned as an herbal remedy for infections in Islamic, Ayurveda and Traditional Chinese Medicine (TCM) literature as well. Using the Indian costus to treat disease is one of the cross-cultural practices, just like cupping therapy and meditation. This would mean that it is safe and beneficial. In the saying (Hadith) of the prophet of Islam, it was prescribed to treat pharyngitis and pleurisy (Ahmad et al., 2009). In TCM, Costus root (Guang Mu Xiang) powder is used to treat gastroenteritis and tenesmus (Nystrom, 2015). In Ayurveda, it is used as a spasmolytic and antiparasitic for intestinal disease (Pandey et al., 2007). Among the pharmacological benefits of costus is the antimicrobial effect. This includes the antibacterial, antiviral, antifungal and antiparasitic action of the substances to be discussed here. We did a focus on the antimicrobial effect in the three systems, compared and concluded findings through modern medicine to verify the evidence here.

**Keywords:** *Islamic, Ayurveda, TCM, Costus, antibacterial, anti-fungus, anti-viral, anti-parasitic.*

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## 1. INTRODUCTION

Before fourteen centuries at least, that ancient species, the Indian costus was described in the Chinese, Indian and Arabic culture as a broad-spectrum remedy with seven cures. What Arabs used to call as “Indian costus” may include *S. lappa*, *C. speciosus* (Al-Kustul Hindi) and may be *Costus pectus* or *Inula recemosa* Hook. f. (Al-Kustul Bahri).

Then that valuable plant species reputation grew more and more to be a national treasure that is now prone to eradication because of the unwise consumption by investors.

Based on a search of the databases of Google Scholar, PubMed, Science Direct, and Springer Link, this review provides an account of unique investigations on Indian costus antimicrobial new and traditional uses of the herb.

Being one of the cross-cultural remedies (as Indian costus herbal remedy, cupping therapy - Hijama, needling and meditation), it is getting more supported by solid scientific evidence studies nowadays (Hussein, Negm, Shaikh, & Saleh, 2023).

The recent studies on Indian costus found it rich and beneficial as described in the advice of our ancestors in traditional medicine. A folkloric historical review would help us explore the ancient uses and increase the scope of research to verify and adjust practice according to the new advances available now. Medical applications of Indian costus include treating pharyngitis, headaches, hirsutism, decongestant, improving Parkinsonism, constipation, vaginal discomfort, and TB (Table – 1.) (Ahmad et al., 2009).

## 2. DISCUSSION

**TABLE -1. COMPARISON BETWEEN THE ANTIMICROBIAL USES OF INDIAN COSTUS IN THE THREE SYSTEMS:**

Islamic Prophetic Medicine	Ayurveda	Traditional Chinese Medicine
Upper respiratory tract infection.	Respiratory tract infection.	Stomach and spleen qi stagnation syndrome.
Lower respiratory tract infection with pleurisy.	Ulcers. Gastritis.	Diarrhea and dysentery with tenesmus due to qi stagnation of large intestine.
Gastro enteritis, colitis.	Parasitic infestations.	Liver and gallbladder qi stagnation syndrome (e.g., viral hepatitis and jaundice).
Infected wounds and ulcers.	Leprosy.	
Puerperal sepsis.	High fever.	

## Taxonomic classification

Scientific Latin name: *Saussurea lappa* L.

English Name: *Costus*

Local Name: Kuth

Arabic Name: Al-Kustul Bahri, Al-Kustul Hindi, Al-O'oudul Hindi

Family: Asteraceae.

Habit and Habitat: Annual wild herb.

Distribution: European countries, In Pakistan (Kashmir and Northern Areas).

Parts used: Roots (Ahmad et al., 2009).

## 2.1 Islamic Medicine perspective of Indian costus

*Costus speciosus* is one of the most potent traditional Islamic medicines. The reliable Hadith included in Sunan Abi Dawud's Book of Medicine (Kitab Al-Tibb) attests to this (El-Far et al., 2018).

It was mentioned in Ahadith of Muhammad, the prophet of Islam PBUH That:

حَدَّثَنَا صَدَقَةُ بْنُ الْفَضْلِ، أَخْبَرَنَا ابْنُ عَيْنِيَّةَ، قَالَ سَمِعْتُ الرَّهْرِيَّ، عَنْ عَبْدِ اللَّهِ، عَنْ أُمِّ قَيْسِ بِنْتِ مِخْصَنٍ، قَالَتْ سَمِعْتُ النَّبِيَّ صَلَّى اللَّهُ عَلَيْهِ وَسَلَّمَ يَقُولُ " عَلَيْكُمْ بِهَذَا الْعُودِ الْهِنْدِيِّ، فَإِنَّ فِيهِ سَبْعَةَ أَشْفِيَةٍ. يُسْتَنْعَطُ بِهِ مِنَ الْعُدْرَةِ، وَيُلْدُّ بِهِ مِنْ دَاتِ الْجَنْبِ ". وَدَخَلْتُ عَلَى النَّبِيِّ صَلَّى اللَّهُ عَلَيْهِ وَسَلَّمَ بِإِنِّي لَمْ يَأْكُلِ الطَّعَامَ فَبَالَ عَلَيْهِ، فَدَعَا بِمَاءٍ فَرَسَّ عَلَيْهِ.

**Figure 1. A: First Hadith On Indian Costus, Arabic Language.**

That means: The Prophet (PBUH) is reported to have said, "Treat with the Indian incense, for it has healing for seven diseases; it is to be sniffed by one having throat trouble, and to be put into one side of the mouth of one suffering from pleurisy." Figure 1.A.

A kid of mine who was breast fed (unable to eat yet), when I went to Allah's Messenger spilled pee on him, the Messenger called for some water and sprinkled it over the area where the urine had been. (Rassool & Morris, 2020), (Al Zamil, 2019).

Also:

حَدَّثَنَا مُحَمَّدُ بْنُ مُقَاتِلٍ، أَخْبَرَنَا عَبْدُ اللَّهِ، أَخْبَرَنَا حُمَيْدُ الطَّوِيلُ، عَنْ أَنَسٍ - رَضِيَ اللَّهُ عَنْهُ - أَنَّهُ سُئِلَ عَنْ أَجْرِ الْحَجَّامِ، فَقَالَ اخْتَجَمَ رَسُولُ اللَّهِ صَلَّى اللَّهُ عَلَيْهِ وَسَلَّمَ حَجَمَهُ أَبُو طَيْبَةَ، وَأَعْطَاهُ صَاعَيْنِ مِنْ طَعَامٍ، وَكَلَّمَ مَوْلَاهُ فَخَفَّفُوا عَنْهُ، وَقَالَ " إِنَّ أُمَّتَلَّ مَا تَدَاوَيْتُمْ بِهِ الْحَجَّامَةَ وَالْفُسْطُ الْبَحْرِيُّ ". وَقَالَ " لَا تُعَذِّبُوا صِبْيَانَكُمْ بِالْعَمَزِ مِنَ الْعُدْرَةِ، وَعَلَيْكُمْ بِالْفُسْطِ ".

**Figure 1. B: Second Hadith On Indian Costus, Arabic Language.**

Which means: Anas reported that he was questioned regarding the pay of the person who cups other people. He claimed, "Allah's Messenger was cupped by 'Abou Taiba, to whom he gave two units of food and made a plea on his behalf to his superiors, who subsequently decreased what they used to demand of him every day. The Prophet then declared, "Cupping

and sea incense are the greatest medications you may use to heal yourself. He said, "You should not torture your children by treating tonsillitis by pressing the tonsils or the palate with a finger, but instead use incense." (عزیزی & یونس, 2021), (Figure 1.B).

Thus, the costus root powder can be sniffed to treat painful pharyngeal conditions like pharyngo - tonsillitis or adenoid in children and its decoction can be poured sublingual in the side of the mouth to treat pleurisy of different cause (as pleurisy rarely come isolated thus costus also treats pneumonia) other than that five cures are there in Indian incense.

The author of Tibb-e-Nabawi book mentioned its benefit for diarrhea, constipation, flatulence, and gut worms. Also, it is mixed with honey as paint for vitiligo, soaked in olive oil as a fomentation for painful joints, its powder sprinkled on the infected wounds to control infection, and its vapor helps the hygiene of female genital tract during menses and puerperium (Al-Jozi (Aljawziyya)).

The summation of that makes seven main uses or seven cures. In the Arabic language, the number "seven" cures may mean a big number of cures, which agree with a lot of benefits mentioned later.

## 2.2 Ayurveda perspective of Indian costus:

Saussurea lappa treats asthma, inflammatory illnesses, ulcers, and stomach issues. It is a well-known and significant medicinal plant that is utilized in many traditional systems of medicine (Pandey et al., 2007).

In Indian traditional medicine, the rhizomes, and roots of *C. speciosus* are said to offer anthelmintic, anti-inflammatory, anti-diabetic, hepatoprotective, anti-hyperlipidemic, antispasmodic, and antibacterial properties. This is evident from folklore. Additionally, individuals with high fevers might take a bath with *C. speciosus* leaf extract.

Leprosy and headache alleviation are historically treated with rhizome juice administered with sugar. Additionally, an extract of its alkaloid is employed as a muscle relaxant with antispasmodic properties. Southeast Asia also consumes *C. speciosus* as a plant food (El-Far et al., 2018).

As above mentioned, Indian costus is a treatment of Leprosy. That was stated in Ayurveda textbook, V. Ayurveda series 54 by Chaukhamba Bharati Academy. Figure 2. A, B. (Ismaeil, 2008).

Kustha has been known for its healing properties since ancient times. Atharvaveda regards it as a powerful plant, second only to Soma (a divine plant), in treating various ailments. Atharvaveda also refers to Kustha as Takmanashana, which means it can cure fevers. Kustha is found in the Himalayas and Kashmir, and in Ayurveda, its root is used to treat fevers, skin diseases, headaches, and other conditions. Kustha is described in almost all Nighantus with various synonyms. Some scholars believe that there are two types of Kustha, sweetish and bitter, but the one with a bitter taste is the true Kustha.

In the market, Pushkarmool (*Inula racemosa* Hook.f.) is available as the sweet variety of Kustha (Al-Kustul Bahri).

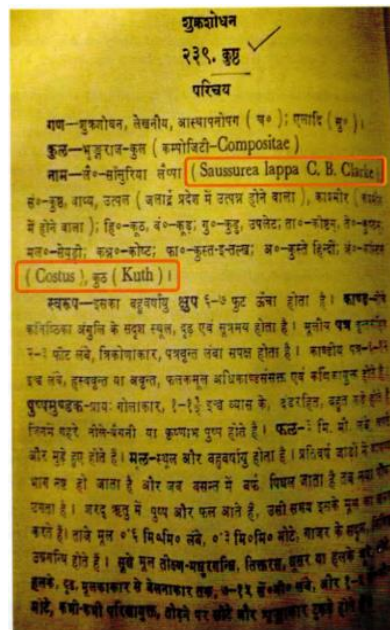
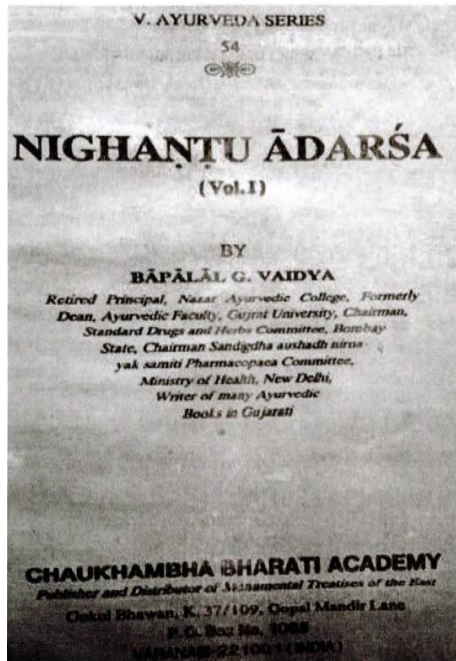


Figure 2. (A, B): Ancient Antimicrobial Uses Of Indian Costus In Ayurveda. (P:92, 93) (Ismaeil, 2008)

The word "Kustha" is derived from "Krushnaati rogam," which means the plant ploughs out or drags out the disease from the body. This is the etymological origin of the term (Prasad).

### 2.3 TCM perspective of Indian costus:

The Chinese Herbal Pharmacopoeia's "Regulate Qi" subcategory includes Mu Xiang, which translates to "wood fragrance" and is also known as Radix Auclandiae Lappe or Costus root.

Every herb is classified according to its taste and temperature and which organs/ channels it goes to. Mu Xiang is acrid, bitter, and warm and because of how this herb works we know, in the Chinese Pharmacopoeia, that the "channels" or organs Mu Xiang enters is the Gallbladder, Large Intestine/Colon, Spleen and the Stomach. Due to the acrid, bitter, and warm properties Mu Xiang is contraindicated for use with patients who have depleted fluids and yin (Nystrom, 2015).

### 2.4 Antibacterial activity, a modern approach:

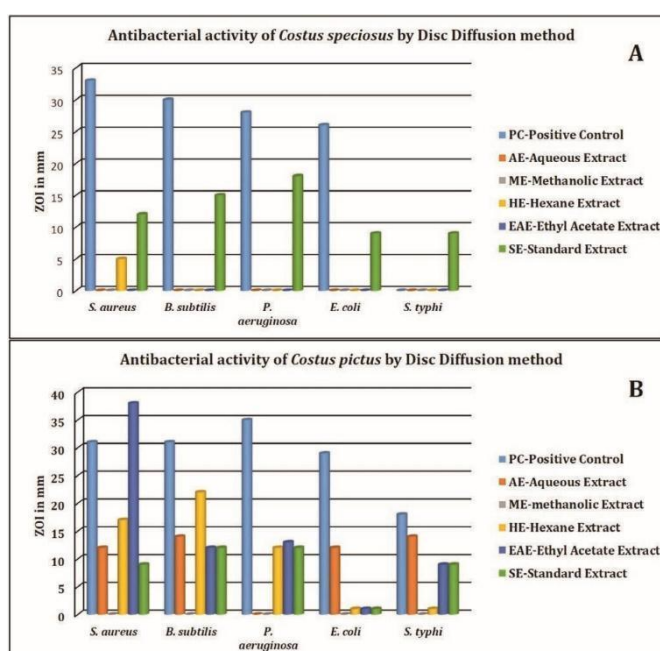
Hexane and methanol extracts of *C. speciosus* leaf and rhizomes made an inhibition zone towards *Shigella* spp., *Staphylococcus aureus*, *Escherichia coli*, *Klebsiella pneumoniae*, *Pseudomonas* spp., *Bacillus subtilis*, and *Salmonella* spp. in comparison to silver sulfadiazine cream (El-Far et al., 2018).

Compared to the standard Gentamycin zone, Table 2. Demonstrates the Anti-microbial activity of *Costus speciosus* rhizome extract against both Gram-positive and Gram-negative organisms (Ariharan, Devi, Rajakokhila, & Prasad, 2012).

An interesting factor observed in the study is that, in the habitat of *C. speciosus* there was no incidence of any bacterial, fungal, viral or pest diseases in the plant organs. Most probably due to the preservative effect of the Indian costus. It may be due to the presence of phenolics and alkaloid substances. A good Indian study had the antibacterial and antifungal activities of *Costus speciosus* (Koen ex.Retz.) tested using disc diffusion method and minimum inhibitory concentration (MIC). Figure 3, Table 3 (Shaikh, Bawazir, & Yahya, 2022).

**TABLE – 2. ANTIMICROBIAL ACTIVITY OF COSTUS SPECIOUS RHIZOME EXTRACT**

S. No	Bacterial Strains	Inhibition zone (mm)	Standard Gentamycin (mm)	Percentage of inhibition
I Gram positive organism				
1.	<i>Staphylococcus aurea</i>	15.5	21	74
2.	<i>Staphylococcus epidermidis</i>	12.9	18	72
II Gram negative organism				
1.	<i>Escherichia coli</i>	8.3	15	55
2.	<i>Pseudomonas aeruginosa</i>	15.4	27	57
3.	<i>Salmonella typhimurium</i>	18.0	31	58



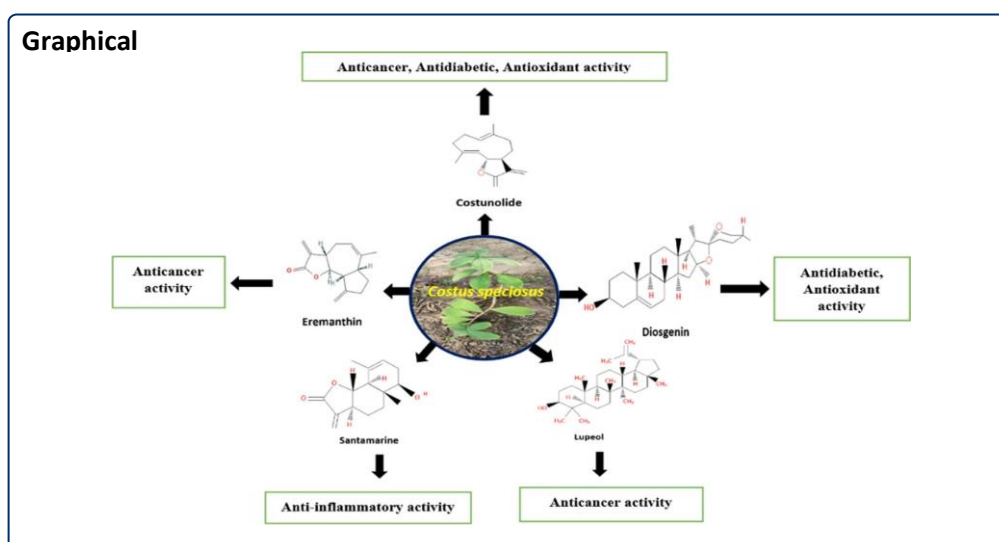
**Figure 3. Graphical Representation Of The Zone Of Inhibition Achieved By Disc Diffusion Method (Shaikh Et Al., 2022)**

**TABLE – 3. DISK DIFFUSION MEHTOD RESULTS (Shaikh et al., 2022).**

Microorganism	Zone of inhibition (in m)											
	<i>Costus speciosus</i>						<i>Costus pictus</i>					
	PC <sup>a</sup>	AE <sup>b</sup>	ME <sup>c</sup>	HE <sup>d</sup>	EAE <sup>e</sup>	SE <sup>f</sup>	PC	AE	ME	HE	EAE	SE
<i>Staphylococcus aureus</i>	33	-	-	5	-	12	33	-	-	-	11	12
<i>Bacillus subtilis</i>	30	-	-	-	-	15	3	-	80	-	12	13
<i>Pseudomonas aeruginosa</i>	28	-	-	-	-	18	25	-	70	-	10	1
<i>Escherichia coli</i>	26	-	-	-	-	9	26	-	80	-	80	9
<i>Salmonella typhi</i>	-	-	-	-	-	9	-	-	14	60	60	9

aPC: Positive control, bAE: Aqueous extract, cME: Methanolic extract, dHE: Hexane extract, eEAE: Ethyl acetate extract, fSE: Standard extract

In Figure 3. A. (regarding costus speciosus), Figure 3. B. (regarding costus pectus) a graphic representation of the anti-bacterial activity against *S. aureus*, *B. subtilis*, *P. aeruginosa*, *E. coli* and *S. typhi* was demonstrated.



**Figure 4. Active Ingredients Contained In The Costus Speciosus With Eminant Curable Effects (Sohrab, Mishra, & Mishra, 2021).**

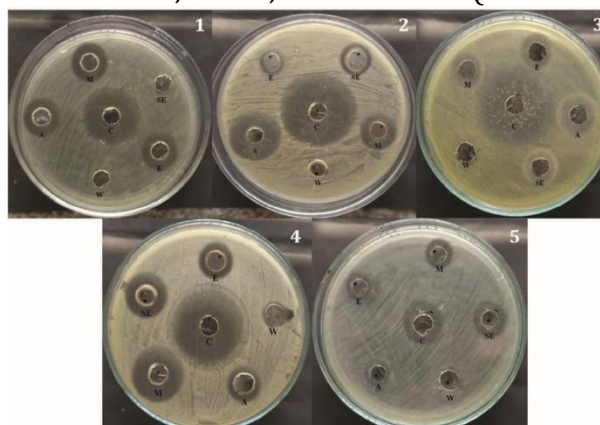
Column chromatography was used to isolate compounds from hexane extract. X-ray crystallography technique and GC-MS analysis were used to identify the compounds.

Antibacterial and antifungal activities were observed in hexane, chloroform, ethyl acetate and methanol extracts. Hexane extract showed a promising antibacterial and antifungal activity while the isolated compound costunolide showed a good antifungal activity (Duraipandiyan, Abdullah Al-Harbi, Ignacimuthu, & Muthukumar, 2012).

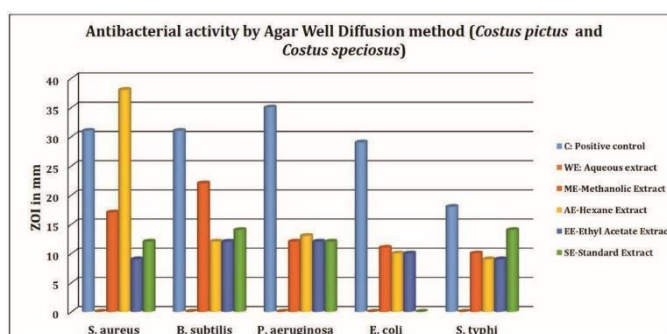
A group of active ingredients contained in the *costus speciosus* plant gave it much valuable curable effects on malignant tumors, antidiabetic, antioxidants and anti-inflammatory as well. Figure 4 (Sohrab et al., 2021).

Since the pharmaceutical companies commercially exploit this plant, its conservation status is deteriorating, and it is already in a precarious position, more attention needs to be paid to it. As a result, more thorough, systematic research must be conducted in a sustainable way (Sohrab et al., 2021).

The biofilm protective development in pathogenic bacteria through the process of QS (quorum sensing) enables bacteria to tolerate higher concentrations of antibiotics to make them not useful. In this study, specioic acid showed an eminent effect with MIC values of 150, 400, and 550 µg/mL towards *S. aureus*, *E. coli*, and *B. cereus* (Ibrahim et al., 2019).



**Figure 5. Zone Of Inhibition For Agar Well Diffusion (1) Escherichia Coli (2) Pseudomonas Aerogenosa (3) Staphylococcus Aureus (4) Salmonella Typhi (5) Bacillus Subtilis (Shaikh Et Al., 2022).**



**Figure 6. Graphical Representation Of The Zone Of Inhibition Achieved By Agar Well Difusion Method (Shaikh Et Al., 2022).**





Figure 7. *Costus speciosus* plant parts (Shaikh et al., 2022).  
flowers (B) rhizomes (C) whole plant of *C. speciosus*.



Figure 8. *Costus pictus* plant parts (Shaikh et al., 2022).  
(A) flowers (B) roots (C) whole plant of *C. pictus*.

**TABLE – 4. AGAR WELL DIFFUSION METHOD RESULT (Shaikh et al., 2022).**

Agar well diffusion method results						
Microorganism	Zone of inhibition (mm)					
	PC <sup>a</sup>	<i>Costus speciosus</i> (SE <sup>f</sup> )	<i>Costus pictus</i>			
			AE <sup>b</sup>	ME <sup>c</sup>	HE <sup>d</sup>	EAE <sup>e</sup>
<i>Staphylococcus aureus</i>	31	12	-	17	38	9
<i>Bacillus subtilis</i>	31	14	-	22	12	12
<i>Pseudomonas aeruginosa</i>	35	12	-	12	13	12
<i>Escherichia coli</i>	29	-	-	11	10	10
<i>Salmonella typhi</i>	18	14	-	10	9	9

aPC: Positive control, bAE: Aqueous extract, cME: Methanolic extract, dHE: Hexane extract, eEAE: Ethyl acetate extract, fSE: Standard extract

Another comparative study between the antibacterial effect of the most famous two members of this plant family especially in India and gulf region herbal shops, viz. *costus speciosus* (CS) and *costus pectus* (CP) is growing valuable, Figure 7,8 demonstrates both plant morphology and Table 4. demonstrate the antibacterial effect through the agar well diffusion method. (Shaikh et al., 2022).

This pharmacognostic investigation of CS and CP provided crucial insights into the morphology of crude costus. They may be utilized for CS and CP authentication across all *Costus* spp. These medications' purity and adulteration can both be identified.

The comparative study and antibacterial potential against certain bacterial infections have not yet been documented. In addition, the originality of the current work is to distinguish between the activity of bacterial strains that are Gram-positive and Gram-negative.

The antibacterial activity of (CP) against *S. aureus* may rise by two folds, yet (CP) exhibits comparable activity to PC (positive control). The findings suggest that both plants may have antibacterial potential, resulting in bioactive chemicals that are helpful in basic healthcare. There is a need to investigate the mechanism of antibacterial action and the separation, characterization, and purification of the active ingredients (Shaikh et al., 2022).

## 2.5 Antifungal activity:

The minimal inhibitory concentration values for costunolide (active ingredient of *S. lappa*) antifungal effect were significant at 62.5 g/ml against *Trichophyton mentagrophytes*, 62.0 g/ml against *Trichophyton simii*, 125 g/ml against *Epidermophyton floccosum*, 31.25 g/ml against *Trichophyton rubrum*, 125 g/ml against *Curvularia lunata* and 62.5 g/ml against *T. rubrum* (El-Far et al., 2018).

According to a different research paper, specioic acid has a strong antifungal impact on *C. albicans* (MIC 320 g/mL). Quorum sensing inhibitory (QSI) activity was seen in most of the tested fractions against *C. violaceum* (Ibrahim et al., 2019).

## 2.6 Antiparasitic (Anthelmintic) activity:

*Trypanosoma cruzi*, *Clonorchis sinensis*, and various Nematoda infections were tested for *Saussurea costus*' antiparasitic potential.

When *Saussurea costus* decoction was given orally to rabbits that had been exposed to *Clonorchis sinensis* to evaluate its in vivo clonorchicidal activity, the effects on the rabbits' ability to lay eggs were seen to be moderately suppressive (Rhee, 1985).

Based on percentage decreases in the number of fecal eggs per gram (EPG) in children who were naturally infected with the relevant worms, *Saussurea costus*' antinematode effectiveness was examined. In the doses examined, it did not cause any unfavorable side effects and included active ingredients that were efficient against nematodes (Akhtar and Riffat, 1991). The epimastigote form of *Trypanosoma cruzi*, clone Bra C15 C2, was evaluated in vitro with *Saussurea lappa* methanolic extract at 27 °C in F-29 medium at a concentration of 100 g/ml in axenic cultures. The reference medication utilized was allopurinol. The inhibitory activity of an extract of *Saussurea lappa* was 100% (Pandey et al., 2007).

## 2.7 Antiviral activity:

It is essential to research *Costus speciosus* antiviral abilities against increasingly prevalent illnesses such infectious viral hepatitis, avian influenza, and human immunodeficiency viruses (El-Far et al., 2018).

Another study purpose was to evaluate the antiviral activity of a plant extract derived from the roots of the *Saussurea lappa* against SARS-CoV-2 infection. Where Vero E6 cells were employed to test the neutralizing effect of Indian costus against that virus.

A sensitive real-time cell analyzer (xCELLigence RTCA) with a high repetition rate is employed to identify anti-viral activity. A difficult mouse experiment was planned because of the in vitro study.

Ten mature female K18-hACE2 transgenic mice are used in each group for a challenge test against SARS-CoV-2. The *S. lappa* Group mice are gavaged two days before the virus is given intravenously. Instead of the extract, the control group was given PBS (phosphate buffered saline).

For the first three days of the experiment, the SARS-CoV-2 virus was provided intranasally while the *S. lappa* extract was given by gavage in the afternoon. Mice in the *S. lappa* group continued to live through the study's 10th day, whereas animals in the control group did not.

Thus, the *Saussurea* plant has antiviral properties against SARS-CoV-2 in vitro and in animal models, and the extract protects the mice against the SARS-CoV-2 virus in 90% of the instances (Ulbegi Polat et al., 2023).

Schematic illustration of an in vivo experiment to evaluate the effectiveness of *S. lappa* extraction. SARS-CoV-2 (Wuhan) isolates were administered to human ACE2 (hACE2)-expressing mice for 3 days before they began receiving *S. lappa* extract for 8 days beginning on the third day after infection (n = 10/group).

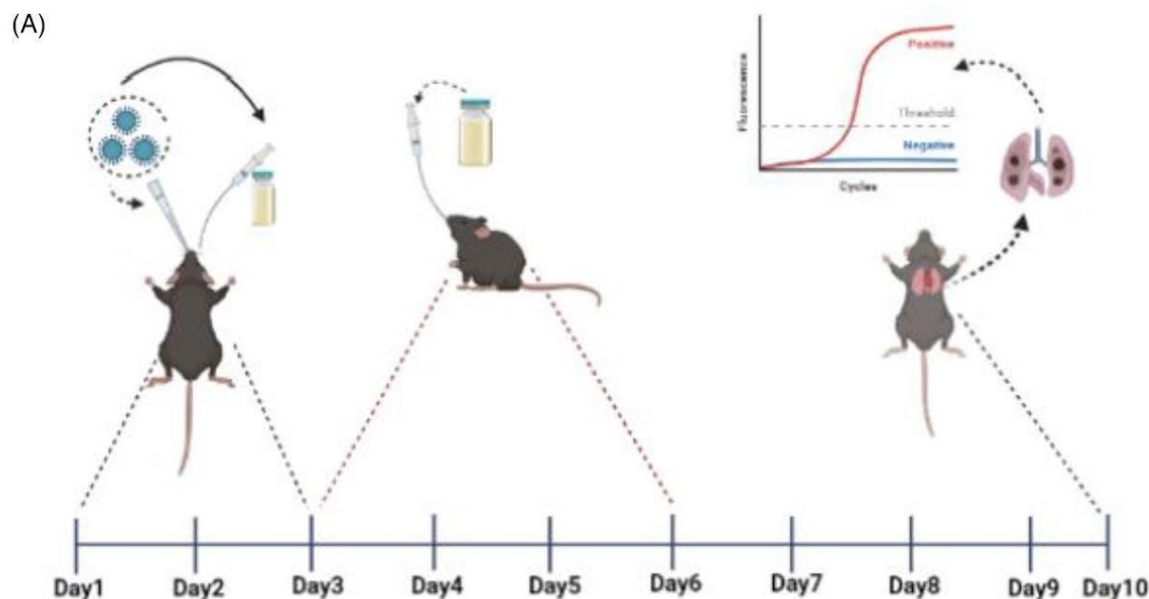
The typical change in body weight over time in mice treated with *S. lappa* extract versus control animals. The two-way ANNOVA test was conducted using the weight graph. The p value for the graph is 0.0295. There was no remarkable difference between the *S. lappa* treated groups and control groups throughout the trial period.

Figure 9. Shows the neutralization effect of *S. lappa* in vivo, where Viral loads in the lungs of the control and *S. lappa*-treated groups, determined by real-time PCR using two distinct SARS-CoV-2 Nucleocapsid gene sections (n = 10).

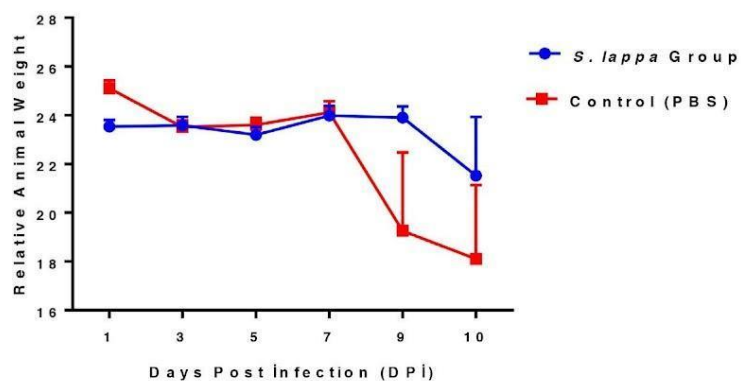
This graph makes use of the t test. The significance of the p value, which is p 0.0001, was established because p is less than 0.05 (Ulbegi Polat et al., 2023).

The authors of a different paper on the treatment of COVID-19 infection detailed the production of a large TaibUVID Forte mix (approximately 30 doses), with each TaibUVID stock mix including 1 big tablespoon of costus powder (corresponding to around 15 grams). After nasopharyngeal swab PCR results are negative, it could take a few days before COVID-19 is completely eradicated.

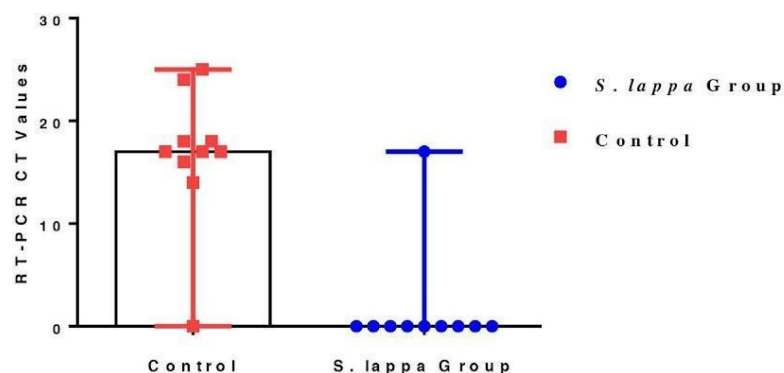
TaibUVID dietary supplements provide immune-potentiating and tissue-protective actions, which may be hopeful for a quick recovery in COVID-19 cases and many prospective therapeutic advantages for COVID-19 patients (El Sayed et al., 2020).



(B) Animal Weight Change Graphic



(C) qPCR Viral Load



**Figure 9: Neutralization effect of *S. lappa* extraction in vivo (Ulbeigi Polat et al., 2023).**

### 3. CONCLUSION

Indian costus plant shows diverse pharmacological effects due to the presence of a variety of bioactive phytochemicals that made it antibacterial, antiviral, antifungal and antiparasitic as well. This is why it can be exploited as an economically sustainable source of effective drugs against various infections with a high safety and potent effect.

Hence, further protection and research is needed to explore the mechanisms of Indian costus pharmacological actions with human trials.

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