



## Review Article

## COVID19 – An Approach Towards Using Traditional Medicine

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## ABSTRACT

Viral infections in recent times creates life threatening conditions in patients. Recent covid infection is the major proof for this action in human immune system. As it has the capability to mutate in various different structures so, no counter mechanism is there to protect against the severe form. We have found many cases in Africa and other continents where mass destruction of human life occurs due to different viral infections. Many countries have their traditional practices to counteract the disease. From ancient times it has been found that traditional medicines plays a very important role in diagnosis of these infections. We have discussed various ethnopharmacologically important plant and their compounds which takes part in active role in anti inflammatory and antiviral effect on human populations. Different compounds isolated from different plant either it is root, stem or leaf can be very potential for diagnosing the diseases. It can also effect multiple organ system and try to cope up with various infections. The signal transduction pathway plays a very crucial role in activating different cell types and act according to their target cell. In recent times we develop various synthetic drugs to compensate the natural molecules but it has serious side effects in human and different viral strains are adapted to those synthetic molecules in a very quick manner. So we have to go for the natural and try to use it in our daily life which slowly reduce the burden of the viral infection in our body.

**Keywords:** Covid; Synthetic Drugs; Ethnopharmacology; Anti Inflammatory

## INTRODUCTION

Viruses utilize their host system for successful accomplishment of their life cycle and therefore are known to invade all animal species on earth. Epidemiological evidences show several viral outbreaks in human populations which not only resulted in massive loss of human life but also triggered severe economical hazard in the global scale<sup>1</sup>. Similarly, COVID-19 outbreak in the recent time has already become a threat to the human population and has been declared pandemic throughout the World.

The fast-spreading COVID-19 is a RNA virus measuring 60-140nm in diameter with spike like projections on its body surface, and hence the name "Corona virus". Only four out of hundred different members of the coronaviridae family invade the human body and cause respiratory problems including flu like symptoms in the upper respiratory tract. These four common corona viruses are 229E, NL63, OC43, HKU1 which can cause mild to moderate symptoms in

humans<sup>2</sup>. Three other corona viruses of animal origin, namely Severe Acute Respiratory Syndrome, Middle-east Respiratory Syndrome and Severe Acute Respiratory Syndrome CoV-2, have been reported to undergo transmission to humans. Such cross-species transmission as seen in case of Covid-19 may occur due to antigenic shift. Virologist identified two similar strains of corona virus- L and S type. The L type strain resulting from ORF8 gene mutation (ORF8- L84S), is thought to be more severe in many cases<sup>3-5</sup>. The first outbreak of this virus was reported from Wuhan city sea food market and in no time spanned across the globe. It has 95% sequence homology with bat corona virus and 70% similarity with SARS. In India the first case was reported on 30<sup>th</sup> January in a student who returned to Kerala from Wuhan.

Since ancient times, Indian herbs have been used for the treatment of various infections and diseases. These herbs contain numerous molecules possessing significant antiviral

and anti-inflammatory activities with minimum side effects.

In this article we intended to focus on some of the potential herbs found in different parts of the Indian sub-continent and their antiviral and anti-inflammatory activities. This literature survey may prove beneficial to the scientific community in exploring drugs to limit viral outbreaks especially in the present pandemic scenario owing to the worldwide Covid-19 outbreak.

### ***Anti viral/ Anti inflammatory property of synthetic and traditional medicinal plants***

Viral infections are the most dreaded causes of high morbidity and mortality worldwide. Such miserable condition result due to lack of proper medications and therapeutic drugs and resistant strategies against viruses. Disease specific vaccination to viral infection is the only ray of hope in the recent times. However, a major proportion of the world population relies on prophylactic measures. Application of synthetic drugs and herbal antiviral drugs are the two different aspects of prophylactic treatments. Synthetic drugs have many side effects including alterations of normal cell physiology. In addition, viral strains rapidly develop resistance to synthetic drugs. To avoid such issues, 70-80% of the world population is relying on herbal medicines as preventive medicines<sup>6</sup>.

World Health Organization also gives special emphasize on researches involving traditional medicinal system for finding cure against infections and diseases. According to WHO 80% of the world population living in the rural areas depends on the indigenous medicinal plants, and most of their drugs are developed from those medicinal herbs, shrubs or tree<sup>7</sup>. There is always an increasing need for finding new compounds for protection against viral invasions due to the ever growing problem of viral resistance, latency and recurrent infection in immunocompromised patients. Plants synthesize and preserve various biochemical compounds which can be extracted and used for various investigations against viral infections. These compounds can be either primary or secondary metabolites. Primary metabolites have found throughout the plant kingdom and act as a precursor for various other compounds whereas secondary metabolites have restricted origin and functions. Higher plants are considered to act as novel sources of antiviral compounds including tannins, flavones, alkaloids<sup>6,8</sup>. In this present article we have enlisted and discussed some of the medicinal plants which has certain antiviral properties and anti-inflammatory properties and can be used as potential ingredient for novel drug discovery against viral diseases.

#### ***Aloe vera (Asphodelaceae)***

**Common name:** Chalkonoregh, Gheekumari, Khorpad, Kathalai.

**Distribution in India:** Assam, Mizoram, Tamil Nadu, Andhra Pradesh, Maharashtra. It also found across India.

**Brief description:** It is a stem less thick and fleshy green plant contains moist and mucilaginous fluid called Aloe vera gel. The leaves are grayish green with margins that are pinkish with many spines and height of about 50cm long.

**Major active compounds:** Acemannan, Glucomannans

**Function-** Acemannan acts as an antiviral agent against HIV, Herpes simplex virus-1<sup>9</sup> and HSV-2<sup>10</sup>. Polysaccharides found in mucilage layer of *Aloe vera* also inhibit the function of Influenza A virus causes acute respiratory distress syndrome<sup>11</sup>. Acemannan, a beta (1, 4) linked poly-dispersed and highly acetylated mannan found in Aloe plant where it is produced by a specialized cell called leucoplast. It acts on the viral agents by modifying glycosylation of both viral infected cells and glycoprotein coats of viruses thus inhibiting virus replication process as well as infectivity<sup>12</sup>. It has also possessed immunomodulatory activities on dendritic cells by inducing its maturity. This activity is characterized by the recognition of terminal mannose by the macrophages as a foreign substance. It allows the production of different cytokines like IL-6, INF-gamma and TNF which in turn related to receptors for mannose monosaccharide and activity of macrophages<sup>13</sup>.

#### ***Saussure alappa (Asteraceae)***

**Common name:** Kuth, Kood, Kostham, Kuth

**Distribution in India:** Mainly in Kashmir and Alpine Himalaya, Western Ghat

**Brief description:** Perennial herb grows upto 1-2m, stem is upright, stout and fibrous white root, leaves are lobate, flowers are stalkless dark purple to black in colour.

**Major active compounds:**

Terpenes- Costunolide, dihydrocostunolide, dihydrocostus lactone<sup>14</sup> journal of pharmacognosy and phytochemistry, vol: 6<sup>15</sup>

**Function-** *S alappa* has various activities against Hepatitis B and other viruses<sup>16,17</sup>. Two active compounds costunolide and dehydrocostus lactone which show strong suppressive effect on the expression of hepatitis B surface antigen by inhibiting the expression at the mRNA level<sup>15,17</sup>. The major molecular targets of costunolide include protein kinase, telomerase, cyclins and CDKs, Nf-kB and AP-1. The compound also diminished the expression of proinflammatory mediators such as cyclooxygenase-2, nitric oxide synthase, prostaglandins. In case of anti-inflammatory agent, costunolide hindered the protein and mRNA expression of interleukin 1b<sup>18</sup>. It concealed the AP-1 transcription factor activity. In other case the use of lactone showed considerable increase in osteoblast growth and hydrogen peroxide<sup>19</sup>. Costunolide negated Nf-kB activation by blockade of Ik-Ba phosphorylation thereby reducing the expression of proinflammatory markers. It has also diminished STAT1 and STAT3 phosphorylation in IL-22 or IFN- gamma

induced human keratinocytes<sup>20</sup>. Costunolide also markedly inhibited the expression of CD4+ cells and its subset polarizing master genes such as T bet, GATA3<sup>21</sup>.

### *Andrographis paniculata* (Acanthaceae)

**Common name:** Chireta

**Distribution in India:** It is widely distributed with low risk by IUCN.

**Brief description:** This plant is an erect herb to a height of 30-110cm in moist and shady places. The leaves are lance shaped and hairless blades up to 8 cm. The flowers are pink, solitary, racemes or panicle.

**Major active compounds:** Andrographolide, 14-deoxyandrographolide, neoandrographolide

**Functions:** It has potent antiviral activity against HIV. Andrographolide and its derivative inhibited gp-120 mediated cell fusion of HL2/3 cells<sup>22</sup>. Andrographolide exhibit immunomodulatory activity by effectively enhancing Tc cells, NK cells and ADCC by inhibiting viral pathogenesis<sup>23</sup>. Time of addition and RNA transfection studies showed that andrographolide affected chikungunya virus replication. Post infection treatment with andrographolide completely abolished expression of CHIKV E1:226AS and greatly inhibited the expression of CHIKV E1:226VS. Different studies have shown that andrographolide is capable of inducing autophagy and has been shown to be activated in CHIKV infection where it promotes viral replication<sup>24-26</sup>. The subversion of autophagy requires the interaction of CHIKV protein and host cell protein. It is possible that this compound interferes with the subversion process, allowing the increased activation of autophagy to promote the clearance of viral proteins. Andrographolide also inhibit terminal autophagosome- lysosome fusion. Andrographolide inhibit LPS induced NO production and inducible NO synthase expression in murine macrophage like cell line<sup>27</sup>. It has also been reported to suppress IL-2 production and T cell proliferation in a mixed lymphocyte reaction and to inhibit dendritic cell maturation and antigen presentation<sup>28</sup>.

### *Acacia nilotica* (Fabaceae)

**Common name:** Gum Arabic tree, Babul, Karuvelam

**Distribution in India:** Maharashtra, Kerala, Dhule

**Brief description:** A moderate size thorny tree upto 10 m. Solitary flower, a moniliform pod with bipinnate leaves.

**Major active compounds:** Niloticane, Beta- sitosterol, Gamma-sitosterol

**Functions:** It has been found that *Acacia niloticapods* and leaves extract has anti influenza-A, BHV- 1 activity<sup>29</sup>. Plant extract from the *Acacia* has antiviral activity against hepatitis C virus in liver infected cells<sup>30</sup>. *Acacia* extract treatment can Inhibit Influenza A virus by interacting with viral haemagglutinin and significantly affect nuclear transport of viral nucleoprotein. It has been reported that

beta sitosterol inhibits vascular adhesion molecule 1 and intracellular adhesion molecule 1 expression in TNF-alpha stimulated cell and attenuates the phosphorylation of Nf-kB p65<sup>31</sup>.

### *Santalum album* (Santalaceae)

**Common name:** Agarugandha, Chandana, Safed chandan

**Distribution in India:** This indigenous species found in the tropical belt of peninsular India

**Brief description:** The height of the tree is 4-9 m and lives for more than hundred years. It is usually upright to sprawling and interwine with other species.

**Major active compounds:** Alpha and beta santalols, Bergamotols, Beta bisabolene

**Functions:** The essential oil extracted from this plant was tested for antiviral activity *in vitro* against HSV-1 and 2. The replication of viruses has been inhibited in the presence of the oil<sup>32</sup>. This plant also has certain anti inflammatory activities in case of carrageenan induced inflammation. *S. album* inhibits the oxidative enzyme 5- lipoxygenase and has DPPH radical scavenging activity. The oil inhibits the pro inflammatory chemokines and cytokines produced in response to stimulation by lipopolysaccharide<sup>33,34</sup>. Production of PGE2 was also suppressed through inhibition of cyclooxygenase<sup>35</sup>.

### *Sesbania grandiflora* (Fabaceae)

**Common name:** Agati, Agase, Avisia

**Distribution in India:** Assam, Maharashtra, West Bengal, Andhra Pradesh

**Brief description:** Small deciduous tree with compound leaves. It is a quick growing plant. Flowers are white with 5cm across and fruit is a long pod.

**Major active compounds:** 3, 4, 5 trimethoxyphenol, Erucic acid

**Functions:** A potential antiviral activity has been found against HSV- 1 of *Sesbania grandiflora* flower extract<sup>36</sup>. Antibacterial properties are much more effective in this plant<sup>37</sup>.

### *Swertia chirata* (Gentianaceae)

**Common name:** Chirayata

**Distribution in India:** Critically endangered plant that grows at high altitude of temperate Himalayan region from Bhutan to Kashmir and in the Khasi hills.

**Brief description:** It has an erect around 2-3 ft long stem. Stem is orange brown or purplish in color with large continuous yellowish pith. Leaves are lanceolate in opposite pairs no stalk. The root is simple yellowish, oblique.

**Active anti viral compounds:** Amarogentin, Swertia- marin

**Functions:** The antiviral activity of *S chirata* was tested against HSV- 1<sup>38</sup>. Amarogentin is reported to be effective

against diabetes and against cancer<sup>39</sup>.

### *Azadirachta indica* (Meliaceae)

**Common name:** Neem, Limba, Nimgach, Veppur etc.

**Distribution in India:** Widespread in India

**Brief description:** Medium to large deep rooted, ever-green tree upto 15m tall. Bark moderately thick, with small scattered tubercles. Leaves are alternate.

**Active anti viral compounds:** Azadirachtin, Nimbidin<sup>40</sup>.

**Functions:** Bark of neem plant act as a potent entry inhibitor of against HSV- 1<sup>41</sup>. The extract from neem bark identifies a potent anti HSV activity. It significantly inhibited HSV -1 entry and viral glycoprotein mediated cell to cell fusion by blocking either protein or sugar receptors. The leaf extract of neem plant was reported against coxsackie virus group B<sup>42</sup>.

Anti inflammatory activity has been found via nuclear factor NF-kB activity and suppression of inflammation<sup>43</sup>. A study result has confirmed that extract of *A. indica* leaves at a certain dose showed significant anti inflammatory activity in cotton pellet granuloma assay in rats<sup>44</sup>.

### *Curcuma longa* (Zingiberaceae)

**Common name:** Halodhi, Halud, Haldi, Manjal etc.

**Distribution in India:** Widespread in India

**Brief description:** The plant is perennial, rhizomatous, herbaceous plant. The rhizomes are used fresh or boiled in water and dried.

**Major active compounds:** Curcumenol, Curcumin.

**Functions:** Different bioconjugates of curcumin worked against variety of viruses including parainfluenza virus type 3, HSV, Rous sarcoma virus<sup>45</sup>, dengue fever<sup>46</sup>. Viral long terminal repeat has a potent role in transcription of HIV-1 provirus. Inhibition of LTR activity can be a possible pathway for antiviral drug candidates in order to block HIV 1 replication<sup>47</sup>. Curcumin also inhibited the acetylation of Tat protein of HIV significantly by p300 associated with suppression of HIV-1 multiplication. Curcumin by targeting the acetyltransferase protein of p300 and CREB binding protein can be a potent compound against HIV-1<sup>48</sup>.

Curcumin also show the potential anti inflammatory activity<sup>49</sup>. Curcumin thoroughly established their anti-inflammatory role and reported to downregulate the activity of COX-2, lipoxygenase and inducible nitric oxide synthase enzymes<sup>50-52</sup>.

Reduction in the WBC count in asthmatic patients group treated with *C. longa* extract of curcumin has been observed<sup>53</sup>. In another study the curcumin capsule help in improving the bronchial asthma in the patients<sup>54</sup>.

### *Ocimum basilicum* (Lamiaceae)

**Common name:** Ram tulasi, tirunetru

**Distribution in India:** Cosmopolitan in distribution

**Brief description:** It is an erect glabrous herb which grows to between 30- 90cm height. Leaves are ovate, lanceolate, toothed. The upper surface is smooth and lustrous. Flowers are white or pale purple in color<sup>55</sup>.

**Major active compounds:** Methyl chavicol, Cinnamate, Eugenol, Beta- myrcene.

**Functions:** Apigenin, linalool and ursolic acid, exhibit a broad spectrum of antiviral activity against HSV, adenovirus and hepatitis B<sup>56</sup> by inhibiting viral replication. Eugenol an active compound of *O. basilicum* exhibited antiviral activity against HSV-1, 2 by preventing viral replication and reducing the viral infection<sup>57</sup>.

*Ocimum basilicum* also possess certain anti inflammatory activities using paw edema, peritonitis, granulomatous inflammation. Eugenol has anti inflammatory activity on LPS induced acute lung injury. Pretreatment with eugenol inhibited the inflammatory response and leukocyte recruitment into the lung tissue by the down regulation of proinflammatory cytokines like IL-6 and TNF- $\alpha$  expression and NF-kB signalling<sup>58</sup>. *Ocimum* sp. traditionally used for the treatment of upper respiratory tract infections like bronchitis, sore throat, and wound healing. Th2 cells which induced the production of IL-4, 5 and 13 and accelerated the pathophysiology of the disease. It has also stimulated the B cells for the production of IgE in allergic asthma. Three different phases of allergic asthma development including induction phase where Th2 cytokines play a role in development of asthma, early phase in which different mediators are formed and late phase where neutrophils, macrophages and T cells produce inflammatory molecules and lead to inflammation<sup>59</sup>. *O. basilicum* inhibit the production of those mediators. *O. basilicum* contain flavonoids like quercetin, kaempferol, rutin and glycosids like esculin, syringing responsible for the anti inflammatory activity<sup>60</sup>. Th1/Th2 balance has been modulated during the infection. The compounds from the plant extract have certain immunomodulatory activity by which suppress the infection<sup>61</sup>.

### *Withania somnifera* (Solanaceae)

**Common name:** Ashwagandha, Indian ginseng, Panneru etc.

**Distribution in India:** Tamil Nadu, Kerala, Maharashtra

**Brief description:** It is a short tender perennial shrub growing 35 – 75 cm tall. Leaves are dull green, elliptic upto 10 – 12 cm long. Flowers are small green, bell shaped. Ripe fruit is orange red.

**Major active compounds:** Withanolides, Withaferin A

**Functions:** It has a potent effect against bursal disease and act as an antiviral agent<sup>62</sup>. Withaferin A has been a broad area of medicinal properties against antiviral property. It act against the neuraminidase of H1N1 influenza and attenuate the action of it<sup>63</sup>. Recently it has been postulated that withanone block or weakens the nCov19 entry in to the

host cells<sup>64</sup>.

Root powder of *W. somnifera* has a potential anti-inflammatory activity in case of collagen induced rat arthritis<sup>65</sup>. Another compound withaferin A block the NF- $\kappa$ B pathway in case of cystic fibrosis<sup>66</sup>.

Recently it has been found that COVID 19 has been engaged the host cell ACE2 through its spike protein receptor binding domain (RBD). The compound withanone docked with the ACE2- RBD complex and weaken the salt bridges and destabilize the virus occupancy in the cell. It now weakens the entry of COVID19 and its infectivity<sup>64</sup>.

### *Glycyrrhiza glabra* (Fabaceae)

**Common name:** Jasthimadhu, mulaithi, jeshthamadha

**Distribution in India:** Baramulla, Srinagar, Jammu, Dohradun and part of South India.

**Brief description:** It is a herbaceous perennial plant growing to 1 m in height. Leaves are pinnate with 9 – 17 leaflets. Flowers are purple to pale whitish blue. The fruit is an oblong pod with multi seed.

**Major active compounds:** Glycyrrhizin, a terpenoid responsible for sweet taste of licorice root<sup>67</sup>.

**Functions:** Glycyrrhizin and its derivatives reduced hepato cellular damage in chronic hepatitis B and C<sup>68</sup>. *In vitro* studies revealed the antiviral activity against HIV-1, SARS related coronavirus, respiratory syncytial virus, arboviruses, vaccinia virus. Previous studies reported that it has antiviral activity against HIV by inhibiting replication of virus and interfering with virus to cell binding and cell to cell infection<sup>69</sup>. Licorice extract inhibits the growth of viruses, including herpes simplex, Varicella zoster, and of Japanese encephalitis, influenza virus, vesicular stomatitis virus, type A influenza virus<sup>70</sup> and does not allow the virus cell binding. Glycyrrhizin inhibiting the virus gene expression and replication, reducing adhesion force and reducing High mobility group box1 binding to DNA. The compound also activates by blocking the degradation of I $\kappa$ -b, activating T lymphocyte proliferation or suppressing host cell apoptosis<sup>71</sup>.

*G glabra* is very much popular for cough, cold and respiratory ailment among the tribals of Madhya Pradesh. The effect of *G glabra* (saponin) was investigated on albino mice and found certain anti asthmatic effect of it<sup>72</sup>. The component glycyrrhizin isolated from licorice show antiallergic effect in mice<sup>73</sup>.

### *Zingiber officinale* (Zingiberaceae)

**Common name:** Ada, Adrak, Allam, Aduwae etc.

**Distribution in India:** Widely distributed in India

**Brief description:** It is a flowering plant whose rhizome is widely used as a spice. It is a herbaceous perennial plant with pseudostem about 1 m tall bearing narrow leaf blades. The inflorescences bear pale yellow with purple flowers<sup>74</sup>.

**Major active compounds:** Zingiberene, Shogaol, Gingerol

**Functions:** Gingerol has antiviral activity against RSV by blocking viral attachment and internalization<sup>75</sup>. *In vitro* study from the extract of this plant tested for antiviral activity in case of hepatitis C virus<sup>76</sup>. Crude extract of *Z. officinale* was able to reduce skin edema and rat paw and act as an inflammatory agent.

Zingiberene produced significant reduction in acute inflammation produced by carrageenan, dextran and formalin induced chronic inflammation by scavenging superoxide, DPPH, hydroxyl radicals and tissue peroxidation *in vitro*<sup>77</sup>. Shogaol has prevented the upregulation of claudin 2 and the disassembly of claudin-1 via the suppression of signalling pathways involved with PI3K/Akt and Nf- $\kappa$ B<sup>78</sup>. 6-dehydroshogaol is more potent anti-inflammatory activity than 6- gingerolin reducing the generation of proinflammatory cytokines<sup>79</sup>. The bioactive compounds of ginger oil suppress prostaglandins synthesis through inhibition of cyclooxygenase -1 and 2. It has been recently observed that synergistic effect of ginger with anti tuberculosis treatment was more beneficial. Other study revealed that in case of anemic patients the iron absorption increases and decrease level of C reactive protein in case of anemia patients<sup>80</sup>. As we have discussed about the anti-inflammatory activities of ginger it can also suppresses the synthesis of prostaglandins and leukotrienes. The ethanolic extract of ginger possess anti-inflammatory activity against allergic airway inflammation. The level of production of IgE antibody as well as IL-4 and IL-5 also decrease in serum of mice<sup>81</sup>.

## CONCLUSION

Recent covid19 outbreak pandemic in the whole world creates a havoc among the populations. Certain viral invasion in the human body shows us a curiosity among us that epidemic can be arise any time in the world and not by chance. From starting of the civilization human race could find many alternative medicines to cure the viral infections. In our Indian history we have found many of the traditional medicines by which we can protect us from various viral infections. Anti-inflammatory and anti-viral activity can be cured by various compound isolated from the different plant species either from root, bark, leaf etc. Those compounds have various capacity and action by which it directly affects the disease prognosis and severity among the patients. We also know that synthetic drugs has various side effects in the human body which not suitable for all ages and the dose also matter in case of severity. So, we have to focus on the use of traditional medicine and try to involve in our daily life by which we are protected from many of the diseases.

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**Table 1: Anti viral property of some selected plants found in the Indian subcontinent**

Name	Common name	Family	Major active compound(s)
<i>Aloe vera</i>	chalkonore, gheekumari, khorpad, kathalai	Asphodelaceae.	Acemannan, glucomannans
<i>Saussurealappa</i>	Kuth, Kood, Kostham, Kuth	Asteraceae	Costunolide, dihydrocostunolide, dihydrocostus lactone
<i>Andrographispaniculata</i>	Chireta	Acanthaceae	Andrographolide, 14-deoxyandrographolide, neoandrographolide
<i>Acacia nilotica</i>	gum Arabic tree, babul, karuvelam	Fabeaceae	Niloticane, b- sitosterol, y-sitosterol
<i>Santalum album</i>	Agarugandha, chandana, safedchandana	Santalaceae	alpha and beta santalols, bergamotols, beta bisabolene
<i>Sesbania grandiflora</i>	Agati, agase, avisa	Fabeaceae	3,4, 5 trimethoxyphenol, erucic acid
<i>Swertiachirata</i>	Chirayata	Gentianaceae	Amarogentin, swertiamarin
<i>Azadirachtaindica</i>	Neem, limba, nimgach, veppur	Meliaceae	Azadirachtin, nimbidin
<i>Curcuma longa</i>	Halodhi, Halud, Haldi, Manjal	Zingiberaceae	Curcumenol, Curcumin
<i>Ocimumbasilicum</i>	Ram tulasi, tirunetru	Lamiaceae	Methyl chavicol, cinnamate, eugenol, beta- myrcene
<i>Withaniasomnifera</i>	Ashwagandha, Indian ginseng, Panneru	Solanaceae	Withanolides, withaferin A
<i>Glycyrrhizaglabra</i>	Jasthimadhu, mulaithi, jesthamadha	Fabeaceae	Glycyrrhizin, a terpenoid responsible for sweet taste of licorice root
<i>Zingiberofficinale</i>	Ada, adrak, allam, aduwae	Zingiberaceae	Zingiberene, shogaol, gingerol

**Table 2: Anti asthmatic property of some selected plants**

Name	Common name	Family	Major active compound(s)
<i>Curcuma longa</i>	Halodhi, Halud, Haldi, Manjal	Zingiberaceae	Curcumenol, Curcumin
<i>Ocimumbasilicum</i>	Ram tulasi, tirunetru	Lamiaceae	Methyl chavicol, cinnamate, eugenol, beta- myrcene
<i>Withaniasomnifera</i>	Ashwagandha, Indian ginseng, Panneru	Solanaceae	Withanolides, withaferin A
<i>Glycyrrhizaglabra</i>	Jasthimadhu, mulaithi, jesthamadha	Fabeaceae	Glycyrrhizin, a terpenoid responsible for sweet taste of licorice root
<i>Zingiberofficinale</i>	Ada, adrak, allam, aduwae	Zingiberaceae	Zingiberene, shogaol, gingerol

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