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REVIEW ARTICLE

Traditional plants utilized for the viral disease treatment

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Abstract

Ethnobotanical research is a well-established field of science that attracts a lot of interest in medicine. Plants are responsible for over 80% of folk remedies used in primary care worldwide. Traditional and herbal medicine knowledge is essential in scientific research, especially when the literature and survey data are not adequately examined. Viral diseases affect millions of individuals worldwide, and they have a significant impact on human health and socioeconomic growth. Many infectious and non-infectious illnesses have long been treated with medicinal plants. The value of medicinal plants has risen in recent centuries. The human immunodeficiency virus (HIV) alone affects almost 40 million people. Coronavirus disease is now the most common viral illness globally, affecting an estimated 176 million people worldwide (COVID-19). A wide range of plant species was found to be effective in treating viral diseases. This review summarizes viral illness, disease outbreaks, and medicinal plants and herbs with antiviral properties useful in drug development programmes.

Keywords

Coronavirus (COVID-19), Ethnobotany, Folk, HIV, Traditional medicines, Viral diseases

Introduction

Traditional herbal remedies and other forms of medicine in India use approximately 6000 different plants. India's diversity is unrivalled, with 16 diverse agroclimatic zones, 25 biotic provinces, ten vegetation zones and 426 biomasses (1). According to a WHO report, more than 80% of the world's population relies on traditional medicine, which typically involves plant extracts or active ingredients. (2-4). Rabies has been confirmed to be one of India's oldest zoonotic viral illnesses and has plagued the country since Vedic times, almost 3000 years ago (5). Because of this, the vast majority of the world's population relies on plants to meet their basic therapeutic needs, particularly in less developed countries. Consequently (6, 7). Homegrown plants (as used in Ayurveda as referenced in the Charaka Samhita and Susruta Samhita or other customary medication practices), plant inferred compounds (also known as phytoconstituents), plant concentrates of specific plant parts, and dietary supplements and nutraceuticals find wide application in treating illnesses ranging from standard to uncommon irresistible and non-irresistible ailments (8).

In India, the Rig-Veda, written between 4500 and 1600 BC, is the eldest storehouse of human old-style Knowledge on medicinal plant use (9). The study aims to learn more about how plants treat viral diseases, such as which plant components are used and how herbal antiviral medications are

made and given (10). Even though viral infections almost always follow secondary bacterial infections, viral infections play a substantial influence on the global incidence of transmissible illnesses (11). Vaccines for major viral diseases like HIV and hepatitis C virus (HCV) are still in the early stages of development. They have a slim chance of success because millions of people are already chronically infected with these viruses (12). COVID19 pandemic, which is caused by the SARSCoV2 coronavirus, has engulfed the entire globe; every day, people are dying due to the masses, and there appears to be no way of stopping this global fitness calamity without an actual treatment (13). COVID19 currently affects over 210 countries and territories throughout the world. COVID19 has negatively impacted many countries around the world. A wide variety of natural ingredients are being used to develop antiviral drugs. This review focuses on a summary of medicinal plants and herbs with antiviral activities that could benefit drug development programmes. India's health policy must be rethought and revised to expand disease control efforts. A thorough assessment and reorganization of the healthcare system are urgently required to ensure equity and high-quality care (14).

Description of the viral diseases and plants used in viral diseases treatment

Influenza flu

Influenza A virus has been around for a long time has harmed human health, and is now posing a threat to humanity. Using natural plant extracts, which contain polyphenols important in controlling and reducing disease outbreak symptoms, was one treatment method. For example, from 1918 to 1920, India was struck by a highly lethal influenza epidemic as part of the global Spanish flu pandemic (15, 16). The pandemic, also called the Bombay Influenza or Bombay Fever in India, kills up to 17-18 million people, the maximum of any country (Table 1, 2 & 3) (17-19).

Pure natural herbs are used in Ayurvedic therapies to combat the spread of the flu. This medicine encourages people to drink particular herbs or decoctions to boost their immunity. (20). The plants used in the treatment are as follows: Geranium (*Geranium sanguineum* L.) extract helps treat influenza infections as this possesses a broad range of beneficiary activities. *Cistus incanus* have the dominant polyphenolic additives, the catechins that have influenza activities found to be green in several human and avian influenza virus strains reduction. These days, polyphenol-rich extracts of *Punica granatum* have been studied for anti-influenza virus activity. It has been shown that Echinacea supplements can increase mucin and pro-inflammatory cytokines production in epithelial cells of nasal, mucous and tracheobronchial tissues. (21). Green Tea (*Camellia sinensis*) has many different beneficial activities containing polyphenolic compounds. (-)- epigallocatechin gallate (EGCG), (-)- epicatechin gallate, (-)- epigallocatechin, (-) -epicatechin, and (+)- catechin is among the catechins responsible for green tea's health benefits. Green tea catechins have an antiviral effect on various viruses by interfering with their reproduction cycle (22).

L-theanine and γ-aminobutyric acid (GABA) are non-proteinaceous amino acids found in tea leaves. L-Theanine is the maximum ample non-proteinaceous amino acid that contributes to tea taste and features. GABA is the second most plentiful non-proteinaceous amino acid that contributes to tea characteristics and is regulated more via the range than by using outside variables (23). Pathogenic avian IV (HPAIV) of the H5 and H7 viruses and Human H1N1-type IV virus has been inactivated in mobile tradition with *Echinacea purpurea* extract (Echinaforce®). This shows that the extract interferes with cells' viral front and reduces virus receptor binding activity. For IV replication and dissemination, this standard formulation of *Echinacea* at the indicated dose might be a beneficial supplement that is widely available and inexpensive (24).

Table 1. Plants and plants parts used in the treatment of viral diseases (22-26)

Sl. No.	Plants used	Vernacular name	Family	Parts Used
		Influenza flu		
1	*Camellia sinensis* (L.) Kuntze	Green Tea	Theaceae	Leaves
2	*Cistus incanus* L.	Hairy Rockrose	Cistaceae	Leaves
3	*Citrullus lanatus* (Thunb.) Matsum. & Nakai	Wild Watermelon	Cucurbitaceae	Fruit
4	*Echinacea purpurea* (L.) Moench	Echinacea	Compositae (Asteraceae)	Aerial Parts, Roots
5	*Geranium sanguineum* L.	Geranium	Geraniaceae	Roots
6	*Ocimum sanctum* L.	Tulsi	Lamiaceae (Labiatae)	Leaves
7	*Punica granatum* L.	Pomegranate	Lythraceae (Punicaceae)	Peel, Fruit
		Common cold		
8	*Achyrocline satureioides* (Lam.) DC.	Marcela	Asteraceae	Whole Plant
9	*Allium haemanthoides* L.	Loosha	Amaryllidaceae	Whole Plant
10	*Allium sativum* L.	Garlic	Amaryllidaceae	Bulb
11	*Allium ursinum* L.	Wild Garlic	Amaryllidaceae	Bulb
12	*Allium ursinum* L.	Wild Garlic	Amaryllidaceae	Bulb

13	*Althaea officinalis* L.	Marsh Mallow/ Khatmi	Malvaceae	Petal
14	*Anchusa italica* Retz.	Bugloss	Boraginaceae	Petal, Leaves, Roots
15	*Cinnamomum zeylanicum* Bl.	Cinnamon	Lauraceae	Bark, Leaves
16	*Citrus limon* (L.) Burm. f.	Lemon	Rutaceae	Fruits, Leaves
17	*Citrus reticulata* Blanco	Mandarin tree	Rutaceae	Roots, Leaves, Peel
18	*Citrus sinensis* (L.) Osbeck	Orange tree	Rutaceae	Leaves, Fruit
19	*Eucalyptus camaldulensis*	River Red Gum	Myrtaceae	Leaves
20	*Falcaria vulgaris* Bernh.	Sickleweed	Apiaceae	Petal, Leaves, Stem
21	*Gochnatia polymorpha* (Less.) Cabrera	Cambara	Asteraceae	Aerial Parts
22	*Illicium verum* Hook. f.	Star anise	Illiciaceae	Posa, Seeds
23	*Lallemantia iberica* (M. Bieb.) Fisch. & C.A. Mey.	Dragon's Head	Lamiaceae	Grain
24	*Malva neglecta* Wallr.	Dwarf Mallow	Malvaceae	Grain
25	*Matricaria recutita* (L.) Rauschert	Chamomile	Asteraceae	Petal, Branch
26	*Mentha piperita* L.	Peppermint	Lamiaceae	Leaves
27	*Mikania sp.*	Guaco	Asteraceae	Leaves
28	*Nectaroscordum tripedale*	Sicilian Honey Garlic	Alliaceae	Whole Plant
29	*Nepeta elymatica* Bornm.	Catnip	Lamiaceae	Leaves, Grain
30	*Nerium oleander* L.	Nerium	Apocynaceae	Leaves, Grain
31	*Ocimum selloi* Benth.	Green pepper basil	Lamiaceae	Aerial Parts
32	*Ocimum sanctum* L.	Tulsi	Lamiaceae	Leaves
33	*Origanum majorana*	Marjoram	Lamiaceae	Flower, Leaves
34	*Phleum pratense* L.	Timothy grass	Poaceae	Branch
35	*Plantago psyllium* L.	Desert Indian wheat	Poaceae	Whole Plant
36	*Punica granatum* L.	Pomegranate	Lythraceae	Grain
37	*Quercus brantii* Lindl.	Brant's Oak	Fagaceae	Fruit, Leaves
38	*Salvia hydreangae* DC. ex Benth.	Gol-e Arrooneh	Lamiaceae	Petal
39	*Salvia multicaulis* Vahl.	False Whorled Sage	Lamiaceae	Petal
40	*Stachys lavandulifolia* Vahl.	Pink Cotton Lamb's Ear	Lamiaceae	Petal, Branch
41	*Tanacetum parthenium* L.	Feverfew	Asteraceae	Roots
42	*Verbena* sp.	Verbena	Verbenaceae	Aerial Parts
43	*Zingiber officinale* Roscoe	Ginger	Zingiberaceae	Rhizome
44	*Ziziphus jujube* Mill.	Jujube/ Red Date	Rhamnaceae	Fruit, Peel, Kernel
		Respiratory syncytial virus		
45	*Amaryllis belladonna* L.	March Lily	Amaryllidaceae	Bulb
46	*Blumea laciniata* (Wall. ex Roxb.)	Cut leaf Blumea	Compositae	Whole Plant
47	*Elephantopus scaber* L.	Elephant's Foot	Asteraceae	Whole Plant
48	*Mussaenda pubescens* Dryand.	Mussaenda	Rubiaceae	Leaves, Roots
49	*Narcissus tazetta* L.	Nargis	Amaryllidaceae	Stem, Leaves, Roots
50	*Ocimum sanctum* L.	Tulsi	Lamiaceae (Labiatae)	Leaves
51	*Schefflera heptaphylla* (L.) Frodin	Umbrella Tree	Araliaceae	-
52	*Scutellaria indica* L.	Skullcap	Lamiaceae	Aerial Parts
53	*Selaginella sinensis* (Desvaux) Satou	Fern Allies	Selaginellaceae	Whole Plant
		Adenovirus infection		
54	*Lithospermum erythrorhizon* Sieb. Et Zucc.	Purple Gromwell	Boraginaceae	Roots
55	*Thymus daenensis L.*	Celak	Lamiaceae	Leaves, Stem
56	*Zataria multiflora* Boiss.	Shirazi Thyme	Lamiaceae	

		Measles		
57	*Artemisia dubia* var. subdigitata (Mattf.) Y.R.Ling.	Shieh	Asteraceae	Aerial parts
58	*Bambusa vulgaris* Schrad. ex J.C.Wendl.	Bamboo	Poaceae	Leaves
59	*Cinnamomum camphora* (L.) J. Presl	Camphor Tree	Lauraceae	Leaves
60	Coriandrum sativum L.	Coriander	Apiaceae	Seeds, Old Leaves
61	*Cymbopogon citratus* (DC.) Stapf	Lemongrass	Poaceae	Leaves
62	*Eclipta prostrata* (L.) L.	False Daisy	Asteraceae	Leaves
63	*Elephantopus scaber* L.	Elephant's Foot	Asteraceae	Whole Plant
64	*Elsholtzia cristata* Willd.	Crested Late- Summer Mint	Lamiaceae	Leaves
65	*Glycyrrhiza uralensis* Fisch.	Chinese Liquorice	Fabaceae	Roots
66	*Houttuynia cordata* Thunb.	Chameleon Plant	Saururaceae	Leaves, Rhizome
67	*Jasminum sambac* (L.) Aiton	Jasmine	Oleaceae	Leaves
68	*Lactuca indica* L.	Indian Lettuce	Asteraceae	Leaves
69	*Lactuca sativa* L.	Lettuce	Asteraceae	Leaves
70	*Morus rubra* L.	Mulberry	Moraceae	Leaves
71	*Nelumbo nucifera* Gaertn.	Lotus	Nelumbonaceae	Leaves
72	*Ophiopogon japonicas* (Thunb.) Ker Gawl.	Fountain plant	Asparagaceae	Rhizome
73	*Origanum majorana* L.	Marjoram	Lamiaceae	Leaves
74	*Perilla frutescens* (L.) Britton	Beefsteak Plant	Lamiaceae	Leaves
75	*Phaseolus vulgaris* L.	Black beans	Fabaceae	Pod
76	*Polycarpon prostratum* (Forssk.) Asch. & Schweinf	Manyseed	Fabaceae	Stem, Leaves, Roots
77	*Prosopis juliflora* (Sw.) DC.	Prosopis	Fabaceae	Leaves, Pod
78	*Pueraria thomsoni* DC.	Japanese Arrowroot	Fabaceae	Root, Flower, Leaves
79	*Saccharum officinarum* L.	Sugarcane	Poaceae	Stalk
80	*Scoparia dulcis* L.	Licorice Weed	Plantaginaceae	Whole Plant, Seeds
81	*Senna alata* (L.) Roxb.	Candle bush	Fabaceae	Seeds
82	*Typha elephantina* Roxb.	Elephant grass	Typhaceae	Stem, Leaves, Roots
83	*Wedelia chinensis* (Osbeck) Merr.	Chinese Wedelia	Asteraceae	Leaves
		Malaria		
84	*Aloe barbadensis* (L.) Burm. f.	*Aloe vera*	Asphodelaceae	Gel, Latex
85	*Andrographis paniculata* Burm. f.	Green Chiretta	Acanthaceae	Aerial Parts
86	*Callistemon citrinus* (Curtis.) Skeels.	Lemon Bottlebrush	Myrtaceae	Aerial Parts
87	*Eucalyptus globulus* Labill.	Blue Gum	Myrtaceae	Leaves
88	*Mormodica feotida* Schumach. et Thonn.	Wild Cucumber	Cucurbitaceae	Fruits, Leaves, Roots
89	*Nyctanthes arbor-tristis* L.	Night-Flowering Jasmine	Oleaceae	Leaves
90	*Vernonia amygdalina* Del.	Bitter Leaf	Asteraceae	Leaves
		SARS and SARS-CoV2		
91	*Artemisia annua* L.	Sweet Wormwood	Asteraceae	Aerial Parts
92	*Astragalus membranaceus* (Fisch.) Bge.	Mongolian Milkvetch	Fabaceae	Roots
93	*Atractylodes macrocephala* Koidz. (AM)	Bai Zhu	Asteraceae	Rhizome
94	*Glehniae radix*	Coastal Glehnia Root	Apiaceae	Roots
95	*Glycyrrhiza uralensis* Fisch.	Chinese Liquorice	Leguminosae	Roots, Rhizome
96	*Isatidis folium*	Woad Chinese	Cruciferae	Leaves, Roots

97	*Lonicera japonica* Thunb.	Japanese Japonica	Caprifoliaceae	Aerial Parts
98	*Lycoris radiata* (L'Hér.) Herb.	Red Spider Lily	Amaryllidaceae	Root, Bulb
99	*Mentha spicata* L.	Spearmint	Lamiaceae)	Leaves
100	*Morus alba* L.	Folium Mori/ Mulberry	Moraceae	Fruit, Root, Leaves
101	*Ocimum sanctum* L.	Tulsi	Lamiaceae (Labiatae)	Whole Plant
102	*Pyrrosia lingua* (Thunb.) Farw.	Felt Fern	Polypodiaceae	Leaves
103	*Radix saposhnikoviae* (Turcz.) Schischk.	Divaricate Saposhnikovia Root	Umbelliferae	Roots, Rhizome
104	*Phragmitis rhizoma*	Reed Root		Roots
105	*Salvia miltiorrhiza* Bge.	Red Sage	Lamiaceae	Roots
106	*Tinospora cordifolia* (Thunb.) Miers	Giloy	Menispermaceae	Stem, Roots
107	*Withania somnifera* (L.) Dunal	Ashwagandha	Solanaceae	Roots, Stem, Leaves

Table 2. Details regarding viral diseases (22, 23)

Sl. No.	Disease	Agents	Symptoms	Infect	Spread	Treatment
1.	Flu	Influenza virus	Fever, aching muscles, headache, shortness of breath, persistent cold, runny and stuffy nose, sore throat, eye pain, vomiting, diarrhea.	Nose, throat, lungs, the epithelial lining of trachea, and bronchi	Flu cough, sneeze or talk, sending droplets with the virus into the air, touching own mouth, eyes or nose.	Oseltamivir (Tamilflu), Zanamivir (Relenza), Peramivir (Rapivab), Baloxavir (Xofluza).
2.	Common cold	Rhinovirus (RNA Virus)	Fever, headache, body aches, fatigue, nasal congestion, sneezing, sore throat, cough.	Mouth, eyes, nose	Coughs or sneezes, handshakes or hugs, kissing or shared drinks, touching a contaminated surface, droplet infection.	Oxymetazoline nasal (Afrin), Acetaminophen (Tylenol), Ibuprofen (Advil), Antihistamin Diphenhydramine (Benadryl).
3.	Respiratory syncytial virus infection	RSV (Respiratory Syncytial Virus)	Runny nose, dry cough, sore throat, fever, sneezing, headache, wheezing, bluish discoloration of the skin.	Bronchiolitis (Lungs)	Contaminated hands with infectious secretions, direct contact, air on infected respiratory droplets	Acetaminophen (Tylenol), Nasal saline drops.
4.	Adenovirus infection	Adenovirus	Common cold, fever, sore throat, acute bronchitis, pneumonia, pink eye, acute gastroenteritis.	The lining of the eyes, airways, lungs, intestines, urinary tract and nervous system.	Direct contact, the air by coughing and sneezing, touching the contaminated area or object.	Cidofovir, Ribavirin.
5.	Parainfluenza virus infection	Human Parainfluenza Viruses (HPIV)	Fever, runny nose, barky cough, redness or swelling of the eyes, wheezing, harsh breathing, rattling felt over the chest.	Respiratory tract.	Sneezing, Contact with infected objects and mouth, nose, or eye areas.	Saline nose drops, Analgesics like aspirin (Bufferin) or acetaminophen (Tylenol).
6.	Severe acute respiratory syndrome (SARS)	SARS-associated syndrome (SARS-CoV)	Fever, dry cough, sore throat, headache, muscle aches, difficulty breathing, body aches, night sweats and chills.	Lungs, multiple cell types in several organs, immune cells, pulmonary epithelium.	Airborne respiratory droplets, skin-to-skin contact, saliva, touching a contaminated surface.	Antiviral medications, Kaletra.
7.	Norovirus infection	Norovirus	Diarrhea, vomiting, nausea, stomach pain, fever, headache, body aches.	Small Intestine.	Direct contact, touching contaminated surfaces, eating food, or drinking liquid contaminated with norovirus.	No medicine.
8.	Rotavirus infection	Rotavirus	Vomiting, watery diarrhea, fever, abdominal pain, dry mouth and throat, feeling dizzy, decreased urination.	Stomach, Intestines.	Fecal-oral route transmission, touching a contaminated surface, ingestion of dirty water or food.	Oral rehydration.
9	Astrovirus infection	Astrovirus	Mild diarrhea, nausea, vomiting, stomach ache, loss of appetite, body aches, fever	Gastrointestinal tract	Fecal-oral route from person to person contact, through contaminated food or water.	No Vaccines, By neutralizing monoclonal antibodies

10.	Measles	Morbillivirus	Cough, runny nose, inflamed eyes, sore throat, fever, red blotchy skin rash, white spots inside the mouth.	Respiratory tract, other parts of the body through the blood-stream.	Airborne respiratory droplets, saliva, touching a contaminated surface, skin-to-skin contact, mother-to-baby pregnancy, labor, or nursing.	MMR Vaccine (Measles Mumps Rubella), Acetaminophen (Tylenol), Ibuprofen (Advil), Vitamin A supplements, GamaSTAN S/D (Immune globulin intramuscular).
11.	Mumps	Paramyxovirus (RNA Virus)	Swollen, painful salivary glands, fever, headache, fatigue, appetite loss.	Brain, Parotid gland.	Airborne respiratory droplets (coughs or sneezes), touching contaminated surfaces (blanket or doorknob), direct contact with the nose and throat discharge.	MMR Vaccine (Measles Mumps Rubella Vaccine), Acetaminophen (Tylenol), Ibuprofen (Advil, Motrin IB).
12.	Rubella	Rubella Virus	Mild fever, headache, red rash on the body, muscle pain, runny or stuffy nose, swollen lymph nodes, red eyes.	Skin, Lymph nodes.	Close contact with tiny drops of fluid from the nose and throat when sneezing and coughing, airborne respiratory droplets, saliva.	MMR (Measles Mumps Rubella) Vaccine, Acetaminophen (Tylenol).
13.	Chickenpox/ Varicella	Varicella zoster virus	Itchy, blister-like rash on the skin.	Skin.	Saliva, skin-to-skin contact with infected persons, airborne droplets.	Analgesic and antihistamine, vaccine of chickenpox.
14.	Chikungunya virus infection	Chikungunya Virus (CHIKV)	Fever, severe joint pain, muscle pain, headache, fatigue, rash.	Joint.	Animal, Insect bites or stings, blood to blood contact.	Acetaminophen (Tylenol) or Paracetamol.
15.	Hepatitis A	Hepatitis A Virus	Fatigue, sudden nausea, vomiting, abdominal pain, loss of appetite, low-grade fever, dark urine, joint pain, jaundice, intense Itching.	Liver.	Close contact with an infected person, ingestion of contaminated food and water.	No medicine.
16.	Hepatitis B	Hepatitis B Virus	Yellowing of eyes, abdominal pain, dark urine, belly pain.	Liver.	Close contact with contaminated blood, open sores, or body fluids.	Entecavir (Baraclude), Tenofovir (Viread), Lamivudine (Epivir), Adefovir (Hepsera), Telbivudine (Tyzeka).
17.	Hepatitis C	Hepatitis C Virus	Fatigue, nausea, loss of appetite, yellowing of the eyes and skin.	Liver.	Blood products (Unclean needles or unscreened blood), mother to baby by pregnancy, labor or nursing.	Ribavirin, Grazoprevir.
18.	Hepatitis D	Hepatitis Delta Virus	Yellow skin and eyes, stomach upset, belly pain, fatigue, joint pain, dark urine, light-colored stool.	Liver.	Blood products (Unclean needles or unscreened blood), mother to baby by pregnancy, labor or nursing.	Pegylated interferon-alpha.
19.	Hepatitis E	Hepatitis E Virus	Jaundice, lack of appetite, nausea.	Liver.	Fecal-oral route due to fecal contamination of drinking water, contaminated food or water.	Ribavirin, Pegylated interferon-alpha.
20.	Warts	Human Papilloma Virus	Fleshy, painless growth on the skin, small bumps, rough to touch, sprinkled with tiny black pinpoints, clotted blood vessels.	Skin layer (Epidermis).	Skin to skin contact.	Salicyclic acid, Cryotherapy.
21.	Oral/ Genital Herpes	HSV (Herpes Simplex Virus) 1 causes oral herpes, HSV 2 causes genital herpes	Blistering sores in the mouth or genital organs, pain during urination, Itching, ulcers scabs.	Mouth or genital organs.	Sexual contact with infected persons, skin-to-skin contact.	Acyclovir (Zovirax), Famciclovir (Famvir), Valacyclovir (Valtrex).

22.	Small Pox	Varicia virus (DNA Virus)	Fever, headache, severe fatigue, severe back pain, vomiting.	Respiratory passages, then skin.	Droplet infection (contagion possible via wounds in the skin).	Tecovirimat (TPOXX), Cidofovir, Brincidofovir.
23.	Ebola	Ebola virus	Fever, intense weakness, muscle pain, headache, sore throat, vomiting, stomach pain.	Organs, liver, kidney, immune system.	Direct contact with body fluids such as blood from infected people or animals, tissues, saliva, sweat.	Ervebo (Ebola vaccine rvsv-ZEBOV).
24.	Molluscum contagiosum	Poxvirus (Molluscum contagiosum virus)	Round, firm, painless bumps on the skin, Itching.	The trunk of the body, arms and legs.	Direct contact, touching a contaminated object	Potassium hydroxide, Podophyllotoxin, Imiquimod, Benzoyl peroxide, Tretinoin.
25.	Lassa fever	Lassa virus	Fever, weakness, sore throat, severe headache, chest pain, back pain, vomiting, abdominal pain, and diarrhea.	Liver, spleen, kidneys.	Urine or feces of Mastomys rats to humans, direct contact with blood, body fluids, urine, the stool of Lassa fever patient.	Ribavirin, Fluid and electrolytes.
26.	Dengue fever	Dengue virus (DENV)	High fever, headache, rash, muscle joint pain, vomiting, nausea, lymph nausea.	Organs, internal bleeding.	Bite of an infected Aedes species A.aegypti or A. Albopictus mosquito, from mother to child, infected blood, lab or healthcare setting exposures.	Acetaminophen (Tylenol).
27.	Yellow fever	Yellow fever virus	High fever, jaundice, headache, muscle aches, joint aches, chills.	Liver, kidney, heart, and gastrointestinal tract	Bite of Aedes mosquitoes (Aedes aegypti mosquitoes).	17D vaccine (Live attenuated viral strain).
28.	Marburg hemorrhagic fever	African fruit bat, *Rousettus aegyptiacus*	Fever, chills, headache, and muscle aches, hemorrhagic fever.	The circulatory system of Human beings, African bats, or green monkeys.	Exposure to African green monkeys and certain bats, exposure to an infected human.	Balancing fluid and electrolyte, maintaining oxygen and blood pressure.
29.	Crimean- Congo hemorrhagic fever	Tick-borne virus Nairovirus	Fever, muscle ache, dizziness, neck pain and stiffness, backache, headache, sore eyes and photophobia.	Ticks, cattle, sheep and goats.	Infected ticks, the blood of cattle or sheep or goats.	Ribavirin drug.
30.	Polio	Poliovirus	Fatigue, fever, muscle weakness, headache, nausea.	Throat and intestines.	Contaminated food or water (fecal-oral transmission)	Pain relievers, NSAIDs (Ibuprofen, Diclofenac, and Acetaminophen), polio vaccine.
31.	Rabies	Rabies virus	Muscle spasms or paralysis with weak muscles, fear from water, dizziness, fatigue, fever, nausea, or vomiting.	Animal bite (stray dogs).	The saliva of infected animals.	Favipiravir (T-705) drug (broad-spectrum Antiviral).
32.	Viral meningitis	Echovirus, Poliovirus, coxsackievirus	Headache, fever, and stiff neck.	Brain and Spinal cord.	Saliva or stool of infected person.	Antiviral medications.
33.	Viral encephalitis	HSV Type 1, HSV Type 2, Mosquito born virus, Enterovirus	Fever, headache.	Brain.	Cough and sneezes from infected persons.	Antiviral medications (Acyclovir (Zovirax), Ganciclovir (Cyotovene), Foscarnet (Foscavir)).
34.	AIDS	HIV	Flu-like symptoms, abdominal pain, weight loss, fever or night sweats, swollen lymph nodes.	Immune system.	Infected blood, semen, vaginal fluids, needles, syringes.	Antiretroviral therapy.
35.	Human papillomavirus	HPV	Genital wart, wart, cervical cancer.	Genitals or surrounding skin.	Skin to skin contact or sexual contact with an infected person.	Imiquimod, Podofilox, Sinecatechins.
36	Viral gastroenteritis	Norovirus, Rotavirus	Diarrhea, abdominal cramps, nausea or vomiting, fever.	Intestine.	Contact with an infected individual, infected food, or water.	Promethazine, prochlorperazine, metoclopramide, ondansetron.

37.	Viral pneumonia	RSV, SARS CoV-2	Flu-like symptoms, Dry cough, fever, chills, shortness of breath, rapid breathing.	Lungs.	Coughing, sneezing.	Oseltamivir (Tamiflu), Zanamivir (Relenza), Ribavirin (Virazole).
38.	Zika	Aedes mosquito	Fever, red-eye, joint pain, headache.	Brain cells.	Mosquito bites.	No medicine.
39.	COVID-19	Coronavirus	Fever, cough, cold, loss of taste or smell.	Lungs, respiratory tracts.	Physical contact with an infected person.	2-DG drug.
40.	Rift valley fever	Arbovirus	Fever, muscle pains, headaches, loss of sight, confusion, bleeding, liver problems.	Domesticated animals.	Blood, body fluids, or tissues of infected animals or infected mosquitoes.	No medicine.
41.	Monkeypox	Monkeypox virus	Fever, headache, muscle pains, swollen lymph nodes, feeling tired.	Rodents and primates.	Lesions, body fluids, respiratory droplets of infected rodents, primates, human beings.	Smallpox vaccine.
42.	Plague	Yersinia pestis bacteria	Swollen lymph nodes in the groin, armpit, or neck.	Lymph nodes.	Infected flea.	Antibiotics (streptomycin, gentamicin, doxycycline, ciprofloxacin).
43.	Listeriosis	Listeria monocytogenes	Sepsis, meningitis, encephalitis.	Brain, spinal cord.	Through contaminated food or sexual contact with infected persons.	Ampicillin.
44.	Human infection with avian influenza A(H5N8)	Influenza virus	Flu-like symptoms.	Trachea, brain, and intestines.	Infected birds (saliva, mucus, feces).	Oseltamivir (Tamiflu), peramivir (Rapivab), or zanamivir (Relenza).
45.	Typhoid	Salmonella typhi	High fever, headache, stomach pain, weakness.	Bloodstream, gastrointestinal tract.	Contaminated food and water.	Ciprofloxacin, ceftriaxone.
46.	Human infection with seasonal reassortant A(H1N2)	Influenza virus	Respiratory infection.	Nose, throat, lungs.	Through cough and sneeze of an infected person.	Antiviral drugs.
47.	Diphtheria	Corynebacterium diphtheriae	Difficulty in breathing, heart failure, paralysis.	Throat, nose.	Through respiratory droplets, the saliva of an infected person.	DTaP vaccine.
48.	Hantavirus	Sin Nombre virus	Fatigue, fever, muscle aches, headache, dizziness, chills, nausea, vomiting, diarrhea, abdominal pain.	Heart, lungs, kidney.	Through fresh urine, droppings, or saliva of infected rodents.	No medicine.
49.	Swine flue	Swine Influenza Virus, H1N1 Virus	Fever, cough, sore throat, chills.	Upper and lower respiratory tracts.	Through infected pigs, coughing and sneezing infected droplets in the air.	Oseltamivir (Tamiflu), Zanamivir (Relenza).
50.	Nipah virus	Nipah virus	asymptomatic infection, acute respiratory illness, encephalitis	Respiratory tract, brain, heart.	Coughing and sneezing infected droplets in the air, pigs, fruit bats.	No medicine.

Table 3. Disease outbreak of the viral disease in India (23)

Sl. No.	Disease	Affects
1.	Nipah Virus	7 August 2018; 31 May 2018
2.	Zika Virus Infection	26 May 2017
3.	Chikungunya	17 October 2006; 17 March 2006
4.	Avian Influenza	23 February 2006, 21 February 2006
5.	Japanese Encephalitis (JE)	13 September 2005
6.	Meningococcal Disease	14 June 2005, 30 May 2005, 17 May 2005, 12 May 2005, 9 May 2005
7.	Dengue Fever	12 November 2003, 30 October 2003
8.	SARS (Severe Acute Respiratory Syndrome)	14, 13, 12, 10, 9, 8, 7 May 2003; 30, 29, 28, 26, 25, 24, 23, 22, 21, 19, 18, 17 April 2003
9.	Plague	20 February 2002
10.	Cholera	14 August 2001

Wild watermelon juice (WWMJ) has anti-influenza property that restricts the adsorption and viral replication in late stages, leading to virus internalizing reduction. As a result, it's employed as a valuable food by-product in developing anti-influenza medications and agents. For example, in Madin-Darby canine kidney cells, the juice of *Citrullus lanatus* (wild watermelon) inhibited influenza virus multiplication the most effectively (25).

In MDCK cells, PPE (Pomegranate Polyphenol Extract) inhibits Influenza A virus replication by inhibiting the virus' ability to replicate. Viral ribonucleoprotein (RNP) entrance into the nucleus or virus RNP translocation from the nucleus to the cytoplasm were not altered by PPE in MDCK cells. Toxicologically, Punicalagin inhibited viral replication, prevented viral agglutination of chicken RBCs, and had antiviral effects on the virus. Thus, oseltamivir's anti-influenza properties were boosted when it was used in conjunction with the PPE. PPE suppressed human influenza A/Hong Kong (H3N2) *in vitro* (26). Quercetin and its derivatives used in complementary therapy and traditional medicine in treating influenza and other inflammatory diseases found in fruits and vegetables contain flavanol compounds that have a strong reputation for inflammatory diseases treatment (27).

Common cold

The common cold was discovered in the 1950s, but it appears to have been around since the dawn of civilization (28). The term "cold" was coined in the 16th century because of its similarity to exposure to cold weather (29). For prevention of Common Cold, entire plant of *Allium haementhoides* is cooked and its boiled liquid is consumed; bulb of *Allium ursinum* is cooked or taken as raw; *Althaea officinalis* petal, *Anchusa italic* petal, leaf and root, *Eucalyptus comaldulensis* L. leaf, *Lallemantia iberica* grain, *Malva neglecta* grain, *Matricaria recutita* petal and branch, *Ziziphus jujube* fruit, peel and kernel, *Quercus branti* fruit and leaf; *Salvia hydreange* and *Salvia multicaulis* petal, *Stachys lavandulifolia* petal and branch, *Tanacetum parthenium* root is taken as boiled liquid; Petal, leaf and stem of *Falcaria vulgaris*, *Zingiber officinale* leaf and root is brewed; *Nectaroscordeum tripedale* entire plant is taken as raw; leaf and grain of *Nepeta elymatica* is taken as brewed and dry with yogurt; *Nerium oleander* leaf and grain is used as steam sniff; *Phleum pretense* L. branch is used as brewed; *Plantago psyllium* entire plant is used as brewed or boiled liquid; *Punica granatum* grain is taken in dried form eaten with food (30). Citrates and Vitamin C are detected in EXO-CLS (exosome-like nanovesicles from *Citrus limon* L. juice). They exhibited a substantial protective impact against oxidative stress when taken up by mesenchymal stromal cells (MSCs) in vitro (31, 32).

When common cold symptoms first appeared, patients were randomly allocated to receive either the herbal mixture (*Matricaria chamomile, Glycyrrhiza glabra, Althaea officinalis, Malva sylvestris, Adiantum capillus-veneris, Hyssopus officinalis* and *Ziziphus jujube*) or an inactive placebo. Compared to placebo, the herbal blend substantially reduced the intensity of coughing and overnight awakenings. Children with intermittent asthma may benefit from a short course of this traditional herbal preparation, which is administered at the commencement of a viral respiratory tract infection (33). Anise Seeds are rich in calcium, iron, copper and potassium sources. They are also a good supplier of manganese zinc and magnesium. For safe usage as a superfood supplement, anise seeds and essential oils are promising and raw components in the pharmaceutical and culinary sectors. It comprises anethole, estragole, eugenol, pseudo-eugenol, coumarins, scopoletin, umbelliferon and estrols, as well as hydrocarbon terpenoids and polyacetylenes as its primary constituents. Phytochemically and clinically, the plant's oil has a positive impact (34).

Alpha Terpineol, L-terpinene-4-ol and Beta-Linalool were the primary chemicals produced from an aqueous extract of essential oil from the aerial portion of *Origanum majorana* L. (35). The *Z. jujube* fruit is a traditional remedy as well as food. It strengthens and nourishes the liver and spleen as well. For example, lignans and flavonoids are among the many types of triterpenoid compounds that can be found in plants. TCM relies on ZJF's digestive, cardiovascular, neuroprotective, sedative-hypnotic and anxiolytic properties and its ability to strengthen and replenish the middle Qi and nourish the blood to help people relax and cope with anxiety (36).

Respiratory syncytial virus infection

Amaryllis belladonna L., *Blumea laciniata*, *Elephantopus scaber* L., *Mussaenda pubescens* Dry, *Narcissus tazetta* L., *Schefflera heptaphylla* (L.), *Scutellaria indica* L., *Selaginella sinensis* are medicinal herbs that are beneficial in the treatment of respiratory virus infections (37). Supercritical fluid extract of *Citrus reticulata* showed antiviral activity against the respiratory syncytial virus (RSV) *in vitro*. Tangerine and Nobiletin, two polymethosylated flavones, were found to have more significant anti-RSV activity than ribavirin, the positive control. Tangeretin dose-dependently reduced the development of RSV-induced plaques on HEp-2 cells and inhibited the expression of RSV phosphoprotein (P protein) (38). An ethanolic extract of *M. piperita* leaves includes significant levels of flavonoids and phenolic acids in lipopolysaccharide-stimulated RAW 264.7 cells, shown antiviral activity against RSV with a long selectivity list, and dramatically reduced NO, TNF-γ, IL-6 and PGE2 production (39).

Adenovirus infection

A significant component of shikonin, Radix Lithosperm eyrthrorhizon, has various biological properties that limit the growth of Adenovirus type 3 infection and was thus employed in ancient Chinese medications (40). *Thymus daenensis, Thymus vulgaris* and *Zataria multiflora*, 3 medicinal plants of Lamiaceae, were planted in Iran to test the compound's ability to treat adenovirus infection. Monoterpene phenols, particularly thymol and carvacrol, are abundant in *T. daenensis* oil. It is also rich in pcymene and β-caryophyllene (41). Flavonoids and carvacrol, 2 plant components, have anti-inflammatory properties. In addition to reducing oxidative stress, *Z. multiflora* can be applied to remedy oxidative damage. *Z. multiflora* was also found to reduce malondialdehyde levels and preserve nitric oxide levels in the serum. Furthermore, *Z. multiflora* and its com-

ponents, carvacrol and thymol, were found to progress serum IgE levels, decrease pro-inflammatory cytokines (IL-4, TGF and IL-17) and raise anti-inflammatory cytokines (IFN-γ and FOXP3) (42).

Measles

In the 4th century BC or as late as AD 500, people were infected with a forerunner to the measles (43, 44). To prevent measles, coriander seeds and old leaves are cooked and bathed by the youngster. *Phiopogon japonicus* includes *Perilla frutescens* var. *crispa, Pueraria thomsoni, Elsholtzia cristata, Ophiopogon japonicus* and *Glycyrrhiza uralensis* are used as a fine powder is regarded as one of the best treatments for years. Children drink boiling jasmine leaves to prevent measles, while *Houttuynia cordata* juice is used to treat cough (45). Lemongrass, marjoram, old coriander leaves are cooked for cleaning the children's bodies. The herbs such as *Elsholtzia cristata* leaves, *Wedelia chinensis* leaves, lettuce leaves, *Lactuca indica*, mulberry leaves, bamboo leaves, *Ecliptaalba hassk*, *Senna alata* seeds, *Glycyrrhiza uralensis* or sugarcane and ripe mulberry leaves, *Eclipta prostrata*, *Glycyrrhiza uralensis*, lotus leaf, black beans, clean water are cooked to form a condensed liquid (46).

Artemisia dubia Wall. ex Besser, *Cinnamomum camphora*, *Elephantopus scaber*, *Polycarpon prostratum*, *Prosopis juliflora*, *Scoparia dulcis*, *Typha elephantina* are important plant species used in treating measles. Mostly leaves and roots are used in producing medicine against measles other than rhizomes, fruits and whole plants (47). Plants known as *Bambusa vulgaris* treat hepatitis, measles and kidney problems in Asian and African countries. According to the results, the methanolic extract had the maximum free radical scavenging capability and flavonoid concentration (48). Each chemical variety of camphor (*Cinnamomum camphora*) has a distinct essential oil makeup. It includes camphor as its primary component, along with eugenol, cineole, nerolidol, limonene, safrole, borneol and camphene, as well as myrcene and p-cymene (49).

Malaria

The malaria epidemic in India peaked in the 1950s, with an estimated 75 million cases and 0.8 million deaths each year (World Wellbeing Organization, Nation Office for India). By 1961, the National Malaria Control Programme (NMCP) had altogether diminished the number of complex cases to 50000 and there had been no detailed fatalities (50). *Vernonia amygdalina*, *Callistemon citrinus*, *Mormodica feotida*, *Cyphostemma adenocaule*, *Aleo vera*, *Eucalyptus globulus* are essential plants used in treating malaria. Stem, bark and leaves were often used (51). *Andrographis paniculata* and *Nyctanthes arbor-tristis* are the ethnomedicinal plants among 38 commonly used plants used in malaria treatment and prevention from Odisha tribal areas. Studies show the anti-malarial compound presence against *Plasmodium falciparum* (52). In addition to sesquiterpenes (the primary one is eugenol), the tulsi leaves contain monoterpenes. By mobilizing mucus 15, a liquid extract of leaves coupled with honey and ginger is used to treat bronchitis, asthma, malaria, cough and cold. This plant stimulates interferon- γ, IL-4, T-helper cells and NK cells, reducing bacterial burden through phagocytosis 17 (53). Mosquitocidal and antibacterial properties of silver nanoparticles made from *A. vera* leaf extract. In experimental settings, *Aloe vera* extract was toxic to *Anopheles stephensi* larvae and pupae, even at low dosages. Silver nanoparticles produced in green were extremely poisonous to *Anopheles stephensi*. When applied in outdoor settings, silver nanoparticles produced by *A. vera* reduce *A. stephensi* larvae numbers (54).

SARS (Severe Acute Respiratory Syndrome) and SARS-COV (COVID-19)

SARS, SARS CoV-2 (Covid-19), and MERS are the serious known coronaviruses that infect humans. The virus that causes COVID-19 (coronavirus disease 2019), the respiratory ailment that started the COVID-19 pandemic, is the severe acute respiratory syndrome coronavirus 2 (SARSCoV2). It was formerly known by its preliminary designation, 2019 novel coronavirus (2019-nCoV), and has also been termed human coronavirus 2019 (HCoV-19 or hCoV-19) and came to India in the year 2020 (55, 56). *Folium mori, Radix menthae, Rhizoma phragmitis, Glehniae radix, Radix saposhnikoviae, Isatidis folium* and many more are the essential plants used in treating SARS (57). *Withania somnifera* (Ashwagandha) has two inhibitors Withanoside V and Somniferine, *Tinospora cordifolia* (Giloy), has one inhibitor, Tinocordiside and *Ocimum sanctum* (Tulsi) has three inhibitors Vicenin, Isorientin 4′-*O*-glucoside 2″-*O*-*p*-hydroxybenzoate and Ursolic acid against SARS-CoV-2 (58). *Lycoris radiata, Artemisia annua, Pyrrosia lingua* and *Lindera* aggregate demonstrated anti-SARS-CoV benefits with the median effective concentration of 200 Chinese herbal extracts. Antiviral drugs that impede COVID-19 development can be obtained from ethnomedicinal plants (59).

Glycyrrhiza uralensis, *Lonicera japonica*, *Atractylodes macrocephala*, *Astragalus membranaceus*, *Salvia miltiorrhiza* and many other plants are used in COVID-19 clinical treatment (60). SARS Coronavirus Main Protease and Papain-like Protease were shown to be inhibited by the tulsinol family of compounds A-G and dihydrodieuginol B. Due to its immunomodulatory characteristic and ACE II binding properties, *Ocimum sanctum* extract can be used as a preventative strategy against CoV (61). The patient who obtained Traditional Chinese Medicine decoction within 3 days of admission had a notably shorter time to negative SARS-CoV -2 swabs from the nasopharynx and mouth and a shorter time to negative SARS-CoV-2 urine, stool and blood samples. TCM decoction taken more than seven days before admission may be associated with longer hospitalization days, more extended disease period and slower SARS-CoV-2 conversion to the negative state. Hence, they recommended receiving TCM decoction therapy in the early stages of their illness (62).

Future Research Challenges

A lot of hurdles must be overcome in addition to the various benefits. Traditional Knowledge of plants is dissolving day by day because of insufficient recording and low intergen-

erational knowledge transfer. Furthermore, due to the rapid land-use change, most vital medicinal plants are rapidly vanishing. Secondary metabolites may stimulate synthesis via a particular regulatory pathway and a unique transport route in specific organs, tissues and cells. Molecular regulatory mechanisms of active component production and metabolism in medicinal plants are needed at various development stages and stress situations. The molecular regulatory mechanisms can be discovered using new methods for studying genomes, transcriptomics and metabolomics. These may reveal changes in metabolic pathways of the main active constituents of medicinal plants. In recent years, many advanced biotechnological approaches have been used to select and evaluate medicinal plants for use in traditional and modern medical preparations and drug discovery. However, throughout laboratory-based assays detected during clinical trials, the toxicities of plant metabolites are occasionally missed. Because the isolation and purification of pure plant-derived chemicals are very complicated, time-consuming and labour-intensive, failures in clinical trial phases are highly disheartening. Ethnobotanical research and pharmacological and phytochemical characterization are critical for expanding overall Knowledge of plant pharmacophylogeny curative effect.

Conclusion

This review revealed the importance of educating herbal medicines and the selective use of botanicals to treat viral illnesses. Traditional herbal drugs have fewer side effects and are less expensive, so people extensively use them. Herbal plants are effective conventional pharmaceuticals for the treatment of viral infections. However, scientific research into the efficacy of these plants in the treatment of ailments as suggested by traditional healers is required.

Authors contributions

GM: Conceptualization and design of this work; UM and JB (equal contribution to both authors): Writing, collection, interpretation and arrangement of data; GM: Critically revised the manuscript; All the authors read and approved the final manuscript.

Compliance with ethical standards

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References

1. Asthana A, Anil Kumar, Gangwar S, Dora J. Pharmacological Perspectives of *Cynodon dactylon*. Res Pharmaceut Biol Chem Sci. 2012;3(2):1135-47.
2. World Health Organization (WHO). Summary of WHO guidelines for the assessment of herbal medicines. Herbal Gram. 1993;28:13 -14.
3. Mamman PH, Mshelia WP, Susbatrus SC, Sambo KW. Antibacterial effects of crude extract of *Azadirachta indica* against *Escherichia coli*, *Salmonella* spp. and *Staphylococcus aureus*. Int J Med Med Sci. 2013;5(1):14-18.
4. Pattanayak S, Mandal TK, Bandyopadhyay SK. Use of plants as digestive stimulator and tonic in three southern districts of West Bengal, India. Int J Herbal Med. 2015;3(5):01-08.
5. Bharati K, Vrati S. Viral vaccines in India: an overview. Proc Natl Acad Sci India Sect B Biol Sci. 2012; 82(1):181-98. https//doi.org/10.1007/s40011-011-0014-9
6. Dogra KS, Chauhan S, Jalal JS. Assessment of Indian medicinal plants for the treatment of asthma. J Med Plants Res. 2015; 9 (32):851-62. https://doi.org/10.5897/JMPR2015. 5890
7. Kotwal GJ, Kaczmarek JN, Leivers S, Ghebremariam YT, Kulkarni AP, Bauer G, CDEB, Preiser W, Mohamed AR. Anti-HIV, anti-poxvirus, and anti-SARS activity of a non-toxic, acidic plant extract from the Trifolium species Secomet-V/ anti-Vac suggests that it contains a novel broad-spectrum antiviral. Ann NY Acad Sci. 2005;1056:293-302. https://doi.org/10.1196/annals.1352.014
8. Rates SM. Plants as Source of Drugs. Toxicon. 2001;39(5):603-13. http://doi.org/10.1016/S0041-0101(00)00154-9
9. Ngono NRA, Koanga MML, Tchinda TA, Magnifouet NH, Motso PR, Mballa BZ, Ebelle ERM, Ndifor F, Biyiti L, Amvam PH. Ethnobotanical survey of some Cameroonian plants used for the treatment of viral diseases. Afr J Plant Sci. 2011;5(1):15-21. https://doi.org/10.5897/AJPS.9000106
10. Pompei R, Flore O, Marccialis MA, Pani A, Loddo B. Glyrrhizic acid inhibits Virus Growth and inactivates Virus Particles. Nature. 1979; 281(5733):689-90. https://doi.org/10.1038/281689a0
11. Rollinger JM, Steindl TM, Schuster D, Kirchmair J, Anrain K, Ellmerer EP, Langer T, Stuppner H, Wutzler P, Schmidtke M. Structure-based virtual screening for the discovery of natural inhibitors for human rhinovirus coat protein. J Med Chem. 2008; 51(4):842-51. https://doi.org/10.1021/jm701494b
12. Mehendale R, Joshi M, Patravale V. Nanomedicines for treatment of viral diseases. Critical Reviews™ in Therapeutic Drug Carrier Systems. 2013;30(1);1-49. http://doi.org/10.1615/CritRevTherDrugCarrierSyst.2013005469
13. Adhikari B, Marasini BP, Rayamajhee B, Bhattarai B, Lamichhane G, Khadayat K, Adhikari A, Khanal S, Parajuli N. Potential roles of medicinal plants for the treatment of viral diseases focusing on COVID-19: A review. Phytother Res. 2020; 35(3):1298-1312. https://doi.org/10.1002/ptr.6893
14. John TJ, Dandona L, Sharma VP, Kakkar M. Continuing challenge of infectious diseases in India. The Lancet. 2011;377(9761):252-69. https://doi.org/10.1016/S0140-6736(10)61265-2
15. Tsoucalas G, Antonios K, Markos S. The 1918 Spanish Flu Pandemic, the origins of the H1N1-virus strain, a glance in history. Eur J Clin Biomed Sci. 2016;2.4:23-28.
16. Deja Flu: Spanish Lady killed 14 million in British India a century ago. Times of India 2020.
17. Chhina SAM. Explained: When corpses of Influenza victims were dumped in the Narmada River in 1918. Indian Express 2021.
18. Coronavirus: What India can learn from the deadly 1918 Flu. BBC 2020.
19. Mayor S. Flu experts warn of the need for pandemic plans. British Med J. 2000;321(7265):852. https://doi.org/10.1136/bmj.321.7265.852
20. Choudhari S, Priya VV, Gayathri R. Herbal remedies for Swine flu. Res J Pharm Techno. 2016; 9(10):1789-92. https://doi.org/10.5958/0974-360X.2016.00362.0
21. Hudson JB. The use of herbal extracts in the control of influenza. J Med Plants Res. 2009; 3(13):1189-95.
22. Mahmood MS, Mártinez JL, Aslam A, Rafique A, Vinet R, Laurido C, Ali S. Antiviral effects of green tea (*Camellia sinensis*) against

pathogenic viruses in humans and animals (a mini-review). Afr J Trad Complement Altern Med. 2016;13(2):176-84. https://doi.org/10.4314/ajtcam.v13i2.21

23. Yu Z, Yang Z. Understanding different regulatory mechanisms of proteinaceous and non-proteinaceous amino acid formation in tea (*Camellia sinensis*) provides new insights into the safe and effective alteration of tea flavor and function. Crit Rev Food Sci Nutr. 2020; 60(5):844-58. https://doi.org/10.1080/10408398.2018.1552245

24. Pleschka S, Stein M, Schoop R, Hudson JB. Antiviral properties and mode of action of standardized *Echinacea purpurea* extract against highly pathogenic avian influenza virus (H5N1, H7N7) and swine-origin H1N1 (S-OIV). Virol J. 2009;6(1):1-9. https://doi.org/10.1186/1743-422X-6-197

25. Behera K, Mandal U, Panda M, Mohapatra M, Mallick SK, Routray S, Parida S, Mahalik G. Ethnobotany and folk medicines used by the local healers of Bhadrak, Odisha, India. Egyptian J Bot. 2021; 61(2):375-89. https://doi.org/10.21608/EJBO.2020.26337.1474

26. Haidari M, Ali M, Casscells III SW, Madjid M. Pomegranate (*Punica granatum*) purified polyphenol extract inhibits influenza virus and has a synergistic effect with oseltamivir. Phytomed. 2009;16 (12):1127-36. https://doi.org/10.1016/j.phymed.2009.06.002

27. Mehrbod P, Hudy D, Shyntum D, Markowski J, Łos MJ., Ghavami S. Quercetin as a Natural Therapeutic Candidate for the Treatment of Influenza Virus. Biomolecules. 2021;11(1):10. https://doi.org/10.3390/biom11010010

28. Eccles R, Weber O. Common cold. Springer Science & Business Media; 2009. https://doi.org/10.1007/978-3-7643-9912-2

29. Tyrrell DAJ. Interferons and their clinical value. Clin Infect Dis. 1987;9(2):243-49. https://doi.org/10.1093/clinids/9.2.243

30. Delfan B, Kazemeini H, Bahmani M. Identifying effective medicinal plants for cold in Lorestan Province, West of Iran. J Evid Based Complementary Altern Med. 2015;20(3):173-79. https://doi.org/10.1177/2156587214568458

31. Da Costa Mendieta M, Heck RM, Ceolin S, de Souza AD, Vargas NR, Piriz MA, Borges AM. Medicinal plants indicated for flu and colds in the South of Brazil. Rev Eletr Enf. 2015;17(3):1-8. http://dx.doi.org/10.5216/ree.v17i3.28882

32. Baldini N, Torreggiani E, Roncuzzi L, Perut F, Zini N, Avnet S. Exosome-like Nanovesicles. Isolated from *Citrus limon* L. Exerts Anti-Oxidative Effect. Curr Pharm Biotechnol. 2018;19(11):877-85. https://doi.org/10.2174/1389201019666181017115755

33. Li Y, Liu Y, Ma A, Bao Y, Wang M, Sun Z. In vitro Antiviral, anti-inflammatory and antioxidant activities of the ethanol extract of *Mentha piperita* L. Food Sci Biotechnol. 2017;26(6):1675-83. https://doi.org/10.1007/s10068-017-0217-9

34. Makrane H, Aziz M, Berrabah M, Mekhfi H, Ziyyat A, Bnouham M, Eto B. Myorelaxant activity of essential oil from *Origanum majorana* L. on rat and rabbit. J Ethnopharmacol. 2019;228:40-49. https://doi.org/10.1016/j.jep.2018.08.036

35. Liu SJ, Lv YP, Tang ZS, Zhang Y, Xu HB, Zhang DB, Wei SM. *Ziziphus jujuba* Mill. A plant used as medicinal food: a review of its phytochemistry, pharmacology, quality control and future research. Phytochem Rev. 2020;1-35. https://doi.org/10.1007/s11101-020-09709-1

36. Sobhani Z, Nikoofal-Sahlabadi S, Amiri MS, Ramezani M, Emami SA, Sahebkar A. Therapeutic effects of *Ziziphus jujuba* Mill. Fruit in traditional and modern medicine: A review. Med Chem. 2020;16(8):1069-88. https://doi.org/10.2174/1573406415666191031143553

37. Venu LN, Austin A. Antiviral efficacy of medicinal plants against respiratory viruses: Respiratory Syncytial Virus (RSV) and Coronavirus (CoV) / COVID 19. J Phytopharmacol. 2020;9(4):281-90. https://doi.org/10.31254/phyto.2020.9412

38. Xu JJ, Wu X, Li MM, Li GQ, Yang YT, Luo HJ, Li YL. Antiviral activity of polymethoxylated flavones from "Guangchenpi", the edible and medicinal pericarps of *Citrus reticulate* 'Chachi'. J Agricul Food Chem. 2014;62(10):2182-89. https://doi.org/10.1021/jf404310y

39. Shahrajabian MH, Sun W, Cheng Q. Chinese star anise and anise, magic herbs in traditional Chinese medicine and modern pharmaceutical science. Asian J Med Biol Res. 2019; 5(3):162-79. https://doi.org/10.3329/ajmbr.v5i3.43584

40. Gao H, Liu L, Qu ZY, Wei FX, Wang SQ, Chen G, Qin L, Jiang FY, Wang YC, Shang L, Gao CY. Anti-adenovirus activities of shikonin, a component of Chinese herbal medicine *in vitro*. Biol Pharm Bull. 2011;34(2):197-202. https://doi.org/10.1248/bpb.34.19

41. Saderi H, Abbasi M. Evaluation of anti-adenovirus activity of some plants from Lamiaceae family grown in Iran in cell culture. Afr J Biotech. 2011; 10(76):17546-50. https://doi.org/10.5897/AJB10.1686

42. Khazdair MR, Ghorani V, Alavinezhad A, Boskabady MH. Pharmacological effects of *Zataria multiflora* Boiss L. and its constituents focus on their anti-inflammatory, antioxidant and immunomodulatory effects. Fundam Clin Pharmacol. 2018;32(1):26-50. https://doi.org/10.1111/fcp.12331

43. Kupferschmidt K. Measles may have emerged when large cities rose, 1500 years earlier than thought. Sci. 2019. https://doi.org/10.1126/science.aba7352

44. Furuse Y, Suzuki A, Oshitani H. Origin of measles virus: divergence from rinderpest virus between the 11 th and 12 th centuries. Virol J. 2010;7(1):1-4. https://doi.org/10.1186/1743-422X-7-52

45. Hoi HT. The roles of medicinal herbs in the treatment of measles. Int J Res Pharm Sci. 2020; 11 (3);3872-77. https://doi.org/10.26452/ijrps.v11i3.2570

46. Gupta S, Mukherjee M. Some useful medicinal plants used against measles from West Bengal. J Pharmacy. 2015;5(2):13-19.

47. Dash G, Mohanty KK, Sahoo D, Mahalik G, Parida S. Traditional medicinal plants used for the treatment of asthma in Bhubaneswar, Odisha. Int J Herb Med. 2018;6(5):57-60.

48. Adeyanju O, Akomolafe SF, Atoki V, Oboh G. The leaves of *Bambusa vulgaris* (L.) ameliorate. Pro- oxidants induced nephrotoxicity in rats - *In vitro*. FUTA J Res Sci. 2019;15(1):102-12.

49. Hamidpour R, Hamidpour S, Hamidpour M, Shahlari M. Camphor (*Cinnamomum camphora*), a traditional remedy with a history of treating several diseases. Int J Case Rep Images. 2013;4(2):86-89. https://doi.org/10.5348/ijcri-2013-02-267-RA-1

50. Sharma SK, Tyagi PK, Padhan K, Upadhyay AK, Haque MA, Nanda N, Joshi H, Biswas S, Adak T, Das BS, Chauhan VS. Epidemiology of malaria transmission in forest and plain ecotype villages in Sundargarh District, Orissa, India. Trans R Soc Trop Med Hyg. 2006;100(10):917-25. https://doi.org/10.1016/j.trstmh.2006.01.007

51. Malinga GM, Baana K, Rutaro K, Opoke R, Atube F, Opika-Opoka H, Oryema C. An ethnobotanical study of plants used for the treatment of malaria in Budondo sub-county, Eastern Uganda. Ethnobot Res Appl. 2020;19:1-5. https://doi.org/10.32859/era.19.04.1-15

52. Singh H, Dhole PA, Krishna G, Saravanan R, Baske PK. Ethnomedicinal plants used in malaria in tribal areas of Odisha, India. Indian Journal of Natural Products and Resources. 2018;9(2):160-67.

53. Goel N, Wadi I. A Review on Herbal Therapy for Respiratory Ailments. Int J Life Sci Pharma Res. 2016;5(2).

54. Dinesh D, Murugan K, Madhiyazhagan P, Panneerselvam C, Kumar PM, Nicoletti M, Suresh U. Mosquitocidal and antibacterial activity of green-synthesized silver nanoparticles from *Aloe vera*

extract: towards an effective tool against the malaria vector *Anopheles stephensi*. Parasitol Res. 2015;114(4):1519-29. https://doi.org/ 10.1007/s00436-015-4336-z

55. Gorbalenya AE, Baker SC, Baric RS, de Groot RJ, Drosten C, Gulyaeva AA, Haagmans BL., Lauber C, Leontovich AM., Neuman BW., Penzar D. Coronaviridae study group of the International Committee on Taxonomy of Viruses. The species severe acute respiratory syndrome-related coronavirus: classifying 2019-nCoV and naming it SARS-CoV-2. Nat Microbiol. 2020;5(4):536-44. https://doi.org/10.1038/s41564-020-0695-z

56. Wong G, Bi YH, Wang QH, Chen XW, Zhang ZG, Yao YG. Zoonotic origins of human coronavirus 2019 (HCoV-19/SARS-CoV-2): why is this work important? Zoolog Res. 2020; 41(3):213. https://doi.org/10.24272/j.issn.2095-8137.2020.031

57. Shahrajabiana MH, Sun W, Shen H, Cheng Q. Chinese herbal medicine for SARS and SARS-CoV-2 treatment and prevention, encouraging using herbal medicine for COVID-19 outbreak. Acta Agric Scand B Soil Plant Sci. 2020;70(5):437-43. https://doi.org/10.1080/09064710.2020.1763448

58. Shree P, Mishra P, Selvaraj C, Singh SK, Chaube R, Garg N, Tripathi YB, Targeting COVID-19 (SARS-CoV-2) main protease through active phytochemicals of ayurvedic medicinal plants – *Withania somnifera* (Ashwagandha), *Tinospora cordifolia* (Giloy) and *Ocimum sanctum* (Tulsi) - a molecular docking study. J Biomol Struc Dynamics. 2020; 26:1-4. https://doi.org/10.1080/07391102.2020.1810778

59. Shoaib A, Azmi L, Shukla I, Alqahtani SS, Alsarra IA, Shakeel F. Properties of ethnomedicinal plants and their bioactive compounds: Possible use for COVID-19 prevention and treatment. Curr Pharm Des. 2021;27(13):1579-87. https://doi.org/10.2174/1381612826666201106092021

61. Akalın E, Ekici M, Alan Z, Elevli EO, Bucak AY, Aobuliaikemu N, Uresin AY. Traditional Chinese medicine practices used in COVID-19 (Sars-cov 2/Coronavirus-19) treatment in the clinic and their effects on the cardiovascular system. Turk Kardiyol Dern Ars. 2020; 48(4):410-24. https://doi.org/10.5543/tkda.2020.03374

62. Varshney KK, Varshney M, Nath B. Molecular Modeling of isolated phytochemicals from *Ocimum sanctum* towards exploring potential inhibitors of SARS coronavirus main protease and papain-like protease to treat COVID-19. SSRN 3554371. 2020. https://ssrn.com/abstract=355437

63. Shi J, Lu Y, Zhang Y, Xia L, Ye C, Lü Y, Chen S, Xu Q, Tang B, Yin K, Zhang J. Traditional Chinese medicine formulation therapy in the treatment of coronavirus disease 2019 (COVID-19). American J Chinese Med. 2020;48(07):1523-38. https://doi.org/10.1142/S0192415X20500755

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