The Nobel Prize Weed. Why Are We Warned Not to Use It?

https://youtu.be/0UfbPi_u-qc?si=F_pU1CE1QNpAI_bE

Topic: Medicinal Plants & Traditional Medicines grown by ***EGG Pharma***

Table of Contents

The Plant That Won a Nobel Prize

Malaria has killed half of all humans who have ever lived.

In 1967, it was killing more soldiers in Vietnam than bullets. The world's most powerful armies were powerless against a microscopic parasite. Their drugs had failed. The resistance was spreading.

They needed a weapon that did not exist in modern science.

So the Chinese government did not look forward. They looked backward - into a forbidden archive from the year **340 AD**.

What they found was a chemical bomb hidden inside a common garden plant. A plant that:

- Hunts cancer cells
- Obliterates parasites
- Cures fever in hours

And a plant that the pharmaceutical industry is terrified you will learn to grow.

They say it is dangerous to use the whole plant. They say you must buy the extracted pill.

But for 1,600 years, nobody told the emperors of China that.

1,600 Years of Ancient Wisdom

The Year 340 AD - Eastern Jin Dynasty

A scholar named **Ge Hong** is compiling an emergency medical handbook. He calls it *Zhou Hou Bei Ji Fang* - "Emergency Prescriptions Kept Up One's Sleeve."

Inside, he documents hundreds of remedies. But one stands out.

For intermittent fevers (what we now call malaria), he prescribes a specific plant. His instructions are oddly precise:

"Take a handful of Qing Hao, soak it in about half a gallon of water, wring out the juice, and drink it all."

But here is what makes the prescription remarkable: **He never says to boil it.**

For 16 centuries, that detail seemed insignificant. Then in 1971, it saved the world.

1596 - The Ming Dynasty

Li Shizhen, the most celebrated physician of the Ming Dynasty, includes Qing Hao in his *Compendium of Materia Medica*. He recommends tea made from it specifically for malaria.

The plant becomes foundational in Traditional Chinese Medicine - used not just for fever, but for expelling intestinal parasites.

They call it **Wormwood**. The name tells you what it does.

Project 523: The Secret Military Operation

The Vietnam Crisis

Fast forward to 1967. The Vietnam War is destroying armies on both sides - not just with combat, but with disease.

Malaria is killing thousands. In China alone: **30 million cases every year and 300,000 deaths.**

The standard drugs are failing:

- Chloroquine fails
- Quinine fails
- The parasites have learned to resist

May 23rd, 1967

The Chinese government holds an emergency meeting in Beijing. They launch a secret military operation called **Project 523** - named for that date.

Their mission: Find a cure before malaria decimates the military.

They screen over **240,000 compounds**. Nothing works.

Enter Tu Youyou

In January 1969, they bring in **Tu Youyou**, a pharmaceutical chemist at the China Academy of Traditional Chinese Medicine.

Her assignment is nearly impossible: Review ancient medical texts and find something modern science missed.

She and her team:

- Screen over 2,000 traditional recipes
- Test 380 herbal extracts from about 200 different plants
- Most fail

One plant keeps appearing in the old texts: *Artemisia annua* - Sweet Wormwood.

The Breakthrough

Initial experiments are frustrating. They boil the wormwood according to conventional scientific methods. The results are inconsistent - it works one day, fails the next.

Tu Youyou is perplexed. The ancient texts clearly say this plant works. What are they missing?

Then she remembers Ge Hong's instructions from 340 AD: **He never mentioned heat.**

She realizes that boiling water might be destroying the active compound.

October 4th, 1971

Using a low-temperature ether extraction instead of boiling water, Tu Youyou successfully isolates a compound that shows **100% effectiveness** against malaria in mice and monkeys.

But nobody knows if it is safe for humans.

In an act of remarkable courage, Tu Youyou and two colleagues volunteer to be the first test subjects. She later said: "As head of this research group, I had the responsibility."

They survived. Clinical trials followed. All 21 malaria patients in the first study recovered completely.

They named the compound **Qinghaosu**. The world now knows it as **Artemisinin**.

October 5th, 2015 - Stockholm, Sweden

Tu Youyou, now 84 years old, receives the **Nobel Prize in Physiology or Medicine**. She is the first mainland Chinese scientist to win a Nobel Prize in a scientific category. She did it without a doctorate, without a medical degree, without training abroad - just ancient texts and persistence.

Her acceptance speech title: *"Discovery of Artemisinin - A Gift from Traditional Chinese Medicine to the World."*

How Artemisinin Kills Malaria

The Molecular Weapon

The secret lies in a molecular weapon hidden inside the leaves: an **endoperoxide bridge** - a rare chemical structure that reacts with iron.

The Mechanism

Malaria parasites survive by feasting on hemoglobin in your red blood cells. Because of this, they are loaded with iron.

When artemisinin enters the parasite:

1. It reacts with that high iron concentration

2. The endoperoxide bridge breaks apart
3. It generates free radicals
4. Essentially detonating a **microscopic bomb** inside the parasite

It kills them within hours - **faster than any other antimalarial drug in history**.

The Impact

According to World Health Organization estimates:

- Artemisinin-based drugs have reduced global malaria mortality by over **20%**
- In Africa alone, more than **100,000 lives are saved every year**

The Lasker Foundation calls it *"arguably the most important pharmaceutical intervention in the last half century."*

Follow the Money

The WHO's Official Position

Why does the World Health Organization discourage people from growing and using artemisia themselves?

Their official reasoning:

- Concerns about standardization
- Dosage variability
- Quality control
- The potential for developing drug resistance

It sounds reasonable... until you follow the money.

The Market Numbers

- **Artemisinin pharmaceutical market:** $75-96 million in 2024, projected $225-677 million by 2030
- **Artemisinin-based combination therapy market:** $362 million in 2024, projected $529 million by 2030

Major pharmaceutical giants like **Sanofi** have invested heavily in producing semi-synthetic artemisinin using genetically engineered yeast.

This centralizes production. It eliminates the small farmer. It ensures artemisinin remains under corporate control.

The Alternative

Compare that to the alternative:

- A packet of *Artemisia annua* seeds costs about **$5** online
- The plant thrives in poor soil
- It requires minimal water
- It produces multiple harvests per year

One backyard garden could supply antimalarial tea for months.

If people in malaria-endemic regions simply grew artemisia in their gardens and made tea, they would not need to buy expensive pills from Novartis or Sanofi.

The WHO's position protects that infrastructure. It protects those profit margins.

Beyond Malaria: Cancer & Parasites

Cancer Cells and Iron

Since the early 1990s, researchers have discovered that the same mechanism that kills malaria parasites also targets cancer cells.

Remember the iron? Malaria parasites hoard iron. But cancer cells are even worse.

Cancer cells are metabolic hogs. They require **5 to 15 times more iron** than normal cells to sustain their rapid growth and division.

They are essentially primed to explode.

Antiparasitic Properties

Studies confirm that *Artemisia absinthium* (Bitter Wormwood) and *Artemisia annua* both possess potent antiparasitic properties. They kill:

- Tapeworms
- Roundworms
- Pinworms

A 2017 study found *Artemisia absinthium* extract caused paralysis, death, and ultrastructural damage to *Hymenolepis nana*, a common human tapeworm.

The active compounds include thujone (in bitter wormwood) and various sesquiterpene lactones. These compounds interfere with the parasites' nervous systems, causing paralysis and eventual expulsion from the host body.

In developing countries where antiparasitic drugs like albendazole are expensive or unavailable, wormwood represents an accessible alternative. It grows readily, requires no pharmaceutical infrastructure, and has been used safely for millennia.

Yet again, major health organizations remain silent on wormwood's antiparasitic properties outside malaria.

The Absinthe Myth

The Green Fairy

The plant has a cousin, *Artemisia absinthium*, better known as the primary ingredient in **Absinthe**.

In the late 19th century, absinthe was the drink of Europe. Van Gogh drank it. Toulouse-Lautrec drank it. Oscar Wilde drank it. Ernest Hemingway drank it.

They called it "the green fairy."

It was also blamed for madness, violence, and moral collapse.

The 1905 Catalyst

A Swiss man named Jean Lanfray murdered his wife and two daughters in a drunken rage. The press focused on the two glasses of absinthe he had consumed before the killings.

They ignored that he had also drunk cognac, brandy, creme de menthe, wine, and beer. He was a chronic alcoholic who had been drinking since breakfast.

But the damage was done. Prohibitionists seized the moment. They claimed wormwood caused psychosis. They invented a condition called "absinthism."

By 1915, absinthe was banned across Europe and the United States.

The official reason was **thujone**, a compound in wormwood said to be a dangerous neurotoxin. The French wine industry, which had long viewed cheap absinthe as competition, actively lobbied for the ban.

The Truth Revealed

For a century, the prohibition held. Then in the 1990s, scientists actually tested vintage bottles of pre-ban absinthe.

They measured thujone content. The levels averaged **1.3 mg per liter** - far below anything needed for psychoactive or toxic effects.

The madness was a myth.

The hallucinations were just extreme alcohol intoxication combined with adulterated cheap brands that added toxic substances like antimony and methanol.

Modern research confirms thujone at absinthe concentrations poses no more risk than any high-proof spirit.

The European Union lifted bans in 1998. The United States followed in 2007.

It was a trade war disguised as public health.

Who Benefits From Your Ignorance?

Where We Stand

We have a plant:

- Used safely for **1,600 years**
- Validated by a **Nobel Prize in 2015**
- Proven to kill parasites **faster than any drug on the market**
- Showing massive potential against **cancer cells**

And yet, the authorities tell you it is dangerous to grow it in your garden. They tell you it is irresponsible to use the whole plant. They tell you that standardization is more important than access.

But standardization is just another word for centralization - for corporate control, for profit protection.

The Real Question

Is wormwood a miracle cure-all? No. Does it have limitations? Absolutely. Raw plant material does vary in artemisinin content based on growing conditions. And there are legitimate questions about optimal dosing.

But the question you have to ask is: **Who benefits from you not knowing about it?**

- Not people in malaria-endemic regions who lack pharmaceutical access
- Not cancer patients seeking affordable complementary therapies
- Not communities wanting healthcare self-sufficiency

The beneficiaries are pharmaceutical companies protecting their market share, regulatory agencies maintaining institutional control, and a medical-industrial

complex that profits from complexity and centralization rather than from accessible, affordable plant medicines.

Self-Sufficiency Works

Organizations like **Doctors Without Borders** have successfully implemented artemisia-based treatment programs in sub-Saharan Africa, training local farmers to grow and process the plant according to standardized protocols.

These initiatives demonstrate that quality control and efficacy can be achieved without pharmaceutical industry involvement.

The difference: When communities grow their own medicine, they are no longer customers. They are self-sufficient.

The Math

- One packet of seeds costs **$5**
- One pharmaceutical prescription costs **hundreds of dollars**
- One log of growing data, one generation of knowledge passed down versus a lifetime of dependence on pills you cannot afford

Tu Youyou's Words

In 2015, Tu Youyou said in her Nobel acceptance speech:

"Artemisinin is a true gift from old Chinese medicine. But this is not the only instance in which the wisdom of Chinese medicine has borne fruit."

She was acknowledging something modern medicine consistently downplays:

Ancient plant wisdom, tested across millennia of human use, often contains profound therapeutic value.

They can ban a bottle. They can discourage a tea.

But they cannot patent a weed.

The Effects of *Artemisia* Plant and Its Components Against Respiratory Viruses Like Influenza and Their Mechanisms of Action

Context:*Artemisia* genus and its chemical constituents show antiviral activity against different viruses. The aim of this study was to review the effects of selected *Artemisia*

species and their components against respiratory viruses like influenza and coronavirus.
Methods:All the articles published in English or Persian related to the effects of *Artemisia* and its components on viral respiratory infections and relevant mechanisms of action were searched throughout Medline, Science Direct, Scopus, Ebsco, Google Scholar, and Cochrane Library Database from 1966 up to April 2020.
Results:A few numbers of *Artemisia* species such as *A. scoparia*, *A. rupestris*, and *A. annua* and their components showed efficacy against the influenza virus and coronaviruses. Furthermore, some chemical compounds isolated from *Artemisia* species, like rupestonic acid, showed potent anti-influenza activity. The mechanism of antiviral activity was also determined for some of these compounds.
Conclusions:The present study summarized the efficacy of a number of *Artemisia* species and their components against respiratory viruses like influenza and coronavirus. Future studies on other *Artemisia* species may lead to the discovery of new antiviral drugs against the influenza virus and coronaviruses.
Keywords
Artemisia
Compounds
Respiratory Virus
Influenza
Coronavirus
Mechanism

1. Context

Respiratory viruses are among the most common agents causing diseases in humans and have significant impacts on global morbidity and mortality rates (1). Although the influenza virus is the most prevalent viral infection associated with respiratory problems, other respiratory viruses may be responsible for substantial diseases in adults and the elderly (2). Some of these respiratory viruses include the adenovirus, human influenza virus, human bocavirus, human pneumovirus, human parainfluenza, human rhinovirus, human respiratory syncytial virus, severe acute respiratory syndrome (SARS) virus, and the coronavirus (COV) associated with SARS (SARS-COV).

Influenza is an acute infectious disease caused by a number of viruses belonging to the orthomyxovirus family. Influenza epidemics may lead to morbidity and mortality in the elderly and other high-risk patients (3). There are different types of influenza viruses including influenza virus type A, B, and to a much lesser extent, C. Although respiratory viruses are responsible for a variety of health problems in humans, no considerable preventive or therapeutic interventions are currently available for their associated diseases. Herbal medicine has an important role in the prevention and

treatment of viral respiratory infections (VRI). Some of these herbs have a long history in the traditional medicine practices of different countries for treating respiratory diseases. These plants are generally used by patients with the common cold, viral pharyngitis, acute bronchitis, influenza, etc. (4).

Artemisia is a genus of the Compositae (Asteraceae) family and harbors more than 500 species, called 'Worm wood', 'Mug word', or 'Tarragon' (5). It is mainly distributed in the temperate zones of Europe, Asia, and North America, but Asia has the greatest share of these species (6). Different species of the genus *Artemisia* contain various chemical compounds, mainly flavonoids, terpenoids, coumarins, caffeoylquinic acids, acetylenes, and sterols (6). Also, *Artemisia* species are considered as good sources for volatile oils (5). These plants have a wide range of bioactivities such as antimalarial, cytotoxic, antihepatotoxic, antibacterial, antifungal, anti-diabetic (7-10), antispasmodic (11), antioxidant, and antiviral activities (12-14). The antiviral activity of this genus has been investigated against the Herpes Simplex virus, Hepatitis B Virus, Bovine viral diarrhea virus, and respiratory viruses (15-18). On the other hand, different compounds of *Artemisia* species have revealed various biological activities such as antimalarial, antibacterial, and antiviral effects. Some of these compounds, such as cirsimaritin, have potent effects against respiratory viral infections (19). Another known compound of *Artemisia*, artemisinin, is a sesquiterpene lactone isolated from some *Artemisia* species like *A. annua* and a potent antimalarial drug by acting against *Plasmodium falciparum*. Artemisinin derivatives have also shown various biological activities against the influenza virus (20).

The present review emphasizes the effects of *Artemisia* species and their components on viral respiratory infections (VRIs) and investigates their antiviral mechanisms. Also, this study suggests researchers to investigate the impacts of this genus and its active compounds against other viruses causing VRIs, like coronaviruses.

2. Methods

All the articles published in English or Persian, related to the efficacy and mechanisms of action of *Artemisia* species and their components in managing VRIs were searched in the Medline, Science Direct, Embase, Scopus, Ebsco, Google Scholar, and Cochrane Library databases from 1966 up to April 2020. The main

keywords were *Artemisia*, viral, respiratory, influenza, coronavirus, component, mechanism, and infection.

3. Results and Discussion

According to the findings, different *Artemisia* species and their components showed potent antiviral activities against respiratory viruses such as the influenza virus and coronavirus (Table 1).

Table 1. *Artemisia* Species and Their Constituents Against Respiratory Viruses

***Artemisia* Species**	***Artemisia* Extract or Compounds**	**Type of Viruses**	**References**
A. annua	Ethanolic extract	SARS-CoV	(21)
	Dihydroartemisenin	Influenza A	
A. rupestris	Rupestonic acid	Influenza A_3	(3)
	6-demethoxy-4'-O-methylcapillarisin aromatic	Influenza A	(22)
	Rupestonic acid ester derivatives	Influenza A_3	(3)
	Methyl esters of rupestonic acid	Influenza A (H1N1)	(23)
A. scoparia	Extract	Influenza virus	(24)
	Cirsimaritin	Influenza A	

3.1. Traditional Uses of Artemisia in Persian Medicine

Artemisia genus (Afsantin in Persian medicine) is known to have a hot and dry temperament in traditional medicine. Total heat produced by the extracts of this genus is greater than the whole plant, flowers, or seeds. They can dilate the blood vessels or dissolve thick or viscous matter to remove the obstruction (called "Mofatteh" in Persian medicine), show astringent, diuretic, appetizer, diaphoretic, and larvicidal effects, and purge serous bile that is collected in the stomach and strengthen the stomach. Avicenna believed that it is the best choice for treating gastric disorders, but it may cause headaches in susceptible patients (especially

those with a hot temperament) and it can liquefies thick and viscous matters (called "Molattef" in Persian medicine) (25).

Artemisia has antipyretic effect and its decoction is a solution to chronic and compound fevers, intermittent fever, malaria fever, and phlegmatic disorders and can cleanse chest and lung vessels. It is also beneficial for cold, bronchitis, and influenza (26).

3.2. Artemisia Species Against Respiratory Viruses

3.2.1. Artemisia scoparia

Artemisia scoparia is one of the plants used in traditional Chinese medicine to prevent and treat fever, cough, and cold. Recent studies have shown that it has inhibitory activities against several influenza virus strains. Wang et al. (27) confirmed the in vitro and in vivo antiviral effects of *A. scoparia* extracts and determined their mechanisms of action against the influenza virus. They reported that *Artemisia* extract effectively intervened in influenza virus replication, decreased the activity of influenza virus neuraminidase, and reduced the expressions of the hemagglutinin and M2 proteins (27).

3.2.1.1. Active Components of A. scoparia

The active constituent of *A. scoparia* against the influenza virus is a flavonoid, cirsimaritin, whose inhibitory effect on the influenza virus is close to that of ribavirin or amantadine (27) (Figure 1). The influenza A virus (IAV) infection is associated with the activation of the nuclear factor kappa B (NF-κB) pathway, causing the overexpression of viral proteins. Also, studies revealed that the replication of influenza viruses could be elevated by the activation of the NF-κB signaling pathway (28-30).

Yan et al. (24) concluded that cirsimaritin could reduce IAV titer and its RNA and protein synthesis in a dose-dependent manner. Also, cirsimaritin promoted its anti-IAV activity via downregulating the phosphorylation of MAPKs (p38 and JNK) and suppressing the NF-kB signaling pathway, leading to a reduction in inflammatory cytokines such as IL-1β, IL-8, IL-10, and TNF-α (27).

3.2.2. Artemisia afra

Artemisia afra is one of the plants commonly used in the traditional medicine of South Africa to treat different illnesses such as coughs and colds, as well as sore throat and flus. Most commonly, *A. afra* fresh leaves are inserted into the nostrils to clear blocked nasal passages (31).

3.2.3. Artemisia rupestris

Artemisia rupestris L. is a perennial herb growing in China and also central Asian countries. It is used to treat colds in folk medicine (32). Zhang et al. (33) showed that the aqueous extract of *A. rupestris* could be an efficient adjuvant for influenza virus vaccines to boost immune responses and reduce the antigen doses required for triggering the immune system (33).

3.2.3.1. Active Compounds of A. rupestris

Rupestonic acid is a sesquiterpene isolated from *A. rupestris*, including multifunctional groups. It can inhibit the influenza virus to a moderate extent (23). In a study, a group of 2-substituted rupestonic acid methyl esters was synthesized to investigate their effects against the influenza virus, revealing potent activities against the 3b and 3c strains of the influenza H1N1 virus with the half-maximal inhibitory (IC_{50}) concentrations of 2.12 and 1.71 μM, respectively (Figure 1) (23).

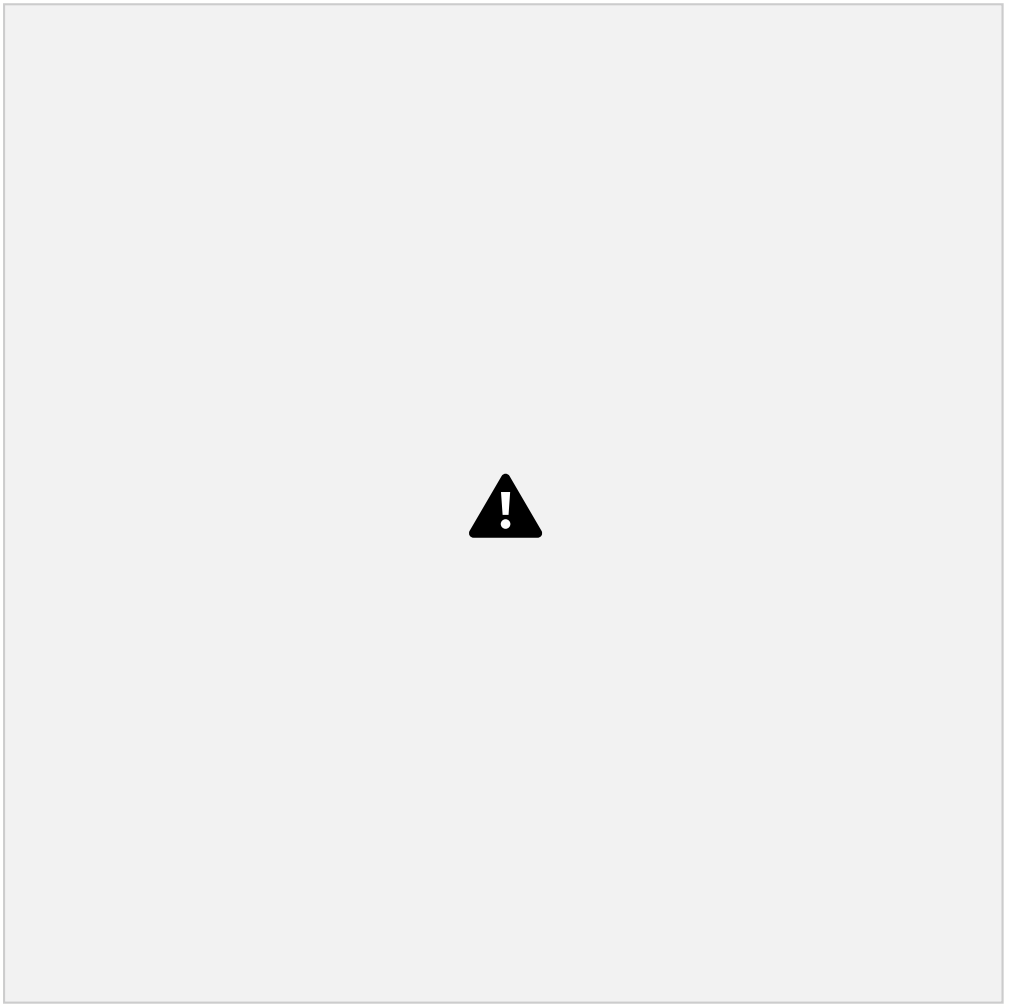

Figure 1.

Chemical structures of anti-respiratory virus compounds from *Artemisia* species. A, rupestonic acid; B, circimaritin; C, dihydroartemisenin; D,

6-demethoxy-4'-O-methylcapillarisin; E, methyl esters of rupestonic acid; F, aromatic ester derivatives of rupestonic.

In another study, the fatty ester and aromatic ester derivatives of rupestonic acid showed significant antiviral activities against the A_3 and B strains of the influenza virus. The highest inhibitory effect was observed against the influenza A_3 virus (IC_{50} = 0.5 µmol/L) in exposure to one of the aromatic ester compounds, which was almost 10-fold higher than that of the reference drug, oseltamivir (Figure 1) (3).

The flavonoids extracted from *A. rupestris* showed inhibitory effects against viral infections. The antiviral properties of one of these flavonoids, 6-demethoxy-4'-O-methylcapillarisin (DMO-CAP), and its antiviral mechanism were studied against the IAV. Western blot analysis, qRT-PCR, and the luciferase assay were used to investigate the antiviral mechanisms of DMO-CAP against the IAV. According to the results, DMO-CAP revealed significant antiviral activities against the IAV in vitro by suppressing its replication via activating the Nrf2/heme-oxygenase-1 (HO-1) pathway. Subsequent to the up-regulation of HO-1 expression, the stimulation of the interferon (IFN) response induced the expression of IFN-stimulated genes, leading to efficient anti-IAV effects (22).

3.2.4. Artemisia annua

Artemisia annua L. is a medicinal plant harvested from Asia and Europe and is cultivated in Africa. It is used in Chinese traditional medicine for treating fever and chills (25). This plant is widely cultivated in Africa for treating malarial fever (5).

Li et al. (21) screened some herbal extracts against the SARS-COV, using the 3-(4,5-dimethylthiazol-2-yl)-5-(3-carboxymethoxyphenyl)-2-(4-sulfophenyl)-2H-tetrazolium inner salt (MTS) assay for the cytopathic effect (CPE) induced by the virus. The results showed that some of these extracts, including the components extracted from *A. annua* L., showed antiviral activity against the SARS-CoV in a Vero cell-based CPE/MTS screening assay. The half-maximal effective concentration (EC_{50}) and 50% cytotoxic concentration (CC_{50}) of the ethanolic extract were 34.5 ± 2.6 and 1035.0 ± 92.8 mg/mL, respectively (21).

3.2.4.1. Active Compounds of A. annua

Artemisinin (a sesquiterpene lactone) is an active constituent of *A. annua*, discovered in 1970. Due to artemisinin poor solubility in water and oil, its semisynthetic derivatives have been designed in appropriate formulations (20). The effect of dihydroartemisenin was studied against the influenza A virus, verifying its

ability to inhibit the IAV by inducing the expression of tumor necrosis factor-α (TNF-α) and interleukin 6 (IL-6) in bronchial epithelial (BEAS-2B) cells through the extracellular signal-regulated kinase signaling pathway. The mRNA expression levels of TNF-α and IL-6, as well as the protein levels of TNF-α, IL-6, and phospho-ERK (p-ERK) were significantly up-regulated in the IAV group compared to the normal control group ($P < 0.05$). Likewise, a dose-dependent reduction in the mRNA levels of IL-6 and TNF-α and protein levels of TNF-α, IL-6, and p-ERK protein was seen in the IAV + dihydroartemisenin group compared to the IAV group ($P < 0.05$) (34).

4. Conclusions

The present review focused on the antiviral activities of *Artemisia* species and their constituents and summarized their impacts against respiratory viruses. The anti-virus components of some species, such as *A. rupestris*, *A. scoparia*, and *A. annua*, responsible for their effects against influenza viruses and coronaviruses, have been determined (21). The most important chemical compounds of *Artemisia* species against influenza viruses are flavonoids such as crisimaritin and sesquiterpenes like rupestonic acid. Since *Artemisia* species show significant activity against respiratory viruses, they can be proposed as good sources for effective drugs against influenza viruses and coronaviruses, including the causative agent of COVID-19. However, further investigations are necessitated to ascertain the best *Artemisia* species that are enriched in active compounds against influenza viruses and coronaviruses.

EGG PHARMA MEDICINAL PLANTS - Footnotes

- **Authors' Contribution:**
- Study concept and design: Asie Shojaii. Analysis and interpretation of data: Asie Shojaii and Roshanak Ghods. Drafting the manuscript: Asie Shojaii. Critical revision of the manuscript for important intellectual content: Roshanak Ghods and Asie Shojaii.
- **Conflict of Interests:**
- Authors have no conflict of interest.
- **Funding/Support:**
- Iran University of Medical Sciences supported this study.

References

- *1.*
- Boncristiani H, Criado M, Arruda E. *Encyclopedia of Microbiology*. Academic Press; 2009.
- *2.*
- Shi T. The etiological role of common respiratory viruses in acute respiratory infections in older adults: A systematic review and meta-analysis. *Eur Resp J*. 2018;**52**(62):PA4504.
- *3.*
- Yong J, Aisa HA. Chemical Modification of Rupestonic Acid and Preliminarily In Vitro Antiviral Activity Against Influenza A3and B Viruses. *Bull Korean Chem Soc*. 2011;**32**(4):1293-7. https://doi.org/10.5012/bkcs.2011.32.4.1293.
- *4.*
- Yarnell E. Herbs for Viral Respiratory Infections. *Altern Complementary Ther*. 2018;**24**(1):35-43. https://doi.org/10.1089/act.2017.29150.eya.
- *5.*
- Koul B, Taak P. The Artemisia Genus: A Review on Traditional Uses, Phytochemical Constituents, Pharmacological Properties and Germplasm Conservation. *J Glycomics Lipidomics*. 2018;**7**(1). https://doi.org/10.4172/2153-0637.1000142.
- *6.*
- Bora KS, Sharma A. The genus Artemisia: a comprehensive review. *Pharm Biol*. 2011;**49**(1):101-9. [PubMed ID: 20681755]. https://doi.org/10.3109/13880209.2010.497815.

- *7.*
- Mohammadian A, Moradkhani S, Ataei S, Shayesteh TH, Sedaghat M, Kheiripour N, et al. Antioxidative and hepatoprotective effects of hydroalcoholic extract of Artemisia absinthium L. in rat. *J HerbMed Pharmacol*. 2016;**5**(1):29-32.
- *8.*
- Obistioiu D, Cristina RT, Schmerold I, Chizzola R, Stolze K, Nichita I, et al. Chemical characterization by GC-MS and in vitro activity against Candida albicans of volatile fractions prepared from Artemisia dracunculus, Artemisia abrotanum, Artemisia absinthium and Artemisia vulgaris. *Chem Cent J*. 2014;**8**(1):6. [PubMed ID: 24475951]. [PubMed Central ID: PMC3907663]. https://doi.org/10.1186/1752-153X-8-6.
- *9.*
- Mojarrab MAHDI, Emami SA, Gheibi S, Taleb AM, Heshmati Afshar F. Evaluation of anti-malarial activity of Artemisia turcomanica and A. kopetdaghensis by cell-free β-hematin formation assay. *Res J Pharmacogn*. 2016;**3**(4):59-65.
- *10.*
- Nathar VN, Yatoo GM. Micropropagation of an antidiabetic medicinal plant, Artemisia pallens. *Turk J Bot*. 2014;**38**:491-8. https://doi.org/10.3906/bot-1204-27.
- *11.*
- Taherkhani M. In vitro cytotoxic activity of the essential oil extracted from Artemisia absinthium. *Iran J Toxicol*. 2014;**8**(26):1152-6.
- *12.*
- Temraz A, El-Tantawy WH. Characterization of antioxidant activity of extract from Artemisia vulgaris. *Pak J Pharm Sci*. 2008;**21**(4):321-6. [PubMed ID: 18930849].
- *13.*
- Alesaeidi S, Miraj S. A Systematic Review of Anti-malarial Properties, Immunosuppressive Properties, Anti-inflammatory Properties, and Anti-cancer Properties of Artemisia Annua. *Electron Physician*. 2016;**8**(10):3150-5. [PubMed ID: 27957318]. [PubMed Central ID: PMC5133043]. https://doi.org/10.19082/3150.
- *14.*

- Michaelsen FW, Saeed ME, Schwarzkopf J, Efferth T. Activity of Artemisia annua and artemisinin derivatives, in prostate carcinoma. *Phytomedicine*. 2015;**22**(14):1223-31. [PubMed ID: 26655404]. https://doi.org/10.1016/j.phymed.2015.11.001.
- *15.*
- Saddi M, Sanna A, Cottiglia F, Chisu L, Casu L, Bonsignore L, et al. Antiherpevirus activity of Artemisia arborescens essential oil and inhibition of lateral diffusion in Vero cells. *Ann Clin Microbiol Antimicrob*. 2007;**6**:10. [PubMed ID: 17894898]. [PubMed Central ID: PMC2099429]. https://doi.org/10.1186/1476-0711-6-10.
- *16.*
- Karamoddini MK, Emami SA, Ghannad MS, Sani EA, Sahebkar A. Antiviral activities of aerial subsets of Artemisia species against Herpes Simplex virus type 1 (HSV1) in vitro. *Asian Biomed*. 2011;**5**(1):63-8.
- *17.*
- Geng CA, Yang TH, Huang XY, Yang J, Ma YB, Li TZ, et al. Anti-hepatitis B virus effects of the traditional Chinese herb Artemisia capillaris and its active enynes. *J Ethnopharmacol*. 2018;**224**:283-9. [PubMed ID: 29890315]. https://doi.org/10.1016/j.jep.2018.06.005.
- *18.*
- Romero MR, Serrano MA, Vallejo M, Efferth T, Alvarez M, Marin JJ. Antiviral effect of artemisinin from Artemisia annua against a model member of the Flaviviridae family, the bovine viral diarrhoea virus (BVDV). *Planta Med*. 2006;**72**(13):1169-74. [PubMed ID: 16902856]. https://doi.org/10.1055/s-2006-947198.
- *19.*
- Du Toit A, Van der Kooy F. Artemisia afra, a controversial herbal remedy or a treasure trove of new drugs? *J Ethnopharmacol*. 2019;**244**:112127.
- *20.*
- D'Alessandro S, Scaccabarozzi D, Signorini L, Perego F, Ilboudo DP, Ferrante P, et al. The Use of Antimalarial Drugs against Viral Infection. *Microorganisms*. 2020;**8**(1). [PubMed ID: 31936284]. [PubMed Central ID: PMC7022795]. https://doi.org/10.3390/microorganisms8010085.
- *21.*

- Li SY, Chen C, Zhang HQ, Guo HY, Wang H, Wang L, et al. Identification of natural compounds with antiviral activities against SARS-associated coronavirus. *Antiviral Res*. 2005;**67**(1):18-23. [PubMed ID: 15885816]. [PubMed Central ID: PMC7114104]. https://doi.org/10.1016/j.antiviral.2005.02.007.
- *22.*
- Zhong M, Wang H, Ma L, Yan H, Wu S, Gu Z, et al. DMO-CAP inhibits influenza virus replication by activating heme oxygenase-1-mediated IFN response. *Virol J*. 2019;**16**(1):21. [PubMed ID: 30786886]. [PubMed Central ID: PMC6381609]. https://doi.org/10.1186/s12985-019-1125-9.
- *23.*
- Obul M, Wang X, Zhao J, Li G, Aisa HA, Huang G. Structural modification on rupestonic acid leads to highly potent inhibitors against influenza virus. *Mol Divers*. 2019;**23**(1):1-9. [PubMed ID: 29971616]. https://doi.org/10.1007/s11030-018-9840-5.
- *24.*
- Yan H, Wang H, Ma L, Ma X, Yin J, Wu S, et al. Cirsimaritin inhibits influenza A virus replication by downregulating the NF-kappaB signal transduction pathway. *Virol J*. 2018;**15**(1):88. [PubMed ID: 29783993]. [PubMed Central ID: PMC5963025]. https://doi.org/10.1186/s12985-018-0995-6.
- *25.*
- Aghili Khorasani M. *Makhzan al-Advieh (The Storehouse of Medicaments)*. Tehran: Bavardaran Press; 2001. 546 p.
- *26.*
- Noorani M. *The Great Encyclopedia of Islamic Medicine*. Qom: Armaghan-e-yousef; 2005.
- *27.*
- Wang L, Si L, Li Y, Wang H, Xu F, Bian H, et al. Study on mechanism and active ingredient of Artemisia scoparia extracts against influenza virus. *Lat Am J Pharm*. 2017;**36**(7):1355-60.
- *28.*
- Flory E, Kunz M, Scheller C, Jassoy C, Stauber R, Rapp UR, et al. Influenza virus-induced NF-kappaB-dependent gene expression is mediated by overexpression of viral proteins and involves oxidative radicals and activation

of IkappaB kinase. *J Biol Chem*. 2000;**275**(12):8307-14. [PubMed ID: 10722660]. https://doi.org/10.1074/jbc.275.12.8307.

- *29.*
- Pahl HL, Baeuerle PA. Expression of influenza virus hemagglutinin activates transcription factor NF-kappa B. *J Virol*. 1995;**69**(3):1480-4. [PubMed ID: 7853480]. [PubMed Central ID: PMC188737]. https://doi.org/10.1128/JVI.69.3.1480-1484.1995.
- *30.*
- Wurzer WJ, Ehrhardt C, Pleschka S, Berberich-Siebelt F, Wolff T, Walczak H, et al. NF-kappaB-dependent induction of tumor necrosis factor-related apoptosis-inducing ligand (TRAIL) and Fas/FasL is crucial for efficient influenza virus propagation. *J Biol Chem*. 2004;**279**(30):30931-7. [PubMed ID: 15143063]. https://doi.org/10.1074/jbc.M403258200.
- *31.*
- Snijders AJ. Medicinal plants of South Africa, 2nd edition, B-E Van Wyk, B van Oudshoorn and N Gericke : book review. *J South Afr Vet Assoc*. 2010;**81**(3). https://doi.org/10.4102/jsava.v81i3.145.
- *32.*
- Nigam M, Atanassova M, Mishra AP, Pezzani R, Devkota HP, Plygun S, et al. Bioactive Compounds and Health Benefits ofArtemisiaSpecies. *Nat Prod Commun*. 2019;**14**(7). https://doi.org/10.1177/1934578x19850354.
- *33.*
- Zhang A, Wang D, Li J, Gao F, Fan X. The effect of aqueous extract of Xinjiang Artemisia rupestris L. (an influenza virus vaccine adjuvant) on enhancing immune responses and reducing antigen dose required for immunity. *PLoS One*. 2017;**12**(8). e0183720. [PubMed ID: 28841693]. [PubMed Central ID: PMC5571932]. https://doi.org/10.1371/journal.pone.0183720.
- *34.*
- Ou L, Qin K, Yang ZX, Bie MJ. [The Effects and Mechanisms of Dihydroartemisinin on Influenza A Virus H1N1 Induces TNF-alpha and IL-6 Expression in Bronchial Epithelial Cells]. *Sichuan Da Xue Xue Bao Yi Xue Ban*. 2020;**51**(2):171-7. Chinese. [PubMed ID: 32220184]. https://doi.org/10.12182/20200360604.