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Unveiling the Pharmacological Potential of Vitis vinifera and Kalanchoe pinnata: a Review on Their Medicinal Uses

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ABSTRACT
The therapeutic potential of medicinal plants in treating a range of illnesses has long been acknowledged. Two extensively researched plants with a variety of pharmacological characteristics are the grapevine Vitis vinifera and the air plant Kalanchoe pinnata. This review examines their potential medical uses, emphasizing their hepatoprotective, cardioprotective, antibacterial, anti-inflammatory, anti-arthritic, and antioxidant properties.Although Kalanchoe pinnata is well known for its wound-healing, immunomodulatory, and anti-inflammatory qualities because of the presence of bioactive compounds like flavonoids, terpenoids, and bufadienolides, Vitis vinifera is rich in polyphenols, flavonoids, and resveratrol, which all contribute to its strong antioxidant and cardiovascular benefits. These plants' combined abilities to fight inflammation, oxidative stress, and degenerative disorders demonstrate their potential as natural remedies. This review highlights their importance in contemporary medicine by offering a thorough examination of their pharmacological activities, mechanisms, and potential avenues for further study.

Keywords: Vitis vinifera, Kalanchoe pinnata, pharmacological properties, medicinal plants, antioxidant.

I. INTRODUCTION:

A widespread condition that affects a vast population, arthritis is characterized by painful joint swelling. The two most prevalent types are rheumatoid arthritis and osteoarthritis. Rheumatoid arthritis is an inflammatory condition with an uncertain cause, while osteoarthritis is a degenerative joint disease primarily affecting the elderly [1]Inflammatory cell infiltration, synovial tissue proliferation, and bone loss are the hallmarks of rheumatoid arthritis (RA), autoimmune and chronic inflammatory disease of the joints. Patients with RA frequently experience pain, stiffness, enema, deformities, and loss of joint function [2]usually is a crippling illness that can strike at any age. However, it usually peaks between the ages of 35 and 50[3].The pathophysiology of RA is thought to be significantly influenced by pro-inflammatory cytokines like tumour necrosis factor-α (TNF-α), interleukin (IL)-1β, IL-6, IL-17, IL-18, and IL-23, as well as inflammatory enzymes like cyclooxygenase-2 (COX-2) and inducible nitric oxide synthase (ions) that are produced by T cells and macrophages [4].Hyperactivity of specific immunological responses, persistent synovitis with diffuseproliferation, and, in the majority of patients, the deposition of autoantibodies to immunoglobulins known as rheumatoid factor (RF) are the hallmarks of this chronic multisystem disease. In extreme situations, bone erosion, articular cartilage degradation, and alterations in joint integrity are caused by synovial inflammation. Peripheral joints are typically affected [5] Osteoarthritis (OA) is a multifactorial, mainly non-inflammatory, slowly developing degenerative disease of the synovial joints that is frequently brought on by trauma or aging. Eventually, degradative mechanisms cause the articular cartilage and other joint tissues to irreversibly degrade. Despite being the most prevalent musculoskeletal disorder in the world and a major contributor to social, economic, and health issues, research has not yet been able to pinpoint the precise origin of OA. The start and course of OA are significantly influenced by age-related articular cartilage and subchondral bone loss, limb usage, overloading and malalignment, hereditary diseases, and metabolic syndromes (obesity, inflammatory reactions, and diabetes [6].

PATHOPHYSIOLOGY OF ARTHRITIS

Large-scale research employing cutting-edge genomic tools created our current understanding of the genetics of rheumatoid arthritis. Genome-wide association studies have identified hundreds of loci that are predisposed to the development of the disease using single nucleotide polymorphisms. Some of these loci are also linked to other inflammatory illnesses, but the

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majority are involved in immune systems. The HLA system is the most significant system linked to the onset and outcome of rheumatoid arthritis. This robust correlation raised the possibility that peptide binding plays a role in the disease's pathophysiology. In addition to predicting the onset of the disease, the HLA type can also indicate its severity, potential consequences, and mortality [7,8,9].Through both genetic and environmental integrations, the pathophysiology of the disease is closely linked to epigenetics. Ten roles have been linked to an increased risk of the illness in recent big research. Normally, histone acetylation and DNA methylation control the biology of leucocytes and fibroblasts. Rheumatoid arthritis has been linked to malfunctions in this system. The current strategy entails researching how people with rheumatoid arthritis respond to microRNA therapy [10].

Botanical Description:

Vitis vinifera

The world is home to a diverse range of medicinal plants. Many of the weeds in our surroundings are highly effective medicinal plants that can aid in the treatment of number of serious health problems. Among ancient civilizations, India has long been known as a rich repository of natural medicines Vitis vinifera is a popular grape species in the Vitaceae family that belongs to the genus Vitis. There are seedless and non-seedless cultivars of Vitis vinifera, as well as red, black, and white types. As the Vitis vinifera species outnumber all other species by 90 percent, they are easy to find1. Western Asia and southern Europe are the origins of grapes. Grapes are one of the most important agricultural products.As a result, viticulture, or grapes cultivation, is one of the most beneficial types of agriculture. There are over 10,000 different grape varieties in the globe. The root, stem, cane, leaf, seed, fruits, pomace, and skin all contain various phytochemical substances. Phenolic compounds, aromatic acids, flavonoids, proanthocyanins, and stilbenes are among the important chemicals discovered. Grapes contain nutritious elements such as minerals, proteins, carbohydrates, fats, fibres, vitamin C, and sugar in addition to bioactive substances.In Pakistan, Italy, and Turkey, grapes have been used traditionally for a variety of medicinal purposes, such as treating laxatives, carminatives, colds, flu, anaemia, wound care, allergies, and bronchitis. Numerous studies have demonstrated the antiviral, anticancer, antibacterial, antifungal, anti-inflammatory, anti-acne, anti-aging, antihypertensive, protective, anti-asthma, antiplatelet, anticataract, anti-obesity, anticholinergic, ant sunburn, ant hyperpigmentation, wound-healing, and antiviral qualities of the bioactive compounds present in grapes: Viral infections are brought on by harmful viruses that proliferate throughout the body [11].

Taxonomical Classifications of Vitis vinifera [12]

S NO.	Kingdom	Plantae
1.	Clade	Tracheophytes
2.	Clade	Angiosperms
3.	Clade	Eudicots
4.	Clade	Rosins
5.	Order	Vitals
6.	Family	Vitaceae
7.	Genus	Vitis
8.	Species	Vitis vinifera

Table-2: Phytochemistry of Vitis Vinifera

SNO.	PLANT PART	CHEMICAL CONSTITUENTS
1.	Grapes roots extract	Stilbene compounds [13]
2.	Grapes leaves extract	Hydroxybenzoic acid (quinic acid, gallic acid, vanillic acid, syringic acid) coumarin, Quercetin, kaempferol [14,15].
3.	Grapes seeds extract	Procyanidin, gallic acid, epicatechin, catechin,

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		quercetin, white grapes have flavanol glycosides, black grapes have flavanol glycoside, resveratrol, anthocyanidins, phenolic compounds, caffeic acid, coumaric acid, coumaric acid, ferulic acid, fertaric acid, routine, quercetin-3-beta-D-glucoside, quercitrin, myricetin, catechin, epicatechin, linoleic acid, primaric acid, caffeic acid, p-hydroxy-phenylacetic acid, gallic acid [16,17,18,19,20].
4.	Grapes skin extracts	Flavanols, anthocyanins, flavan-3-ols, stilbenes, phenolic acid, quercetin, vanillic acid, kaempferol, syringic acid, gallic acid [21,22,23,24,25]
5.	Grape's juice	Caffeic acid, coumaric acid, ferulic acid, caftaric acid, coutaric acid, fertaric acid, epicatechin, catechin, resveratrol, procyanidin, flavanols, quercetin, rutin, kaempferol, quercitin-3-O-glucoside, quercitin-3-Oglucuronide [26].

Kalanchoe pinnata

The "miracle leaf" is another name for Kalanchoe pinnata. Many cultures have traditionally used it as a traditional medicine. Flavonoids, phenolic acid, and other bioactive compounds found in its leaves are thought to be responsible for the plant's wide range of pharmacological effects. Temperate areas of Asia, including Australia, New Zealand, the West Indies, Mascarenes, Melanesia, and Hawaii, have seen the naturalization of Kalanchoe pinnata. It is considered an invasive species in many of these, including Hawaii. Kalanchoe pinnata has been identified as a danger to biodiversity in French Polynesia. It is also commonly available in the Philippines and is referred to as katakataka or kataka-taka, which is an adjective that also means amazing or astounding. It grows wild in the hills of North-Western India and in gardens [27].It can reach up to 1.5 meters in height. Its agreenis-gray colour and newly spoon-shaped leaves placed in an arrested arrangement with serrated edges are among its distinguishing characteristics. The size of the leaves is 8–12 and 6–8 cm. Petioles are joined by a ridge around the stem, and the upper is often 3-5 or occasionally 7 folios late, long, and pointy [28]

Plant description

Botanical Name	: Bryophyllumpinnatum
Family Name	: Crassulaceae
Sanskrit Name	: Pashanabheda
Hindi Name	: Patharchu
Synonym:	Bryophyllumcalycinum, Bryophyllumpinnatum [29,30,31].
Kingdom:	Plantae
Plantae	Magnoliopsida

The plant thrives in hot, humid climates across India, particularly in Bengal. It is a succulent perennial plant with a hollow, four-angled, and typically branching stem that reaches a height of 1 to 1.5 meters. The opposing, succulent, decussate leaves are 10–20 cm long. While the top three to seven leaves are foliate and have long petioles, the lower leaves are simple. They have a characteristic scalloping and crimson trimming, and they are meaty and dark green. Petiolules measure 2-4 cm, the leaf blade is pinnately complex with 3-5 leaflets, 10-30 cm, and the leaflet blades are oblong to elliptic, 6-8 X 3-5 cm, with a latent bud in each notch that can grow into a healthy plantlet apex obtuse [32].

Medicinal uses of vitis vinifera:

Antioxidant activity:

Trolox equivalent antioxidant capacity (TEAC), ferric reducing antioxidant power

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(FRAP), and oxygen radical absorbance capacity (ORAC) were used to investigate the antioxidant activity of grape seed extracts. The results showed that the extracts had antioxidant activity of 6.1 ± 0.8 mmol TE/g, 6.5 ± 0.5 mmol FE/g, and 8.6 ± 0.7 mmol TE/g [33].Using the 2,2-diphenyl-1-picryl-hydrazyl (DPPH), FRAP, 2,2'-azino-bis (3-ethylbenzothiazoline-6-sulfonicacid) (ABTS), and chlorophyllin free radical (CHFR) methods, the antioxidant activity of grape seeds from ten vine varieties (Laurot, Kofranka, Hibernal, Blaufrankisch, Zweigeltrebe, Erilon, Palava, Welschriesling, Cerason, and Gewürztraminer) of V. vinifera was assessed. Ten vine types' average antioxidant activity in 2017 was 11.624 µg/g GAE according to the DPPH technique, 14.807 µg/g GAE according to the FRAP method, 6518 µg/g GAE according to the ABTS method, and 3084 µg/g GAE according to the CHFR form. Cerason is the type that shown antioxidant action in every approach [34].

Anti-inflammatory activity:

By reducing edema at a dose of 400 mg/kg (50.02%) at 4 hours using the carrageenan-induced hind paw edema test, high doses of V. vinifera leaf extract indicated strong anti-inflammatory efficacy. The anti-inflammatory properties of quinic acid, kaempferol, resveratrol, and quercetin [35].High doses of V. vinifera var. FeteascăNeagră leaf extract shown anti-inflammatory effect by lowering inflammatory cytokines (IL-8, IL-6, and IL-1β) in cells generated by lipopolysaccharide [36].Balea claims that Pinot noir and grape pomace from V. vinifera L. var. FeteascăNeagră also exhibited anti-inflammatory properties. Miricetol and quercitrin were compounds that were crucial as anti-inflammatory agents [37].

Antifungal activity:

3,4'-dimethoxy-resveratrol and 3,5-dimethoxy-resveratrol were found in grape (V. vinifera L.) canes. With a minimum inhibitory concentration of 29–37 µg/ml against Candida sp., both compounds demonstrated antifungal efficacy [38].

Antihypertension activity:

Using the tail-cuff method, skin grape aqueous extract (Vitis vinifera L.) may be able to stop spontaneously hypertensive rats' systolic blood pressure from rising. The findings showed that rats with hypertension had blood pressures greater than 200 mmHg, and rats treated with grape skin extract had blood pressures lower than 150 mmHg [39].revealed both in deoxy cortisone acetate (DOCA) and fructose-induced rats, the myricetin content of grape raisins could lower systolic blood pressure. Salt The hypertensive [40,41].

Antipyretic activity:

The yeast-induced pyrexia paradigm was used to measure the antipyretic efficacy. After 22 hours following yeast injection, it was discovered that the leaf extract from V. vinifera could lower the rectal temperature at doses of 100 mg/kg, 200 mg/kg, and 400 mg/kg. And after 23 hours of injection, a notable decrease happened at doses of 200 and 400 mg/kg [42].

Medicinal uses of kalanchoe pinnata:

Anti-inflammatory activity

To test Kalanchoe piñata's effects on formaldehyde-induced oedema experimentally, leaf extracts were made in methanol, acetone, chloroform, and petroleum ether. When compared to all other extracts, the methanolic extract had the strongest impact on preventing paw edema. Bradykinin, prostaglandins, serotonin, and histamine were also measured in formaldehyde-induced inflammations from injured cells that have sufficient ability to create the endogenous mediators. Therefore, based on these experimental findings, it was determined that the presence of bufadienolides and other water-soluble extracellular elements was primarily responsible for the suppression of oedema in rats caused by formalin [43].

Anti-allergic activity:

According to certain recent scientific studies, up to 75% of animal deadly anaphylaxis can be avoided by oral therapies containing quercitrin that has been identified and extracted from plants. These findings demonstrate the effectiveness of oral administration of Kalanchoe pinnata in reducing the modules of immunological responses produced by pro-anaphylactic reactions. The protection provided by quercetin indicated that the most important ingredient in Kalanchoe pinnata that is found to be helpful against severe allergic reactions is flavonoids [44]

Wound healing activity:

The ethanolic extracts of Kalanchoe pinnata demonstrate wound healing properties by considerably reducing the size of cuts and wounds as well as oedema at the affected locations. Recent studies, however, have shown that the presence of steroidal glycosides and phenolic antioxidants may

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be the cause of these wound-healing properties. According to some recent research, extracts made using water, petroleum ether, and alcohol may have the ability to heal wounds. Compared to alcoholic and etheric extracts, these experimental studies showed that aqueous extracts have greater potential [45].

CNS depressant activities:

Significant behavioural pattern changes were elicited by methanolic fractions of Bryophyllum pinetum leaves, including dose-dependent potentiation of pentobarbitone sleeping time and notable impacts on analgesic activity. Conversely, there was a noticeable decline in exploratory performance and a loss of lingering curiosity [46].

Side effects of plant Vitis vinifera and kalanchoe pinata

Plant	Side Effects
Vitis vinifera	
Allergic reactions	Skin rash, itching, or swelling (especially in individuals sensitive to grapes) [47].
Digestive upset	Nausea, stomach upset, diarrhoea (at high doses or with supplements) [48].
Blood-thinning effect	May increase the risk of bleeding when taken with anticoagulant medications (e.g., warfarin) [49].
Kalanchoe pinnata	
Liver toxicity	Potential hepatotoxic effects when consumed in large quantities due to pyrrolizidine alkaloids [50].
-Allergic reactions	Skin irritation, rash, or respiratory symptoms in sensitive individuals [51].
-Potential toxicity	Risk of toxicity to animals (cattle, sheep) and humans if consumed excessively [52].
-Drug interactions	May interact with medications such as sedatives or immunosuppressants [53].

Future Prospects

Future research on Vitis vinifera and Kalanchoe pinnata should focus on elucidating their molecular mechanisms, conducting extensive preclinical and clinical trials, and exploring their synergistic effects with other drugs. Advancements in nanotechnology-based drug delivery can enhance bioavailability and therapeutic efficacy. Standardization of phytochemical extraction and toxicological studies are essential for ensuring safety and consistency. Additionally, their potential applications in chronic diseases, including metabolic and neurodegenerative disorders, warrant further investigation. Sustainable cultivation practices should also be promoted to preserve biodiversity and ensure a stable supply for medicinal use.

II. CONCLUSION

The pharmacological potential of Vitis viniferaand Kalanchoe pinnata highlights their significant role in modern medicine. Their diverse therapeutic properties, including antioxidant, anti-inflammatory, anti-arthritic, antimicrobial, hepatoprotective, and cardioprotective effects, make them promising candidates for natural drug development. The presence of bioactive compounds such as polyphenols, flavonoids, terpenoids, and bufadienolides contributes to their medicinal efficacy. However, further research is needed to establish their precise mechanisms, optimize dosages, and validate their clinical applications through extensive trials. Standardization, toxicity evaluation, and novel drug delivery approaches can enhance their therapeutic potential. Overall, Vitis vinifera and Kalanchoe pinnata offer a natural and effective alternative for managing various diseases, reinforcing the need for continued scientific exploration and pharmaceutical development.

Abbreviation

HLA: Human leukocyte antigen
DNA: Deoxy ribonucleic acid
ABTS: 2,2'-azino-bis (3-ethylbenzothiazoline-6-sulfonic acid)
RNA: Ribonucleic acid.

Author Contributions:

The author conceptualized, researched, and drafted the manuscript. They performed a comprehensive

review of the literature and contributed to the critical analysis of the topic.

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Conflict of Interest
The authors hereby declare that they have no conflict of interest.

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