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A Brief Overview of *Vitis vinifera* L. (Draksha) and its Health Benefits

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Abstract
Vitis vinifera L. (Draksha) is a generally known medicinal plant in the traditional medical system of Ayurveda. Vitis vinifera belongs to the Vitaceae (grape) family and is local to Europe and Central Asia. Maharashtra is the state with the largest grape production in India. *V. vinifera* is a widespread deciduous mountaineering plant. The maximum typically used part of the plant is the dried ripe fruit. *Vitis vinifera* contains large amounts of phytochemicals such as polyphenols, flavonoids, flavonols, anthocyanins, tannins, stilbenoids, and non-flavonoids. Draksha is widely used in the traditional Indian system of medicine Ayurveda for the treatment of a variety of diseases. Its compactness, consistency, flavor and variety have made it a popular finger food in countries around the world. In this article, a detailed literature review of the drug has been done in terms of its vernacular names, taxonomical hierarchy, habitat, botanical description, macroscopy, microscopy, chemical constituents, physicochemical parameters, phytochemical screening, pharmacological activities, ayurvedic aspects, marketed formulations, and patents filed on *V. vinifera*.

Keywords: ayurveda, Draksha, flavonoids, polyphenols, pharmacological activities, *Vitis vinifera*

Introduction
Ayurveda is the ancient science of life with a holistic approach to health. It is dynamic and progressive. It attaches great importance to therapeutic strategy. According to WHO, 80% of people rely on natural medicines for some aspects of their health care. In the classics, it is clearly stated that an ideal medicine should have multiple effects, should be available in different dosage forms, should possess all the necessary properties suitable for a patient to get rid of the disease, and should be free from any undesirable effects.
Vitis vinifera L., commonly known as grape (draksha), belongs to the family Vitaceae. Grape is one of the most important agricultural products. The cultivation of grapes is known as viticulture. India's leading grape-producing state is Maharashtra. Grape cultivation is prevalent in Nashik, Pune, Ahmednagar, Sangli, Osmanabad, Solapur, and Satara districts of the state. Nashik is called the Wine Capital of India. It also has a grape packhouse facility. Grape is a highly versatile crop. Grapes can be cultivated in nearly any climate, including temperate, tropical, and subtropical. The Mediterranean climate is best for grape cultivation. Grape cultivation can be done in Well-drained sandy loam to loamy soil having good organic matter. Soil pH should be below pH 8.7. It should contain up to 20% lime concentration and 10% calcium carbonate [1]. The grape contains about 20% sugar in an easily digestible form and is also rich in calcium and phosphorus. Worldwide, it is grown mainly for wine production (82% of production), raisin production (10% of production) and the rest for table purposes (8%) [2]. There are about 10,000 varieties of grapes in the world. It is the most produced fruit in the world. In India, there are different varieties like Thompson seedless (Sultana), Anab-e-Shahi (table grapes), Dilkhush, Banglore blue, Sharad seedless, Perlette, Bhokri, Gulabi, Arkavati, Sonaka, Manik Chaman and Tas-A-Ganesh, Arka Kanchan [3]. The root, stem, leaf, seed, fruit, pomace, and skin of grape contain various phytochemicals and nutrients that exhibit various pharmacological activity such as Anti-inflammatory, Hepatoprotective, Antioxidant, Antidiabetic, Antiasthmatic, Antihypertensive, Anti-ischemic, Antimicrobial, Anti-aging, Anti-cancer, Anticataract, Antipyretic, Antinociceptive, Protection against bone loss, Anticholinergic, CNS protective, Anti-alzheimer, Anti-acne, Anti-sunburn, Antiplatelet, Wound healing, Antispasmodic, Anti-viral activity in SARS-CoV-2 [4].

Biological source
Draksha consists of dried mature fruit of *Vitis vinifera* Linn., belonging to the family Vitaceae.

Ayurvedic names
Draksha, Dehydrated fruit - Daakh, Munnakaa, Kishmish [5].

Vernacular names
In Sanskrit it is known as Draksha, Mrdvika, Gostani; Marathi Draksha as well as Manukka; Hindi Angur; In English it is well known as Dry grapes, Raisins; Gujarati Drakh, Darakh; Bengal Maneka; Tamil Drakshai, KottaiDrakshai; Telugu DrakshaKottai; Kannada Draksha; Punjabi Munaca.

Taxonomical Hierarchy

Table 1: Taxonomical hierarchy

Kingdom	Plantae
Super division	Angiosperm
Division	Eudicots
Class	Rosids
Order	Vitales
Family	Vitaceae
Genus	Vitis
Species	vinifera

Part Used
Dried matured Fruit [6].

Distributions
Vitis vinifera is a member of the Vitaceae (Grape) family, native to Europe and Central Asia. It is a deciduous climber, mostly cultivated in north western India in Punjab, Himachal Pradesh, Delhi, Maharashtra, Uttar Pradesh and Kashmir. It is found in China, India, Iran, Egypt, Turkey, Brazil, Mexico, Central and Southern Europe, Western Asia Such as Anatolia, Caucasus, Middle East, China, Africa, Northern Mediterranean Coast, South Africa, North Africa, California, Michigan, New Mexico, New York, Oregon, Washington State, British Columbia, Ontario, Quebec, Chile, Argentina, Uruguay, Peru. The most wine produced in Germany, France, Italy, Canada, USA, New Zealand. Raisin production is popular in countries such as Iran, Turkey, India, USA [7]. There are different varieties found in India such as Thompson seedless (Sultana), Anab-e-Shahi (Table grapes), Dilkhush, Banglore blue, Sharad seedless, Perlette, Bhokri, Gulabi, Arkavati, Sonaka, Manik Chaman and Tas-A-Ganesh, Arka Kanchan.

Macroscopic Description
Vitis vinifera L is a perennial woody climber, 15-30 m or more tall, but during cultivation, it is drastically restricted by pruning.

Root
The root system of Vitis vinifera is extensive and can grow very deep into the soil.

Stem
Stem is green in color. It grows up to 35 m long in zigzag form. has a rough, textured appearance due to the presence of bark. The bark is dark brown and the flaky bark peels off in fibrous strips.

Leaves
Leaves are simple, thin, circular, or circular-ovate in outline. They are green in color, deciduous, opposite leaf arrangement, lobed, and dentate margin. Hairs are present on leaves. The leaf is 3-6 inches in length and 5-25 cm wide. Tendrils are branched, at each node opposite to leaves, absent at every third node.

Flowers
The flower is a greenish or gold/yellow color, insignificant, has panicle inflorescence, numerous pendulous clusters of tiny non-showy flowers, calyx very shortly 5 lobed, corolla with 5 petals, up to 5 mm long, joined at the tip, forming a cap (calyptra) which falls off at anthesis, disk glanduliferous and prominent.

Fruit
Fruit is green or dark brown to black in color, 1.5-2.5 cm long, 0.5-1.5 cm wide. It is soft, clusters of pulpy berries, oval or oblong, ellipsoidal to globose, skin adhering to the pulp. It is juicy, sweet, or sour. External surface is Fleshy in fresh, irregularly wrinkled forming ridges and furrows on dry. Seeds 2-4, pyriform, sometimes none [8]

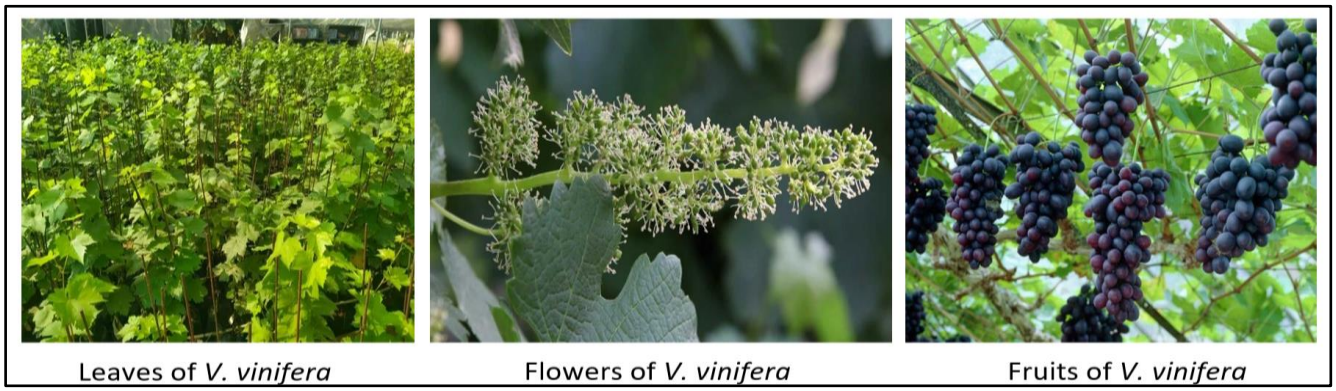

Fig 1: Leaves, flowers, and fruits of *V. vinifera*

Microscopy
Epidermis cells are single layered, filled with reddish-brown contents. Mesocarp is pulpy and made up of thin-walled irregular cells containing calcium oxalate crystals which are prismatic and 13.75-41 µ in diameter. Some fibro-vascular bundles are also present in this region. Seeds are composed of testa and endosperm. Testa is composed of thick-walled yellowish cells. Endosperm is composed of angular parenchymatous cells containing oil globules and cluster crystals of calcium oxalate, measuring 11-16 µ in diameter [6].

Phytochemical composition
V. vinifera contain large amounts of phytochemicals. There have been at least 183 phenolic compounds identified in the roots, woods, canes, stems, and leaves of plants, including various subclasses such as 78 stilbenes (23 monomers, 30 dimers, 8 trimers, 16 tetramers, and 1 hexamer), 15 hydroxycinnamic acids, 9 hydroxybenzoic acids, 17 flavan-3-ols (of which 9 are proanthocyanidins), 14 anthocyanins, 8 flavanones, 32 flavonols, 2 flavones, and 5 coumarins [9]. *V. vinifera* is rich in polyphenols such as catechins, epicatechins. *V. vinifera* contains flavonoids including myricetin, lacitrin, isorhamnetin, kaempferol [10]. Flavonols are a subcategory of the flavonoid and are characterized by the presence of the yellow pigment quercetin. The content of flavonols in grape berries can be increased by exposure to sunlight. Hydroxycinnamic acids (non-flavonoids), resveratrol (Stilbenoids) are also produced by *V. vinifera.* Stilbenoids are a type of natural polyphenolic compounds found in various plants, including grapes [11]. Resveratrol is a well-known stilbenoid that is found in high concentrations in grape skins, particularly in *V. vinifera* grapes, which are used to make red wine [12]. Chemical structures are as shown in **Fig 2.**

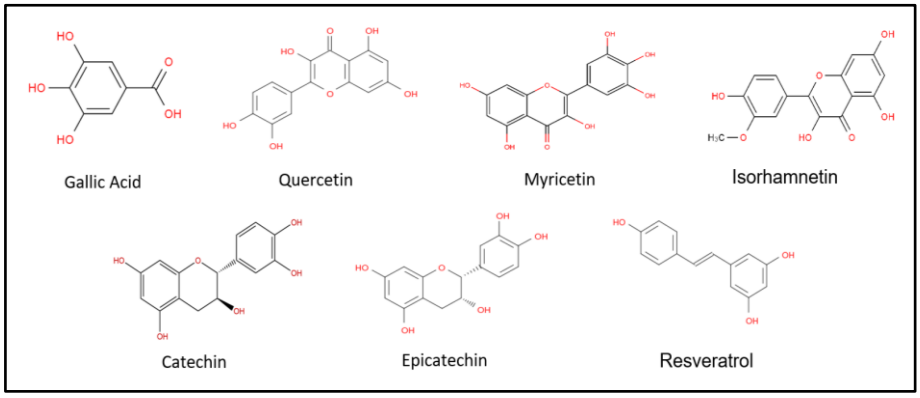

Fig 2: Chemical structures

Qualitative analysis

Physicochemical analysis

Physicochemical analysis of fruit was performed by different parameters such as foreign organic matter, loss on drying, total ash, acid insoluble ash, water soluble extractive, and alcohol soluble extractive [6]. Values were determined as per Ayurvedic Pharmacopoeia of India. Standard values are shown in **Table 2**.

Table 2: Physicochemical analysis

Sr. No.	Parameters	Standards
1.	Foreign Organic matter	NMT 2 %
2.	Loss on Drying	NMT 15 %
3.	Total Ash	NMT 3 %
4.	Acid Insoluble Ash	NMT 0.2 %
5.	Water Soluble Extractive	NLT 70 %
6.	Alcohol Soluble Extractive	NLT 25 %

Phytochemical analysis

Qualitative preliminary phytochemical screening of *V. vinifera* was done. The extract was obtained with three different solvents such as water, methanol, and chloroform by maceration process. This phytochemical screening indicates the presence of carbohydrates, proteins, alkaloids, glycosides, phenolic compounds, Flavonoids, anthocyanins, and saponins [13]. By this research, researchers conclude that methanolic extract contains most of the phytochemical compounds due to highest solubility of active compounds in methanol as compared to other solvents. Reported results with test as shown in **Table 3.**

Table 3: Phytochemical Screening

Sr. no.	Test (Methanolic extract of *V. vinifera*)	Observation	Result	Result
1.	Carbohydrates	Fehling's test	A brick red precipitate.	Present
2.	Protein	Biuret test	A pink color solution in ethanolic layer.	Present
3.	Alkaloids	Mayer's test	A dull white precipitate.	Present
4.	Glycosides	Borntrager's test	A pink color solution.	Present
5.	Phenolic Compound	Lead acetate test	A bulky white precipitate.	Present
6.	Flavonoids	Shinoda test	A pink or magenta red color.	Present
7.	Anthocyanins	Sodium hydroxide test	bluish green color.	Present
8.	Saponins	Extract + water (Shaking)	Formation of froth	Present

Pharmacological Activity

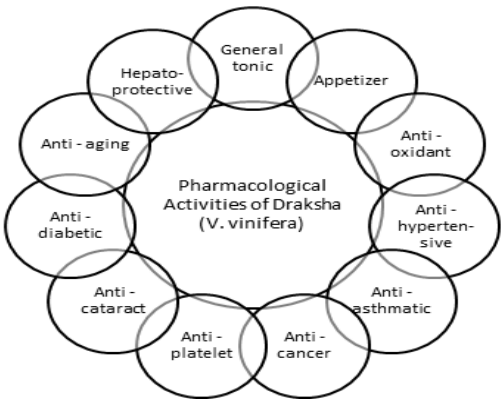

Fig 3: Pharmacological activities

Antioxidant activity

Grapes are a good natural source of antioxidants. Antioxidants, including phenolic compounds, flavonoids, and carotenoids, can reduce the risk of oxidative damage by scavenging free radicals and oxygen, and chelating catalytic metals. The grape pulps have stronger antioxidant activities than those of the grape skins. Seven different Trolox standards were prepared in methanol in concentrations ranging from 0.05 to 0.73 mM for the calibration curve. To prepare the sample, 50.0 0.1 to 72.0 0.1 mg of extract were dissolved in 10 mL of methanol, and the resulting mixture was diluted ten times with methanol. When a *V. vinifera* shoot extract was added to cultured normal human keratinocytes, it demonstrated *in vitro* antioxidant properties that were stronger than Vitamin E and Vitamin C [14]. The antioxidant activity of *V. vinifera* was determined by using a DPPH assay, ORAC, FRAP, and TEAC assays. The FRAP assay determines the powers of antioxidants at reducing ferric irons, while the TEAC assay measures the capacities of antioxidants on scavenging $ABTS^{\bullet+}$ free radicals. The *V. vinifera* extract was assayed for their capacity to neutralize free radicals. A smaller IC_{50} value indicates a higher antioxidant activity. For the DPPH, ABTS and FRAP (hydrogen atom transfer based) assays, the lowest IC_{50}-values (highest antioxidant capacity) were found for *Vitis vinifera.* In the case of the ORAC, the highest value was shown by *Vitis vinifera* [15]. Lipophilic, hydrophilic, and insoluble bound fractions of different grape varieties (pulp) were analyzed by FRAP and TEAC assay. The results indicated that most of the antioxidants in grape pulps responsible for the reduction of oxidants were distributed in the lipophilic fractions, followed by the hydrophilic fractions, while the insoluble-bound fractions contained the least. The grapes with the highest total FRAP values were Pearl Black Grape (Xinjiang, 11.767 μ mol Fe (II)/g FW) > Seedless Red Grape (California, 7.880 μ mol Fe (II)/g FW) > Summer Black Grape (Shaanxi, 7.830 μ mol Fe (II)/g FW) > Pearl Green Grape (Xinjiang, 7.346 μ mol Fe (II)/g FW) > Black Grape (Yunnan, 7.267 μ mol Fe (II)/g FW) in decreasing order [16].

Antihypertensive/cardioprotective activity

V. vinifera contains Myricetin and Quercetin shows antihypertensive activity. Mechanistically, flavonoids mediate their antihypertensive effects through increasing nitric oxide (NO) bioavailability, reducing endothelial cell oxidative stress or modulating vascular ion channel activity [17]. The mechanism of action of NO is based on the activation of the cGMP-protein kinase G cascade in smooth muscle cells in vessels. Once the cascade is activated, there is stimulation of potassium channels, a process that results in membrane hyperpolarization and inhibition of intracellular calcium influx, producing vasodilation. The action of protein kinase G is based on the phosphorylation of myosin light chains, a process by which the vasoconstriction of the smooth muscles in the vessels decreases. Myricetin, a flavonoid present in grape raisins, has been shown to lower systolic blood pressure in fructose-induced rats as well as deoxycortisone acetate-induced (DOCA) hypertensive rats with a high salt intake. In addition, adult male rats fed a high-fat diet (24 percent fat) and grape skin extract (ACH09) (100 mg/kg) during lactation were protected from hypertension later on in life [18]. Lyophilized red grape juice, at doses up to 0.01 μg, demonstrated cardioprotective effects against doxorubicin induced toxicity in cardiac-derived H9c2 myocytes. In contrast, at doses of 0.01 μg to 0.05 μg, it enhanced oxidative stress in cardiac cells, probably because of pro-oxidant effects of the juice, as indicated mainly by the increase in reactive nitrogen species and antioxidant enzyme levels [19].

Anticancer activity

Grapes show anticancer activity. It reduces the risk of certain cancers such as colon cancer, breast cancer etc. Grape antioxidants play a major role in their anticancer activity because of their antioxidant, anti-inflammatory and anti-proliferative properties. Antioxidants present in the grape have shown to induce cell cycle arrest and apoptosis in the cancer cells and also prevents carcinogenesis and cancer progression in study models. The mechanism of anti-cancer action is due to their effect on multiple cellular events associated with tumor initiation, promotion and progression [10]. The grape seed extract is a chemo preventive drug that increases transient gap-junction intercellular communications (GJIC), increases connexin-43 gene (cx34) expression in MCF-7 cells, relocalizes connexin-43 protein (Cx43), and suppresses oestrogen [20]. The anticancer effect of resveratrol metabolites, including resveratrol-3-O-sulfate, resveratrol-3-O-glucuronide, and resveratrol-4-O-glucuronide, on colon cancer cells was demonstrated. At a concentration of 30μM, they inhibited the proliferation of metastatic colon cancer cells and caused strong cell accumulation in the S phase of the cell cycle. At concentrations of 10 or 20μM, they showed synergistic chemotherapeutic effects with SN38 and oxaliplatin in metastatic colon cancer cells (SW620) [21].

Antimicrobial, antiviral, and antifungal activity

The increasing order of grape anti-microbial activity is from flesh, whole fruit grape extract, fermented pomace, skin, leaves and seed [22]. Resveratrol exhibits a strong cytotoxic activity in cultured cells and has an antiviral action against polyomavirus [23]. Grape pomace polyphenols exhibited bacteriostatic as well as bactericidal activities against both the Gram Positive and Gram-negative bacteria. Resveratrol, a phenolic compound in grape have shown to possess antifungal activity against the human pathogenic fungi *Candida albicans* and the notable benefit of polyphenols against the chemical derived drug was that there was no induction of hemolytic activity on human erythrocytes. Thus, the observed antifungal activity of gapes has been attributed to their commercial applications and are being incorporated into the skin care cosmetics. Alcohol-free red and white wine extracts have been shown to have moderate antifungal activities on *Candida albicans* depending on their total phenolic contents [10, 24].

Anti-inflammatory activity

Grape polyphenols have been found to decrease chronic inflammation by changing the way that inflammatory pathways work or by reducing ROS levels. Grape flavonoids and proanthocyanins are natural compounds that can target multiple pathways to overcome chronic inflammation, which makes them more effective than synthetic mono-targeted anti-inflammatory drugs [10]. Proanthocyanidins present in grape seeds have been shown to possess anti-inflammatory properties, as they are capable of scavenging free radicals, inhibiting lipid peroxidation and reducing the formation of pro-inflammatory cytokines [25].

Hepatoprotective effect

Pre-exposure to grape seed extract (3 or 7 days, 100 mg/kg, p.o.) followed by hepatotoxic doses of acetaminophen (400 and 500 mg/kg, i.p.) has been shown to significantly attenuate acetaminophen-induced hepatic DNA damage, apoptotic and necrotic cell death of liver cells, and counteract the effect of acetaminophen-induced changes in bcl-XL expression in mice. In one study, grape seed extract (50 mg/kg daily orally for 28 days) protected rat liver from oxidative damage after bile duct ligation. In another study, administration of grape seed extract at a dose of 50 mg/kg/day orally for 15 days before ischemia/reperfusion injury and repeatedly before the reperfusion period reduced hepatic ischemia/reperfusion injury in rats [26].

Antidiabetic action

Many *in vivo* studies have proved the anti-diabetic actions of grape and grape byproduct polyphenols, especially grape seed extracts. *V. vinifera* extract (100 mg/kg and 200 mg/kg, p.o., 12 weeks) could protect prediabetic mice, in which diabetes was induced by a high-fat diet, from peripheral change measured by intraepidermal nerve fiber (IENF) length (in mm) and was independent of any effect on glucose control. Lipid profiles were also improved [27].

Ayurvedic aspects

द्राड्क्ष्यते, द्राक्षि काड्क्ष्यायाम् || [28]

Meaning supposed to be

The term "Draksha" refers to a fruit that is known for its delicious taste.

Draksha is a well-known drug since Vedic period. Draksha is the Sanskrit name of a medicinal plant mentioned in the Ayurvedic classics. According to Ayurvedic Pharmacopoeia of India it consists of dried mature fruit of *Vitis vinifera* L. It is considered under Nitya Rasayana dravyas [29]. Draksha is called phalottama, i.e., among all fruits, grapes are the best [30]. In Ayurveda, draksha (raisins) is considered a nourishing and rejuvenating food. Draksha acts as Rasayana, meaning it has rejuvenating properties that nourish the body's tissues and enhance overall health and vitality. By improving the Dhatusara (nutrition and nourishment of the bodily tissues) and Ojas (the essence of all bodily tissues responsible for immunity and vitality), Draksha helps to boost the body's immunity or Vyadhikshamatva. This increased immunity helps the body to fight off infections and diseases more effectively. Draksha, or grapes, and is considered Vatapittahara because of its Madhura Vipaka (sweet taste after digestion) and Sheeta Virya (cooling potency). It helps to balance Vata and Pitta doshas in the body and is useful in conditions where these doshas are aggravated, such as Vata Pradhana Kaphaja Kasa (cough with predominant Vata and Kapha doshas) [31]. It is believed to balance vata dosha and strengthen the body. According to Ayurvedic principles, draksha is cooling in nature and can help soothe Pitta dosha. It is also believed to improve digestion and relieve constipation [32]. Additionally, draksha is rich in antioxidants, which are beneficial for overall health and can boost immunity. It is often recommended in Ayurvedic practices to consume draksha soaked in water overnight to reap its full benefits. Charaka advises avoiding the combination of grapes and milk. This is because the sourness of the grapes can curdle the milk, making it difficult to digest. This is a common issue with sour fruits when combined with milk, and Charaka recommends avoiding such combinations. In Caraka Samhita, Draksha is mentioned in 111 places [29].

तेषां द्राक्षा सरा स्वर्या मधुरा स्निग्धशीतला ।
रक्तपित्तज्वरश्वास तृष्णादाहक्षयापहा ॥ च. सू. ४७ [28]

(As per original text)

This means that,Grapes improve mobility and voice quality. They are sweet, greasy in nature and give a cooling effect. It gives relief from hyperacidity, fever, asphyxia, thirst, burning sensation and general debility.

Ayurvedic Properties and Actions [6, 33]

Rasa-Madhura, Kasay, Guna-Guru, Sara, Snigdha Virya–Sita Vipaka-Madhura, Karma-Brmhana, Vatapittahara, Swarya

Dose [34]

Kalka-10 to20 gm, Swarasa - 40 to 50 ml, 5-10 gm of drug

Marketed Ayurvedic Formulations of Draksha (*V. vinifera*)

As shown in **Table 4**, several ayurvedic market products have been developed by different manufacturers using different chemical compounds from draksha.

Table 4: Marketed formulations

Sr.No.	Marketed Formulation	Type of Formulation	Manufacturer	Indications
1.	Drakshagandha	Arishta	Aushadhi Bhavan (Ayurved Seva Sangh)	General Tonic, Appetizer
2.	Drakshadi Gutika	Tablets	Yajurvid Pharma	Dyspepsia, Vertigo, Rheumatism
3.	Drakshadi Kashayam	Kashayam	Kairali Ayurvedic Products	Liver Disorders, Treats Alcoholic Hangover,
4.	Drakshadi Paka	Syrup	S N Pandit Ayurveda	Improve digestion, Constipation
5.	Hepacap	Capsules	Capro Labs	Liver Disorders

Patents Filed on *V. vinifera* [35,36]**:**

Different patents filed on *Vitis vinifera* (Draksha) with its application no., applicant name, and field of invention as shown in **Table 5.**

Table 5: Patents filed on *V. vinifera*

Sr.No.	Application No.	Applicant Name	Field of Invention	Title of Invention
1.	202321001255	Nitin P Khade	Chemical	A Novel Process of Drying Grapes to Making Resins
2.	201711021975	Indian Council of Agricultural research (ICAR)	Chemical	A Method for Extraction of Anthocyanins and Composition Thereof
3.	202241071778	1. Dr. G. Rajeswari 2. Mr. Manikandan Bose 3. Dr. N. Maybel Starlin 4. Dr. B. Sajitha 5. Dr. S. Menaga 6. Dr. Jeban Benjamin 7. Dr. A. Doss 8. Dr. R.P. Praveen Pole 9. Dr. R.S. Dhivya 10. Dr. R.S. Vidhya	Chemical	Dry Grape (*Vitis vinifera*) Extract and Its Anticancer Effect
4.	202141055807	Dr. Deeparani Urolagin	Biotechnology	Process For Polyherbal Formulation Using *Vitis vinifera*, *Ixora coccinea* and *Piper longum* for Anticancer Potential
5.	202141000636	1. Dr. S. Kavitha Bharathi 2. Dr. M. Dhavamani 3. Dr. K. K. Savitha	Electronics	The Detection of Downy Mildew Disease on Grapes Using IOT And Advanced Image Processing Techniques

Conclusion

Vitis vinifera, commonly known as grapes, has been used for medicinal purposes in Ayurveda for centuries. It is also known as "Phalottama" i.e., best fruit in the fruit category. Grape is a fruit which has nutritional as well as medicinal values. This plant is a rich source of bioactive compounds, such as polyphenols and flavonoids, which have been shown to possess numerous pharmacological properties, including antioxidant, anti-inflammatory, anti-diabetic, anti-cancer, antihypertensive, and neuroprotective effects. Moreover, recent studies have demonstrated the potential use of *Vitis vinifera* in the development of new therapeutic agents for various diseases. However, further research is needed to better understand the mechanisms of action, potential side effects, and optimal doses of *Vitis vinifera* compounds for clinical applications. Overall, this literature review highlights the potential of *Vitis vinifera* as a valuable source of bioactive compounds with various health benefits.

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