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# Phytochemistry of *Uvaria narum*: A Multifaceted Perspective and Ethnopharmacological Potential †

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**Abstract:** The blooming ethnomedicinal plant *Uvaria narum* (Dunal) Wall is mostly found in the deep forests of the Western Ghats and belongs to the Annonaceae family. *Uvaria narum* is a spreading, pubescent shrub with large, dark bluish-green leaves. Phytochemistry and pharmacognostic studies have revealed that the plant possesses a variety of phytochemicals that are remarkable and beneficial to humans. The plant also possesses a number of beneficial properties, such as antioxidant activity exhibited by the presence of polyphenols and tannins, antifungal activity brought on by the benzoic acid moiety, and tumour-fighting ability contributed by terpenoid and alkaloids. The presence of phytoconstituents in the plant has been attributed to the various medicinal properties of the plant, such as anticancer activity. The plant may also be considered for use against ageing and other diseases caused by free radicals. In vitro cytotoxicity is due to terpenoids, phytosterols, and flavonoids, whereas the liver is protected by flavonoids. The chemical profile of the plant shows that acetogenins, including stereoisomers, are important constituents of the root bark. Eczema, itching, varicose veins, haemorrhoids, jaundice, inflammation, and fever are the main ailments for which this herb is used.

**Keywords:** *Uvaria narum*; benzoic acid; terpenoids; acetogenins; tumour-fighting

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## 1. Introduction

India, which is aptly known as the Botanical Garden of the World, is the country that produces the most medicinal plants. Several medicinal herbs have been used by the indigenous system of medicine for thousands of years. India has a valuable heritage of herbal remedies for various ailments [1]. About 120 genera and more than 2000 species make up the enormous plant family known as Annonaceae. It is a highly uniform family in terms of habitat and anatomy. This family is valuable economically because it produces edible fruits and oils [2]. Approximately 210 species of the Annonaceae family have been identified, and they are widely distributed in tropical and subtropical wet forests in Africa, Madagascar, continental Asia, Malaysia, northern Australia, and Melanesia. Some Uvaria species are known to possess biologically valuable compounds, which have a number of therapeutic characteristics, and are often evergreen [3]. Uvaria is a genus of flowering plants in the soursop family Annonaceae. Because several species in this genus produce edible fruits that resemble grapes, the name Uvaria is derived from the Latin word uva, which means grape. These are spectacular bushes with sparsely haired branch lets. They have huge, woody stems and are climbing shrubs. *Uvaria narum* is a sizable straggling

shrub with dark bluish-green leaves that is woody and stellately hairy [1]. This article seeks to give a thorough overview of *Uvaria narum*'s botanical characteristics, phytochemistry, ethnopharmacology, and ethnomedical applications.

## 2. Plant Description

### *2.1. General Details*

Binomial Name: *Uvaria narum* (Dunal) Wall
Family: Annonaceae
Common Name: Narumpanal, Pulikkan
Habit: Shrub or woody climber
Flowering Class: Dicot
Part Used: Seeds, aerial parts, roots, leaves

### *2.2. Taxonomical Classification*

Kingdom: Plantae
Order: Magnoliales
Family: Annonaceae
Phylum: Magnoliophyta
Class: Magnoliatae
Genus: Uvaria

### *2.3. Vernacular Names*

English: South Indian *Uvaria*
Indian Languages: Saplivel
Malayalam: Narumpanal, kureel, kooril, koorilvalli
Tamil: Puliccan
Sanskrit: Nilavalli, valeesha-khota
Kannada: Bugadeeballi, bugadeehoo, guavaara
Marathi: Kala-apakara

### *2.4. Distribution*

#### 2.4.1. Global Distribution

*Uvaria narum* is found in South India and Sri Lanka.

#### 2.4.2. Indian Distribution

*Uvaria narum* is particularly found in southern India, mainly in the forests of Western Ghats from South Kanara to Travancore and the hills of Salem. It is occasionally distributed in the southern dry mixed deciduous forests at low altitudes.

The plant is specifically seen in the states of Maharashtra (Kolhapur, Satara, Raigad districts), Karnataka (Coorg, Chikmagalur, North and South Kanara, Mysore districts), Kerala (all districts); and Tamil Nadu (Madurai, Salem, Namakkal, Nilgiri, Tiruvannamalai, Vellore, Viluppuram, Dharmapuri,Tirunelveli districts).

### *2.5. Morphology*

#### 2.5.1. Leaves

Leaves are simple alternate lanceolate; oblong to elliptic; about 10–16 cm × 2.5–6 cm across; apex acuminate; asymmetrical; dark green; base rounded, oblong pointed, or long pointed; hair lesson both sides; and stalks short and less than 6 mm. Crushed leaves smell like cinnamon.

#### 2.5.2. Flowers

Flowers are bisexual, usually solitary, extra axillary, leaf-opposed, with slender pedicels about 1–1.2 cm tomentose. Sepals are 8 × 5 mm, broadly ovate, basally connate. Outer petals slightly larger and wider than the inner petals. Petals are fleshy, with outer petals

2 × 1.5 cm and inner petals 2 × 1 cm, obovate, apex in curved and golden brown. Stamens have anthers concealed by overlapping connectives. Carpels are numerous, 5 mm, oblong, scarletred, and tomentose.

#### 2.5.3. Seeds

Seeds are around 4–6 in a row, compressed or ovoid, chestnut brown, and sub-orbicular, and have the extremities of the carpels that are plano-convex and middle ones that are compressed and nearly flat.

#### 2.5.4. Reproduction

*Uvaria* species flowers are complete bisexual, i.e., with the functional male (androecium) and female (gynoecium) including stamens, carpels, and ovary. Pollination is entomophillous, i.e., by insects. The plant is rarely unisexual.

#### 2.5.5. Flowering/Fruiting

The season of flowering is from November to December, and fruiting is from December to April.

#### 2.5.6. Soil Requirement

Sandy loam soil with a loose structure and good drainage is needed [1,4].

## 3. Phytochemistry

Investigations into the phytochemistry of plants have identified various types of compounds with a variety of structural characteristics, and these compounds are still a rich source of novel natural products. *Uvaria narum* (Annonaceae) is one of the less chemically studied species in this intriguing group, according to a chemical literature review. Oils and fatty acids are discovered to be abundant in a number of Annonaceae species. Before 1982, fatty acids with an abnormally high molecular weight that were insecticidal were found in the seeds of Annonaceae species. These substances appear to have later been classified as lipids and fatty acids as a new class of natural goods known as tetrahydrofuranoid acetogenins. It has been discovered that certain Annonaceae plants, including *Uvaria narum*, contain polyphenolic chemicals. Many species of the Annonaceae family include phenolic acids, including caffeic acid, p-hydroxy benzoic acid, p-coumaric acid, and vanillic acid. The leaves of several members contain common flavonoids, including quercetin, quercitrin, and rutin.

Due to the presence of essential oils, many Annonaceae species are aromatic. Their oils typically contain monoterpenes, sesquiterpenes, or aromatic chemicals that are well-known.There are species of *Uvaria* from specific Annonaceae genera that elaborate aromatic chemicals. In numerous *Uvaria* species, benzylbenzoate or its derivatives are frequently found. It seems that the potential to use benzyl or benzoyl groups to substitute various kinds of secondary metabolites is a recurring topic in the chemistry of *Uvaria*. Through research on various *Uvaria* species, a new class of secondary metabolites known as polyoxygenated cyclohexene derivatives combined with benzoyl esters has been discovered. They belong to a tiny family of secondary metabolites found in plants, and the curiosity about these peculiar substances has led to enquiries on their biogenesis [2].

Most Annonaceae alkaloids have an isoquinoline-derived structure, and they can be divided into simple isoquinolines, benzyl-tetrahydroisoquinolines, bisbenzyl-isoquinolines and bisbenzyl-tetrahydroisoquinolines, protoberberines, tetrahydroprotoberberines, oxoaporphines, phenanthrenes, and other miscellaneous isoquinoline-type alkaloids. Acetogenins, including the stereoisomer glutinone, glutinol, taraxerol, beta-sitosterol, benzyl benzoate 15.2%, and patchoulenone, are typically found in thisplant. Benzoic acid ester, 2-E-(2-oxo-cyclopent-3-en-1-ylidene) ethyl benzoate, tetratriacontanol, tritriacontane, and sitosterol are isolated from leaves, and novel acetogenins, such as squamocin-28-one, panalicin, and *Uvaria* micin-I, II, and III, are isolated from the bark. By using mass spectrometry and

capillary gas chromatography, the leaf oils of certain Annonaceae genera were examined. The three main substances were found to be -phellandrene (20.1%), gurjunene (21.9%), and bicycloelemene (9.6%). Selinene (12.3%), bicyclogermacrene (10.9%), caryophyllene oxide (10.4%), and bicycloelemene (5.6%) were all present in high concentrations in the oil. The primary components of *Uvaria* were bicycloelemene (18.3%), germacrene D (30.2%), bicyclogermacrene (26.4%), and bisabolene (7.7%), whereas elemene (54.0%) was the component of *Uvaria* dac oil with the highest single abundance. The majority of the other chemicals, myrcene (3.8%) and limonene (3.8%), were all found in concentrations less than 5%. Using GC/MS to examine the root bark essential oil, roughly 52 components—22 of which were identified—were found to be present. The two main chemical components of the oil were discovered to be bornyl acetate (15.2%) and patchoulenone (8.1%), a tricyclic sesquiterpene ketone [1].

The crude leaf aqueous extracts of *Uvaria narum* revealed the presence of alkaloid carbohydrate, coumarins, flavonoids, phenols, proteins, quinones, sterols, and terpenoides according to the preliminary phytochemical screening [5].Similar studies were conducted using a leaf extract that was dissolved in methanol and contained phenols, saponins, glycosides, and steroids. Carbohydrate, coumarins, phenols, phytosterols, proteins, sterols, and terpenoids were discovered in the chloroform extract. Glycosides, phenols, phytosterols, proteins, terpenoids, alkaloids, and carbohydrate were found in the acetone extract of *Uvaria narum* leaves. Steroids are recognised to be crucial for their cardiotonic effects in *Uvaria narum*, as well as having insecticidal and antibacterial characteristics [6–9]. The structures of some of the phytochemicals found in *Uvaria narum* are shown in Figure 1.

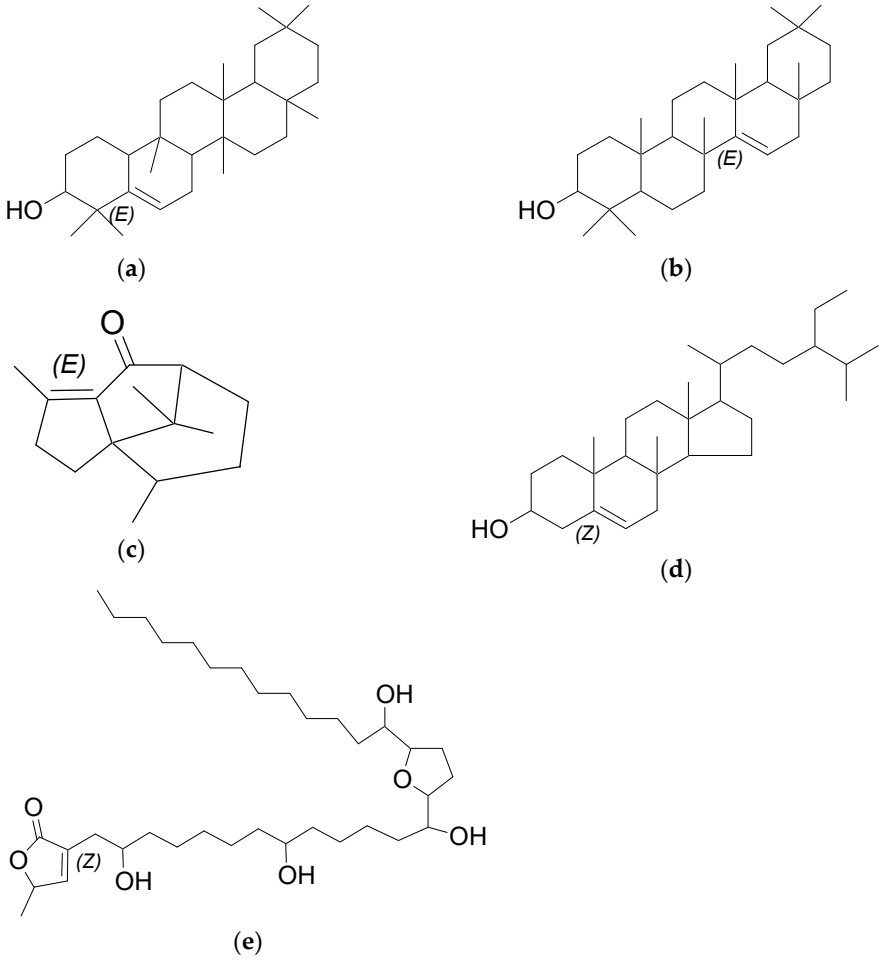


**Figure 1.** The structures of some of the phytochemicals found in *Uvaria narum*: (**a**) glutinol, (**b**) taraxerol, (**c**) patchoulenone, (**d**) beta-sitosterol, and (**e**) acetogenins [10].

## 4. Ethnopharmacology

The various therapeutic activities proved by many researchers are mentioned next.

### *4.1. Antioxidant Activity*

When compared to previous studies, the level of antioxidant activity of 523.70 µM (Fe)/gm root powder of *U. narum*'s whole-root extract is promising. As antioxidant activity is directly proportional to the phenolic compounds in plants, this activity may be attributed to 0.8% of phenols present in the total root powder. Therefore, *U. narum*'s whole-root extract could be used medicinally as a potential free-radical scavenger. The plant may also be used as a defence against ageing and other diseases brought on by free radicals [1,11].

### *4.2. Antibacterial Activity*

The antibacterial activity of the sample was analysed usingstandard tube dilution procedures with some modifications. In terms of antibacterial activity, the plant showed inhibitory properties against both Gram-positive and Gram-negative bacteria, namely *Staphylococcus aureus*, *Escherichia coli*, *Bacillus* spp., and *Lactobacillus* ferment. Herbs frequently have antibacterial properties, especially when used as drugs to treat skin conditions. Therefore, given that the plant has been used as a medicine to treat skin conditions, it is not surprising that it possesses antibacterial action against a diverse variety of bacterial species. As a result, the plant may be used to treat skin conditions, such as eczema and others brought on by bacterial infections [11–13].

### *4.3. Hepatoprotective Activity*

Significant hepatoprotective action is demonstrated by the ethanolic extract of *U. narum* leaves against $CCl_4$-induced liver damage in rats. This might be because of the presence of identified phytoconstituents, particularly flavonoids with antioxidant properties. A number of plants are being used for the treatment of hepatic disorders, and *Uvaria narum* is one of the potential plants for liver diseases, such as jaundice. The hepatoprotective activity of its extract was found in carbon-tetrachloride-induced liver toxicity, paracetamol-induced liver toxicity, and thiocetamide-induced liver toxicity. The hepatoprotective potential of the leaves of *Uvaria narum* (Annonaceae) was found by noting elevation in hepatic biomarkers, such as SGPT, SGOT, ALP, bilirubin, and other biochemical parameters, such as cholesterol, triglycerides, urea, and tissue LPO, and a decrease in total protein, albumin, glucose, and tissue GSH, CAT, and SOD in $CCl_4$-induced liver toxicity [14].

### *4.4. Antitumour Activity*

Plants have strong immune-modulating and antioxidant characteristics that promote anticancer action. It was discovered that taxol and podophyllotoxin were effective in treating refractory ovarian, breast, and other malignancies. A good source of potential cytotoxic alkaloids and antraquinones is the seed oil of *Uvaria narum*. The phytoconstituents terpenoids and alkaloids found in *Uvaria narum* contribute to its antitumour action [1].

### *4.5. In Vitro Cytotoxicity*

Using the trypan blue exclusion method, the cytotoxic effects of each extract on Ehrlich's ascites carcinoma (EAC), Dalton's lymphoma ascites (DLA), and normal rat spleen cells were assessed. Extracts of PE, CHL, acetone (ACT), and methanol (MeOH) demonstrated a strong toxic effect on these cells. The aqueous extract, however, proved non-toxic. Petroleum ether extract chemicals, which are toxic to cancer cell lines but less deadly to healthy spleen cells, serve as an example of differential cytotoxicity. In the phytochemical screening and TLC analysis of petroleum extract, terpenoid and phytosterol are determined to be two of the major phytoconstituents. The cytotoxic effect of the PE extract is therefore anticipated to be connected to its terpenoidal concentration. The cytotoxicity demonstrated by PE extract was selective, being more toxic to cancer cells than to normal spleen cells (IC50 for DLA was 19 $\pm$ 0.57 and that for EAC cells was 38 $\pm$ 0.74 g/mL, while over 100 g/mL

for normal spleen cells). CHL, ACT, and MeOH extracts demonstrated the potential for cytotoxicity, and they have cytotoxic effects on cancer cells that are comparable to those of normal cells. This suggests that *U. narum* leaves are an important source of physiologically significant cytotoxic phytoconstituents [15].

### *4.6. Antidiabetic Activity*

The earlier trend in diabetes treatment involved oral administration or injections, which necessitated careful examination of natural products, particularly *Uvarianarum*, by attempting to identify phytochemicals and chemical constituents as well as conducting clinical trials on natural products and their analogues in drug discovery studies. According to a review of many literary works, diabetes can be treated with plant leaves. *Uvaria narum*'s methanolic extract substantially reduced the activity of glucosidase and amylase. Acarbose was used as a reference medication to quantify these inhibitory effects. Additionally, the cell showed no cytotoxic effects due to *Uvaria narum*. Amylase and glucosidase activities were effectively inhibited by the *Uvaria narum* extract in a good percentage. UN extract inhibited amylase activity by 71.31%, while the control medication acarbose inhibited it by 88.54%. In addition, the extract inhibited glucosidase activity by 79.11%, whereas acarbose inhibited it by 87.35%. Additionally, IC50 values were found. Furthermore, after being exposed to the extract, 75.49% of 3T3-L1 cells took up glucose and 70.67% of them expressed GLUT4 [16].

### *4.7. Antifungal Activity*

In traditional and ethnomedical practices, *Uvaria narum* has been used to treat gastrointestinal issues, jaundice, fever, and skin ailments. The acetone extract of *U. narum*'s leaves showed extremely good antifungal activity in preliminary antifungal testing. Using bioactivity-guided fractionation, the active ingredient in the acetone extract of *U. narum* leaves was identified. It was then characterised as a novel compound called 2-E-(2″-oxo-5″-acetoxy cyclopent-3″-en-1″-ylidene) ethyl benzoate using NMR, IR, and mass spectroscopic methods. Viable isolation has shown excellent effectiveness against the fungus *Colletotrichum gloeosporioides* [17]. *Uvaria narum* was tested against two important plant fungal pathogens, *Fusarium moniliforme* and *Corynespora cassiicola*. The leaves of *Uvaria narum* were subjected to sequential Soxhlet extraction in four solvents, i.e., petroleum ether (PE), chloroform (Chl), acetone (Ac), and methanol (Me). The extracts thus obtained were subjected to antifungal tests using the poison food technique. The sequentially extracted PE extract and the chloroform extract derived thereafter inhibited fungal growth by 65% and about 49%, respectively, in the case of *Fusarium* and 70% and 45%, respectively, in the case of *Corynespora* [18].

### *4.8. Antihelmintic Activity*

Acetogenins were tested at concentrations of 0.05%, 0.15%, 0.25%, 0.75%, and 1.25%, and the crude extract was tested at concentrations of 0.1%, 0.3%, 0.5%, and 2.5%. The same ethanol/water mixtures (30% ethanol) in which drug solutions were prepared were used, and mebendazole was used as the standard drug. At every concentration, the extract exhibited a notable inhibitory effect, and when compared to the control, it exhibited almost 0.5% inhibition. This demonstrated the effectiveness of *U. narum*'s antihelmintic activity [13].

### *4.9. Antiproliferative Activity*

To measure antiproliferative activity, the MTT test was performed. *Uvaria narum* seed oil caused a dose-dependent reduction in cell viability in Vero (normal monkey kidney cells), HCT-15 (human colorectal adenocarcinoma cells), HepG2 (hepatocellular carcinoma cells), and HeLa cells (human cervical carcinoma cells) in culturesexposed to it at various concentrations, indicating that it has antiproliferative potential. The viability of all cells was shown to decrease depending on the amount of oil, and all cells were susceptible to UNSO.

The UNSO concentration needed in HeLa cells to cause a 50% reduction in cell viability (IC50 value) was discovered to be greater than 100 ± 2.35 g/mL. However, the IC50 values with HepG2, HCT-15, and Vero cells after exposure to UNSO were 50.30 ± 1.45, 40.0 ± 1.94, and 48.05 ± 2.43 g/mL, respectively [19].

## 5. Ethnomedicinal Applications

*Uvaria narum* is mostly used to treat patients with skin conditions, such as dermatitis andpityriasis, and constipation. It is also used to treat fever, jaundice, haemorrhoids, varicose veins, and irritation and itching. In rheumatic swelling, jaundice, biliousness, and fever, leaves are advised. The root is used to cure typhoid, jaundice, fever, and biliousness. Women are given a decoction of the root bark to manage fits during labour. It is also used for skin conditions, such as eczema; gastrointestinal issues in children; and rheumatism. The oil reduces liver burning when extracted from the root. *Uvaria narum*whole-root extract may be used medicinally as a potential free-radical scavenger. The plant may also be used as a defence against ageing and other diseases brought on by free radicals. For gastrointestinal disorders, Uvaria's aerial portions are used [1,20].

## 6. Conclusions

This review of *Uvaria narum* shows that the plant is significant because of its therapeutic benefits and extensive phytochemical profile. The plant displays a good amount of phenols, tannins, and antioxidants. The chemical composition of the plant also reveals that stereoisomers and acetogenins are significant components of the root bark. Additionally discovered in isolation are glutinone, glutinol, beta-sitosterol, taraxerol, and benzyl benzoate. According to research that has been written about a variety of plants, the existence of these phytoconstituents in *Uvaria narum* has been linked to various medical qualities in the plants, such as anticancer, antioxidant, anthelmintic, antiproliferative, hepatoprotective, antitumour, and antibacterial activities. As a result, it is used to treat rheumatic infections, as well as eczema, biliousness, jaundice, and gastrointestinal issues.

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