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## ***EUPHORBIA PULCHERRIMA*: A SCIENTIFIC UPDATE**

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### **ABSTRACT**

*Euphorbia pulcherrima* is member of Euphorbiaceae family of medicinal plants, and it is used to cure variety of ailments which includes toothache, vomiting, fractures, severe bleeding, bruising, and hypermenorrhoea. *Euphorbia pulcherrima* has been found to possess a variety of chemicals, including alkaloids, steroids, terpenoids, flavonoids and reducing sugars. The review analyses its pharmacological profile, chemical component, and phytochemistry, with an emphasis on antioxidant activity, antimicrobial activity, Osteoclast activity, analgesic activity, anti-inflammatory activity, sedative activity, muscle relaxant activity, anticonvulsant activity and toxicological profile, in order to better assess the plants medicinal potential. Due to extensive research on the pharmacological effects and active compounds of *Euphorbia pulcherrima*, it has a great deal of potential in modern medicine. This review provides current research on the phytochemical composition of *Euphorbia pulcherrima* as well as other material that can be used as a reference for future studies.

**Keywords:** *Euphorbia pulcherrima*, Phyto-chemicals, Eupulcherol A, rutin, pharmacological activity

### **INTRODUCTION**

The primary source of numerous classes of secondary metabolites is medicinal plants [1]. There is a connection between plants' medicinal efficacy and the presence of natural chemicals. Several bioactive natural compounds have been identified and are important components of contemporary medical system [1]. One of the most

significant sources of medicines comes from plants. Plant-derived chemicals, or phytochemicals, are gaining popularity as natural substitutes for manufactured chemicals. All traditional medical systems are based on the use of plant extracts to treat a variety of ailments. The treatment and control of diseases by the use of available

medicinal plants in a locality will continue to play significant roles in medical health care implementation in the developing countries [2]. Today's advances in technology in chemical, pharmacological, and microbiological research have made it possible to effectively screen higher plants for active chemicals [2]. Numerous plants are being studied for the development of novel drugs since medications made from plants are more potent yet less toxic.

### Botanical description and taxonomy

*E. pulcherrima* is a perennial herb that is well known for treating a range of diseases. It is found throughout the world's tropical and subtropical regions [3]. *Euphorbia pulcherrima* (EP) belongs to family: Euphorbiaceae and genus: Euphorbia (English name: Poinsettia [Christmas star], Nepali name: Lalupate, Hindi name: Lalpatta). Popular Christmas plants like *Euphorbia pulcherrima* are planted for their scarlet leafy bracts. It is a flower with Mexican ancestry that is endemic to the Pacific coast of the United States, some regions of central and southern Mexico, including the Mexican Pacific coast, and a few locations in Guatemala. It is commonly

referred to as a poinsettia. Additionally, it is also readily accessible throughout Nepal, particularly in the hilly area [4].

Distribution: Native to: Guatemala, Mexico Central, Mexico Gulf, Mexico Northeast, Mexico Northwest, Mexico Southeast, Mexico Southwest.

Introduced into: Gulf of Guinea Islands, Hainan, Honduras, Italy, Juan Fernández Islands, Malawi, Nicaragua, Bangladesh, Brazil Northeast, Caroline Islands, China South-Central, China Southeast, Comoros, Costa Rica, East Himalaya, El Salvador, Gambia, Panamá, Society Is., Southwest Caribbean, Taiwan, Thailand, Trinidad-Tobago, Tubuai Is., Vanuatu, West Himalaya.

Cultivation: Tropical evergreen, semi evergreen or deciduous shrub, leggy to 10 feet or taller. Coarse leaves on upright canes. Inconspicuous flowers, but has showy petal-like bracts in shades of red, white, pink, coral, and purple tones, or combinations of these colours. In truly tropical areas the plant can be adapted outdoors as a shrub or informal hedge, but in almost all cases is grown as a flowering indoor plant for the winter holiday season.

Table 1: Taxonomic classification of *Euphorbia pulcherrima*

|                 |   |
|-----------------|---|
| Kingdom:        | Plantae- Plants                                 |
| Subkingdom:     | Viridiplantae- Green plants                     |
| Super division: | Embryophyta                                     |
| Division:       | Tracheophyta- Vascular plants, teacheophytes    |
| Class:          | Magnoliopsida                                   |
| Subclass:       | Rosidae   |
| Order:          | Eephorbiales                                    |
| Family:         | Euphorbiaceae                                   |
| Genus:          | Euphorbia                                       |
| Species:        | <i>Euphorbia pulcherrima</i> Willd. Ex Klotzsch |

### Traditional uses

In Mexico and Guatemala, poinsettia (*Euphorbia pulcherrima*) has been used as a hair removal lotion. The latex has been employed as an anti-vomiting and toothache treatment. Aches and pains have been treated with leaf poultices. Despite the safety issue, the entire plant and its sap (latex) are utilized for making medicines. Despite the fact that it is believed to cause abortion when consumed by pregnant women, some take poinsettia to treat fever and promote the production of breast milk. In a related discovery, it has been claimed that the plant's leaves have some wound-healing capabilities of ethanol extract and water free extract [5]. In traditional Chinese medicine it has been used it to treat fractures, severe bleeding, bruising, and hypermenorrhoea [6].

### Chemical constituents isolated from *Euphorbia pulcherrima*

This plant is rich in medicinal benefits. There are many different types of phytochemicals in plants, like alkaloids, steroids, terpenoids, flavonoids and reducing sugars [1]. The crude methanol extract of whole plant of *E. pulcherrima* (L) was fractionated using ethyl acetate. The ethyl acetate fraction was first eluted with 200 mL of 100% n-hexane first and then with varying ratios of hexane. The A, B, C, D, E, F, G, and H fractions obtained from the column chromatography were concentrated

on rotary evaporator and analysed using GC-MS-QP2010 Plus Shimadzu and FT-IR model 8400S scanned in accordance with ATSM1252-98 to determine the probable compounds responsible for the bioactivity of the fractions. The results of the GC-MS analysis of fractions A, B, C, D, E, F, G, and H revealed different Phyto-chemicals such as terpenoids, flavonoids, alkaloids, saponin, and steroids [5]. By using GLC and mass spectrometry, the sterol and triterpenol components of *Euphorbia pulcherrima* latex were investigated. Sitosterol, B-amyrin, germanicol, cycloartenol,  $\beta$ -amyrin acetate, and germanicol acetate were all present in the latex extracts from the various types. Only sitosterol was significantly generated by cultured *E. pulcherrima* tissues [7]. *E. pulcherrima's* (8.0 kg) air-dried aerial portions were extracted three times using 80% acetone in water. The crude extract was divided with EtOAc and suspended in water. A number of column chromatographic purification processes were used to separate the EtOAc-soluble fraction across silica gel, MCI, and Sephadex LH-20. Two distinct organic compounds and 13 recognised compounds, including 3,4-acetyloxy-olean-13(18)-en-12-one[8] and 18,19-epoxyolean-3-ol acetate, have been found in the aerial portions of *Euphorbia pulcherrima* Willd [3]. Column chromatography allowed for the separation of 243 subfractions from the phytochemicals that were subjected to

chromatographic examination among the chloroform fraction, using 24.27 gm of silica gel as the stationary phase. By using advanced spectroscopic analysis and contrasting the spectrum and physical data, spinacetin and patuletin were specifically discovered [9]. From the whole plant of *Euphorbia pulcherrima*, a new triterpenoid with an unusual carbon skeleton was extracted. Comprehensive spectroscopic data analysis, including HRESIMS and 1D and 2D NMR, was used to determine its structure, and single crystal X-ray diffraction analysis was used to determine its absolute configuration [10]. *Euphorbia pulcherrima* due to the presence of bioactive components, including rutin, one of the flavonoids, which makes it well known for

its therapeutic effects. In the current study, rutin was separated and extracted using 80% methanol from the dried leaves of *E. pulcherrima*. Alkaloids, steroids, terpenoids, saponins, glycosides, reducing sugars, and amino acids were among the groups of chemical compounds identified by the phytochemical screening of *E. pulcherrima*. TLC was used to conduct a qualitative analysis of the crude extract of *Euphorbia pulcherrima*. Further HPLC analysis of the partially purified sample was performed to characterize the Rutin content of the extract. The outcome showed a significant peak at 3.178 minutes, indicating that rutin was present in the methanolic extract [11].

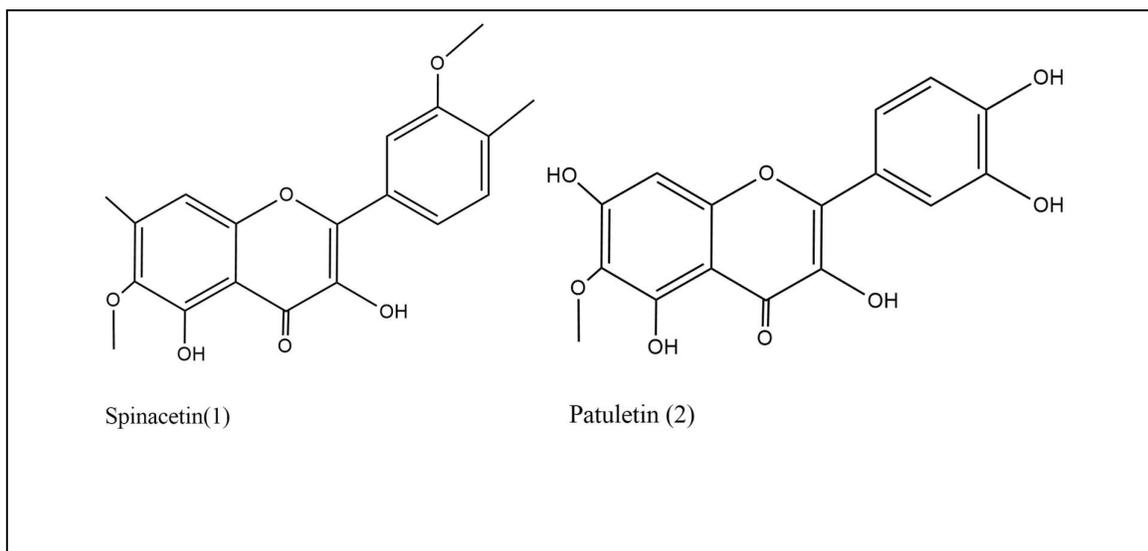
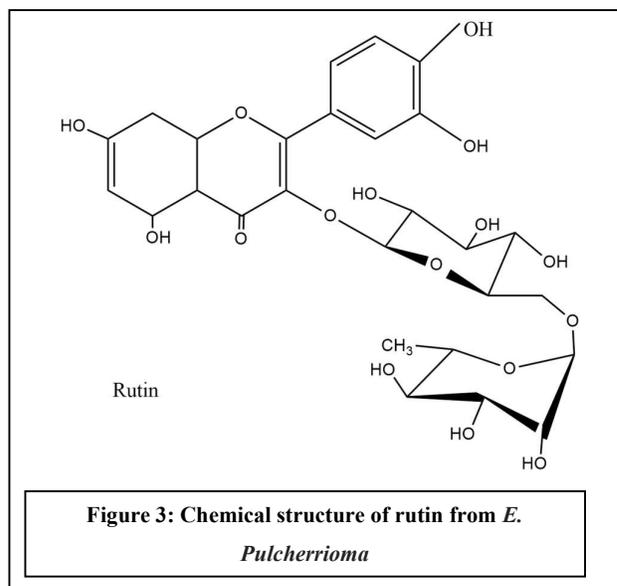
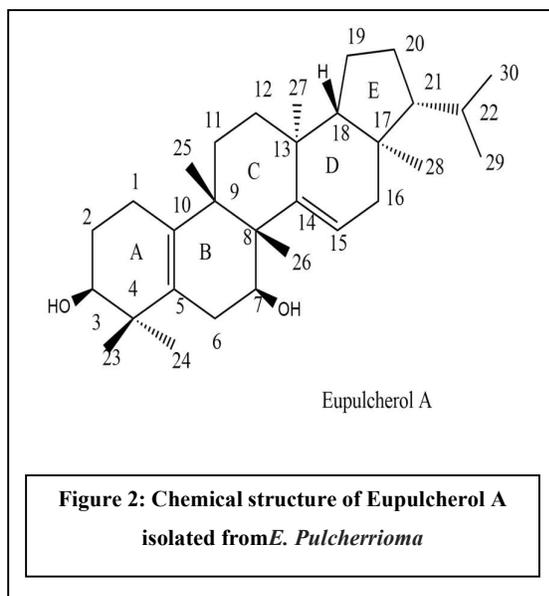


Figure 1: Chemical structure of spinacetin (1) and patuletin (2) isolated from *E. Pulcherrima*



## Pharmacological activities

### Antioxidant activity:

A significant DPPH free radical scavenging activity was observed by various solvent fractions of *E. pulcherrima* using four extracts (n-hexane, chloroform, ethyl acetate and methanol). The maximum (90.22%) free radical scavenging effect was observed with methanolic extract at higher concentration (500  $\mu\text{g/ml}$ ), while the effect was weak (24.94%) at 20  $\mu\text{g/ml}$  the antioxidant effect of ethyl acetate was higher (91.31%, at 500  $\mu\text{g/ml}$ ) but the effect at lowest concentration (20  $\mu\text{g/ml}$ ) was 20.41%. the free radical scavenging effect of chloroform and n-hexane fraction was moderate (60.55 and 48.41%) at tested concentration of 500  $\mu\text{g/ml}$  [1].

### Antimicrobial activity:

The disc diffusion and macro broth dilution techniques were used to test *Euphorbia*

*pulcherrima* antimicrobial activity against bacteria *Salmonella typhi*, *salmonella Paratyphi* and *Escherichia coli* and fungal isolates namely: *Aspergillus Niger*, *Candida albicans* and *Trichophyton tonsurans*. Ciprofloxacin control for antibiotic activity was used and for antifungal activity Ketoconazole and Fluconazole was used. Antimicrobial activity of aqueous and ethanolic extract of *Euphorbia pulcherrima* on some bacterial and fungal clinical isolates using disc diffusion method showed High inhibitory effect against *S. typhi* and *E. coli* 0157:H7 by aqueous and ethanolic extract at disc potencies of 5000 to 10000  $\mu\text{g}$ , with zones of inhibition ranging from 8.0 to 14.0 mm. Additionally, the whole plant extracts were active at 2000 to 5000  $\mu\text{g}$ , with 9.0 to 10.0mm zone of inhibition diameters respectively. The fungal isolates especially *A. Niger* and *T. tonsurans* showed

sensitivity even to inflorescence extract at discs potencies of 2000 and 5000 ug of sensitivity respectively. Antimicrobial activity of aqueous and ethanolic extract of *Euphorbia pulcherrima* on some bacterial and fungal clinical isolates using macro broth dilution technique showed the minimum inhibitory concentration (MIC) for ethanolic extract of leaves and the whole plant was 0.10, 100 and 10.0 mg/ml on *S. typhi*, *S. Para typhi* and *E. coli* 0157:H7 respectively. However, the values were higher for inflorescence ethanolic aqueous extracts with 100 and >1000 mg/ml respectively [2].

#### **Osteoclast activity:**

The ability of each isolate (3,4-acetyloxy-olean-13(18)-en-12-one and 18,19-epoxyolean-3-ol acetate) to suppress osteoclastogenesis in BMMs was assessed. BMM cells were plated on a 96-well plate and then grown with finished -MEM medium supplemented with M-CSF using the TRAP staining method. Compound concentrations (20, 40, and 60 M) and RANKL (50 ng/mL) were applied to the plate overnight. Following that, cells were stained for 1 hour at 37 °C with TRAP (tartrate resistant acid phosphatase). It was discovered that 18 compounds, including 3 novel compounds and 2 initially isolated natural products (3,4-acetyloxy-olean-13(18)-en-12-one and 18,19-epoxyolean-3-ol acetate) were isolated from *E.*

*pulcherrima's* aerial portions. The ability of each isolate to inhibit osteoclastogenesis in favour of BMMs was assessed. Compounds 7 and 10 (supinenolone C acetate and 3 $\beta$ -acetoxy-30-nor-20-oxolupane) among them demonstrated notable inhibition in a concentration-dependent manner [3].

#### **Analgesic activity:**

Spinacetin and patuletin, two isolated compounds, were tested for their anti-analgesic activity in living animals. Compounds 1 and 2, which are spinacetin and patuletin, were tested at different doses against hot plate-induced painful stimuli, and they demonstrated outstanding (p 0.05) dose-dependent analgesic effects [9].

#### **Anti-inflammatory activity:**

Histamine-induced edema and carrageen paw edema were used for anti-inflammatory screening. The mice were split up into different groups, each of which had six mice. Negative control (10 mL/saline) and positive control (diclofenac; loratadine; 5 mg/kg) are dispersed among the animal groups. In a carrageenan-induced paw edema model, spinacetin and patuletin both showed 35.22 and 46.00% attenuation. Their anti-inflammatory effects peaked at 79.22 and 89.01% after three hours at a dose of 20 mg/kg, and they were still effective in the fifth hour. In the same way, spinacetin and patuletin (2; 20 mg/kg) showed initial phases of activity of 76.45 and 91.45% in the first hours and 78.33 and 94.00% at the end

of the second and up to the third hours in the histamine paw edema model. Compared to loratadine, spinacetin and patuletin showed outstanding activity [9].

#### **Sedative activity:**

Sedative qualities of the isolated flavonoids patuletin (2) and spinacetin (1) were examined [12]. Every animal was split up into several groups, each of which contained six creatures. The control was given to the entire group and contained 0.5 mg/kg of diazepam. When testing the sedative effects of the flavonoids patuletin (2) and spinacetin (1), mice were placed in special design boxes with lines that had to be crossed by each mouse being observed. At tested doses (5, 10, 15, and 20 mg/kg), spinacetin (1) and patuletin (2) shown a promising ( $p < 0.001$ ) sedative effect in a dose-dependent manner. At 20 mg/kg, patuletin (2) demonstrated considerable ( $p < 0.001$ ) activity by impeding the mobility of animals in a specific box [9].

#### **Muscle Relaxant activity:**

An investigation on muscle relaxants was carried out using the inclined plane method. The inclination plan and traction model were used to test the muscle-relaxant effects of spinacetin (1) and patuletin (2), an isolates of *Euphorbia pulcherrima* which both had promising promise. In both models, the studied drugs both exhibit good activity. From the beginning of the experiment, both substances had excellent results when compared to the reference drug [13].

#### **Anticonvulsant activity:**

According to reports, *Euphorbia pulcherrima* possesses advantageous features like an anticonvulsive impact. Various neuropharmacological effects, such as the anticonvulsant effect, were observed and evaluated using the Maximum Electroshock Seizure test (MES) In the MES test model, mice administered with EP had significantly shorter durations of tonic hind limb extension than mice treated with vehicles. A dose of 1000 mg/kg of EP was the most effective. With the use of EP in three different dosages in the PTZ-induced seizure model, there was also a notable increase in the latency and decrease in the incidence of convulsions [14].

#### **Toxicological Profile:**

At greater doses of 10, 20, and 200 mg/kg, purified spinacetin (1) and patuletin (2) were utilised to screen a toxicological examination. The animals received intraperitoneal (i.p.) administration of spinacetin (1) and patuletin (2). The test animals were maintained under observation for two days. It was counted how many animals were alive and how many were dead. All treated animal groups survived all doses that were tested. Interestingly, all tested doses of spinacetin (1) and patuletin (2) were deemed safe [13]. *pulcherrima* methanol extract was tested for its acute and subchronic toxicity. In order to evaluate the effect of the extract on kidney and liver

functioning along with histopathological assessments of the liver and kidney, respectively, Lorke's technique and subchronic toxicity were used. The determined LD50 for intraperitoneal and oral administration was 3807.89 mg/kg. The kidney function measures showed that both the control group and the group treated with 10 mg/kg of the extract had elevated serum urea above the normal value, with mean values of 7.92 1.19 and 7.86 1.14 m Mol/L, respectively. The levels of the electrolytes and creatinine were normal. Each time, the results of the tests for ALAT, ASAT, ALP, T protein albumin, and bilirubin were within the normal range. All groups' kidney, liver, and relative organ weight function parameters were statistically insignificant. This demonstrates that the liver and kidney function parameters were unaffected by different *E. pulcherrima* extract concentrations [5].

#### **Anti-Alzheimer activity:**

Alzheimer's disease (AD) is a neurological condition that causes gradual cognitive deterioration. Its pathological features include abnormal a-amyloid (A) plaques and aberrant tau (p-tau) phosphorylation [15]. *Caenorhabditis elegans* strain CL4176 was used for the experiment. According to biological tests, compound 1 (eupulcherol A) has anti-Alzheimer's disease (AD) bioactivity that might prevent transgenic AD *Caenorhabditis elegans* from paralyzing.

Additionally, a potential biogenetic route for eupulcherol A was suggested.

#### **Antinociceptive activity:**

The antinociceptive impact of dried latex extract of *E. pulcherrima* was evaluated in a study using the hot plate test method, tail flick test, and acetic acid-induced writhing, among other neuropharmacological effects. According to the results, there was a rise in delay of time, which was also dose-dependent. The hot plate test method demonstrated statistical significance at a dosage of 1000 mg/kg. There wasn't much of a difference between the vehicle control-treated and test drug-treated groups in the tail-flick test model. When 0.6% acetic acid was administered, writhing's were evoked that were considerably (P 0.05) less frequent in the EP group compared to the vehicle-treated group [16].

#### **CONCLUSION**

*E. pulcherrima* is used for a variety of medical purposes, including as a central analgesic, antipyretic, anti-inflammatory, sedative, and antidepressant, as well as for the treatment of skin problems. Studies reveal that different extracts of *E. pulcherrima* (Poinsettia) sections have antibacterial efficacy on *S. typhi*, *S. Paratyphi A*, *E. coli* 0157:H7, *C. albicans*, *T. tonsurans*, and *A. Niger* due to the wide biological potential. As a result, this gives traditional healers' use of this herb to treat typhoid-like fever, some dermatophytic

diseases, and possibly systemic fungal infections a scientific basis. When phytochemical test was conducted using the standard procedure number of phytochemicals like alkaloids, steroids, terpenoids, flavonoids and reducing sugars was reported which further played parts in its medical benefits. It was found that many compounds had been isolated and identified from the different part of *E. pulcherrima* using different techniques like HPTLC, FT-IR, GC-MS, NMR, X-ray diffraction analysis. Some of the listed isolated compounds which have played major roles in health benefits are mentioned above with its chemical structure in figure 1,2,3. Spinacetin (1) and patuletin (2) isolated from *E. Pulcherrioma* which showed analgesic activity, anti-inflammatory activity, and sedative activity. (3,4-acetyloxy-olean-13(18)-en-12-one and 18,19-epoxyolean-3-ol acetate) isolated of *E. Pulcherrioma* have shown results to suppress osteoclastogenesis. Eupulcherol A isolate of *E. Pulcherrioma* showed anti-alzheimer activity (Alzheimer's disease (AD) a neurological condition) according to biological tests and additionally mentioning the potential benefits of the compound and the plants *E. Pulcherrioma*. Rutin (therapeutic flavonoid) an isolated compound from the dried leaves of *E. Pulcherrioma* with 80% methanol which is responsible for various treatment of chronic

disease like cancer, diabetes, hypertension are mention and discussed above. In conclusion, this study assessed the varied impacts of crude dried extracts of several aerial components, including latex, from *Euphorbia pulcherrima*. This investigation offers proof in favour of anticonvulsive, anti-inflammatory, anti-microbial, sedative, antinociceptive, anti-Alzheimer, anticonvulsant, muscle relaxant, analgesic, and osteoclast action. To identify and segregate the active chemicals and, when possible, understand their mechanisms of action, additional detailed studies are required. Therefore, additional research is required to identify the precise mechanism(s) of action.

#### **Conflict of Interest**

The authors declare no conflict of interest.

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