

## EPIPREMNUM AUREUM (JADE POTHOS): A MULTIPURPOSE PLANT WITH ITS MEDICINAL AND PHARMACOLOGICAL PROPERTIES

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### ABSTRACT

Plants belonging to the Arum family (Araceae) are commonly known as aroids as they contain crystals of calcium oxalate and toxic proteins which can cause intense irritation of the skin and mucous membranes, and poisoning if the raw plant tissue is eaten. Aroids range from tiny floating aquatic plants to forest climbers. Many are cultivated for their ornamental flowers or foliage and others for their food value. Present article critically reviews the growth conditions of *Epipremnum aureum* (Linden and Andre) Bunting with special emphasis on their ethnomedicinal uses and pharmacological activities, beneficial to both human and the environment. In this article, we review the origin, distribution, brief morphological characters, medicinal and pharmacological properties of *Epipremnum aureum*, commonly known as ornamental plant having indoor air pollution removing capacity. There are very few reports to the medicinal properties of *E. aureum*. In our investigation, it has been found that each part of this plant possesses antibacterial, anti-termite and antioxidant properties. However, apart from these it can also turn out to be anti-malarial, anti-cancerous, anti-tuberculosis, anti-arthritis and wound healing etc which are a severe international problem. In the present study, details about the pharmacological actions of medicinal plant *E. aureum* (Linden and Andre) Bunting and *Epipremnum pinnatum* (L.) Engl. is discussed based on modern scientific investigations. There are immense properties hidden in *Epipremnum* species that need to be explored using the scientific investigations to make it beneficial for the environment and human health.

**Keywords:** *Epipremnum aureum*, Araceae, Toxicity, Propagation, Phytochemicals.

### INTRODUCTION

*Epipremnum aureum* (Linden and Andre) Bunting is also used as the scientific name of the prosperity plant by many and considered synonym of *Scindapsus aureus*. Besides money plant, other names used commonly for this plant are Pothos, Silver Vine, Devil's Ivy and Solomon Island's Ivy. This plant is native to Southeastern Asia and New Guinea [1]. *Crassula ovata* is also known as jade plant, friendship tree, lucky plant or Money Plant sometimes referred to as the money tree. *Pachira aquatica* is also referred to as a money tree. Hence, confusion exists in the nomenclature. In Asia, however, *Scindapsus aureus* is grown as money plant in houses. It may be grown both as a trailer and a climber. It is a scrambler shrub and it can climb by means of aerial roots over the trees and plants which hook over the tree branches [2]. The leaves of the *Scindapsus aureus* are similar to *Philodendron scandens*.



Fig. 1: *Epipremnum aureum* plant

*Epipremnum aureum* is an excellent air cleansing plant [3, 4]. Its decorative marbled leaves and easy maintenance make it very popular amongst indoor plants. This plant is grown mainly as an indoor plant and the special characteristic of the plant, is that it can

grow even in a water-filled bottle (alone for a reasonable time if you simply keep the water changing or refill at frequent intervals.) or a container without any soil. Although many plants can be grown as hydroponics but money plant survive without addition of nutrients in the water just with naturally found salts in the water. It grows well with bright filtered light. But in more or less light, discoloration of the leaves take place. The Genus *Epipremnum* is further organized into finer groupings including many species and varieties.

### Classification of *Epipremnum*

*Epipremnum aureum* belongs to a large family Araceae having 110 genera and 2500 species in the world distributed mostly in the tropics and subtropics of both the hemispheres [5]. *Epipremnum* Linn. is represented by more than one species in India, of which *E. aureum* and *E. pinnatum* is the most widely cultivated and best known species among the other species.

### Species

Zipcode Zoo has pages for 36 species, subspecies, varieties, forms, and cultivars in the Genus *Epipremnum*: *E. amplissimum*, *E. aureum* (Neon Pothos), *E. aureum* 'Neon' (Neon Golden Pothos), *E. aureum* (Linden ex Andre) G. S. Bunting 'Erich Gedalius', *E. aureum* (Linden ex Andre) G. S. Bunting 'Marble Queen', *E. carolinense*, *E. ceramense*, *E. crassifolium*, *E. crassum*, *E. dahlia*, *E. falcifolium*, *E. giganteum*, *E. glaucecephalum*, *E. magnificum*, *E. meeboldii*, *E. miniatum*, *E. moluccanum*, *E. moszkowskii*, *E. nobile*, *E. nobilis*, *E. obtusum*, *E. papuanum*, *E. pinnatum* (Variegated-Philodendron), *E. pinnatum* 'Aureum', *E. pinnatum* 'Aztec', *E. pinnatum* 'Cebu Blue', *E. pinnatum* 'Golden Queen' (Centipede Tonga-Vine), *E. pinnatum* 'Marble Queen' (Marble Queen Centipede Tonga-Vine), *E. pinnatum* 'N' Joy', *E. pinnatum* 'Neon', *E. pinnatum* 'Silver Splash', *E. pinnatum* 'Skeleton Key', *E. pinnatum* (L.) Engl. 'Erich Gedalius', *E. pinnatum* (L.) Engl. 'Variegata', *E. pinnatum* var. *Neon* (Centipede Tonga-Vine), *E. silvaticum*.

### Relevance as per feng shui and vastu principles

There is a popular belief if money plant thrives well it brings prosperity. Hence, the good growth of *Epipremnum aureum* in any

household is an indicator of wealth. Growing nature of the plant shows that money plant is a perennial climber and young plants bear three-four inches long heart-shaped leaves. Money plant is considered a good Feng Shui plant as it is considered to remove toxins from the air caused by cleaning products and modern furnishings made of synthetic materials. It energizes the home by filtering air and increasing oxygen inflow. Feng Shui experts recommend keeping one plant near each computer, television or

WiFi router. Placing money plant in front of a sharp corner or angle reduces anxiety and stress. Vaastu experts recommend planting of money plant inside the house as it brings good luck to the house. In addition to basic photosynthesis that removes carbon dioxide and returns oxygen to the air, plants can remove toxicants from air, soil, and water as they can metabolize some toxic chemicals, releasing harmless by-products, and also they can incorporate toxicants such as heavy metals into plant tissues, thus sequestering them.

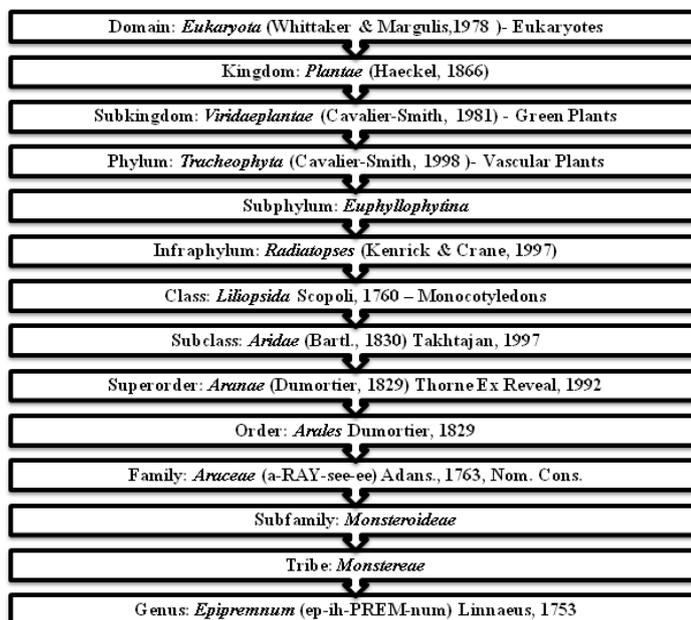


Fig. 2: Classification of Genus *Epipremnum*

### Indoor air purification

According to the NASA/ALCA study on the use of common indoor plants for indoor air purification Golden Pothos is one of the top three plants besides Philodendron and Spider plant that has been labeled the most effective in removing formaldehyde. Golden pothos grown on an activated carbon filter system reduced air levels of benzene and trichloroethylene inside a Plexiglas chamber measuring 0.58 cubic yard from approximately 36 ppm to barely detectable levels within 2 hours. One indoor contaminant of particular concern is formaldehyde, which is released by many household products, among them pressed woods, some types of foam insulation, paper products, some paints and varnishes, and permanent-press fabrics. The National Toxicology Program lists formaldehyde as reasonably anticipated to be a human carcinogen. Those studies fit well with evidence on the biochemical mechanisms involved in plant detoxification of formaldehyde. Three kinds of potted plants were tested for their capacity to remove formaldehyde from indoor air. It was found that the formaldehyde-removal capacity of the plants depended on the dehydrogenase activity in the leaves and root system—that is, how efficiently the plant could metabolize formaldehyde [6]. It was also found that plants remove formaldehyde through diffusion-limited as earlier reported [7].

### Toxicity

Plant ingestions are among the chief cause of accidental poisonings in children younger than 5 years. Pets are common victims of plant poisonings [8]. The plant is listed as “toxic to cats and toxic to dogs” by the ASPCA due to the presence of insoluble calcium oxalates. Calcium oxalate is a chemical compound that forms needle-shaped crystals. Its chemical formula is  $\text{CaC}_2\text{O}_4$  or  $\text{Ca}_2$ . Calcium oxalate crystals are being involved in defense against termites, cheak pea and other pests. So it is used as effective natural pesticides, it also involved in calcium regulation. All parts of this plant are poisonous with toxic calcium oxalate crystals. Care should be taken to ensure that plant is not consumed by house pets. Symptoms may include oral irritation, vomiting, eye pain, skin irritation, mouth swelling etc [9].

### Origin, distribution and morphology

*E. aureum* of Araceae family is monocotyledonous flowering plant in which flowers are born on a type of inflorescence called a spadix. The spadix is usually accompanied by and sometimes partially enclosed in a spathe or leaf-like hood. Its evergreen and waxy leaves are heart-shaped, alternate and simple or beautifully variegated with white, cream, yellow and various shades of green. Colors variegation and sizes of foliage are extremely variable depending upon lighting conditions and other cultural factors. This plant produces trailing stems when it climbs up trees and these take root when they reach the ground and grow along it.

Confusion can occur between *Epipremnum* and the other Malesian monsteroide genera. If fruits are mature, seed characters are useful in separating *Epipremnum* and *Rhaphidophora*. *Epipremnum* has fruits with few large, strongly curved, seeds with a bony, smooth to ornamented testa. The fruits of *Rhaphidophora* each contain many small ellipsoid seeds with a brittle, smooth testa. Alternatively, immature fruits can be dissected and the number of ovules counted (few in *Epipremnum*, almost always many in *Rhaphidophora* [10]. The only way to differentiate these *Scindapsus* and *Epipremnum* species, aside from field experience, is to observe inflorescences or, better, semi-mature infructescences. *Scindapsus* has fruits with a solitary curved seed. However, certain *Epipremnum* species (e. g. *E. ceramense* and *E. falcifolium*) seem to habitually abort all but one ovule and produce fruits with a solitary seed. Older texts [11] state that *Scindapsus* seed is exalbuminous but recent studies of Araceae seed [12] have demonstrated that *Scindapsus* seeds do contain small quantities of endosperm. Nevertheless the embryo is still relatively larger in *Scindapsus* [10].

### Growing environment

Golden Pothos is a hardy plant which requires very little care. No direct sunlight is required. It can stand bright light, but the best results are achieved with a medium indirect light. Minimal temperature: 14-16 °C (57-60 °F) Optimal temperature: 22-26 °C (71-78 °F). At a temperature lower than 10 °C, leaves turn yellow and develop spots. It requires

frequent watering from spring to autumn but over watering should be avoided in the winter. It grows well if top soil is dried out in the warm & bright climate. This plant tolerates heat and humidity. Sandy loam to clay loam soil is perfect for its growth.

### Propagation

It is propagated by tip cutting or stem cuttings that root easily in soil or water. Best season for using cuttings is either summer or spring. It can be grown on moss sticks as the climber or allowed to trail down. *In vitro* culture of *E. aureum* somatic embryos formed directly at the cut edges or on the surface of petiole explants of *Epipremnum* cultured on MS medium supplemented with TDZ (N-phenyl-N'-1,2,3-thiadiazol-5-ylurea) and NAA ( $\alpha$ -naphthalene acetic acid) or TDZ and 2,4-D (2,4-dichlorophenoxyacetic acid) [13]. Somatic embryos were able to germinate on the initial induction medium and after transferring onto MS medium containing BA (6-benzylaminopurine) and NAA.

Regeneration of adventitious shoots of Pothos (*Epipremnum aureum* Linden and Andre) 'Jade' from the leaf and petiole explants and plantlets acclimatized rapidly in the greenhouse after transfer to pots with commercial potting medium [14]. Effect of different levels of nitrogen on the growth of *E. aureum* cuttings initiated at Ornamental Nursery of Horticulture Department, Peshawar showed application of urea to increase the performance of money plant [15].

The effect of ultraviolet light on thermo luminescence, oxygen evolution and the slow component of delayed light have been investigated in chloroplasts and Pothos leaves. These results explained the involvement of photo system II in generating thermo luminescence and slow components of delayed light in photosynthetic materials [16]. The influence of storage duration and temperature of *Philodendron Scandens* oxycardium and *Epipremnum aureum* unrooted cuttings on subsequent fresh weight production showed plants stored longer to have less fresh weight [17].

### Phytochemicals

*E. aureum* contain the broad spectrum of phytochemicals including alkaloids, steroidal terpenoids, flavonoids, tannins and cardiac glycosides which has been investigated by preliminary analysis of the ethanolic explant extract (leaves and root) [18]. The plant *Rhaphidophora aurea* is a popular ornamental foliage plant. It has got a characteristic host – guest relationship in that it twines over other trees and grows by sucking its nutrients. Phytochemical constituents of *Rhaphidophora aurea* climbed over *Lawsonia inermis* revealed the presence of alkaloids, flavonoids, saponins, phenols, glycosides, anthraquinone and anthocyanins [19]. Plants containing cardiac glycosides inhibit sodium-potassium ATPase and cause signs and symptoms that are similar to those in digoxin poisoning. Alkaloids and glycosides that are also GI irritants are found in *E. aureum* and also a diverse group of plants. These toxins can cause nausea, vomiting, abdominal cramping, and diarrhea, among other symptoms. The mechanism of action and toxic concentration differ by genus and phytotoxin.

### Ethnomedicinal uses and pharmacological activities

Cytotoxicity against cancers cells and immunomodulating characters are present in *Epipremnum*. Detoxification, removes toxic, heat, tendonitis, fractures, burns, carbuncles, sores, and redness. Many different types of plants in India are used for medicinal purposes. These plants contain natural chemicals that are believed to help all sorts of illnesses, from arthritis to stomach pain. Some are familiar in other parts of the world. Many others are unique to India.

Plants are the most remarkable chemical factories and sources of many unique and complex bioactive molecules recognized as potential source for flavor, fragrance, pigments and pharmacologically active compounds. Plant based antimicrobials represents a vast untapped source for medicine. Plant based antimicrobials have enormous therapeutic potential as they can serve the purpose without any side effects that are often associated with synthetic antimicrobials. *E. aureum* also has antibacterial, antitermites and antioxidant properties [20]. Biological activities of *E. aureum* are reported with the crude extracts of leaf and aerial root. However, crude extracts of

different parts of *E. aureum* have been used as traditional medicine for the treatment of various diseases. The leaves of *Lawsonia inermis* are used in the form of a decoction or ointment in the treatment of burns, skin inflammations, wound and ulcers. Apart from antifungal and antibacterial activity [21] the ethanol extract of *Lawsonia inermis* and lawsone have greatly contributed towards wound healing activity ( $p < 0.05$ ) when taken orally and topically in the form of ointment. Some pharmacological actions of *E. aureum* have been discussed below.

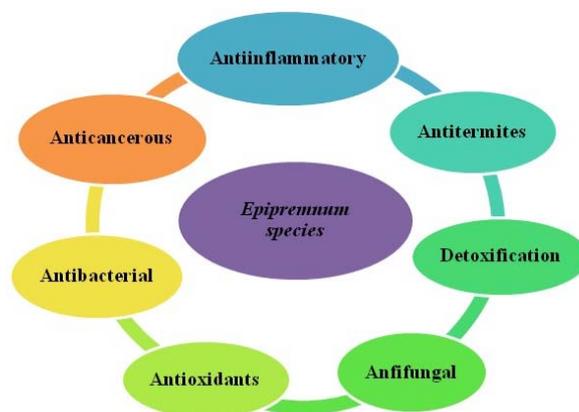


Fig. 3: Ethnomedicinal and pharmacological properties of *Epipremnum* species

#### Anti-inflammation

*Epipremnum pinnatum* (Linn.) Engl. aerial parts were evaluated for anti-inflammatory activity in Wistar albino rats and showed significant inhibition of carrageenan-induced rat paw oedema in comparison to standard drug Indomethacin. The plant also possess anti-lipid peroxidation and analgesic effects [22]

#### Anti-bacterial and Anti-fungal

Various solvent extracts of *E. aureum* leaves and aerial roots revealed antibacterial activity against microorganisms, it has been found that water extracts of aerial root part showed clear and approximately similar zone of inhibition in comparison to standard disc against test organisms in decreasing order *Escherichia coli* > *Micrococcus luteus* > *Bacillus cereus* > *B. subtilis* [18]. Methanolic leaf extracts of *E. aureum* showed antibacterial activity against *Escherichia coli* and *Staphylococcus aureus* and the antifungal activity was evaluated against *Candida albicans* [23]. The ethyl extract of the aerial roots of *Raphidophora aurea* (climbed on *Areca catechu*) also showed against antibacterial and antifungal activity [19, 24]. Petroleum ether, acetone and ethanol extract of *E. aureum* shows considerable antibacterial activity against *E. coli* and *S. aureus* [18].

#### Anti-termite

It has been first reported that all parts of this plant preferably root extract in ethanol was more potent, ninety six to hundred percent against termites and significantly different from the percent mortality in control (crude ethanol) that is sixty percentage [20]. Studies have been conducted to show the *in vitro* antitermite effect due to alkaloids isolated from *E. aureum* against Indian White termite *Odontotermes obesus*. Highest mortality rate is reported in alkaloids isolated from leaves compared to stem and roots. Thus supporting the use of this plant for the development of herbal formulations to overcome synthetic termiticides borne problems [25]

Similarly in HPLC studies phenolic acids detected in the alcoholic extracts of the plant material by chromatograms. A number of peaks were detected, some of which could be identified in the presence of rare standards. In the *E. aureum* plant, cinnamic acid and quercetin dehydrates are commonly present in both explants (leaf and root) while Caffeic acid, sinnapic acid and p-coumeric acid are identified only in root explants [20].

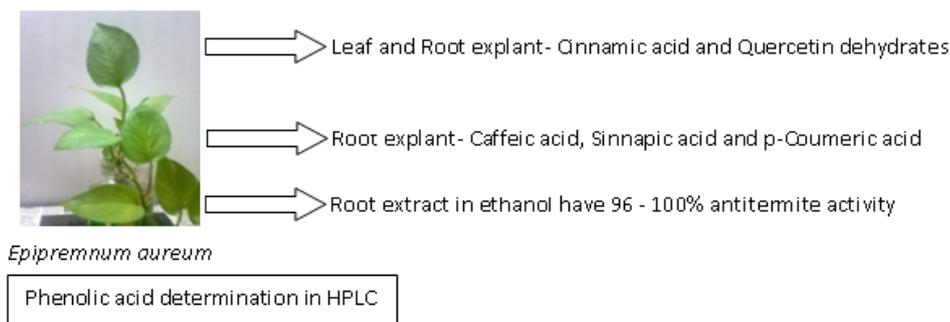


Fig. 4: Phenolic acid determination in *Epipremnum aureum* by HPLC [20]

#### Anti-cancer

Chloroform extracts of *Epipremnum pinnatum* (L.) Engl. Showed significant growth inhibition against T-47D breast carcinoma cells and further cell death mechanisms indicated that the extract elicited both apoptotic and non-apoptotic programmed cell deaths [26].

#### Anti-oxidation

Antioxidant activity testing of different solvent extracts of the aerial roots of *Pothos aurea* intertwined over on *Lawsonia inermis* and *Areca catechu* carried out by 1, 1-diphenyl-2-picryl hydrazyl (DPPH) radical scavenging assay and reducing power test show higher antioxidant potential of the extracts [24, 27].

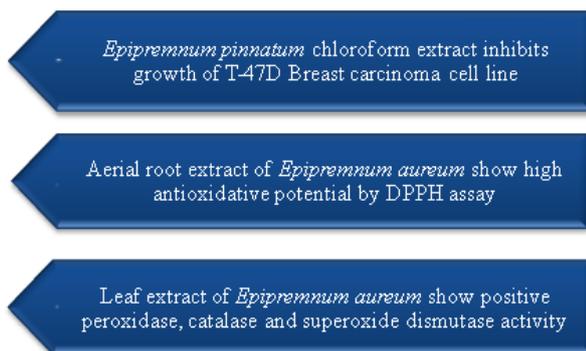


Fig. 5: Antioxidative property of *Epipremnum aureum* [26, 27, 20]

The crude extracts of *Epipremnum aureum* both (leaves and aerial roots) have also been used for its antioxidative properties. Peroxidase (PX) Superoxide dismutase (SOD) and Catalase (CAT) activity of the plant's leaf extracts showed positive results that have industrial application and looking forward pharmaceutical actions [20].

#### Detoxification

Golden Pothos has been the most effective plant in removing formaldehyde. It has been found effective in removing benzene and carbon monoxide too. The detoxification potential of air pollutants by *Epipremnum aureum* exposed, absorption of nicotine onto the leaf surface without entering mesophyll. It is taken up by the roots of *E. aureum* [28]. The roots of *Epipremnum aureum* though not synthesizing nicotine themselves, take up exogenously fed nicotine as a xenobiotic [29]. Thus *E. aureum* has detoxification potential for formaldehyde and nicotine and can be used for self-regenerating bio-filter system for indoor air purification [30].

#### CONCLUSION

There is regular information regarding the use of *E. aureum* well known as ornamental plant. But in last few years, ethno-botanical and traditional uses of natural compounds, especially of plant origin received much attention as they are well tested for their efficacy and

generally believed to be safe for human use. It is best classical approach in the search of new molecules for management of various diseases. It mainly contains calcium oxalate crystals of various size and shape which depends upon location and culture conditions. Among these studies it could be thus concluded that leaves and aerial roots of the *E. aureum* (rich in flavonoids, alkaloids and other phenolic components) have shown great potential for pharmaceutical uses. With further studies in these directions it would be possible to enhance the antimicrobial, antioxidant, and other medicinal properties of traditional grown *E. aureum* for the induction of secondary metabolites as an antimicrobial potential.

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#### CONFLICT OF INTERESTS

The authors declare "no conflict of interest"

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