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A REVIEW OF THE EXTENT OF EXPLORED POTENTIAL FOR PHYTOCHEMICAL AND PHARMACOLOGICAL ACTIVITY OF *DURANTA ERECTA* LEAVES

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ABSTRACT: Phytomedicines from herbal plants are widely used as a home remedy in ancient times to maintain the normal health of human beings. As per World Health Organization (WHO) estimation, nearly 75-80% of the population in the world utilizes medicinal plants for their primary health care. *Duranta erecta* itself has antioxidant and anti-microbial activities and has been used in Africa and Asia to treat a wide range of diseases. Evaluation of the study is based on the phytochemical profile, anti-microbial and antioxidant activities of *D. erecta* to ascertain its health benefits in traditional medicine. Plant parts with antimalarial, anti-bacterial, antioxidant, anthelminthic, antifungal, antiparasitic, insecticidal, and cytotoxic activity have been reported to include leaves, fruit, stems, and flowers. Fruit, flowers, leaves, and stems were screened for the presence of phytochemicals such as iridoid glycoside, alkaloids, flavonoids, saponins, terpenes, tannins and sterols, C-alkylated flavonoids beta-sitosterol, naringenin, triterpenes saponins, steroidal glycosides. Plant extracts of *D. erecta* leaves that have antioxidant activities show potential effects in many conditions initiated by oxidative stress. This review reveals various medicinal use and the study of the presence of different Phytoconstituents of *D. erecta* leaves.

INTRODUCTION: In developing countries, Phyto medicine is popular amongst individuals and communities. *D. erecta* has been used in Africa and Asia to treat various health-related problems [1]. Herbal plants are the backbone of etheno-medicine[2]. Conventionally, plant preparation as a drug source is based on the experience and superstitions passed from generation to generation, virtually by word of mouth [3]. Research on the herbal plant has gained attention recently all over the world. Herbal plants have the potential to fight against different diseases; therefore, it has been used in various systems of medicine.

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It is species of flowering shrub in the verbena that belongs to the family *Verbenaceae*, indigenous from Mexico to South America and the Caribbean. This genus of *Duranta erecta* is named after French botanist Castor Durante [3].

Taxonomy Description: The genus name is in honor of Castore Durante, a fifteenth-century Italian botanist. The specific epithet *erecta* means "upright" in Latin. The plant is also known as *D. repens*, from the Latin for "creeping". The latter name was originally used to identify Smaller-leaved varieties of the species.

Cultivation: *Duranta erecta* is usually cultivated for ornament purposes in tropical and subtropical regions all over the world. It is also known as the golden dewdrop, pigeon berry, and sky-flower. Sky flower is extensively grown up as an ornamental plant throughout tropical and sub-tropical regions [2, 3].

A wide variety of cultivars are available, including 'Alba', 'Aurea', 'Aussie Gold', 'Gold Mound', 'Geisha Girl', 'Sapphire Showers', and 'Variegata'. It is cultivated all over India, especially on the sides of rivers and banks of streams, mostly found on roadsides in villages. For soil and ecosystem stability, it plays an important role [3].

Geographical Distribution: Golden dewdrop (*D. erecta*) is a popular ornamental plant that grows wild from near sea level to over 100 meters above sea level in a dry coastal area. It is mostly found in moister habitats, particularly along roads. Mexico, the Caribbean, South America, Central America, Southern Florida (possibly naturalized), Argentina, Bermuda, the Bahamas, and the West Indies are all home to *D. erecta*. It is also found in California, Arizona, Florida, Louisiana and Texas in the United States [2, 3].

Morphology: *Duranta erecta* is a morphologically variable and polymorphic perennial flowering shrub in Verbenaceae family, originally native to Central and South America [4]. A tree that can grow up to 18 feet (5.5 meters) tall. The stem forms a multi-stemmed clump. Golden dewdrop is a vine-like tender evergreen shrub or small with branches herbaceous but woody below, erect, branched solidly, and green. When carrying many fruits, there are several stems or drooping spiny branches. Axillary thorns are absent in young plant stems [5, 6].

FIG. 1: *DURANTA ERECTA* LEAVES AT VINDHYA HERBAL PLANT

Phytochemical Review: *D. erecta* contains various bioactive compounds. All parts of the *D. erecta* species have been exploited for phytochemical investigation and various phytoconstituents are isolated. Various important phytochemicals have been reported such as steroids, flavonoids, terpenoids, triterpenes, C-alkylated flavonoids beta-sitosterol, naringenin, triterpenes saponins, and steroidal glycosides. Several iridoid glycosides as durantosides are isolated from duranta species [3]. Two new triterpene saponins, named durantanin IV (1) and V (2) were isolated from *D. erecta* leaves along with ten well-known compounds like bidesmosidic saponin, oleanolic acid, three phenylethanoids, and five flavonoids [26].

TABLE 1: PHYTOCHEMICAL CONSTI-TUENTS OF *D. ERECTA* [5]

Test	Leaves	Unripe Fruits	Ripe Fruits
Tannins	+	+	+
Glycosides	+	+	+
Alkaloids	-	+	-
Coumarins	-	-	-
Saponins	+	+	+
Flavonoids	+	+	+
Triterpenoids	+	+	+
Sterols	+	+	+

Note: + Present, - Not detected

Alcohols, phenols, alkanes, aldehydes, ketones, aromatics, aliphatic amines, aromatic amines, amides, carboxylic acids, esters, nitro compounds, alkynes, primary and secondary amines, and alkyl halides were detected using FTIR analysis. There was also evidence of iron and copper. The total phenolic and tannin contents were 2.20 [+ or -] 0.15 to 14.54 [+ or -] 0.29 mg gallic acid equivalent (GAE)/100g and 3.55 [+ or -] 0.07 to 13.82 [+ or -] 0.04 mg GAE/100g, respectively. The total flavonoid content ranged from 41.76 [+ or -] 0.96 to 343.49 [+ or -] 3.45 [micro]g quercetin equivalent (QE)/100g [8].

Agawane SB, Gupta V. S. *et al.* investigated presence of zinc (1.82 ± 0.03 mg/100g), selenium (0.59 ± 0.04 mg/100g) and moderate concentrations of vitamin C (0.35 ± 0.01 mg/100 g),vitamin E (0.68 ± 0.07 mg/100g).[20]

Pharmacological Properties:

Anti-Bacterial Activity: Donkor S, Larbie C, Komlaga G., *et al.* found the anti-bacterial activity of volatile oils hydro distilled from leaf, stem, fruit, and root reported for the first time [8]. The anti-bacterial activity of a methanol extract of *D. erecta* leaves from Nigeria was tested using the agar diffusion method against bacteria such as *P. mirabilis*, *Bacillus subtilis*, *S. typhi*, and *B. aereus*

at various concentrations (75-600 mg/mL). The minimum inhibitory concentrations of methanolic extract were found to be 129 mg/mL for *P. mirabilis*, 141 mg/mL for *B. subtilis*, 81 mg/mL for *S. typhi* and 100 mg/mL for *B. aereus*. The anti-bacterial activity of seeds of *D. erecta L*. (Verbenaceae) against human pathogenic bacteria, *B. subtilis*, *Pseudomonas aeruginosa*, *Staphylococcus aureus*, and *Escherichia coli*, were determined using the Disc diffusion method [9]. Ogbuagu AS, Okoro K *et al.* also found that extract of *D. erecta* leaves revealed the anti-microbial activity against human pathogenic bacteria [22]. Jain C, Khatana S. *et al*. used different solvents to investigate extracts' anti-microbial activity by disc diffusion, well diffusion, and broth dilution. The results revealed that the methanolic extract of the stem has potent activity against *A. flavus*, *P. chrysogenum*, and *Rhizopus spp* [24].

Anti-Microbial Activity: The hydroethanolic extracts of *D. erecta* leaves (DRL), unripe fruits (DRU) and ripe fruits (DRR) were screened for the presence of phytochemical constituents and anti-microbial activity using standard methods. Atomic absorption spectroscopy (AAS) was used to analyze the raw sample and the extract for elements. To identify functional groups, FTIR and UV-VIS spectroscopy were used. The presence of triterpenoids, sterols, alkaloids, flavonoids, saponins, glycosides, and tannins were discovered through phytochemical screening **Table 1** [5].

Anthelminthic Activity: Adult male albino mice infected with Heligmosomoides bakeri were used to test the anthelminthic potential of *Duranta erecta L*. (Verbenaceae) fruits. The extract had an LD50 higher than 5000 mg/kg body weight and was thus not acutely toxic for oral use. It was also discovered that plant extract, even at high doses, was unable to eliminate fecal egg output or adult worms in the gastrointestinal tracts of infected animals. Because the study yielded a poor anthelminthic effect, it was not recommended as an anthelminthic drug [10].

Antifungal Activity: The aqueous and methanolic leaf extracts of *D. repens L*. were tested against human pathogens (*A. niger*, *Candida albicans*, and *Mycobacterium gypseum*). Both *D. repens* leaf extracts were effective against the test organism.

At 200mg/ml concentration, the maximum inhibition zones (14.66, 13.33, and 12mm) were found against *C. albicans*, *M. gypseum*, and *A. niger*, respectively. However, aqueous leaf extract inhibited *C. albicans*, *M. gypseum*, and *A. niger* with zones of inhibition of 10, 12.33, and 11mm, respectively [11].

Different *D. repens* extracts inhibited the growth of all test pathogens to varying degrees. For the antifungal activity of the test plant, methanol was found to be a better extractive solvent than distilled water. The current study adds to our understanding of *D. repens* anti-microbial properties. The findings support the use of this plant in traditional medicine as a source of alternative treatment for infectious diseases caused by resistant microorganisms. Furthermore, to develop novel leads of pharmaceutical interest, the bioactive molecules responsible for the activities should be isolated.

Antiparasitic Activity: Ijaz *et al.* investigated antiplasmodial activity against the chloroquine-sensitive and chloroquine-resistant strains of Plasmodium falciparum, with IC_{50} values of 8.5±0.9 and 10.2±1.5 µg/mL, respectively [12].

Insecticidal Property El-Naggar *et al.* evaluated that extracts from *D. repens* showed activity againt insecticides observed in larvae of *Culex pipiens* and *Spodoptera littoralis* [13].

Antioxidant Activity: Flavonoids are the best-known phytochemicals that act as antioxidants and thus inhibit disease-causing factors [23].

Christopher CU, and Chioma AA investigated Plant extracts of *D. erecta* leaves that have antioxidant activities and show potential effects in many conditions initiated by oxidative stress. They evaluated the phytochemical composition and antioxidant activity of methanol extract of *D. erecta* leaves extract after performing the in-vitro study.

The extract of leaves was subjected to different analytical methods like DPPH inhibition, phytochemical screening, nitric oxide determination, ferric reducing antioxidant power (FRAP), antioxidant vitamins, and minerals composition analysis. All methods were performed using standard biochemical procedures.

After phytochemical evaluation, plant extract showed the presence of flavonoids, terpenoids, steroids and saponins, alkaloids, total phenol and tannins. Extract of leaves showed antioxidant activity after *Vitro* antioxidant determination. The antioxidant property of the sample was compared to that of ascorbic acid (for DPPH and nitric oxide determination) and gallic acid (for FRAP) as standards. The antioxidant mineral composition of the extract showed the presence of zinc. The antioxidant Vitamins composition of the extract revealed the presence of vitamin C [18]. After all analysis, it has been observed that the methanol extract of *Duranta erecta* leaves could be a good source of antioxidants [14]. Anti-oxidant efficacy of the hydroalcoholic extract of *D. repens* (whole plant) was also found during study [25].

Khan A *et al.* evaluated various concentrations [0-1000 µg/ ml] of ethanol and methanol extract of *D. repens* and tested against HEK293T cells for 24h of duration and then treated with 100 µM hydrogen peroxide for one day. Finally, they found antioxidant activity and antioxidant constituents were determined [15-16].

Bangou MJ *et al.* also found antioxidant activity on *Duranta erecta* leaves after plotting the calibration curve for gallic acid and quercetin by UV visible spectrophotometer [17]. Alade AT, Aboaba SO *et al.* studied that *D. erecta* herb can be used as a potential anti-urolithiasis agent for kidney stone removal [19].

CONCLUSION: After all findings from the present study, it reveals that the extract of *Duranta erecta* leaves contains a sufficient quantity of important phytochemicals like Alkaloids, tannins, flavonoids, phenolics, saponins, *etc.*, which shows its antioxidant activity. It also reveals the anti-bacterial, anti-microbial, insecticidal, anti-parasitic, anthelminthic, and antifungal activity and contains minerals; selenium zinc as well as antioxidant vitamins; vitamin C and E. various vitro antioxidant assays (DPPH, FRAP and NO radical scavenging assay) reveals that extract of *Duranta erecta* leaves showed antioxidant properties which depend on concentration. Therefore, the overall finding of this study suggests that Duranta erecta leaves could serve as the best source of antioxidants. These antioxidants could have acted as therapeutic agents in preventing or slowing the progress of diseases due to oxidative stress.

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