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Review on *In vitro* Antioxidant Activities on *Orthosiphon diffusus* Benth

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ABSTRACT

Orthosiphon diffuses (Lamiaceae) is one of those plants which have tremendous value with respect to the chemical constituents and pharmacological properties. So, in the current paper, the plant had been reviewed for its traditional claims, pharmacological activities and chemistry hoping for the future research on the plant. The methanol extract of aerial parts of Orthosiphon diffusus was investigated and 5 isopimarane diterpenes, 2 diterpenes and 3 oxygenated staminane diterpenes were isolated from the extract. The majority of the volatile constituents that are isolated were β-ocimene, t-caryophyllene, n-eicosane, octocosane, elemol and methyl palmitate. Various properties were proven scientifically like Hepatoprotective, Antioxidant, Antifungal activities which also the traditional claims of the plant to treat kidney stones, edema, rheumatism and jaundice.

Key words: *Orthosiphon*, Diterpenes, Staminanes, Volatile oils, Pharmacological review

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INTRODUCTION

In the history of medicine till now significant research had been conducted on natural drugs to employ them as potential treatment of diseases. The extraction of active principles and finding leads to synthesize drugs that are able to treat diseases effectively in comparison to the synthetic drugs is on demand currently [1,2]. In view of their medicinal properties and traditional claims, natural drugs had been extensively reviewed to keep them up to date with changes in the research [3,4]. *Orthosiphon diffusus* is one of those plants which have tremendous value with respect to the chemical constituents and pharmacological properties [5]. So, in the current paper, the plant had been reviewed for its traditional claims, pharmacological activities and chemistry hoping for the future research on the plant.

Distribution and habitat

Orthosiphon diffusus is synonymously called as Endostemon viscosus (Roth) M.R. Ashby belonging to the family Lamiaceae which is flowering plant distributed in South Asian countries like India, Thailand etc. The medicinal it is perennial herb that is distributed in many parts of India especially Western and Eastern Ghats in South India [6]. The plant taxonomy is as follows

Kingdom: Plantae

Clade: Angiosperms

Order: Lamiales

Family: Lamiaceae

Subfamily: Nepetoideae

Tribe: Ocimeae

Genus: *Orthosiphon*

Species: *Diffusus*

Morphology

Orthosiphon diffusus is a shrub with a woody base and puberulous branches [7]. Leaves are decussate and elliptical or orbicular in shape and measure up to 2 cm long and 1.5 cm wide. They are densely spaced and pubescent with truncate base, crenate margins and petiole of 1 cm long. Flowers are in whorls of 6's in raceme pattern, peduncle 9 cm with ovate bracts and pedicel of 0.5cm. The calyx is villous and has 2 lips with ovate upper lip and suborbicular in nature. Lower lips are longer and lanceolate. The corolla is pink in colour with overall width of 4.5-3 cm diameter. The corolla tube is 3mm long and has 2 lips where the upper lip is 3mm long and lower one is 3.5mm with lot of hair

down the throat of the corolla. It has 4 stamens which are didynamous in nature that descends into the lower lip. The stamenal filaments are 2mm long with 2 celled anthers. The nutlets are erect and basilar in nature and are enclosed inside an accrescent calyx (Figure 1) [8].

Traditional claims

Ethno pharmacological history of the *Orthosiphon diffusus* stated that the folklore practitioners used plant parts for treating hypertension, hepatitis/jaundice and fever. The activity of the plant was claimed by the tribal communities in Western and Eastern Ghats and was proven by various investigators too [9]. Few researches claimed that *Orthosiphon* diffuses along with other species in the genus *Orthosiphon* are traditionally used to treat diabetes, kidney stones, rheumatism and edema [10]. There are few claims that the leaf juice of *Orthosiphon* diffuses when applied directly on the skin effectively repels ticks and mites [11]. The other traditional claims state that the plant leaf pastes commonly called as kaayapathin mixed with salt was applied externally can cure topical tumours which were called as Puthu Kattigal in regional language of Tamil Nadu [12].

Chemical constituents

Chemical investigations on the phytoconstituents on *Orthosiphon* species revealed the presence of mono, di and triterpenes, organic acids, saponins and flavonoids [10]. The methanol extract of aerial parts of *Orthosiphon diffusus* was investigated and 5 isopimarane diterpenes, 2 diterpenes and 3 oxygenated staminane diterpenes

Figure 1: Inflorescence of *Orthosiphon* diffuses.

were isolated from the extract. Staminolactones A and B, norstaminol A and B were also isolated. Tezuka et al., [13] isolated 16 compounds like 7, 3', 4'-tri-O-methylluteolin, eupatorin, sinensetin, 5-hydroxy-6, 7, 3'4'-tetramethoxyflavone, 6-hydroxy-5, 7, 4'-trimethoxyflavone, vomifoliol, aurantiamide acetate, rosmarinic acid, salvigenin and ladanein. Caffeic acid, ursolic acid, β-sitosterol and oleanolic acid were also isolated from the plant extract [13]. Two new substituted polychiral 5, 6-dihydro-α-pyrones from *Orthosiphon diffusus* methanolic extract and molecular docking studies. The isolated Orthodiffene different chemical structure such as IR, 1H and 13C NMR spectrum, COSY and HMBC [14] and also anticancer activities previously reported in India.

The isolated diterpenes from the plants were proven to show cytotoxicity against 26-L5 carcinomatous cells of metastatic liver murine colon and the ED50 calculated 10-90 μg/ml [13]. The furanopyrans isolated from the plant exhibited invitro cytotoxicity against U-937 and HeLa cell lines which was comparably similar to etoposide and camptothecin. The IC50 values were calculated at 26.98 and 21.18 μg/mL respectively [15]. The investigations to elucidate chemical constituents of *Orthosiphon diffusus* using advanced FTIR, 1D and 2D NMR and FABMS has resulted in the isolation of 2 polychiral furanopyran and orthodiffenes AM-1 and 2 [15]. In another study, orthodiffenes A and B were characterized using X-ray crystallography and investigated for cytotoxicity against Jurkat and HL-60 cell lines invitro. The isolated compounds showed a significant cytotoxicity against the cell lines when compared to camptothecin [16]. Based on the previous report hepatoprotective activity of *Orthosiphon diffusus* methanolic active fraction through antioxidant and anticancer activities (In vitro and In vivo) significantly reduced the levels of serum LDH [17].

In other research, various constituents in the essential oil of *Orthosiphon* diffuses were isolated by hydro distillation followed by GC-MS. Overall 25 compounds were isolated from the plant with constituted about 95.3% of oil. The majority of the volatile constituents that are isolated were β-ocimene, t-caryophyllene, n-eicosane, octocosane, elemol and methyl palmitate.

Pharmacological activities

The chemical constituents extracted from the methanol fraction of *Orthosiphon diffusus* were investigated for hepatoprotective activity against CCL4 induced hepatotoxicity in HepG2 cell lines and antioxidant activity against hydrogen peroxide induced free radical generation. The activity was significantly similar to the standard drug, silymarin. The results proved that the fraction inhibited lipoxygenase pathway and efficiently combated ROS by DNA expression and also kappaB nuclear factor suppression [18]. This proves the antioxidant and hepatoprotective activity of the plant, *Orthosiphon* diffuses. Other investigations on the antioxidant activity of *Orthosiphon* diffuses proved that methanol extract showed significant activity against hydrogen peroxide

free radicals and stress induced genotoxicity by regulation of gene expression of antioxidant enzymes. The extract of the plant also reduced the levels of DH and ALP in rat serum. It was also found effective against CCL4 induced hepatotoxicity in albino wistar rats [19]. Extensive review of pharmacological activities the genus *Orthosiphon* was conducted by Mukesh et al., [10] which supported the constituents of the members of genus exhibited anti-inflammatory, hepatoprotective, anti-diabetic, antioxidant and analgesic activities which might also be coherent in the current plant of review.

Chitra Vijayan et al., [20] investigated the antioxidant activity of 5 species of lamiaceae family; Ocimum canum, Ocimum gratissimum, *Orthosiphon* stamineus, *Orthosiphon diffusus*, and *Orthosiphon* thymiflorus in DPPH assay. In the work, *Orthosiphon* diffuses showed a significant activity at various concentrations which was comparable to other plants and the total phenol content was directly influencing the antioxidant potential of the plants.

Antifungal activity of *Orthosiphon* diffuses was established against M. musicola by inhibition of the germinating spore's assay. Methanol extract was found to be effective in inhibiting the spores of the selected fungal strain supporting the traditional claims of the plant [21]. Another interesting study was conducted to estimate the gold reuptake by the plant, *Orthosiphon* diffuses. The study was conducted in the Kolar belt, Karnataka, India which revealed that the plant inhabited with other species showed a significant absorption of gold metal where the humic acid activity was higher in the soil and is directly proportional to the reuptake. Other elemental concentration in the soil was constant and didn't have any influence in the absorption rate [22]. The modern medicines are cost effective or liver damage, it helps to regenerative liver cells.

Anti-inflammatory: Methanolic extract of 250-1000mg kg-1 of dose were significant.

Antioxidant: Different extracts using DPPH, Superoxide showed potential activity.

Hepatoprotective: Methanolic extract CCL induced liver damage in rats.

Anticancer: Different extracts or isolated compounds tested for different cancer cell lines.

Antihypertensive: To decrease in blood pressure and cardiac output.

Antibacterial: Different extracts or isolated bioactive compounds were tested against micro-organisms (Gram-Positive and Gram-Negative).

CONFLICTS OF INTEREST

The authors declared no conflict of interest.

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REFERENCES

1. Senthil R, Meenakshi Sundaram KK, Bupesh G, et al. Identification of oxazolo [4, 5-g] quinazolin-2 (1H)-one derivatives as EGFR inhibitors for cancer prevention. Asian Pac J Cancer Prev 2022; 23:1687-1697.
2. Sundaram KK, Bupesh G, Saravanan KM. Instrumentals behind embryo and cancer: A platform for prospective future in cancer research. AIMS Mol Sci 2022; 9:25-45.
3. Balaji AP, Bhuvaneswari S, Raj LS, et al. A review on the potential species of the Zingiberaceae family with anti-viral efficacy towards enveloped viruses. J Pure Appl Microbiol 2022; 16:796-813.
4. Saravanan KM, Zhang H, Senthil R, et al. Structural basis for the inhibition of SARS-CoV2 main protease by Indian medicinal plant-derived antiviral compounds. J Biomol Struct Dyn 2022; 40:1970-1978.
5. Vijayaram S, Kannan S, Saravanan KM, et al. Preliminary phytochemical screening, Antibacterial potential and GCMS analysis of two medicinal plant extracts. Pakistan J Pharm Sci 2016; 29.
6. https://www.gbif.org/species/3892822
7. https://indiabiodiversity.org/species/show/225736
8. Okaiyeto K, Nwodo U, Mabinya L, et al. A review on some medicinal plants with hepatoprotective effects. Pharmacogn Rev 2018; 12:186-199.
9. Chin JH, Abas HH, Sabariah I. Toxicity study of *Orthosiphon* stamineus benth (misai kucing) on Sprague dawley rats. Trop Biomed 2008; 25:9-16.
10. Singh MK, Gidwani B, Gupta A, et al. A review of the medicinal plants of genus *Orthosiphon* (Lamiaceae). Int J Biol Chem 2015; 9:318-331.
11. Kottaimuthu R. Ethnobotany of the Valaiyans of Karandamalai, Dindigul District, Tamil Nadu, India. Ethnobotanical leaflets 2008; 2008:24.
12. Rajesh P, Meenakshi R, Rajkumar R, et al. A survey on ethnoveterinary medicines used by the tribal peoples of kalasapadi hills, Dharmapuri District of Tamil Nadu. Int J Trend Scient Res Develop 2017; 1:1181-1196.
13. Tezuka Y, Stampoulis P, Banskota AH, et al. Constituents of the Vietnamese medicinal plant *Orthosiphon* stamineus. Chem Pharm Bulletin 2000; 48:1711-1719.
14. Holla H, Sharma A, Bhat P, et al. Two new substituted polychiral 5, 6-dihydro-α-pyrones from *Orthosiphon diffusus* and molecular docking studies. Phytochem Letters 2017; 22:21-26.
15. Majhi A, Holla H, Shinde D, et al. Two novel polychiral furanopyrans from *Orthosiphon diffusus* (Benth.). Indian J Chem 2017; 56B:855-861.

16. Holla H, Srinivas Y, Majhi A, et al. Novel cytotoxic constituents of *Orthosiphon diffusus*. Tetrahedron Letters 2011; 52:49-52.

17. Ghaffari H, Venkataramana M, Nayaka SC, et al. Hepatoprotective action of *Orthosiphon diffusus* (Benth.) methanol active fraction through antioxidant mechanisms: An In vivo and In vitro evaluation. J Ethnopharmacol 2013; 149:737-744.

18. Fehér J, Lengyel G. Silymarin in the prevention and treatment of liver diseases and primary liver cancer. Curr Pharm Biotechnol 2012; 13:210-217.

19. Manivasagan V, Saranya K, Poojashree S, et al. *In vitro* antioxidant, antidiabetic and antibacterial activities of *Orthosiphon diffusus*. Res J Pharmacogn Phytochem 2022; 14:163-170.

20. Armatu A, Colceru-Mihul S, Bubueanu C, et al. Evaluation of antioxidant and free scavenging potential of some Lamiaceae species growing in Romania. Romanian Biotechnol Letters 2010; 15:5274-5280.

21. Aman M, Rai VR. Antifungal activity of fungicides and plant extracts against yellow sigatoka disease causing Mycosphaerella musicola. Curr Res Environ Appl Mycol 2015; 5:277-284.

22. Prabhakar BC, Rashmi BN, Gireesh RV. Trace elemental expression in soil substratum and floral species in selected lateritic profiles in the northern part of kolar schist belt, Dharwar Craton, India. Int J Geosci 2017; 8:1004-10024.