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Review Article

A Comprehensive Overview On Ruellia Patula

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ABSTRACT

Ruellia patula (syn.Dipteracanthus patulus Nees) is commonly known as Chilanthinayagam, Sisodi, Kirandhinayagam and Tutadi. It is a small, hairy undershrub distributed in various regions like Sri Lanka, India, Pakisthan, Burma, Arabia and Africa. Phytochemical studies had revealed the presence of tannins, lignans, saponins, flavonoids and steroids. Pharmacological studies done by many researchers had proved the existence of Anti-bacterial, Anti-inflammatory, Anti-ulcer, Anti-mutagenic, Anti-oxidant, Wound healing and Hepatoprotective activity. It is also used to treat various diseases including gonorrhea, sore eyes, renal infection, kidney stones, dental problems, stomach ache, syphilis, tumors, Rheumatic complaints, itches, insect bites, cough, scalds, paranchia and act as cardiotonic and anti-ulcer agent. Still now, scientific validation of various traditional uses would be appreciated, particularly to explore and authenticate several novel biologically active compounds of this herb. This review article shows the comprehensive benefits of Ruellia patula in phytotherapy. It enables the scientists to discover the further potential of this herb in other biomedical applications.

INTRODUCTION

Medicinal plants are the part and parcel of human society to combat diseases, from the dawn of civilization. Many ancient literatures referred plants for curing difficult and incurable diseases [1]. A huge variety of plants consists of a wide range of bioactive substances known for their pharmacological activities. One such plant species is *Ruellia patula*, a flowering medicinal plant traditionally used in the treatment of wounds and

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also in treating various diseases. In folklore remedies, the leaves are used to treat cuts, wounds and poisonous bites [3]. It belongs to the family Acanthaceae, with about 250 genera and more than 2500 species [7]. Due to the increasing number of adverse effects and other potential limitations of many synthetic drugs, natural therapeutic strategies like plant-based medicines are mostly preferred now-a-days. They are comparatively safe with limited or no adverse effects [14].

The WHO estimates that around 80 % of the world population in developing countries uses the traditional plant medicines for their primary healthcare needs [16]. Plants can produce Primary & Secondary metabolites as a part of their normal metabolic activity. Therapeutic activity of plant is owed to secondary metabolites [19]. Medicinal plants are the sources of modern medicines [16]. The use of medicinal plants for their curative properties is a time-tested experience of humans [21]. Hence medicinal plants have become the focus of intense study in recent years to determine whether their traditional uses are supported by their actual pharmacological effects or it is merely based on folklore [25]. *Ruellia patula* (syn.*Dipteracanthus patulus Nees*) is popularly called as Kirandhinayagam, Chilanthinayagam ,Tutadi , Sisodi etc… It is a hairy undershrub distributed in the tropical and subtropical regions of Africa, Arabia, Sri Lanka, Pakisthan, Burma and India. In India, it is especially found in Rajasthan, Haryana, Tamilnadu, Western Ghats and Andhra Pradesh [27]. This plant is commonly distributed in wastelands in Tamilnadu[3].The flowering season of this plant is from September to March [30].

Phytochemical investigations of this plant had been revealed the presence of Flavonoids, Saponins, Steroids, Phenols, Tannins and Lignans [28]. It has been used as a medicine for a variety of diseases including Gonorrhea, Sore eyes, Syphilis, Renal infection, Cough, Scalds, Stomach ache, Kidney stones, Tumors, Rheumatic complaints, Dental problems, Itches, Insect bites, Paranchia, Veneral diseases for wound healing and as a Cardiotonic and Antiulcer agent [3]. Juice of leaves act as Sedative, Roots are used as an antipyretic agent, Leaf paste is used as an anti-inflammatory and Flower and raw fruit is used as an anti-diabetic agent [27]. *Ruellia patula* is a single drug remedy against the deadly poison of Kaduvachilandhi (Tiger Spider) [25]. Because of understanding wide usage of *Rueilla patula* in folklore medicine and its therapeutic importance, we are presenting a brief information about this plant in this review.

Geographical distribution:[10]

Tamil Nadu : Dindigul district
Kerala : All district of kerala
Maharashtra : Akola district
Telangana : Mehboobnagar district, Adilabad district, Nalgonda district
Andhra Pradesh: Kurnool district, Kadapa district, Anantapur district, Guntur district

SYNONYMS:

Dipteracanthus erectus Nees, Dipteracanthus ocymoides C. Presl, Dipteracanthus patulus (Jacq.) Nees, Dipteracanthus matutinus C.Presl, Petalidium patulum (Jacq), Dalzell & A.Gibson.

MORPHOLOGICAL CHARACTERS: DESCRIPTION:

Ruellia patula is a hoary pubescent, undershrub, basally woody, erect and many branched shrublet with ± quadrangular twigs. It can grow about 50 cm tall.

Figure 1: Entire plant of Ruellia patula

LEAVES:

Leaves are opposite, rarely obovate, (1.2 -)1.5- 5 × (-6) ×1-3 (-4.5) cm, basally rounded, obtuse or subacute, cuneate-truncate at base, acute at apex, lamina elliptic-ovate, densely pubescent on both sides and branchlets are 4-angled. It consists of about 4-10 mm long petiole [11].

Figure 1 : Leaves of Ruellia patula

FLOWER:

Flowers are about 3-4cm long, pale-white in color, sessile, solitary axillary, flowers solitary or in 3 (-5) -Flowered axillary cymes, pedicels 0-2 (-5) mm long, peduncles in cymes 1-6 (-12) mm long, calyx 3-8 (-9) mm long, glabrous to puberulous; bracteoles (bracts in cymes) ovate-elliptic or narrowly so, 7-18≈3-8 mm, divided to 1-2 mm base, uniformly puberulous or with ciliate lobes and midribs or glabrous; lobes 4-15≈3-15 mm, bracteoles leafy, rarely 2-3 in cynes, elliptic-spathulate or ovate, obtuse and petiolate. Calyx contains 5 lobes, equal, 4-5 mm long, linear-subulate to lanceolate, acute and ciliate at margin. Corolla tube has 5 lobes, can grow up to 3 cm long, campanulate to infundibuliform, limb lobes are suborbicular, 8-10 mm long and obtuse. Staminal filaments are glabrous, anthers are oblong and 2 mm long. Ovary is glabrous, 2 mm long, style filiform is 2-3 cm long and hairy. Capsule is glabrous, elliptic, clavate and 1.4-1.8 cm long [2].

Figure 3: Flower of Ruellia patula

ROOT :

The roots of *Ruellia patula* are thick and cylindrical, finger- like structure.

Figure 4: Root of Ruellia patula

SEEDS:

Ruellia patula consists of about 8-10 seeds. Seeds are flat, 3 mm across ± orbicular, Dark brown, 3-4.5 ≈ 2.5-4.5 mm and seed broadly ellipsoid to circular [2].

Figure 5: Seed of Ruellia patula

STEM:

Stems are 0.6 (-1) m long, erect to trailing, sometimes with stalked capitate glands. When young subglabrous to densely pubescent or pilose [7].

Figure 6 : Stem of Ruellia patula

CLASSIFICATION:

Botanical name : Dipteracanthus patulus
Kingdom : Plantae
Division : Tracheophyta
Class : Magnoliopsida
Family : Acanthaceae
Genus : Dipteracanthus
Species : patulus

VERNACULAR NAMES:

Tamil : Kiranti nayan, Vedichchedi
Malayalam :Velipadakkam, Thuppalampotti
Engilsh : Bell weed
Marathi : Katmora

Some other vernacular names in India are cilantanceti, cilantinayakam, upu-dali, nittinaviral, cukkulam, patakilam, cuntuilicceti, cuntumam, cuntuyili, kiranti, icaimuti, vaikkirantitam, nayakam, turuputpam, kiranti nayakam, kakapikanayacceti, kirantinayakan, kirantippuntu, punkiranticceti, kattunayakam, kakapicam, punkiranti, kattunayakacceti, kirantinayan ,nittinaviralkurittan, vaikkirantitacceti and putakilanceti [11].

PHYTOCHEMICAL CONSTITUENTS:

Alkaloids, Coumarins, Lignans, Flavonoids, Triterpenes, Sterols, Phenolic glycosides, Megastigmane glycosides, Phenyl ethanoids, and Benzoxazinoid glycosides are the major phytochemical constituents in genus *Rueilla* [3,7]. The different extract of the *Rueilla patula* consists of Tannins, Alkaloids, Flavonoids, Iridoid glycoside, Steroids,and Glycosides. The Methanolic extract of *Dipteracanthus patulus* contains βSitosterol, β-carotene, Phenols, Saponins, Tannins and high amount of Flavonoids [19,42].

Phytochemical investigation of *Dipteracanthus patulus* reveals the presence of 5,5, dimethoxy, Lyoniresinol – 9-o-β-D-glucoside, α – ethyl galactose, Apigenin-7-o-rutinoside, α-D-glycose, β-sitosterol, Lupeol, Lariciresinol-9-o-β-glycopyranoside, β-D-glucose, β-D-fructose, 7-Hydroxy-4-methyl coumarin, stigmosterol, Stimat-6-en-3-beta-ol, Compesterol and Dicoumarol [37,38].

Mamdouh N.Samy (et al, 2015), has isolated various compounds like β-Sitosterol β-D-glucopyranoside, Bioside (decaffeoyl verbascoside), Vanilloside, Byzantuionoside B 6'-O-sulfate, Acteoside, Syringin, Demethoxycentaureidin 7-O-β-D-galacturonopyranoside, Benzyl alcohol O-β-D-xylopyranosyl-(1″→2')-β-D-glucopyranoside,

Pectolinarigenin 7-O-α-L-rhamnopyranosyl-(1’’’→ 4’’)-β-D-glucopyranoside, Cistanoside E, Phenethyl alcohol O-β-D-xylopyranosyl-(1’’→2’)-β-D-glucopyranoside, (6S,9R)-Roseoside, (Z)-Hex-3-en-1-ol-O-β-D-xylopyranosyl-(1’’→2’)-β-D-glucopyranoside, Pectolinarigenin 7-O-α-L-rhamnopyranosyl-(1’’’→6’)-β-D-glucopyranoside, Isoacteoside, 3,4,5-Trimethoxyphenol O-α-L-rhamnopyranosyl-(1’’→6’)-β-D-glucopyranoside, Lyoniresinol 3α-O-β-D-glucopyranoside [7].

S.No	Phytochemicals	Molecular Formula	MW	RT	Peak Area (%)
1	Propane,1,1,3-triethoxy	C9H20O3	176	2.85	8.21
2	3,7,11,15-tetramethyl-2-hexadecan-l-ol	C20H40O	296	12.20	7.58
3	3,7,11,15-tetramethyl-2 hexadecan-l-ol	C20H40O	296	11.71	28.75
4	Dodecanoic acid ethyl ester	C14H28O2	228	13.56	1.71
5	1,2-Benzenedicarboxylic acid diheptyl ester	C22H34O4	362	13.17	1.71
6	Phytol	C20H40O	296	15.06	8.15
7	Pentanal, 2-methyl	C6H12O	100	17.45	0.74
8	9,12,15-Octadecatrienal	C18H30O	262	15.84	2.39
9	Pentanal,2,4-dimethyl	C7H14O	114	19.96	0.63
10	Squalene	C30H50	410	5.55	24.84
11	Didodecyl phthalate	C32H54O4	502	20.99	0.97
12	9,12-octadecodienoic acid[z,z],phenylmethyl ester	C25H38O2	370	31.35	10.27
13	γ – tocopherol	C28H48O2	416	28.01	2.87
14	α -amyrin	C30H50O	426	33.46	6.11
15	α – Sitosterol	C29H50O	414	32.64	14.35
16	d-Mannose	C6H12O	180	8.98	1
17	Dodecanoic acid, 2-(acetyloxy) -1-[(acetyloxy)methyl] ethyl ester	C19H34O6	359	13.43	4
18	Oleic acid	C18H34O2	282	19.62	8
19	9-Octadecenoic acid, [2-phenyl-1,3-dioxolan-4-yl] methyl ester, cis	C19H44O4	445	11.55	12
20	Tetradecanoic acid	C14H28O2	229	15.8	15
21	Cyclopropanebutanoic acid, 2[[2-[[2-[[2-pentylcycloprophyl]methyl]cyclopropyl]methyl]methyl]cyclopropyl]methyl]-,methyl ester	C25H42O2	375	17.15	1
22	Cholestan-3-0l, 2-methylene-,(3a,4A)-	C28H48O	401	16.25	13
23	n-Hexadecanoic acid	C16H32O2	256	17.88	33
24	Octadecanoic acid	C18H36O2	284	19.83	4
25	9-Hexadecanoic acid	C16H30O2	254	19.13	7
26	3’,8,8’-Trimethoxy-3-piperidyl-2,2’-binaphthalene-1,1’,4,4’-tetrone	C28H25NO7	488	23.37	2

RT = Retention Time, MW = Molecular Weight

Table:01 Ethanolic extract of *Ruellia patula*[14,27]

Flavonoids, Sterols, Megastigmane glycosides, Lignans, Triterpenes phenyl ethanoids, Phenolic glycosides and Coumarins are some of the phytochemicals present in *Ruellia patula*.

1. Sterols:

The main function of sterols is to control permeability and membrane fluidity and some sterols have a unique function in signal transduction. *Ruellia patula* consists of sterols like Stigmasterol, Campesterol, Stimat-6-en-3-β-ol and β -Sitosterol glucoside.

2. Coumarins:

Coumarins belongs to a group of colourless polyphenolic and crystalline oxygenated heterocyclic compounds. *Ruellia patula* consists of coumarins like Dicoumarol and 7- Hydroxy-4-methyl coumarin.

3. Triterpenes:

Triterpenes are the compounds or substances that are isolated from animals, fungi or plants, which has various biological activities. Lupeol is the only triterpenes present in *Ruellia patula*.

4. Flavonoids:

Flavonoids are the group of natural substances found in root, stem, flowers, grains, vegetables and fruits. Demethoxycentaureidin7-*O*-β-D-galacturonopyranoside, Pectolinarigenin7-*O*-α–L-rhamnopyranosyl-(1’’’→4’’)-β-D-glucuronopyranoside, Pectolinaridenin 7-*O*-α – L-rhamnopyranosyl-(1’’’→4’’)-β-D-glucopyranoside and Apigenin 7-*O*-rutinoside are some of the flavonoids in *Ruellia patula*.

5. Phenyl ethanoids :

Phenylethanoid glycosides are the water-soluble compounds present in flowers, leaves, stem, roots, seeds and fruits without organ selectivity. Available phenyl ethanoid compounds in *Rueilla patula* are Acteoside, Bioside (decaffeoylverbascoside), Phenethyl alcohol *O*-β-D-xylopyranosyl (1’’→2’)-β-D-glucopyranoside , Isoacteoside and Cistanoside E.

6.Megastigmanes, Lignans and Phenolic compounds:

- Megastigmanes – Byzantionoside B 6’-*O*-sulfate and (6S,9R)- Roseoside ,
- Lignans – (+)-Lyoniresinol-9’-*O*-β-D-glucopyranoside and 5,5’-dimethoxylariciresinol 9-*O*-β-D-glucopyranoside (Rupaside).
- Phenolic compounds – 3,4,5-trimethoxyphenol *O*-α – L-rhamnopyranosyl-(1’’→6’)-β-D-glucopyranoside, Vanilloside, Benzyl alcohol*O* -β-D-xylopyranosyl-(1’’→2’)-β-D- glucopyranoside and Syringin.[34]

S.No	Phytochemicals	Molecular formula	Molecular weight	RT Value	Peak Value
1.	1,2-Benzene dicarboxylic acid, diisooctyl ester	C24H38O4	390	24.75	9.89
2	9,12,15-Octadecatrienoic acid, ethyl ester(z,z,z)	C20H34O2	306	19.11	3.82
3	Octadecanoic acid ethyl ester	C20H40O2	312	19.48	1.22
4	Linoleic acid, ethyl ester	C20H36O2	308	19.01	4.13
5	9,12-Octadecadienoic acid(z,z)	C18H32O2	280	18.75	4.24
6	9,12,15-Octadecatrienoic acid, methyl ester(z,z,z,)	C19H32O2	292	18.85	9.66
7	Hexadecanoic acid, ethyl ester	C18H36O2	284	16.47	6.49
8	Dibutyl phalate	C16H22O4	278	16.00	17.75
9	n-Hexadecanoic acid	C16H32O2	256	16.16	13.41
10	Octadecane	C18H38	254	13.84	4.93
11	4-hydroxy-2 methylpyrrolidine-2-carboxylic acid	C6H11NO3	145	9.99	7.94
12	Hexadecane	C16H34S	226	11.30	6.68
13	Tetradecane	C14H30	198	8.88	2.86
14	2,6-dimethyl-6-trifluoroacetosyoctane	C12H21F3O2	254	4.78	2.67
15	Octane,3,3-dimethyl	C10H22	142	3.87	3.06
16	Hexa decanoic acid, methyl ester	C17H34O2	270	15.50	3.21

17	α-tocopherol	C29H50O2	430	27.68	3
18	2,6,10.14,18-pentamethyl-2,6,10,14,18-eicosapenataene	C25H42	342	23.82	1
19	4,5,6,7-Tetrahydroindoxazen-5-ol-4-one,3-[10-phendecyl]	C23H31NO3	370	25.78	4
20	9-Octadeneoic acid[z],2-hydroxy-1[hydroxymethyl]ethyl ester	C21H40O4	357	22.92	13
21	9-Octadecenoic acid[z],2,3, -dihydroxyprophyl ester	C21H40O4	357	20.05	2
22	Hexadecanoic acid,1-[hydroxymethyl]-1,2-ethanediylester	C35H68O5	569	21.28	8
23	Hexadecanoic acid, octadecyl ester	C34H68O2	509	17.63	41
24	Hexadecanoic acid, butyl ester	C20H40O2	313	15.93	25
25	Dodecanoic acid,10-methyl-, methyl ester	C14H28O2	228	15.22	3

Table:02 Methanol extract of *Rueilla patula*[3,27]

PHARMACOLOGICAL ACTIVITIES:

Antiulcer activity:

Formation of lesions in the stomach, duodenum and intestine is called as ulcer. Ulcer is formed due to the imbalance between gastro-protective and aggressive factors. The decrease in gastro-productive factors like bicarbonate secretion, mucus and gastric mucosal blood flow and increase in aggressive factors like elevation of acid/pepsin secretion and *H.pylori* infection may results in gastric ulceration. Many literature studies revealed the presence of phenols and flavonoids in hydroethanolic extract of *Ruellia patula* and reported the Anti-ulcerogenic activity. The gastro-productive effect of this plant may be due to the mechanism of reduction in the level of free radicals and lipid peroxidation. Besides, phytoconstituents like flavonoids, phenols, terpenoids and glycosides might be responsible for anti-ulcer activity [43].

Antimutagenic activity:

Innate metabolic defects in the cellular systems, morality in living organisms and triggering morbidity leads to mutations. Mutagens are responsible for initiation and promotion of several human diseases, including cancer. Reactive oxygen species play a vital role as endogenous initiators of degenerative process like mutation and DNA damage, which is related to heart disease, cancer and aging. Methanolic extract of *Ruellia patula* had proved the decrease in the number of revertant colonies against sodium azide induced mutagenicity. It may inhibit the interaction between genes and biochemically reactive mutagens, pro-mutagens making them unavailable for the enzymatic process and free radical scavenging activity [41].

Anti-inflammatory activity:

The result of the host response to the injuries of tissue (or) any change in pathology can lead to the normal tissue structure and function restoration. Long term inflammation may lead to the pathogenesis of various inflammatory diseases like cancer, metabolic disease, obesity, cardiovascular diseases, Atherosclerosis and Rheumatoid Arthritis [44,45]. The methanolic stem extract of contains maximum quantity of flavonoids than leaves and roots, which is responsible for curing inflammation. Leaf paste of *Ruellia patula* has an excellent anti-inflammatory activity [27,28].

Wound Healing activity:

Physical injuries resulting in an opening or break of the skin are called as wounds. The process of restoring a damaged tissue to its normal state is known as wound healing. It involves various phases like contraction, epithelization, granulation and collagenation. Wound- healing is important for restoration of disturbed function of skin and improper anatomical activity. The leaves of

Ruellia patula are made into a paste and used to treat fresh wounds. The methanolic extract of the leaves contains phytochemical constituents like flavonoids, phenols, tannins, saponins, steroids, glycosides and lignans are responsible for wound healing activity by increasing the cellular proliferation and formation of granulation tissue [39].

Antibacterial Activity:

Bacteria are the single celled prokaryotic organisms that are mainly found in mucosal layer, intestinal tract of humans and surface of the skin [46]. Substances that kill or eliminate bacteria is known as Bactericidal whereas the substances that inhibit the growth of bacteria is known as Bacteriostatic [27]. Nowadays drug resistance is developed by the microbes. Secondary metabolites like tannins, terpenoids, alkaloids and flavonoids are responsible for anti-bacterial activity. An ethanolic extract of *Ruellia patula* showed the higher anti-bacterial activity against Gram-positive and Gram-negative bacteria [16,19]. Ethanolic extract contains the highest bacterial inhibition than the methanolic and ethanolic extract. Presence of flavonoids inhibits the nucleic acid synthesis causing damage to cytoplasmic membrane and its functions by the inhibition of formation of D-alanine-Dalanine. Terpenes like thymol, menthol and linalool showed the inhibition of bacteria via membrane lipid bilayer penetration through the fatty acyl chains and disrupting the lipid packing, thus altering the fluidity of cell membrane [27[.

Hepatoprotective activity:

The whole plant of *Dipteracanthus patulus* contains phytoconstituents like lupeol, β-sitosterol, β-carotene and Rutin. The ethyl acetate and chloroform extract show the significant reduction in Serum Glutamic Oxaloacetic Transaminase (SGOT), Serum Glutamic Pyruvic Transaminase (SGPT), Alkaline Phosphatase (ALP), triglycerides, urea, total cholesterol and uric acid levels [30].

Antioxidant activity:

Generation of free radicals in our body is due to the oxidation of biomolecules. Formation of these free radicals can cause injury to cells an also responsible for many diseases like cancer, Atherosclerosis, Alzheimer's disease and inflammatory disorders [19]. Anti-oxidants scavenge the free radicals by preventing the damage of cellular constituents. They block the harmful effects of free radicals. These substances stimulate the cellular defense and helps in preventing oxidative damage of cellular constituents. Anti-oxidants can decrease the risks of occurring diseases like heart diseases, cancer and stroke [47]. Presence of various phytoconstituents like β-carotene, α-carotene, terpenoids, lycopene, lutein, polyphenolics, catechins, isoflavone and other secondary metabolites contains anti-oxidant properties. Phenolics and Flavonoids are mainly responsible for Anti-oxidant activity [19].

Conglomerate activities:

The leaves of *Ruellia patula* are used to treat cuts and wounds, Gonorrhea, syphilis, cure eye sore, poisonous bites, renal infections, vomiting, alopecia, diarrhea, constipation, myelosuppression, itches, insect bites, tumors, skin diseases, dental problems, cardiotonic, cough, scalds, kidney stones, toothache, stomach ache, paronychia, venereal diseases, sedative and ear diseases [7,14]. Roots are used as anti-pyretic [27]. Decoction of stem of *Dipteracanthus patulus* with cow milk is taken orally for treating bone fracture [28]. Stem paste along with mustered oil is applied topically to treat muscle pain. Whole plant extract with sugar is used in the treatment of pneumonia in children [36].

CONCLUSION:

Ruellia patula, a well- known, essential, traditionally used medicinal plant containing a

large number of biologically active phytochemical constituents with a wide range of therapeutic activities. The biological properties were assigned because of existence of various bioactive chemical constituents in the plant extract. Phytochemical investigation of *Ruellia patula* was proved to have a huge biological property and are very effective in treating popular diseases like, poisonous bites, renal infections, vomiting, alopecia, diarrhea, constipation, myelosuppression, itches, insect bites, tumors, skin diseases, dental problems, cardiotonic, cough, etc. Nowadays, *Ruellia patula* is widely used in traditional system of medicines like Siddha, Ayurveda, Unani, Homeopathy and Naturopathy. On contemplating the uncomplicated availability and medicinal properties, there is a possible opportunity for the scientific researchers to adventure the complete therapeutic activities and other unrevealed properties. In future prospects, *Ruellia patula* may have a global demand in many Pharma industries because of its safety and reduced toxic effects.

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