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PHYTOCHEMICAL AND PHARMACLOGICAL STUDIES OF MIRABILIS JALAPA.LINN.

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Abstract

Mirabilis Jalapa .L is a perennial herbal medicinal plant, has a long traditional uses. Various constituents are found in different parts of the plants. The active chemical constituents reported from this plant are alkaloids, flavonoids, phenols, glycosides, tannins, saponins, lignins, carbohydrates. In conventional medicine, the plant is used in treatment of skin diseases, carminative, cathartic, purgative, stomachic, tonic and vermifuge properties, anti-dysenteric, anti-parasitic, wound healer, digestive stimulant. Its various extracts reported number of pharmacological activities such as anti-diabetic, anti-inflammatory, anti-oxidative, anti-bacterial, anti-microbial, anti-fungal, anti-spasmodic, antinociceptive, anti-viral, diuretic, anthelmentic and urinary tract disorder. The present review is therefore an effort to give a detailed survey of the literature on its pharmacognosy, phytochemical and its traditional uses along with special emphasis given on pharmacological activities.

Keywords: *Mirabilis Jalapa .L*, Nyctaginaceae, phytochemicals, Biological activities.

Introduction:

Mirabilis jalapa.L (MJ) commonly known as Four o'clock plant belonging to family Nyctaginaceae is found in India, Tropical South America, throughout the Philippines in settled areas and also in France. It is known as Anthi-Mandhaari in Tamil, Naalumanipoovu in Malayalam, Gulabakshi in Marathi, Beauty of night, Four O' clock, Marvel of Peru in English, Chandrakantha in Telugu [(1)]. It is a perennial herb or under shrub. An erect herb to 50-100 cm high, native of peru but now dispersed throughout tropics . It is a popular ornamental plant grows worldwide for the beauty of its flowers which can be white , red, pink, purple or multi colored , sweet fragnances [(2)] and is a favorite garden plant surviving under climatic conditions . MJ characterized as a quick growing much- branched perennial herb with erect, angular, distinctly joined stem, swollen at the

nodes. It has been used in traditional medicine which may be due to presences of some biomolecules of pharmacological importances [3, 4]. In herbal medicine, parts of the plant may be used as a diuretic, purgative, and for vulnerary wound healing purposes .The cheerful *Mirabilis jalapa.L* got the common name "Four o' clock" because the flowers open in the evening and wilt the next morning, but the plants continue to produce new flowers from late spring till fall. Their other common name "Marvel of peru" because the native to the topical areas of South America. Mirabilis means wonderful, in Latin. It is cultivated throughout India but naturalized throughout the tropics of South America, Latin America, Frances. The flowers are used in food coloring. The leaves may be eaten cooked as well, but only as an emergency food. An edible crimson dye is obtained from the flowers to color cakes and jellies. The root is believed an aphrodisiac as well as diuretic and purgative. It is used in the treatment of dropsy. The leaves are used to reduce inflammation. A decoction of them (mashing and boiling) is used to treat abscesses. Leaf juice may be used to treat wounds. Powdered, the seed of some varieties is used as a cosmetic and a dye. Stem is used as anti-microbial activity. The whole plant used as anti-inflammatory, antiviral, anti-bacterial, anti Candidal, anti-fungal, antispasmodic and antinociceptive. Seeds are cathartic and vermifuge. [5]

Extensive studies within the last half a century have demonstrated *Mirabils Jalapa.L* to be an effective natural remedy for variety of ailments. So the present review deals with the evidence-based information regarding traditional uses and pharmacological profile of *Mirabilis Jalapa*.

Fig*: mirabilis jalapa .L*(Nyctaginaceae)

Scientific classification:

Kingdom : Plantae

Sub kingdom : Trcheobionta

Division : Angiosperms

Class : Dicotyledons

Sub class : Caryophylidae

Order : Caryophyllales

Family : Nyctaginaceae

Genus : *Mirabilis*

Species : *M. jalapa*

History:

Mirabilis jalapa.L was introduced into Europe by the Spaniards in 1596. It is native of peru , as one of its common name, " Sweet Marvel of peru", suggests Heimer(1901) found it to be native also to northern Mexico and southern boundary of the United states. Under cultivation color varities not known to the wild condition have occurred, and the recurring, spontaneously. (19)

Cultivation:

Mirabilis Jalapa.L is a small glabrous herb grows up to 0.5m in height, with succulent stems. It is not particular about soil ph, but does best in a soil that is neutral to slightly acidic. They are heavy feeders, though, and a rich, well-draining soil is ideal. They can go dormant in dry conditions .Propagation is done through seeds. It exhibits excellent regrowth after cutting or grazing with in short period and produces high yield also. It persists best when grazed lightly during the wet season.

Description:

Mirabilis Jalapa .L. is the herbaceous plant are erect and spreading, 2-3ft (0.6-0.9m) tall and just as Wide. They have numerous branches and opposite, pointed leaves, coriaceous obovoid fruits and prominent tuberous roots, planted as an ornamental plant. The leaves are opposite measuring 3.5-7.5 cm wide, 2-4 in (5-10 cm) long , unequal, ovate to sub cordate [(6)]. Flowers are

tubular, cluster, funnel-shaped, simple or double, fragrant, white, yellow, pink or purple. .Flowers in group of three flowers with five green bracteoles, surrounding the perianth, usually yellow crimson, white or variegated and opening in the evening. Perianth lobes five, gamophyllus, stamens five with unequal filaments. Carpel one, unilocular, superior ovary with a single ovule, a nectariferous disc surrounds the ovary. Fruit achene surrounded by a leathery, ribbed , persistant perianth . The self-compatible, perfect flowers each have 5-6 stamens and a single-ovulate ovary. An individual flower opens for one night in the early evening, the exact time depending on temperature and relative humidity, and closely the next morning. An individual plant produces between 25and75 flowers in one flowering seasons .The seeds are olive, brown or black in color. The root system of *Mirabilis Jalapa. L.* consists of a fairly thickened and tuberous up to 1mm high, stem swollen at nodes [(7)].

Phytoconstituents:

Roots, seeds and leaves are the reported plant part used from ancient times. The major phytoconstituents found in *Mirabilis Jalapa.L.* are the rotenoids (mirabijalones A-D,boeravinones C and F), an isoquinoline derivate as well as terpenoids , steroids, phenolic compounds, alanine, alpha-amyrine, arabinose, beta-amyrins,oleanolic acid, trophan, stigmasterols, beta-sistosterol,beta-D –glucoside, urolic acid, mirablisoic acid, mirabalisol, trigonellin and antiviral protein, C-methylabronisoflavone, tartaric acid, betanin , brassicasterol, betalanic acid . *Mirabilis jalapa.L.* is rich in many active compounds of which, particular interest to researchers is a group of amino acid proteins ,called mirabilis antiviral proteins **.**

Phytochemical screening of the roots shows the presence of alkaloids, glycosides, carbohydrates and phytosterols by phytochemical analysis. Trigonellin is the important component in roots[(8)].Chemical analysis showed the presences of alkaloids, flavonoids , phenols, steroids , triterpenes, glycosides, tannins, saponins and lignins. Better image analysis elucidation of compounds are visualized from TLC are alanine, arabinose, campesterol, daucosterol and dopamine, d-glucan, hexacon-1-ol, indicaxanthin, isobetanin, 6-methoxyboeravinone,C-methylabronisoflavones, miraxanthins, n-dotriacontane, n-nonacosane, n-pentacosane, n-triacontane. Flowers mainly contain flavonoids, anthocyanins. A number of active compounds were extracted from different organs of MJ, including ribosome-in activating protein(RIP) associated with anti-viral activity, anti-fungal phenolic compounds, anti microbial peptides and rotenoids showing inhibition of HIV-1 reverse transcriptase, further isolation of active components is under progress[(9)].

Traditional Uses:

Mirabilis jalapa.L. is known as a very bioactive plant and used in various diseases as folklore medicine. The leaves are used as traditional folk medicine in the south of Brazil to treat inflammatory and painful diseases and as a laxative. Leaf juice is used as an boils, to heal wound as external application, bruises and also for allaying itching in urticaria .The whole plant used for its antiviral, antibacterial, anticandidal, antifungal, antispasmodic, anti diabetic, antitumour, diuretic, hydragogues, anti-oxidative, anthelmentic, anti microbial, antinociceptive actions. In traditional medicine *Mirabilis jalapa Linn* is widely used as antidysenteric, antiparasitic, carminative, digestive stimulant, tonic, vermifuge, wound healer .seeds are used as cathartic. The roots is having aphrodisiac, diuretic and purgative properties. It is also used as dropsy. *Mirabilis jalapa.L.* to cure many infirmities including dysentery, diarrhea, muscular pain and abdominal colic. Scientifically validate its popular use for the treatment of diarrhea. Stem is having antimicrobial activity. Secondary metabolites proved to be the most important group of compounds that showed wide range of antibacterial and antifungal activity. This plant contains bio active components like trigonellin as a purgative and rotenoids used as a antispasmodic. In ayurveda this plant used as a boils, inflammations, constipation, diabetes, urinary disorders. Dried flowers used as a snuff for headaches, fungal infection and root decoction to wash wounds, treat skin afflictions as leprosy [3, 5,10] .It is also used a remedy for the kidney stones and gall bladder, chyluria [21].

Photochemical Screening:

The plant extracts were screened for the presences of various chemical constituents alkaloids, flavonoids, saponins, tannins, cardiac glycosides, steroids, terpenoids, anthroquinones, phlobannins, proteins and carbohydrates [11].

Table-I: Preliminary phytochemical screening of various extracts of *M. jalapa.L.*[12]

Bioactive Constituents	Aqueous Extract	Ethanolic Extract	Methanolic Extract	Petroleum Ether Extract
Alkaloids	+	+	+	+
Saponins	+	+	+	+
Tannins	+	+	+	+

Phlobatannins	-	-	-	-
Flavonoids	+	+	+	+
Terpenoids	+	-	+	-
Steroids	-	+	-	-
Cardiac glycosides	-	+	-	-
Anthraquinones	-	-	-	-
Carbohydrates	-	+	+	+
Proteins	-	-	-	-

Key: + = detected(present), - =(absent)

Pharmacological profile:

Pharmacological studies have confirmed that *Mirabilis jalapa* exhibit a broad range of biological effects, some of which are very interesting for promising future development.

Antidiabetic activity studies:

Oral administration of ethanolic extract of *Mirabilis jalapa.L* root (10mg/kg &20mg/kg) streptozotocin induced diabetic rats for 12days and mices for 28 days. It showed significantly reduced serum, glucose, triglycerides, urea, creatinine, total cholesterol, LDL-cholesterol and the activity of gluconeogenic enzyme glucose-6-phosphate, but increased serum insulin , HDL-cholesterol, protein, liver and skeletal muscle [4,13].

Anti-inflammatory activity studies:

The study was obtaining the anti-inflammatory activity of the alcoholic , aqueous, pet ether extracts from the leaves of *mirabilis Jalapa.L* by carrageenan- induced paw edema , formalin-induced paw edema ,cotton pellet induced granuloma models in wistar albino rats [14,15].

Antinociceptive activity studies:

Studies on the antinociceptive activity of extracts of the leaves and stem is models of pain in mice. They found that the crude extract of the stem was effective than the hydroethanolic extract of the leaves while amongst the fractions studied the ethyl-acetate fraction of the leaves was more effective and potent to induce antinociception. The mode of the ethyl acetate

fraction seem to be dependent up on the cholinergic system. It did not alter locomotory activity, gastroinstestial transist nor did it produce any gastric lesions [16].

Cytotoxicity and antioxidant activity studies: Petroleum ether, chloroform and methanol crude extract of leaves and bark of *mirabilis Jalapa.L* were screened for cytotoxicity by brine shrimp lethality bioassay. In same study methanol extract of bark was screened for antioxidant using the DPPH free radical scavenging assay [6].

In-vitro anthelmintic activity:

The Methanolic aerial parts extract of *Mirabilis Jalapa.L* significantly demonstrated time of paralysis and time of death of the worms especially higher concentration of 80% w/v as compared to standard references albendazole. This is the first report on the anthelmintic activity of aerial parts using in vitro models using phertimaposthuma as test worms. Methanol extract of aerial parts is most potent and required very less time of paralysis and death of worms compared to other extracts [8] .

Anti-microbial activity studies

There was so many studies which have been reported on anti-microbial activity of mirabilis jalapa.L. The methanolic , acetone , chloroform, ethanolic extracts of leaves of MJ were tested for their anti bacterial activity against different pathogenic resistant Gram-positive and Gram-negative clinical isolates and minimum inhibitory concentration was determined by disc diffusion method .The leaves extract exhibited the largest zone of inhibition(21mm in diameter with 500micro gram/disc extract) against staphylococcus and the highest inhibition of fungal radial mycelia growth(95% with 500microgram/ml medium) against Aspergillus flavus. The Methanolic extract exhibited lowest MIC against staphylococcus aureus (39 micro gram/ml) and Aspergillus flavus (45 microgram/ml) [9,17].

In-vitro antibacterial activity:

Methanolic stem extract of *Mirabilis Jalapa.L* was evaluated anti bacterial activity against the Gram positive bacteria viz., staphylococcus aureus , Bacillus substilis and the gram negative bacteria viz., Escherichia coli and pseudomonas aeruginosa [18].

Antispasmodic activity:

The Methanolic extract of *Mirabilis jalapa .L* showed inhibitory effect on gut smooth muscle contractility while at the same time stimulated the contraction of rabbit aortic muscle in a concentration –dependent manner. These effects were not due to either Ach of histamine receptor blockage, IP_3, cAMP, cGMP,Ca^{2+} release from intracellular storage or protein kinase mediated

contraction- relaxation mechanism. This effect may be mediated via serotoninergic mechanism which in turn interacts with other adrenergic systems[10].

Antifungal activity: A bioassay-guided fraction of an organic extract of the cell mass form manipulated plant cell culture of *Mirabilis jalapa.L* resulted in the isolation of the three new phenolic compounds. Two of the phenolic compound showed inhibitory activity against candida albicans[20] .

Conclusion:

Major thrust by whole of the pharmaceutical industry is focused towards design and development of new plant based drugs through investigation of leads from traditional system of medicines. In the study of *Mirabilis jalapa .L* alcoholic extracts of roots, leaves and flowers gives different pharmacological activities like antileprosy,anti-inflammatory, antihelmintic, anti spasmodic, antifungal, diuretic, anti microbial and antihyperlipidemic. Many important phytoconstituents responsible for the activity were isolated. The scientific research on *Mirabilis jalapa.L suggests* a huge biological potential of this plant. The acute toxicity studies of MJ have been found that the no mortality or any signs of behavioral changes was observed. It is strongly believed that detailed information as presented in this review might provide detailed evidence for the use of this plant in different medicines. At the same time, the organic and aqueous extracts of *Mirabilis jalapa.L* could be further exploited in the future as a source of useful phytochemicals compounds for the pharmaceutical industry.

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