



A REVIEW ON PHARMACOLOGICAL ACTIVITIES OF *POLYALTHIA LONGIFOLIA* L

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ABSTRACT

Polyalthia longifolia L. is an ornamental tree (mostly used as an avenue tree) which belongs to Annonaceae. As per the review of the research papers it also has so many important chemical constituents in its different parts. These chemicals are alkaloids, flavonoids, phenols, terpenoids and essential oil etc that can be used for the preparation of different medicines for several diseases. In this review authors focused on the pharmacological properties and ethnomedicinal properties of the plant parts and their implementation in the pharmacological science. The plant part different extracts showed different types of pharmacological activities like Antibacterial activity, Antifungal activity, Antitumor (Anticancer activity), cytotoxic activity, Anti-oxidant activity, Anti-inflammatory activity, Antimalarial activity and Antiulcer activity. Even the plant also has so many traditional medicinal uses. So, its not just an ornamental tree but it can be good resource for the secondary metabolites and considered as medicinally important plant.

INTRODUCTION

Medicinal plants play an important role in human's life. Herbs and humans have a great relation with each other. At present days medicinal plants play vital role in scientific development and holds much more hidden treasure to be explored as almost eighty percent human population in developing countries dependent on plant resources for their primary health care (Chandaka *et al*, 2018) [1]. Plant

based therapy has been used as a vital component in traditional medicine system and also serves as the main source of inspiration for pharmaceutical drugs used in the defence against various diseases (Prateek Dixit. *et al*, 2014) [2]. The genus *Polyalthia* includes about 120 species found mainly in Africa, South and South Eastern Asia, Australia and New Zealand. *Polyalthia longifolia* is one of the most important indigenous medicinal plant in Indian medicinal literature. Almost all the parts of this plant are used



in india for medicinal purposes for the treatments of various ailments and the significant medicinal properties was further reported through scientific researches (Subramanion L Jothy. *et al*,2013) [3]. The plant grows throughout the tropical and subtropical parts of India up to an altitude of 1500 meter. A tall, evergreen, handsome, pyramid like, columnar tree, univided, growing up to 12m or more. Branches short about 1-2 m or long, glabrous and pendulous. Leaves are alternate, exstipulate, mildly aromatic and it belongs to the family Annonaceae (Ram Bahor Saket and SB Singh. 2017) [4]. Number of chemical constituents has been identified from the leaves such as azafluorene alkaloid and three new Aporphin N-oxide alkaloids (Doshi. *et al*, 2015) [5].

Scientific Name: *Polyalthia longifolia* L.

Common Names: False Ashoka, Buddha Tree, Green champa, Indian mast tree, and Indian Fir tree.

Taxonomical classification (According to Bentham & Hooker)

Kingdom: Plantae

Sub kingdom: Phanerogams

Class: Dicotyledons

Sub class: Polypetalae

Series: Thalamiflorae

Order: Ranales

Family: Annonaceae

Genus: *Polyalthia*

Species: *longifolia* L.

Morphological Characters: The plant grows throughout the tropical and subtropical parts of India up to an altitude of 1500 m. The plant is tall, evergreen, pyramid-like, columnar tree. Main stem straight, univided, growing up to 12 m or more. Branches slender, short, about 1-2 m long, glabrous, and pendulous. Young plants have straight trunks and weeping pendulous branch. The longest branch is seen at the base and shorter at the end of the trunk, it gives conical crown appearance. Leaves are long narrow dark green and glossy. Leaf blade are ovate-oblong shape to ovate-lanceolate shape with wavy margins. Flowers are delicate pale green colour with wavy petals. The flowers last for a short period. It is usually two to three weeks. Seals are ovate-triangular. Petals are greenish yellow. Fruits are borne in clusters of 10-20. It is usually void in shape. Initially fruits are green in colour but later it turns in to purple or black when ripe. Seeds are pale brown in colour and ovoid in shape. (Chandaka Lavanya *et al*, 2018) [1], (K.V Katkar *et al*, 2010) [6].

PHARMACOLOGICAL ACTIVITIES

Antibacterial Activity: Ghosh G. *et al*, 2011 [7] described that the petroleum ether extract of *Polyalthia longifolia* var. *angustifolia* stem bark can yield a highly potent form of novel antibacterial molecule due to presence of steroidal alkaloid, by the process of tube dilution of petroleum ether extract against *Escherichia coli*, *Bacillus subtilis*, *Salmonella typhi*, *Proteus mirabilis*, *Pseudomonas aeruginosa*, *Klebsiella sp.*, *Staphylococcus aureus*. Manasa M. *et al*. 2014 [8] described antibacterial activity of methanolic extract of *Polyalthia longifolia* against a Gram-positive bacterium *Staphylococcus aureus* NCIM-2079 and two Gram negative bacteria *Salmonella typhi* MTCC-734 and *klebsiella pneumoniae* NCIM-2957 by inoculation in sterile nutrient broth at 37° C for 24-hour incubation, by the process of Agar well diffusion method Kavitha P A. *et al*, 2013 [9] described that the flavanoids of leaves of *Polyalthia longifolia* from methanolic extract is very effective bioactive compound against *Staphylococcus aureus*, *Streptococcus faecalis*, *Pseudomonas aeruginosa*, *Bacillus subtilis* and *Escherichia coli*.

Anticancer Activity: Hepatocellular carcinoma (HCC) is one of the most common life-threatening malignancies which accounts for nearly 85% of the primary malignant tumours of liver and is the third most common causes of cancer. A.J.M Christina. *et al*, 2014 [10] described that the methanolic extract of fruit of *Polyalthia longifolia* shows antioxidant activity, which reduced the effect of Diethylnitrosamine that causes DNA mutation in rats by dose dependent manner. S Rupachandra and D V L Sarada 2014 [11] shows the cytotoxic peptide isolated from the seeds of *Polyalthia longifolia* with an average mass of 679.8 by the process of Liquid chromatography-electrospray ionization-Mass spectrometry (LC-ESI-MS/MS) analysis, plays significant antiproliferative role against lung (A549) cancer cells at concentration of 10 µg/ml and cervical (HELA) cancer cell lines at 30 µg/ml, respectively. Verma Monika *et al*, 2008 [12] described that the leaves extract (A001) and its chloroform fraction (F002) of *Polyalthia longifolia* inhibited cell proliferation of various human cancer cell lines in which colon cancer cells SW-620 showed maximum inhibition with IC50 value 6.1 µg/ml. According to Gaurav Mahesh Doshi and Hemant D. Une, 2015 leaves and root extract of *Polyalthia longifolia* and *Carissa congesta* respectively, shows good anticancer activity on human leukemia cell line MOLT4 and human breast cancer cell line MCF7, respectively by the process of sulforhodamine B (SRB) assay.

Antifungal Activity: Satish S, *et al*. 2010 [14] shows the fraction of petroleum ether extract of leaves of *Polyalthia longifolia* recorded highly significant



antifungal activity against all the test bacteria like *Fusarium equiseti*, *Fusarium lateritium*, *Aspergillus candidus* and *Penicillium chrysogenum* etc, by the process of poisoned food technique. Dileep N, *et al.* 2013 [15] described antifungal activity of leaf and pericarp of *Polyalthia longifolia* against mycelial growth of two pathogenic fungi *Fusarium oxysporum* and *Pythium aphanidermatum* which are isolated from soft rot specimen of ginger by the process of poisoned food technique. K.V Katkar. *et al.* 2010 [16] shows the diterpenoids like 16 α -hydroxy-cleroda-3,13(14)-Z-diene-15,16-olide and 16-oxo-cleroda-3,13(15)-E-diene-15-oic acid, isolated from the hexane extract of the seeds of *Polyalthia longifolia*, demonstrated significant antibacterial and antifungal properties by the method of Bioassay monitored isolation. Swami Narsinghchandra Dev and Kantishree De, 2016 [16] described that the ethanolic and methanolic extract of bark and leaf of *Polyalthia longifolia* showed antifungal potential against *Candida albicans* and *Candida krusei* by agar well diffusion method.

Anti-inflammatory Activity: Sharma R K. *et al.* 2011 [17] reported that the aqueous extracts of *Polyalthia longifolia* show significant antiinflammatory activity as evident by decrease in the weight of granuloma tissue when compared to the standard drug Indomethacin by Cotton pellet granuloma test. Shibajee Mandal. *et al.* 2012 [18] shows antiinflammatory activity in both the ethanolic and aqueous extracts of leaves of *Polyalthia longifolia* due to the presence of flavonoids and phenolic compounds at various time intervals that was evaluated by Carrageenan-induced paw edema model. Denaturation of protein is well documented cause of inflammation. Ogbomade R.S. *et al.* 2019 [19] documented anti-inflammatory effect of 56.74 \pm 0.99 % in ethanolic extract, 55.57 \pm 0.22 % and 35.59 \pm 3.39 % in fresh and dry leaves aqueous extract respectively, which shows inhibitory effect on protein denaturation by using (comparing) diclofenac sodium the standard drug. Chandaka Lavanya *et al.* 2018 [1] revealed the most anti-inflammatory effect of the three doses of methanolic extract (300, 600, 900 mg/kg) of *Polyalthia longifolia* leaves by comparing it with standard Diclofenac sodium. Chandi Vishala Thonangi and Annapurna Akula 2018 [20] described that the methanolic extract from seed of *Polyalthia longifolia* exhibit significant dose dependent 58.46% anti-inflammatory activity with comparison of 56.92% diclofenac standard drug by inhibiting the acute inflammatory mediators released by egg albumin.

Anti-malarial Activity: D. Santha kumari. *et al.* 2016 [21] concluded that the methanolic extract of fruit of *Polyalthia longifolia* contain major chemical classes such as phenols and alkaloids which exhibits good in vitro antiplasmodial activity against CQ-

Resistance strain of *plasmodium falciparum*. Bethel Kwansa-Bentum. *et al.* 2019 [22] described that the ethyl acetate extract of leaves of *Polyalthia longifolia* exhibits antiplasmodial activity with IC50 value of 9.5 μ g/ml by using SYBR Green assay method. Stephen Y Gbedema. *et al.* 2015 [23] described that the obtained compounds such as 16-hydroxycleroda-3,13(14)-dien-16, 15-olide,16-oxocleroda-3,13(14)E-dien-15-oic acid and 3,16- dihydroxycleroda-4(18),13(14) Z-dien-15,16-olide from the ethanolic extract of stem bark of *Polyalthia longifolia* shows potent antiplasmodial activity for treating malaria.

Antioxidant Activity: According to Goutam Ghosh. *et al.* 2010 [24] the methanolic extract of *Polyalthia longifolia* showed increased scavenging activity against free radicals due to presence of more antioxidant principles. The phytochemical study on extract of *Polyalthia longifolia* has showed that flavonoids and tannins are abundant in this plant. Flavonoids and tannins have been reported to be antioxidative action in biological system, acting as scavenger of singlet oxygen and free radicals. From the study, Dileep N. *et al.* 2012 [25] found that the phenolic content in the ripe pericarp of *Polyalthia longifolia* could be responsible for the antioxidant activity which was observed by the DPPH free radicle scavenging method. Shibajee Mandal *et al.* 2012 [18] shows antiinflammatory activity in both the ethanolic and aqueous extracts of leaves of *Polyalthia longifolia* due to the presence of flavonoids and phenolic compounds at various time intervals that was evaluated by Carrageenan-induced paw edema model in the presence of standard Indomethacin against Albino rats. Santhepete N Manjula. *et al.* 2010 [26] shows DPPH scavenging activity of *Polyalthia longifolia* in methanol at room temperature with the presence of ascorbic acid as standard, which reduce ferric ion and inhibited lipid peroxidation which proves its antioxidant activity. According to Subramanion L Jothy. *et al.* 2015 [27] the antioxidant molecules in *Polyalthia longifolia* leaf extract might also play an important role in the prevention of genotoxic damage, Therefore, the genoprotective effect of *Polyalthia longifolia* leaf extract may have also rendered a radioprotective effect as observed in the present study. Ojewuyi O.B. *et al.* 2014 [28] described that the obtained phenols by the Harborne standard detection chemical test from the young and mature leaves of *Polyalthia longifolia* shows antioxidant activity which prevent oxidative damage to biomolecules such as DNA, lipids, and proteins that play a role in chronic diseases such as cancer and cardiovascular disease.

Antiulcer Activity: P Malairajan. *et al.* 2008 [29] described that the ethanolic extract of leaves of *Polyalthia longifolia* are used with some standard drug like ranitidine, sucralfate, and omeprazol to performe three different mechanisms like



Antisecretory, Cryoprotective, Proton pump inhibition, which eventually prove reduction of ulcer in Rats. O Timothy *et al*, 2019 [30] also described that 800 mg/kg methanolic extract of leaves of *Polyalthia longifolia* shows 100% inhibition of gastric ulcer in rats with comparison of standard drug, ranitidine. According to Prateek Dixit. *et al*, 2014 [2] the ethanolic extract of *polyalthia longifolia* was investigated for anti-ulcer activity against aspirin plus pylorous ligation induced gastric ulcer in rats, HCl – ethanol induced ulcer in mice and water immersion stress induced ulcer at 300 mg/kg body weight which showed a significant reduction in gastric volume, free acidity and ulcer index as compared to control.

Cytotoxic Activity: O Atolani *et al*, 2019 [31] carried out cytotoxic assay to evaluate the potential cytotoxicity of Soxhlet extraction of seed of *Polyalthia longifolia* by using HFF on human foreskin fibroblast cells. Phadnis AP *et al*, 1988 [32] described cytotoxic activity of well known diterpenes compounds such as (-)-16-oxocleroda-3, 13(14) Edien-15-oic acid and (-)-16 α -hydroxycleroda-3,13(14)Z-dien-15,16-olide which are obtained from the leaves of *Polyalthia longifolia*. Alagbe J.O, 2017 [33] described Pharmacological studies on the bark and leaves of the *Polyalthia longifolia* which shows effective antimicrobial activity, cytotoxic function and hypotensive effects.

ETHNOMEDICINAL USES

(Tripta Jain and Kanika Sharma 2011) [34] described ethanopharmacological uses of *Polyalthia longifolia* like traditionally dried bark powder is given with milk for relief in menorrhagia and leucorrhoea, decoction made from bark is used to cure mouth ulcers, the seeds of this plant were used as febrifuge, the bark is also used as a febrifuge in Balasore district of Orissa. It is also used as a very popular herb in Bangladesh due to its traditional uses in treatment of rheumatism, bone fracture and gastric ulcer (Md. Moniruzzaman. *et al*, 2015) [35]. The bark is used in skin diseases, fever, diabetes, hypertension and helmenthiasis. (M. Marthanda Murthya. *et al*, 2005) [36]. The leaves, stem bark and root extracts of *Polyalthia longifolia* var. *Pendula* possess high antipyretic activities comparable to aspirin. This may provide scientific evidence for its use as a traditional remedy for fever (K. Annan. *et al*, 2013) [37]. The bark is used for the treatment of pyrexia and other bleeding disorders in India (Chandaka Lavanya. *et al*, 2018) [1]. Tribal people of Kharagone, Madhya Pradesh use stem bark to cure malignant tumor also the fresh stem bark juice is used in the treatment of the various digestive disorders. (Prashith Kekuda TR *et al*, 2014) [38], (Rashmi Saxena Pal. *et al*, 2016) [39]. The leaves of *Polyalthia longifolia* is also prescribed as herbal recipe by traditional medicine practitioners

(TMP) in Ilorin, Kwara State for the treatment of Diabetes mellitus, malarial fever, cough and hypertension (M. K. Bello and L. Lajide 2011) [40]. (Sengottuvelu S. *et al*, 2014) [41] shows its uterine disorder, and wound healing activity in rats from the ethanolic extract of leaves of *Polyalthia longifolia*. The plant has its utility in colitis, diarrhea, anorexia, sore throat, cough (Shazid M. D. Sharker. *et al*, 2010) [42] and helminthiasis as well as vitiated condition of Vatta and Pitta. (Patil Ankita Sanjeev and Gaurav Mahesh Doshi 2018) [43].

CONCLUSION

In this review we attempted to bring together the pharmacological, phytochemical and ethnomedicinal information on *Polyalthia longifolia*, a medicinally important *Polyalthia longifolia* used in the traditional system of medicine and an ancient remedy to be explored for novel therapeutic uses. The medicinal applications of this plant and the countless possibilities for investigation still remain in relatively newer areas of its function. So, we can say that the plant is not only used for an ornamental purpose but its good medicinal plant that can be further studied with phytochemistry aspects.

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