



A REVIEW ON BIOLOGICAL AND PHARMACOLOGICAL ACTIVITIES OF
HERBAL PLANT: *JUSTICIA GENDARUSSA*

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ABSTRACT

Medicinal plants are a reservoir of biologically active compounds with therapeutic properties that over time have been reported and used by diverse groups of people for treatment of various diseases. This review covers pharmacological activity on different parts of *Justicia gendarussa* including, Investigation of the phytochemical constituents, biological and pharmacological activities of the selected medicinal plants is reported. In Ayurveda, the plant is useful for the treatment of inflammation, bronchitis, vaginal discharges, eye diseases, dyspepsia and fever. The decoction of the leaves and tender shoots are diaphoretic and they are given in chronic rheumatism. Oil prepared from the leaves is useful in eczema, and the mixture of leaves is given internally for hemiplegia, cephalalgia and facial paralysis. This review article is a compilation of Pyrexia and biological activities of *Justicia gendarussa*.

Key words: *Justicia gendarussa*, Review, Pharmacological activity, Uses.

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INTRODUCTION:

There are many traditional systems of medicine in the world, each with different associated philosophies and cultural origins. Some of these, such as Tibetan traditional medicine, remain relatively localised in their country of origin; while others such as Ayurvedic and Chinese traditional medicines are increasingly used in many different areas of the world. Ayurveda is the most widely practised of the Indian traditional medicine

systems, but there are others such as Siddha and Unani which are also used in the Indian subcontinent.

India has centuries old and rich heritage of medicinal & aromatic plant due to diversity in environment for curing human illness. The most common illness is fever which is pharmacological known as pyrexia characterized by elevation of temperature

above the normal range of 36.5°C to 37.5°C. Fever is associated with symptoms of sickness behavior which consist of lethargy, depression, anorexia, sleepiness, & inability to concentrate. This increase in set point triggers increased muscle tone & shivering. However antipyretic medication can be effective at lowering the temperature which may include the affected persons comfort. Medicinal plants are the only easily accessible health care alternative for most of our population and traditional medicines remained a part of our integral health system (Aneesh *et al.*, 2009).

Pyrexia or fever

Pyrexia or fever is caused as a secondary impact of infection, tissue damage, inflammation, graft rejection, malignancy or other diseased states. It is the body's natural defense to create an environment where infectious agent or damaged tissue cannot survive. Normally the infected or damaged tissue initiates the enhanced formation of pro-inflammatory mediator's (cytokines like interleukin 1 β , α , β and TNF- α), which increase the synthesis of prostaglandin E2 (PGE2) near preoptic hypothalamus area and thereby triggering the hypothalamus to elevate the body temperature (Spacer and Breder, 1994). As the temperature regulatory system is governed by a nervous feedback mechanism,

so when body temperature becomes very high, it dilate the blood vessels and increase sweating to reduce the temperature; but when the body temperature becomes very low hypothalamus protect the internal temperature by vasoconstriction. High fever often increases faster disease progression by increasing tissue catabolism, dehydration, and existing complaints, as found in HIV, when fever during seroconversion results faster disease progression (Veugelers *et al.*, 1997). Most of the antipyretic drugs inhibit COX-2 expression to reduce the elevated body temperature by inhibiting PGE2 biosynthesis (Cheng *et al.*, 2005). Moreover, these synthetic agents irreversibly inhibit COX-2 with high selectivity but are toxic to the hepatic cells, glomeruli, cortex of brain and heart muscles, whereas natural COX-2 inhibitors have lower selectivity with fewer side effects. A natural antipyretic agent with reduced or no toxicity is therefore, essential.

Justicia gendarussa Burm f. Syn: *Gendarussa vulgaris* is an erect undershrub, 0.6 to 1.2 m in height with subterete branches. Leaves are simple, lanceolate or linear – lanceolate, 7.5 to 12.5 cm long, glabrous, short- petioled, pale green beneath and dark violet green above, 8 pairs of main nerves, mid rib and main nerves prominent on the under surface. Stems and branches are dark violet. Flowers are 5-12.5

cm long from the uppermost leaf -axils; white coloured, spotted with purple and clustered in the interrupted spikes. Fruits glabrous capsules. Calyx 3.8-5mm; with nearly glabrous linear segments. The leaves and roots are acrid, febrifuge, thermogenic, emetic, anodyne, emmenagogue, diaphoretic, insecticidal and antipyretic (Warrier *et al.*, 1995; Khare, 2007).

Scientific classification:

Kingdom: Plantae

Division: Magnoliophyta

Class: Magnoliopsida

Order: Scrophulariales

Family: Acanthaceae

Genus: *Justicia*

Species: *gendarussa*



Reported pharmacological activities of *Justicia gendarussa*

Antinociceptive and antidiarrheal activity

Phytochemical constituents, acute toxicity, antinociceptive and antidiarrheal activities were determined and assessed by various tests such as Molisch's test, Fehling test, Mayer's test, frothing test, FeCl₃ test, alkali test, Salkowski's test, Keller-killiani test and CuSO₄ test, OECD guidelines, formalin-induced pawlicking, acetic acid-induced writhing, castor oil and MgSO₄ induced diarrheal test by (Rahman *et al.*, (2018). The

extract showed presence of carbohydrates, alkaloids, flavonoids, tannins, glycosides, triterpenoids, fat and fixed oils. Mortality, behavioral changes or sign of any toxicity were not observed up to the dose as high as 4000mg/kg. The crude extract was found to have significant (P<0.05, vs. control) analgesic activity at the oral dose of 200 mg/kg and 400 mg/kg (b. wt.) in the tested animals. Moreover, both doses of (200 mg/kg and 400 mg/kg) ethyl acetate extract significantly (P<0.05, vs. control) reduced the gastrointestinal motility and inhibit the percentage of diarrhea in antidiarrheal models. But 400 mg/kg dose showed better antinociceptive and antidiarrheal activity than 200 mg/kg dose compared to control.

Cytotoxic effect

Cytotoxic effect of the root of *Gendarussa vulgaris* on MCF7 cell line and vero cell line done by Dasadia *et al.*, (2016). The effect of defatted methanolic extract of root of *Gendarussa vulgaris* at 100, 500, 1000 µg/ml concentration and compared with standard Vinblastine on MCF7 cell line using MTT cell viability assay and Trypan blue assay was evaluated. MTT cell viability assay of methanolic extract of root shows 7.3% cytotoxicity at 1000µg/ml concentration in MCF 7 cell line. MTT cell viability assay of methanolic extract of root shows 24.9 % cytotoxicity at 1000µg/ml concentration in vero cell line. The methanolic root extract of *Gendarussa vulgaris* does not shows cytotoxic activity in VERO &MCF 7 cell line.

Anti-inflammatory property

Anti-inflammatory property of the leaf extracts of *Gendarussa vulgaris* (G. vulgaris) Nees was

done by Saleem *et al.*, (2011). *G. vulgaris* Nees of the family Apocynaceae is a medium sized tree grown in semishade or no shade and is common in the Ernad and Nilambur taluks of Kerala. Various parts of this plant have been used in the treatment of ulcers, sores, inflammation, dyspepsia, healing of wounds, etc. *In vitro* method was estimated by human red blood cell membrane stabilisation (HRBC) method and *in vivo* method was estimated on the carrageenan induced paw oedema. Both the methods showed significant anti-inflammatory property of the different extracts tested. The alcoholic extract at a concentration of 300 mg/mL showed potent activity on comparing with the standard drug diclofenac sodium.

Anti-Oxidant Activity

The aerial part (leaf) extract of plant *Justicia gendarussa* evaluated for its anti-oxidant action through DPPH, free radical scavenging activity at the dose of 10 μ g/mL. The methanolic extract of the plant were studied for the anti-oxidant activities using *in-vitro* models (Kumaresh and Chowdhury, 2015). The plant extract of stem (methanol) *Justicia gendarussa* derived callus on the solid and liquid surface has been shown the remarkable anti-oxidant activity by DPPH scavenging at the concentration of 145 \pm 5.00 μ g/ml and 185 \pm 8.66 μ g/ml respectively (Chandrashekar, 2013).

Hepatoprotective Activity

The extract which is obtained by using the solvent methanol from the plant stem *Justicia gendarussa* shows the remarkable hepatoprotective action against CCl₄ induced hepatotoxicity in albino rats at the dose of 300mg/kg-1 (Krishna *et al.*, 2010). The methanolic and ethyl acetate fraction of plant

leaf *Justicia gendarussa* shows the hepatoprotective action in Carcon Tetrachloride (CCl₄) induced hepatic damage at the dose of 200 and 400mg/kg b.w (Phukan *et al.*, 2014).

Anti-viral Activity

The diphyllin glycosides obtain from the methanolic fraction of leaf and stem of plant *Justicia gendarussa* shows the anti-HIV activity against the broad spectrum HIV strains (Zhang *et al.*, 2017). The extract (ethanolic) obtained from plant leaves *Justicia gendarussa* showed the anti-HIV effect against HIV-infected MT-4 (Human T-cell leukemia lines) (Widodo *et al.*, 2018).

Anti-arthritic Activity

The extract (95% ethanolic extract) obtained from the plant leaf *Justicia gendarussa* shows the action against arthritic in FCA (Freund's complete adjuvant) induced arthritis in male albino wistar rats at concentration of 100mg/kg. Ethanolic (95%) plant extract of leaves *Justicia gendarussa* shows the activity against arthritis in FCA (Freund's complete adjuvant) and also in bovine type II collagen induced arthritis in male albino wistar rats at the dose of 100mg/kg (Paval *et al.*, 2009).

Trypsin and Protein denaturation inhibitory activity

Justicia gendarussa root and leaf shows the Trypsin (Proteinase) and remarkable inhibition of protein denaturation at the dose of 10, 100 and 1000 μ g/ml and 10, 25 and 50 μ g/ml leaf and root respectively. Methanolic extract of the

plant gives this activity (Patel and Zaveri, 2014).

Collagenase (Matrix Metalloproteinases) inhibitory assay

Plant methanolic extract of leaf *Justicia gendarussa* has been shown the Collagenase (Matrix metalloproteinases) inhibitory activity at the various concentration (100, 250, 500 and 1000µg/ml) (Patel and Zaveri, 2016).

Anti-bacterial activity

Plant *Justicia gendarussa* stem extract (aqueous and hexane extract) has been evaluated their anti-bacterial action against the *Escherichia coli* and *Staphylococcus aureus* by using the discs diffusion method (Venkatachalam *et al.*, 2019).

Anti-fungal activity

Hexane and aqueous extract from the plant stem *Justicia gendarussa* shows the significant anti-fungal action against *Candida albicans* through using the disc diffusion method (Venkatachalam *et al.*, 2019).

HRBC membrane stabilization assay

The plant leaves extract of the *Justicia gendarussa* showed the in-vitro membrane stabilization activity against the HRBC membrane stabilization assay at three different concentration 250, 500 and 1000 g ml⁻¹ (Nirmalraj and Perinbam, 2015).

In-vitro anthelmintic activity

The plant *Justicia gendarussa* leaves and stem extract obtained by using the solvent methanol shows the significant in-vitro anti-helmintic action at the dose of 10, 20, 30, 40 and 50mg/mL. Albendazole used as a reference drug at the concentration of 10mg/mL (Saha *et al.*, 2012).

Analgesic activity

Aerial part with ethanol (95% v/v) of the plant *Justicia gendarussa* showed the significant analgesic activity through the hot plate and acetic acid induced writhing test method at the concentration of 250 and 500mg/kg-1 (Jothimaniv *et al.*, 2010). The 95% ethanolic extract of leaves *Justicia gendarussa* shows analgesic activity on swiss albino mice through the acetic acid-induced writhing assay and hot plate method at the concentration of 125, 250 and 500mg/kg (Shikha *et al.*, 2010).

Anti-depressant activity

The aerial part of the plant *Justicia gendarussa* hydro-alcoholic (ethanol and water at 30:70 ratio) extract showed the anti-depressant activity by forced swimming test (FST) method at the dose of 250-500mg/kg (Mythili and Jothimanivannan, 2017).

Osteoblastic Activity

Justicia gendarussa leaves extract (96% ethanol) has been shown the significant osteoblastic action against the mouse osteoblastic cell line (MC3T3-E1) (Supparmaniam and Bohari, 2015).

Sedative and Hypnotic activity

The 95% v/v ethanolic extract of plant leaves *Justicia gendarussa* shows the sedative and hypnotic activity on the male swiss albino mice against the traction test and thiopental-induced sleep method at the concentration of 250 and 500mg/kg, p.o. (Subramanian *et al.*, 2014).

Anti-anxiety activity

Aerial part extract of (95% v/v ethanol) *Justicia gendarussa* shows the anti-anxiety activity on the swiss albino mice of either sex by elevated plus maze test and light dark test at the concentration of 250 and 500 mg kg⁻¹ b.wt. orally (Jothimaniv *et al.*, 2013).

Anti-diabetic activity

The plant methanolic extract of leaf *Justicia gendarussa* shows the anti-diabetic action against alloxan induced diabetic mice at the concentration of 200 and 400 mg/kg (b.w.) and the cytotoxicity assay was performed of the plant extract on brine shrimp (*Artemia salina*) nauplii using the Meyer method (Mohammed *et al.*, 2015).

Anti-hyperurcemic activity

Leaves of the plant *Justicia gendarussa* showed the anti-hyperuracemic activity in oxonate-induced hyperuracemia in rats in ethanol at the concentration of 5.2 g/g bw (Sangeetha *et al.*, 2014).

Anti-angiogenic activity

Determination of the anti-angiogenic activity of ethanolic and aqueous extract of the plant leaves *Justicia gendarussa* showed by Chrio Allontoic Membrane assay (CAM) assay. Both extract shows the inhibition of the neovascularization in concentration ranging from 10-100µg/ml (Sangeetha *et al.*, 2014).

Traditional Uses

In Ayurveda, the plant is useful for the treatment of inflammation, bronchitis, vaginal discharges, eye diseases, dyspepsia and fever. The decoction of the leaves and tender shoots are diaphoretic and they are given in chronic rheumatism. Oil prepared from the leaves is useful in eczema, and the mixture of leaves is given internally for hemiplegia, cephalalgia and facial paralysis.

The juice of the fresh leaves is dropped into the ear for earache and into the corresponding nostril on the side of the head affected with hemicranias (Kirtikar and Basu, 1994).

In Madagascar, the decoction of the root boiled with milk is used in rheumatism, dysentery and jaundice. The decoction of the flower tops is

generally used for the purpose of fumigation. *Justicia gendarussa* leaves are used as a contraceptive agent in male and female. Chewing of leaves in male reduces the sperm count and in female it postpone pregnancy.

Root extract obtained from *Justicia gendarussa* is mostly prescribed for constipation, laxative action helps in normal bowel movement.

CONCLUSION

The plant *Justicia gendarussa* has emerged as a good source of medicines for the treatment of various disorders. The crude extracts of these plants have also exhibited a wide range of *in vitro* and *in vivo* pharmacological effects, including anti-oxidant and anti-microbial. This review article provides an insight to the researchers regarding further exploration of unexplored species of this plant so that they can also be used as herbal drugs to cure various ailments.

REFERENCES

1. Aneesh, Hisham, M., Sekhar, M.S., Madhu, M., Deepa T.V. (2009). International market scenario of traditional Indian herbal drugs –India declining', *IJGP*, 3(3): 184-190.
2. Spacer, C.B., Breder, C.D. (1994). The neurologic basis of fever. *New England J Med*, 330: 1880-1886.
3. Veugelers, P.J., Kaldor, J.M., Strathdee, S.A., Page-Shafer, K.A., Schechter, M.T., Coutinho, R.A., Keet, I.P., Van Griensven, G.J. (1997). Incidence and prognostic significance of symptomatic primary human immunodeficiency virus type 1

- infection in homosexual men. *J Infect Dis*, 176: 112-117.
4. Cheng, L., Ming-liang, H., Lars, B. (2005). Is COX-2 a perpetrator or a protector? Selective COX-2 inhibitors remain controversial. *Acta Pharmacologica Sinica*, 26 (8): 926-933.
 5. Warriar, P.K., Nambiar, V.P.K., Ramankutty, C. *Indian Medicinal Plants—A Compendium of 500 Species*, vol. 3. Orient Longman Ltd., Chennai. 272–273.
 6. Khare C.P. (2007). *Indian medicinal plants*, springer science – business media LIC. 350.
 7. Mushiur Rahman S.M., Saha, B., Rahman, Md. H. Islam A, Nahar S, Hasan, T.I., Sakib, N. (2018). Phytochemical screening, acute toxicity, antinociceptive and antidiarrheal activity of *Gendarussa vulgaris* leaves extract. *Journal of Pharmacognosy and Phytochemistry*. 7(5): 577-584.
 8. Dasadia, J., Vyas, V., Patel, S., Zaveri, M. (2016). *In-vitro* Cytotoxicity of Root of *Gendarussa Vulgaris* on MCF 7 and Vero Cell. *J PharmSci Bioscientific Res*. 6(5):660-665.
 9. Mohamed Saleem, T.K., Azeem, A.K., Dilip, C., Sankar, C., Prasanth N.V., Duraisami. R. (2011) Anti-inflammatory activity of leaf extracts of *Gendarussa vulgaris* Nees. *Asian Pacific Journal of Tropical Biomedicine*. 1(2):147-9.
 10. Kumaresh, P., Chowdhury, R.H. (2015). Phytochemical and anti-oxidant studies of *Justicia gendarussa* Burm. F. an ethanomedicinal plant. *International Journal of Pharmaceutical Sciences and Research*, 6: 3454-62.
 11. Chandrashekar N.B. (2013). Evaluation of plant and callus extracts of *Justicia gendarussa* Burm. f. for phytochemicals and antioxidant activity. *International Journal of Pharmacy and Pharmaceutical Sciences*. 5: 82-85.
 12. Krishna, K.L., Mruthunjay, K., Patel, J.A. (2010). Antioxidant and Hepatoprotective Potential of Stem Methanolic Extract of *Justicia gendarussa* Burm. *International Journal of Pharmacology*. 6: 72-80.
 13. Phukan, B., Kakoti, B., Verma, V., Kumar, A. (2014). Hepatoprotective Activity of *Justicia gendarusa* Linn. Leaves in Carbon Tetrachloride Induced Liver Injury in Mice. *Journal of Natural Remedies*, 14: 132-137.
 14. Zhang, H.J., Rumschlag-Booms, E. Guan, Y.F., Liu, Wang, D.Y., Li, W.F., Rong, L. (2017). Anti-HIV diphyllin glycosides from *Justicia gendarussa*. *Phytochemistry*, 136: 94-100.
 15. Widodo, A., Widiyanti, P., Prajogo, B. (2018). Antiviral activity of *Justicia gendarussa* Burm.f. leaves against hiv-infected MT-4 cells. *African Journal of Infectious Diseases*. 12: 36-43.
 16. Paval, J., Kaitheri, S.K., Potu, B.K., Govindan, S., Kumar, R.S., Narayanan, S.N., Moorkoth, S. (2009). Comparing the anti-arthritis activities of the plants *Justicia gendarussaburm* F. and *Withania somnifera* Linn. *International Journal of Green Pharmacy*, 3: 281-281.
 17. Patel, S.S., Zaveri, M.N. (2016). Collagenase inhibitory activity and phytochemical profile of leaf of *Justicia gendarussa*. *World Journal of Pharmaceutical Research*, 5: 1382-1389.

18. Venkatachalam, D., Rahman, A., Sunny, B., Jacob, J., Kuriyan, N. Raman, R. Vaniapurackal, R. (2019). Screening of Antimicrobial Activity of Various Extracts of the Stem *Justicia gendarussa*. Asian Journal of Research in Medical and Pharmaceutical Sciences, 6: 1-7.
19. Nirmalraj, S., Perinbam, K. (2015). Studies on Phytochemical Screening and in vitro Antioxidant Activity of Ethyl Acetate Leaf Extract of *Justicia gendarussa* Burm. F. Research Journal of Botany, 10: 30-36.
20. Saha, M.R., Debnath, P.C., Rahman, M.A., Islam, M.A.U. (2012). Evaluation of in vitro anthelmintic activities of leaf and stem extracts of *Justicia gendarussa*. Bangladesh Journal of Pharmacology. 7: 50-53.
21. Jothimaniv, C., Kumar, R.S., Subramania, N. (2010). Anti-Inflammatory and Analgesic Activities of Ethanol Extract of Aerial Parts of *Justicia gendarussa* Burm. International Journal of Pharmacology. 6: 278-283.
22. Shikha, P., Latha, P. G., Suja, S.R. Anuja G.I., Shyamal, S., Shine, V.J., Sini, S., Kumar, K., Rajasekharan, N.M. (2010). *Justicia gendarussa* Burm. f. leaves. Indian Journal of Natural Products and Resources. 1: 456-461.
23. Mythili, A., Jothimanivannan. (2017). Evaluation of anti-depressant activity of ethanolic extract of *Justicia gendraussa* Burm with wister rat. International Journal of Drug Development and Research. 9.
24. Supparmaniam, K., Mohd Bohari S.P. (2015). Effects of *Justicia gendarussa* ethanolic extract on osteoblastic activity of mc3t3-e1 cell. Jurnal Teknologi, 77: 1-6.
25. Subramanian, N., Jothimanivannan, C., Senthilkumar, R., Kameshwaran, S. (2014). Sedative and hypnotic activity of ethanolic extract of *Justicia gendarussa*. International Journal of Phytopharmacology. 5: 354-357.
26. Jothimaniv, C., Subramania, N., Senthil Kumar, R., Kameshwara, S. (2013). Evaluation of Anti-anxiety Activity of *Justicia gendarussa* Burm. Pharmacologia, 4: 404-407.