ISSN No:-2456-2165

Phytochemicals of *Jatropha gossypiifolia* (Linn.): A Review

Reetu Dubey[1], Sanjukta Rajhans[2], Archana U. Mankad[3]
Department of Botany, Bioinformatics and Climate Change Impacts Management
School of Science, Gujarat University
Ahmedabad, Gujarat, India.

Abstract:- *Jatropha gossypiifolia* (Linn.) is one of the poisonous ornamentals, as well as a medicinal plant. The shrub is native to Gujarat State (India), Central and South America. This review study includes the complete Botanical description, Phytochemical constituents and Pharmacological activity and ethnomedicinal properties of *Jatropha gossypiifolia* (Linn.) plant parts. *Jatropha gossypiifolia* (Linn.) is a member of the family Euphorbiaceae, which is the largest family belonging to the Angiosperms. This plant has been used since ages for its well-known medicinal properties. It has been well established that the phytochemicals are responsible for the pharmacological properties. This review has included extensive information regarding the various aspects of the plant.

Keywords:- *Jatropha gossypiifolia (Linn.), Pharmacological properties, Phytochemistry, Traditional uses.*

I. INTRODUCTION

Jatropha gossypiifolia (Linn.) is small shrub, common ornamental garden plant and medicinal plant belonging to family Euphorbiaceae. The family contains 172 identified species. Euphorbiaceae is the largest family among the Angiosperms (J. Felix-Silva *et al.*, 2014). It is placed in the order, "Geraniales". Euphorbiaceae family is rich in secondary metabolites such as alkaloids, cyanogenic glycosides, diterpenes, glucosinolates, tannins and triterpenes. *Jatropha* is a Greek word in which *"jatros"* means doctor and *"trophe"* means food (Kumar A and Sharma S, 2008; Sabandar C.W. *et al.*, 2013). This present review of *Jatropha gossypiifolia* (Linn.) is focused on its morphology, distribution, phytochemistry, medicinal properties, ethnomedicinal uses and its future prospectives.

➢ *Taxonomy of Jatropha gossypiifolia (Linn.)*
- **Kingdom:** Plantae (Plant)
- **Subkingdom**: Tracheobionta (Vascular plant)
- **Super-division:** Spermatophyta (Seed plant)
- **Division:** Magnoliophyta (Flowering plants)
- **Class**: Magnoliophyta (Dicotyledons)
- **Order** – Geraniales
- **Family**- Euphorbiaceae
- **Genus** - *Jatropha*
- **Species** – *gossypiifolia* (L.)

***Jatropha gossypiifolia* plant**: *Jatropha gossypiifolia* (Linn.) is a member of the family Euphorbiaceae. The plant is monoecious, erect, soft wooded and deciduous. (Hammad Saleem *et al.*, 2015). The plant attains an average height of 1.8-2.5m. (Md. Mahmodul Islam *et al.*, 2017; Hammad Saleem *et al.*, 2015). Stems are non woody and hairy with Height 8.5cm to 10.5 cm and width 10cm to 12 cm. Surface of the stem is reddish brown to greenish in colour. (V. S. Parvathi, *et al.*, 2012). The branches are rich in laticiferous ducts. The leaves are dark green in colour. Serrated margin, acuminate apex with alternate and palmate variation is seen. The petiole is long and the plant leaf margins are covered with multi headed glandular hairs. (Md. Mahmodul Islam, *et al.*, 2017). The stipules are thick and 3-5 lobed. Anamocytic type of stomata is mostly present on the lower surface of the leaves. (V. S. Parvathi *et al.*, 2012). The Reddish-purple colour flowers are unisexual. The shape of the fruit is like capsule. The capsule consists of a seed with a single locule. (V. S. Parvathi *et al.*, 2012). The seeds are spherical in shape and are greyish-brown in colour. These contain copious starchy endosperm. (Hammad Saleem *et al.*, 2015). The seed pods are like cherries. These are very poisonous in nature. (Félix-Silva *et al.*, 2014). They are dark red in colour. The male flower consists of a petaloid tube. The *Jatropha gossypiifolia* (Linn.) forms a unique five root system in which the tap root is present in the centre and other four roots are on the periphery. (M. B. G. Viswanathan *et al.*, 2018).

➢ *Vernacular names of Jatropha gossypiifolia (L.)*
- India: Athalai, Lal-bherenda, Ratan-jyoti
- French: Medicinier sauvage
- Spanish: Purga de huane
- Marma: Karachuni
- Garo: Kander
- Africa: Babatidjin
- Nigeria: Pignut, Fignut, Lapalapa, Botuge pupa, Botuje red, Binidasugu.
- Venezuela: Frailecillo, Sibidigua, Tuatua. (J. F. Silva *et al.*, 2014).

Distribution: *Jatropha gossypiifolia* (Linn.) is native to the Gujarat State (India), Central and South America. (Sabandar C.W. *et al.*, 2013). It is mostly found in the tropical regions of the world. The plant is widely distributed in the subtropical and semiarid regions of African and the American regions of the world. (S. R.

Mariz *et al.*, 2010). In India generally, the plant is seen in the wild.

Flowering season of *Jatropha gossypiifolia* (L.): April-August (Shahidul *et al.* 2019)

II. PHYTOCHEMISTRY OF THE PLANT

The whole plant of *Jatropha gossypiifolia* (Linn.) is rich in many bio-active compounds. The plant parts contain different phytochemical constituents. These chemical constituents have been extracted by using various solvent systems. (C. Lans 2007; R. Seth and R. Sarin., 2010). Phytochemicals like alkaloids, flavonoids, diterpenoids, tannins, steroids, saponins, phenolic compounds have been found to be present in this species. (Nwokocha *et al.*, 2011; Rufino *et al.*, 2010; Gupta *et al.*, 2011). The species is also rich in anthocyanins, carotenoids, carbohydrates, proteins, phytosterols and amino acids. (Rufino *et al.*, 2010).

The leaves of the plant are rich in tannins, phenols and flavonoids. The bark has the highest amount of the alkaloid named as Jatrophine. (Oduola *et al.*, 2005). Jatroden (a lignin) isolated from stem part of *Jatropha gossypiifolia* (Linn.). (Oduola *et al.*, 2005). The priminary phytochemical screening showed that the stem of *Jatropha gossypiifolia* (Linn.) plant are rich in lignin and also possess Jatrophan, Gadain, Prasanthaline, Arylnapthalene, Gossypifan, Jatrodien, Gossypiline, Gossypidien, Isogadain. (Sabandar C.W. *et al.*, 2013). The stems are also contended with tannins, steroid, phenolic substances (tetradecyl-(E)-ferulate, ferulic acid and fraxetin), ascorbic acid, alkaloids (4'-O-Demethyl retrochinensin) flavonoids. (N. Nwokocha *et al.*, 2011), lignoids and terpenoids (Vitexin, Isovitexin, Apigenin). (Sabandar C.W. *et al.*, 2013; Singh *et al.*, 2014; Zhang X.P. *et al.*, 2009; Das B. *et al.*, 2018). In *Jatropha gossypiifolia* (Linn.) root the content of the phenolic compounds is very high. This is one of the main compounds responsible for the anti-inflammatory and anti-oxidant properties. (Maisuthisakul *et al.*, 2007). Sesquiterpenes such as 1,4-Epoxy-p-methan-2-ol and 4-Patchoulen-15-oic acid are found mostly in the rhizomes. The roots contain 9β-13α-Hydroxyisabellion and jatrophenone as the chief compounds. (Pertino *et al.*, 2007).

The whole plant is rich in phenolic acids such as galic, vanilic, syringic, 2,5-dihydroxy benzoic, p-coumaric, caffeic, and rosmarinic. (Povichit *et al.*, 2010; Nwokocha *et al.*, 2011). In addition, Seeds of this species show the presence of polyunsaturated diterpenes diester. (Haas *et al.*, 2002; Jing *et al.*, 2005). K. M. Hosamani and K. S. Katagi, 2008 have isolated various types of fatty acids from the seeds in the petroleum ether extract. Zhang X.P. *et al.*, 2009 discovered a new compound Cyclogossine A in the Latex part of *Jatropha gossypiifolia* (Linn.). The essential oils from the stem and leaves contain bioactive compounds such as limonene, menthol, linalool and caryphyllene which are used as flavouring agents in food products in European Commission. (H. Morten *et al.*, 2012).

Classification	No.	Chemical component	Part of plant	Reference
Protein	1.	Cyclogossine A	Latex	Zhang X.P. *et al.*, 2009
	2.	Cyclogossine B	Latex	Fatokun *et al.*, 2016
Alkaloid	3.	Ricinine	Leaves	Bullangpoti V. *et al.*, 2016
	4.	Piperidine	Whole plant	Fatokun *et al.*, 2016
	5.	4'-O-Demethyl retrochinensin	Stem	R. Das *et al.*, 2004
	6.	Cleomiscosin A	Stem	B.Das *et al.*, 2003
	7.	2α-Hydroxyjatrophone	Roots	F.X. Silva *et al.*, 2014
	8.	2β-Hydroxy-5,6-isojatrophone	Roots	F.X. Silva *et al.*, 2014
	9.	2β-Hydroxyjatrophon	Roots	F.X. Silva *et al.*, 2014
	10.	Piperidine	Whole plant	Fatokun *et al.*, 2016
	11.	9-acetoxynerolidol	Seeds	Falodun A *et al.*, 2012
Phenols	12.	Gallic Acid	Whole plant	Povichit *et al.*, 2010
	13.	Vanilic Syringic	Whole plant	Povichit *et al.*, 2010
	14.	2,5-dihydroxy benzoic	Whole plant	Povichit *et al.*, 2010
	15.	Caffeic	Whole plant	Povichit *et al.*, 2010
	16.	Rosmarinic acid	Whole plant	Povichit *et al.*, 2010
Flavonoid	17.	Ferulic acid	Stem	C.W. Sabandar *et al.*, 2013
	18.	Fraxetin	stem	C.W. Sabandar *et al.*, 2013
Coumarin-lignoid	19.	p-coumaric	Aerial parts	Fatokun *et al.*, 2016
	20.	Gossypiline	Aerial parts	Shahwar D. *et al.*, 2010
	21.	Gossypifan	Stem	Povichit *et al.*, 2010
	22.	Vitexin	Leaves	C.W. Sabandar *et al.*, 2013
	23.	Apigenin	Leaves	C.W. Sabandar *et al.*, 2013
	24.	Isovitexin	Leaves	C.W. Sabandar *et al.*, 2013

Coumarin-lignoid	25. 26. 27. 28. 29. 30. 31. 32.	Prasanthaline Isogadain Cleomiscosin A Gossypidien Jatrodien Jatrophane Jatrophan Arylnapthalenes	Stem Stem Stem Stem Stem Roots Seeds seeds	Fatokun *et al.*, 2016 Biswanath D *et al.*, 2003 Biswanath D *et al.*, 2003 Biswanath D *et al.*, 2003 Fatokun *et al.*, 2016 Fatokun *et al.*, 2016 Fatokun *et al.*, 2016 Fatokun *et al.*, 2016
Diterpene	33. 34. 35. 36. 37. 38. 39. 40. 41.	Propacin Jatropholone A Jatrophone B Jatrophone Jatrophenone Falodone 12-Deoxy-16-hydroxyphorbol 9b-13a-Hydroxyisabellione Citlalitrion	Whole plant Roots Roots Roots Whole plant Roots Seed oil Rhizome Whole stem	Das and Venkataiah., 2001 Fatokun *et al.*, 2016 Fatokun *et al.*, 2016 Fatokun *et al.*, 2016 Ravindranath N *et al.*, 2003 A. Falodun *et al.*, 2012 C.W. Sabandar *et al.*, 2013 Pertino *et al.*, 2007 Das *et al.* 2009
Cardiac-glycosides	42. 43. 44. 45.	Apogenin Isovitexin Orientin/Isoorientin Schaftoside	Leaves Leaves Leaves Leaves	F.X. Silva *et al.*, 2014 F.X. Silva *et al.*, 2014 A. C. Pilon *et al.*, 2014 A. C. Pilon *et al.*, 2014
Esters	46.	12-Deoxy-16-hydroxylphorbol	Seeds	Fatokun *et al.*, 2016
Fatty acids	47. 48. 49. 50. 51. 52. 53. 54. 55. 56.	Oleic acids Palmitic acid Palmitoleic acid Ricinoleic acid Stearic acid Vernolic acid Myristic acid Linoleic acid Capillic acid Arachidic acid	Seeds Seeds Seeds Seeds Seeds Seeds Seeds Seeds Seeds Seeds	K. M. Hosamani and K. S. Katagi,2008 K. M. Hosamani and K. S. Katagi,2008 K. M. Hosamani and K. S. Katagi,2008 K. M. Hosamani and K. S. Katagi,2008 K. M. Hosamani and K. S. Katagi,2008 K. M. Hosamani and K. S. Katagi,2008 K. M. Hosamani and K. S. Katagi,2008 K. M. Hosamani and K. S. Katagi,2008 K. M. Hosamani and K. S. Katagi,2008 K. M. Hosamani and K. S. Katagi,2008
Triterpenes	57. 58. 59.	2,24,25-Trihydroxylanosta-1,7dien-3-one 2,24,25-Trihydroxylanost-7-en-3on 3-O-acetylaleuritolate acid	Leaves Leaves Rhizome	Fatokun *et al.*, 2016 Fatokun *et al.*, 2016 C.W. Sabandar *et al.*, 2013
Monoterpene	60.	1,4-Epoxy-p-methan-2-ol	Rhizome	Pertino *et al.*, 2007
Sesquiterpene	61.	4-Patchoulen-15-oic acid	Rhizome	Pertino *et al.*, 2007

Table 1

III. PHARMACOLOGICAL ACTIVITIES

Jatropha gossypiifolia (Linn.) plant plays a key role in the treatment of various infectious as well as non-infectious ailments. Various relevant scientific studies have confirmed its pharmacological potential. So far numerous researchers have reported, *Jatropha gossypiifolia* (Linn.) as a plant with wide range of pharmacological potential. Antimicrobial, antidiabetic, hepatoprotective, antioxidant, anti-inflammatory (Yerramsetty N. *et al*., 2013), cytotoxic, antihypertensive, antithrombotic, antipyretic (Murugalakshmi, M. *et al.*, 2014), anti-coagulating (Murugalakshmi M. *et al*., 2012), anti-cholinestrate (Pratap B. *et al*., 2013), analgesic (Panda *et al.*,2009), anti-schistosomicidal (Sherifat A. *et al.*, 2015), anti-malarial (Koudouvo K. *et al.*, 2011), antifertility (Sachin J. *et al*., 2012), anticancer (Apurba *et al.*, 2013), anti-diarrhoeal (Apurba *et al.*, 2013), pesticidal activity (Tripathi Y.C. *et al.*,2015) are some of the pharmacological properties this plant possesses.

➢ *Anti-bacterial Activity of the plant:*

Several studies have revealed the antibiotic potential of the plant using different extracts. (Seth and Sarin, 2010; Purohit and Purohit, 2011). Aqueous and Benzene extract of the leaves demonstrated antimicrobial activities against *Bacillus subtilis* and *Escherichia coli*. As a result, the aqueous extract showed minimum effect (zone of inhibition 2.04 ± 0.02mm) and the benzene extract displayed the maximum antimicrobial potential (zone of inhibition 13.05 ± 0.02mm) in opposition of the organism (Seth and Sarin 2010). Okho *et al*., 2016 investigated the antibacterial potential of the essential oil extracted from the stem and the leaves, against *E. coli*, *E. faecium*, and *S. aureus.* The extract derived from the stem exhibited the maximum potential (MIC=0.025–0.05mg/ mL) and the extract derived from the leaf showed minimum efficacy (MIC = 0.05–0.1mg/mL) against the test microorganisms.

Jatropha gossypiifolia (Linn.) methanolic extract has shown potential against various pathogens such as *A. fumigatus*, *A. flavus*, *S. pyogene* and *S.typhi*. (Singh, 2018). The different concentrations of the ethanolic and the aqueous leaf extracts have shown inhibitory effects against *E. coli*, *S. aureus*, *N. gonorrhea* and *C. albicans* bacteria. (Ajayi, O.A. *et al*., 2018). *Jatropha gossypiifolia* (Linn.) ether, alcohol, chloroform leaf extracts showed antimicrobial activity against *Escherichia spp*., *Pseudomonas spp*., *Staphylococcus spp*., and *Bacillus spp*. The best result was obtained in the alcoholic extract. (D. A. Dhale and A. R. Birari., 2010). The leaf extract of dichloromethane/methanol (DCl/MeOH) possesses antibacterial activity & antiprotozoal activity against *Staphylococcus aureaus,* and *Plasmodium falciparum.* (Jansen *et al*., 2010).

➢ *Anti-diabetic Activity of the plant:*

Diabetes mellitus is a chronic disease caused by the deficiency of insulin. Saleem *et al.*, 2016 demonstrated that the extracts from *Jatropha gossypiifolia* (Linn.) plants showed significant α-glucosidase activity. The α-glycosidase comprises of a family of enzyme hydrolase, which is located in the brush-border surface membrane of small intestinal cells. Neha R. *et al*., 2013 has revealed that the stem possesses antidiabetic activity and hypolipidemic activity in a fraction comprising of 95% ethanolic extract with chloroform. The fraction restored the blood glucose profile, serum lipid level, renal and hepatic functions to nearly normal level.

➢ *Anti-inflammatory Activity of the plant:*

The methanolic extracts of the aerial parts of the plant were effective in reducing pain and inflammation in carrageenan-induced paw oedema in rats. (Panda B. B. *et al*., 2009). The ethanolic extracts of the leaves are similarly effective in reducing pain and inflammation (Bhagat *et al.*, 2011). The leaf extract of the plant was treated with aqueous (4.2%) and ethanol (5.8%) and was dried. At 200µg/mL concentration both the extracts showed essential immobilization of membrane of Human red blood cell (HRBC) (Nagaharika *et al.*, 2013). Some researchers have explained that some secondary metabolites such as alkaloids and steroids present in the extracts have the ability to reduce the release of histamine, kinins and serotonin, which are the main reasons for inflammation. (Bhagat *et al*., 2011; Nagaharika *et al.*, 2013).

Ahmed S. A. *et al*., 2015 also described the anti-inflammatory and anti-arthritis activity of the plant due to the rich flavonoid content of the latex of *Jatropha gossypiifolia* (Linn.). The latex showed the anti-inflammatory potential in carrageenan induced acute model (edema) and anti-arthritis potential in CFA induced (sub-chronic model) in rats. Xavier-Santos *et al.*, 2018 revealed that the leaf extract of the plant was rich in C-glycosyl flavonoids and was the main curing agent of the cutaneous inflammatory disease.

➢ *Anti-oxidant Activity of the plant:*

The leaf extracts possess antioxidant properties (Kharat *et al.*, 2011; J. Sachin *et al*., 2015; F. Silva *et al.*, 2014). The presence of the phytochemicals such as tannins, phenols and flavonoids are responsible for the antioxidant activity. (Okoh *et al.*, 2016; Shahwar *et al.*, 2010). The leaf and the stem bark have shown the activity with the IC50 value of 31.32 ± 1.72µg/mL and 10.79 ± 1.56µg/mL. (Rofida, 2015). Okoh *et al.*, 2016 studied the antioxidant activity from the essential oils of the stems and leaves. The drugs produced from the oils create a probability for curing Alzheimer's disease and arteriosclerosis (Qinghua Wu *et al*., 2019).

➢ *Anti-cancer Activity of the plant:*

Investigation of the cytotoxic potential of the plat has provided positive results. (G.M. Cragg and D. J. Newman., 2005). The methanolic and the ethanolic extracts of the stem has shown positive result against HeLa cell lines (Nazeema and Girija 2013). A diterpenoid Falodone has been isolated from the roots of the plant. This diterpenoid exhibited potent proliferation inhibition activity against the A-549 human cancer cell line (Falodun *et al.*, 2012). Jatrophone a phytochemical isolated from the stem bark

ISSN No:-2456-2165

was effective against human cancer cell line Hep G2. (ASEP *et al.*, 2017). Like the various parts of the plant the latex has also exhibited anticancer properties. (F. O. A. Ajose, 2007). Phytochemicals like Jatrophone, Jatrophenone, and Spruceanol are the main constituents for the effective results against various cancer cell lines. (Devappa *et al.*, 2011).

➢ *Anti-neoplastic Activity of the plant:*

A phytochemical named Jatrophone present in the plant *Jatropha gossypiifolia* (Linn.) exhibited an effective result against the hepatocellular cancer cell line Hep G2 1886. (Asep *et al.*, 2017). The leaves and branches of this plant contain a phytochemical named atrogossones which have been reported to be effective against RKO colon carcinoma cell line. (Zhang *et al.*, 2018).

➢ *Anti-purgative Activity of the plant:*

In castor- oil induced diarrhoea, the methanolic extract of the leaves, at the oral doses of 200 and 400 mg/kg showed significant antidiarrheal activity in mice. The results were highly satisfactory with the decreasing of the mean number of stool and total weight of the faecal output when compared with the control group. (Apu A.S. *et al.*, 2013; Apurba S.A. *et al.*, 2012).

➢ *Anti-cholinesterase Activity of the plant:*

Dichloromethanolic extracts of leaves and roots and methanolic extracts of roots exhibited inhibition of acetylcholinesterase activity at the rate of 57.71–65.43% (Saleem *et al*., 2016). The leaf extracts of the plant demonstrated the inhibition of acetylcholinesterase at the rate of IC50 =0.05mg/mL. (Feitosa *et al.*, 2011). Content of the alkaloids is considered responsible for the maximum level of acetylcholinesterase inhibition. (Saleem *et al.*, 2016).

➢ *Anti-plasmodial Activity of the plant:*

The ethanolic leaf extract of the plant has shown effective results against *P. berghei.* This proves the presence of anti-plasmodial property in the plant specifically in the leaves. (Onyegbule F. A. *et al.*, 2019).

➢ *Neuropharmacological, Sedative and Anxiolytic Properties of the plant:*

Using the hole cross test model researcher Apu *et al.*, 2013 explored the neuropharmacological potential of *Jatropha gossypiifolia* (Linn.) in the methanolic extracts of the fruits and leaves in oral doses of 200 and 400mg/kg in mice. The result was positive for both the extracts. The maze test model represented the sedative and anxiolytic properties of the plant with the dose of 200mg/kg. (Falodun A *et al.*, 2012).

➢ *Lipoxygenase Inhibitory Properties of the plant:*

Saleem *et al.*, 2016 have explored the lipoxygenase inhibitory potential from the various extracts of the plant. The Hexane extract demonstrated the minimum inhibition rate (36.1%) and the dichloromethane extract showed the maximum inhibition rate (92%).

Ethnomedicinal uses: This species of *Jatropha* is used as an effective ethnomedicinal plant. (M.R. Khan *et al.*, 2006).

- In Africa, Latin America and Asia, the plant extracts are used in curing various ailments. (Ayelaagbe, 2007; Sabandar C.W. *et al.*, 2013).
- The young and fresh stems are used as toothbrush and for cleansing the tongue. (Sherifat A. *et al.*, 2015).
- The plant is used for managing diabetes, curing cancer and skin diseases. (S. O. Okoh *et al.*, 2016).
- In certain regions of India, the plant is used for treating diarrhoea, dysentery, itching and eczema. (R. Seth and R. Sarin., 2010).
- In Nigeria, the crushed leaves of the plant are used for treating haemorrhoids, bleeding nose, malaria, eczema, stomach-ache and typhoid. (Opeyemi O. F. *et al.*, 2017).
- The leaf decoction is used for cleaning wounds, the stem sap is applied on skin for providing relief from itching cuts, scratching and bleeding. (B. B. Panda *et al.*, 2009).
- The bark decoction is used for emmenagogue. The roots are used as an antivenom for snakebite. The leaves are used for providing relief from stomach ache and are effective as blood purifiers. (B. B. Panda *et al.*, 2009).
- The various parts are used for curing tooth related problems, ringworm and for reducing inflammation. (Vijayakumar *et al.*, 2016).
- In China the plant is used for reducing pain and fever. It is also used in dysentery. (Geronikaki A *et al.*, 2003).
- Extracts of the stem bark, leaf and root help in the inhibitory effects of α-glucosidase and α-chymotrypsin. The plant is a potential natural healer for ulcers and diabetes. (Saleem and Gill, 2016).
- In Latin America and Caribbean region, the leaves are used in curing rashes, sprains and sores. The latex of the plant is effective against microbes. (Uddin *et al.*, 2006).
- In Togo region the leafy stems are used for treating anaemia (Koudouvo *et al.*, 2011).
- In Ghana the leaf decoction is effective in treating malaria with the combination of *Ocimum canum* and *Combretum ghaselensis* plant parts.

IV. CONCLUSION

From the review of the available works it was concluded that *Jatropha gossypiifolia* (Linn.) is a valuable plant. The plant is used by the traditional healers and is considered as one of the most important ethnomedicinal plant. Almost every part possesses some or the other pharmacological activity. The review has extensively included the list of the phytochemicals present in the specific parts of the plant. Although some of the phytochemicals have been isolated till date, many more are still left to be explored. The review will be helpful for the future explorations of the plant.

REFERENCES

[1]. A. Falodun, U. Kragl, S.-M. T. Touem, A. Villinger, T. Fahrenwaldt, and P. Langer, (2012); A novel anticancer diterpenoid from *Jatropha gossypiifolia*; *Natural Product Communications;* 7(2):151–152.
[2]. Apu A.S, Hossain F, Rizwan F. (2013); Study of pharmacological activities of methanol extract of *Jatropha gossypiifolia* fruits. *Journal of Basic and Clinical Pharmacy*.;4(1):20–24.
[3]. Apurba S.A, Faruq H, Farhana R, Shakhawat H.B, Maima M, Jamaluddin A.T.M. (2012-2013); Study of pharmacological activities of methanol extract of *Jatropha gossypiifolia* fruits. *Journal of Basic Clinical Pharmacy*; 4(1):2024.
[4]. Arfa S. Ahmed, C. T. Chopde, Z. N. Kashmiri (2015); Assessement Of Anti-Inflammatory and Anti-Arthritis Activity of *Jatropha gossypiifolia* In Rats; *International Journal of Pharmacy and Pharmaceutical Sciences*; 7(1): 258-260
[5]. Ashrafuzzaman, Zannatul Naim, Mustahsan Billah, Masud Rana SM., (2019); Biomedical and medicinal properties of *Jatropha gossypiifolia* plants: a short review; MOJ *Bioequivalence & Bioavailability*; 6(1); 7–8
[6]. B. B. Panda, Kalpesh Gaur, M.L. Tyagi, R.K. Nema, C.S. Sharma and A.K. Jain (2009); Anti-inflammatory and Analgesic Activity of *Jatropha gossypiifolia* in Experimental Animal Model; *Global Journal of Pharmacology*; 3(1):1-5.
[7]. Bhagat R., Ambavade S. D., Misar A. V., Kulkarni D. K., (2011); Anti-inflammatory activity of *Jatropha gossypiifolia* L. leaves in albino mice and wistar rat. *J. Sci. Ind. Res.* 70(4):289-292.
[8]. Bharathy V, B. Maria Sumathy and F. Uthayakumari., (2012); determination of phytocomponents by gc – ms in leaves of *Jatropha gossypiifolia* l; *Science Research Reporter* 2(3):286-290.
[9]. Bullangpoti V, Khumrungsee N, Pluempanupat W, Kainoh Y, Saguanpong U. (2011); Toxicity of ethyl acetate extract and ricinine from *Jatropha gossypiifolia* senescent leaves against Spodoptera exigua Hubner [Lepidoptera: Noctuidae]. *Journal of Pesticide Science*. ;36(2): 260–263.
[10]. C. W. Sabandar, N. Ahmat, F.M. Jaafar, and I. Sahidin,(2013); Medicinal property, phytochemistry and pharmacology of several *Jatropha* species (Euphorbiaceae): a review; *Phytochemistry*; 85:7–29.
[11]. Das, B., Reddy, K.R., Ravikanth, B., Raju, T.V., Sridhar, B., Khan, P.U., Rao, J.V., (2009). Multifidone: a novel cytotoxic lathyrane-type diterpene having an unusual sixmembered A ring from *Jatropha multifida*. *Bioorganic and Medicinal Chemistry Letters*; 19(1):77–79.
[12]. Deo SS, Chaudhari TM, Inam F(2012); Evaluation of the immunomodulatory effects of 1-phenylnaphthalene and pericarbonyl lactone lignan compounds. *Der Pharma Chemica*.; 4:771–776.
[13]. Falodun A, Sheng-Xiang Q, Parkinson G, and Gibbons S. (2012); Isolation and characterization of a new anticancer diterpenoid from *Jatropha gossypiifolia*. *Pharmaceutical Chemistry Journal*.;45(10):636–639.
[14]. G.M. Cragg and D.J. Newman (2005); *Journal of Ethnopharmarcology*, 100(1-2):72-79
[15]. H. Morten, T. L. Mygind and M. Rikke, (2012); Essential oils in food preservation: mode of action synergies and interactions with food matrix components; *Front Microbiology*; 3(12).
[16]. Hammad Saleem, Irshad Ahmad, M Ashraf, M Shoaib Ali Gill, Muhammad Faisal Nadeem, M Nabeel Shahid and Kashif Barkat. (2015); In vitro Studies on Anti-diabetic and Anti-ulcer Potentials of *Jatropha gossypiifolia* (Euphorbiaceae); *Tropical Journal of Pharmaceutical Research*; 15(1):121-125
[17]. J. Felix-Silva, R. B. Giordani, A. A. Silva-Jr, S. M. Zucolotto, and M.F. Fernandes-Pedrosa., (2014); *Jatropha gossypiifolia* L. (Euphorbiaceae): A Review of Traditional Uses, Phytochemistry, Pharmacology, and Toxicology of This Medicinal Plant; *Evidence-Based Complementary and Alternative Medicine;* 1-33
[18]. J. S. Ashidi, P. J. Houghton, P. J. Hylands, and T. Efferth, (2010); Ethnobotanical survey and cytotoxicity testing of plants of South-western Nigeria used to treat cancer, with isolation of cytotoxic constituents from Cajanus cajan Millsp. leaves," *Journal of Ethnopharmacology;* 128(2):501–512.
[19]. J.D.F.L. Santos, E. Pagani, J. Ramos and E. Rodrigues (2012); Observations on the therapeutic practices of river in ecommunities of the Unini River, AM, Brazil; *Journal of Ethnopharmacology*; 142(2):503–515.
[20]. K. M. Hosamani and K. S. Katagi, (2008); Characterization and structureelucidation of 12-hydroxyoctadec-cis-9-enoic acid in Jatropha gossypiifolia and Hevea brasiliensis seed oils: a rich source of hydroxy fatty acid," *Chemistry and Physics of Lipids;* 152(1):9–12.
[21]. Kharat, A.R., Dolui, A.K., Das, S., (2011). Free radical scavenging potential of Jatropha gossypiifolia. *Asian J. Chem.* 23(2):799–801.
[22]. M. B. G. Viswanathan, J. D. Jeya Ananthi and N. Venkatesan., (2018); Review on Jatropha., *International Journal of Research and Innovation in Social Science*., Volume 2(8):39-46
[23]. Md. Mahmodul Islam, Ariful Islam and Mohammad Salim Hossain. In-vivo antiemetic and antinociceptive, cytotoxic and in-vitro thrombolytic potential of methanolic extract of stem and leaves of *Jatropha gossypiifolia* Discovery Phytomedicine., Volume 4(4): 35-40
[24]. Md. Shahidul Islam, Hasnat Ara, Kazi Ishtiaq Ahmad, Md. Mayin Uddin (2019); A Review on Medicinal Uses of Different Plants of Euphorbiaceae Family; *Universal Journal of Pharmaceutical Research;* 4(1):47-51
[25]. Murugalakshmi, M, Mari SJ, Vallimail M, Anitha PRJ, Thangapandian V. (2014) Preliminary phytochemical analysis and antipyretic, purgative studies of *Jatropha gossypiifolia*. *World Journal of Pharmacy and Pharmaceutical Sciences*;3(7):1127-1135.

[26]. N. Nwokocha, A. Blessing, I. O. Agbagwa, and B. E. Okoli, (2011)"Comparative phytochemical screening of Jatropha L. Species in the Niger Delta," *Research Journal of Phytochemistry*, 5(2):107-114.

[27]. Nagaharika Y., Kalyani V., Rasheed S., Karthieyan R., (2013); Anti-inflammatory activity of leaves of *Jatropha gossypiifolia* L. by HRBC membrane stabilization method; *J. Acute Dis.*; 2(2):156-158.

[28]. Nazeema T.H., Girija S., (2013); Characterisation of the active antiproliferative principles of *Jatropha curcus* and *Jatropha gossypiifolia* on HeLa cell lines. *Int. J. Pharm. Pharm. Sci.*; 5(2):346-355.

[29]. Neha Rahuja, Akansha Mishra, Rakesh Maurya, Mahendra Nath Srivastava, Akhilesh Kumar Tamrakar, Swatantra Kumar Jain, Arvind Kumar Srivastava (2013); Antidiabetic and Hypolipidemic Activity in Stem of *Jatropha Gossypiifolia* L. *International Journal of Pharmacy and Pharmaceutical Sciences;* 5(4):706-715.

[30]. O. G. Adeosun, T. Oduola, F. A. Fagbomedo et al., "Suitability of stem latex of Jatropha gossypiifolia as a protein precipitant for biochemical analysis," Indian Journal of Clinical Biochemistry.,29(2):210–212,2014.

[31]. Okoh, S.O., Iweriebor, B.C., Okoh, O.O., Nwodo, U.U., Okoh, A. I., (2016). Antibacterial and antioxidant properties of the leaves and stem essential oils of *Jatropha gossypiifolia L. Biomed. Res. Int*., 9392716

[32]. Oliveira F.C.S., Barros R.F.M., Moita Neto J.M., (2010). Plantas medicinais utilizadas em comunidades rurais de Oeiras, semiárido piauiense. Rev. Bras. Pl. Med. 12:282-301.

[33]. Omolola Temitope Fatokun, Omorogbe Liberty, Kevwe Benefit Esievo, Samuel Ehiabhi Okhale and Oluyemisi Folashade Kunl; Phytochemistry, Ethnomedicine and Pharmacology of *Jatropha gossypiifolia* L: A Review; *Archives of Current Research International* 5(3): 1-21, 201.

[34]. Onyegbule F. A. Bruce S. O. Onyekwe O. N. Onyealisi O. L. and Okoye P. C (2019): Evaluation of the in vivo antiplasmodial activity of ethanol leaf extract and fractions of *Jatropha gossypiifolia* in Plasmodium berghei infected mice; *Journal of Medicinal Plants Research;* 13(11): 269-279.

[35]. Opeyemi O. Faokunla, Oluseyi A. Akinloye, Regina N. Ugbaja, Abideen I. Adeogun (2017); Anticarcinogenic effect of alpha-lipoic acid and *Jatropha gossypiifolia* leaves against cypermethrin-induced genotoxicity in rats; *Journal of Medicinal Plants for Economic Development;* 2(1):1-5

[36]. P.M. Almeida1,2, S.S. Araújo1, I.R.M.R. Santos1, M.A. Marin-Morales3, A.M. Benko-Iseppon1, A.V. Santos4, K.P. Randau4 and A.C. Brasileiro-Vidal.,2016; Genotoxic potential of leaf extracts of *Jatropha gossypiifolia* L.; br *Genetics and Molecular Research* 15 (1):1-8.

[37]. Parvathi VS, Jyothi BS, Lakshmi T, Babu PS, Karthikeyan R. (2012); Morpho-anatomical and physicochemical studies of *Jatropha gossypiifolia* (L.). *Der Pharmacia Lettre*; 4(1):256-262.

[38]. Pertino, M., Schmeda-Hirschmann, G., Santos, L.S., Rodríquez, J.A., Theoduloz, C., 2007c. Biotransformation of jatrophone by Aspergillus niger ATCC. *Zeitschrift für Naturforschung* 62b, 275–279.

[39]. Pratap B, Singh A. Piscicidal and anti-AChE activity of medicinal plant *Jatropha gossypiifolia* (Family-Euphorbiaceae). *World Journal of Fish and Marine Sciences* 2013; 5(4):367-372.

[40]. Qinghua Wu, Jiri Patocka, Eugenie Nepovimova, Kamil Kuca (2019); *Jatropha gossypiifolia* L. and its biologically active metabolites: A mini review; *Journal of Ethnopharmacology;* 234:197-203

[41]. R. Bhagat, S. D. Ambavade, A. V. Misar, and D. K. Kulkarni, (2011) "Anti-inflammatory activity of *Jatropha gossypiifolia* L. leavesin albino mice and Wistarrat, "Journal of Scientific and Industrial Research; 70(4):289–292.

[42]. R. Dabur, A. Gupta, T.K. Mandaletal., (2007); Antimicrobial activity of some medicinal plants," *African Journal of Traditional, Complementary and Alternative Medicines*, 4(3):313– 318.

[43]. R. Das, K. Venkateswarlu, V. Saidi Reddy, and B. Das, (2004). 4-Odemethyl retrochinensin a minor new lignan from *Jatropha gossypiifolia*," *Indian Journal of Heterocyclic Chemistry*.,14(2):169–170.

[44]. R. Seth and R. Sarin, (2010); Analysis of the Phytochemicals content and anti-microbial activity of *Jatropha gossypiifolia*," *International Journal of Molecular Science;* 11(11);4417–4425.

[45]. Ravindranath N, Venkataiah B, Ramesh C, Jayaprakash P, Das B. (2003); Jatrophenone, a novel macrocyclic bioactive diterpene from *Jatropha gossypiifolia*. *Chemical and Pharmaceutical Bulletin.*;51(7):870– 871.

[46]. S. L. Cartaxo, M. M. de Almeida Souza, and U. P. de Albuquerque (2010); Medicinal plants with bioprospecting potential used in semi-arid northeastern Brazil," *Journal of Ethnopharmacology*,131(2):326–342.

[47]. S. O. Okoh, B. C. I weriebor, O. O. Okoh, U. U. Nwodo, and A. I. Okoh (2016); Antibacterial and Antioxidant Properties of the Leaves and Stem Essential Oils of *Jatropha gossypiifolia* L.; *BioMed Research International* Volume 2016, Article ID 9392716, 9 pages.

[48]. S. R. Mariz, G. S. Cerqueira, W. C. Araujo et al., (2010) "Estudo toxicologico agudo do extratoetan´olicodepartesa´ereasde *Jatropha gossypiifolia* L. em ratos," *Revista Brasileira de Farmacognosia*,16(3); 372–378.

[49]. S. S. Hebbar, V. H. Harsha, V. Shripathi, and G. R. Hegde, (2004); Ethnomedicine of Dharwad district in Karnataka, India plants used in oral healthcare, "*Journal of Ethnopharmacology,* 94(2-3):261–266,2004.

[50]. Sachin J, Gajendra P.C, Dinesh K.J. (2012); Pharmacological evaluation of anti–fertility activity of ethanolic extract of *Jatropha gossypiifolia* leaf in female albino mice. *Asian Pacific Journal of Tropical Biomedicine*, 2(3): S1671-S167

[51]. Sachin Jain, G. P. Choudhary, D. K. Jain (2015); Antioxidant and Hepatoprotective Potential of Ethanolic Leaves Extract of *Jatropha gossypiifolia*; *International Journal of Plant Science and Ecology*; 1(5):190-195.
[52]. Saleem, H., Ahmad, I., Ali Gill, M.S., (2016). Evaluation of lipoxygenase inhibition of *Jatropha gossypiifolia*, a medicinal plant from Pakistan. *Bangladesh J. Pharmacol*. 11 (2), 319–320.
[53]. Seth R., Sarin R., 2010. Analysis of the phytochemical content and anti-microbial activity of *Jatropha gossypiifolia* L. *Arch. Appl. Sci. Res.;*2(5):285-291.
[54]. Shahwar D, Shafiq SU, Ahmad N, Ullah S, Raza MA. (2010); Antioxidant activities of the selected plants from the family Euphorbiaceae, Lauraceae, Malvaceae and Balsaminaceae. *African Journal of Biotechnology*. 9: 1086-1096.
[55]. Sherifat A. Aboaba, Muritala A. Adebayo, Isiaka A. Ogunwande, Tajudeen O. Olayiwola (2015); Volatile constituents of *Jatropha gossypiifolia* L. grown in Nigeria; American *Journal of Essential Oils and Natural Products*; 2(4): 08-1
[56]. Singh D.D., (2018); Assessment of antimicrobial activity of hundreds extract of twenty *Indian medicinal plants. Biomed. Res.* 29(9):1797-1814.
[57]. Singh, D., and Singh, A., (2005). The toxicity of four native Indian plants: effect on AChE and acid/alkaline phosphatase level in fish Channa marulius. 60 (1), 135–140.
[58]. Sukohar Asep, Herawati Hening, Sari Gema P, Setiawan Gigih, Morfi Chicy Widya ssnd Sahidin (2017); Anticancer Activity of Jatrophone an Isolated Compound from *Jatropha gossypiifolia* Plant Against Hepatocellular Cancer Cell HEP G2 1886; *Biomedical & Pharmacology Journal*; *Chemosphere* 10(2), 667-673
[59]. T. Oduola, G. O. Adeosun, T. A. Oduola, G. O. Avwioro, and M. A. Oyeniyi,(2005) "Mechanism of action of *Jatropha gossypiifolia* stem latex as a haemostatic agent, "*European Journal of General Medicine.*, 2(4):140–143.
[60]. Tripathi YC, Shukla P, Tewari D. (2015); Phytochemical evaluation and antihyperglycemic effects of *elaeocarpus ganitrus roxb* (rudraksha) in streptozotocin induced diabetes, 7(1): 280223.
[61]. U.P.de Albuquerque, J.M. Monteiro, M.A. Ramos, and E.L.C. de Amorim,"Medicinal and magic plants from a public market in northeastern Brazil, "*Journal of Ethnopharmacology*,110(1):76–91,2007.
[62]. V. S. Parvathi, B. S. Jyothi, T. Lakshmi, P. S. Babu, and R. Karthikeyan, (2012) "Morpho-anatomical and physicochemical studies of *Jatropha gossypiifolia* (L.)," *Der Pharmacia Lettre*, 4(1):256–262.
[63]. V. S. Parvathi, B. S. Jyothi, T. Lakshmi, P. S. Babu, and R. Karthikeyan, (2012) "Morpho-anatomical and physicochemical studies of *Jatropha gossypiifolia* (L.)," *Der Pharmacia Lettre*, 4(1):256–262.
[64]. Xavier-Santos, J.B., Félix-Silva, J., Passos, J.G.R., Gomes, J.A.S., Fernandes, J.M., Garcia, V.B., de Araujo-Junior, R.F., Zucolotto, S.M., Silva-Junior, A.A., Fernandes-Pedrosa, M.F., 2018. Development of an effective and safe topical anti-inflammatory gel containing *Jatropha gossypiifolia* leaf extract: results from a pre-clinical trial in mice. *J. Ethnopharmacol.* 227:268–278.
[65]. Zhang X.P., Zhang M.L., Su X.H., Huo C.H., Gu Y.C., Shi Q.W., (2009); Chemical constituents of the plants from genus *Jatropha. Chemistry and Biodiversity*.6:2166–2183.