World Journal of Pharmaceutical Sciences
ISSN (Print): 2321-3310; ISSN (Online): 2321-3086
Available online at: https://wjpsonline.com/
Review Article

Pharmacognostical studies and pharmacological activities of Morinda Tinctoria Roxb – A review article

Sampath Kumar T*[1], C. Jothimanivannan[2], A. Abdul Azim[3], K. Kayalvizhi[3], S. Gokulraj [3], V. Vedhachalam[3]

[1]Department of Pharmacognosy and [2]Department of Pharmaceutical Chemistry, SS Institute of Pharmacy, Sankari, Salem 637301
[3]SS Institute of Pharmacy, Sankari, Salem 637301

Received: 28-04-2022 / Revised Accepted:25-05-2022 / Published: 01-06-2022

ABSTRACT

Morinda tinctoria Roxb plant is very well known for its therapeutics benefits in Indian systems of medicine including Ayurveda and Siddha and in other forms of traditional medicine worldwide for the treatment of several ailments. The colouring matter is found principally in the root bark and is collected when the plants reach three to four years of age. Our review article focusses to pharmacognostical studies and give number of pharmacological activites are antidiabetic, antioxidant, antibiofilm, anticancer, antihyperglycemic, analgesic, anti-inflammatory, hepatoprotective, anticonvulsant, cytoprotective, wound healing activity, antiulcer, antimicrobial and antigenotoxic activities. This article can give potential research areas to explore next, and to formulate new formulation in allopathy and some traditional medicine system.

Keywords: Morinda tinctoria, Indian Mulberry, Anti-diabetic, Anti-cancer, Anti-convulsant activity

INTRODUCTION

Morinda tinctoria is an evergreen shrub or small tree growing to 5–10 m tall. The leaves are 15–25 cm long, oblong to lanceolate. The flowers are tubular, white, scented, about 2 cm long. The fruit is a green syncarp, 2- 2.5 cm diameter. If the trees are allowed to mature then hardly any colouring substance remains. The small roots yield the most dye and those above about 1 cm diameter are discarded. The active substance is extracted as the glucoside known as morindin that upon hydrolysis produces the dye. Morindone is a mordant dye giving a yellowish-red colour with an aluminium mordant, chocolate with a chromium mordant, and dull purple to black with an iron mordant. Morindin is also present in Morinda umbellata but not in Morinda longiflora, a native of West Africa. Although imported into Britain and applied to wool and cotton, the dye did not find commercial success. This article in future will promote many research works and to formulate many polyherbal formulation(1).

Address for Correspondence: Sampath Kumar T, Assistant Professor, Department of Pharmacognosy, SS Institute of Pharmacy, Sankari, Salem 637301, India; E-mail: sampath21gaucher@gmail.com

How to Cite this Article: Sampath Kumar T, C. Jothimanivannan, A. Abdul Azim, K. Kayalvizhi, S. Gokulraj, V. Vedhachalam. Pharmacognostical studies and pharmacological activities of Morinda Tinctoria Roxb – A review article. World J Pharm Sci 2022; 10(06): 87-91;
https://doi.org/10.54037/WJPS.2022.100604

PHARMACOGNOSTIC & PHYTOCHEMICAL SCREENING

T.P.Jayachandran et.al., describes about *Morinda tinctoria (Roxb.)* (Fam: Rubiaceae) is a medicinally important plant being used in different indigenous systems of medicine such as Ayurveda, Siddha, Unani. Extract of its leaves, stems and fruits are used in the treatment of gastropathy, dyspepsia, diarrhoea, stomach ulcer, wounds, gout, inflammation, hernia, and fever. Its comparative pharmacognostic and phytochemical study based on seasonal variation has not been explored fully so far. In this study a detailed pharmcognostic and phytochemical investigation of the crude extracts of the leaf (collected at winter and summer) were executed using standard methods. In quantitative analysis the active constituents like flavanoids, steroids, tannins, phenols, alkaloids showed significant variation in winter and summer season. The glycosides are absent in summer season. As these active metabolites are associated with antiviral, antibacterial, anticonvulsant, psycho-pharmacological, antidiabetic and anti-inflammatory properties, they are widely used in treatment of various diseases. Thus, the potential of the plant as a source of the active metabolites is self-explanatory[(2)].

ROOT-BARK AND FRUIT

A.Praveena et.al., describes the various anatomical characteristics and proximate analysis of root-bark and fruit of Morinda tinctoria were investigated by the microscopic sectioning using standard pharmacopoeia methods. Microscopic examination of the root-bark indicated the presence of calcium oxalate crystals of raphide bundles in the axial parenchyma. Calcium oxalate crystals were also present in the fruit, either as a 4-lobed druse type or as a spindle shaped Raphide type. Proximate analysis was carried out to evaluate the plant as a potential source of active compounds which could be served as potent drug or to develop novel insecticide against the major pest which involve in crop damage. A lower acid insoluble ash content was recorded for the fruit than the root-bark. Acid insoluble ash value of M. tinctoria fruit (0.510%) shows that small amount inorganic compound is insoluble in acid and therefore the fruit may be readily digested and absorbed when consumed[(3)].

PHARMACOLOGICAL ACTIVITIES

1. Anti-diabetic and Anti-oxidant Activity

K. Pattabiraman et.al., reported the antioxidant effect of oral administration of aqueous extract of Morinda tinctoria (MTR) fresh fruits on blood glucose, haemoglobin, glycosylated haemoglobin, plasma insulin, antioxidant enzymes and lipid peroxidation in liver and kidney to streptozotocin (STZ)-induced diabetic rats. Aqueous extract of Morinda tinctoria (MTR) on blood glucose, haemoglobin, glycosylated haemoglobin, plasma insulin, serum lipid and the levels of lipid peroxides and antioxidant enzymes, such as catalase, superoxide dismutase, glutathione peroxidase and reduced glutathione, were examined in the liver and kidney tissues of control and experimental groups. Oral administration of Morinda tinctoria (MTR) aqueous extract to diabetic rats for 30 days significantly reduced the levels of blood glucose, lipids and lipid peroxidation, but increased the activities of plasma insulin and antioxidant enzymes, like catalase, superoxide dismutase, reduced glutathione and glutathione peroxidase. The Morinda tinctoria (MTR) aqueous extract supplementation is useful in controlling the blood glucose level, improves the plasma insulin, lipid metabolism and is beneficial in preventing diabetic complications from lipid peroxidation and antioxidant systems in experimental diabetic rats; therefore, it could be useful for prevention or early treatment of diabetes mellitus[(4)].

2. Anti-biofilm Activity

R. Satish Kumar et.al., reported the effect of methanol extracts of Morinda tinctoria fruits on biofilm formation of clinically important AmpC β-lactamases producing K.pneumoniae. K.pneumoniae clinical isolates were screened for the production of AmpC β lactamases by AmpC disc test. Biofilm inhibition studies were conducted on 24-well polystyrene well plates. Four uropathogenic isolates of K.pneumoniae were shown to produce AmpC β-lactamases. The methanol extracts at Biofilm inhibitory concentration (BIC - 0.06 mg ml-1) of M. Tinctoria fruits (immature, midmature and mature) were revealed to inhibit the biofilms formed by K.pneumoniae. The finding of the present study describes M.tinctoria fruit extracts as a promising source for biofilm inhibition in K.pneumoniae which have acquired resistance to third and fourth generation cephalosporins. This is the first report o biofilm inhibition of AmpC producing K.pneumoniae using fruit extracts of M.tinctoria at different maturit stages[(5)].

3. Anti-cancer Activity

Raju Senthil Kumar et.al., reported the methanol extract of the leaves of Morinda tinctoria Roxb. (MEMT) was studied for its anticancer activity using in vitro and in vivo cancer models. MEMT was investigated for its short-term cytotoxicity on EAC tumor cells by trypan blue dye exclusion method and in vitro cytotoxicity on NIH 3T3, A549, Hep2 and HepG2 cells by MTT assay. In vivo anticancer activity was studied on EAC tumor-bearing mice. Anticancer activity was

assessed by monitoring the mean survival time, the percentage increase in life span, the effect on haematological parameters, antioxidant enzyme levels and solid tumor volume.5 Fluorouracil (5-FU, 20 mg/kg/i.p.) was used as a standard. The extract showed potent in vitro cytotoxicity against each of the tested tumor cell lines, but it was found to be harmless to normal cells. MEMT at the dose of 200 and 400 mg/kg, significantly increased the mean survival time (P<0.001), exerted a protective effect on the hemopoietic system (P<0.05 – 0.001), prevented lipid peroxidation and restored the antioxidant enzymes catalase, superoxide dismutase, glutathione peroxidase and glutathione-S-transferase in the liver of tumor control animals (P<0.001). It also significantly reduces the solid tumor volume (P<0.01). The results showed a significant anticancer and cytotoxic effect of MEMT against EAC and human cancer cell lines, and thus supported the ethnomedical use of Morinda tinctoria[6].

4. Anti-hyperglycemic and Anti-diabetic Activity

Palayan Muralidharan et.al., reported the metabolic surgical procedures have been shown to improve diabetes, but the mechanism of action is poorly understood. To evaluate the antihyperglycemic and antidiabetic effects of Morinda tinctoria Roxb (MTR) fruit extract in streptozotocin (STZ)-induced diabetic rats. Albino wistar rats with STZ-induced diabetes were divided into four groups: citrate buffer, troglitazone (TGZ; 36 mg/kg), methanolic fruit extract of MTR (50 mg/kg, 100 mg/kg body weight)-administrated groups. Five, 10, and 15 days after administration of each drug, the fasting blood glucose (FBG), blood glutathione (GSH), and serum ceruloplasmin levels were measured. MTR at the high dose (100 mg/kg bodyweight) produced a significant reduction in the FBG level with increase in blood GSH level. This reduction was much less than that in the FBG produced by TGZ. Treatments with TGZ or MTR at both doses did not alter the ceruloplasmin level significantly. MTR fruit extract contains compounds that could be effective in glucose tolerance impairment during diabetes[7].

5. Analgesic and Anti-inflammatory Activity

Srikanth Jeyabalan et.al., reported the analgesic and anti-inflammatory activity of the methanolic extract of leaves of Morinda tinctoria. The preliminary phytochemical screening of the leaves revealed the presence of saponins, terpenoids, tannins, flavonoids, glycosides and sugars. The central analgesic activity of the extract was evaluated using eddy's hot plate method and formalin test whereas peripheral analgesic activity using acetic acid induced writhing test. The extract was studied for anti-inflammatory activity in carrageenan-induced hind paw edema in rats and the paw volume was measured plethysmometrically. The study was carried out using dose (200 and 400 mg/kg, p.o.) of the extract. Pentazocin (10mg/kg, i.p.) is the standard drug for the centrally acting analgesic activity whereas indomethacin (10mg/kg, i.p.) is the standard for peripheral acting analgesics and anti-inflammatory activity. The statistical analysis was carried out using one way ANOVA followed by Dunnet's test. P value less than 0.5 were considered significant. The methanolic extract of Morinda tinctoria significantly (p<0.05) reduced carrageenan-induced paw edema in rats and analgesic activity evidenced by increase in the reaction time by eddy's hot plate method. It also significantly inhibited the neurogenic and inflammatory pain in formalin test as well as the writhing reaction induced by acetic acid. The methanolic extract of Morinda tinctoria showed significant anti-inflammatory and analgesic effect comparative to the standard drugs. The pharmacological screening of the extract showed significant antinociceptive activity with anti-inflammatory profile[8].

6. Hepatoprotective Effect

Mohanraj Subramanian et.al., reported the hepatoprotective activity of aqueous and methanol extracts of leaves of Morinda tinctoria Roxb. against paracetamol induced liver damage into rats. The hepatoprotective activity aimed for plant extracts was investigated for paracetamol induced hepatotoxicity into rats. Spraguee Dawley rats of either sex were divided into 7 groups of 5 animals each and are given orally the following treatment for 10 days. The normal control was given 1% CMC 1 ml/kg b.w., p.o. Paracetamol at dose of 3 g/kg b.w., p.o. was given as toxic dose for inducing hepatotoxicity. Liv.52 (50 mg/animal, p.o) was given as reference standard. Two different doses of M. tinctoria extracts of both aqueous and methanol (100 mg/kg, p.o, 150 mg/kg, p.o) was tested for hepatoprotective activity. The treatment was given for 10 days and after 48 h of last treatment blood was collected from direct cardiac puncture and analysed for various serum parameter like serum glutamic pyruvic transaminase (SGPT), Serum glutamic oxaloacetic transaminase (SGOT), Total Bilirubin (TB), Direct Bilirubin and Total cholesterol (TC) in different groups. The phytochemical investigation of the both extracts showed the presence of alkaloids, flavonoids, glycosides, carbohydrates, saponin and tannin and phenols. The paracetamol intoxication lead to histological and biochemical deterioration. The treatment with both aqueous and methanolic leaves extracts of M. tinctoria reduced the level of SGOT, SGPT, TB, DB and TC and also reversed the hepatic damage towards normal which further supports the hepatoprotective activity of leaf extracts of M. tinctoria. Both aqueous and

methanol extracts of leaves of M.tinctoria have significant effect at higher dose of 150mg/kg.b.w[9].

7. Anti-convulsant Activity

P. Thirupathy Kumaresan et.al., reported the anticonvulsant activity for Morinda tinctoria was evaluated in albino mice of either sex at 3 different dose levels (200, 400 and 600 mg/kg ip) by MES and chemical methods. The extract showed significant ($p<0.001$) against both MES (maximal electroshock) and chemical methods[10].

8. Cytoprotective Effect and Anti-ulcer Activity

D. Sivaraaman et.al., reported the antiulcer efficacy of ethanol leaf extract of Morinda tinctoria Roxb. (EEMT) against aspirin pyloric ligation-induced gastric ulcer model and cysteamine-induced duodenal ulcer in Wistar rats. Oral administration of EEMT at a dose of 200 and 400 mg/kg significantly prevented the occurrence of aspirin pyloric ligation and cysteamine-induced gastric and duodenal ulceration. The volume and acidity of gastric juice in pyloric ligated rats were significantly ($P < 0.01$) reduced by EEMT. There was a significant decrease in the number of ulcers, and its severity in both the models proved the ulcer protective activity of EEMT. Administration of extract at both dose levels has shown a significant increase in potassium and sodium ion concentration in the gastric juice of pylorus ligation group. On the basis of these observations, we concluded that EEMT possessing antiulcer activity may be due to the modulation of defensive factors by improvement in gastric cytoprotection[11].

9. Wound Healing Activity

S. Rex Jeya Rajkumar et.al., reported the wound healing properties of the aqueous extract of Morinda tinctoria Roxb leaves in rats. The study also provides information on the purification, qualitative, and quantitative analysis of phytochemical components present in M. tinctoria Roxb. Wound contraction and period of epithelialization was determined and topical application of M. tinctoria Roxb aqueous leaf extract showed better healing than orally treated and control groups. The results suggest that the efficacy of M. tinctoria Roxb aqueous leaf extract as a wound healing agent and can also be used as a therapeutic agent for internal as well as external wounds[12].

10. Anti-microbial Activity

P. Umadevi et.al., reported the presence of Phytochemical constituents and antimicrobial activity of different extracts of leaves of Morinda tinctoria Roxb. The serial exhaustive extraction was done with a series of solvents: Hexane, Chloroform, Ethylacetate and Methanol with increasing polarity using soxhlet apparatus. The Phytochemical analysis was done by using the standard procedures. Antimicrobial activity was evaluated by Agar well diffusion method against nine human pathogens. The results revealed that the leaf extracts contain a broad spectrum of secondary metabolites: Alkaloids, Phytosterols, Flavonoids, Phenols and Triterpenes in major proportion. Methanol extract was shown to be more effective against all the organisms followed by Ethylacetate, Chloroform and Hexane extracts. Proteus vulgaris (24mm) was found to be most sensitive organism followed by Klebsiella pneumonia (21mm) and Enterococcus feacelis (21mm). The present study concludes that the different extracts of M. tinctoria leaves contain a broad spectrum of secondary metabolites and also exhibit antimicrobial activity against all the tested microorganisms. It can also be concluded that Morinda tinctoria plant can be exploited to discover the bioactive natural products that may serve as leads in the development of new pharmaceuticals[13].

11. Anti-genotoxic Activity

Kantha Deivi Arunachalam et.al., reported the protective effect of methanolic leaf extract of Morinda tinctoria. Roxb (MEMT) (200 mg/kg) via feed in supplementation with standard compound silymarin (400 mg/kg). M. tinctoria (Roxb.) belonging to Rubiaceae, is an evergreen shrub indigenous to unfarmed lands of tropical countries. It is considered as an essential traditional medicine attributing for the potential antioxidant and anti-inflammatory properties. The enhancements of antioxidant and antigenotoxic status in different tissues of cadmium (Cd) intoxicated Pangasius sutchi were evaluated by using various antioxidant assays (superoxide dismutase (SOD) and catalase (CAT) and lipid peroxidation) in addition to micronuclei (MN), binuclei (BN) and comet assay. The cadmium toxicated fish showed a significant ($p < 0.001$) increase in lipid peroxidation (LPO) activities in liver, gills, muscle and kidney whereas significant ($p < 0.001$) decline were observed in superoxide dismutase (SOD) and catalase (CAT) contents in all fish tissues. The results also revealed that, Cd exposure induced the formation of genotoxic endpoints like MN, BN, notched nuclei, kidney shaped nuclei and DNA damage in the fish erythrocytes. Maximum of 26.8% MN frequencies and maximum of 66.74% tail DNA damage were observed on the 7th day of Cd exposure. A time-dependent significant increase ($p < 0.001$) in the frequencies of MN, BN and tail DNA damage were observed in all treated groups against the control which started to decline from 14th day onwards. There was a decline in the LPO content, frequencies of MN, BN and percentage of tail DNA in contrast to significant elevation in SOD and CAT content in all tissues due to the combined

treatment of M. tinctoria feed and water borne Cd exposure. It can be concluded from our observations that, supplementation of M. tinctoria leaf extract through feed alone produced enhanced antioxidant and antigenotoxic status in cadmium treated fish by diminishing oxidative stress and genotoxicity effects in a time dependent manner.

CONCLUSION

This review paper shows all the activities of Morinda tinctoria and the pharmacological activities like anticancer, antidiabetic, antiulcer etc.This plant contains quinones, steroids, terpenoids, phenols, glycosides, tannins, etc. Extract of Morinda tinctoria leaves contains more bioactive principles, which act against the representative human pathogens. Moreover, this reviewed article showed more pharmacological applications and helps to developing the allopathy and traditional formulations.

REFERENCE

1. Kumar TS , Muthuraj S, Muthusamy P, Radha R, Ilango K. Formulation and Evaluation of in vitro antidiabetic Polyherbal tablets form some traditional used Herbs. J Phytopharmacol 2021 ; 10 (3):173 - 179
2. Muthuraj S, Seeni MK, Muthusamy P, Sampathkumar T. Review on Scope of Pharmacognosy graduate in various government research instititute in India. J Phytopharmacol 2021; 10(4):266-271. doi: 10.31254/phyto.2021.10409
3. Praveena.A, Sanjayan K. P.Pharmacognostic Studies on Root-bark and fruit of Morinda tinctoria Roxb. Research Journal of Pharmacognosy and Phytochemistry. Volume - 10, Issue - 3, Year - 2018.
4. K. Pattabiraman and P. Muthukumaran. Antidiabetic and Antioxidant Activity of Morinda tinctoria roxb Fruits Extract in Streptozotocin-Induced Diabetic Rats. Asian J. Pharm. Tech. 2011; Vol. 1: Issue 2, Pg 34-39.
5. R. Satish Kumar, S. Ramesh, K. M. Sucharitha and J. Vinoth. Antibiofilm activity of Morinda tinctoria fruit extracts against AmpC β-lactamase positive Klebsiella pneumoniae. Der Pharmacia Lettre, 2014, 6 (1):160-165.
6. Raju Senthil Kumar, Sekar Vinoth Kumar and Pachiappan Sudhakar. Anticancer activity of methanolic leaf extract of morinda tinctoria roxb. Against Ehrlich ascites Carcinoma in mice. Bull. Pharm. Res. 2017;7(2).
7. Palayan Muralidharan, Dhanasekaran Sivaraman. Antihyperglycemic and antidiabetic effects of Morinda tinctoria Roxb using streptozotocin induced diabetic rats. Asian Biomedicine Vol. 3 No. 4 August 2009; 433-437.
8. Srikanth Jeyabalan, Muralidharan Palayan. Analgesic and anti-inflammatory activity of leaves of Morinda tinctoria Roxb. International Journal of Pharmaceutical Research 2009 1(4) 74-80.
9. Mohanraj Subramanian, Sangameswaran Balakrishnan, Santhosh Kumar Chinnaiyan, Vinoth Kumar Sekar, Atul N. Chandu. Hepatoprotective effect of leaves of Morinda tinctoria Roxb against paracetamol induced liver damage in rats. drug invention today 5 (2013) 223 e228.
10. P. Thirupathy Kumaresan and A. Saravanan. Anticonvulsant activity of Morinda tinctoria-Roxb. African Journal of Pharmacy and Pharmacology Vol. 3(2). pp. 063-065, February, 2009.
11. D. Sivaraman and P. Muralidharan. Cytoprotective Effect of Morinda tinctoria Roxb. against Surgical and Chemical Factor Induced Gastric and Duodenal Ulcers in Rats. Hindawi Publishing Corporation Ulcers Volume 2011, Article ID 142719, 9 pages doi:10.1155/2011/142719.
12. T. Sampath Kumar, C. Jothimanivannan, V. Sasi Kumar, M. Vanitha. A complete review on a complete medicinal plant: Cucurbita. World J PharmSci 2021;9(9): 223-229
13. K. Deepti, P. Umadevi1, G. Vijayalakshmi, B. Vinod polarao. Antimicrobial Activity and Phytochemical Analysis of Morinda tinctoria Roxb. Leaf Extracts. K. Deepti et al./Asian Pacific Journal of Tropical Biomedicine (2012) S1440-S1442.