

INTEGRATED IMMINENT WIDE SCIENTIFIC POTENTIAL FROM TROPICAL WEEDY MEDICINAL PLANT OF TEPHROSIA PURPUREA (LINN.) PERS. AN OVERVIEW

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Article Received on
09 May 2014,
Revised on 03 June
2014,
Accepted on 28 Jun 2014

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ABSTRACT

Tephrosia purpurea (L.) pers a well-known plant of Indian and Chinese traditional system of medicines, commonly known as Sarapunkha has drawn attention of researchers in recent times. The weedy plant of *T. purpurea* native to east India Wild Indigo grows as common wasteland weed. Mainly it has been used as a traditionally folk medicine. This review deals with the key bioactive compounds and the role of medicinal value in various aspects of medicine in India and their earlier investigations. It has also been used traditionally in many parts of the world for its innumerable medicinal properties but still its identity as a medicinal plant is not established. To date, several flavonoids, Isoflavonoids, tannins and protein fractions have been isolated from its different parts and their medicinal uses have been

established, but many bioactive constituents and pure compounds have so far been neglected by phytochemists and pharmacologists and a large amount of work has been done only on extracts and not the isolated fractions which shows scope for further study in this direction. Since there has been an increasing demand for the Phytopharmaceutical products need firm of Ayurvedic industries in all the countries because allopathic drugs have more side effects. Many pharmaceutical companies are now concentrating on manufacturing of Ayurvedic Phytopharmaceutical products. Ayurveda is the Indian traditional system of medicine, which also deals about pharmaceutical science. *T. purpurea* the principal bioactive chemical constituent of the plant has shown credible anticancer, anti-inflammatory, angiogenic, Antihelminthic activity, antidiabetic, antimalarial potentially in various investigations around

the globe. This paper contains brief explanation about active constituent and pharmacological activity of tropical weedy plant *T. purpurea*. Different type of plant parts used for the Ayurvedic formulation; overall out line of those herbal scenario and its future prospects for the scientific evaluation of medicinal plants used by traditional healers are also discussed. In India most of them, where Ayurvedic treatment is frequently used, for their ailments and provides instructions to local people how to prepare medicine from the herbs. As much as possible importance is also given for the taxonomic literature.

KEY WORDS: *Tephrosia purpurea*, Pharmacology, Phytochemical Constituents, Potential use, Conventional medicine.

INTRODUCTION

Tephrosia purpurea (Linn.) Pers, belongs to the family Fabaceae, subfamily Faboideae, tribe Millettieae, and it is a highly branched suberect herbaceous perennial, up to 60 m in height with spreading branches; the leaves are narrow imparipinnate, the flowers are Lavender or purple colour in extra-axillary racemes, the pods are slightly curved, 3 – 4.5 cm long, grey, smooth and containing 5–10 seeds per pod (Kokila and Anup, 2010). The plant grows abundantly in the upper Gangetic plains, and western Himalayas. The herb is commonly grown as a green manure in paddy fields in India and in tobacco and rubber plantation in other countries. It grows ubiquitously in all soils, sandy, rocky and loamy (Anitha *et al.*, 2013). In India and South Africa, it is used as a fodder before flowering, but in Australia it is reported to cause livestock poisoning. In northern India, dry plants are collected for fuel. All parts of the plant have tonic and laxative properties. Traditional medicine is widespread and plants still presents a large source of natural antioxidants that might serve as leads for the development of novel drugs (Hegazy *et al.*, 2009). Several anti-inflammatory, digestive, anti-necrotic, neuroprotective, and hepatoprotective drugs have recently been shown to have an antioxidant and/or anti-radical scavenging mechanism as part of their activity (Linn and Huang, 2002). Conventional medicine is now pursuing the use of natural products such as herbs to provide the support that the liver needs on a daily basis (Andrew *et al.*, 1981). Since the beginning of human civilization, medicinal plants have been used by mankind for its therapeutic value (Rajesh *et al.*, 2013). Nature has been a source of medicinal agents for thousands of years and an impressive number of modern drugs have been isolated from natural sources. Many of these isolations were based on the uses of the agents in traditional medicine. The plant-based, traditional medicine systems continues to play an essential role in

health care, with about 80% of the world's inhabitants relying mainly on traditional medicines for their primary health care (Chaudhari *et al.*, 2012). The dried plant is deobstruent, diuretic and useful in treating bronchitis, bilious febrile attacks and obstructions of the liver, spleen and kidneys. It is also recommended as a blood purifier, in the treatment of boils and pimples and is considered a cordial treatment. In southern India, a decoction of the fruit is given for intestinal worms and a fruit extract is used to relieve bodily pains and inflammatory problems. Rotenoid compounds derived from fish poison bean (*Tephrosia vogelii*) (Lambert *et al.*, 1993) are also used as insecticides and rotenone has been reported to have antitumor potential.

Bioactive potential of *Tephrosia purpurea* Past and present view

Throughout the past several years, *Tephrosia purpurea* has been gaining an assortment of interest according to researcher's point of view. In recent times *Tephrosia purpurea* plant possessed many pharmacological innovative scientific particulars indefinitely expelled out more and more noble findings besides the currently available biological field. The overall summary of that peculiar finding presented below.



T. purpurea



T. villosa



T. leptostachya



T. uniflora



T. falciformi

Fig: 1- Structural view of different types of Tephrosia family plants

DESCRIPTION

Perennial erect or decumbent herbs or subshrubs, up to 50 cm tall. Leaves imparipinnate; leaflets 7-15, 1-2.8 x 0.3-1 cm, oblanceolate or obovate, base cuneate, apex obtuse to

emarginate or truncate, mucronate; stipules 3-6 mm long, lanceolate. Dicotyledon, Flowers c. 7 mm long, in few-flowered, leaf-opposed, pseudoracemes; pedicels 3-4 mm long; bracts c. 2 mm long. Calyx 3-4 mm long. pubescent lobes subulate. Corolla pink to purplish; standard c. 4 mm broad, orbicular. Staminal tube to 4 mm long. Pods 2.5-4 x 0.3-0.4 cm, linear-oblong, 5-7-seeded. Seeds ellipsoid, dark brown). Herbal drugs are frequently considered to be less toxic and free from side effects than synthetic drugs.

Taxonomy

Kingdom: Plantae

Order : Fabales

Family : Fabaceae

Genus : *Tephrosia*

Species : *purpurea*

Binomial name: *Tephrosia purpurea* (L.) Pers.

Vernacular name(s)

Tephrosia purpurea (Linn) Pers, (Leguminosae) is a polymorphic, much branched sub erect perennial herb popularly known as “Sarapunkha” in Sanskrit, “Purple Tephrosia” in English and “Kaattukolingi” in Tamil. It is a highly branched, sub – erect perennial herb (Kritikar and Basu, 1956). Its aerial parts and roots are used in bronchial asthma, hepatic ailments, cutaneous toxicities, pain and inflammation.

Kingdom : Plantae

Division: Magnoliophyta

Class : Magnoliopsida

Order: Fabales

Tribe : Millettieae

Family: Leguminosae (Fabaceae)

Genus: *Tephrosia*

Species: *villosa* Pers.

Vernacular Names

Tam. : Vaykkaralai, Punaikkayvelai

Tel.: Nooguvempali

Guj. : Runchhalisarpankho

Oriya : Sroetokolothiya

Geographical distribution

It is found throughout India and Sri Lanka in poor soil, through the plains of India, Ceylon, Mauritius, Tropical Africa and subtropical regions.

Morphology of *T. purpurea*

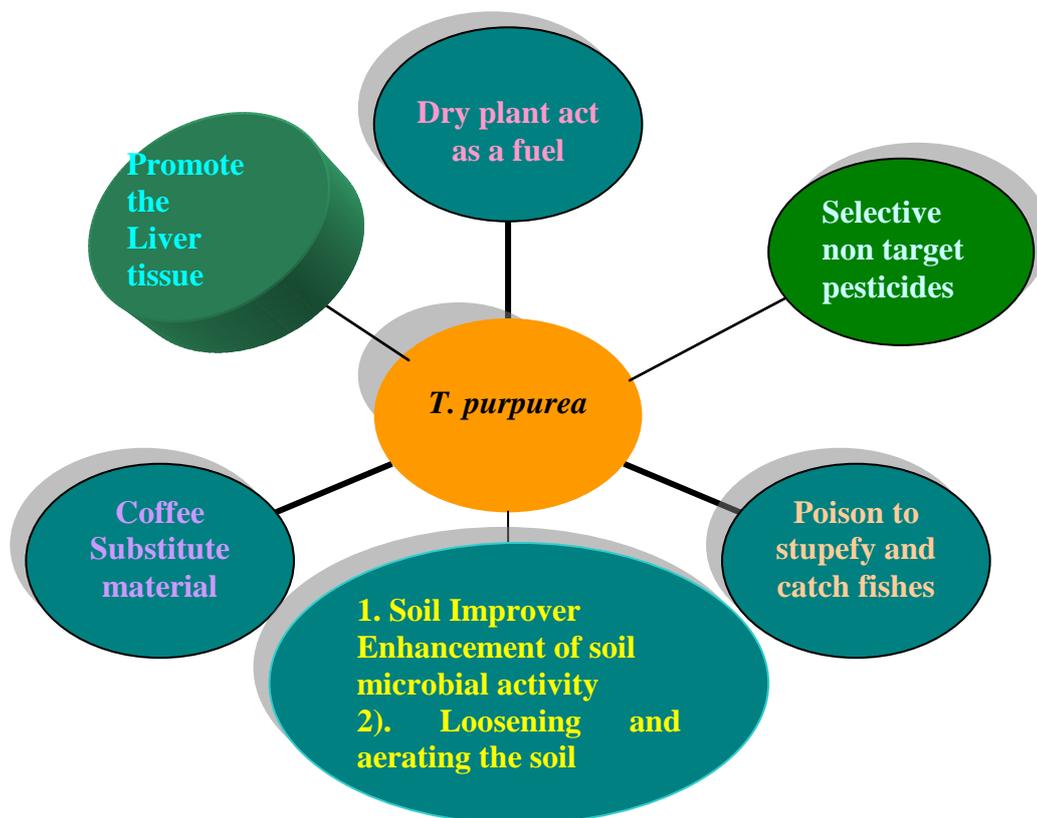


Fig: 1. Additional economically viable uses of *T. purpurea* plant

Table-1: Bioactive compounds identified from the *T. purpurea* plant

Parts used	Identified Bioactive compounds	Analyzed techniques	References
Roots	Isolonchocarpin	¹ H NMR spectra	Manoj and Sangeeta (2012)
Roots	Pongamol, Lanceolatin-B and Lanceolatin-A	UV, IR	Vishal and Thangavel, (2011)
Roots	Flavones and Chalcones	NMR	Andrew <i>et al</i> (1981)
Roots	purpurenone, purpurin, dehydrosodericin, maackiain	¹³ C NMR	Kapil <i>et al.</i> , 2004
Roots	3-hydroxy, 6-methoxy, 2-oxy (3- butanone), 7 (d	spectral analysis	Chang <i>et al.</i> , (2000)
Aerial part	Tephrosin, Pongaglabol, and Semiglabin	NMR spectra	Shah <i>et al</i> (2010)

Stem	Neoflavonoid glycoside, Serratin 7-O-[beta-D-glucopyranosyl-(1-4)- O-beta-D-Galactopyranoside	¹ H NMR	Saxena and Choubey, (1997)
aerial parts	Flavanone, named as Purpurin	¹ H NMR and Mass spectral analysis	Sangeetha and Krishnakumari, (2010)
aerial parts	3-hydroxy, 6-methoxy, 2-oxy (3- butanone), 7 (dioxolane-4-one), 2, 3,- Dihydrobenzopyrone11	column chromatography	(Saleem et al., 2001)
aerial parts	Tephropurpulin A, Isoglabratephrin and Glabratephrin	X-ray analysis	Ali Khalafalah et al (2010)
Leaves	2-propenoic acid, 3-(4-(acetyloxy) - 3-methoxypheny)-3(4-actyloxy)-3-methoxyphenyl)-2-propenyl ester, 2: a sesquiterpene	GCMS- Studies	Rao and Ranga, 1984
Leaves	tephrorins A and B and (+)-tephrosone tetrahydrofuran moiety-14	NMR spectral analysis	Chang LC et al (2000)
Whole plant	Sitosterol, ursolic acid and sigmasterol- α	1). IR, UV, crystallographic methods 2). Tephrosin Pongaglabol Semiglabrin Tephrorin A Tephrorin B Tephrosone	Khalafallah et al., (2009)
Root Root and seed	Tephropurpulin-A, Isoglabratephrin	Glabratephrin Semiglabrin Terpurinflavone Lanceolatin 7, 4-dihydroxy-3,5- (-)- medicarpin dimethoxyisoflavone 3-hydroxy, 6-methoxy, 2-oxy (3-butanone), 7 (dioxolane-4-one), 2, 3,- dihydrobenzopyrone	Chang et al., 2000 Vishal and Thangavel, 2011
Leaf	tephrorins A (1) and B (2) and (+)-tephrosone	quinone reductase induction assay	Farnsworth et al., 2000

Major species of Tephrosia family

T. purpurea, T. falciformis, T. leptostachya, T. strigosa, T. subtriflora, T. uniflora, T. villosa, T. wallichii, T. hirta

Medicinal properties**Conventional Medicinal Uses**

According to Ayurveda, plant is digestible, anthelmintic, alexiteric, antipyretic, alternative, cures diseases of liver, spleen, heart, blood, tumours, ulcers, leprosy, asthma, poisoning etc. According to Unani system of medicine, root is diuretic, allays thirst, enriches blood, cures diarrhea, useful in bronchitis, asthma, liver, spleen diseases, inflammations, boils and pimples; Leaves are tonic to intestines and a promising appetizer. Good in piles, syphilis and gonorrhoea. Due to the wide spread use of this plant by the rural communities to treat several diseases. Hence the present review study was framed to its Bioperspectives in all the way of medicinal properties because this plant all the parts were constantly used as a medicines both human and other ruminant animals,

Impacts and uses in Biological level

Used as a fish poison; the leaves and seeds contain tephrosin, which paralyzes fish. Larger doses are lethal to fish, but mammals and amphibians are unaffected. It is also used traditionally as folk medicine. According to Ayurveda, the plant is anthelmintic, alexiteric, alterative, and antipyretic; it is used in the treatment of leprosy, ulcers, asthma, and tumors, as well as diseases of the liver, spleen, heart, and blood. A decoction of the roots is given indyspepsia, diarrhea, rheumatism, asthma and urinary disorders. The root powder is salutary for brushing the teeth, where it is said to quickly relieve dental pains and stop bleeding. An extract, termed 'betaphroline' (not a systematic name) is claimed to promote release of endorphins, antimicrobial compounds leuteolin (Beckstrom and Duke, 1994) and finds use in certain cosmetic preparations (Khare and Saxena, 1999).

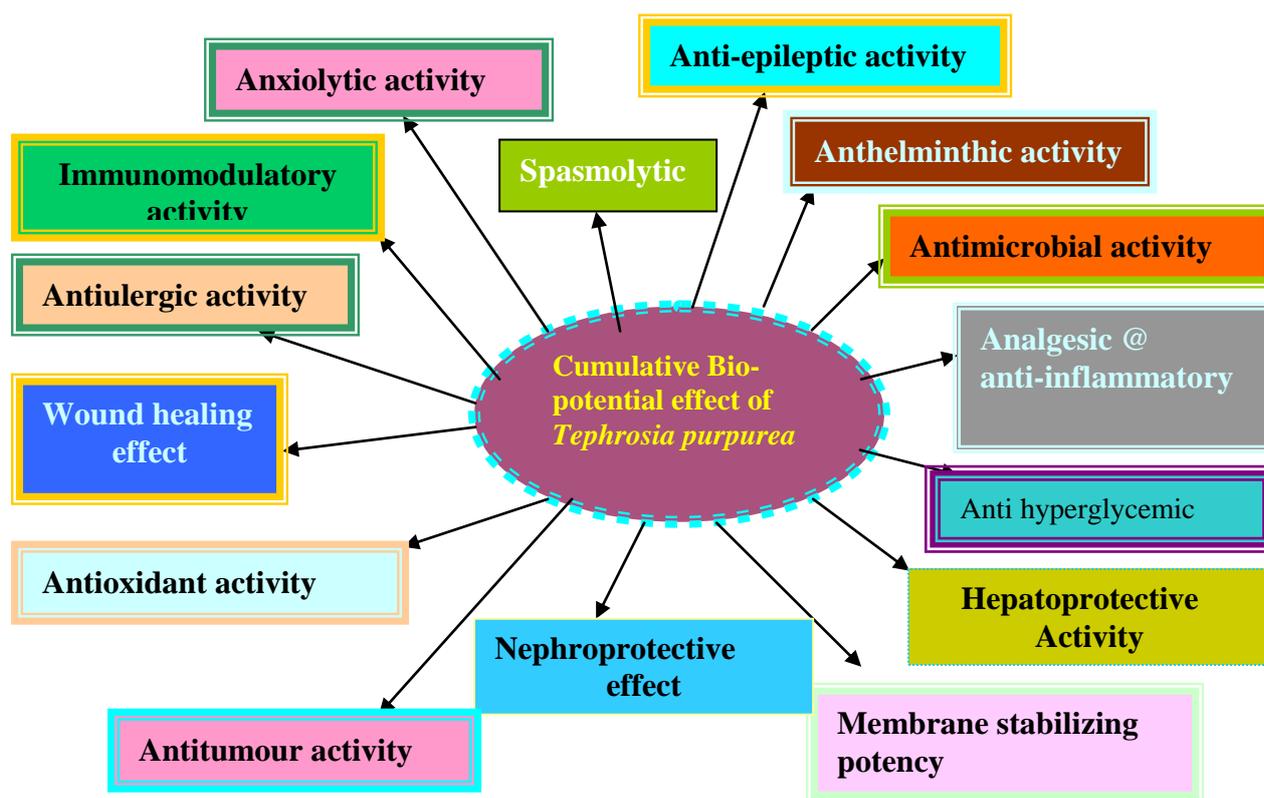
Key constructive benefits

Wild Indigo promotes skin healing. The oil from the seeds of the plant is beneficial in treating skin eruptions, eczema, scabies and leprosy.

A poultice made from the plant acts as an insect-repellant.

Table-2: Over all biomedical competence in *Tephrosea pupurea* (L.) Pers.

Parts used	Pharmacological actions	Indications	Preliminary Phytochemical(s)	Ayurvedic uses
Root	Cholagogue	1. Asthma 2. Carbuncles 3. Hepatic dropsy 4. Intestinal worms 5. Liver and spleen enlargement	1. Trace albumen 2. ash containing trace manganese 3. Brown resins 4. Chlorophyll 5. Quercetin or querritin 6. Glucoside rutin	1. Disease of liver 2. Shoth 3. Skin diseases 4. Tonsillitis, Pharyngitis, Laryngitis Anticarcinogenic and antilipidperoxidative
Powder	Deobstruent,	Chemopreventive Potential and Antilipidperoxidative	Flavones, flavanones and prenylated flavonoids	Cough, Asthma, laxative, diuretic, uterine tonic
Leaf	Laxative and Tonic	Treating Skin eruption	purpurenone, (+)-purpurin, (-)-purpurin, dehydroisodericin, (-)-macckiain,	Jaundice, Splenomegaly, Filariasis, Dysmenorrhea, Anaemic fever
Seed	Febrifuge	Insecticidal property, eczema, scabies and leprosy	seven prenylated flavonoids, two rotenoids, beta-sitosterol, stigmasterol, lupeol and quercetin	Resolve the kidney stones; it acts as diuretic, stomachic, emmenagogue,
Flower	Diuretic,		pseudosemiglabrin, (-)-semiglabrin ⁴ . Purpuritenin, purpureamethide	used in the treatment of Bronchitis, asthma, liver and spleen disorders. Anthelmic, digestive

Figure-2: Cumulative Biopotential efficiency in weedy plant of *T. purpurea* (L.) Pers.

Medicinal properties

Tephrosia purpurea has anti-allergic activity, anticarcinogenic and anti-lipid peroxidative, hepatoprotective activity, immuno-modulatory, antimicrobial activity. Tender leaves show good results in treating eczema and other skin conditions. It is generally considered as anthelmintic, blood purifier, anti-tumor, alexiteric and antipyretic. The leaf decoction is used for treating sluggish liver, heart and spleen disorders, cancerous tumors, asthma and digestive complaints. The root decoction is taken for rheumatism, diarrhea, dyspepsia and urinary tract infection, and also gargled for toothache and bleeding gum (Naghma and Sonia, 2001). Recently, Chaudhari *et al.* (2012) described the plant *Tephrosia purpurea* has still a wide array of pharmacological activities and many isolated compounds on their pharmacological activity and consequently seems to be a sensible to technically make legitimate and pharmacological properties from this plant.

Physicochemical Properties

Later, Sangeetha and Krishnakumari, (2010) collected sixty indigenous medicinal plants from Dharwad and its surroundings. Indian medicinal plant widely used in the preparation of ayurvedic formulations. Previously, Preeti *et al.*, (2003) reported insecticidal (Bentley *et al.*,

1987) and piscicidal plants, including *Tephrosia*; Botanical and their role in agriculture, Microorganisms in insect pest managements and chemistry of plant products in insect pest control. Moreover, the roots are bitter and the decoction is used as a nematicide for treatment against *Toxocora canis* larvae which cause a lung disease in Sri Lanka; it is also used for treating dyspepsia, colic, and chronic diarrhoea and as an Antihelminthic (Linn and Huang, 2002). The legume *Tephrosia* (*Tephrosia purpurea*) contains insecticidal properties Depicted by Jain *et al.* (2006).

Antimicrobial Activity

The antibacterial activity of *T. purpurea* leaves oil against various bacterial and fungal strains. The Neem oil showed considerably activity against bacterial [Gram-positive bacteria: example, *Staphylococcus species* and the Gram-negative bacteria: example *Escherichia coli*] and fungal strains. The antibacterial activity against microbial cultures namely: Bacterial Strain; *Escherichia coli*, *Bacillus cerus*, *Proteus vulgaris*, *Salmonella typhi*, *Klebsiella pneumoniae*, *Shigella dysenterae* and Fungal strain; *Fusarium oxysporum*, *Aspergillus flavus*, *Aspergillus fumigates*, *Aspergillus niger*, *Candida albicans*, *Cladosporium sp.*, *Microsporium canis*, *Microsporium gypseum*, *Trichophyton rubrum*, *Trichophyton mentagrophytes*, *Penicillium notatum etc.* The oil was not able to inhibit *Proteus vulgaris*. It was observed that the oil exhibited inhibitor effects against most of the microorganisms tested. The antifungal activity of neem oil against above fungal strains showed considerably activity. Moreover, the aqueous extract of plant has been previously reported to show antifungal activity (Joshi *et al.*, 2010). Antimicrobial activity of *Tephrosia purpurea* (Linn.) Pers. Root, leaves and seeds against some clinical bacterial isolates ethanolic root extracts of *T. purpurea* were found to be active against *P. aeruginosa*, two other *Pseudomonas* strains and two coliform strains. Ethanolic leaf extracts and all the water extracts showed no activity against any of the isolates. The bark extract of *T. villosa* showed activity against three *Staphylococcus* isolates including *S. aureus*. The MIC of ethanolic root extracts of *T. purpurea* and bark extract of *T. falciformis* were both found to be 128mg/L (Abayasekara *et al.*, 2009).

Antifungal

In past Thetwar *et al.* (2006) revealed that the seed extracts of the plant *T. purpurea* were tested for their antimicrobial and antifungal properties in various solvents against some human, animal and plant pathogenic 56 bacteria. The seed extract showed a good inhibition effect against all the tested micro-organism.

Antihelminthic activity

Plant of *T. purpurea* is tonic, laxative, anthelmintic to children given to purify the blood and as cordial, decoction is tonic. Root is bitter chewed to cure colic pain, used in asthma. Juice is mixed with molasses and given for stomach pain applied on skin eruptions. Powder is smoked for cough, asthma and respiratory diseases, as paste applied on belly to cure dyspepsia, powdered and boiled in milk is applied on leprosy and wounds (Preeti *et al.*, 2003). Previously, Karnick and Majumdar, (1982) 'Sarapunkha' and considered as anthelmintic for a number of worms, especially Ksara (ash) of the Pancanga is utilized for the purpose. It is said to possess laxative properties and considered as a blood purifier. Root is given in tympanitis, dyspepsia and chronic diarrhea whereas the bark of the fresh root is ground with pepper and the pills are orally used to control piles and the obstinate colic. Gastric and duodenal ulcers are a kind of inter wound (Erah *et al.*, 1997). Helicobacter Pylori infection prevents healing of the wounded gastric and duodenum epithelium and its eradication drastically reduce the pathological symptoms (Sumbul *et al.*, 2011). Moreover, this plant act as anti-Helicobacter pylori agent in term of bacteriostatic and bactericidal activities efficacy at stomach acidic pH (Kusters *et al.*, 2006; Lodhi *et al.*, 2006; Jain *et al.*, 2012) likelihood of developing resistant mutants and synergistic capacity with common antibiotic also the effect on ethanol induced gastric ulcer dose of aqueous extract of *TP* 1-20mg/kg, and 5-20mg/kg of *TP* gives dose dependent protection in indomethacin induced ulcers

Antioxidant activity

Ethanollic extract of *TP* possesses a definite prohealing action and improved collagen maturation by cross-linking and also increase in dry granuloma weight (Akkol *et al.*, 2009). The ethanollic extract contains flavonoids which have potent antioxidant, antibacterial and free radical scavenging activities Chinniah *et al.*, 2009). Antioxidants enzymes (Superoxide dismutase and Catalase) are known to quench the superoxide radial thus prevent the damage of cells caused by free radicals (Sinha *et al.*, 1982), so that the scavenging effect might be one of the most important component of wound healing. Ethanollic extract of *TP* effectively stimulates wound contraction by increasing tensile strength (Anitha *et al.*, 2012; Avuri *et al.*, 2013). In this way these finding could justify the inclusion of this plant in the management of wound healing. While, Kavitha and Manoharan, 2006; Shah *et al.*, 2010 investigated *Tephrosia purpurea* have marked amount of total phenols which could be responsible for the anti oxidant activity of hydroalcoholic extract of *Tephrosia purpurea*

Hepatoprotective activity

Tephrosia purpurea (aerial parts) was evaluated by Ramamurthy M Sree et al for its efficacy in rats by inducing hepatotoxicity with D-galactosamine HCl (acute) and carbon tetrachloride (chronic). The results of the study indicated that the administration of *Tephrosia purpurea* along with the hepatotoxins offered a protective action in both acute (D- galactosamine) and chronic (CCl₄) models (Ramamurthy *et al.*, 1992). Later Jain et al (2006) reported that Ethanol extract of leaves and flavonoid (isolated from leaves extract) from *T. purpurea* were evaluated for hepatoprotective activity in rats by inducing hepatotoxicity with carbon tetrachloride and conclude that the hepatoprotective activity was more in ethanolic extract of leaves than isolated flavonoid. Subsequently, the similar activity of a benzopyrone from *T. purpurea* Pers. was reported by Shankar, (2005). The hepatoprotective activity of the aerial parts of *T. purpurea* and stem bark of *Tecomella undulata* against thioacetamide-induced hepatotoxicity was proved by Amit *et al.*, (2005). Consequently, Mitra 1998 reported the protective effect of HD-03 (an herbal formulation) against *Tephrosia purpurea* in rats and anticholestatic activity of HD-03(an herbal formulation) in thioacetamide induced experimental homeostasis (Mitra, 1999). Effect of *T purpurea*, an herbal hepatoprotective on drug metabolism in patients of cirrhosis and hepatic enzyme function in experimental liver damage has been reported by Chauhan *et al.* (1992).

Antiulcer activity

The antiulcer activity of the aqueous extract of the roots of *Tephrosia purpurea* (Fabaceae) was studied in rats, in which gastric ulcers were induced by oral administration of ethanol or 0.6M HCl, indomethacin and by pyloric ligation, and duodenal ulcers were induced by the oral administration investigated by Khan *et al.* (2001). The results suggested that *T. purpurea* possessed a significant antiulcer property, which could be due to the cytoprotective action of the drug (Kokila *et al.*, 2010). The protective effect of *T. purpurea* against cysteamine-induced duodenal ulcers could be due to the strengthening of the duodenal mucosa or by other mechanisms like increased gastric and duodenal alkaline secretion or by increased luminal prostaglandin levels (Deshpande *et al.*, 2003). It was likely that flavonoidal compounds, tephrosin, pongaglabol, and semiglabin present in the *T. purpurea* could be involved in this action, as flavonoids have been reported to possess significant antiulcer activity in various experimental models of gastric and duodenal ulceration (Parmar and Parmar, 1998).

CONCLUSION

The traditional knowledge – it's holistic and systems approach supported by experimental base can serve as an innovative and powerful discovery engine for newer, safer and affordable medicines. These plant species mentioned in the ancient texts of Ayurvedic and other Indian systems of medicines may be explored with the modern scientific approaches for better leads in the health care. Hence, the present review is focused an overall out line of plant used in Ayurvedic drug scenario and its future prospects for the further scientific investigation. Considerable research on Pharmacognosy, chemistry, pharmacology and clinical therapeutics has been carried out on Ayurvedic medicinal plants. Several preclinical and clinical studies have examined cytoprotective, immunomodulatory and immunoadjuvant potential of Ayurvedic medicines. The development of these traditional systems of medicines with the perspectives of safety, efficacy and quality will help not only to preserve this traditional Microorganisms are becoming resistant more quickly than new drugs are being found. Thus, future research in antimicrobial therapy may focus on finding how to overcome resistance to antimicrobials, or how to treat infections with alternative means. Many of researchers have been investigated scientifically for antimicrobial activity and a number of products have been shown to inhibit the growth of pathogenic microorganisms. A number of these agents appear to have structures and modes of action that are distinct from those of the antibiotics in current use, suggesting that cross resistance with agents already in use may be minimal. So, it is worthwhile to study plants and plant products for activity against resistant bacteria.

ACKNOWLEDGEMENT

We are grateful to Malankara Catholic College (Former Correspondent Fr. Premkumar, M.S.W) for given the support and sustaining preparation of this review manuscript. The corresponding author also wish to expressed the sincere gratitude to Corespondent, Bursar and Principal in the present Management of Malankara Catholic College, Mariagiri.

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