ORIGINAL ARTICLE

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Tephrosia purpurea (L.) Pers. (Sarphuka, Wild Indigo): An important drug of Unani system of medicine

ABSTRACT

Tephrosia purpurea is a species of flowering plant in the pea family, Fabaceae, widespread in the Indian subcontinent. In Unani system of medicine it is either used as a single drug or as an ingredient in many Unani formulations which are use in the treatment of various ailments of the body. In the present manuscript the information available about this drug in Unani literature, phytochemical and pharmacological investigations carried out upto August 2018 are summarized. Sarphuka is a blood purifier, diuretic, digestive, laxative, resolvent, antidote etc. It is used in the treatment of syphilis, gonorrhea, leprosy, pruritus, inflammation, hemorrhoids and skin diseases. Pharmacological and clinical investigation of *Tephrosia purpurea* revealed anti-inflammatory, analgesic, hepatoprotective, immunomodulatory anti-diabetic, anti-bacterial, antioxidant, antileishmanial, anti-carcinogenic and anti-lipidperoxidative activities.

Key words: Phytochemistry; Pharmacology; Sarphuka; Unani medicine; Wild Indigo.

INTRODUCTION

Unani System of Medicine is a complete medical system which offers promotive, preventive and curative healthcare since antiquity. This is based on medical substances derived from plants, animals and minerals. More than one thousand drugs are described in alphabetic manner in the text of Advia (pharmacology) from all the three natural sources. Based on their origin, the Unani drugs are classified into three categories: Drugs of plant origin including root, stem, bark, leaves, flower, seed, fruit, gum, resin, extract etc. Drugs of mineral origin including metals; metal ores and nonmetals in the natural form, while animal origin drugs are animal glands, tissues and certain animal poisons.[1] Plant origin drugs are the backbone of Unani pharmacotherapy. *Tephrosia purpurea* Linn.(*T. purpurea*) is a well-known plant described in the ancient text of Unani meaning "*ash-colored*," referring to the grayish tint given to the leaves. It belongs to high medicinally valued plant family Fabaceae, comprising of more than 400 species. It is found throughout India and Sri Lanka flourishing in poor soil, through the plains of India, Ceylon, Mauritius, Tropical Africa and subtropical regions.[2]

Tephrosia species have historically been used by indigenous cultures as fish toxins because of their high concentration of rotenone. It has a long history of its use as an important drug for the treatment of syphilis, gonorrhea, leprosy and various skin diseases. Its roots, leaves, seeds and stem bark are traditionally used as folk medicine. In Ayurveda *T. purpurea* is considered as digestible, anthelmintic, alexiteric, antipyretic and alternative. It cures diseases of liver spleen, heart, blood, asthma and in mild poisoning. Leaf extract is used to treat piles, bronchitis, boils and pimples. Roots and seeds are insecticidal. Ointment prepared from the root is used in elephantiasis'. The oil from seeds is said to be specific against scabies, itch, eczema and other eruption on the skin. Leaves are used as a fodder also. Seeds can be used as substitute of coffee.[3]

The drugs in Unani system of medicine are categorized according to their actions e.g. tonic, aphrodisiac, purgatives, concoctive, exhilarants, blood purifiers etc. *T. purpurea* comes under the category of blood purifier.[4,5] The scrutiny of Unani literature revealed that *Sarphuka* is an efficient drug used in various dosage forms for the treatment of skin and other disorders associated with morbid blood. It is also used as an important ingredient in blood purifier formulations.[6]

Due to the unorganized literature available on this important drug an effort has been made in the present paper to compile all the available information which reveals the therapeutic potential of this multi potent drug. The aim is to explore the properties mentioned in Unani and ethno botanical literature and emphasize its phyto pharmacological attribute.

METHODOLOGY

A bibliographic search was carried out to collect the available information on *T. purpurea*. Contemporary reference books, relevant articles, periodicals, peer reviewed indexed journals and other published works available on Pub Med, Science Direct, and Scopus were searched to retrieve online literature. The search was

conducted using the terms "Sarphuka" '*Tephrosia purpurea*', 'studies on *Tephrosia purpurea*, 'review on *Tephrosia purpurea*". Further books, monographs and reports on *Tephrosia purpurea* published in Urdu and English were used to compile the information. Standard Unani Medical Terminology published by Central Council for Research in Unani Medicine in collaboration with World Health Organization was used to describe the appropriate Unani terminologies. Plant names cited throughout manuscript were checked for the currently accepted valid names through www.theplantlist.org. The full text of each included article was critically reviewed, and valuable information was summarized.

VERNACULAR NAMES[7]

Bengali	:	Bannilgachh, Sarphonka, purple tephrosia, fish poison
English	:	Wild Indigo
Gujrati	:	Ghodakan, Jhila, Sarpankho, Sharpankho
Hindi	:	Sarphoka, Sarphonka, Dhamasia
Kannada	:	Empali, Vajaraneeli, Koggili
Malyalam	:	Kolinnil, Kozhenjil, Kaatamiri
Oriya	:	Kolothiyapokha, Mohisiakolothiga, Pokha, Soropokha
Punjabi	:	Bansa, Bansu, Jhojhru, Sarpankh, Sarphonka
Sanskrit	:	Banapunkha, Ishupunkhika, Kalashaka, Kalika, Sharapunkha
Tamil	:	Kolingi, Paavali, Katkolingi, Kolluk-kay-velu
Urdu	:	Sarabhuka

BOTANICAL DESCRIPTION

Macroscopic features

T. purpurea is a perennials, erect or decumbent herbs or sub shrubs, height ranges from 50 cm to 1.5 meter. Compound leaves imparipinnate; terminal leaflets 7-15, 1-2.8 x 0.3-1 cm, oblanceolate or obovate, base cuneate, apex obtuse toemarginate. Flowers 7 mm long, purplish to white, bisexual, symmetrically, zygomorphic, hypogynous. In few-flowered, leaf is opposed, pseudoracemes; pedicels 3-4 mm long; bracts, 2 mm long, calyx, 3-4 mm long. Corolla, pink to purplish; 4 mm broad, orbicular and staminal tube, 4 mm long. Pod is dry dehiscent 2.5-4 x 0.3-0.4 cm, linear-oblong, 5-7-seeded. Seeds are ellipsoid, dark brown in colour.[8]

Microscopy

Study of stomatal index shows a range of 11-24 adaxial surface and 6-16 abaxial surface.Study shows that its leaves have vein-islet number within the range of 14-29 with non glandular, simple, elongated and aseptate trichomes, crystal sheath surrounding the large vascular bundle which are capped by fiber strands on both adaxial and abaxial side and presence of collenchyma cells on the upper ridge of the midrib.[9]

ETHNOMEDICINAL USES

T. purpurea is reported to be useful in kidney disorders and cough. In Bundelkhand region the folk men use the smoke of its root powder for the treatment of asthma and cough. An extract of pods is given as a cure for pain and inflammation. Their decoction is used to stop vomiting and as a vermifuge.[10] The dried herb is effective as an energizer, laxative and diuretic. It is also used in the treatment of bronchitis, bilious febrile attack, boils, acne, diseases of teeth, scrofula, painful labor and hemorrhoids. The roots and seeds are reported to have insecticidal, pesticidal, and vermifugal properties. Leaves are prescribed in dyspepsia, pectoral diseases and hemorrhoids, etc.[11] The roots are effective in leprous wounds and the root juice is useful in skin eruptions. Seeds, roots and ash are useful traditionally and also cultivated as fertilizer.[12] For rodent bites, the seed powder of *T. purpurea* is used with butter milk to treat poisoning.[13]

DESCRIPTION OF SARPHUKA IN UNANI LITERATURE

Morphological characteristics

The morphological characteristics of *Sarphuka* in Unani literature is not as efficient as needed for its identification. However, some of the key features are described by Unani physicians, on the basis of that description *Sarphuka* is identified as the plant of *T. purpurea* Linn. According to Unani literature, *Sarphuka* is an Indian origin plant, half meter long, stem is thin has many branches, leaves are arranged in parallel manner. It bears flowers and legumes. Its two types are mentioned on the basis of the color of flower. One has white and other has red flowers. The plants bearing white flowers are rare. Seeds are small kidney shaped, four to five seeds are found in a single pod. Taste of whole plant is bitter and unpleasant.[4,14,15,16,17]

Properties

Temperament

Like all entities of the Universe, Drugs are also constituted by the mixing of elements, therefore, their basic character is indicated by the resulting qualitative temperament. *Mizaj* (temperament) is one of the basic concepts of Unani system of medicine. The *Mizaj* of drugs have been articulated in terms of four *kaifiyat* (qualities) *viz. har* (hot), *barid* (cold), *yabis* (dry) and *ratab* (moist).[18,19] The degree of *mizaj* depends upon the relative proportion of these four *kaifiyat* and the drugs of particular temperament are categorized accordingly. When it is said that a drug is hot or cold, it does not mean that it is intrinsically very hot or cold, or that it is hotter or colder than the human body. Rather, it indicates that such a drug produces a greater degree of heat or cold in the body than what was originally present. Further, the same drug may be less hot for one person than for the other. This is one of the reasons why different drugs are prescribed for the same disease in different persons.[20] The temperament of Sarphuka is hot and wet in first degree.[4,15,16,17] According to the book Ilmul advia Nafisi temperament of Sarphuka is hot and dry in first degree.[14]

Pharmacological actions[4,14,15,16,17]

A few references regarding its pharmacological properties are available in Unani text. It is cited to have blood purifier, diuretic, antidote, anthelmintic, antipyretic, tonic, laxative, deobstruent, digestive, euphoretic and antileprotic properties.

Mechanism of action[4,14,15,16,17]

T. purpurea is one such drug which is listed in the blood purifier group of drugs. It has the property to purify blood from toxic substances by various mechanisms. Since its taste is bitter and temperament is hot therefore it has a number of pharmacological properties viz. demulcent, laxative, resolvent, deobstruent, diuretic, antiseptic etc. By virtue of these characteristics it is able to transform the morbid viscous matter into such a form which can be easily evacuated by the body. Since it has laxative and diuretic property therefore morbid matters are removed by respective organs. It also has the property to tone up the function of sluggish liver, kidney and stomach, in this way it does not only cure the disease but also prevent it by normalizing the performance of all these organs.

Therapeutic uses[4,5,14,15,16,17]

In the light of above mechanism of action, *T. purpurea* is used in the treatment of all those diseases which are caused by impure/morbid blood such as acne, ulcer, itching, leprosy, syphilis, fever, inflammation and numerous skin disorders as well as venereal diseases. Since each part of *T. purpurea* has medicinal properties therefore either whole plant or its part are used in the treatment of various disorders e.g. Tender leaves have good results in treating eczema and vitiligo or patchy skin. It is also used to reduce blood toxicity caused by heavy metallic drugs or bhasma. Apart from skin diseases Sarphuka is also used in various other ailments of the body. For this purpose, it is either used orally in various dosage forms viz. powder, syrup, decoction, extract, tablet etc. or locally as paste and ointment. Its root is diuretic, allays thirst and enriches blood. The dried herb is given for the treatment of bronchitis, bilious febrile attacks, boils, pimples and bleeding piles. The leaf decoction is used for treating fever, heart and spleen disorders, digestive complaints, asthma and cancerous tumors. The extract of leaf is used in the management of abortion, quaternary and tertiary fever. Apart from single and compound formulations, *Sarphuka* is also combined with other drugs viz.100 gm of crushed leaves of *Sarphuka* and 50gm of cannabis leaves (*Cannabis sativa* Linn.) are mixed together, from which 4-6 gm if taken regularly for forty days cures piles. Tablet made from black pepper (*Piper nigrum)* and fresh root of *Sarphuka,* is used to reduce chronic gastric problems. If the paste of black pepper (5gm) and *Sarphuka* (7gm) applied locally reduces the inflammation of breast. Juice of *Sarphuka* with dry ginger (*Zingiber officinale* Roscoe.) provides relief from irritable bowel syndrome and with clove (*Syzygium aromaticum*) powder relieves chronic diarrhoea. If used in combination with *baubadang* (*Embelia ribes*), is very useful in expelling intestinal worms. Leaves juice is effective in leprosy. It relieves constipation and effective in spleenomegaly.

Toxicity

It is common belief that Unani drugs are safe but the fact is that the drug will not be a drug if it does not produce any side effect or unwanted effect. For this purpose Unani drugs are categorised into four degrees and mostly first and second degree drugs are found safe if used for short period but third and fourth degree drugs are not free from toxic effect therefore they are detoxified by some corrective procedures.[21] Unani physicians have not discussed any toxic effect of *T. purpurea*, however some of the physicians reported that it causes eructation.[4,5,14,15,16,17]

Correctives

Sarphuka is listed in the first category hence it does not need any corrective procedure however Unani system of medicine has a unique specialty of adding Corrective Drugs (*Muslih Adwiya*) to counter the

toxicity/undesirable effect of the main drug if any. Brahmadandi (*Tricholepis glaberrima* DC) is suggested as corrective drug for *Sarphuka.*

Substitutes

Amongst the various aspects of basic principles of drugs, *Abdale-e-Advia,* (substitution of drugs) is one of the most important principles, which governs the rules relating to drug substitution. Classical Unani literature has fully discussed about substitutes of almost all single drugs used in Unani System of Medicine[22] because all crude drugs are not available at all the times and everywhere.[22,23] The substitute of Sarphuka is suggested by Unani physicians are Mundi *(Sphaeranthus Indicus)* or Neelkanthi (*Ajuga bracteosa*).[4,14,15,16,17]

Compound formulations

Unani System of Medicine prescribes elaborate formulation or pharmaceutical processing of drugs for achieving stability, palatability, absorption and assimilability, and for enhancing efficacy and safety. The compound preparations of *Sarphuka* are *Sharbate musaffi, Safoof juzam, Arq maul jubn, Arq murakkab musaffie khun banushka kala.* These formulations contain blood purifier drugs with *Sarphuka* as one of the ingredients, prescribed widely with other *musaffie dam* (blood purifier) formulations in the management of skin diseases. These formulations especially *arqiyat* (distillate) are used to catalyze or enhance the efficacy of other *musaffie dam* preparation.[4,14,15,16,17]

PHYTOCHEMISTRY

Phytochemical screening of the plant discovered numerous compounds such as presence of rotenoids, isoflavones, flavanones, chalcones, sterols, flavonols, flavones, alkaloids, steroids, rutin and rotenoids, oil as well as fatty acids. Other compounds like quercetin were also isolated from *T. purpurea*. The immense range of structure is due to variation in the position of hydroxy substituents or isoprenyl substituents. Seeds contain karanjin, purpurin[24] pongamol , lanceolatin B , purpuritenin, and purpuretimethide[25] etc. Very few chalcones were reported in this genus. They are either furano or chromano chalcones with un substituted B ring. Roots contain flavonoids, apollinine, semiglabrin, semiglabrinol, tephroglabrin, tepurindiol, pongamol, iso-lonchocarpin, *O*-methylpongamol, lanceolatins A and B etc. Leaves contain a flavonoid: rutin, a triterpenoid: lupeol, and a sterol: *β*-sitosterol, etc. The whole plant contains the flavonoids (+)-tephrorins A and B and (+)-tephrosone[26] an isoflavone 7, 4-dihydroxy-3', 5'-dimethoxyisoflavone and a chalcone (+)-tephropurpurin.[27]

Reinvestigation of the extract of aerial parts of *T. purpurea* resulted in the isolation and structural elucidation of three compounds, namely an aromatic ester, a sesquiterpene of the rare rotundane skeleton and a prenylated flavonoid isolated for the first time from this species.[28]

PHARMACOLOGICAL ACTIVITY

Nephroprotective and anti lithiatic activity

Alcoholic extract of *T. purpurea* revealed nephroprotective activity in gentamicin-induced kidney cell damage and *in vitro* hydroxyl radical scavenging activity.[29] A research was conducted on the chemopreventive efficacy of *T.purpurea* against *N*-diethylnitrosamine-initiated and potassium bromate-mediated oxidative stress and toxicity in rat kidney. The result indicates that *T. purpurea* is a potent chemopreventive agent against renal oxidative stress and carcinogenesis induced by *N*-diethylnitrosamine and KBrO3by reducing lipid peroxidation and xanthine oxidase activities and enhancing antioxidant enzyme activity.[30]

Antiulcer activity

Antiulcer activity of *T. purpurea* extract was studied in rats in which gastric ulcers were induced by oral administration of ethanol, or 0.6 mol·L−1 HCl, or indomethacin, or by pyloric ligation, and duodenal ulcers were induced by oral administration of cysteamine HCl. Omeprazole was used as a reference drug. The ulcer index in the *T. purpurea*-treated animals was found to be significantly less in all the models compared to vehicle control animals. The antiulcer property was more prominent in animals in which ulcers were induced by HCl, indomethacin, and by pyloric ligation. Omeprazole produced a significant gastric and duodenal ulcer protective effect when compared with the control group. The anti-ulcer activity of *T. purpurea* was however, less than that of omeprazole. Results suggest that *T. purpurea* possesses significant antiulcer property which could be either due to cyto-protective action or by strengthening of gastric and duodenal mucosa, and thus enhancing mucosal defense.[31] The aqueous root extracts of *T. purpurea* (100 and 200mg·kg−1) were screened for ulcerative colitis using the method of acetic acid-induced ulcerative colitis in mice. Macroscopical study of the colon, level of myeloperoxidase in colon, and histopathology of the colon tissue was studied for the assessment of activity. Results showed that the aqueous extract was effective in the treatment of ulcerative colitis at adose of 200 mg·kg−1.[32]

Spasmolytic, bronchodilator and vasorelaxant activity

Soni et al., (2004) performed the experiment for spasmolytic activity from leaves on isolated tracheal tissue of guinea pig. The effect of alcoholic and water extract of *T. purpurea* was dose dependent and the action was prolonged with increase in dose.[33] The methanolic extract of the whole plant of *T. pupurea,* Linn. on application to spontaneous contractions in isolated rabbit jejunum preparations exerted a concentration dependent(0.003-3.0 mg/mL) relaxant effect. The extract also caused concentration dependent relaxation of K+ (80 mM)-induced spastic contractions. These findings were further supported by the observations that the extract caused a concentration dependent right ward shift of the Ca2+ response curves in manner similar to that of verapamil. The extract exhibited a relaxant effect on carbachol and high K+ (80 mM)-induced contractions of isolated rabbit tracheal preparations in a manner similar to verapamil. The observed non-specific bronchodilator response is possibly mediated through Ca2+ channel blockade. Moreover, the extract also exhibited a dose dependent relaxant effect on phenylephrine (1 μM) and K+ (80 mM)-induced contractions in a manner similar to verapamil.[34]

Antileishmanial Activity

A fraction (F062) obtained from *N*-butanol extract of *T. purpurea* showed consistent antileishmanial activity at 50 mg/ kg against *Leishmania donovani* infection in hamsters. Activity was further confirmed in a secondary model, i.e., Indian langur monkeys (*Presbytis entellus*). Thus, the fraction F062 from this plant possesses potential to produce significant antileishmanial activity by oral route without producing any toxic effect.[35]

Antidiabetic activity

Studies revealed that an aqueous seed extract of *T. purpurea* resulted in a decrease in the blood glucose concentration, and also increased insulin level, which could be due to the stimulation of insulin secretion from remnant pancreatic *β*-cells which in turn enhance glucose utilization by peripheral tissues. Antioxidant status was observed in streptozotocin-induced diabetic rats. There is decreased hemoglobin and increased glycosylated hemoglobin levels in diabetic rats. Increased hemoglobin in *T. purpurea*-treated diabetic rats indicated decreased blood glucose level and glycosylated hemoglobin. Oral administration of *T. purpurea* to diabetic animals significantly improved hexokinase and glucose-6-phosphatase activities.[36]

Another study reported that *T. purpurea* seeds possess membrane stabilizing effect in streptozotocin induced diabetic male Wistar rats probably due to the presence of flavonoids and isoflavonoids which could be responsible for its anti-lipid peroxidative and insulin stimulatory effects.[37]

Antioxidant activity

Antioxidant activity of ethanol extract and ethyl extract of *T. purpurea* were tested for CCl4–induced lipid peroxidation and superoxide generation. Results indicate that ethyl acetate extract has pronounced antioxidant effect as compared to ethanol extract. The effects of tannins and flavonoids can be largely attributed to their antioxidant properties.[38]

Antiepileptic Activity

Investigation revealed the anti-epileptic action of *T. purpurea* in status epilepticus induced in rats by pilocarpine administration after lithium chloride. The results of the lithium- Pilocarpine-induced status epilepticus model confirmed that the ethanolic extract of *T. purpurea* has significant ability in treating the severity of status epilepticus.[39]

In one more study, aqueous extract of *T. purpurea* root showed antilithiatic effect by reducing the formation of stone and dissolving existing, calcium oxalate (gentamicin and 5% ammonium oxalate) and magnesium ammonium phosphate stones (zinc discs).[40]

Wound healing activity

Wound healing potential of different root extracts of *T. purpurea* was assessed by excision, incision and dead space wound models in rats. The result demonstrated that methanolic extract have a definite pro healing action. This was confirmed by a significant increase in the rate of wound contraction and by enhanced epithelization. Significant increase in tensile strength and collagen levels were seen, which was further supported by histopathological studies and gain in granuloma breaking strength.[41] In another study ethanolic extract of *T. purpurea* (aerial part) in the form of simple ointment were used on three types of wound models in rats as incision wound, excision wound and dead space wound. The results were compared to standard drug Fluticasone propionate ointment, in terms of wound contraction, tensile strength, histopathological and biochemical parameters such as hydroxyproline content, protein level, etc. Histopathological study showed significant ($P<0.05$) increase in fibroblast cells, collagen fibres and blood vessels formation. All parameters were observed significant ($P<0.05$) in comparison to control group.[42]

Antiviral activity

The methanol extract of *T. purpurea* flowers was studied for antiviral activity by using various virus cultures viz., HeLa cell cultures, HEL cell cultures and Vero cell cultures. The results showed good antiviral activity of the flower extract of *T. purpurea*.[43]

Hepatoprotective activity

The ethyl acetate fraction of an ethanol extract of the roots of *T. purpurea* was investigated for its hepatoprotective activity in rats by inducing hepatotoxicity with CCl4. The results showed that oral administration of *T. Purpurea* resulted in a significant reduction in aspartate aminotransferase, alanine transaminase, alkaline phosphatase and total bilirubin, when compared with CCl4-damaged rats. A comparative histopathological study of liver from the test group exhibited almost normal architecture, as compared to the CCl4-treated group. Hepatoprotective activity of *T. purpurea* exhibited better effectiveness than Silymarin in certain parameters.[44]

In other study Twenty four wistar albino rats of either sex were randomly divided into three groups. Group II and III were orally administered with sodium arsenite (10 mg/kg) daily in drinking water for 28 days. Additionally Group III was orally treated with hydro-alcoholic extract of *T. purpurea* at 500 mg/kg daily for the same time period, while only deionized water was given to Group I (control). Results revealed that *T. purpurea* significantly ($P < 0.01$) reduced serum ALT, AST, ALP activity and increased total protein and reduced necrosis and inflammation in liver of group III compared to group II.[45]

Aqueous-ethanolic extract of aerial parts of *T. purpurea* (100, 300 and 500 mg/kg/day and ethanolic extract of stem bark of Tecomella undulata (200, 500 and 1000 mg/kg/day were studied for their hepatoprotective effects. Hepatotoxicity was induced in albino rats of either sex by subcutaneous injection of thioacetamide. Test drugs shoewed significant reduction in serum aspartate aminotransaminase (35% and 31%, respectively), alanine aminotransaminase (50% and 42%, respectively), gamma glutamyl transpeptidase (56% and 49%, respectively), alkaline phosphatase (46% and 37%, respectively), total bilirubin (61% and 48%, respectively) and liver MDA levels (65% and 50%, respectively), and significant improvement in liver glutathione (73% and 68%, respectively) when compared with thioacetamide damaged rats. Histology of the liver sections of the animals treated with the extracts also showed dose-dependent reduction of necrosis.[46]

Analgesic and Anti-inflammatory activity

Analgesic activity of *T. purpurea* was carried out using acetic acid-induced writhing in mice and the tail flick test in rats. The anti-inflammatory activity was estimated using carrageenan-induced rat paw edema and cotton pellet granuloma formulation in rats. *T. purpurea* were found to be more effective in preventing carrageenan-induced rat paw edema, cotton pellet granuloma formation, and acetic acid-induced rat paw edema.[47] Anbarsi and Vidya, (2015) reported that anti inflammatory activity of *T. purpurea* seeds extract is due to presence of several bioactive compounds such as flavonoids and triterpenoids.[48]

Antimicrobial activity

The isolated saponin was tested for its antimicrobial activity. Maximum inhibition was recorded against the Gram-positive bacterium *Streptococcus pneumoniae*, and complete inhibition was observed on the growth of the fungus *Alternaria alternata*.[49]

In other study, the petroleum ether, alcoholic and aqueous extract of seeds of *T.purpurea* were found to have antibacterial activity against *Bacillus subtilis, Escherichia coli* and *Pseudomonas aeruginosa*.[50]

Anxiolytic activity

Hydroalcoholic extract of *T .purpurea* was studied in mice using the elevated plus-maze, zero-maze, y-maze, and hole-board models. In addition, the anxiolytic effects of the hydroalcoholic extract at the dose 200 and 400 mg·kg−1 orally was compared with diazepam. extract was able to increase the time spent and the number of arm entries in the open arms of the elevated plus-maze and elevated zero-maze, as well as decrease the visits by mice in the Y-maze, it also significantly increased nose poking, line crossing, and rearing in the hole-board assay. This effect was comparable to that of the diazepam, indicating that the extract of *T. purpurea* is an effective anxiolytic agent.[51]

Mast cell stabilizing potential (anti allergic) activity

An extract of the aerial part of *T. purpurea* was studied for the mast cell stabilizing potential against clonidine-induced mast cell degranulation, in adult Wistar rats. The result revealed that the ethanolic extract has dose-dependent, significant reduction in mast cell degranulation as compared to the clonidine-treated animals; however its effect was less than dexomethasone and disodium cromoglycate, which are potent mass cell stabilizers.[52]

Cytotoxic activity

The chloroform extract of the powdered root of *T. purpurea* was used for preliminary chemical

screening, and brine shrimp hatch ability and lethality testing. The inquiry was extrapolated to animal cell lines, Daltons lymphoma ascities and Erhlich ascites carcinoma. The Trypan blue exclusion method was used for this screening and confirmed the potent cytotoxic activity of *T. purpurea*.[53] The chemopreventive potential of *T. purpurea* extract was assessed in *N*-nitrosodiethylamine-induced hepatocellula rcarcinoma in Wistar rats. Hepatocellular carcinoma was induced by a single intraperitoneal injection of *N*-nitrosodiethylamine (200 mg·kg−1) followed by subcutaneous injections of CCl4 (3 mL·kg−1 per week) for six weeks. *T. purpurea* extract were administered orally once a day throughout the study. The levels of liver cancer markers, including α-fetoprotein and carcinoembryonic antigen, were substantially increased by *N*-nitrosodiethylamine treatment. *T. purpurea* extract treatment significantly reduced liver injury and restored the entire liver cancer markers. Additionally the extract normalized the activity of antioxidant enzymes, namely lipid peroxidation, reduced glutathione, catalase, superoxide dismutase, glutathione peroxidase, and glutathione-*S*-transferase in the liver of *N*-nitrosodiethylamine treated rats.[54]

Treatment with *T. purpurea* significantly reduced the nodule incidence and multiplicity in the carcinogen-bearing rats. Histological observations of the liver tissues correlated with the biochemical observations. Cytotoxic activity of different fractions of *T. purpurea* was tested in the human MCF-7 cancer cell line by trypan blue exclusion method. Two fractions of *T. purpurea* showed IC50 values of 152.4 and 158.71 µmol·L−1.[55]

According to Muralidhar et al., (2014), aqueous and ethanolic extracts of roots of this plant showed potential anticancer activity against Ehrlich ascites carcinoma cells in Swiss albino mice.[56]

Antimalarial activity

The extract of *T. purpurea* proved antiplasmodial activity against the D6 (chloroquine-sensitive) and W2 (chloroquine-resistant) strains of *Plasmodium falciparum* with IC50 values of (10.47 ± 2.22) and (12.06 ± 2.54) µg·mL−1, respectively. A new prenylated flavone, terpurinflavone, isolated from *T. purpurea* extract illustrated antiplasmodial activity with IC50 values of (3.12 ± 0.28) µmol·L−1 (D6) and (6.26 ± 2.66) µmol·L−1 (W2).[57]

Atilaw et al.,(2017), isolated four new prenylflavones with seven known compounds from the stem of *T. purpurea* subsp. leptostachya. The isolated flavones were tested for antiplasmodial activity against the D6 strain of *Plasmodium falciparum*. Among these, (E)-5-hydroxytephrostachin (1) showed good activity (IC50 1.7 _M).[58]

Anti pyretic activity

The methanolic extract of whole plant of *T. purpurea* at a dose of 250mg/kg and 500mg/kg body weight were investigated for antipyretic activity. The methanolic extracts showed potential significant antipyretic activity from 1 hour onwards as compared to the standard drug paracetamol amongst various extracts. The significant antipyretic activity may be due to the presence of flavonoids.[59]

CNS depressant and analgesic activity

Investigation of CNS depressant and analgesic activities of ethanol, ethyl acetate, chloroform and petroleum ether extracts of *T. purpurea* root using actophotometer for CNS depressant activity and analgesic activity using tail immersion method in albino rats of both sexes. The result showed that all the extracts were found to possess CNS depressant and analgesic activities. Ethanol extract showed higher CNS depressant activity and possessed approximately similar analgesic activity as that of diclofenac sodium after 120 minutes.[60]

Anti hyperlipidemic activity

The anti hyperlipidemic activity of ethanolic extract of *T. purpurea* at dose of 400 and 800 mg/kg b.w. was found to be significant as indicated by decrease in total cholesterol level of rats when compared to hyperlipidemic control.[61]

Anthelmintic activity

The various concentrations of aqueous and methanolic extract of leaves were evaluated for anthelmintic activities on *Pheretima posthuma*. The methanolic leaf extract not only showed paralysis but death of the organism with increasing concentration.[62]

CONCLUSION

On the basis of available literature it is concluded that *Sarphuka* is a drug used in Unani and other traditional system of medicine for the treatment of various ailments of the body. It is a multi potent drug though its major use in the treatment of skin diseases due to its blood purifying activity is also found effective in many other health problems. A number of research studies viz. hepatoprotective, diuretic, analgesic, antifungal, antioxidant, anti-inflammatory, and antibacterial, antipyretic, wound-healing are testimony of its potentials. Interestingly, most of the properties, which are claimed by Unani physicians, are verified by pharmacological studies. However, all these studies are preliminary in nature; no study is conducted on skin diseases and safety profile is also not established yet. Therefore, a detailed toxicity, animal

and clinical study is needed in general and in skin diseases in particular so that its safety, efficacy and exact mechanism of action can be established.

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CONTRIBUTION OF THE AUTHORS

All the authors equally contributed in the writing of this manuscript.

CONFLICT OF INTEREST

The authors have no conflict of interest.

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