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TRADITIONAL MEDICINAL PLANTS OF HIGH VALUE: *TRIBULUS TERRESTRIS*: A REVIEW

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ABSTRACT

Tribulus terrestris (TT), a dicotyledonous herbal plant belonging to Zygophyllaceae is commonly known as Gokshur or Gokharu or puncture vine. It has been used for a long time in both the Indian and Chinese systems of medicine. The plant has been used in traditional Chinese and Indian medicines and is now considered as one of the most popular aphrodisiacs. It is mainly planted in the Mediterranean and in sub-tropical regions such as India, China, South America, Mexico, Spain, Bulgaria, and Pakistan.

KEYWORDS: Herbal medicines, anti-cancer, anti-diebetic, Zygophyllaceae.

1. INTRODUCTION

Tribulus terrestris, *Mucuna pruriens*, and Ashwagandha (Withania somnifera) are widely known as antioxidant effective herbals and have been reported to possess aphrodisiac activities in traditional usages (Sahin et al. 2016). *Tribulus terrestris* (TT), a dicotyledonous herbal plant belonging to Zygophyllaceae family is a well-patronized medicinal herb by Ayurvedic seers as well as by modern herbalists (Duke et al. 2002). The plant has been used in traditional Chinese and Indian medicines and is now considered as one of the most popular aphrodisiacs. It is mainly planted in the Mediterranean and in sub-tropical regions such as India, China, South America, Mexico, Spain, Bulgaria, and Pakistan. The plant parts have different pharmacological activities including aphrodisiac, antimicrobial antiinflammatory, and antioxidant potential. *T. terrestris* is most often used for infertility and loss of libido. It has potential application as hepatoprotective, immunomodulatory, anthelmintic hypolipidemic, and anticarcinogenic activities (Shahid et al. 2016). The plant is used

individually as a single therapeutic agent or as a prime or subordinate component of many compound formulations and food supplements. It is an annual shrub found in Mediterranean, subtropical, and desert climate regions around the world, viz. India, China, southern USA, Mexico, Spain, and Bulgaria (Nadkarni et al 1972; Wealth of India 1972)

2. Taxonomy

The genus *Tribulus*, consists of about 20 species in the world, of which three species, viz. *Tribulus terrestris*, *Tribulus cistoides*, and *Tribulus alatus*, are of common occurrence in India (Trease and Evans 2002).

3. Morphology

It is small prostrate, 10-60 cm height, hirsute or silky hairy shrub. Leaves are opposite, often unequal, paripinnate; pinnae from five to eight pairs, elliptical or oblong lanceolate. Flowers are yellow in color. Its carpel fruits are of characteristic, stellate shape, somewhat round-shaped, compressed, five cornered, and covered with princkles of very light yellow color (Chhatre et al. 2014).The fruits from the five mericarps are ax-shaped, 3–6 mm long, and arranged radially and have a diameter of 7–12 mm and a hard texture. The root is slender, fibrous, cylindrical and frequently branched, bears a number of small rootlets and is light brown in colour Chhatre et al. 2014). The fruits and roots of TT, as a folk medicine, have been used for thousands of years in China.

4. Medicinal properties

Tribulus terrestris (TT) is a dicotyledonous herbal plant of the Zygophyllaceae family. In ancient medicine, extracts of the aerial parts and fruits have been used for its diuretic, tonic, and aphrodisiac properties. It has diuretic, aphrodisiac, antiurolithic, immunomodulatory, antidiabetic, absorption enhancing, hypolipidemic, cardiotonic, central nervous system, hepatoprotective, anti-inflammatory, analgesic, antispasmodic, anticancer, antibacterial, anthelmintic, larvicidal, and anticariogenic activities.

5. Phytochemistry

Indian and Chinese systems of medicine for treatment of various kinds of diseases. Its various parts contain a variety of chemical constituents which are medicinally important, such as flavonoids, flavonol glycosides, steroidal saponins, and alkaloids. Wu et al. (1999) reported three new compounds, tribulusterine, terrestribisamide and 25R-spirost-4-en-3,12-dione and together with 10 known compounds, N-p-coumaroyltyramine, terrestriamide, hecogenin,

aurantiamide acetate, xanthosine, fatty acid ester, ferulic acid, vanillin, p-hydroxybenzoic acid and β-sitosterol, from dried fruits of Tribulus terrestris. Tribulusamide C, tribulusterine, tribulusin A, harmine. Harman, harmmol, tribulusimide C, terrestriamide, N-transcoumaroyltyramine, N-trans-cafeoylyramine, terrestribisamide, are the main alkaloids isolated from the stems, leaves, and fruits of TT (see review Wu et al. 1999; Lv AL 2007; 2008).

6. Antidiabetic activity

Diabetes mellitus is a metabolic disorder with chronic hyperglycaemia, which results from a defect in insulin secretion, insulin action, or both (Van et al. 2006). The gross saponins of *T. terrestris* (GSTT) showed the inhibition activities of a postprandial increase in blood glucose and improvement in insulin dependent diabetes symptoms (Zhu et al. 2017). Clinical trials reported by Samani et al. (2006) proved that the water extract of *T. terrestris* (WETT) has an antidiabetic activity. The fasting blood glucose, 2-h postprandial glucose, glycosylated haemoglobin and lipid profile of diabetic women treated with TT extract (1000 mg day^{-1}) for three months were lowered compared to those of the placebo group (Samani et al. 2006).

7. Aphrodisiac

Qureshi et al. (2014) studied aphrodisiac effects of *T. terrestris*. They reported that a limited number of animal studies displayed a significant increase in serum testosterone levels after *T. terrestris* administration, but this effect was only noted in humans when TT was part of a combined supplement administration. This suggests that the marketing claims of enhancing testosterone concentrations in humans are unstained. However Sahin et al. (2016) reported for the first time that Mucuna, Tribulus and Ashwagandha supplementation improves sexual function in male rats via activating Nrf2/ HO-1 pathway while inhibiting the NF-κB levels. However Santos et al. (2019) reported that the use of tribulus and maca (Lepidium meyenii Walp, Brassicaceae) were not scientifically supported to improve serum T levels in men.

8. DISCUSSION

Anticancer properties of alkaloids have been reported in various scientific literatures (Mohan et al. 2012). Apoptotic processes are involved in the antitumor mechanisms induced by the herb. Basaiyye et al. (2018) identified several genes which are predicted to mediate apoptotic cell death via both intrinsic and extrinsic apoptosis pathway. They reported identification of new N-feruloyltyramine derivatives from alkaloid extract of *T. terristris* fruit with probable anti-leukemic and pharmacological potential. Basaiyye et al. (2018) demonstrated apoptosis-

inducing potential and mechanism of action of *Tribulus terristris* alkaloid extract in Jurkat E6-1 cancer cell line. They further reported that Jurkat cells treated with alkaloids extract at sub-lethal concentration showed DNA fragmentation, enhancement in caspase-3 activity and phosphatidylserine trans- location (apoptosis indicator) compared to control cells. The natural bioactive compounds include alkaloids, flavonoids, saponins, terpenoids, tannins, phenolics, etc. Alkaloids have comparatively higher bioactive potential due to their structural peculiarity (Cordell et al. 2001). Bhadra and Kumar (2011) reported that Isoquinoline alkaloids, like Berberine, Jatrorrhizine and Sanguinarine interact with nucleic acid have importance in antineoplastic research. Leukemia has been reported as the prime cause of cancer deaths in United States in 2010 for men aged below 40 years and in women aged between 20 to 59 years (Siegel et al. 2014). Leukemic cancer can be managed through the employment of stem cell transplantation, chemo- therapy and drug therapy. However, these therapies are known to associated with side effects like low blood cell counts, infection, graft versus host diseases and formation of kidney stones. Therefore, worldwide researchers are trying to develop effective anticancer drug analogues with minimal side effects. Natural compounds contributed 64% among all the approved drugs during 1981-2010 (Newman and Cragg 2012).

The alkaloids of *Camptotheca acuminata* alkaloids are marketed as irinotecan (CPT-11, Campto®) and Topotecan (TPT, Hycamtin®) as antitumor agents (Bailly et al. 2000). Patel et al. (2019) studied the anticancer mechanism of TT on MCF-7 breast cancer cells Patel et al. (2019) suggested that the *Tribulus terrestris* (TT) extracts may exert their anticancer activity by both extrinsic and intrinsic apoptotic pathways. These investigations give directions for future investigations concerning detailed assessment of its pharmacological potential.

CONCLUSION

Future research may be focussed on the pure forms of identified chemical constituents of the extract with validation of apoptosis markers involved. Pure forms of the identified N-feruloyltyramine derivatives may have enhanced cytotoxic activities than the whole alkaloid extract of *Tribulus terrestris.*

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