

## Abstract

The *Tamarix dioica* (*T. dioica*) is widely used medicinal plant to cure many chronic ailments. *T. dioica* is being used to treat diabetes mellitus in traditional medicinal system, however very little scientific evidence is available on this plant in this context. The plant was collected from Khyber Pakhtunkhwa province of Pakistan. The current study involves the fractionation of crude methanolic extract of *T. dioica* using, n-hexane, ethyl acetate, chloroform and n-butanol, the dried plant material obtained from each solvent was dissolved in methanol and was further investigated for its antimicrobial activity and other studies. The screening for antioxidant activity using 2,2-diphenyl-1-picrylhydrazyl (DPPH) assay was carried out. The total antioxidant activity was determined by phosphomolybdenum method. The *in vitro* antidiabetic potential was assessed by measuring  $\alpha$ -glucosidase inhibition. Total phenolic and flavonoid contents along with metal chelating activity were also determined for each fraction. The metabolites were identified using highly sensitive and emerging  $^1\text{H-NMR}$  technique.

The antibacterial activity was tested by agar well diffusion method against three Gram-positive strains (*Bacillus sp.*, *Actinomyces viscosus*, *Corynebacterium minutissimum*) and three Gram-negative strains (*Escherichia coli*, *Pseudomonas fluorescens*, *Klebsilla pneumoniae*). The antifungal activity was tested by agar diffusion method against three fungal strains (*Aspegillus flavus*, *Aspergillus niger*, *Penicillium digitatum*). The chloroform fraction exhibited the highest inhibitory effect in all the tested bacterial strains especially against *Escherichia coli* and *Klebsilla pneumoniae* with zone of inhibition of 7.50mm and 11.10mm respectively. The ethyl acetate fraction was also active against *Escherichia coli* with zone of inhibition of 11.50mm. In antifungal activity ethyl acetate fraction showed highest %age of zone of inhibition of 71.58% against *Aspegillus flavus* and 68.57% against *Aspergillus niger*. It was noted that all results were concentration dependant that is higher the concentration of plant extract more will be the activity.

The results revealed, the ethyl acetate fraction as the most potent with DPPH scavenging activity of  $84.44 \pm 0.21\%$  and  $\alpha$ -glucosidase inhibition with  $\text{IC}_{50}$  value of  $122.81 \pm 2.05$   $\mu\text{g/mL}$ . The total antioxidant activity of ethyl acetate fraction was  $163.12 \pm 1.66$  mg ASE/g PE followed by chloroform fraction  $152.12 \pm 1.18$  mg ASE/g PE. The total phenolic and flavonoid content values of  $205.45 \pm 1.36$  mg gallic acid equivalent per gram dried extract and  $156.85 \pm 1.33$  mg quercetin equivalent per gram dried extract were obtained for ethyl acetate

~~fraction~~. The results of metal chelating ability of *T. dioica* showed that its ethyl acetate and chloroform fractions possess almost the same iron chelating ability. Ethyl acetate fraction showed percentage iron chelating of  $58.28 \pm 0.54\%$  followed by chloroform with  $57.92 \pm 0.28\%$  iron chelating ability, these values were much lower than the value given by the standard EDTA that is  $94.38 \pm 0.05\%$ .

The bucketing of  $^1\text{H-NMR}$  spectra indentified 22 metabolites including some pharmacologically important like tamarixetin, tamaridone, quercetin, rutin, apigenin, catechin, kaempferol, myricetin and isorhamnetin. Leucine, lysine, glutamic acid, aspartic acid, serine and tyrosine were the major amino acids identified in ethyl acetate fraction. The molecular docking analysis provided significant information on the binding affinity among secondary metabolites and  $\alpha$ -glucosidase. These metabolites were most probably responsible for the antioxidant activity and  $\alpha$ -glucosidase inhibitory potential of ethyl acetate fraction. The study ascertained the ethnomedicinal use of *T. dioica* to manage diabetes mellitus and may be a helpful lead towards naturopathic mode for anti-hyperglycemia.

**Keywords:** *Tamarix dioica*, antibacterial, antifungal, antioxidant,  $\alpha$ -glucosidase,  $^1\text{H-NMR}$ , metabolites.