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Research Article

ANTIMICROBIAL, ANTIOXIDANT AND MINERALS EVALUATION OF *CUSCUTA EUROPEA* AND *CUSCUTA REFLEXA* COLLECTED FROM DIFFERENT HOSTS AND EXPLORING THEIR ROLE AS FUNCTIONAL ATTRIBUTE

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Abstract: The Antioxidant potential, antimicrobial activity and mineral contents of the plant *Cuscuta reflexa and Cuscuta europea* extracted with different polarity based solvents are assessed. The antioxidant activities are evaluated by the measurement of total phenolic contents (TPC), total flavonoid contents (TFC), DPPH radical scavenging (IC_{50}). Zn, Fe, Cu, Co and Pb are analyzed by using Atomic Absorption Spectrophotometer. The plant materials are contained the TFC (13.91- 68.13 CE mg/100g of dry extract), TPC (35.18- 189.68 GAE mg/100g of dry extract), DPPH radical scavenging activity, IC_{50} (669.37-88.85%), respectively. The antimicrobial activities are assessed against *Bacillus subtilis, Pasteurella multocida* and *Staphylococcus aureus* bacteria strains and *Aspergillus niger* and *Aspergillus flavus* fungal strains. The concentration of Zn ranges from 13.75±0.05-24.5±0.03 ppm, Fe 21.35±0.05-28.50±0.08 ppm, Cu 6.00±0.01-11± 0.05 ppm, Pb 2.50±0.01-7.00±0.08 ppm, Co 0.00±0.00-0.25±0.02 ppm. It is concluded that extracts of plant may be used as potential source of antioxidant agents in food industries.
Key**words** *Cuscuta reflexa, Cuscuta europea,* Antioxidant potential, Antimicrobial activity, Mineral contents, AAS.

Introduction

In the present age of drug progress and innovation of newer drug molecules, a number of plant and herb products are assessed on the principles of their mineral contents and their traditional uses. *Cuscuta sp.* is a beneficial plant which appears as leafless and yellowish green in appearance; also characterized as a twining herb, which belongs to the family *Convolvulaceae*. It has no root under the ground.[1]

It is commonly found on *zizyphus, clerodendrum, sesbania* and other shrubs and trees throughout the Indo Pakistan subcontinent and is abundant in the plains of Bengal. The stem of *cuscuta* sp. is a long branched, glabrous succulent, densely interlaced and possesses waxy white flowers, which are regular, bisexual, small and scented.[2]

The plant stem and seeds have highly important medicinal values, whereby the stem can be used for bilious disorders. Stem decoction is used for constipation and liver complaints. In vitro studies showed that that the *Cuscuta* stem abstraction had antiviral and anti cancerous activities.[3] It only grown as a parasitic twine on other plants, hence it is also known as Akaswel (sky twinner) or amerbel (immortal twine). In English it is known as dodder.[2] Due to parasitic nature of dodder, it absorbs different phyto-pharmaceutically active solutes from the host plant. [4]

Akaswel (sky twinner), Amerbel (immortal twine), Dodder.It is often added as a nutrient in porridge and alcoholic beverages to improve vision and also used to prevent abortion as well as aging in clinical treatment. *Cuscuta sp.* possesses anticancer and immune stimulatory activities. It also shows anti-inflammatory, antipyretic, antiviral, and pesticidal activities.[5]

Experimental Section

Sample of fresh stems of *Cuscuta europea and Cuscuta reflexa* is collected from different plant hosts present in different localities of Punjab province. All the chemicals and reagents that were used of Merck (Darmstadt, Germany), Sigma Aldrich and Oxoid (Canada) unless stated. Sample was washed under the running tap water, air dried at room temperature and then homogenized to fine powder and stored in air tight bottle before further analysis.

20g Sample of *Cuscuta* powder was extracted using different solvents (methnol, *n*- hexane). The sample was placed for the night at room temperature in an orbital shaker. The extract was isolated from the residue by filter paper of Whatmann No. 1 used. The residues were extracted for two times with the same solvents and extracts were combined. Then, those combined extracts were allowed to dry under reduced pressure at 45^{o}C by using rotary evaporator. The dry extracts were weighed to calculate the percentage yield and stored in a refrigerator (4^{o}C), until used for further analyses.

Wet Digestion of Plant Samples

Wet digestion was carried out as reported by[6] with little modifications. Triplicate sets of 0.50g of all plant samples were weighed in separate beakers and treated with 10mL of concentrated nitric acid to raze the organic material, alongside 10mL of mineral acid was also added in 100mL beakers, which served as blanks for all the procedure. For thermal agitation, the samples were placed on a hot plate and covered up with crucible lids. The hot plate was set at 70±1˚C, which resulted in a minor boiling of the samples after heating for 2-3 hours, the temperature of hot plate, was then increased to 150±1 ˚C and then removed the crucible lids to evaporate the digestion mixture. After that 3mL of conc. nitric acid was added and 5mL of

hydrogen peroxide were added drop wise. The hydrogen peroxide was added as decolorizing agent. The whole digestion procedure was performed in the fume hood for the avoidance of dangerous effects of nitric acid. Continued heating until complete decomposition of organic matter took place; a clear and translucent solution was obtained. The contents of beakers were cooled and then deionized water was added. The solution was filtered twice through Whatmann filter papers No. 42, and finally the volume was made up to 25mL by using deionized water.

Results and Discussion

The *cuscuta* or dodder is a parasitic angiosperm twining herb belonging to the family Convolvulaceae. They are used in folk medicine as alterative, purgative and anthelmintic. It has diuretic properties, and used in jaundicse, pain of joints, paralysis and vomiting. The purpose of present project to analyzed the *Cuscuta europea and Cuscuta reflexa* for medicinal importance, including mineral evaluation and investigation of the antimicrobial and antioxidant activity of extracts.

% yield of *Cuscuta reflexa and Cuscuta europea* in Methanol and *n*-hexane Extracts

The % yield (g/100g) of *Cuscuta reflexa and Cuscuta europea* from different host plants in methanol and *n*-hexane extracts are shown in **table 1**. The methanol solvent showed higher amounts of extractions then *n*-hexane solvent. *Cuscuta europea* from the host plant *Lycium barberum 1* showed the highest amount of % yield of 14.20 in methanol solvent. The *Cuscuta reflexa* from host plant *Zizyphus jojoba* 2 showed lowest % yield of 2.50 in *n*-hexane solvent. The amount of extracted material from a plant depends on the nature and quantity of solvent used during the extraction procedure and the extraction material varied from sample to sample.[7]

Table 1: % yield of *Cuscuta reflexa and Cuscuta europea* from different host plants in methanol and *n*-hexane extracts

***Cuscuta* sp.**	Host plant	Yield(g/100g) in methanol extract	Yield(g/100g) in *n*-hexane extract
Cuscuta reflexa	*Accacia nilotica 1*	8.00±0.61	3.50±0.41
	Accacia nilotica 2	10.50±0.78	2.52 ±0.35
	Zizyphus jojoba 1	13.00±0.83	8.50±0.65
	Zizyphus jojoba 2	7.50±0.54	2.50±0.33
	Lycium barberum 2	8.0±0.60	6.00±0.51
Cuscuta europea	*Lycium barberum 1*	14.20±0.84	7.00±0.53
	Zizyphus jojoba 3	10.50±0.78	8.50±0.66
	Zizyphus jojoba 4	12.50±0.81	2.53±0.34
	Azadirecta indica	10.30±0.78	4.72±0.48
	Calatropis procera	8.20±0.65	2.58±0.33

Values are expressed as mean of triplicate ± SD

Antioxidant Activities

Total Flavonoid Contents

The amount of total flavonoid contents of methanolic and *n*-hexane extracts of *Cuscuta reflexa and Cuscuta europea* are shown in table 2 respectively. The total flavonoid contents are ranging from 13.91-68.13 CE (mg/100g) in both solvents. Generally the significant difference ($p< 0.05$) was observed between different solvents. Methanol is a polar solvent and exhibited higher amount of TFC. *Cuscuta europea* from host plant *Zizyphus jojoba 4* showed highest TFC value of 68.13 CE (mg/100g) in methnolic extract. The *Cuscuta europea* from host plant *Zizyphus jojoba 3* showed lowest value of 13.91 CE (mg/100g) in *n*-hexane extract. Methnol is most frequently used to extract antioxidative components including phenolic acids and other phenolic components as flavonoids.[8]

Table 2: Total flavonoid contents mg/100g (CE) of *Cuscuta reflexa and Cuscuta europea* from different host plants

***Cuscuta* sp.**	**Host plant**	**Methanol**	***n*-hexane**
Cuscuta reflexa	*Accacia nilotica 1*	48.5±0.46	19.86± 2.56
	Accacia nilotica 2	59.45±0.41	41.64 ±1.27
	Zizyphus jojoba 1	54.01±1.97	35.93±1.20
	Zizyphus jojoba 2	45.55±2.31	40.45±2.66
	Lycium barberum 2	64.55±0.43	53.77±1.24
Cuscuta europea	*Lycium barberum 1*	44.76±1.99	31.64±1.92
	Zizyphus jojoba 3	38.51±1.97	13.91±0.94
	Zizyphus jojoba 4	68.13±0.48	52.17±2.63
	Azadirecta indica	59.62±1.92	43.97±1.28
	Calatropis procera	66.05±0.42	47.40±0.94

Values are expressed as mean of triplicate ± SD

Total Phenolic Contents

Total phenolic contents of *Cuscuta reflexa and Cuscuta europea* from different host plants are shown in table 3. Total phenolic contents are ranging from 35.18 to 189.68 GAE (mg/100g) in both solvents. Generally the significant difference ($p< 0.05$) was observed between different solvents in TPC results. Methanol is a polar solvent and exhibited higher amount of TPC. *Cuscuta europea* from host plant *Zizyphus jojoba 4* showed highest value of TPC mg/100 g (GAE) of 189.68 in methnolic extract. The *Cuscuta europea* from host plant *Calatropis procera* showed lowest value of 35.18 mg/100 g in *n*-hexane extract. Methanol is most frequently used to extract antioxidative contents including phenolic acids and other phenolic components as flavonoids.[8] As methanol is a polar solvent so it extracted a reasonable quantity of TPC. Contrarily *n*-hexane is a non-polar solvent in nature and showed that it is slightly effective for the extraction of phenolics. Mostly lipidic components are hexanes soluble which exists at lower concentration as compared to other antioxidative compounds. No earlier reports are available on TPC of *Cuscuta reflexa and Cuscuta europea* from different host plants with which to compare the results of present work.

Table 3: Total phenolic contents mg/100g (GAE) of *Cuscuta reflexa and Cuscuta europea* from different host plants

***Cuscuta* sp.**	**Host plant**	**Methanol**	***n*-hexane**
Cuscuta reflexa	*Accacia nilotica 1*	145.05±0.82	76.50± 0.35
	Accacia nilotica 2	146.32±0.83	80.50 ±0.42
	Zizyphus jojoba 1	114.05±0.55	53.14±0.28
	Zizyphus jojoba 2	112.95±0.52	51.59±0.26
	Lycium barberum 2	110.05±0.53	85.14±0.44
Cuscuta europea	*Lycium barberum 1*	114.23±0.55	81.32±0.42
	Zizyphus jojoba 3	183.05±1.03	53.41±0.31
	Zizyphus jojoba 4	189.68±1.05	54.31±0.33
	Azadirecta indica	108.32±0.48	58.14±0.38
	Calatropis procera	97.68±0.42	35.18±0.25

Values are expressed as mean of triplicate ± SD

DPPH Free Radical Scavenging Activity

DPPH is a stable organic free redical with violet colour which gives absorption maxima at 515-528 nm. It loses its chromophore and becomes yellow. DPPH free scavenging activity increased by increasing phenolic concentration then as the result the antioxidant activity also increased.[9] DPPH free scavenging activity of *Cuscuta reflexa and Cuscuta europea* from different host plants are shown in table 4. The results of DPPH free scavenging activity of methanolic and *n*-hexane extracts of *Cuscuta reflexa and Cuscuta europea* are shown in figure 1.a and 1.b respectively. Generally the significant difference ($p< 0.05$) was observed between different solvents in DPPH free scavenging activity's results. *Cuscuta reflexa* from host plant *Lycium barberum 2* showed highest value of 669.37 of IC_{50} value in *n*-hexane. *Cuscuta reflexa Zizyphus jojoba 1* showed lowest IC_{50} value of 88.85 in methnolic extract. To the best of my knowledge no earlier reports are available on DPPH free radical scavenging activity of *Cuscuta reflexa and Cuscuta europea* from different host plants with which to compare the results of present study.

Table 4: DPPH radical scavenging activity (IC_{50} value) of *Cuscuta reflexa and Cuscuta europea* from different host plants

Cuscuta sp.	Host plant	methanol	*n*-hexane
Cuscuta reflexa	*Accacia nilotica 1*	113.89 ±1.04	305.60 ±1.30
	Accacia nilotica 2	196.42 ±1.09	323.11±1.34
	Zizyphus jojoba 1	88.85 ±0.07	478.46±1.51
	Zizyphus jojoba 2	243.10 ±1.24	589.17 ±1.78
	Lycium barberum 2	174.93 ±1.04	669.37 ±2.04
Cuscuta europea	*Lycium barberum 1*	230.25 ±1.02	273.72 ±1.27
	Zizyphus jojoba 3	262.69±1.27	518.36 ±1.48
	Zizyphus jojoba 4	289.47±1.30	429.92 ±1.43
	Azadirecta indica	174.52±1.04	301.86 ±1.31
	Calatropis procera	189.36 ±1.06	360.39 ±1.38

Values are expressed as mean of triplicate ± SD

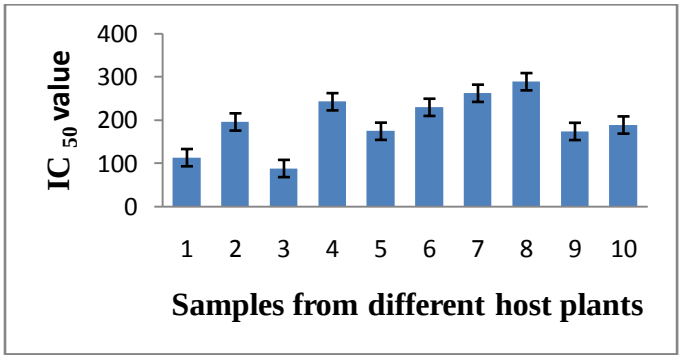

Figure 1.a: DPPH radical scavenging activity (IC_{50} value) of *Cuscuta reflexa and Cuscuta europea* from different host plants in methanol extracts

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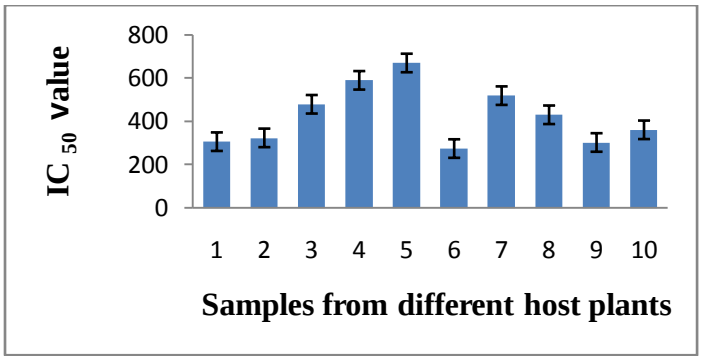

Figure 1.b: DPPH radical scavenging activity (IC_{50} value) of *Cuscuta reflexa and Cuscuta europea* from different host plants in *n*-hexane extracts

Antimicrobial activity of *Cuscuta europea and Cuscuta reflexa*

Antibacterial "assay of methanolic and n-hexane's extracts

By applying antibacterial activity of plant exracts was observed against three bacterial strains, *Pasturella multocida Bacillus subtilis and Straphylococcus aureus. B. subtilis and S. aureus* are gram positive bacteria where *P. multocida* is gram negative bacteria. Zone of inhibition was measurd by zone reader. The demonstration of antibacterial activity of *cuscuta europea and cuscuta reflexa* against both Gram positive and Gram negative bacteria may be indicated by the presence of broad spectrum antibiotic compounds.

Antibacterial activity of *Cuscuta europea* and *Cuscuta reflexa* against *Bacillus subtilis*

Antibacterial activity of methanolic extracts and *n*-hexane extracts of *Cuscuta europea and Cuscuta reflexa* against *B. subtilis* is shown in table 5.a and 5.b. respectively. The maximum activity against S. *subtilis* was shown by standrad. The methanolic extract of *Cuscuta reflexa* from host plant *Zizyphus jojoba* 2 showed mild zone of inhibition against selected bacterial strains. While in the case of *n*-hexane extracts the extract of *Cuscuta europea* from host plant *Zizyphus jojoba* 3 and *Azadirecta indica* were shown very poor inhibition zone even skown nil activity against *B. subtilis. Cuscuta reflexa* of host plant Lycium barberum 2 in methanolic extract and *Accacia nilotica 2 n*-hexane extract and *Cuscuta europea* of host plant *Zizyphus jojoba 4* in both solvents can be potent to control the diseases caused by this bacterium.

Antibacterial activity of *Cuscuta europea and Cuscuta reflexa* against *Pasteurella multocida*

Antibacterial activity of methanolic and *n*-hexane extracts of *Cuscuta europea and Cuscuta reflexa* against *P.multocida* is shown in table 5.a and 5.b. respectively. The maximum activity against *P.multocida* was shown by standrad. Methanolic extract of *Cuscuta europea* from *Azadirecta indica* showed mild zone of inhibition,but in *n*-hexane extracts *Accacia nilotica* 1 and *Calatropis procera* were shown very poor zone of inhibition,even shown nil activity against selected bacterial strain. The methanoiic extract of *Cuscuta europea of host plant* Zizyphus jojoba 4 and *n*-hexane extract *Lycium barberum* 2 showed good results against this bacterium. So, these can be useful to control the diseases caused by this bacterium.

Antibacterial activity of *Cuscuta europea and Cuscuta reflexa* against *Staphylococcus aureus*

Antibacterial activity of methanolic and *n*-hexane extracts of *Cuscuta europea and Cuscuta reflexa* against *S. aureus* is shown in table 5.a. and 5.b. respectively. Antibacterial activity of extracts of *Cuscuta europea and Cuscuta reflexa* against *S. aureus* is shown in figures given below. The maximum activity against S. *aureus* was shown by standrad. Methanoiic extract of *Cuscuta europea* from *Azadirecta indica* showed mild zone of inhibition but in *n*-hexane extracts , *Lycium barberum 1* showed nil activity against selected bacterial strain. The maximum activity against *S. aureus* showed by the methanoiic extract of *Cuscuta europea* collected over *Zizyphus jojoba 4.* The methanolic extracts of *Cuscuta reflexa* of host plant *Lycium barberum* 2, in *n*-hexane extracts *Accacia nilotica* 2 and *Cuscuta europea* of host plant *Zizyphus jojoba 4* in both solvents, can be potent to control the diseases caused by *S. aureus.*

Antifungal assay of *Cuscuta reflexa* and *Cuscuta europea* from different host plants of methanolic and *n*-hexane extracts

The antifungal activity was examined by using disc diffusion method against four fungus strains *Aspergillus niger* and *Aspergillus flavus.*

Antifungal activity of *Cuscuta europea and Cuscuta reflexa* against *Aspergillus niger*

Antifungal activity of methanolic extracts and *n*-hexane extracts of *Cuscuta europea and Cuscuta reflexa* against *Aspergillus niger* is shown table 6.a. and 6.b. respectively. The maximum activity against *Aspergillus niger* was shown by standrad. The methanolic extract of *Cuscuta europea* from host plant *Zizyphus jojoba* 3 showed mild zone of inhibition against selected fungal strains. While in the case of *n*-hexane extracts the extract of *Cuscuta reflexa* from host plant, *Lycium barberum 2* was exhibt very poor inhibition zone.

Antifungal activity of *Cuscuta europea and Cuscuta reflexa* against *Aspergillus flavus*

Antifungal activity of methanolic extracts and *n*-hexane extracts of *Cuscuta europea and Cuscuta reflexa* against *Aspergillus niger* is shown in table 6.a. and 6.b. respectively. The maximum activity against *Aspergillus niger* was shown by standrad. The methanolic extract of *Cuscuta reflexa* from host plant *Zizyphus jojoba* 2 showed mild zone of inhibition against selected fungal strains. While in the case of *n*-hexane extracts the extract of *Cuscuta reflexa* from host plant, *Lycium barberum 2* was exhibit very poor inhibition zone even it exhibited nil zone.

Table 5.a: Antibacterial Activity of *Cuscuta europea* and *Cuscuta reflexa* in methanolic extract

Cuscuta sp.	Sample origin	Bacteria Strains		
		Bacillus subtilis	*Pasteurella multocida*	*Staphylococcus aureus*
Cuscuta reflexa	*Accacia nilotica 1*	19 ±0.41	18 ±0.43	18 ±0.41
	Accacia nilotica 2	19±0.41	18 ±0.41	20 ±0.52
	Zizyphus jojoba 1	20 ±0.41	20 ±0.41	19 ±0.41
	Zizyphus jojoba 2	18 ±0.44	20 ±0.70	21 ±0.41
	Lycium barberum 2	20 ±0.41	21 ±0.41	19 ±0.51
Cuscuta europea	*Lycium barberum 1*	19 ±0.44	20 ±0.42	20 ±0.41
	Zizyphus jojoba 3	17 ±0.45	20 ±0.41	20 ±0.70
	Zizyphus jojoba 4	22 ±0.41	22 ±0.41	22 ±0.51
	Azadirecta indica	19 ±0.41	17 ±0.45	15 ±0.41
	Calatropis procera	19±0.70	19±0.70	18±0.41
Standard		36±0.43	26±0.47	28±0.41

Values are mean ± SD of three separate experiments

Table 5.b: Antibactrial Activity of *Cuscuta europea* and *Cuscuta reflexa* in *n*-hexane extract

Cuscuta sp.	Sample origin	Bacteria Strains		
		Bacillus subtilis	*Pasteurella multocida*	*Staphylococcus aureus*
Cuscuta reflexa	*Accacia nilotica 1*	17 ±0.41	Nil	11 ±0.41
	Accacia nilotica 2	20±0.41	16±0.41	18 ±0.52
	Zizyphus jojoba 1	18 ±0.44	10 ±0.41	12 ±0.41
	Zizyphus jojoba 2	18±0.41	12 ±0.70	10 ±0.41
	Lycium barberum2	18 ±0.41	17 ±0.41	11 ±0.51
Cuscuta europea	*Lycium barberum1*	12 ±0.44	15 ±0.42	Nil
	Zizyphus jojoba 3	Nil	11 ±0.41	16 ±0.70
	Zizyphus jojoba 4	20 ±0.41	16 ±0.41	18 ±0.51
	Azadirecta indica	Nil	11 ±0.45	12 ±0.41
	Calatropis procera	14±0.70	Nil	13±0.41
Standard		36±0.43	26±0.47	28±0.41

"Values are mean ± SD of three separate experiments"

Table 6.a: Antifungal Activity of *Cuscuta europea* and *Cuscuta reflexa* in methanolic extract

Cuscuta sp.	Sample origin	Strains	
		Aspergillus niger	*Aspergillus flavus*
Cuscutareflexa	*Accacianilotica 1*	13mm±0.41	15mm±0.43
	Accacianilotica 2	17mm±0.45	20mm±0.44
	Zizyphus jojoba 1	17mm±0.44	19mm±0.43
	Zizyphus jojoba 2	11mm±0.40	11mm±0.40
	Lyciumbarberum 2	11mm±0.41	13mm±0.40
Cuscutaeuropea	*Lyciumbarberum 1*	15mm±0.42	18mm±0.42
	Zizyphus jojoba 3	10mm±0.41	14mm±0.41
	Zizyphus jojoba 4	19mm±0.44	20mm±0.44
	Azadirectaindica	20mm±0.44	22mm±0.44
	Calatropisprocera	18mm±0.41	18mm±0.44
Standard		32mm±0.47	36mm±0.48

Values are mean ± SD of three separate experiments

Table 6.b: Antifungal Activity of *Cuscuta europea* and *Cuscuta reflexa* in *n*-hexane extract

Cuscuta sp.	Sample origin	Strains	
		Aspergillus niger	*Aspergillus flavus*
Cuscuta reflexa	*Accacianilotica 1*	14mm±0.41	16mm±0.41
	Accacianilotica 2	17mm±0.43	19mm±0.42
	Zizyphus jojoba 1	17mm±0.45	18mm±0.42
	Zizyphus jojoba 2	12mm±0.40	14mm±0.40
	Lyciumbarberum 2	11mm±0.40	Nil
Cuscuta europea	*Lyciumbarberum 1*	16mm±0.42	17mm±0.42
	Zizyphus jojoba 3	Nil	16mm±0.42
	Zizyphus jojoba 4	19mm±0.45	19mm±0.43
	Azadirectaindica	19mm±0.45	22mm±0.44
	Calatropisprocera	21mm±0.45	24mm±0.44
Standard		32mm±0.47	36mm±0.48

Values are mean ± SD of three separate experiments

Mineral Evaluation

The mineral composition (Zn, Fe, Cu, Pb and Co) of *Cuscuta reflexa* and from different host plants was investigated and results are shown in figures given below. Zn contents were ranged from 13.75±0.05-24.5±0.03 ppm in *Cuscuta reflexa* of host plant *Lycium barberum 2* and *Accacia nilotica* 2.Cu contents were ranged from 6.00±0.01-11± 0.05 ppm in *Cuscuta europea* of host plant *Calatropis procera* and in *Cuscuta reflexa* of host plant *Lycium barberum 2.* Fe contents ranged from 21.35±0.05-28.50±0.08 ppm. Pb contents were ranged from 2.50±0.01-7.00±0.08 ppm in *Cuscuta europea* of host plant *Zizyphus jojoba 4* and in *Cuscuta europea* of host plant *Lycium barberum* 1. Co contents were ranged from 0.00±0.00-0.25±0.02 ppm. *Cuscuta reflexa* of host plant *Accacia nilotica 1* and *Accacia nilotica 2* showed zero concentration of Co contents, while all other host plants of *Cuscuta reflexa* and *Cuscuta europea* exhibt 0.25±0.02 ppm concentration of Co contents.

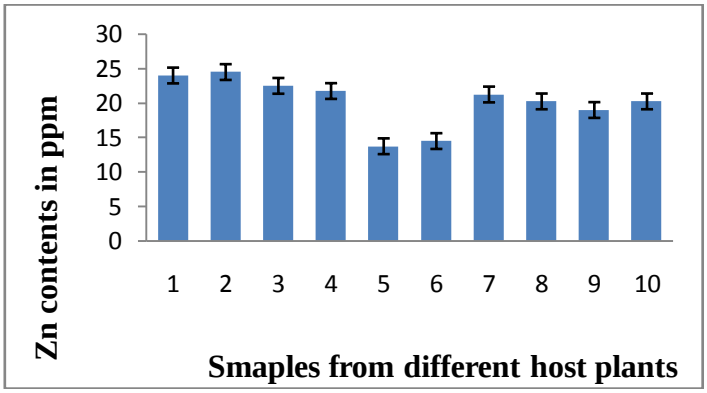

Figure 2.a: Concentration of Zn contents (ppm) in *Cuscuta reflexa* and *Cuscuta europea* collected over different host plants

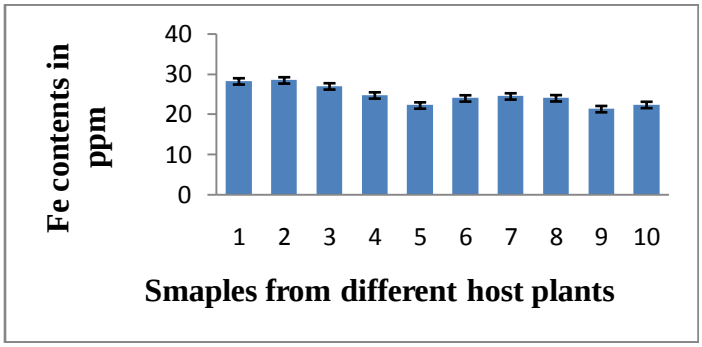

Figure 2.b: Concentration of Cu contents (ppm) in *Cuscuta reflexa* and *Cuscuta europea* collected over different host plants

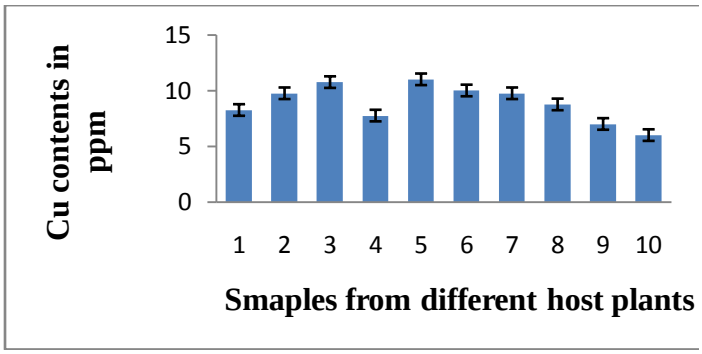

Figure 2c : Concentration of Cu contents (ppm) in *Cuscuta reflexa* and *Cuscuta europea* collected over different host plants

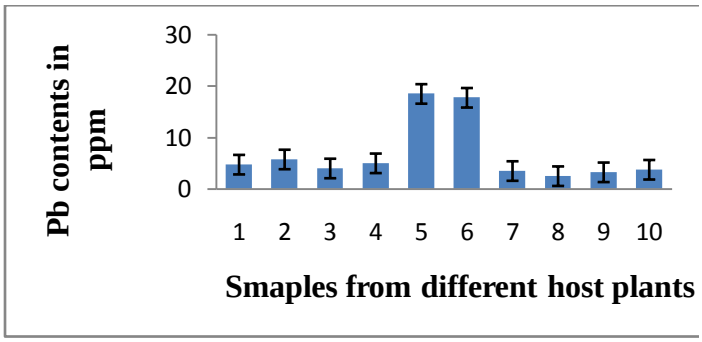

Figure 2.d: Concentration of Pb contents (ppm) in *Cuscuta reflexa* and *Cuscuta europea* collected over different host plants

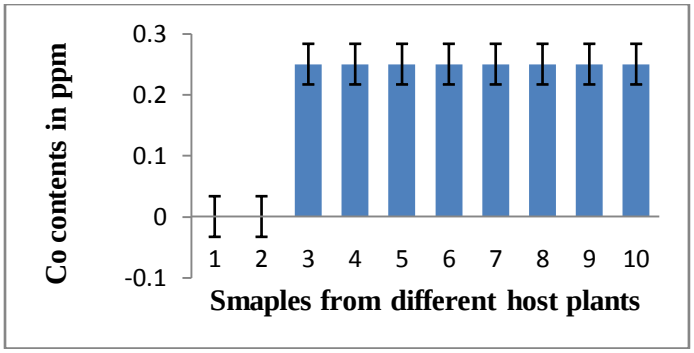

Figure 2.e: concentration of Co contents (ppm) in *Cuscuta reflexa* and *Cuscuta europea* collected over different host plants.

Conclusion

Cuscuta reflexa and *Cuscuta europra* are collected over different plants exhibited considerable bioactivity i.e. antioxidant as well as antimicrobial activity. The methanolic extracts exhibited good biological activities as compared to *n*-hexane extracts. This plant is rich in Fe and Zn contents, the toxic metal Pb is also found but in very low concentration in mineral evaluation. The present research would be helpful to further investigate the natural as well as pharmaceutical therapies for treatment of infectious diseases in humans and plant species in future.

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