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ANTIMICROBIAL ACTIVITIES OF SELECTED WEED PLANTS

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ABSTRACT

The present study was aimed at investigating the antimicrobial potential of four selected plants belonging to two different genera i.e Tamarix and Acacia. Both the genera have many weeds plants. Selected plants were Tamarix aphylla, Tamarix dioica, Acacia cyanophylla and Acacia stenophylla. Two different concentrations (1mg and 2mg disc^{-1}) of each plant extracts were subjected for antimicrobial screening against eight pathogenic bacterial and one fungal strain by Disc Diffusion Method. Results showed that all the four plants showed better inhibitory effect at concentration of 2 mg disc^{-1} against the tested microbes. Among plants, highest zone of inhibition was shown by Tamarix aphylla which was 81.25 % against Bacillus atrophus (gram positive). Similarly, highest antifungal activity was shown by Acacia cyanophylla against Candida albican which was 72.22%. E. coli was the most resistant bacterium to all plant extracts at both concentrations. It is concluded that all the selected plants had strong antimicrobial potential.

Key words: Anti-microbial activity, disc diffusion method, microorganisms, weeds.

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INTRODUCTION

The discovery of the first antibiotic penicillin has led to the emergence of resistant strains of micro-organisms (Davies *et al.,* 1994), still the need for antimicrobial substances is yet to be satisfied. Bacterial resistance to antibiotics is a public health concern these days (Monroe and Polk, 2000). In addition, the development of bacterial resistant strains resulted in failure to many bacterial infections.

Fresh antimicrobial agents are generated for the development of bacterial resistant strains (Bhavnani and Ballow, 2000). Chariandy

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et al. (1999) revealed that plant medication has been revived due to a general concept of a lower incidence of untoward reactions to plant extracts as compared to synthetic pharmaceuticals. The less costs of plant preparations make such medications an attractive option for the general public (Barr *et al.,* 1993; Lassak and McCarthy, 2006). Gotep *et al.* (2009) stated that plants are used alone as well as in combinations for treatment of microbial infections.

The genus *Acacia* belongs to family Leguminosae and sub-family Mimosaceae (Hemamalini *et al.,* 2013; Paula Lorenzo *et al.,* 2010). It is noticeable that the *Acacia* species occur worldwide as weeds (New *et al.,* 1984). *Acacia cyanophylla* and *Acacia cyclops* were introduced to South Africa for soil stabilization in 1845 (Roux *et al.,* 1961) which have by now became major environmental weeds (Orchard and Wilson, 2001). Okoro *et al.* (2012) reported that genus *Acacia* comprises of the constituents galactan, catechol, l-arabinose, galactoaraban, Nacetyldjenkolic acid, galactose, saponin, sulphoxides pentosan, and tannin. They further added that their stem-bark exudates are in the form of gums that have many medicinal uses like cough etc. Khare *et al.* (2007) collected information and confirmed that the members of genus *Acacia* are used against diseases such as cancer, diarrhoea, inflammation, hemorrhoid, leprosy, ophthalmia, leucoderma problems, and bleeding piles.

The genus *Tamarix* belongs to family Tamaricaceae (Louaar *et al.,* 2014) which has got 125 species, reported from various regions of Asia, Europe, USA and Africa (Sultanoa *et al.,* 2001). Sharma *et al.* (1998) discovered that *Tamarix* species are useful in leucodermic conditions, spleen trouble and eye diseases. They also found that *Tamarix* is rich in polyphenolic compounds e.g. flavonoids, phenolic acids, coumarins and tannins (Mahmoud *et al.,* 1991; Djurdjevic *et al.,* 2006). Traditionally, *Tamarix* species such as *T. aphylla* is used in rheumatism, abscesses, wound, fever, eye inflammation, wound healing, tootache (dental pain), and inflammation (Marwat *et al.,* 2011; Kamal *et al.,* 2009; Abbas *et al.,* 2002). The bark of *Tamarix aphylla* (the ground part) is particularly used as poultice on wounds (Azaizeh *et al.,* 2006; Shahidullah *et al.,* 2000; Sarfaraz *et al.,* 2008). Keeping in mind the above mentioned uses of Genus *Tamarix* and *Acacia*, the present study was aimed at investigating the antimicrobial effecte of four plants from these two genera.

MATERIALS AND METHODS

The present research work was carried out in PCSIR-Complex, Peshawar.

Plant materials

Among the selected plants, *Tamarix aphylla, Acacia cyanophylla* and *Acacia stenophylla* were collected from Pakistan Forest Institute, University of Peshawar and *Tamarix dioica* was selected from Takht Bhai, Mardan. The plants were given voucher numbers and placed in Herbarium, Department of Botany, Islamia College Peshawar.

Extraction

The collected plant parts i.e stem bark were shade dried for three weeks at room temperature. The dried stem barks of plant were processed with electric grinder for powder formation. 600 gm powder of each plant was soaked in commercial grade methanol (6.3, 4.3, 5 and 4.35 L respectively) for 15 days at room temperature with occasional shaking. After 15 days, it was filtered and the methanol soluble residue obtained was concentrated with rotary evaporator at 40^{o}C.

Antimicrobial activity bioassay

Antimicrobial activity of different plants extracts against various microorganisms was evaluated by means of Disc Diffusion Method. For Gram-positive bacteria azithromycin (6µl and 12µl) was used as positive control while solvent media as negative control. For Gram-negative bacteria ciprofloxacin (6µl and 12µl) was used as positive and solvent media as negative controls. For *Candida albicans,* Clotrimazole (6µl and 12µl) was used as a standard.

RESULTS AND DISCUSSION

Analysis of the data reveals that all the selected plants had antimicrobial potential at both concentrations against all tested microorganisms. All the plants extracts showed better zone of inhibition at dose of 2mg disc^{-1} as compared to 1mg disc^{-1}.

Effects of *Tamarix aphylla* extract on microbial growth

Antimicrobial activity of *Tamarix aphylla* has been shown in Fig. 1. At dose of 2mg disc^{-1}, highest zone of inhibition was shown against *Bacillus atrophus* which was 80.64% and minimum zone of inhibition was 51.47% against *E. coli.* Similarly, dose of 1 mg disc $^{-1}$ showed maximum and minimum zone of inhibition against *Bacillus atrophus* and *E. coli* respectively which were 70.31% and 44.11%. It was found that the *E. coli* was the most resistant and *Bacillus atrophus* was the most susceptible bacterium tested.

Plants containing alkaloids, tannins or glycosides show antimicrobial activity against number of microorganisms as investigated by Adebajo *et al.* (1983). In the present study, antimicrobial activity of stem bark of *Tamarix aphylla* was tested against *Streptococcus aureus, Escherichia coli, Klebsiella pneumonia, Pseudomonas aeruginosa* and *candida albican*. The extracts showed

less antibacterial activity as compared to antibiotic ciprofloxacin. However, the difference of antibacterial activity of ethanol extract of stem bark of *Tamarix aphylla* and antibiotic ciprofloxacin is not significant. Similar results were reported by Adam *et al*. (2011) and Astal *et al.* (2005).

Effects of *Tamarix dioica* extract on microbial growth

The antimicrobial potential of *Tamarix dioica* stem bark was investigated by subjecting plant extract at two different concentrations (Fig. 2). Both the doses showed inhibitory effect but the zone of inhibition at dose of 2mg disc^{-1} was higher. Like *Tamarix aphylla* (Fig. 1) *E. coli* was the most resistant bacterium against *Tamarix dioica* at both concentrations as compared to other germs. The plant extract showed 42.64% and 58.82% zone of inhibition at 1mg and 2mg disc^{-1} respectively which are least zone of inhibition of all (Fig. 2). Analysis of the data further reveal that most susceptible microbes were *Erwinia carotovora* (69.69% ZO) and *Salmonella typhii* (75.00% ZO) at the concentrations of 1 mg and 2 mg disc^{-1}, respectively.

Due to the biological activities of *Tamarix dioica,* it deserves more attention. To investigate the antimicrobial potential of the crude extract *Tamarix dioica* stem bark, the plant was screened against 6 strains of gram-positive and 2 strains of gram-negative bacteria by applying agar well diffusion techniques (Sharma *et al.,* 2008; Korir *et al.,* 2012). Different fungal strains can produce diseases in human beings specially *M. canis* and *C. albicans*. In human the *M. canis* can produce tinea capitis and in pets can produce ringworm, while *C. albicans* can produce skin, ear and bronchial candidiasis (Ginter-Hanselmayer *et al.,* 2004). *A. flavus* can deteriorate cotton seed, it also contaminate peanuts during their harvesting and storage (Ahmad *et al.,* 2012). The researchers are trying to isolate such type of fungicidal chemicals from medicinal plants which should be effective against disease causing fungi (Eloff *et al.,* 2005).

Effects of *Acacia cyanophylla* extract on microbial growth

Acacia cyanophylla stem bark also showed better inhibitory activity against all the tested microorganisms at both the concentrations . The plant extract was equally effective against both bacteria and fungi (Fig. 3). The data reveal that *Candida albicans* was the most susceptible germ at both the subjected concentrations with 72.22% and 66.66% ZI at concentrations of 2 mg and 1 mg disc^{-1} respectively. Similarly, *E. coli* was found the most resistant bacterium at both concentrations with 50.00% ZI at 1 mg and 52.94%, at 2 mg disc^{-1}.

Abeer and Sanaa (2007) reported that ethanol extracts from species of *Acacia* showed varying degrees of activity against Gram-negative bacteria (*Escherichia coli, Klebsiella pneumoniae* and

Pseudomonas aeruginosa) and Gram-positive bacteria (*Staphylococcus aureus*). These results correlate with the studies of antimicrobial activity of stem bark of *Acacia* spp*.* on various microorganisms by Banso *et al.,* 2009.

Effects of *Acacia stenophylla* extract on microbial growth

The antimicrobial activity of crude methanolic extract of *Acacia stenophylla* has been shown in Fig. 4. The plant showed minimum antimicrobial activity against E. coli at both concentrations which were 41.17% and 47.05% at 1mg and 2 mg $disc^{-1}$ respectively. Similarly, highest ZI was shown against *Salmonella typhii* and *Bacillus subtilis* which were 65.38% and 70.96% at 1 mg and 2 mg $disc^{-1}$ respectively.

Anti-microbial potential of ethanol extract of stem bark of *Acacia species* were investigated against some of the pathogens like *Klebsiella pneumoniae, Escherichia coli Staphylococcus aureus, Salmonella typhi* and *Candida albican.* The extract showed inhibitory action on the pathogens used in the present study. This finding correlates with reports of Dabur *et al.* (2007). This may be due to stronger extraction capacity of active component responsible for antibacterial activity. Results revealed that the tested plants can be considered being a rich source for antibacterial agents and can be used in various pathological conditions. This result supports the folkloric use of plant in various ailments like bronchitis and sinusitis (Shinwari *et al.,* 2003).

CONCLUSION

It was concluded that extracts of *Tamarix aphylla, Tamarix dioica, Acacia cyanophylla* and *Acacia stenophylla* were the most effective against micro-organisms. Further studies are needed to isolate effective natural constituents from these extracts.

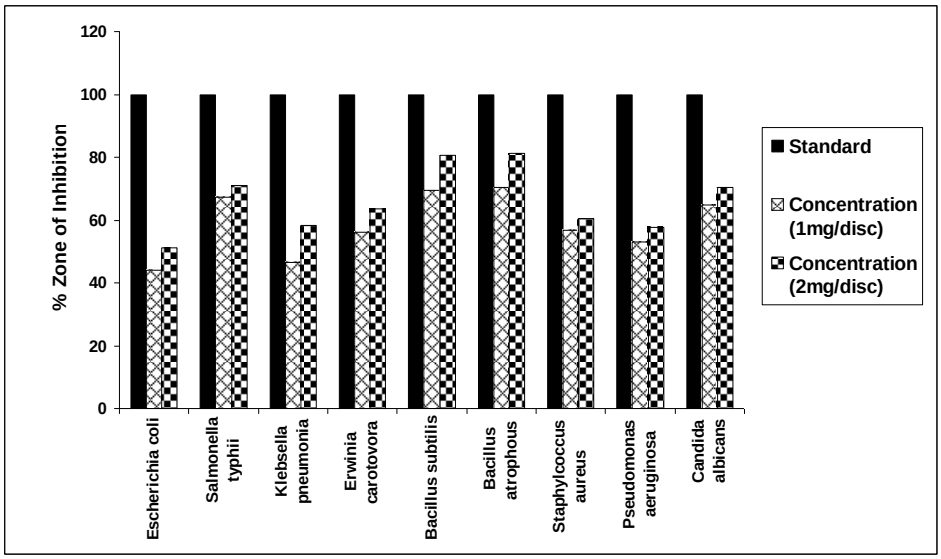

Figure 1: Antimicrobial activity of crude extracts of *Tamarix aphylla* against microbes.

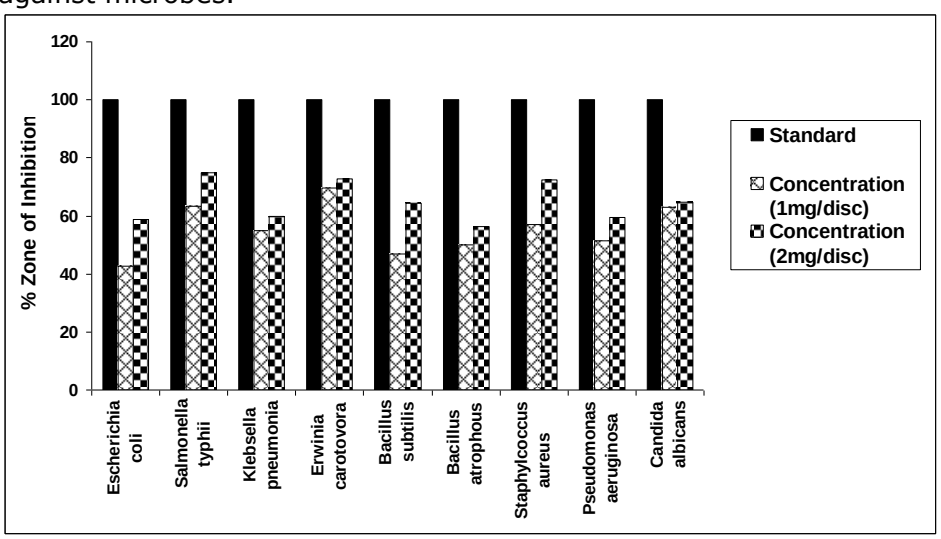

Figure 2: Antimicrobial activity of crude extracts of *Tamarix dioica* against microbes.

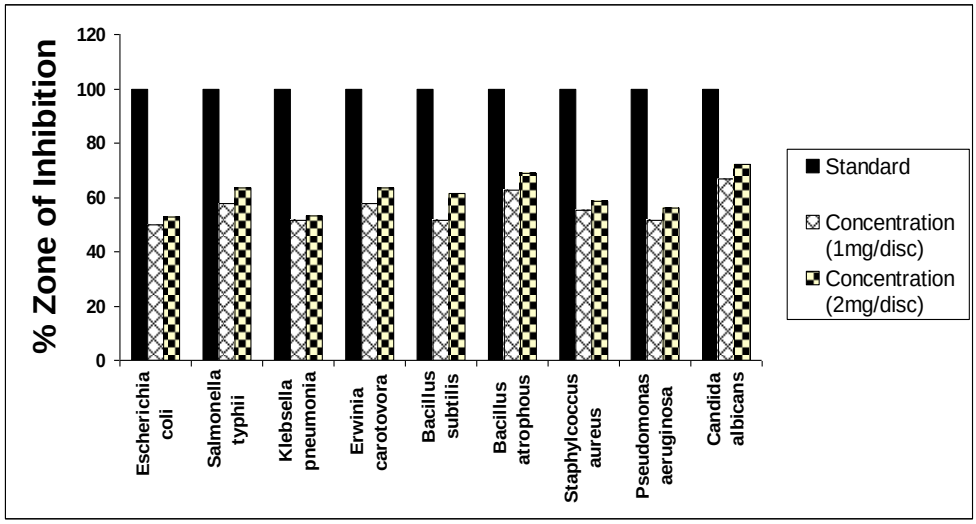

Figure 3: Antimicrobial activity of crude extracts of *Acacia cyanophylla* against microbes.

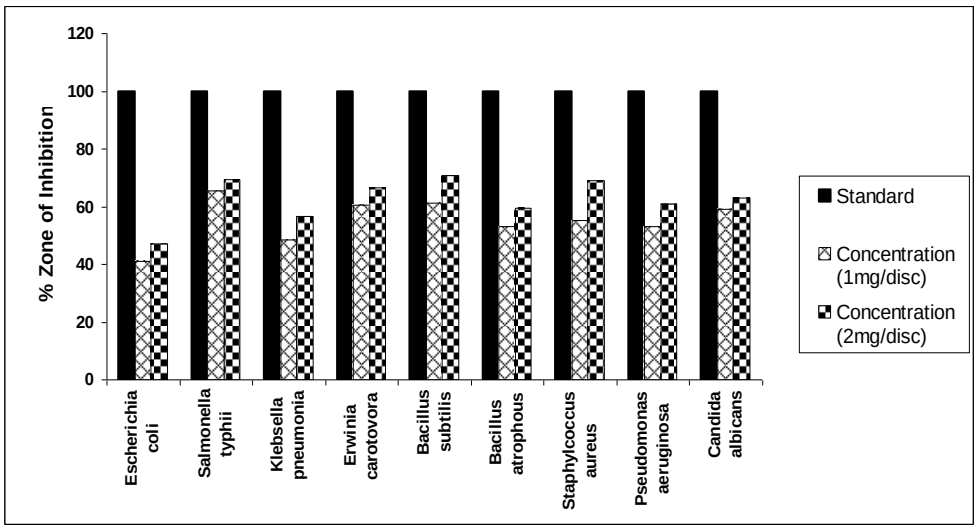

Figure 4: Antimicrobial activity of crude extracts of *Acacia stenophylla* against microbes.

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